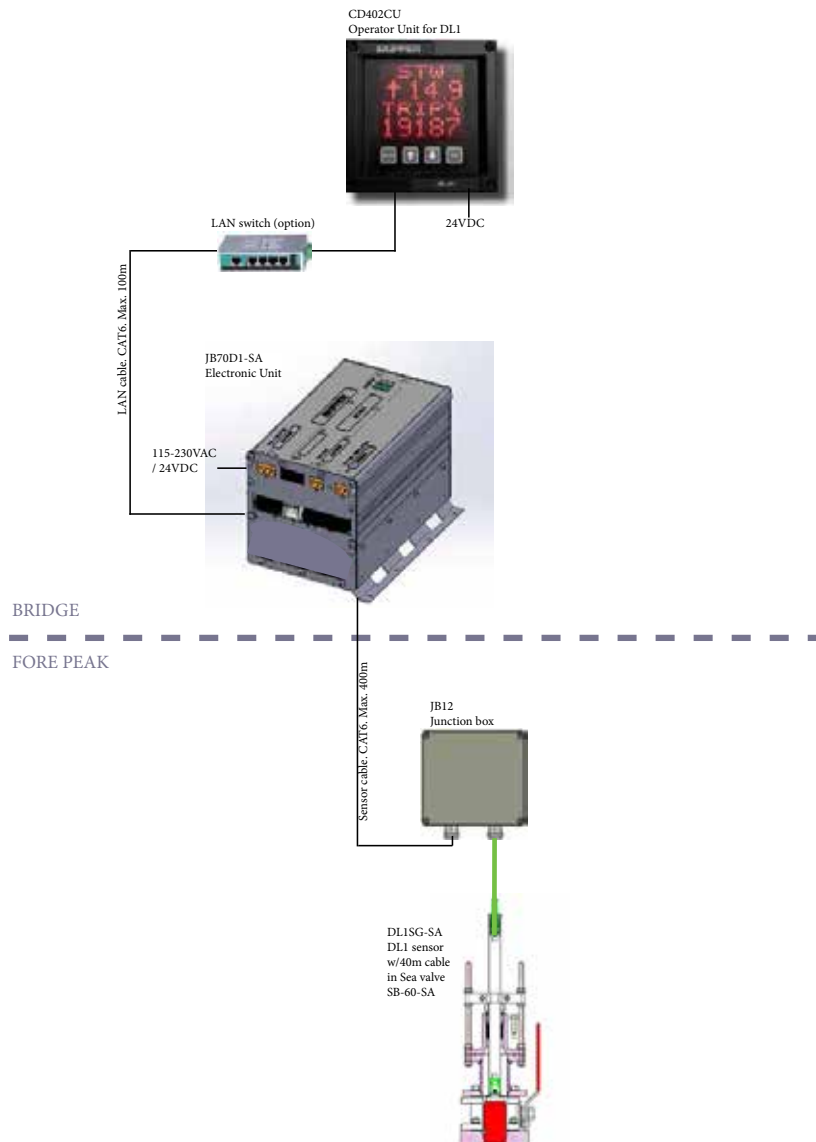


# SKIPPER

## DL1-Multi Single Axis Doppler Speed Log System Installation Manual



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# INSTALLATION MANUAL

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# Terminology

Terms used in this manual

## Units

Unless otherwise stated, all values shown on the display are as follows:

Speed	Knots
Temperature	°C
Tilt	Degrees
Distance	Nautical Miles (NM)

## Abbreviations

In addition, the following symbols are used

WT	Water Track
CAT6	Category 6 cable as defined in the standard
INS	Integrated Navigational System
MED	Marine Equipment Directive
VBW	Dual ground/Water speed
VHW	Heading & Water speed
NMEA	National Marine Electronics Association
NAUT	Class notation for enhanced nautical safety

# INTRODUCTION

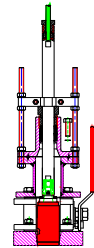
## THE DL1-MULTI DOPPLER SPEED LOG SYSTEM

The DL1-Multi single axis Doppler speed log system is a vessel mounted system that measures speed in one axis (longitudinal) through the water. The system fulfils all class and type regulations based on MED B (wheelmark).

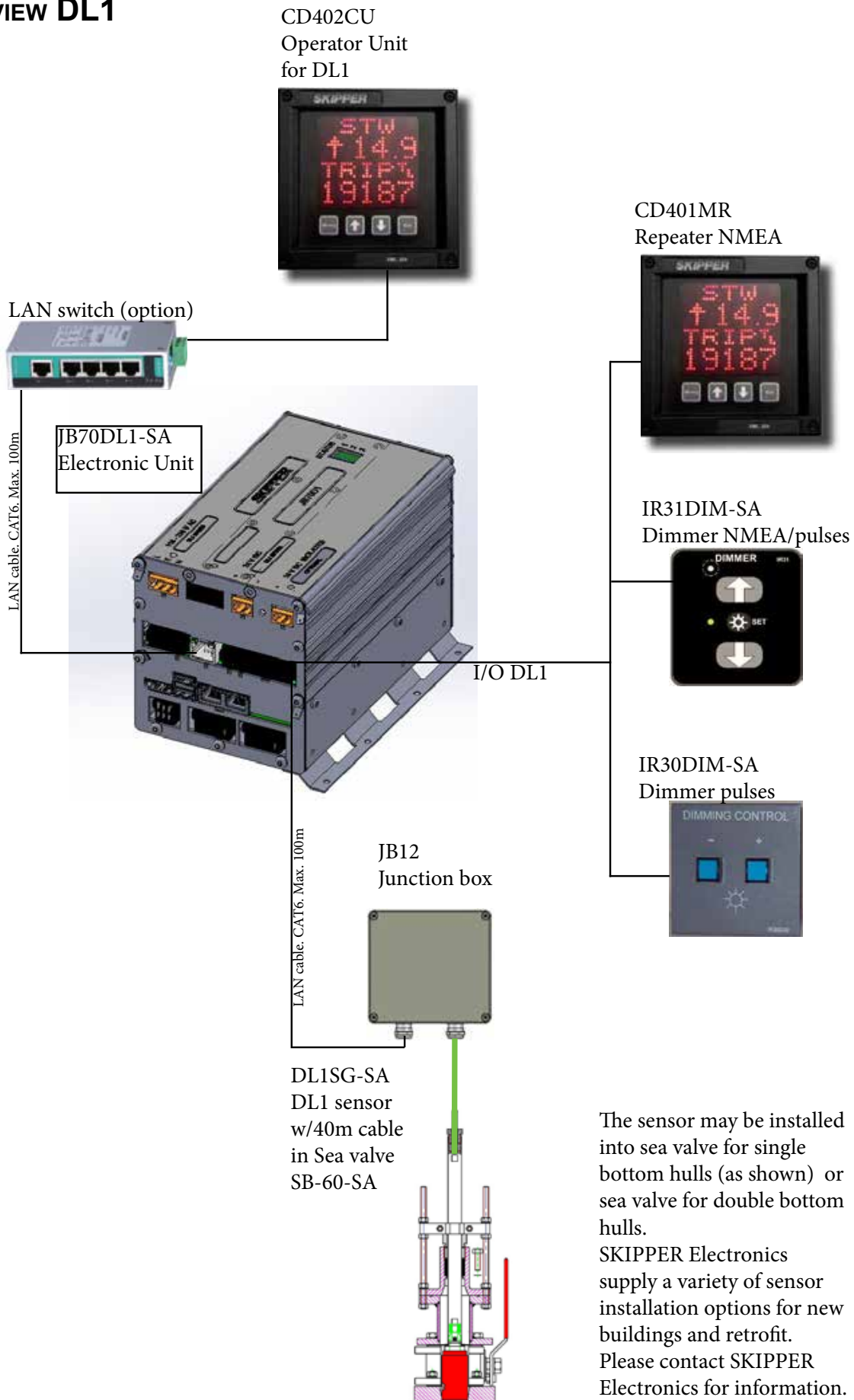
The system requires no external inputs, however adding inputs from other navigational systems enhances the functionality and allows comprehensive quality control of the data.

The system comprises of 3 units;

1. **The control unit** – The system requires a small control unit (CD402CU-XX) to display and set up the required parameters. All setup parameters are also available by connecting to the electronic units web page via a LAN cable.
2. **The electronic unit** – This unit (JB70D1-XX) comprises of a processor/IO board and a power supply. It is packaged in a compact single euro cabinet. This units electronics enable the user to interface to both modern and older navigation systems with all the expected connectivity. The unit has a built-in web server, allowing the system to be fully integrated into existing navigation systems (extra approvals may apply).
3. **The sensor** – The sensor (DL1SXX-XX) contains 2 acoustic elements and a fully programmable transceiver unit, allowing the system to adapt itself to the conditions and requirements. In addition, the sensor contains a temperature sensor for internal compensation and quality control.
4. The sensor is installed into a sea valve or tank welded into the hull.



# OVERVIEW DL1



The sensor may be installed into sea valve for single bottom hulls (as shown) or sea valve for double bottom hulls. SKIPPER Electronics supply a variety of sensor installation options for new buildings and retrofit. Please contact SKIPPER Electronics for information.

## CONNECTORS SUPPLIED WITH JB70D1



ZZN-01126 Relief Housing,  
3 pole snap-on.  
WAGO: 232-633



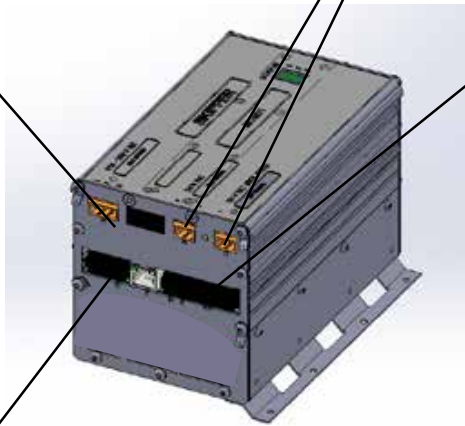
ZZN-01124 Plug, Female 2  
pole, 231-302\_032-000



ZZN-01125 Plug, Female 3  
pole, 231-303 026



ZZN-01121 Connector, Fe-  
male w ejectors 12x2 pole, black  
WAGO 713-1112/037-000



ZZN-01122 Strain relief  
plate, 12x2 pole, width 39 mm,  
713-128



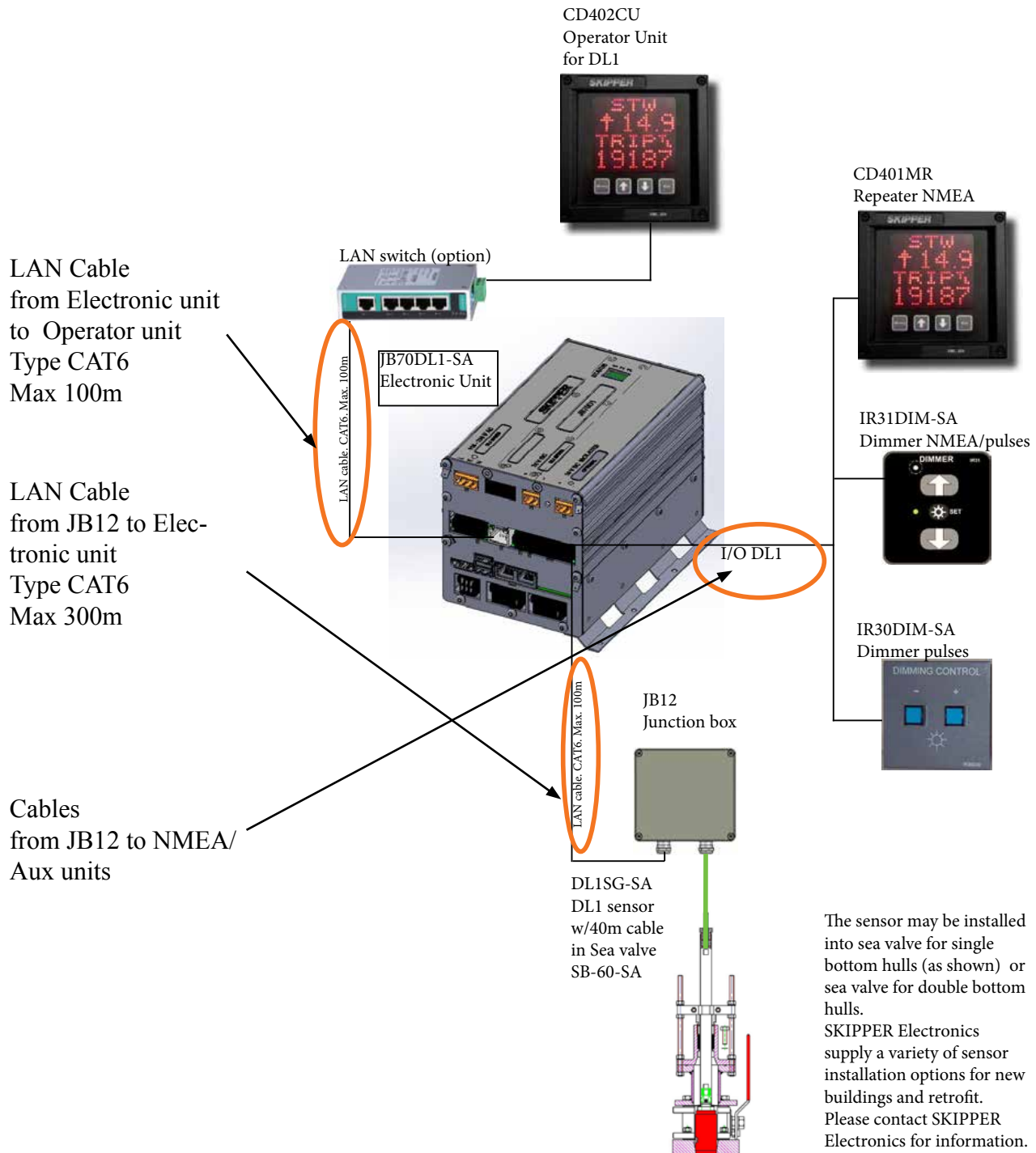
ZZN-01120 Connector Fe-  
male w ejectors 6x2 pole, black  
WAGO 713-1106/037-000



ZZN-01123 Strain relief  
plate, 6x2 pole, width 11 mm  
WAGO 713-126



**ITEMS SUPPLIED LOCALLY**



**Note:** The intermediate tube is yard supply.

**WHAT TO DO**

Before receiving the system, some time must be taken finding the best sensor location, a suitable mounting fixture and wiring design of the system on the vessel. The manufacturer can give advice if required.

# CHAPTER 1: HARDWARE MOUNTING

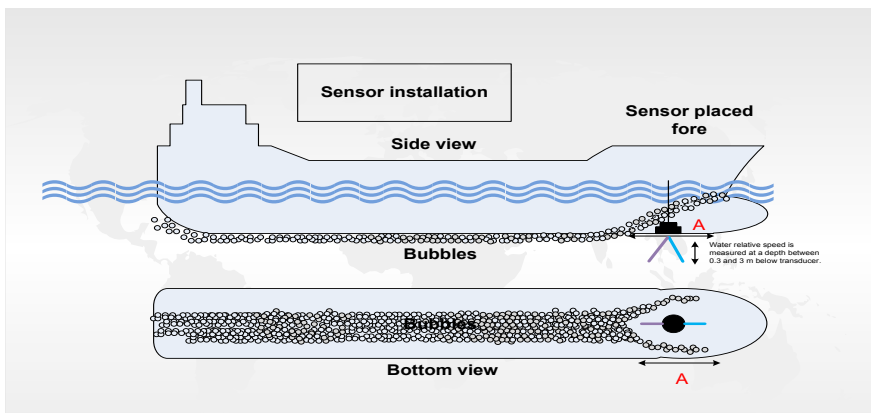
## PLACEMENT OF THE SPEED LOG SENSOR AND BOTTOM INSTALLATION

When placing the speed log sensor, consider the following moments:

- The DL1 doppler sensor measure speed of water in a distance 2-8m away from sensor. 2 acoustic signals, one pointing 30deg forward and the other pointing 30 deg aft.
- The sensor is installed into a sea valve or tank welded into the hull.
- It is necessary to select a part of the hull that is submerged and free from turbulence and aeration under all load and speed conditions, and to avoid positions where air is trapped in heavy weather.

The generally best placement on larger vessels is in the front region of the vessel just behind the bulbous bow (see area A on fig ). This area is generally designed such that the bubbles are pushed to either side of the bulb, leaving a clear area under the bulb and just behind.

- Do not mount transducers aft of bow thruster outlets, or aft of other hull installations (such as outlets, vents or other protruding details) that may create aeration or turbulence.
- Welding seams in this area should be smoothed and rounded off in order not to create turbulence or aeration and maintain a laminar waterflow at all speed ranges of the vessel.
- Select an area that is acoustically quiet. The system operates at frequencies between 700 kHz and 740 kHz.
- If the bottom is sloped a housing (blister) should be constructed. It is recommended to allow a flat area of at least 30 cm in front and behind of the sensor and form the bed as a tear drop.



0.5  
Figure showing placement of a sensor with the individual beams pointing fore and aft.

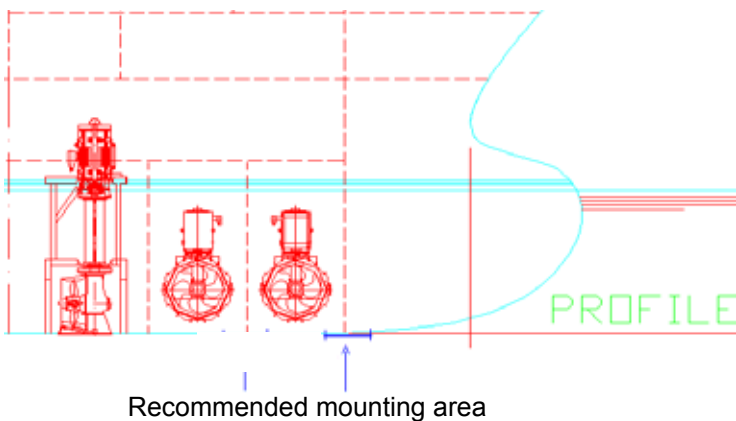


Figure showing the generally best sensor placement in the front region.

A sea valve is highly recommended over a tank installation, as it is possible to service the sensor (clean or replace) without docking the vessel. Economically, a sea valve is similar in price to a tank installation.

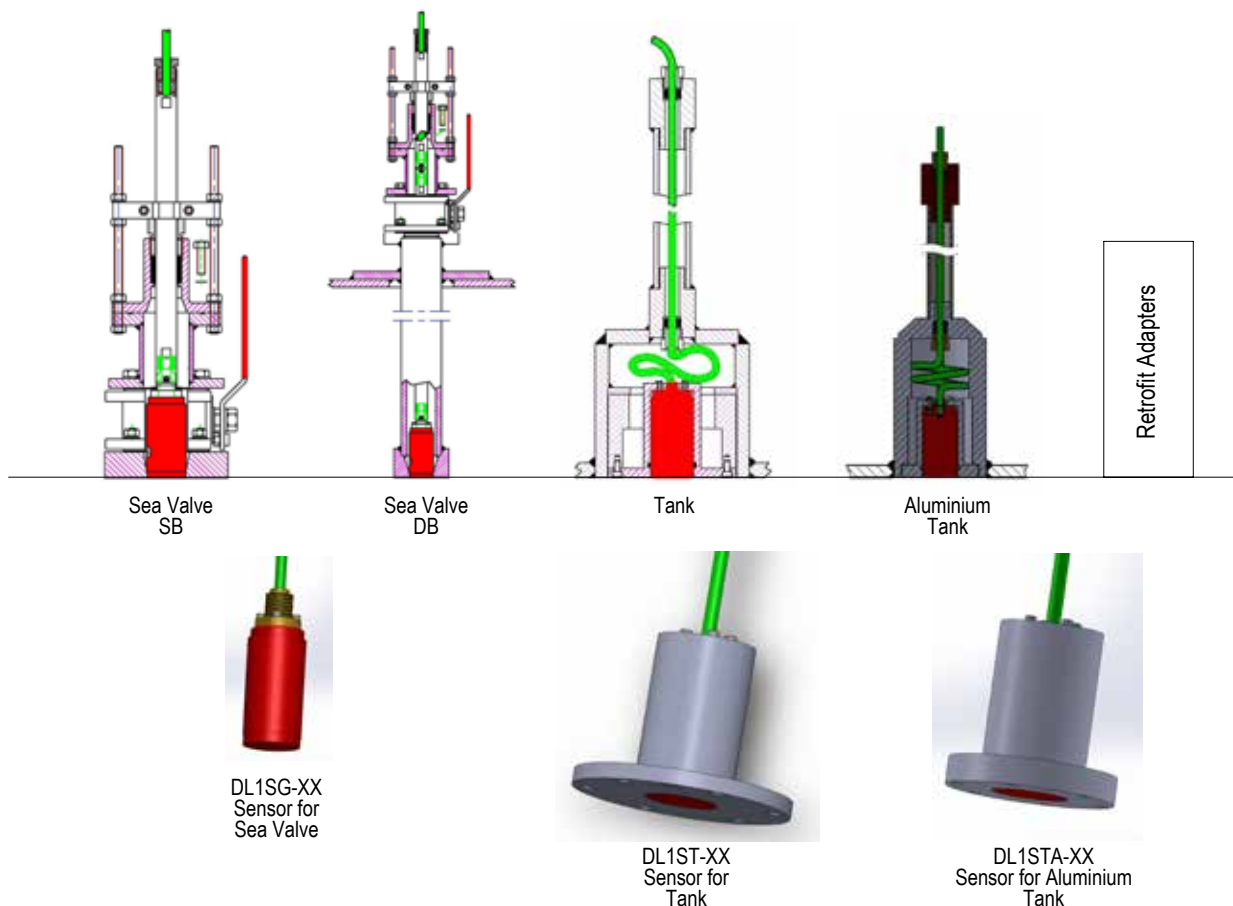
The best place for sensor installation is in a dry and accessible area like bow thruster room, just in front of the fore bow thruster, as deep as possible on the hull.

Even though sensor is approved to be installed in wet areas like ballast tank it is not recommended. If installed in a wet area special care to maintenance and maintenance access should be taken. A dry void space is recommended. A junction box for sensor cable should be mounted close to sensor allowing sensor change.

The sensor cable (green) is waterproof and carries digital signals to and from the sensor and power to the sensor. It must pass through the outer hull using a double water seal. This is included in the bronze tube in sea valves, or in the tank and stuffing tube. The cable is 11 mm in outer diameter with a bending radius of 25 mm. The cable can be cut if required.

Please refer to separate manuals for bottom parts.

Manuals are available from the SKIPPER web site [www.skipper.no](http://www.skipper.no)

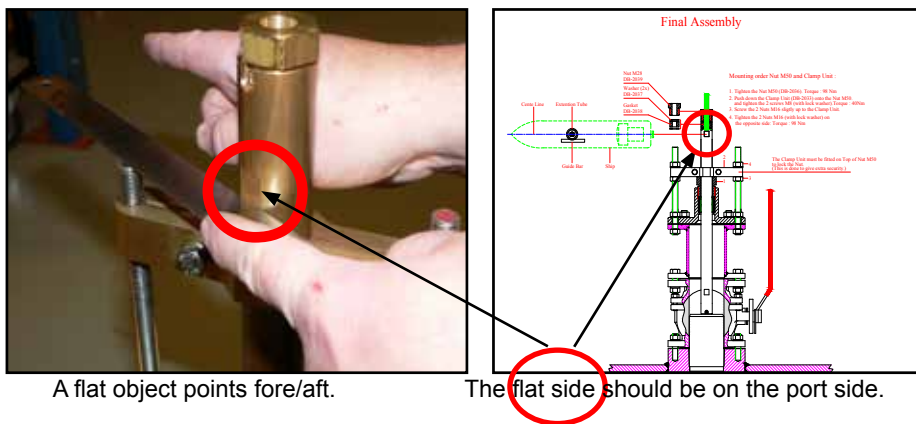


## SENSOR ORIENTATION

Tank mountings have an orientation (an arrow that must point forward) see next page. **Single axis speed logs do not have the possibility to correct heading error electronically and must therefore be mounted in line with the hull (within 2 degrees).**

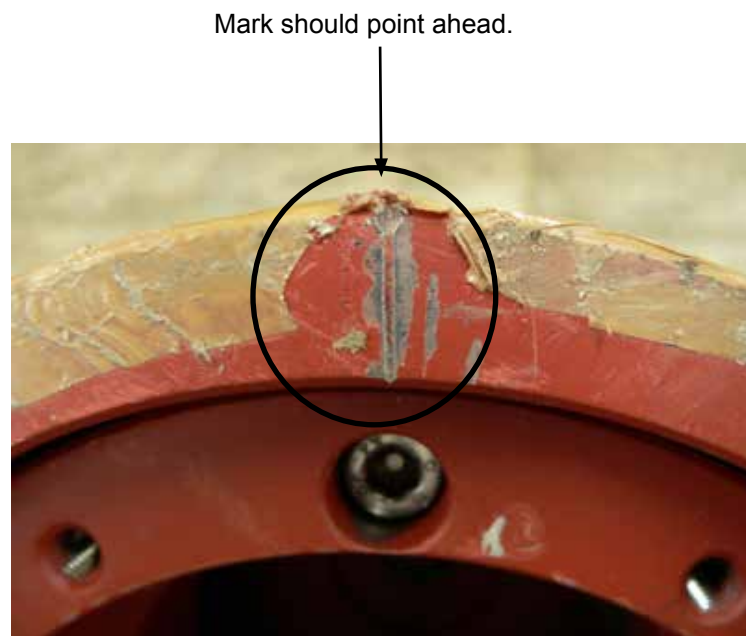
### Orientation in Sea Valve

The sensor is typically mounted after the vessel is in water. Care must be taken that the ahead mark on the bottom installation is correct (seen from the inside by the flat edge being on port side).



### Orientation in Tank

When welding tank to hull care must be taken that the ahead mark on the bottom installation is correct. It is not possible to adjust orientation after vessel is afloat.



**DOCUMENTATION OF INSTALLATION.**

Before vessel is launched from dry-dock it is important to make documentation of hull installation. By providing the pictures in below registration card it may help us understand how the bottom equipment is installed. It is very expensive and time consuming to provide these pictures after vessel is launched.

This document may also be downloaded from the SKIPPER web page

A copy of the document with pictures should be sent to [warranty@skipper.no](mailto:warranty@skipper.no)



*Installation test procedure  
Warranty registration card*

**Speed Log**

Consist of:	Part number	Serial number(s)
Display unit:		
Transceiver/Electronic unit:		
Sensor:		
Bottom parts:		
Repeater(s)		

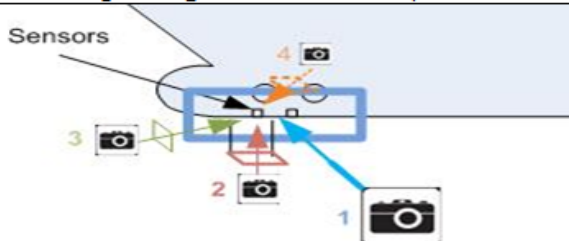
<b>Access to sensor:</b>	(Through cofferdam, ballast tank, fore peak tank, dry compartment, etc.	
--------------------------	---	--

<b>Name of vessel:</b>		<b>SKIPPER registration no:</b>	
------------------------	--	---------------------------------	--

Skipper registration no. is the number you get in autoreply by sending this completed form to [warranty@skipper.no](mailto:warranty@skipper.no)

<b>Owner name:</b>	
<b>Owner address:</b>	

**Before placing vessel in water (Estimated duration 0,5 hours):**



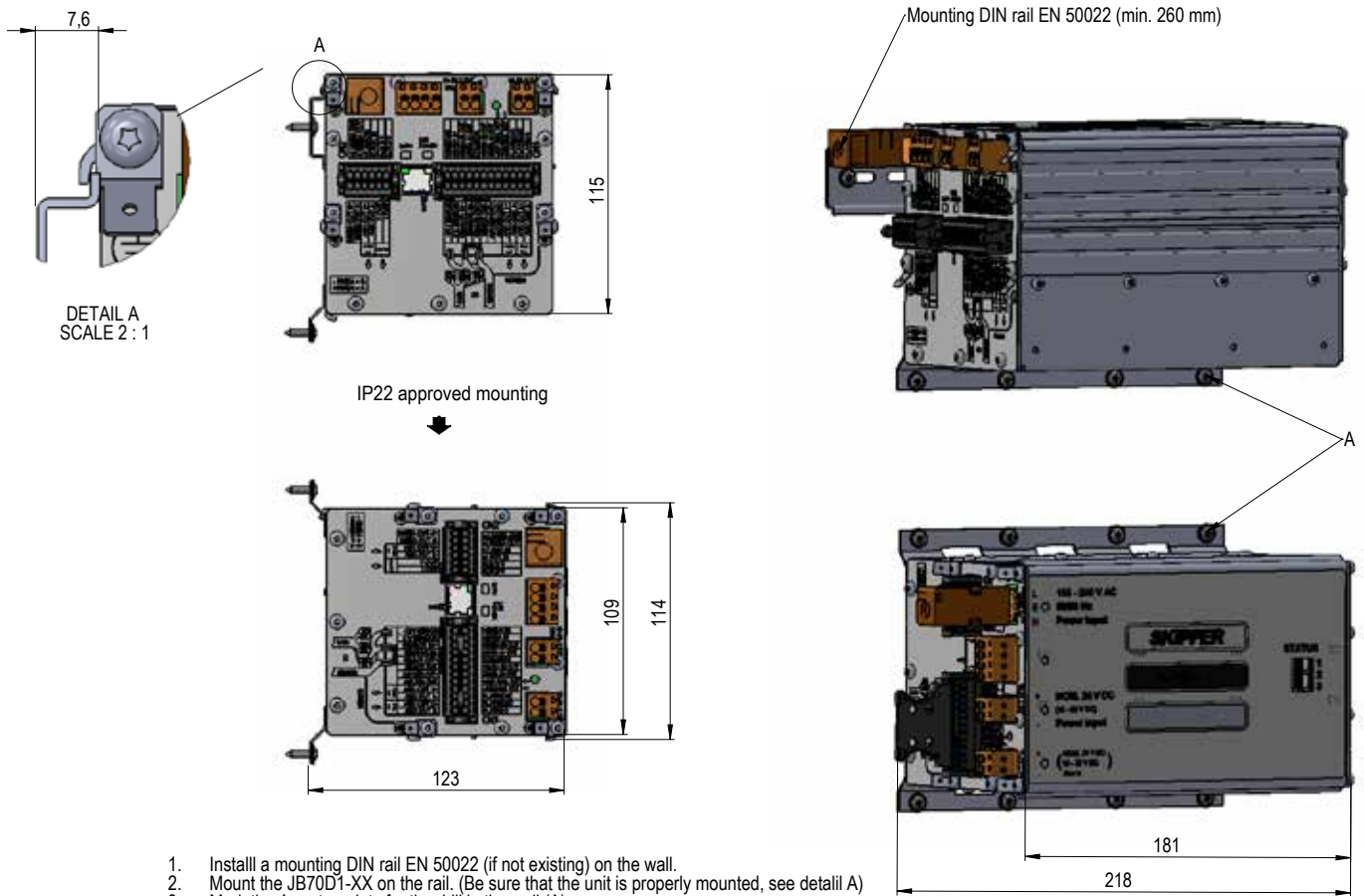
<p>1 Document positioning of the bottom</p> <p style="text-align: center;"></p>	<p>2 Document grinding of welding seams</p> <p style="text-align: center;"></p>
<p>3 position from forward</p> <p style="text-align: center;"></p>	<p>4 Document inside mounting of bottom equipment (show tubing and tank or sea valve)</p> <p style="text-align: center;"></p>
<p>- Check area around sensor is smooth, and no tape or paint on sensor.</p>	

## PLACEMENT OF THE ELECTRONIC UNIT (JB70D1-XX)

All parts of the system are connected to the electronic unit.  
Power, Control unit, Sensor, all I/O signals (alarm, NMEA,puls out etc)

Access to Electronic unit only needed for service.

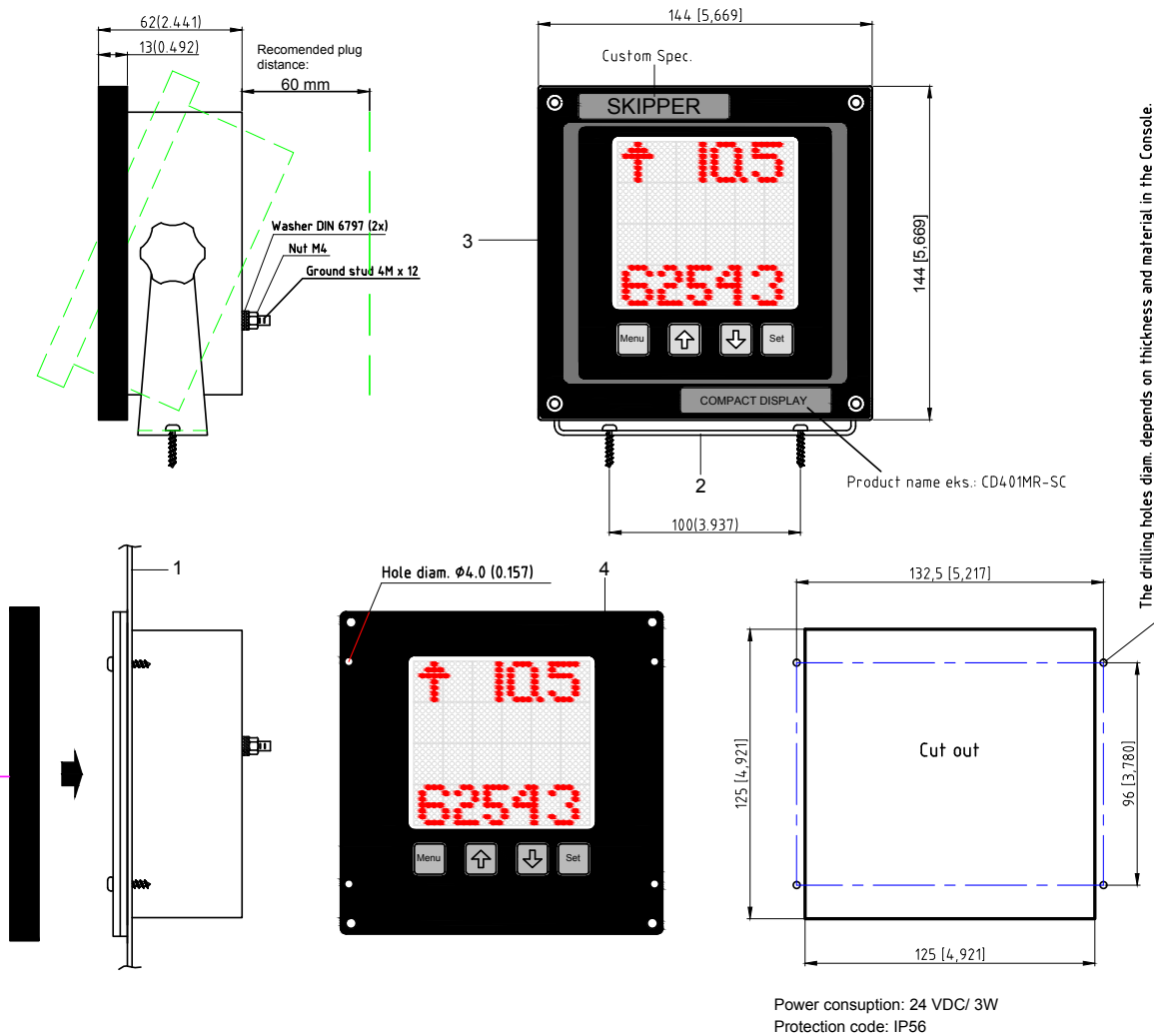
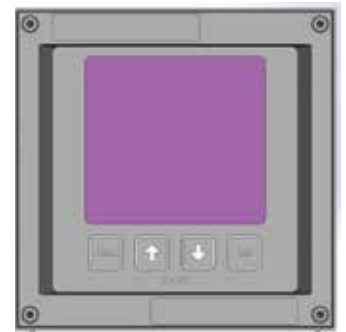
Placement is typically in or near the bridge where the interfaced systems are available, but no nearer than 0.3 m to the GYRO heading sensor.  
ase, it can be placed on, for example, the navigation table.



1. Install a mounting DIN rail EN 50022 (if not existing) on the wall.
2. Mount the JB70D1-XX on the rail. (Be sure that the unit is properly mounted, see detail A)
3. Mark the 4 centerpoints for the drill in the wall (A).
- NB! The drilling holes diam. depends on thickness and material of the wall.
4. Use self tapping screws ST3,5 DIN 7981-C pozidrive (A). (The screw length depends on the wall thickness).

## PLACEMENT OF THE CONTROL UNIT (CD402CU-XX)

If required, the control unit is placed on the bridge. Some standards require some operations of the unit to be available from 'standing position', and in this case the unit must be near the steering position. However, it is also possible to control some of these settings from multi-repeaters with 2-way communication (ex: CD401MR-SB) In which case, the Control unit can be placed on, for example, the navigation table.



## PLACEMENT OF REPEATERS CD401MR-XX

Repeaters are typically installed on the overhead console and/or the bridge wings. These can be routed using NMEA signals. These require a local +24 V DC supply. Same dimensions as CD402.

# CHAPTER 2: WIRING

## ELECTRONIC UNIT

All parts of the system are connected to the electronic unit. The electronic unit has pluggable spring loaded connectors, as well as an RJ45 LAN interface. NMEA (4 output, 1 input ports), pulse, AUX (control signals) and optional analogue output signals can be connected.

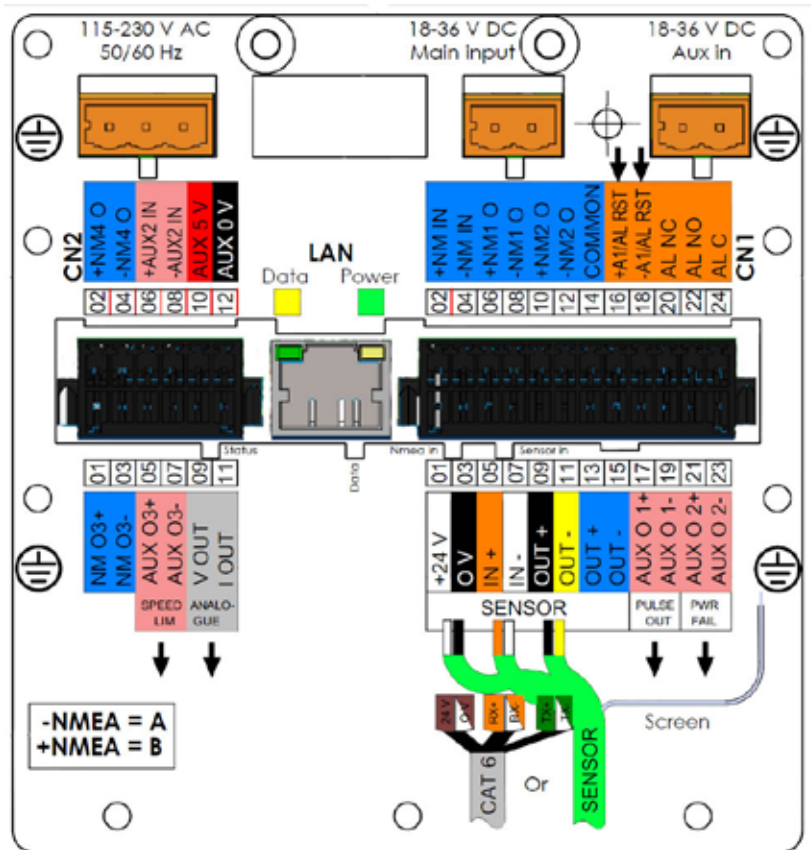
The electronic unit requires either 24 V DC or 115 - 230 V AC (50 - 60 Hz), max 60 W.

Both can be connected simultaneously. If required, a separate AUX 24 V supply can also be connected.

The supplies are not internally isolated and ground will be connected to chassis at a single point (The screw between the DC connectors),

Cables to and from the cabinet should be grounded to the grounding points on the chasis using a faston spade (type AMP - 140814-1 - TAB, FASTON, Example mating part 5-160447-5 - CRIMP RECEPTACLE)

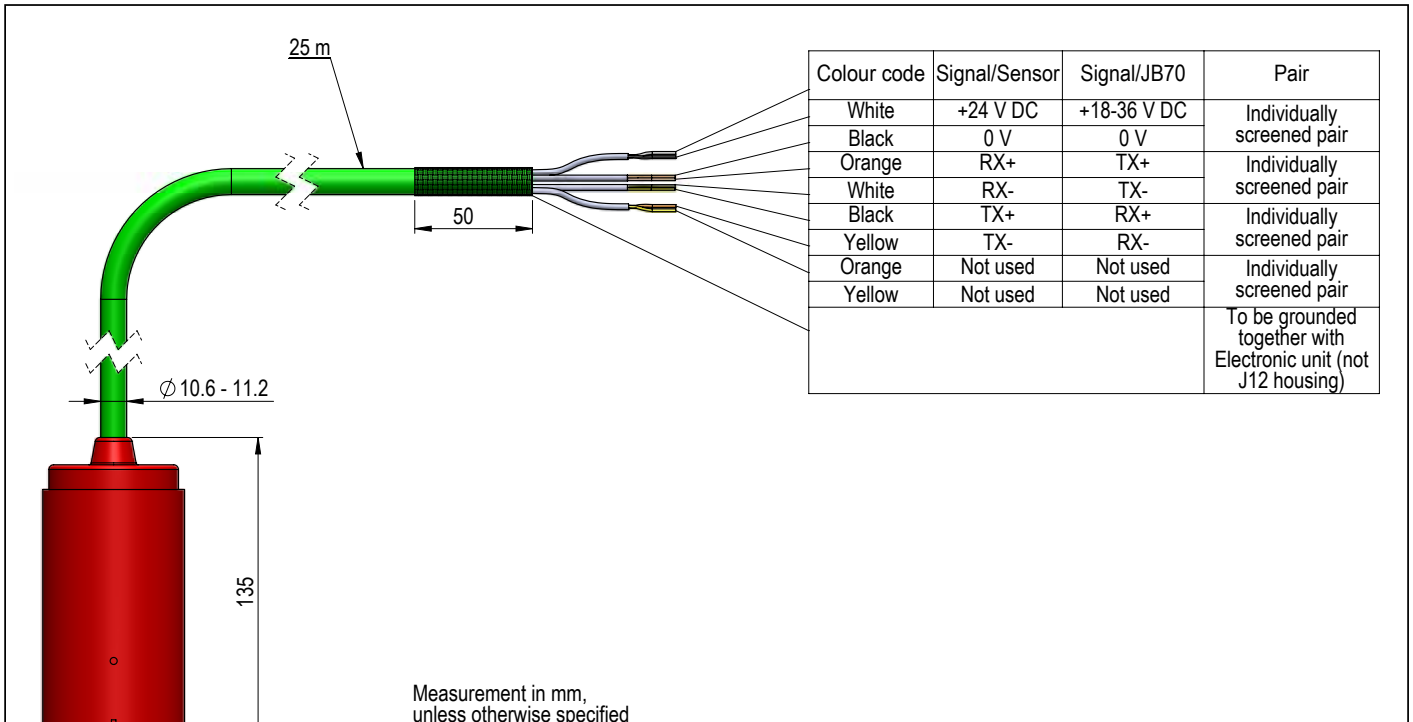
The JB70D1-XX does not contain a physical ON/OFF switch (only software in sleep mode) and should be connected to a circuit breaker, or power cable should be unplugged for removal of power.



## CONNECTING SENSOR TO ELECTRONIC UNIT

The sensor is provided with a 40 m cable. This can be cut, or extended with a screened CAT6 standard, or better, cable. The individual internal wires can be spliced or connected using a JB12 junction box. Signals in these cables are digital differential (RS-422) signals and also power (+24 V DC). Power is the limiting factor in these cables and is tested up to 400 m. For longer distances, a separate +24 V DC power supply may be needed at the JB12 junction box.





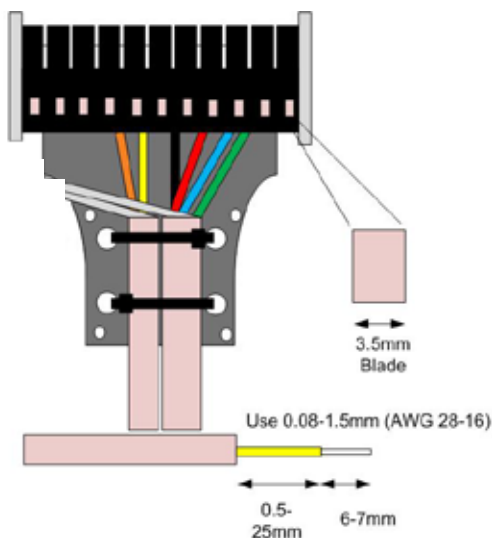
**SENSOR CABLE PLUG**

Cables should be connected as shown, leaving approximately 3 cm of tail. They should be stripped with 6-7 mm of metal showing and these should be connected as in the diagram above. A small screwdriver with blade size approx 3.5 mm, can be used, although WAGO part no 210-719 is ideal for this use.

in a ground stud on the edge of the cabinet. The outer insulation should be cable tied to the plastic handle of the connector, and securely anchored nearby. The plugs, when refitted, must be installed such that their clips are fully in the up position.

If yard cables are too thick or heavy to clamp, anchor the outer insulation nearby, and feed the inner cables to the connector.

If the connector is missing, lost or broken, replacements are available from Skipper (PN ZZN-01121) or Wago (part no. 713-1112/037-000)



**GROUNDING**

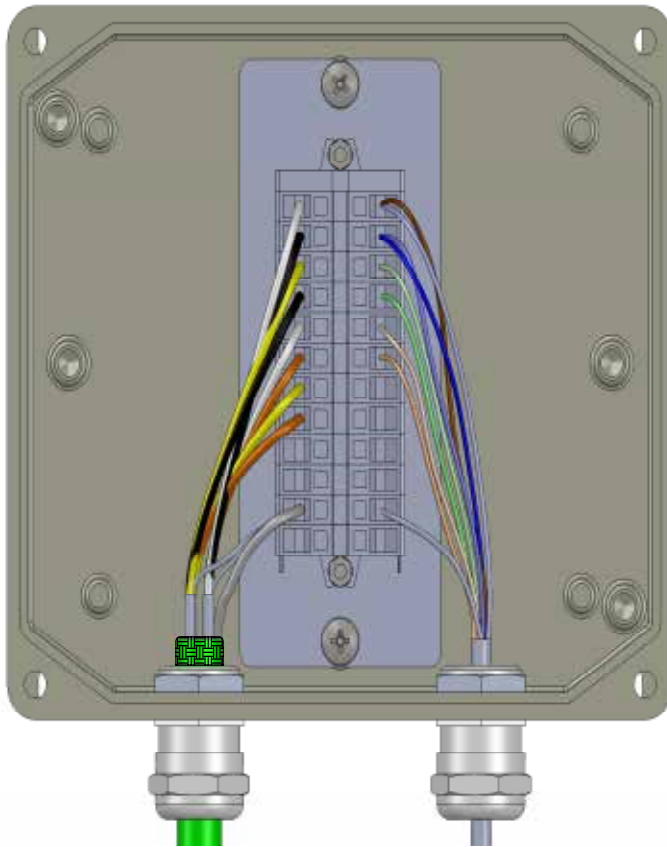
A general rule is that cable shields should be grounded in one end of the cable only. The DL1 sensor contains a grounding point internally and this is connected to the outer shield of the cable. This cable does not need to be grounded at the dry end.

WAGO part no 210-719



THE JUNCTION BOX JB12, AND CABLE EXTENSIONS

Sensor cable				Extension cable	
Colour	Description (seen from JB70XX)	Screen		Colour (for CAT6)	
White	+18 - 36 V DC	Individually screened pair	Common screen	Brown	Pair
Black	0 V			White(Brown)	
Orange	RX+	Individually screened pair		Orange	Pair
White	RX-			White(Orange)	
Black	TX+	Individually screened pair		Green	Pair
Yellow	TX-			White(Green)	
Orange	AUX+	Individually screened pair		N/A	Pair
Yellow	AUX-			N/A	
			All individual screens to be grounded together and passed into the outer screen of the CAT5e cable	Outer shield	



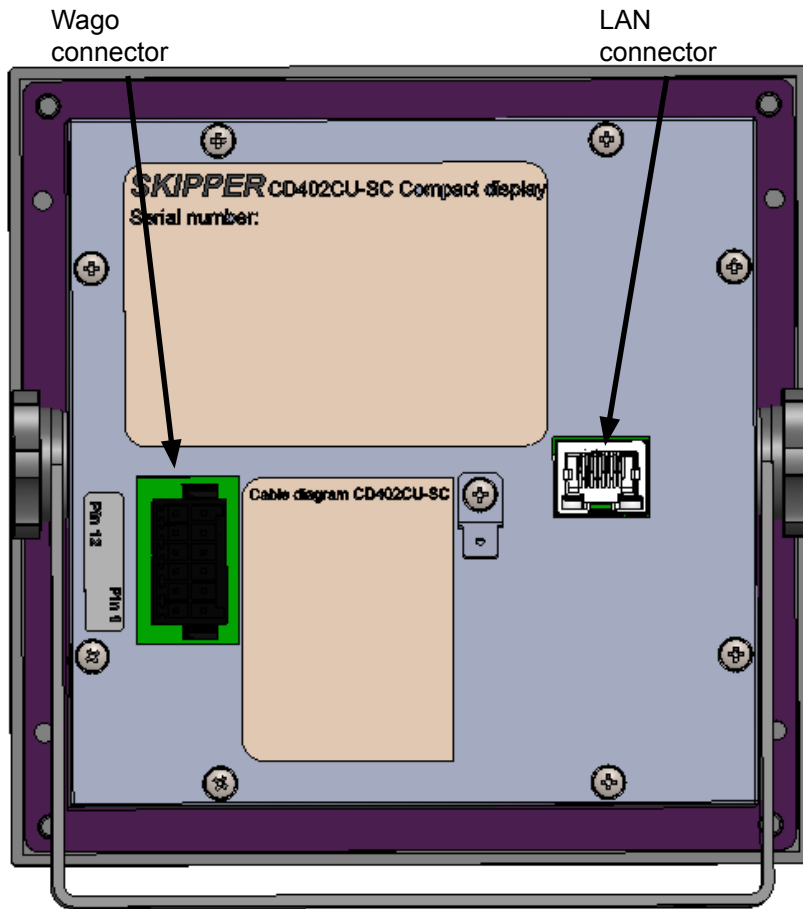
Connect the sensor cable to the Extension cable as shown. All grounds are collected together and connected to the outer ground of the Extension cable. The grounds should **not** be connected to a local ground. If there is no room for the JB12 housing, the cables can be carefully spliced together. Both cables can be cut.

Cable type	AWG/ mm2	Max length at 24V (21V)	Loop ohms	Measured VDC at JB12
CAT6	23/0.258	250 (150)	35 (21)	

Any screened 3 or 4 twisted pair cable can be used as long as the loop resistance (measured by twisting the pair together at one end and measuring the resistance) is less than 35 ohms if the Sensor power supply output is 24V, (21 ohms @ 21V; 9 ohms @ 18V ). \*By using 2 pairs of the cable in parallel for the power pair, the resistance is halved and the max length is doubled.)

### CD402 CONTROL UNIT TO ELECTRONIC UNIT

The CD402XX-SC is powered by local 24VDC on pin 1 and 2 on Wago connector. Connection to Electronic with LAN connector directly or via LAN switch.

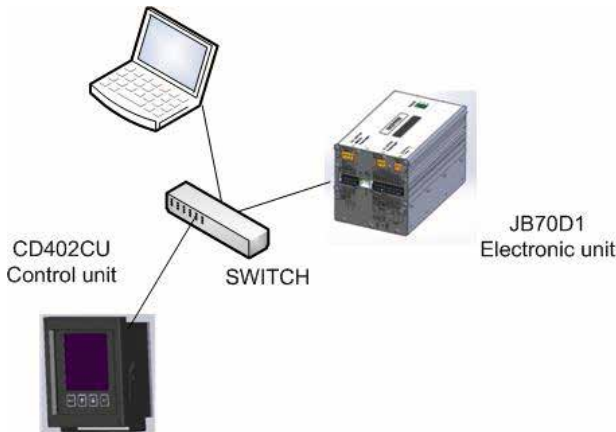


#### CABLE DIAGRAM CD402XX-SC

Signals	Pin number on plugable WAGO back connector
+24 V	1
0 V	2
NMEA IN A	3
NMEA IN B	4
DIM UP A	5
DIM UP B	6
DIM DWN A	7
DIM DWN B	8
NMEA2 IN A *	9
NMEA2 IN B *	10
NMEA1 OUT A	11
NMEA1 OUT B	12

Note: NMEA in/out is not in use on LAN set up.

See appendix for alternative set up.



#### Alternativ 1

Connect CD402 Control unit to JB70D1 via LAN switch



#### Alternative 2

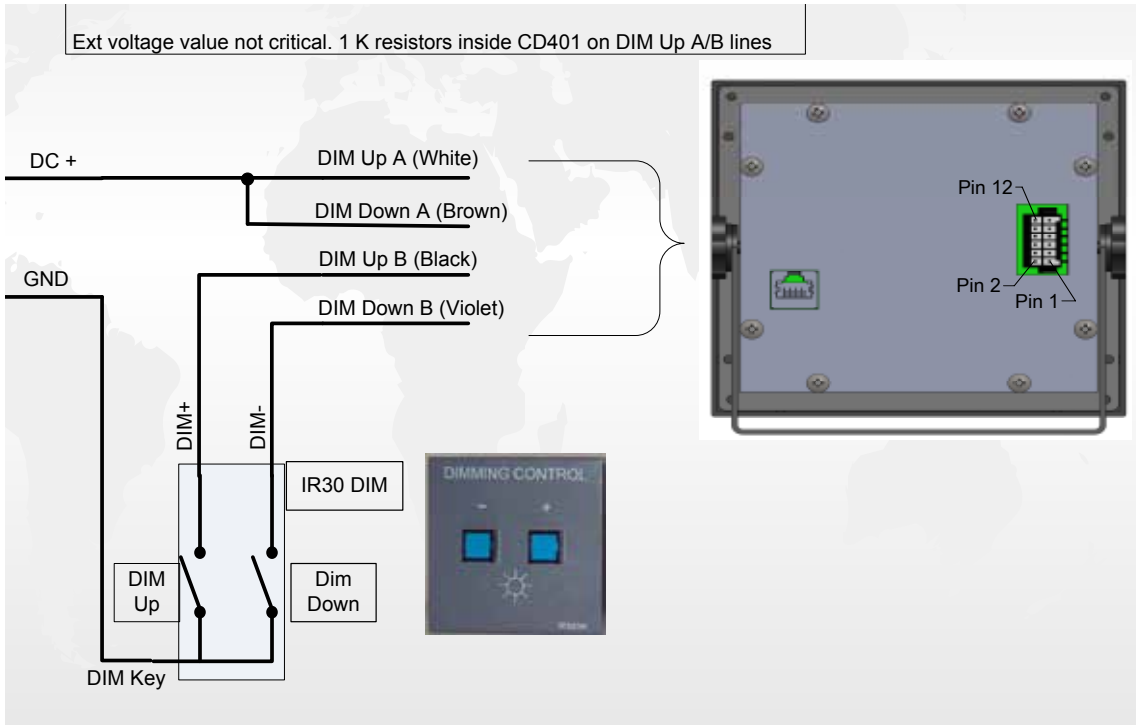
Connect CD402 Control unit to JB70D1 directly.

## CONNECTING DIMMER UNITS TO CD402

### IR30 DIM

This is a simple unit with make or break double push buttons, used for pulse dimming. Holding down the buttons will ramp the dimming. An external DC voltage is required.

The IR30 dimmer may be connected directly to CD402 or to AUX in of JB70D1.



### IR31 DIM

The CD402 may be dimmed by NMEA DDC commands. The DDC command is input to the NMEA input of JB70D1 Electronic unit.

The IR31 taking up to 2 NMEA lines and multiplexing onto it a DDC or Proprietary message each time a button is pushed

Auto mode with internal or external light sensor the unit can be made to send messages when the correct light conditions are reached (User adjustable)

Up and Down relays also allow older repeaters to be adjusted manually or automatically.



## IEC61162-1 NMEA CONNECTION

The JB70D1-XX system has 1 NMEA isolated input and 4 output ports driven separately from a single com port, each capable of delivering 20mA. These are marked in blue and can be programmed to give out a number of messages. In addition, the LAN port can be used to provide the same formats using the IEC61162-450 standard. However, it should be noted that this port will normally also send out proprietry messages with information to the CD401CU-XX control unit. Approved messages are sent at a 1 second interval, and are marked with the 'VD' identifier. Data is sent at 4800 baud, 8 data bits, 1 stop bit. The inputs require 2ma when the voltage is limited to 2V. Generally the inputs use 2.5 mA if available.

NMEA In:

CN1 pin 2 and 4

NMEA Out1:

CN1 pin 6 and 8

NMEA Out2

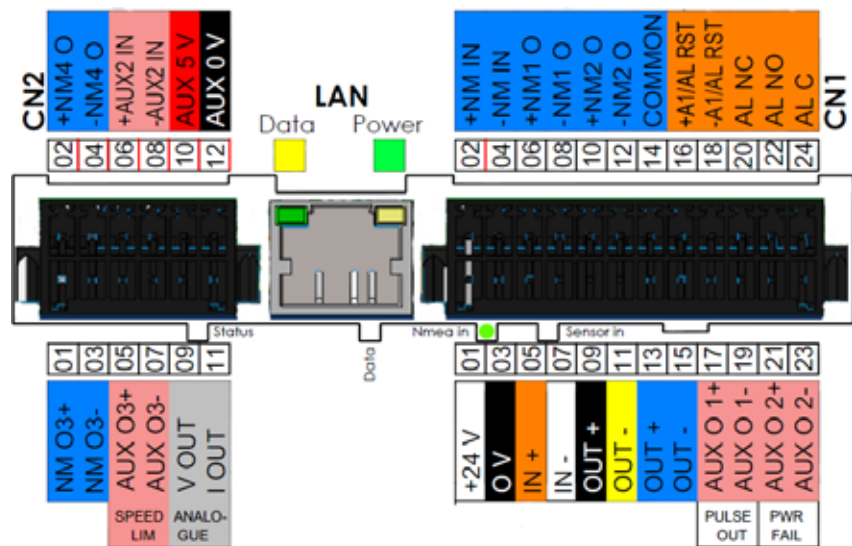
CN1 pin 10 and 12

NMEA Out3

CN2 pin 1 and 3

NMEA Out 4

CN2 pin 2 and 4

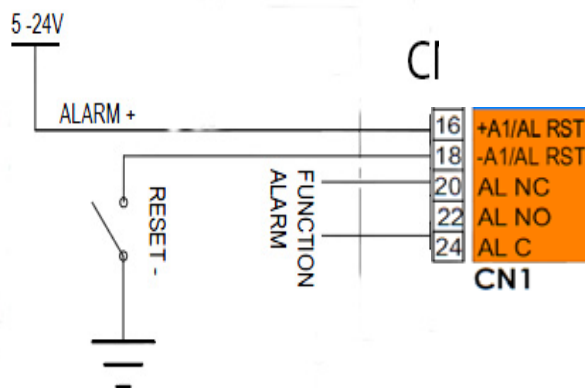


## ALARM CONNECTION

The system has a combined Function and power failure alarm relay. By connecting to the NC and common points the alarm will give a short circuit. The alarm output will change state on power up or power down, indicating a power failure, or when one of the other alarms is activated. If the power failure alarm is to be monitored separately one of the Aux output channels see “Auxiliary inputs and outputs.” on page <?>, can be defined to this purpose (default Aux 2 out)

The Alarm can be reset using the aux inputs (default Aux 1)

Alternatively, all of these functions can be monitored on the NMEA channels. Power failure is monitored by the VDALR message disappearing totally



**AUXILIARY INPUT AND OUTPUTS.**

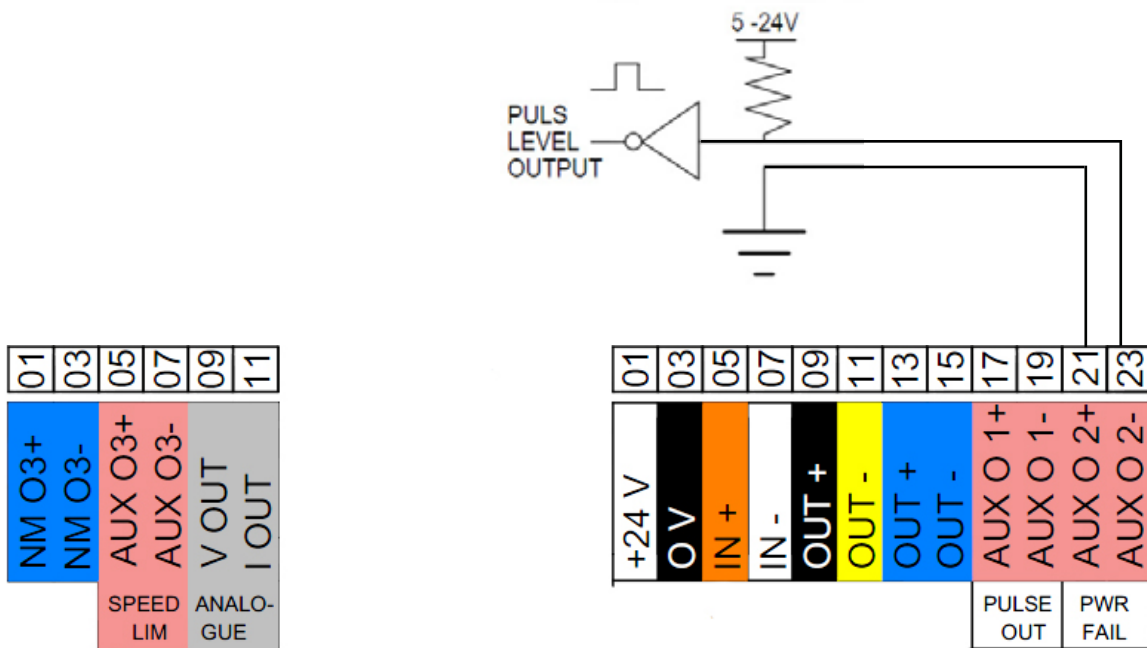
Auxiliary input and outputs are electrically isolated and require a small voltage on the input to work. The labelling of the system is set up for the most common wiring configuration. All the pulse inputs and outputs are programmable and can be configured in the web menus to perform a number of tasks as shown below.

Aux in (marked ALRM RST IN on CN1 pin 16 and 18) can be switched to the following options:

- Alarm reset in (default): acknowledge an alarm
- Dimming Up
- Dimming Down
- Forward reverse (for 2 directional systems)

There are 3 Aux Outputs:

- Pulse out (default Aux Out1)
- Power failure alarm (default Aux Out2)
- Speed warning, min/max range set by the user (default Aux Out3)
- Alarm acknowledge output (default)
- Fitness alarm
- Silent (special non wheelmark option)



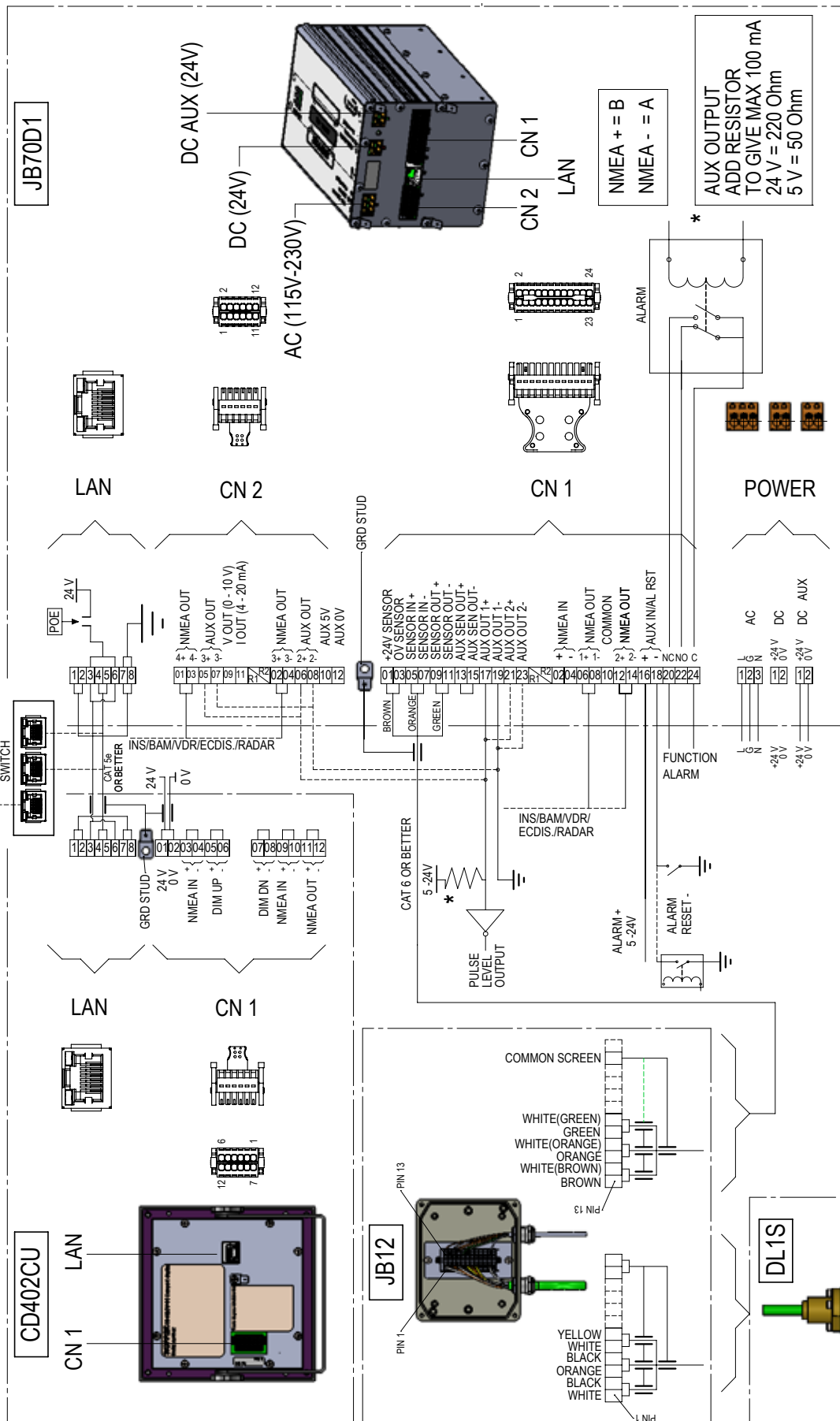
**ANALOG OUTPUT**

The DL1-Multi has outputs for analog speed on connector CN2.

I OUT for 4-20mA on CN2 pin 11

V OUT for 0-10V on CN2 pin 09.

These use a common ground and provide voltage. The current output will be max 24V.

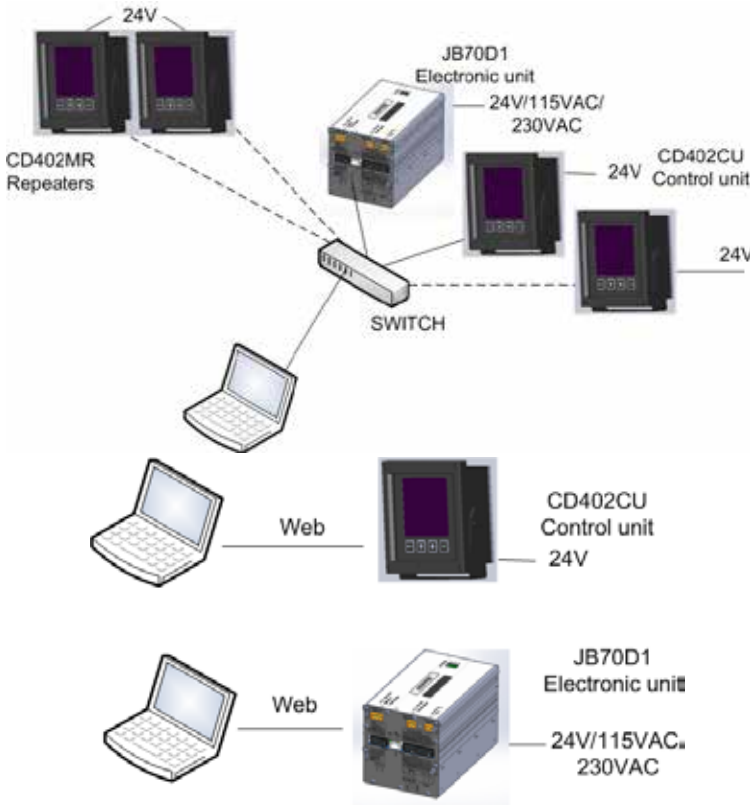


CN	xx-xxx-xx date	Checked by XXX	Approved by - date XXX	Material XXX
Designed by - date A.Mattre 2013.09.18				
<b>SKIPPER</b> Electronics AS				
Name Wiring diagram for DL1 Multi				
Dwg. no. CD-2036				
Gen. tolerance ISO 7:68m				
Scale XX				
Edition date 2013.12.11				

1	2	3	4
---	---	---	---

# CHAPTER 3: SETUP LAN COMMUNICATION

Both the Control unit and the Electronic unit have unique IP addresses, and system identification numbers. These are adjustable via the web page, but the default values are shown on the serial number labels. If changed it is recommended to make a label with the new address. Startup requires the following steps:



Connect the units together and use SKIPPER service software to find the relevant settings, alternatively address individual units using their IP addresses from a web browser

If no switch is available, connect directly to each unit and use its web page to setup. Multirepeaters can be set up directly from the screen.

Note! If no DHCP server on network then change your PC TCP IP settings to “fixed IP”.  
E

## SETUP USING SKIPPER SERVICE SOFTWARE

For setup of IP addresses, Id and port please use SKIPPER service software. Available as download from:

<http://www.skipper-service.no/skipdoc/data////Software//SkipperServiceSoftware/SetupProjectServiceSoftware.msi>  
Start “Com Setup”



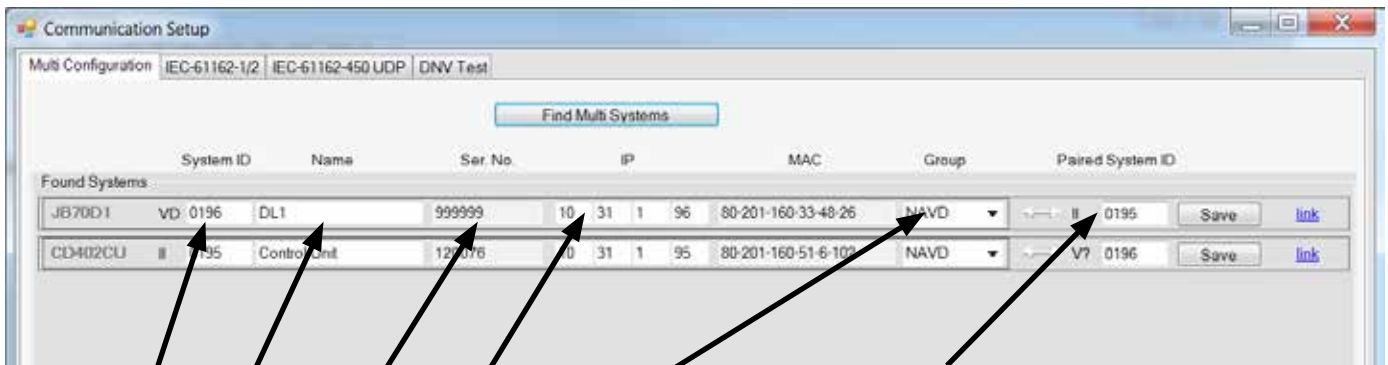


Press “Find multi systems”

The software will search for SKIPPER products and present a list with settings. A table with all the detected system will be generated. and from this table it is possible to configure the units. Each Electronic unit JB70D1-SA must be paired with a control unit (CD402CU-SC) This is done by adding the identification of the JB70D1 unit to the Control units pair field.

If more than one control unit is to be used on a single Electronic unit then the field Pair field on the electronic unit (JB70D1) can be left blank. Otherwise enter the ID for the paired control unit.

Note. All units that are to detect eachother must be in the same Group. this is by default NAVD.



System ID of the unit that this system is to be uniquely connected to (CD402CU must have.)

Group the system belongs to  
IP address for web page

Unit serial number (fixed)

Name for the unit (max 20 characters)

System ID: The unique (SFI) ID of this unit

## LAN SETUP

Turn on the electronic unit and control unit (if attached). The electronic unit will attempt to self-connect, and go to the system setup screen. If the control unit is not available or does not work, (possibly IP clash) it will show a single 'ERROR' on screen, in this case connect a LAN cable to a RJ45 connector.

Go to web page (default IP address 172.16.1.104 for JB70D1 or 172.16.1.103 for CD402CU, or to the labelled IP address. From here you have access to the system setup page. If you can not make contact by the above methods, use the SKIPPER service application (available from the web site, select the correct interface unit, and follow the instructions.

In accordance with the IEC61162-450 LAN interface standard, the System Unique identifier (default VD01XX where XX is the serial number) and Group (default NAVD) can be adjusted. The LAN works at 100BaseT speeds. A typical payload will be 2-7 kB/s

UdPbC0\s:VD0103,n:23\*2A\$VDVBW,10.1,,A,,V,,V,,C\*58<CR><LF>

CD401CU shows error if it does not detect the JB70D1-XX unit



# CHAPTER 4: WEB SETUP OF SPEEDLOG

## CD402CU COMMUNICATION WITH JB70DL

Setup can be performed from web browser (preferably chrome or mozilla) available by connecting a PC to the LAN port using a tLAN cable.

WEB browser for CD402 is just for setup of communication to the JB70D1 unit. All other parameters are on JB70 web browser or directly on CD402.

In adress line type IP adress of CD402CU unit.

Select "system configuration".

The screenshot shows a web browser window with two tabs: 10.31.1.20 and 10.31.1.12. The address bar shows 10.31.1.20. The page header features the SKIPPER logo on the left and "CD402 CU Control unit" on the right. A navigation menu includes links for Home, System Configuration, Screen Configuration, Diagnostics, Maintenance, and Help. The main content area is titled "System Configuration" and contains a table of settings:

Serial No:		999999
Network connection:	IP address:	010 . 031 . 001 . 020
	Subnet mask:	255 . 255 . 000 . 000
	IP address of default router:	010 . 031 . 001 . 001
	MAC Address:	50-c9-a0-33-6-66
Multicast:	System ID (SFI)	II 0204
	Group	NAVD 239.192.0.4
	JB70 ID	VD 0201
CD402 CU connection:	Input and output port: <input type="radio"/> None <input type="radio"/> NMEA <input checked="" type="radio"/> Ethernet (UDP)	Apply Cancel
NMEA baudrate:	NMEA: 4800	Apply Cancel Same baudrate will be set for both input and output.

## JB70DL COMMUNICATION WITH CD402CU

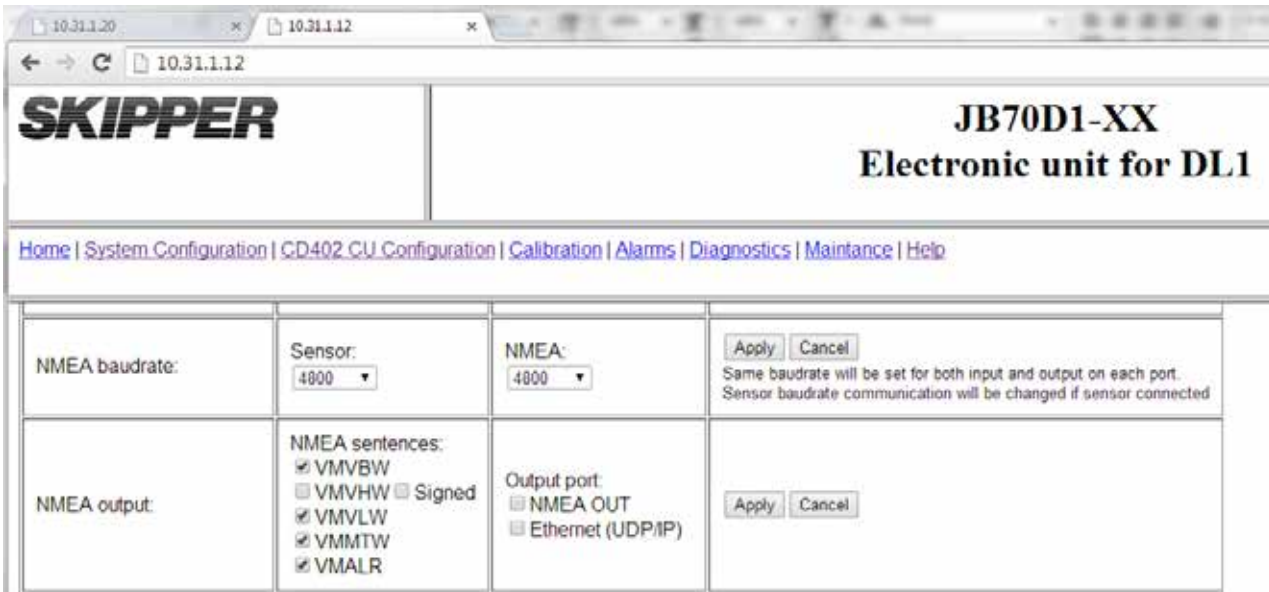
In adress line type IP adress of JB70DL unit.  
Select "system configuration".

The screenshot shows a web browser window with two tabs. The active tab is titled '10.31.1.12'. The browser's address bar shows '10.31.1.12'. The page header features the 'SKIPPER' logo on the left and 'JB70D1-XX Electronic unit for DI' on the right. Below the header is a navigation menu with links: Home, System Configuration, CD402 CU Configuration, Calibration, Alarms, Diagnostics, Maintance, and Help. The main content area is titled 'System Configuration' and contains a table with the following sections:

Serial No:		214001			
Network connection:	IP address:		To change enter password in Maintance page		
	<input type="text" value="010"/>	<input type="text" value="031"/>		<input type="text" value="001"/>	<input type="text" value="012"/>
	Subnet mask:				
	<input type="text" value="255"/>	<input type="text" value="255"/>		<input type="text" value="000"/>	<input type="text" value="000"/>
IP address of default router:					
MAC Address:		50-c9-a0-33-6-65			
Multicast:	System ID (SFI)	<input type="text" value="VD"/>	<input type="text" value="0201"/>		
	Group	<input type="text" value="NAVD"/>	<input type="text" value="239.192.0.4"/>		
	CU ID	<input type="text" value="II"/>	<input type="text" value="0204"/>		
	Alarm Destination ID	<input type="text"/>	<input type="text"/>		
CD402 CU connection:	Input port:	Output port:			
	<input type="radio"/> None <input type="radio"/> NMEA IN <input checked="" type="radio"/> Ethernet (UDP/IP)	<input type="radio"/> None <input type="radio"/> Sensor OUT <input type="radio"/> NMEA OUT <input checked="" type="radio"/> Ethernet (UDP/IP)			
		<input type="button" value="Apply"/>	<input type="button" value="Cancel"/>		

## DL70DL NMEA SETUP

NMEA setup is found under “System configuration”



### NMEA inputs

The following inputs may be used to enhance the DL1:

GPS	Time	GPVZTG, GPZDA, GPGGA	Time taken from these format
TRIP	Trip reset command	\$PSKPRSTT* <hh><CR><LF>	Trip reset from repeaters, etc.
DDC	Display Dimming control	\$DDC,a,xx,a,a*hh <CR><LF>	a is display dimming preset. D = Day time setting K = Dusk setting N = Night time setting O = Backlighting off setting xx is brightness percentage 00 to 99. second a is colour palette.
ACK	Acknowledge alarm	\$ACK,xxx*hh <CR><LF>	xxx is unique alarm number (identifier) at alarm source

### NMEA outputs

VBW	Multiple Speed Commands	\$VDVBW,x.x,,A,,V,,V*hh <CR><LF>	Where x.x is longitudinal speed in knots, y.y is transversal in 2 axis systems speed in knots.
VLW	Distance Travelled through the Water	\$VDVLW,x.x,N,y,N,,N*hh <CR><LF>	x.x is Daily Trip, y.y is total trip in NM
MTW	Temperature	\$VDMTW,x.x,C, *hh<CR><LF>	x.x is temperature in Celsius. All data fields are free format. Values will be presented with sign as needed ( e.g “-“ = Astern, Port)
VHW	Water speed and heading, relative	\$VDVHW,,,,x.x.N,x.x,K *hh<CR><lf>	Resultant speed in knots and km/h.
XDR	Speed direction	\$VDXDR,A,x.x,D,SPDD *hh<CR><LF>	The angular displacement (x.x) is set to 0 in forward direction and 180 in reverse direction.
ALR	Alarm	\$VDALR,hhmmss. ss,xxx,V,A*hh<CR><LF>	hhmmss.ss is time of the alarm condition change (if provided from GPS). xxx is alarm identification number (default 21). See further details in section NMEA ALARM

**DL70DL AUX SETUP**

AUX setup is found under “System configuration”

Auxiliary:		Function:	Buttons	Pulses:	
Aux in 1	Alarm reset	Alarm reset	Apply	Cancel	0
Aux in 2	None	None	Apply	Cancel	0
Aux out 1	Pulse out	Pulse out	Apply	Cancel	0
Aux out 2	Power failure	Power failure	Apply	Cancel	0
Aux out 3	Speed warning	Speed warning	Apply	Cancel	0

Speed warning:  
 0 High speed warning  
 0 Low speed warning  
 Apply Cancel

Aux In 1 is by default set to “Alarm reset”

Aux In options:

Alarm reset

Dim up

Dim down

Reverse (forward heading direction for ferries)

Aux Out options:

Fitness (alarm)

Power failure (alarm)

Alarm acknowledge

Pulse out

Speed warning.

**ALARMS**

The DL1 system is classed as a category B Alarm. It can be remotely acknowledged, if required. It does not have an internal sounder, and must therefore be connected to an external sounder or BAM system. The system has 3 alarm types

Speed High, an alarm that indicates if the vessel exceeds the set speed.

Speed Low, an alarm that indicates if the vessel falls below the set speed. (often indicating loss of steerage)

System Failure: an alarm which will activate if the sensor stops reporting or reports a failure, or if the control unit and Electronic unit loose communication.

In addition the electronic unit can be wired to indicate if the power fails.

**ALARM SETUP**

The system can provide alarms by auxiliary output (power failure is default aux 2), relay or NMEA/LAN. Remote acknowledge can be set up by input (default aux 1) or by ACK NMEA command, (both from NMEA port and LAN). Alarms are available for low speed, high speed and system failure. They can be activated or deactivated and given a unique alarm ID (default 21).

Most users will require an external alarm reset. This is available both as NMEA / (\$XXACK,...\*) signal or as a hardwired switch. In some cases (NAUT) an alarm acknowledge output may also be required. Aux outputs can be used for this purpose, or NMEA ALR messages.

Alarms are activated on the control unit or web. NMEA ALR format can be activated with other NMEA formats. LAN alarms require a destination system ID for the alarm system. This is entered on the web configuration pages.

Situation	What happens	NMEA sentence	Symbol on screen	Hardware action
Spd <Hi spd Spd >Lo spd	No alarm	\$VDALR,hhmmss. ss,21,V,A,,SpeedHi*nn	None	None
Spd >Hi spd or Spd < Lo spd	SpeedHi or SpeedLo alarm	\$VDALR,hhmmss. ss,21,A,V,,SpeedHi*nn	SPDHI or SPDLO Flash 'square'	Relay deactive
Either				
Spd <Hi spd Spd >Lo spd	un- aknowledged alarm, no alarm state	\$VDALR,hhmmss. ss,21,A,V,,SpeedHi*nn	SPDHI or SPDLO flashing	Relay deactive
User acknowledge	No alarm, state user acknowledges	\$VDALR,hhmmss. ss,21,V,A,,SpeedHi*nn	None	Relay active
or				
User acknowledge	aknowledged alarm state	\$VDALR,hhmmss. ss,21,A,A,,SpeedHi*nn	symbol up or symbol down	Relay active
Spd <Hi spd Spd >Lo spd	No alarm acknowledged	\$VDALR,hhmmss. ss,21,V,A,,SpeedHi*nn		
Power failure		No message		Relay deactive separate power failure off

**SENSOR ALARM**

The system also has an internal alarm that will indicate a problem with internal communication or a sensor failure. This alarm will operate if activated, and if the communication fails to the Display, (a CD402CU will then show a single 'ERROR' on screen). If the sensor fails to report, then a flashing 'SENSR' will appear on the screen and NMEA, this is handled by the normal method. A square symbol will be present until the failure is solved.



### CD402 CONTROL UNIT SELF TEST

The user can run an internal system test, run individual hardware tests and report as pass or fail. The tests are designed to check the functionality of the input and output. Some require a loop from an input to an output.

- Test 0: Check LEDs on CD401CU-XX control unit.
- Test 1: Check internal memory.
- Test 2: Check two way communication to the sensor.
- Test 3: Send out a full length NMEA message on NMEA outputs.
- Test 4: Send out a full length NMEA message on sensor outputs.
- Test 5: Activate alarm relay, wait for a reset or loop around.
- Test 6: Send a pulse out of the pulse output (aux 2 out), loop/wait for a pulse on the alarm reset (Aux 1 IN).
- Test 7: Send a pulse out of the AUX 2 output, loop/wait for a pulse on Aux 2 input..
- Test 8: Loop around the NMEA out to NMEA in and check at different baudrates.
- Test 9: Loop around the sensor out to sensor in and check at different baud rates.
- Test 10: Show Raw data from the sensor, and Quality factor

Quality factor is a value from 0 to 8 showing how strong the signal is relative to the noise. If the installation is poor, the noise may rise reducing this number, also if the return signal is weak, this value will also be low. Each unit is 3dB signal to noise ratio. The system is suspect with values below 3. .

CN Pin	Test number	CN Pin		CN Pin	Test number	CN Pin
CN1.2 CN1.4	8: NMEA test ----- -----	CN1.6 CN1.8		CN1.5 CN1.7	9:Sensor Coms ----- -----	CN1.9 CN1.11
CN1.20 CN1.24 CN1.16	5:Alarm ----- ----- -----	CN2.10 CN1.14 CN2.12		CN2.10 CN2.12 CN2.8 CN2.6	6: Aux 1. Aux in ----- ----- ----- -----	CN2.6 CN2.8 CN2.7 CN2.5

## **RUNNING IN DEMO MODE**

Once all parts are installed, the system can be made to run simulations of real situations. These are found in the demo setup.

The system has 4 demos:

**Demo 1:** Slowly ramps a speed up and down. This allows the user to monitor speed outputs, to set and trigger alarm (which can then be reset).

**Demo 2:** Fixes a speed on screen. This can be preset in the web page.

**Demo 3:** Transmits a fixed speed of longitudinal 5 kn and transversal 1 kn.

**Demo 4:** Simulates a speed on the sensor by pinging at the equivalent Doppler frequency - select the desired speed and press "SET".

All these demo/simulations will cause an 'S' to flash in the corner of the CD401CU-XX control unit.



# CHAPTER 5: SEA TEST AND CALIBRATION

A speed log will require calibration of speed after installation.

There are 2 types of calibration procedure

1. Auto Calibration
2. Manual Calibration.

Auto Calibration is designed to ignore water current effects.

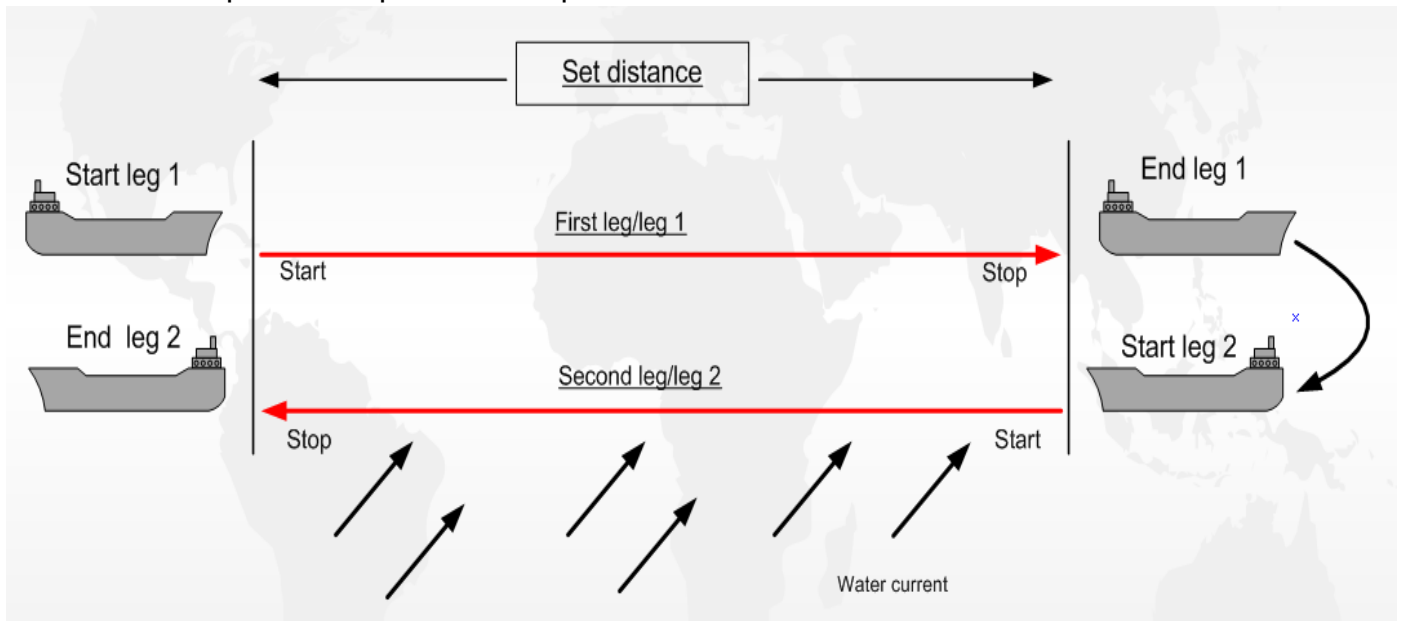
The procedure requires the vessel to sail a fixed length track at a constant speed. To remove the current and wind effects, the same track should then be sailed in the opposite direction at the same speed.

The average of these tracks will be used to calculate the speed difference between the real speed (measured using the actual distance and the time it took), and the measured speed (using distance from the sensor and the time it took).

This procedure must be performed at least once and then other speeds checked with the GPS or manual calibration.

A calibration procedure may be performed from control unit or web browser.

For Control unit procedure please see operation manual.



For Calibration on web page

Open web browser with I.P. adress to JB70D1 Electronic unit.

Goto Calibration and start “Auto Calibration”

Set distance of first leg. The leg should take at least 5 minutes to sail (distance can be shorter when sailin- slowly). Example: A calibration point at 5 knots the distance should be 1nautical mile.

## Auto Speed calibration

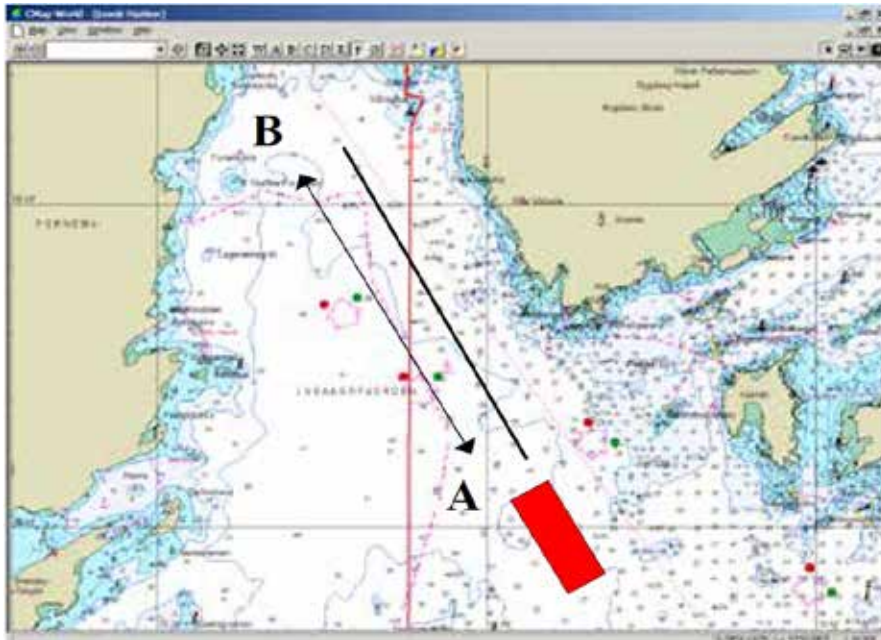
Actual distance to sail: 01 .000 Nautical miles	Type in distance to sail										Set distance
											Break
Calibration point:	1	2	3	4	5	6	7	8	9	10	Save leg in position 1 ▾
Real:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Measured:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Plot a line of known distance on the ships chart in an area with little wind and low, stable current. Enter the length of the plotted line in Actual distance. Sail the line at a stable speed (note: sail along the track, not at a fixed heading). Press start and stop when the vessel crosses the ends of the line. Turn and repeat in the opposite direction at the same speed. This calibration technique is the most accurate.

Draw a line on the chart with the required distance. Point A in start and Point B in end.

Start first leg. (The vessel crosses point A at the calibration speed, towards point B).

- Stop first leg. (The vessel reaches point B on the chart and turns to sail the line in the other direction).
- Save first leg. (If the presented speeds look correct, save the leg and continue).
- Second leg, option. (If you do not have the possibility to turn the vessel, you can use the first leg data directly. If the first leg data is of poor quality, you may not be given the option to continue).
- Start second leg. (The vessel crosses point B sailing towards point A, sailing at the same speed as leg 1).
- Stop second leg. (Press as the vessel passes point B)
- Calibration result and save option. (The user can decide to accept or reject this calibration, and in which memory position to save it)



### Auto Speed calibration

Actual distance to sail: <input type="text" value="01"/> , <input type="text" value="000"/> Nautical miles		Press <i>Start Leg</i> when start of calibration path is reached								<input type="button" value="Start Leg 1"/>	
										<input type="button" value="Break"/>	
Calibration point:	1	2	3	4	5	6	7	8	9	10	Save leg in position: <input type="text" value="1"/>
Real:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Measured:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Plot a line of known distance on the ships chart in an area with little wind and low, stable current. Enter the length of the plotted line in Actual distance. Sail the line at a stable speed (note: sail along the track, not at a fixed heading). Press start and stop when the vessel crosses the ends of the line. Turn and repeat in the opposite direction at the same speed. This calibration technique is the most accurate.

If necessary, the procedure should be repeated at different speeds. SKIPPER recommend that calibration is performed at a low speed and a high speed.

The test and calibration should be documented. Example of HAT/SAT test below.

Complete HAT/SAT document may be downloaded from SKIPPER web page [www.skipper.no](http://www.skipper.no)

A copy of the document should be sent to [warranty@skipper.no](mailto:warranty@skipper.no)



*Installation test procedure  
Warranty registration card*

<b>Speed Log</b>
------------------

Consist of:	Part number	Serial number(s)
Display unit:		
Transceiver/Electronic unit:		
Sensor:		
Bottom parts:		
Repeater(s)		

<b>Access to sensor:</b>	(Through cofferdam, ballast tank, fore peak tank, dry compartment, etc.	
--------------------------	---	--

<b>Name of vessel:</b>		<b>SKIPPER registration no:</b>	
------------------------	--	---------------------------------	--

Skipper registration no. is the number you get in autoreply by sending this completed form to [warranty@skipper.no](mailto:warranty@skipper.no)

<b>Owner name:</b>	
<b>Owner address:</b>	

<b>Harbour test (Estimated duration 0,5 Hour):</b>	<b>Status</b>
- Switch on log, adjust brightness & contrast to correct level and to verify function ok.	
- General checkout of soft keys.	
- Toggle between displaymodes. Check water and bottom track,	
- Check depth on sea chart and compare with sounder function .	
- Activate manual speed and adjust to 10 knots. Verify that repeaters are displaying correct speed & distance.	
- Check actual water temp. with known source and compare with DL850 readout.	
- Verify that test speed is displayed on radars, conning and ecdis if connected.	
<b>Tests performed at sea (Estimated duration: 2 hours):</b>	<b>Status</b>
- Verify proper operation of log, at low speed and high speed.	
- <b>Calibration results. (only first and last speed)</b>	
Heading offset	
Actual speed1	Measured speed1
Actual speed2	Measured speed2
<b>Comments:</b>	

**Installation procedure performed / Instruction in usage given. Sign:**

<b>Date:</b>	
<b>Name:</b>	
<b>Position and company:</b>	

**Installation procedure accepted/Instruction in usage received. Sign:**

<b>Date:</b>	
<b>Name of responsible person:</b>	
<b>Position of responsible person:</b>	

# CHAPTER 6: MAINTENANCE

## MAINTENANCE

### VERSION CONTROL AND LOGGING OF THE SETUP

All SKIPPER systems that use the PI-M001 module (as is the case in JB70D1-XX), use the same software, but are setup with a code number to activate the correct functions and defaults. The setup of the system can be seen in the maintenance web page, in the INFO screen under DIAG menu or on the info page of the CD401CU-XX.

### NAMING THE SYSTEM

The system web page may be available over the whole network. Both the CD401CU-XX and JB70D1 units have very similar web pages, so it is important that the user knows which system is which. A name can be given to the system, and this will be shown in the top right corner of the web page.

## UPGRADING AND EXTERNAL DIAGNOSTICS OF THE SYSTEM

The system has 3 main elements; control unit, electronic unit and sensor. These elements should be upgraded using the SKIPPER service software, available for download from [www.skipper.no](http://www.skipper.no). In the software select the item to be tested/upgraded and follow the instructions. New software updates can be downloaded from the website or via this software.

Connecting to a system element will also allow error logs to be downloaded, reporting errors that have occurred to the system in communications or internal hardware.

More diagnostic information is available in the User manual DM-M005-SA

# CHAPTER 7: TROUBLE SHOOTING

## CONTROL UNIT CD402 TROUBLE SHOOTING.

Check that a red dot is blinking in right top corner of display.  
This is indication of processor being OK.



CD401CU shows "ERROR".

CD402CU does not detect the JB70D1-XX unit

Check that Electronic unit is powered

Check LAN cabling from Display to Electronic unit.

Check port and IP set up "Chapter 3: Setup LAN Communication" on page 24



CD401CU shows "ERROR COM".

CD402CU detects the JB70D1-XX unit but JB70D1 is sending message that it does not receive any message from CD402CU.

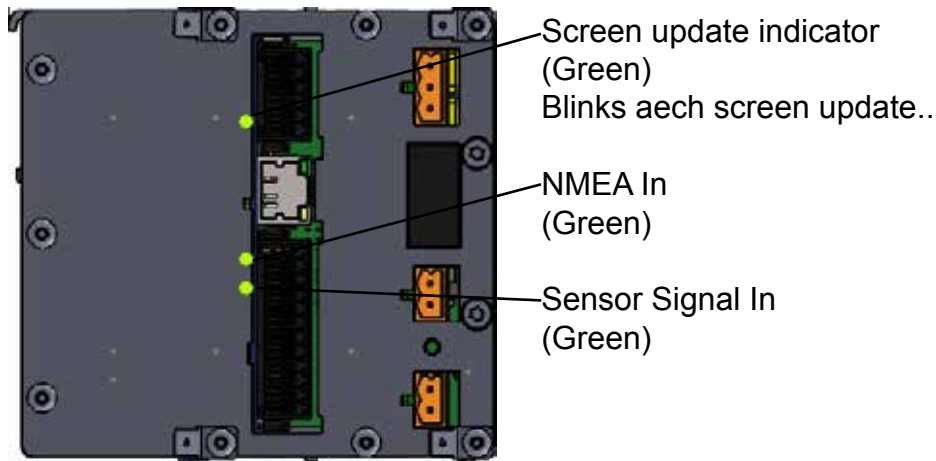
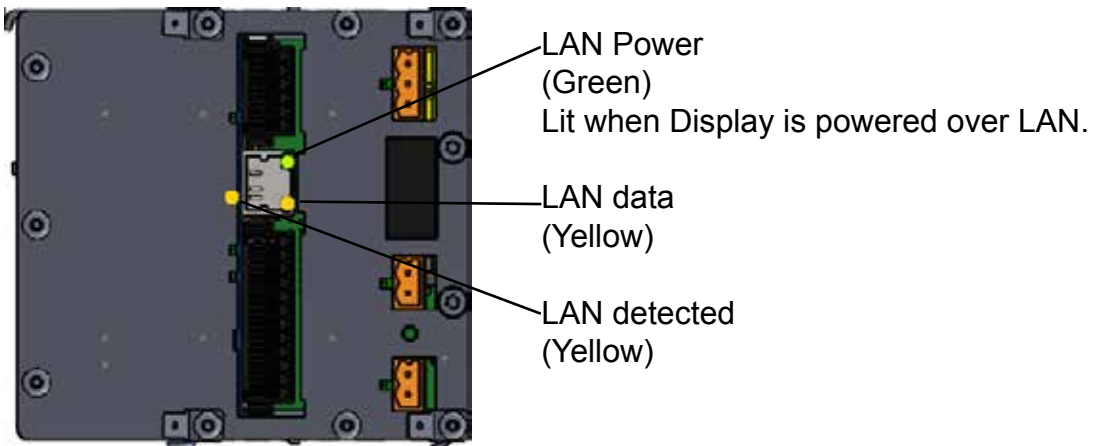
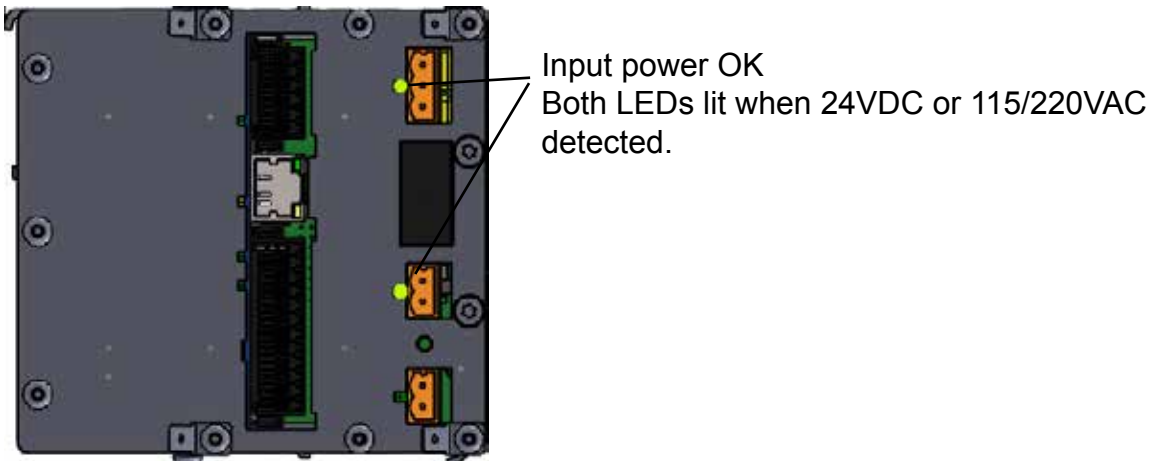
## ELECTRONIC UNIT JB70D1 DIAGNOSTICS



STATUS LED 1  
(Green)  
Blinking= CPU OK

STATUS LED 2  
(Yellow)  
Not in use

STATUS LED 3  
(Red)  
Lit if sensor or Control unit not detected.



# CHAPTER 8: SPECIFICATIONS

	STW 1-axis
Operating Frequency	700-730 kHz
Speed range	+/-50 knots
Bottom track	NA
Water track	<3m (2-12m)
Aft transversal speed	NA
Accuracy (better than)	0.2 knots or 2% Whatever greater
Temperature accuracy	<1 °C
Control Unit	CD-402CU LED display. 144*144mm. Ethernet
Electronic unit	JB70D21. Dimensions: 115*115*180mm
Com. with control unit	LAN
NMEA sentences transmit	VBW, VLW, MTW, VHW, XDR, ALR
NMEA sentences receive	ACK, DDC, VTG, ZDA, GGA
Pulse output	Yes
Analog output	4-20mA and 0-10V
Alarm	Speed alarm, Power failure alarm, function alarm
Power supply	AC 115 - 230 V 50/60 Hz, and/or DC 24 V. Max 60W
Sensor	DL1. 60mm
	Cable outer diameter 11mm
	Cable minimum bending radius 25mm
Sea Valves	Single bottom Double bottom
Tanks	Steel Aluminium
IP rating	IP22 Control unit
	IP22 Electronic unit
	IPX7 Sensor unit
Accessories	IR300 Speed repeater. Dimming Control. CD401MR-SB Multirepeater.
Classification	IMO

## **IEC61162-2 HIGH SPEED NMEA COMMUNICATION**

This standard requires a common signal ground between system requiring extra circuitry for isolation on the receiver side. This unit does not have this circuitry, and cannot fulfill the receiver part of the standard, however by connecting the common signal ground to pin 10 marked Common, the transmitting part of the standard is fulfilled.

## **IEC61162-450 ETHERNET COMMUNICATION**

The system is defined as ONF2 and SF,NF as per the standard (§4.1). This means it will send and receive encapsulated messages as defined in these standards, but has in addition web pages with a separate IP address. The -450 standard requires the UdP multicast messages to have a unique identifier, and transmission group. See "" on page 40

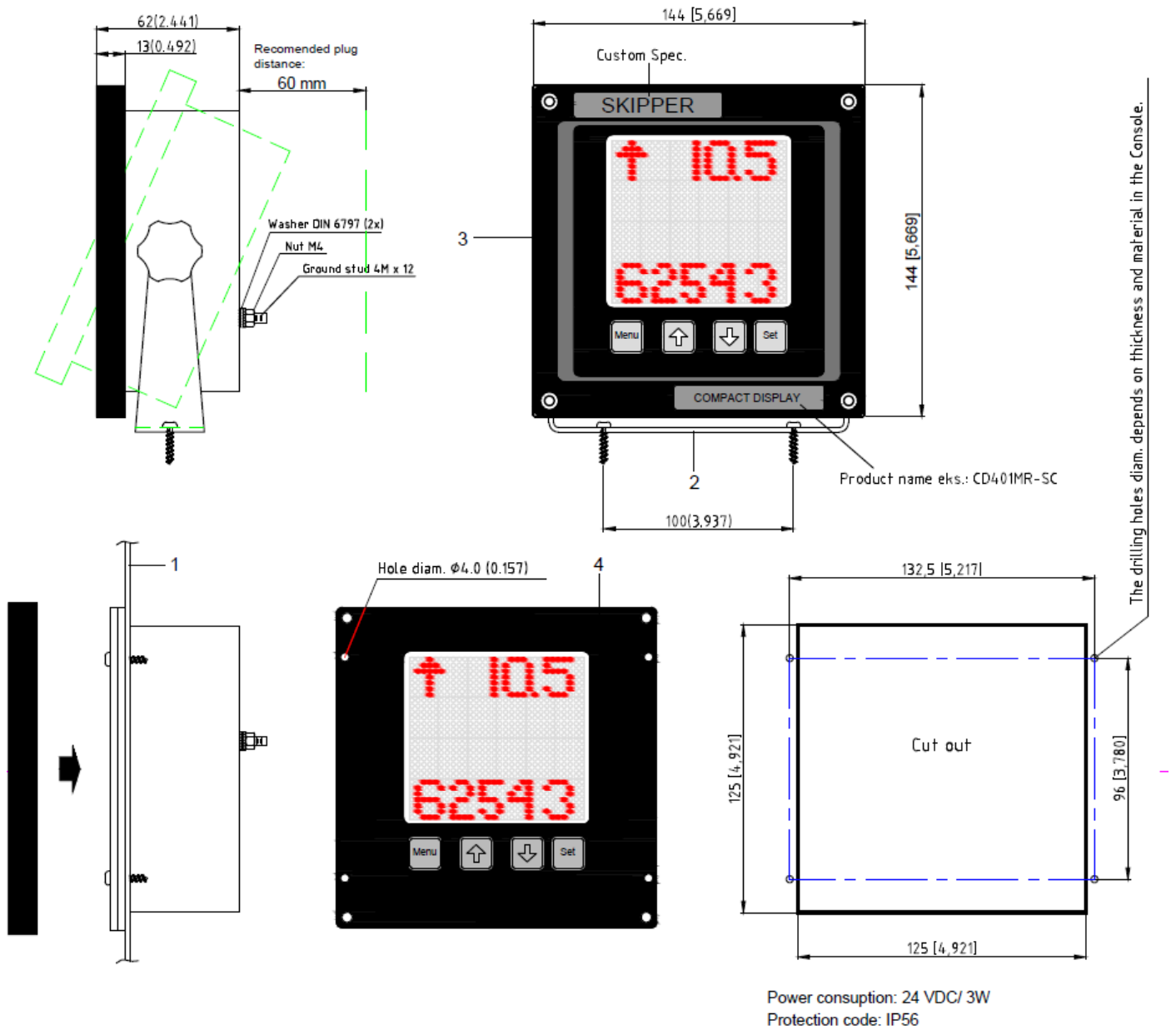
The system can be connected to a standard network using CAT 5 or better cables, the system will load the network with a maximum data rate of 20Kb/s (typical 3Kb/s). and will operate a network loads of up to 20 Mb/s or 10000 datagrams per second. The maximum number of datagrams directed to the unit must not exceed 2500/second (normal usage is 3-5).

Error codes are logged if the formats are not according to specification. These messages can be retrieved and viewed using the "Upgrading and external diagnostics of the system" on page 36.

The CD401CU must be paired to the JB70D1 unit, this to make sure the CD401CU talks only to one electronic unit on the network. To do this the user must enter the SFI ID of the JB70 unit into the web page of the CD401CU. For example VD0133, if the unit is only to have 1 control unit, then the control unit SFI ID can be entered into the JB70 unit. if no SFI is entered into the JB70D1, then any CD401CU with the correct destination SFI will work, allowing multiple control units.



# APPENDIX 1: MISC DRAWINGS



**Console mounting order:**

- A. Make a cut out in the Console (1) 125 x 125 (4.921 x 4.921)
- B. Remove the mountingbracket (2)
- C. Unscrew the 4 screws in the frame (3) (one in each corner) and remove the frame.
- D. Put the Monitor (4) in the cut out and mark the 4 centerpoints for the Drill in the Console (1)  
(The drilling holes diam. depends on thickness and material in the Console.)
- E. Use Panh. screws DIN 7981 Diam. 2.9 (0.114). Length depends on the Console thickness.
- F. Finally put on the frame (3). Make sure that the screwheads correspond with the cut outs in the frame.

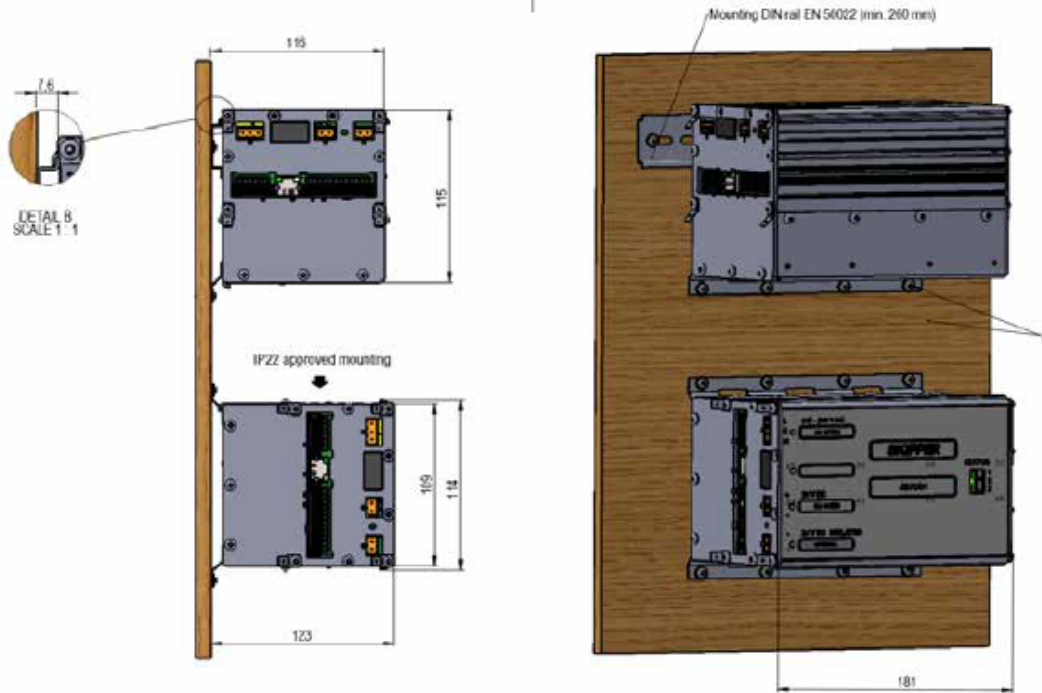
# Product Datasheet



## JB70D1-SA ELECTRONIC UNIT FOR DL1

### Specifications

	Part number	Description
Part number	JB70D1-SA	Electronic Unit for DLX
To be used with	CD401CU-XX DL1SDB-XX	Control Unit Compact with LAN Log Sensor for SB/DB-100-SA Doppler, 25 m
The junction box contains	JB70-ZA M-KIT-JB70XX	Electronic Unit for DLX Mounting Kit for JB70
Power	115-230 VAC 24VDC 24VDC (backup)	Max 60W
Interfaces	NMEA 0183, IEC61162-1, 4 output, 1 input Auxiliary x 3 output, 2 input relay x 1 analogue 1x 0-10V, 1x 4-20mA	NMEA outputs can be used for IEC61162-2 Auxiliary can be designated to alarm, pulse, spd warning relay designated to function and powerfailure alarm 2 wire voltage supplied
LAN	IEC 61162-450 fully implemented web page setup	Connection to CD402CU via LAN or NMEA configurable web pages for setup and runtime functions
Options	Type approved Switch	Moxa produced 5 way switch
IP rating		IP 22
Weight		1.2 kg
Packaging dimensions / weight		30.5 x 21.5 x 21 / 1.7kg
Manufacturer		SKIPPER Electronics AS, Norway



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Date: 2014.07.09

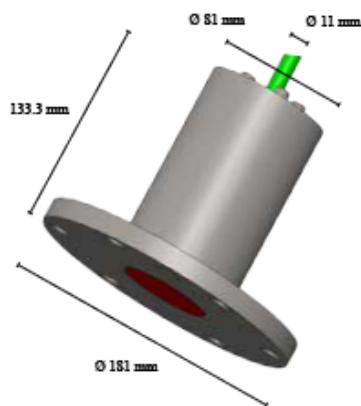
# Product Datasheet

**DL1ST-XX LOG SENSOR FOR TANK  
DOPPLER, 40 m**

**SKIPPER**

## Specifications

	Part number	Description
Part number	DL1ST-XX	Log sensor for Tank Doppler, 40 m
To be used with	DL1 DL1-Multi	
The Sensor contains the following main parts	TC-2009 DL1S-540-ZA	Tank adaptor for sensor EML224ST-XD Doppler sensor moulded 40 m cable
Accuracy		0.2 kn or 2 % whichever is greater
Speed Resolution		0.01 kn
Max speed		+/- 50 kn
Temperature accuracy		1 deg
Temperature resolution		0.1 deg
IP rating		IP 68
Depth rating		6 bar
Operating temperature		-15 to +55 deg
Outputs		1 NMEA (Proprietary formats)
Input		1 NMEA (Proprietary formats)
Power input		Nom. 24V (18V to 32V) 8W
Weight		9 kg
Manufacturer		SKIPPER Electronics AS, Norway



Height: 32 cm  
Diameter of cable 11 mm

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Date: March 2013  
Edition: 08032013

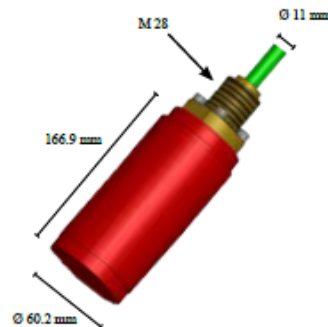
# Product Datasheet



**DL1SG-XX LOG SENSOR FOR SB/DB SEA VALVE, 40 m**

## Specifications

	Part number	Description
Part number	DL1SG-XX	LOG SENSOR FOR SB/DB SEA VALVE, 40 m
To be used with	DL1 DL1-Multi	
The Sensor contains	DB-1023 DL1S-715-ZA ZOA-01018 ZOA-01150	Adapter for EML SB/DB 60 mm Sea valve Doppler sensor moulded 40 m cable Spring washer stainless M5 DIN 127B A4 Allen Screw M5x18 DIN912 A4 70
Accuracy		0.2 kn or 2 % whichever is greater
Speed Resolution		0.1 kn
Max speed		+/- 50 kn
Temperature accuracy		1 deg
Temperature resolution		0.1 deg
IP rating		IP 68
Depth rating		6 bar
Operating temperature		-15 to +55 deg
Outputs		1 x NMEA (Proprietary formats)
Input		1 x NMEA (Proprietary formats)
Power input		Nom. 24 V (15 V to 32 V) 8 W
Weight		5 kg
Manufacturer		SKIPPER Electronics AS, Norway

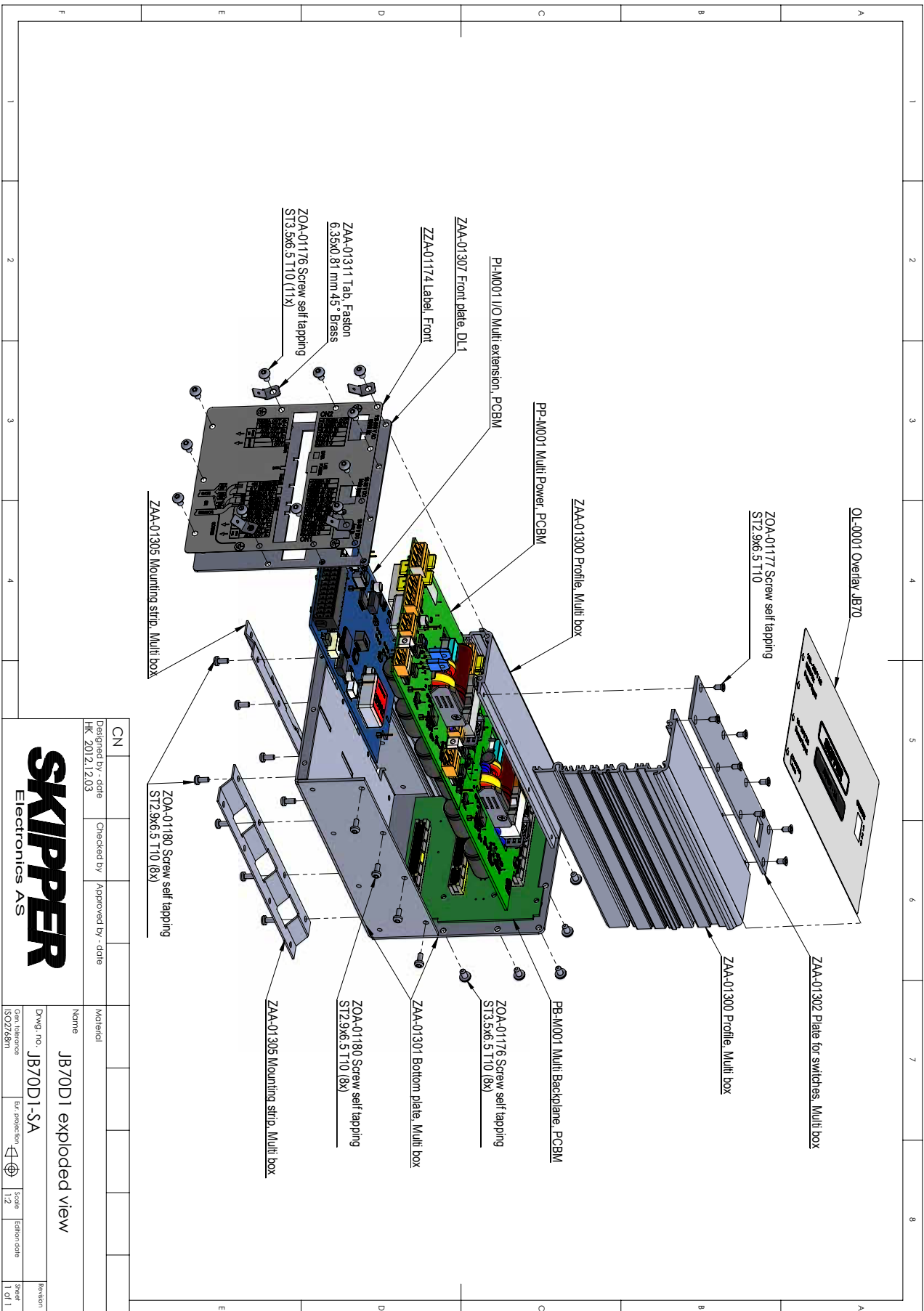


Height: 32 cm  
Diameter of cable 11 mm



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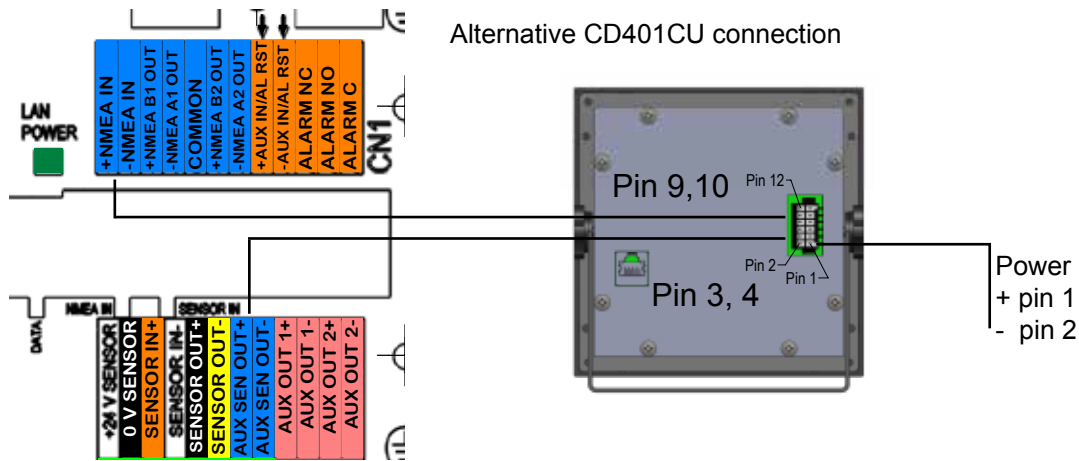
# JB70D1 EXPLODED VIEW



### ALTERNATIVE NMEA COMMUNICATION CD402 TO JB70D1

If the LAN port is required for output communication to other systems and a switch is not available, it is possible to connect the CD402CU via NMEA communications. In this case the connector on the rear of the CD401 NMEA out should be connected to NMEA IN in the JB70D1-XX unit, and the CD401CU-XX NMEA IN should be connected to the -AUX SEN OUT connector. The option CD401 communication should be set to NMEA-SENS.

On the JB70D1.



Alternative CD401CU connection

CD401 CU connection:	Input port: <input type="radio"/> None <input type="radio"/> Sensor IN <input type="radio"/> NMEA IN <input checked="" type="radio"/> Ethernet (UDP/IP)	Output port: <input type="radio"/> None <input type="radio"/> Sensor OUT <input type="radio"/> NMEA OUT <input checked="" type="radio"/> Ethernet (UDP/IP)	Apply Cancel NOTE: Multiple CD401 CUs may be active on the network simultaneously (working in parallel).
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### ALTERNATIVE POWER OVER LAN FOR CD401CU-XX

If the LAN port is used for output communication to JB70D1 directly it is possible to power the 24VDC to CD402 from JB70D1 over LAN cable.

Please note that “power over LAN” is not possible if connected via LAN switch.

# WARRANTY AND UTILIZATION

## WARRANTY:

- SKIPPER Electronics AS gives 12 months limited guarantee on all deliveries from SKIPPER Electronics AS, Norway.
- Please note that if the equipment is delivered by a third party, the third party's warranty conditions may apply.
- All warranty request should be sent to the local supplier of the equipment.

## UTILIZATION:

- This equipment is not to be disposed in normal waste, but be handled in accordance with applicable waste disposal regulations in the country where the equipment is used.

## USER MANUAL:

- For more information of usage and display setup, refer to the User manual (DM-M005). It is available on the SKIPPER web page [www.skipper.no](http://www.skipper.no).

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