XDi
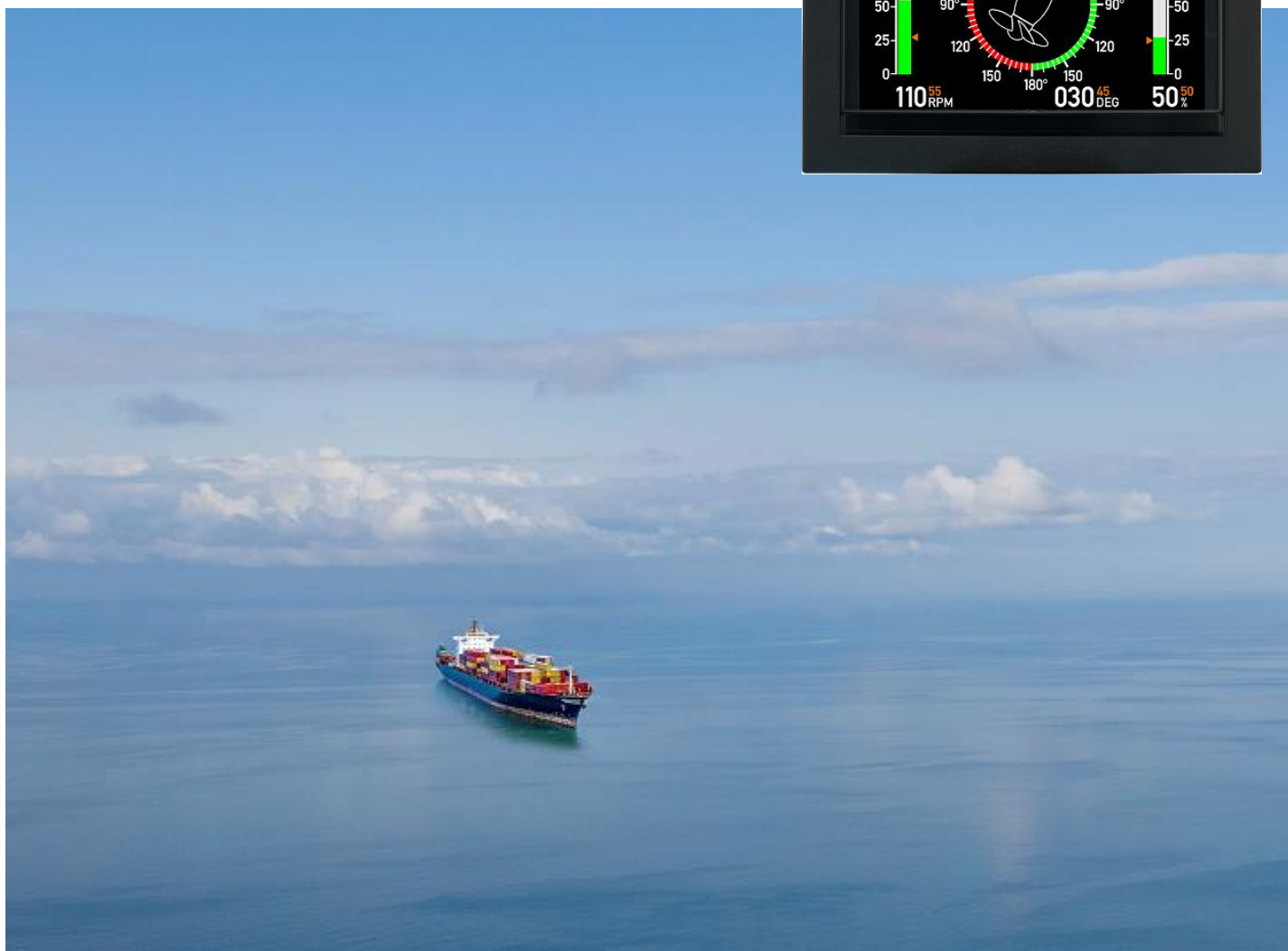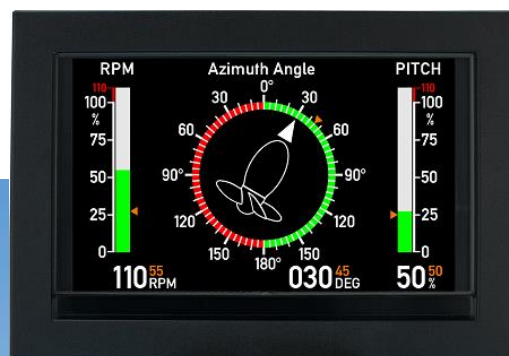
Flexible display indicator

Application notes heading indicator systems

DEIF
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1   General information

1.1   Warnings, legal information and safety

1.1.1   Warnings and notes

Throughout this document, a number of notes with helpful user information will be presented. To ensure that these are noticed, they will be highlighted as follows in order to separate them from the general text.

Notes

The notes provide general information which will be helpful for the reader to bear in mind

1.2   Legal information and disclaimer

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

The units are not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

1.3   Disclaimer

DEIF A/S reserves the right to change any of the contents of this document without prior notice.

The English version of this document always contains the most recent and up-to-date information about the product. DEIF does not take responsibility for the accuracy of translations, and translations might not be updated at the same time as the English document. If there is a discrepancy, the English version prevails.

1.4   Safety issues

Installing and operating the product may imply work with dangerous currents and voltages. Therefore, the installation should only be carried out by authorised personnel who understand the risks involved in working with live electrical equipment.

1.5   Electrostatic discharge awareness

Sufficient care must be taken to protect the terminals against static discharges during the installation. Once the unit is installed and connected, these precautions are no longer necessary.

1.6   Factory settings

The product is delivered from factory with certain factory settings. These are based on average values and are not necessarily the correct settings for matching the product in question. Precautions must be taken to check the settings before running the product.

2 About the application notes

2.1 General purpose
This document includes application notes for DEIF's XDi-N type indicator for heading indication used in a compass system.
XDi-N is available in three sizes: XDi 96 N, XDi 144 N and XDi 192 N.
The DEIF XDi-N with heading indicators is delivered with a pre-installed indicator library with a selection of standard heading indicators to choose from during installation.
The setup guidance in this application note refers to the DEIF standard heading indicator library: Library owner: 000003 Library no. 001 for XDi 144 N and XDi 192 N.
This standard library type is at present not available for XDi 96 N.
In this document, you can find typical application examples.

The general purpose of the application notes is to provide the necessary design information for a use of XDi-N as a heading repeater.

2.2 Intended users
The document is mainly intended for the person responsible for the technical design of indicator systems for ships. In most cases, this would be a system integrator or bridge panel designer. Naturally, other users might also find useful information in this document.
It is important to read the user and installation documentation in addition to the information you get in this application note.

2.3 Contents/overall structure
The document is divided into chapters, and in order to make the structure of the document simple and easy to use, each chapter will begin from the top of a new page.

3 Data sheets and other documents

From the DEIF website www.deif.com, additional documentation such as data sheets, installation manuals, type approval certificates and additional application notes are available for download, this document included.

In the below listed documents, further information about the XDi Dual, Multi and Nav indicators can be found:

- XDi data sheet 4921250067 UK
- XDi-Standard virtual indicator library 4189350067 UK
- XDi designer's handbook 4189350049 UK
- XDi-net CANopen reference manual 4189350066 UK.

4　Product installation details

4.1　XDi-N connections

In the following, the term XDi-N represents any of the three sizes: XDi 96 N, XDi 144 N or XDi 192 N.
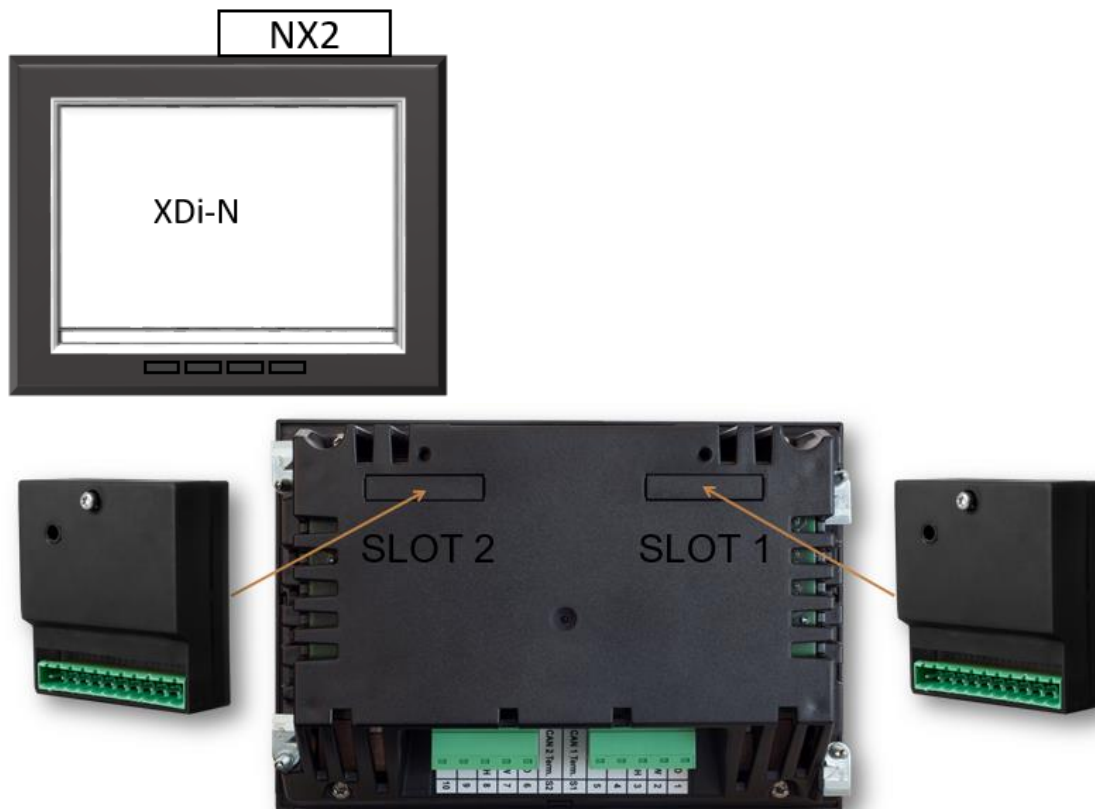
To present heading data from a compass sensor, an NX2 NMEA i/o extension module must be mounted to the rear of the XDi housing. The 3 NMEA inputs on the NX2 module enable the XDi-N to receive NMEA data from several sensors or systems if the selected indicator supports this type of data.
If the magnetic variation is available via NMEA, XDi is able to calculate magnetic heading form true heading or true heading from magnetic heading.

When the XDi-N is used as a second or third indicator (repeater) in a system, it can receive relevant data directly from the CAN bus using the XDi-net protocol. In this case, no NX2 NMEA extension module is required.

Which type of input data to be used depends much on the application as you will see in the different application examples later in this document.

To make the installation setup of the XDi-N, please see appendix 1 where you will find a detailed description of how to select the right setup for dimmer, selection of virtual indicator and input setup. The XDi setup wizard will guide you through these selections.

4.2 XDi-N connections on main unit

Overview for the two connectors on the main XDi unit.

Type	Terminal n	Signal	Marking	Remark
Connector 1	1	CAN 1	CAN 1 GND	Common (do not connect)
	2		CAN 1 LOW	
	3		CAN 1 HIGH	
	4	Supply voltage	+24 V DC	Standard power input 1
	5		0 V	
Dill switch 1	-	ON/OFF	CAN 1 Term.	120 Ω termination
Dill switch 2	-	On/OFF	CAN 2 Term.	120 Ω termination
Connector 2	6	CAN 2	CAN 2 GND	Common (do not connect)
	7		CAN 2 LOW	
	8		CAN 2 HIGH	
	9	Supply voltage	+24 V DC	Standard power input 2
	10		0 V	

Note 1: By default, the CAN bus termination switch is set to "OFF".

4.3 NX2 NMEA extension module connections

NX2 is the extension module enabling the XDi-N to receive and transmit NMEA 0183 serial data (in accordance with IEC61162-1 and -2).
When NX2 module is mounted in the extension slot, several input/output ports are available for the serial NMEA 0183 data.

The different ports and terminal connections are shown in the following table.

Term. no.	Signal	NX2 Label	Remark
1	COM 3 input	RX3 – B	Opto-insulated serial input
2	NMEA 0183	RX3 – A	RS-422 (IEC 61162-1 and -2)
3	COM 1 input	RX1 – B	Opto-insulated serial input
4	NMEA 0183	RX1 – A	RS-422 (IEC 61162-1 and -2)
5	Contact input 1	C-IN 1	Push-button input 1 with internal pull-up to +5 V
6	Contact input 2	C-IN 2	Push-button input 2 with internal pull-up to +5 V
7	COM 1 output NMEA 0183	TX1 – A	RS-422 Differential output
8		TX1 – B	(IEC 61162-1)
9	Common GND	COMMON	Note1
10	COM 2 in/out NMEA 0183	RX/TX2 – B	RS-485 configured as input or output.
11		RX/TX2 – A	Regarding terminal marking see Note 2
Dill switch (red)	RS-485 termination	See picture above	120 Ω termination resistor, default OFF. The red dill switch is located above term. 10.

Note1: Common (Reference GND) for RS-485 COM port, COM 1 output and contact inputs.

Note2: XDi follows the NMEA0183/IEC61162-1 convention for marking NMEA input and outputs terminals. Please be aware that the RS-485 terminals are not marked according to NMEA0183/IEC61162-1 but are in accordance with RS-485, this means that A and B are swapped.

COM 2 is an RS-485 port that can be used as either input or output. When used as NMEA please notice that it is not galvanically separated from CON1 output and the 2 contact inp

5   System applications

5.1 System 1 – Basic heading indicator system

This application describes the basic heading indicator system presenting only the data received from the heading compass.
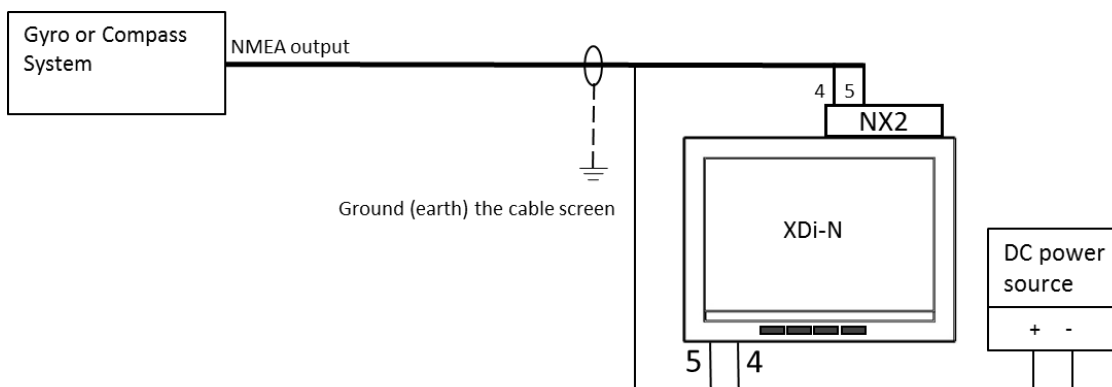
5.1.1 Connecting a heading source to the indicator

Heading sensor	Function		XDi term.	NX2 term.	Power supply
	Supply voltage	-	5	-	0 V
		+	4	-	+ 24 V DC
NMEA out A *)	Input NMEA	A	-	4	
NMEA out B *)	RX1	B	-	3	
Shield	Electrical shielding of data signal cable		No connection		

*) XDi follows the NMEA0183/IEC61162-1 convention for marking of the NMEA input and outputs terminals, please be aware that the A/B marking on some other products may be switched. If this is the case, just swap the NMEA wires.

5.1.2 Installation setting

Using the DEIF standard heading library 001, different indicators can be selected during setup.
The number of different heading indicators in this standard library will be extended over time.

The standard library documentation (pdf) and XDi library packages for upload can be downloaded from the DEIF FTP server. Please see appendix 6 for details. Examples of heading scales:

Tape heading indicator (VI001)

Compass indicator (VI002)

5.1.3 Dimming

Standard dimming of an XDi-N is done via the two centre buttons on the front of the XDi-N unit.

Alternatively, the XDi can be set up for external dimming control from either push-buttons, voltage input, potentiometer or via NMEA, please see appendix 4 for details.

5.1.4 Installation wizard

When the XDi-N has not yet been set up, it will automatically start the start-up wizard. The selections to be made in the start-up wizard to activate dimming from front buttons and select the standard tape heading indicator are shown in the table below.

Select a CAN NodeID.

In this system, CAN/XDi-net is not used, so just press OK to select the default CAN NodeID = 40.

Select virtual indicator and profiles

Product Profile	Virtual indicator	VI setup	NMEA setup
PP01 – Front dimmer	VI 001 Tape Rep.	VS01 NMEA/XDi-net	Make an auto scan to set up NMEA correctly

Please find the detailed first-time setup procedure in Appendix 1.

5.2 System 2 – Advanced heading indicator system

This application describes the more advanced heading indicator system with heading sensor selector or backup function.
The system can have up to 3 heading sources with prioritised automatic source shift (fall-back) in the event that an NMEA source is switched off or props out.
The heading data can all be received via one NMEA input or they can be received from different NMEA inputs.
Using two NX2 extension modules up to 4 standard opto-insulated NMEA inputs and 2 extra RS-485 (NMEA) inputs are available.
In this application, heading data is received from 3 different data sources: Gyro 1, Gyro 2 and a magnetic compass. If needed also ROT data.
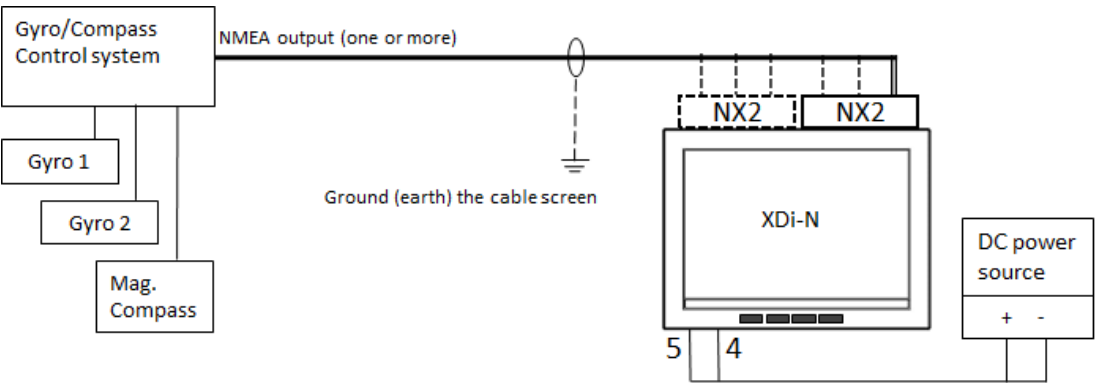
5.2.1 Unique source identification

To distinguish the different sources from each other XDi must be able to recognise the NMEA data input uniquely. The data source recognition is made by the physical input (for example Slot1, RX1), then the talker ID and finally the sentence ID. As long as one of the 3 recognition parameters are different, the XDi is able to use the data as independent sources.
From the installation menu it is possible to change the priority of the data types (GYRO 1, GYRO 2 and MAG. COMPASS) or lock permanently to one of them. See also appendix 1, source select and fall-back setup.

5.2.2 Connecting the heading sources to the indicator

Heading and ROT data can be received on the same NMEA input, or they can be received individually on several NMEA inputs. Use two NX2 modules if more than 3 NMEA inputs are needed.

Heading sensor	Function		XDi term.	NX2 term.	Power supply
	Supply voltage	-	5	-	0 V
Gyro 1		+	4	-	+ 24 V DC
NMEA out 1 A *)	Input NMEA	A	-	4	
NMEA out 1 B *)	RX1	B	-	3	
Shield	Electrical shielding of data signal cable		No connection		
Gyro 2					
NMEA out 2 A *)	Input NMEA	A	-	2	
NMEA out 2 B *)	RX3	B	-	1	
Shield	Electrical shielding of data signal cable		No connection		
Magnetic compass					
NMEA out 3 A *)	Input NMEA	B	-	10	
NMEA out 3 B *)	RX2 (RS-485in)	A	-	11	
Shield	Electrical shielding of data signal cable		No connection		

*) XDi follows the NMEA0183/IEC61162-1 convention for marking of the NMEA input and outputs terminals.
Please be aware that the A/B marking on some other products may be switched. If this is the case, just swap the NMEA wires.

5.2.3 Installation setting

Using the DEIF standard heading library 001, different indicators can be selected during setup.
The number of different heading indicators in this standard library will be extended over time.

The standard library documentation (pdf) and XDi library packages for upload can be downloaded from the DEIF FTP server. Please see appendix 6 for details. Examples of heading scales:

Tape heading indicator (VI001)   Compass indicator (VI002)

5.2.4 Dimming

Standard dimming of an XDi-N is done via the two centre buttons on the front of the XDi-N unit.

Alternatively, the XDi can be set up for external dimming control from either push-buttons, voltage input, potentiometer or via NMEA, please see appendix 4 for details.

5.2.5 Installation wizard

To enable selection of the desired settings, the XDi-N is not set up when received from the factory. Upon power up, it automatically starts the start-up wizard. The selections to be made in the start-up wizard to activate dimming from front buttons and select the standard tape heading indicator is shown in the table below.

Select a CAN NodeID.
In this system, CAN/XDi-net is not used, so just press OK to select the default CAN NodeID = 40.

Select virtual indicator and profiles

Product Profile	Virtual indicator	VI setup	NMEA setup
PP01 – Front dimmer	Select the desired VI	VS01 NMEA/XDi-net	Make an auto scan to set up NMEA correctly

5.2.6 System and source setup

Please find the detailed first-time setup procedure in Appendix 1.

When the automatic NMEA input scan is completed, you must manually check that the sources that are automatically assigned are also the sources you want for the 3 heading data types used in this application.
The 3 heading data types are:
Heading T1 – Heading true instance 1 (Gyro1)
Heading T2 – Heading true instance 2 (Gyro2)
Heading M1 – Heading magnetic instance 1 (Mag. Compass)

5.3 System 3 - Dual heading indicator system

This application is used on ships where there is a need for an extra heading indicator.
This is an extension of system 1 with one extra XDi-N indicator.

The first XDi-N, called the main unit, receives heading (and ROT) data via the RX1 NMEA input from the heading data source. The received data is shared on XDi-net.

The second XDi-N receives data via XDi-net (CAN bus 1). This means that no NX2 module is needed on this unit.
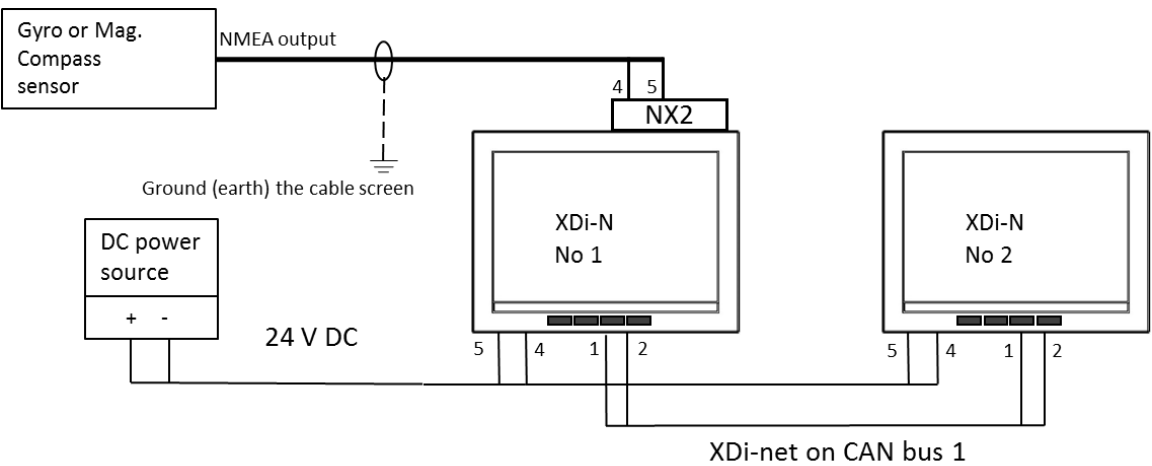
It is possible to extend this system with additional XDi-N indicators. They must be set up as 2 in the described system, but only the last XDi-N on the CAN bus is to be terminated.

5.3.1 Connecting the system

Heading sensor	Function		XDi 1		XDi 2 unit term.	Power supply
			Main term.	NX2 term.		
	Supply voltage	-	5	-	5	0 V
		+	4	-	4	+ 24 V DC
NMEA out A *)	Input NMEA	A	-	4	-	
NMEA out B *)	RX1	B	-	3	-	
Shield	Electrical shielding of data signal cable		No connection			
	CAN 1 Low		1		1	
	CAN 1 High		2		2	
	CAN cable shield		NC		NC	
	CAN 1 termination		ON		ON	

*) XDi follows the NMEA0183/IEC61162-1 convention for marking of the NMEA input and outputs terminals, please be aware that the A/B marking on some other products may be switched. If this is the case, just swap the NMEA wires.

CAN bus termination
It is important to terminate the CAN bus in each end. Just activate the internal CAN bus termination resistor in the XDi in both ends of the system.

5.3.2 Installation setting

Using the DEIF standard heading library 001, different indicators can be selected during setup. The library contains different designs that can be selected, Examples of heading scales:
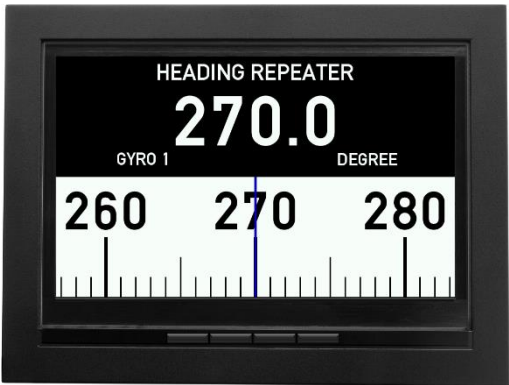
Tape heading indicator (VI001)

Compass indicator (VI002)   and more...

5.3.3 Dimming

Dimming from the front buttons is selected in this application for both indicators. Since they are connected via XDi-Net (CAN), the dimmer level will be synchronised between the two indicators, since by default, they are assigned to dimmer group 1.

See other dimmer alternatives in Appendix 4.

5.3.4 Installation wizard

When the XDi-N has not yet been set up, it will automatically start the start-up wizard.

In the table below, you find the correct wizard setup for this system with two heading indicators.

Select a CAN NodeID.

In this application, XDi-net (on CAN bus) is used to share data with other indicators in the system. The two indicators must have different CAN NodeID. It is not important which ID you select for the two as long as they are different. Select for example 40 (default) and 41.

Select virtual indicator and profiles

Indicator 1			
Product Profile	Virtual indicator	VI setup	NMEA setup
PP01 – Front dimmer Group 1*	Select VI	VS01 NMEA/XDi-net	Make an auto scan to set up NMEA correct

Indicator 2			
Product Profile	Virtual indicator	VI setup	NMEA setup
PP01 – Front dimmer Group 1*	Select VI	VS01 NMEA/XDi-net	No NMEA setup since there is no NX2 module. Select Finish to complete the setup.

*) Select PP03 "Local Dimmer" instead of PP01, to have individual dimmer on the two XDi indicators.

Please find the detailed first-time setup procedure in Appendix 1.

5.4 System 4 – Advanced dual heading indicator system

This application is used on ships where there is a need for an extra heading indicator.

This is an extension of system 2 with one extra XDi-N indicator.

The first XDi-N, called the main unit, receives heading (and ROT) data via the NMEA inputs from the heading sensor system. The received data is shared on XDi-net.

See system 2 for details about multi-source recognition and selection.

The second XDi-N receives data via XDi-net (CAN bus 1). This means that no NX2 module is needed on this unit.

Gyro/Compass Control system

NMEA output (one or more)

Gyro 1

Gyro 2

Mag. Compass

Ground (earth) the cable screen

DC power source

+ -

24 V DC

NX2 NX2

XDi-N No 1

XDi-N No 2

5 4 1 2

5 4 1 2

XDi-net on CAN bus 1
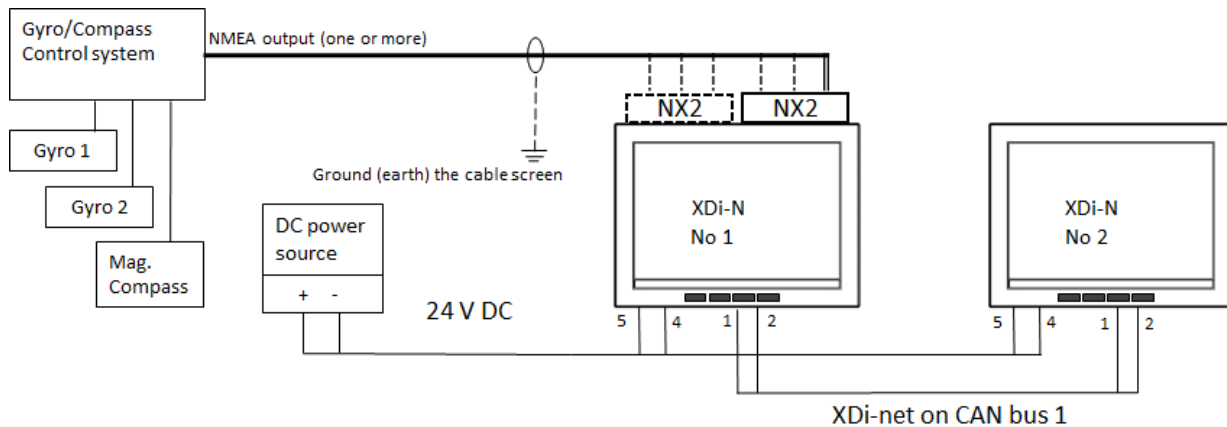
It is possible to extend this system with additional XDi-N indicators. They must be set up as 2 in the described system, but only the last XDi-N on the CAN bus is to be terminated.
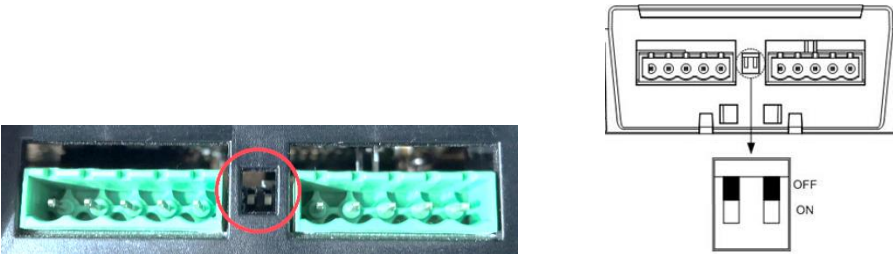
5.4.1 Connecting the system

This is an example where the 3 heading sensors are connected to separate inputs, but it is not necessary as long as XDi can detect the NMEA data from each source uniquely.

Heading sensor	Function		XDi1 term	NX2 term.	XDi2 term.	Power supply
	Supply voltage	-	5	-	5	0 V
Gyro 1		+	4	-	4	+ 24 V DC
NMEA out 1 A *)	Input NMEA	A	-	4	-	
NMEA out 1 B *)	RX1	B	-	3	-	
Shield	Electrical shielding of data signal cable		No connection			
Gyro 2						
NMEA out 2 A *)	Input NMEA	A	-	2	-	
NMEA out 2 B *)	RX3	B	-	1	-	
Shield	Electrical shielding of data signal cable		No connection			
Magnetic compass						
NMEA out 3 A *)	Input NMEA	B	-	10	-	
NMEA out 3 B *)	RX2 (RS-485in)	A	-	11	-	
Shield	Electrical shielding of data signal cable		No connection			
	CAN 1 Low		1		1	
	CAN 1 High		2		2	
	CAN cable shield		NC		NC	
	CAN 1 termination		ON		ON	

*) XDi follows the NMEA0183/IEC61162-1 convention for marking of the NMEA input and outputs terminals. Please be aware that the A/B marking on some other products may be switched. If this is the case, just swap the NMEA wires.

CAN bus termination
It is important to terminate the CAN bus in each end. Just activate the internal CAN bus termination resistor in the XDi in both ends of the system.

5.4.2 Installation setting

Using the DEIF standard heading library 001, different indicators can be selected during setup. The library contains different designs that can be selected, Examples of heading scales:

Tape heading indicator (VI001)

Compass indicator (VI002)

5.4.3 Dimming

Dimming from the front buttons is selected in this application for both indicators. Since they are connected via XDi-Net (CAN), the dimmer level will be synchronised between the two indicators, since by default, they are assigned to dimmer group 1.
See other dimmer alternatives in Appendix 4.

5.4.4 Installation wizard

When the XDi-N has not yet been set up, it will automatically start the start-up wizard.
In the table below, you find the correct wizard setup for this system with two heading indicators.

Selecting a CAN NodeID.
In this application, XDi-net (on CAN bus) is used to share data with other indicators in the system. The two indicators must have different CAN NodeID. It is not important which ID you select for the two as long as they are different. Select for example 40 (default) and 41.

Select virtual indicator and profiles:

Indicator 1			
Product Profile	Virtual indicator	VI setup	NMEA setup
PP01 – Front dimmer Group 1*	Select VI	VS02 NMEA1	Make an auto scan to set up NMEA correct

Indicator 2			
Product Profile	Virtual indicator	VI setup	NMEA setup
PP01 – Front dimmer Group 1*	Select VI	VS01 XDi-net	No NMEA setup since there is no NX2 module. Select Finish to complete the setup.

*) Select PP03 "Local Dimmer" instead of PP01, to have individual dimmer on the two XDi indicators.

Please find the detailed first-time setup procedure in Appendix 1 - XDi-N setup wizard and NMEA setup

5.5 XDi-N setup during installation

When the XDi is new and has not yet been set up, it will automatically start the setup wizard when it is powered up. This wizard will guide you through the simple setup process.

The library owner number, type and number are indicated in the second line where you will also find the library version number.
The library used in this example is the DEIF standard heading indicator library no. 001.
To continue making the setup, press the soft key button below the text "OK".

5.5.1 Select CAN node ID
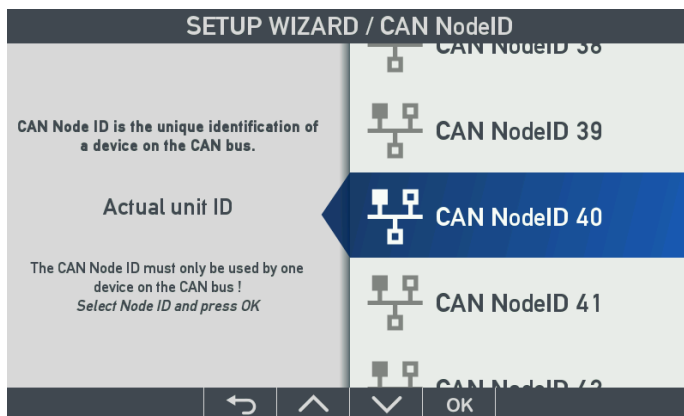
If the CAN bus/XDi-net is not used in your installation, please just press OK on the default CAN NodeID to continue.

In a system with multiple XDi-N indicators, you can use XDi-net (on CAN) to make a cost-effective and easy to install, plug and play system solution. In XDi-net, the CAN NodeIDs are not important as long as they are different for each unit.

The first XDi unit to be set up during installation can be assigned the default CAN NodeID=40, the next XDi can be assigned 41 and so on.
If by accident you select the same NodeID for two XDi units on the same CAN bus, you will see the warning "CAN NodeID conflict" on the display, and the CAN port will not function until you have selected a different CAN NodeID for each unit on the bus.

5.5.2 Select Product Profile (PP)

The product profile (PP) in an XDi-N library contains the setup parameters for all data types supported by NMEA. It also contains all the default CAN bus setup parameters, default dimmer and day/night shift setup parameters.

Dimming from front

Dimmer from front buttons
Default: Dim gr1. Fixed day colour.
RX/TX dimmer value on XDi-net.
Dimming level is shared via XDi-net.

Supported NMEA sentences:
Heading: HDG, HMR, VHW, HTD, HMR,
VHW, HTD, THS and HDT.
MagVar: HMR, RMC and HDG
Rate of turn: ROT
Default: COM1 or 3 at 4.8 kbps

Shares selected NMEA data on XDi-net

PP01 Front dimmer

PP02 Analogue

PP03 NMEA Gr. 1

↩ ⌃ ⌄ OK
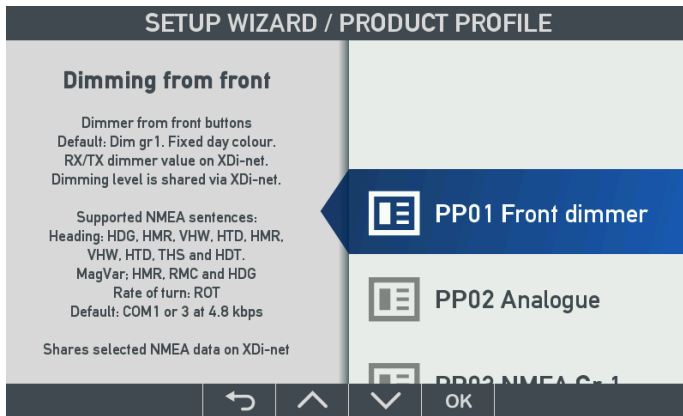
For each PP in the library, there is a description in the left side of the screen to help you make the right choice. Select the product profile that fits your system and press OK.

5.5.3 Select virtual indicator (VI)

Heading Tape Rep. w/ROT
Heading presentation with 0.1 deg
ROT ±30deg/min bar with digital readout

ROT	17.5	DEG/min
30 PS	0	SB 30
HEADING	000.0	GYRO 1
	DEGREE	

350   0   10

With selectable headline and
automatic source name presentation

VI001 Tape Rep.

VI002 Heading

VI003 Tape Rep. ROT

↩ ⌃ ⌄ OK
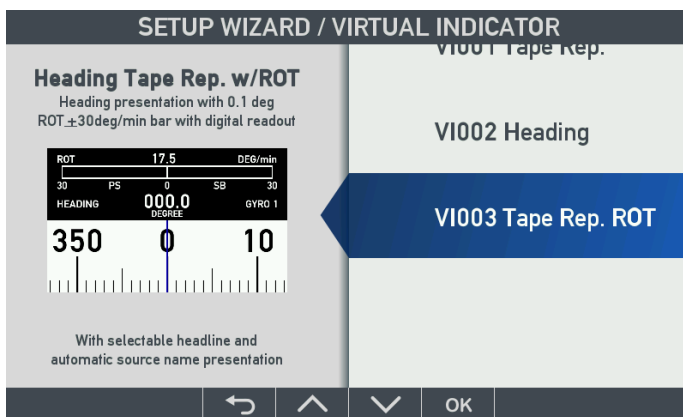
The next step is to select a heading indicator (VI) from the library. The short description and thumbnail picture helps you select the right one.
If the indicator contains more than one screen, the thumbnail picture will toggle between the available screens. Select the VI by pushing the OK soft key.

5.5.4 Select virtual indicator setup (VS)

The VI setup (VS) defines the actual input setup for all pointers and digital readouts in the selected virtual indicator, but also outputs from the indicator to other systems.
The selected virtual indicator VI003 only has one VI-setup profile, VS01 to choose during installation.

VS01 profile is intended for use in a system where input data are received via NMEA when an NX2 NMEA i/o extension module is mounted and via XDi-net (CAN bus) if there is no NX2 module mounted on the XDi.

Input NMEA or XDi-net

Heading + ROT via NMEA (Requires NX2)
or XDi-net via CAN1 or 2

Fall-back function Heading:
1. Gyro 1 (Heading True 1)
2. Gyro 2 (Heading True 2)
3. MAG. COMPASS (Heading Mag 1)

Fall-back function ROT:
1. ROT Instance 1
2. ROT Instance 2
Max digital ROT: +/-180 DEG/min
Default settings can be changed from menu.
Source priority can be changed or
one source can be locked.

VS01 NMEA/XDi-net

↩ ⌃ ⌄ OK

XDi-net data can come from the main XDi-N unit that is equipped with an NX2 NMEA i/o extension module, where heading sensor data and other NMEA data are received and then distributed via XDi-net (CAN bus) to other XDi units without NX2 module connected to the same CAN bus.

When the desired VS profile is highlighted, press OK to continue.

5.5.5 Finish or run NMEA setup

When the XDi is set up as an additional indicator without any NX2 NMEA extension module, the wizard will not show the menu line "NMEA setup", but instead highlight "Finish wizard". Press OK, and the selected virtual indicator will start and receive data from XDi-net.
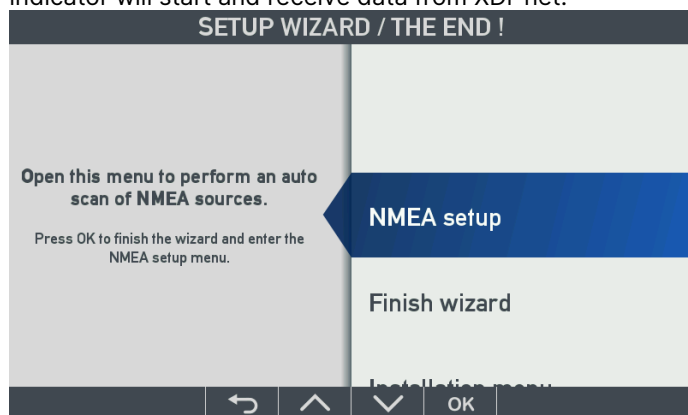
Instead of finalising the setup, you may also access the user and installation menu directly from this step, if additional setup or parameter adjustments are needed.

5.5.6 NMEA setup on a main XDi indicator

If the XDi is a main unit with an NX2 NMEA extension module mounted, the wizard will suggest you to make an NMEA setup as the next task.

Before you push "OK", it is a good idea to make sure that all relevant NMEA sensors and system devices are connected to the relevant NMEA inputs on NX2 and that they are powered up and transmitting data.
Then press OK to select the NMEA setup menu.

5.5.7 NMEA auto scan and input selection

The next step is to select the highlighted "Auto scan and input selection..." by pressing OK. This function will now scan all input channels and look for all relevant NMEA sentences.
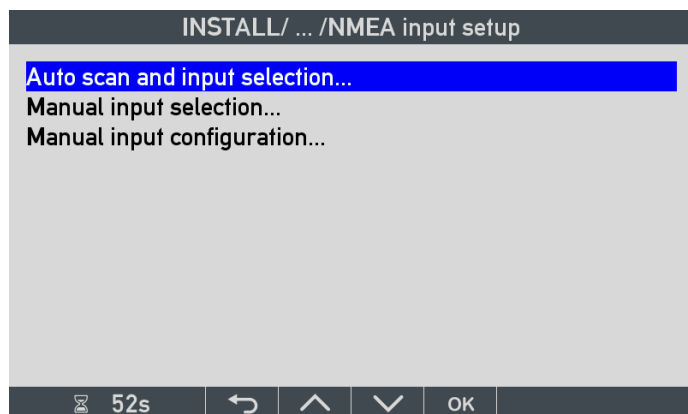
The "Manual input selection..." should not be used until after the auto scan routine is performed.
"Manual input configuration..." can be used to configure an NMEA input where no sentence is available when the input scanning is performed.

If the sensor and other data sources are connected to the correct inputs on the NX2 module, and if there is only one data source for every relevant data type, then the auto scan function will automatically detect and select them as source.

5.5.8 NMEA auto setup example

This example is for a main XDi-N indicator used in an application where heading data is received from several sources but on the same NMEA input line.

The XDi-N setup is: NodeID=40, PP01, VI002, VS01.
The data is coming from a sensor system connected to RX1 (RS-422) on the NX2 module mounted in slot 2 (in XDi, this input is presented as 2.1).

The simulated data sentences sent in this example are:

Gyro1: $HEHTD,A,0.0,L,M,T,45.0,25.0,0.5,3275.0,200.0,1.0,250.0,T,A,A,A,270.0*67
MagC1: $HEHDG,265.5,03.0,E,25.0,E*44
Gyro1: $HEHDT,293.5,T*22
Gyro1: $HEROT,14.0,A*1E
Gyro2: $IIHDT,271.6,T*20

We select auto scan by pushing the OK button, and the automatic NMEA input scanning is performed.

```
             Scanning for NMEA sources

Supported data sources:                    6
Usable sources found:                      6
Auto selected sources:                     6
Need manual decision:                      0
Active inputs (Slot.RX):                  2.1
-------------------------------------------------
Accept selection and save
Stop scan - manual select...
Cancel scan without saving



   ⌛ 289s      -      ∧      ∨     OK
```
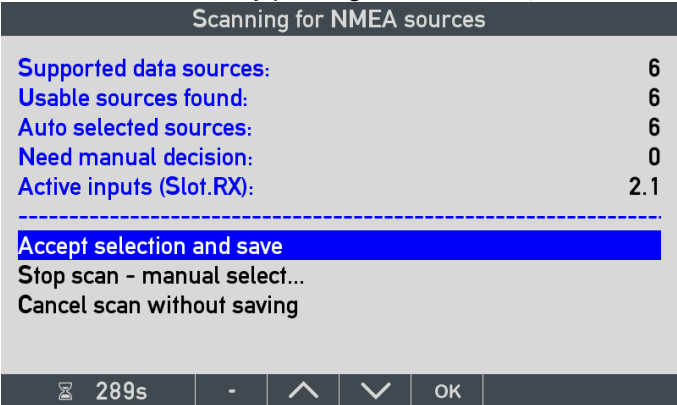
After a short period of time, the numbers in the right side will be stable. This means that no new data sources are detected.

"Supported data sources" are all the sources that can be set up for NMEA in the selected product profile. Normally it covers all data types that the different indicators in the library will use. It also includes the dimmer groups that can be controlled by NMEA. Normally, this figure is more than what is needed for the selected indicator.
In this case, we have selected an indicator that is only able to present heading. However, it is able to receive and distribute 3 heading data types (2 gyros and one magnetic) and 2 instances of ROT. The selected VS is using the fall-back function if multiple heading data is available via NMEA or XDi-net.
The automatic scanning function has found 6 usable data sources and auto-selected all 6.

"Active inputs (Slot.RX)" show the input ports that are currently active and receiving NMEA data.
The figure 2.1 in the menu means slot 2 input 1.

Stop scan - manual select

To see what is actually selected, highlight "Stop scan – manual select..." and press OK.
You will then get this picture:

```
          INSTALL/ ... /NMEA group list

Input group (Press OK to open)        Scan result
-------------------------------------------------
COMPASS                                     ◉




   ⌛ 55s      ↰      ∧      ∨     OK
```
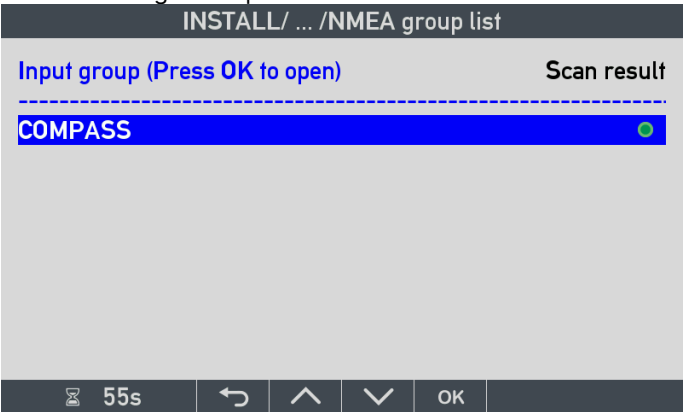
RED dot means that no external sources are available, in this case for the dimmer data group.

YELLOW dot means that sources are available for some data in the group, but it should be checked. Some data types may need manual selection or some may be missing.

GREEN dot means that all data types in this group have been assigned a source.

Even if the dot is green, it is a good idea to look through the automatic selection and check that needed data has the right source assigned.

COMPASS

The compass group is green, so everything should be good. However, in cases where there are multiple instances of the same data type, it may be necessary to change some of the automatic selections made.

If we open this group, we can see which NMEA port and sentence is used to provide data.

INSTALL/ ... /NMEA detailed list	
Input (Press OK to edit)	**Scan result**
Heading M 1	2.1 HE HDG
Heading T 1	2.1 HE HTD
Heading T 2	2.1 HE HTD
Mag. Var. 1	2.1 HE HDG
Rate of turn 1	2.1 HE ROT
Rate of turn 2	2.1 HE ROT

⏳ 59s ↩ ∧ ∨ OK

In this case, "Heading T1" (True heading instance 1) and "Heading T2" (True heading instance 2), are both automatically selected to use the same input source. The HTD sentence is received from input port 2.1, provided by talker HE, and sent in sentence HTD.

The right setting is for Heading T2 to receive data from the talker ID "II" and sentence HDT.
To correct this, highlight "Heading T2" and press OK.

You can now see the sources available for true heading:

INSTALL / ... / Select	
Heading T 2 Available NMEA sources.	XDi–net
	2.1 HE HTD
Active source:	2.1 HE HDT
2.1 HE HTD	**2.1 II HDT**
	2.1 HE HDG cc
Missing source: Scan again or use manual configuration.	
Shaded source: Input is locked by external source.	

⏳ 52s ↩ ∧ ∨ OK

In this case, "Heading T2" must be set up to use II HDT, so just highlight it and press OK.

Calculated data cc:

When the magnetic variation, "Mag. Var. 1" parameter is available on NMEA, the XDi is able to calculate the true heading based on the magnetic heading or the other way around.
In this example, true heading can be calculated based on the HE HDG sentence that is available, and it is shown in the selection list as HE HDGcc (cc for calculated).

5.5.9 Finish the installation

The NMEA setup has now been verified and all data needed is available, and all left to do is to press the return arrow until the heading indicator is shown on the display and starts to present data.

ⓘ When you leave the menu, the NMEA settings will be stored and locked. This means that on selected sources will be used by the XDi.

5.6 Change NMEA setup

If you make changes in your installation or want to change to another data source, you can always access the installation menu and make changes.

5.6.1 How to access the installation menu

To access the installation menu, you must first enter the user menu. Press button 4 shortly and go down to the last point in the quick menu to access the user menu. You can also press button 1 and 4 simultaneously for approximately 5 seconds to open the user menu.
When the user menu is open, you must push the "secret buttons" 2 and 3 for more than 5 seconds to open the installation menu.
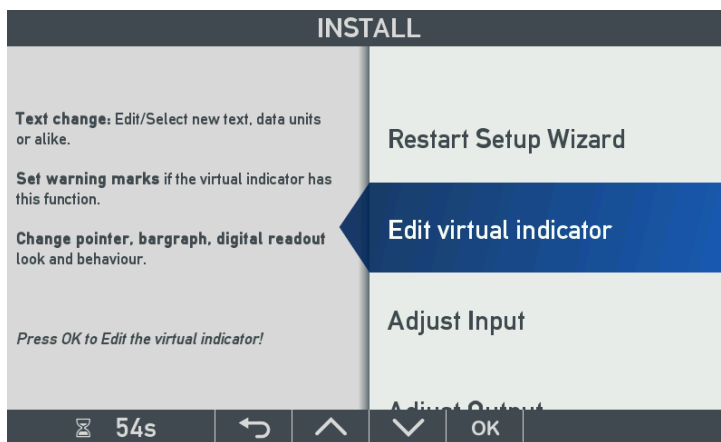
The installation menu contains the following items:
- Restart Setup Wizard
- Edit virtual indicator
- Adjust Input
- Adjust Output
- NMEA setup
- CAN bus setup
- Service

To change the NMEA setup, you must highlight NMEA setup and press OK:

INSTALL/NMEA setup
NMEA input setup...
NMEA output setup...
Routing NMEA in -> out...
Comport setup...
NX Button setup...
⏳ 55s ↶ ∧ ∨ OK

Select NMEA setup....

INSTALL/ ... /NMEA input setup
Auto scan and input selection...
Manual input selection...
Manual input configuration...
⏳ 57s ↶ ∧ ∨ OK
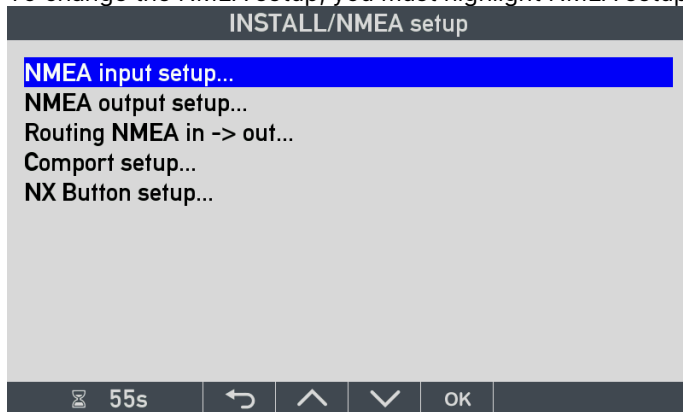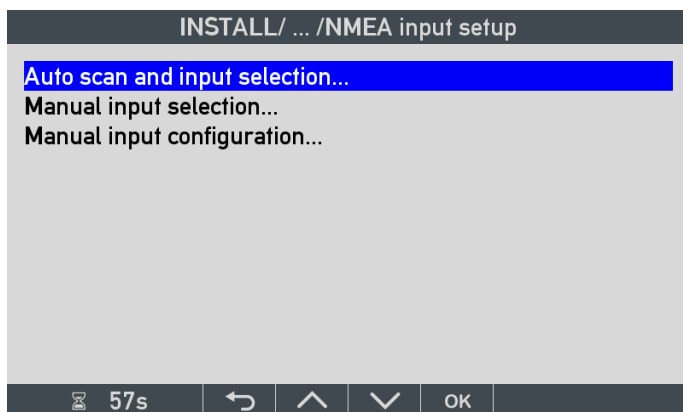
If a new NMEA source is added or a source is moved to another input port, you must run the auto scan again to update the list of available data sources.
Please note that the XDi is not allowed to make source changes automatically, even if it is no longer available. The XDi will keep the locked source selection until you change it manually.

To change a source, you must enter the manual input selection menu, open the data group where you want to make a change and then open the actual data type to select another source.
If you cannot find the NMEA source in the list and you know it is active on an input port, you can run the auto scan function again. If it is still not showing up, you can check if the NMEA data is actually received or not. For this, use the NMEA monitor function in the service menu.
See Appendix 3.

5.6.2 When is it necessary to make a manual setup?

It is necessary to scan the NMEA inputs again and make a manual setup:
- if you move the data source to another input port
- if you change the unit sending NMEA data with a device that has a different talker ID
- If a new device provides NEMA data in a different NMEA sentence type

5.6.3 Master reset

By pushing button 1 and 3 simultaneously for more than 5 seconds, you can make a master reset and bring the unit back to the factory default settings.
It may be a good idea to make a master reset and start from the beginning:
- I If you have made big changes in the NMEA installation
- Moved the XDi from one system to another
Master reset is the only way to completely clear the source selections and start over from scratch.

5.6.4 Adjust heading input data to correct for sensor error

If the magnetic compass sensor was incorrectly aligned when it was mounted, it is possible to make an angle correction in the XDi instead of rotating the physical compass unit.

Enter the installation menu and select "NMEA input setup":

```
INSTALL/ ... /NMEA input setup

Auto scan and input selection...
Manual input selection...
Manual input configuration...



            58s        OK
```
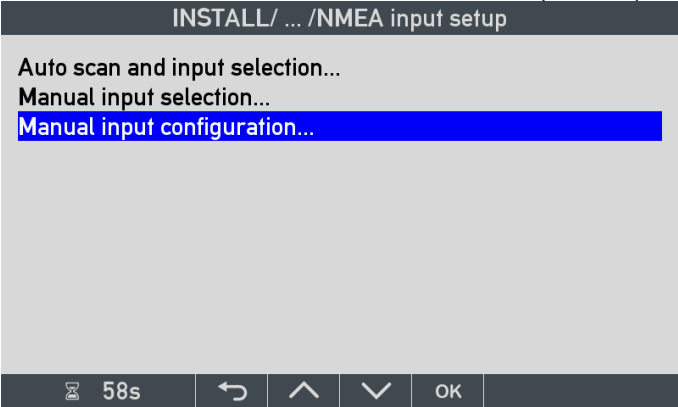
Select "Manual input configuration..."

```
INSTALL/ ... /NMEA group config

Input group (Press OK to open)         Scan result
------------------------------------------------------------
COMPASS                                           ○



            56s        OK
```
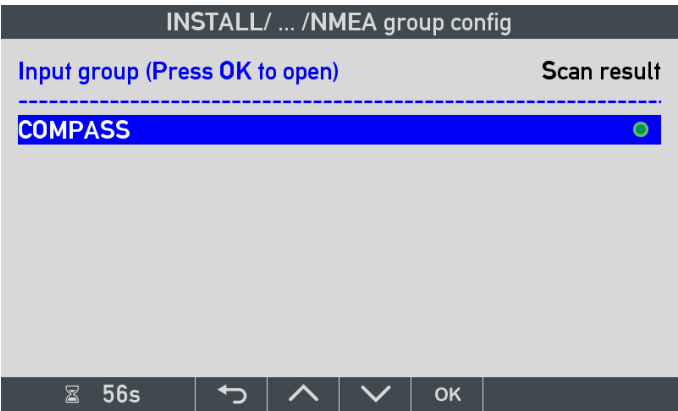
Select the "COMPASS" data group

```
INSTALL/ ... /NMEA config list

Input (Press OK to edit)               Scan result
------------------------------------------------------------
Heading M 1                            2.1 HE HDG
Heading T 1                            2.1 HE HTD
Heading T 2                            2.1 II HDT
Mag. Var. 1                            2.1 HE HDG
Rate of turn 1                         2.1 HE ROT
Rate of turn 2                         2.1 HE ROT


            54s        OK
```
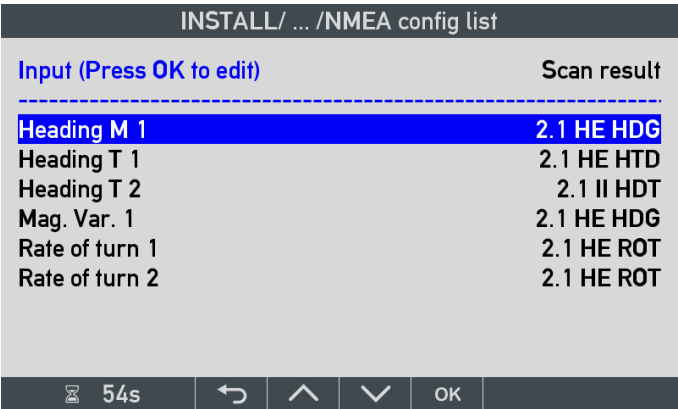
To correct the angle, select the "Heading M 1"; it is magnetic heading instance 1.

```
INSTALL/ ... /NMEA input config

Data index:                            0x3AB1:0x02
COM channel:                                   2.1
Talker ID:                                      HE
Sentence ID:                                   HDG
XDR trans. ID:
Calculation:                                   N/A
Selection:                                     N/A
Offset:                                          0
Filter:                                          0
XDi-net:                               CAN1&CAN2

            59s        OK
```
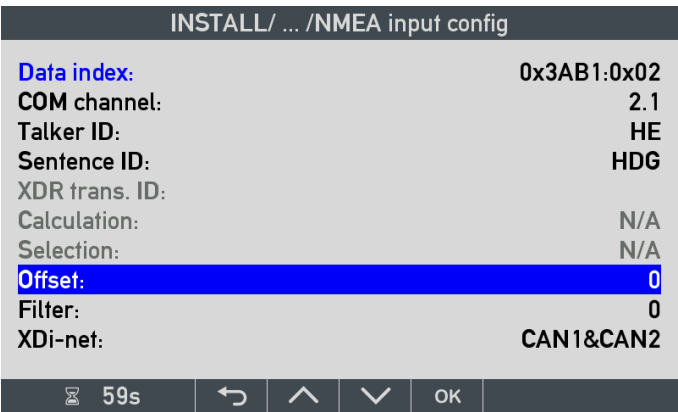
Select the "Offset:" line and insert the angle correction. Be aware that the XDi is using 0.1 resolution of the angle, so a positive angle correction of +2.0 degrees must be entered as 20.
The offset is added to the received heading angle.

```
┌─────────────────────────────────────────┐
│         INSTALL/ ... /NMEA input config   │
├─────────────────────────────────────────┤
│ Data index:                   0x3AB1:0x02 │
│ COM channel:                         2.1  │
│ Talker ID:                            HE  │
│ Sentence ID:                         HDG  │
│ XDR trans. ID:                            │
│ Calculation:                         N/A  │
│ Selection:                           N/A  │
│ Offset:                               20  │
│ Filter:                                0  │
│ XDi-net:                      CAN1&CAN2   │
├─────────────────────────────────────────┤
│  ⧗ 56s    ↩    ∧    ∨    OK               │
└─────────────────────────────────────────┘
```

If the received heading angle is 270.0 degrees, then the correction of 20 (=2.0 degree) is added, and the indicator will show a true heading of 272.0 degrees.
The corrected angle is distributed on CAN using the XDi-net protocol, and all XDi heading indicators on the CAN bus will be able to automatically present the corrected heading angle.

Please note that if the NMEA routing function is used to distribute the true heading sentence, this angle correction will not be included. The received heading sentence will just be routed directly to the output without any change.

It is possible to make an offset on all normal data types, but be aware of the resolution. It can be different from data type to data type. You can find the resolution in the "XDi-net CANopen reference manual 4189350066 UK.pdf".

5.6.5 Changing filter settings

All standard parameters can be filtered to reduce fluctuations.
The filter function is calculating the average of the latest received input values, and the filter value indicates the number of values used to calculate the average value.

Highlight Filter and press OK

```
┌─────────────────────────────────────────┐
│         INSTALL/ ... /NMEA input config   │
├─────────────────────────────────────────┤
│ Data index:                   0x3AB1:0x02 │
│ COM channel:                         2.1  │
│ Talker ID:                            HE  │
│ Sentence ID:                         HDG  │
│ XDR trans. ID:                            │
│ Calculation:                         N/A  │
│ Selection:                           N/A  │
│ Offset:                               20  │
│ Filter:                                0  │
│ XDi-net:                      CAN1&CAN2   │
├─────────────────────────────────────────┤
│  ⧗ 56s    ↩    ∧    ∨    OK               │
└─────────────────────────────────────────┘
```

Highlight Filter and press OK:

```
┌──────────────────────────────────────────────┐
│                   INSTALL                      │
├──────────────────────────────────────────────┤
│                                                │
│                                                │
│                                                │
│  ┌──────────────────────────────────────────┐ │
│  │ Set the average filter   min. 0  008  max. 100│
│  └──────────────────────────────────────────┘ │
│                                                │
│                                                │
│  ⧗ 57s    ↺    ︿    ←    OK                   │
└──────────────────────────────────────────────┘
```

Change the filter value using arrow up and press OK

```
┌──────────────────────────────────────────────┐
│        INSTALL/ ... /NMEA input config         │
├──────────────────────────────────────────────┤
│ Data index:                      0x3AB1:0x02   │
│ COM channel:                            2.1    │
│ Talker ID:                               HE    │
│ Sentence ID:                            HDG    │
│ XDR trans. ID:                                 │
│ Calculation:                            N/A    │
│ Selection:                              N/A    │
│ Offset:                                  20    │
│ Filter:                                   8    │
│ XDi-net:                        CAN1&CAN2      │
│                                                │
│  ⧗ 52s    ↺    ︿    ﹀    OK                  │
└──────────────────────────────────────────────┘
```

When the heading angle is received every 0.1 second from the sensor, the filter value 8 means that data is averaged over the last 8 measurements or over 0.8 seconds.

ⓘ   Please note that all input data types have a dedicated filter value. It often makes sense to fil on some data types than on others.

5.6.6 The other input configuration parameters

```
┌────────────────────────────────────────┐
│       INSTALL/ ... /NMEA input config   │
├────────────────────────────────────────┤
│ Data index:                0x3AB1:0x02  │
│ COM channel:                       2.1  │
│ Talker ID:                          HE  │
│ Sentence ID:                       HDG  │
│ XDR trans. ID:                          │
│ Calculation:                       N/A  │
│ Selection:                         N/A  │
│ Offset:                             20  │
│ Filter:                              8  │
│ XDi-net:                    CAN1&CAN2   │
├────────────────────────────────────────┤
│  ⏳ 52s    ↰    ⋀    ⋁    OK            │
└────────────────────────────────────────┘
```

In this input configuration menu, it is also possible to manually set up the input channel, the talker ID and the sentence. You should only set up or change those parameters if you know what you are doing.
It can however be useful in the situation where an NMEA sentence is not available when the auto scan and setup process is performed during installation. Maybe the sensor is not added until later, but the sentence and input port are known.

The hex value 0x3AB1:0x02 in the top line is the data index and sub-index used to distribute data on XDi-net. In the last menu line, you can change or stop the distribution of this data type on XDi-net (CAN).

5.7 Edit the indicator headline
The headline of the indicator can be changed from the XDi installation menu.

```
┌────────────────────────────────────────┐
│                INSTALL                  │
├────────────────────────────────────────┤
│ Text change: Edit/Select new text, data units │
│ or alike.                               │
│                      Restart Setup Wizard │
│ Set warning marks if the virtual indicator │
│ has this function.                      │
│                   ▶ Edit virtual indicator │
│ Change pointer, bargraph, digital       │
│ readout look and behaviour.             │
│                      Adjust Input       │
│ Press OK to Edit the virtual indicator! │
│                      Adjust Output      │
├────────────────────────────────────────┤
│  ⏳ 59s    ↰    ⋀    ⋁    OK            │
└────────────────────────────────────────┘
```

Select the menu "Edit virtual indicator" and then "Text and units" -> Headlines

You will now see:

```
┌────────────────────────────────────────┐
│ INSTALL / Edit virtual indicator / Text and units │
├────────────────────────────────────────┤
│ Headline 0: HEADING                     │
│                                         │
│                                         │
│                                         │
│                                         │
│                                         │
│                                         │
│                                         │
├────────────────────────────────────────┤
│  ⏳ 51s    ↰    ⋀    ⋁    OK            │
└────────────────────────────────────────┘
```

Press "OK" to select a new headline text from the list of predefined headlines:

INSTALL / ... / Select

Group name:

Select from list

Invisible
Add new text...
HEADING
Heading

⧗ 58s ↺ ∧ ∨ OK
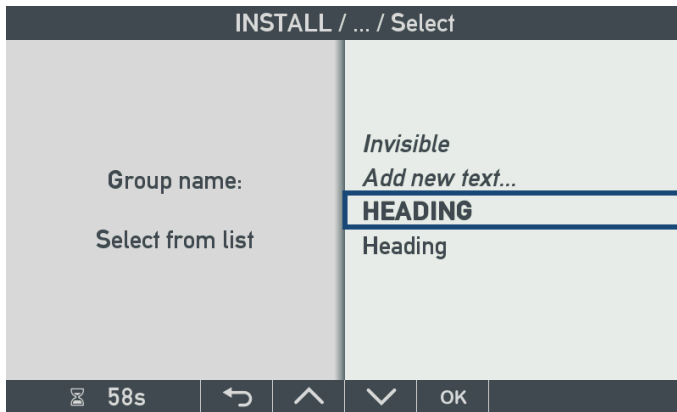
Alternatively, select "Add new text" to enter a new headline using the virtual keyboard.
It is also possible to make the headline invisible.

INSTALL / Edit virtual indicator / Text and units
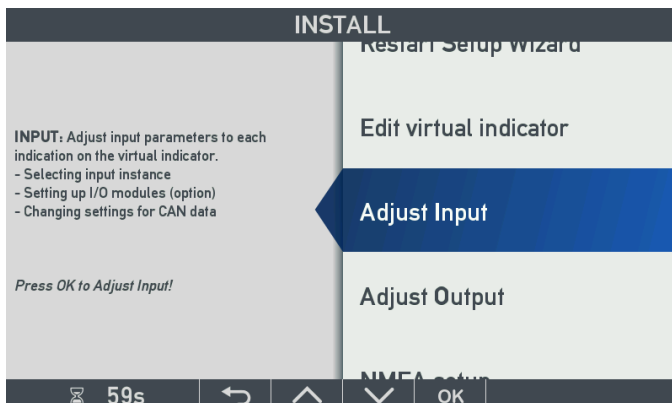
Clear	<- Cursor	Cursor ->	<- BS
Q	W	E	R	T	Y	U	I	O	P
A	S	D	F	G	H	J	K	L	
@	Z	X	C	V	B	N	M	&	SAVE
^Sh	123→+!#:..?	SPACE	↺

⧗ 54s ← ∧ → OK
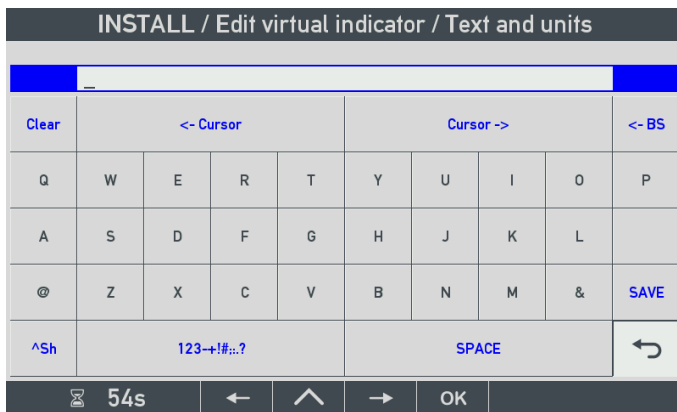
5.8 Source select and fall-back setup

The XDi can be designed to handle up to 3 input sources for each indication in the selected virtual indicator.
For example, in the standard heading indicators, it is possible to connect up to 3 heading sources (Gyro1, Gyro2 and Mag. compass).
The source selection can be automatic. In this case, the 1st priority source is selected if it is available; and if it is unavailable, 2nd priority is used; and if that one drops out, the 3rd priority is used. It is also possible to make a manual fixed selection or change priority, this is made via the installation menu adjust input.
The following example shows the input adjust for VI002 in the standard heading library.
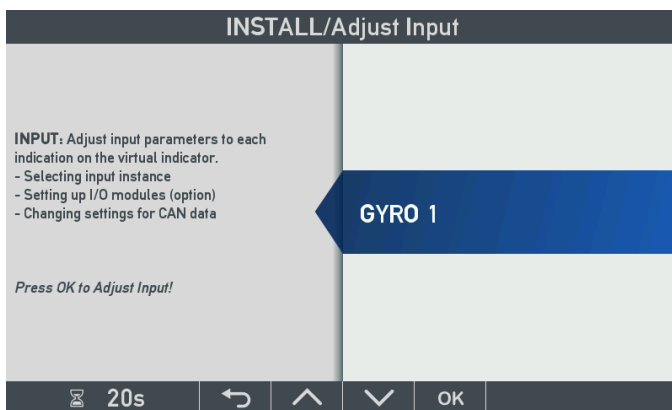

To view or change the multi-source and fall-back function, enter "Adjust input" in the installation menu:
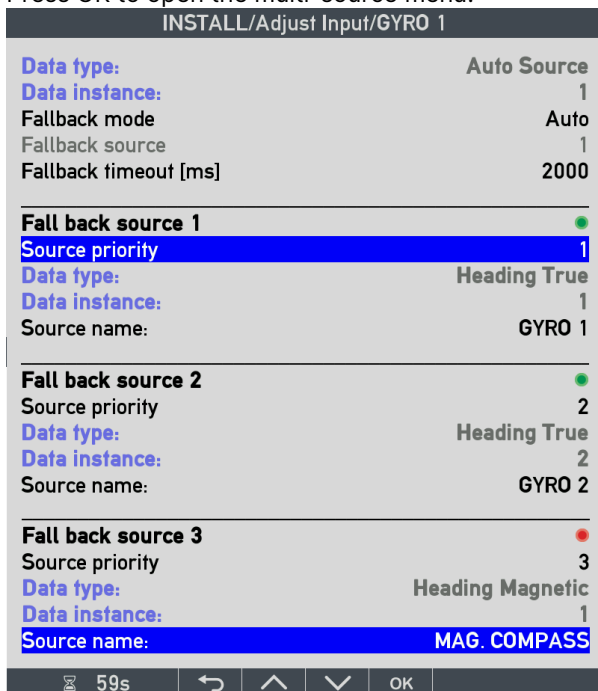

INSTALL

Restart Setup Wizard

INPUT: Adjust input parameters to each indication on the virtual indicator.
- Selecting input instance
- Setting up I/O modules (option)
- Changing settings for CAN data

Press OK to Adjust Input!

Edit virtual indicator

Adjust Input

Adjust Output

NMEA setup

⧗ 59s ↺ ∧ ∨ OK

Restart Setup Wizard

INPUT: Adjust input parameters to each indication on the virtual indicator.
- Selecting input instance
- Setting up I/O modules (option)
- Changing settings for CAN data

Edit virtual indicator

Adjust Input

Press OK to Adjust Input!

Adjust Output

NMEA setup

59s

VI002 is only presenting heading.
In the input adjust menu, the name of the active data type is presented (GYRO 1).

INSTALL/Adjust Input

INPUT: Adjust input parameters to each indication on the virtual indicator.
- Selecting input instance
- Setting up I/O modules (option)
- Changing settings for CAN data

GYRO 1

Press OK to Adjust Input!

20s

Press OK to open the multi-source menu:

INSTALL/Adjust Input/GYRO 1

Data type:	Auto Source
Data instance:	1
Fallback mode	Auto
Fallback source	1
Fallback timeout [ms]	2000

Fall back source 1	●
Source priority	1
Data type:	Heading True
Data instance:	1
Source name:	GYRO 1

Fall back source 2	●
Source priority	2
Data type:	Heading True
Data instance:	2
Source name:	GYRO 2

Fall back source 3	●
Source priority	3
Data type:	Heading Magnetic
Data instance:	1
Source name:	MAG. COMPASS

59s

The fall-back mode can be "Auto" or "Manual".
In manual mode, the fall-back source number (shown in the next line) will be locked as input source.
Fall-back timeout: This parameter defines the time to go before the active source is replaced by the next priority source, after the active source has lost its data.
When a higher priority source reappears, it will automatically take over as source.

● or ● indicates if the source is providing input data or not.

Source priority: It is possible to change the priority order from this menu. It is possible to give 2 fall-back sources the same priority. In this case, reappearance of the other source with the same priority will not result in a source shift.

Source name: It is also possible to change the source name.
Be aware that the source name is often presented at the indicator to show which source is active and providing data.
In the standard heading indicator, the names GYRO 1, GYRO 2 and MAG. COMPASS are shown on the scale as illustrated below.
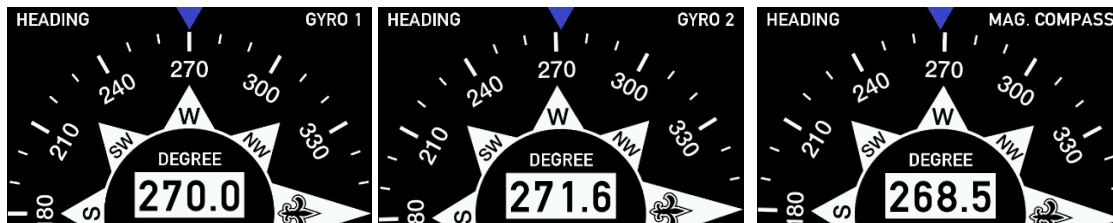
In the standard heading indicator VI003, the ROT has 2 fall-back sources; the input selected should be consistent with the selected gyro. It can also be set to fixed source or the same NMEA source can be selected for both ROT 1 and ROT 2 (the auto NMEA setup will normally select same source for both).

6   Appendix 2 – Normal operation of XDi-N

The normal user functions presented in this example is for the XDi indicators used in system 1 to 3 in this application note. Other types of indicators will have more user functions.

| Indicator mode | Button1 | Button2 | Button3 | Button4 | Dimmer level (0 to 100) |

6.1 Toggle between screens (Button1)

The XDi can have up to 4 screen modes for a virtual indicator. Some of the other standard indicator types use this function, for example, some of the standard wind indicators that have 2, 3 or 4 screens presenting different data types or combinations.

The standard heading indicators only have one screen, and the toggle button is not active.

6.2 Dimmer up/down (Button 2 and 3)

Use the push-buttons below the symbols to dimmer up or down:

Press shortly to adjust the dimmer level one step at a time or keep pushing the button to make larger adjustmets.

The actual dimmer level is shown in the right side of the menu bar: Level 100
Level 100 is maximum backlight and 0 is the minimum level.

6.3 Quick menu (Button 4)

The quick menu opens for the basic user setup functions:
- Unit profile toggle,
- Unit profile setup
- VI mode setup
- Time and date setup
- User menu (gives access to dimmer, warning and sound setup)

The two first menu points are described above, and the last three points are covered in details in the "XDi designers handbook 4189350049 UK.pdf".

7 Appendix 3 - Troubleshooting

7.1 NMEA monitor

XDi has a built-in monitor function that can present all NMEA sentences received (RX) from devices connected to one of the NMEA inputs on an NX2 module.
The monitor will also present NMEA sentences sent out on one of the NMEA outputs.
In the following, it is NMEA data from a wind indicator system that is used to illustrate the function of this monitor tool.
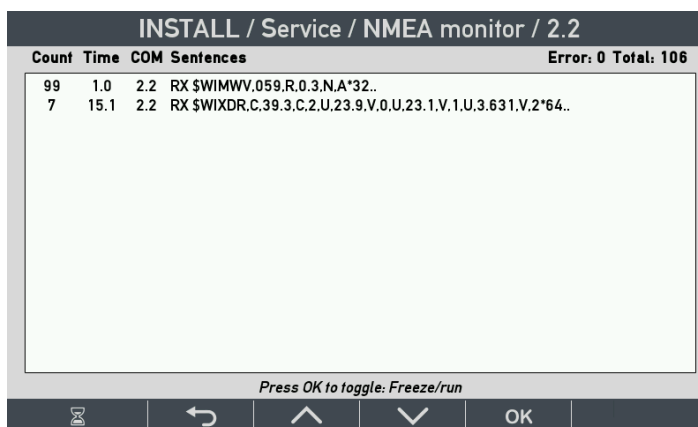
The NMEA monitor is available in the service menu located in the install menu.

When you open the monitor, you can decide if you only want to see data from one of the com ports or you want to see communication on all com ports.
When two NX2 extension modules are mounted on the XDi, there can be up to 6 active ports.

In a fault situation, the NMEA monitor can be a great help determining whether a given NMEA sentence is available or not.
If you know the structure of an NMEA sentence, you can also see if data is valid or invalid.

The NMEA monitor presentation is explained in the table below.

Count	Time	COM	Sentence	
Number of received/tra sentences since the lo started	Interval betweer (in seconds)	COM port on NX2 modu receiving/transmitting da	RX: received TX: transmitted	NMEA sentence

For easy analyse of the NMEA sentence content, it is possible to freeze the screen on the NMEA monitor. Press the OK button once to freeze and once more to return to normal mode showing every received sentence.

In the upper right corner, you find the total number of received sentences and the error counter that shows the number of faulty sentences that have been received since the monitor was started. Errors can occur if the NMEA line is connected and disconnected in a running system, or it can be caused by a faulty NMEA transmitter.

If the received data on one of the NMEA input ports looks very strange, it can be due to wrong polarisation of the A and B input terminals. Try to swap the A and B wires around.

Strange looking sentences can also be caused by input data with an incorrect bit rate. The default bit rate on all NMEA inputs are 4800 bps, but it can be changed via the comport setup located in the INSTALL/NMEA setup menu.

7.1.1 Example

The wind sensor is connected to the XDi, but relative wind speed or direction is flashing, and the data lost pop-up is shown on the indicator.
Enter the service menu and select the NMEA monitor to see the received NMEA sentences.
The NMEA monitor shows:

46	1.0	2.2	RX $WIMWV,70,R,14.6,N,V*2E

This means that 46 sentences are received since you started the monitor, and the MWV wind data sentence is received (RX) every second from COM port 2.2 (Slot 2, NMEA input 2).
$ is the start sign of the NMEA sentence
WI is the talker ID for a weather system.

MWV   is the weather sentence
70   is the wind angle (wind angle can be from 0 to 359 degrees)
R   means that it is relative wind, it can also be T=true wind
14.6   is the wind speed
N   means that wind speed is in knots (other valid units: K=km/h and M=m/s)
V   is the data status flag, V = data is invalid and A = data is valid.
*2E   is the termination and checksum

In this example, the missing wind data is caused by the status flag V indicating that the wind sensor is not able to calculate valid data. The data sent is invalid.

7.2 Typical NMEA faults

No.	Situation	Result on the XDi indicator	Cause of problem
1	The NMEA sentence looks f coming from port 2.2	The NMEA data from the sens auto selected, so the indicato data lost.	The standard library expects the sensor data to be connected to 2.1 or 2.3. In this case, it is port so you must manually select this
2	The status flag in the senter (not A = valid)	The NMEA sentence is select source, but the indicator show invalid.	The heading sensor is not able t heading data and is sending dat invalid.
3	Data on port 2.1 is shown as random letters, and the erro increasing	No NMEA heading source is o and the indicator shows data	The A and B wire is most likely i connected. Check that it is the N and try to swap them around.
4	Data sentence is OK, but so the indicated time jumps fro seconds.	Periodic data lost pop-up	Bad connection, in which case e incorrect sentence from this slot also often be registered.
5	The time jumps from 1.0 to : and the error counter increa	The heading indicator seems	The time jump indicates that dat may be due to a bad connection electrical interference.
6	The heading sentence looks the talker ID is WA (not HE)	No data source is indicated, a missing.	WA is not a valid talker ID and th is therefore rejected. If you know the sentence is OK, manually set the talker ID to "do and the sentence will be accepte
8	The heading sentence is dro periodically	Data lost is indicated. The po digital readout is flashing.	Bad interface cable connection. Bad cable shield connection or g the sensor.

8   Appendix 4 - External dimming

XDi-N offers a number of different ways to control the dimmer level and day/night colour shift.
Dimmer data from external inputs will also by default be shared on XDi-net (CAN), but it is also possible to set up the XDi to send the dimmer value periodically in a DDC command on the NMEA output. This can be used to control other devices in the systems.
Please see the detailed description of the available Product Profiles (PP) with different default dimmer configurations in: XDi144_192_N_000003_001_rxxx_v2xxx.pdf.

8.1 Dimming from external push-buttons

Connect a push-button from each of the two contact inputs on the NX2 module to common and set them up to work similarly to front button 2 and 3. This is done in the installation menu: "NMEA setup..."\"NX button setup...".
The external push-buttons will now dimmer up and down exactly as the two push-buttons on the front. This function will work with any Product Profile setup for dimming via front push-buttons.
The dimmer buttons on the XDi front will still work, and the dimmer setting for the active dimmer group is shared on XDi-net.

8.2 Dimming from external potentiometer (AX1)

In the standard library, product profile PP02 supports dimming from a connected potentiometer.
This requires an AX1 analogue extension module mounted on slot 1 on the XDi-N.
Only XDi 144 N and XDi 192 N have two extension slots allowing for installation of both AX1 and NX2 extension modules at the same time.
XDi 96 N can have an AX1 module installed when it is receiving data via XDi-net, and in this case, it can control other XDi 96 indicators in the same dimmer group via XDi-net.

The dimmer potentiometer must be connected to the AX1 module like this:

AX1 terminal	AX1 name	Potentiometer
1	AGND	Left (min)
2	HV3+/DIMM	Wiper
3	REF*	Right (max)

*) The REF terminal is a reference voltage output (+7.5 V DC). An external voltage >+7.5 V can be connected between REF(3) and AGND(1) and overwrite the ref. voltage. The dimmer level will be scaled correctly relative to the new higher reference voltage.
The analogue dimmer value is shared via XDi-net to all XDi units in dimmer group 1 (default, it can be changed to any group between 1 and 9).

ⓘ   Please note that the front button dimmer will not work when the AX1 module is controlling th
level.

8.3 Dimming from analogue voltage input (AX1)

The product profile PP04 mentioned above can be reconfigured from the user menu to act as a normal voltage input (range 0 to max. 30 V), and the min and max dimmer input voltage must be set up to be scaled to respectively 0 % and 100 % dimmer level.

8.4 Dimming from a central system using NMEA

To have an XDi dimmer group controlled via an NMEA command from another system, one of the product profiles supporting NMEA dimmer must be selected. In addition, one of the standard NMEA inputs must be connected to the NMEA output that transmits a DDC dimmer control sentence.
See the Lib specification: XDi144_192_N_000003_001_rxxx_v2xxx.pdf for details of which PP to select.
If more than one dimmer group is controlled via NMEA, the DDC must either have a separate talker ID or be sent on separate input ports.
The front button dimmer may still work in this mode if DDC command is only sent when a dimmer level is changed. If the DDC command is sent periodically, it will overrule the front button control.

9   Appendix 5 - Installing a CAN bus system

9.1 XDi CAN bus ports

The XDi-N base unit is equipped with two CAN bus ports, and CANopen is the standard interface protocol. The unique DEIF XDi-net plug and play extension to the CANopen protocol is used in all DEIF standard libraries for easy data sharing, and it is also used in many custom specific libraries, to make system setup and integration easy.

The following section describes the basic CAN installation information. The example is using the DEIF standard wind indicator system with multiple XDi indicators.

For more detailed information, please consult the "XDi-net CANopen reference manual 4189350066 UK" which can be found on www.deif.com under the XDi documentation.

9.2 CAN bus system wiring

The XDi-N unit can be connected to the CAN bus either by a short drop cable to the backbone or by daisy-chaining the backbone from unit to unit (see drawing).
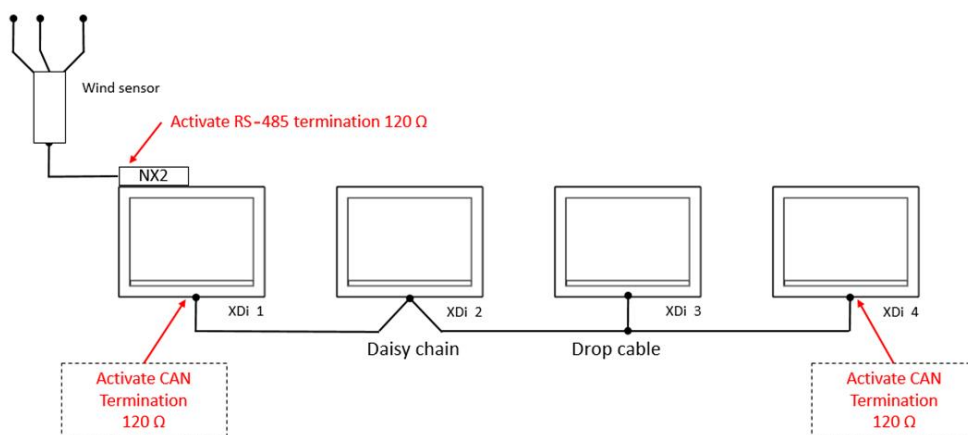

The standard terminal block, with a single row of 5 screw terminals, supplied as standard for the XDi-N, is most appropriate for drop cable connection. Daisy chaining will require two wires to be mounted in each terminal location.

Recommendation: If daisy chain is the preferred installation form, we recommend that you order the XDi-N unit with either the double screw terminal option or the double spring terminal option (see the XDi data sheet for ordering information).

9.3 CAN backbone and termination
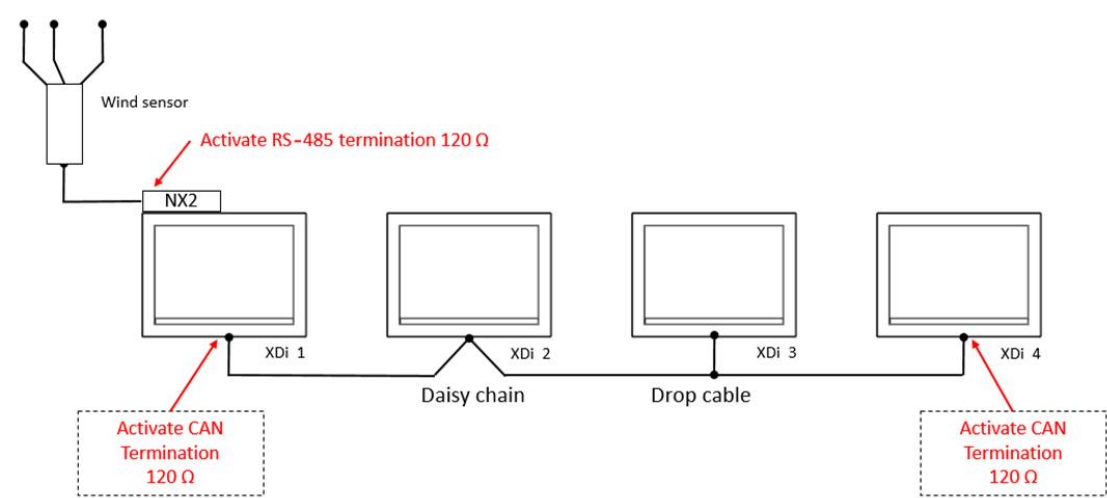
9.3.1 Termination

The CAN bus must be terminated in each end of the CAN bus cable line by a 120 Ω resistor. To make termination easy, the XDi has a built-in 120 Ω termination resistor. Set the switch to ON (see drawing) to activate the termination. Each of the two CAN ports has a separate built-in termination resistor and ON/OFF switch.
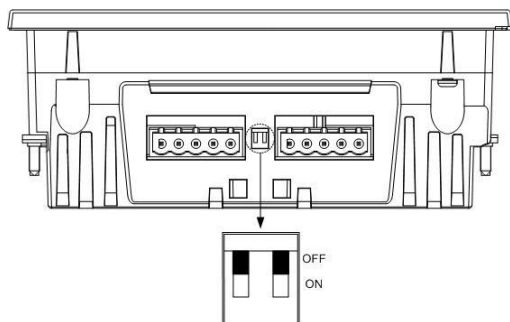
ⓘ   Only two termination resistors can be connected in a CAN bus network. Adding more termin
overload the CAN drivers, disturb communication and in the long run maybe damage the CA
circuit.

9.3.2 Termination example

This example shows a system where it can be considered where to insert the termination.

If the cable from the CAN angle transmitter <u>exceeds</u> the max allowed drop cable length (10 m @125 kbps), then a 120 Ω termination resistor should be installed in the connection box.

If the cable from the CAN angle transmitter is <u>less</u> than the max allowed drop cable length (10 m @125 kbps), then the CAN bus can be terminated using the internal termination in XDi 1 (left side), and the other termination can be made using the internal termination in XDi 3 (right side).

9.3.3 Backbone and drop-cable

The CAN bus backbone is the CAN bus cable between the two end-point terminations. In a practical installation, terminations should be inserted in a way so that the most cable length will be serially connected between the two terminations. This cable will then be defined as the backbone. A cable section connected to the backbone in one end and to a product in the other end (without termination), is called a drop-cable. Drop-cables are not part of the backbone, but the length of all drop-cables must be included in the total allowed CAN bus cable length.

Gage	Not less than AWG24/0.205 mm^2 (approx. 90 mΩ/meter), thicker ca recommended as long as the entity parameters are considered
Characteristic impedance	120 Ω +/-10 % up to at least 500 kHz
Cable loss	The AC signal attenuation must be less than 24 dB/100 m up to 16 MH
Propagation delay	Maximum 5 ns/meter

9.3.4 Specifications of the data wire pair (twisted pair):

The gage should be at least AWG20/0.5 mm^2 (approx. 33 mΩ/meter). Where long supply cables are used, thicker wire is recommended, and worst-case calculations of supply voltage drop in the cable should be performed Guidelines for selecting CAN bus cable can also be found in ISO11898-2.

> If redundant CAN bus is used, the 2 CAN bus cables should be routed separately and in a sa distance from each other to reduce the risk of a single event damaging both CAN bus cable

9.4 Shielding and grounding of the CAN bus cables

9.4.1 Cable shield

Where CAN cables are connected, the cable shield must be interconnected. The cable shield must not be connected to the CAN GND terminal on the XDi. CAN GND is a "common" terminal that must only be used if there is an extra "common mode wire" included in the CAN cable (that is the twisted pair for data + one common wire). This extra wire reduces common mode voltage between CAN devices on the bus, but it is only rarely used in

marine applications.

9.4.2 Grounding of the CAN bus cable

It is recommended only to connect the shield, of the total CAN bus network, to the ship's ground in one single location.
It is important that the ground connection used is free from noise and transients from other devises using the same ground connection. If a good and noiseless ground connection is not available, it is normally better not to connect the CAN bus cable shield to ground at all.

Using multiple ground connections on the CAN bus cable may create electrical noise loops in the CAN bus communication.

10 Appendix 6 – Standard heading library overview

You can find the latest content of DEIF standard libraries and a detailed description of indicators and setup profiles via www.deif.com.
In the XDi documents folder, open "Other technical documents" and the document: "XDi-Standard virtual indicator library 4189350067.pdf". Link: https://www.deif.com/documentation/xdi/

The indicator scales can also be viewed in the Scale viewer by clicking on Scales button at https://www.deif.com/products/xdi.

In the document, you will find useful information and a link to the DEIF FTP server where the detailed library documentation and the DEIF standard library installation packages can be downloaded.

The standard library documentation (pdf) and XDi library packages for upload can be downloaded from the DEIF FTP server: ftp://support.deif.com

Username	Password
deif_xdi	rFCy1CMM

Open the folder "Standard Lib. documents" and "Owner_3_Lib001 Navigation".

The standard heading library has library owner number 00003 and library number 001.

11 Appendix 7 – Ordering XDi for a heading system

In this appendix, you will find lists that make it easy to order a heading indicator system. In the application document, you must first find the system that best matches your system application and then find and fill in the order sheet for that system.

11.1 ORDER SHEET SYSTEM 1, 2 – single indicator system
Select one green box below to select the main indicator component.
To complete the system, select the options needed from the orange boxes.

Type	Product name	Order number	Library no.	Select
Indicator 1	Main unit	NMEA interface		
Main indicator (NMEA in)	XDi 96 N	2951270020-01		
	XDi 144 N	2951270030-01	Owner 3, Lib 1	
	XDi 192 N	2951270040-01	Owner 3, Lib 1	
Option for XDi-N	NX2 ext. module	NMEA i/o		1
	IP66 front	IP66 from front		
	AX1 ext. module	analogue input (dimmer)		*
	Front frame	without buttons		
	5-pole plug	double screw terminals		
		double spring terminals		

*) AX1 can only be ordered for XDi 144/192 N. The XDi 96 N has one extension slot that is occupied by the NX2 module.

11.2 ORDER SHEET SYSTEM 3 - Double indicator system

Select one green and one blue box below to select the main system component.
(The yellow boxes are mandatory selections)
To complete the system, select the needed options from the orange boxes.

Type	Product name	Order number	Library no.	Select
Indicator 1	Main unit	NMEA interface		
Main indicator (NMEA in)	XDi 96 N	2951270020-01		
	XDi 144 N	2951270030-01	Owner 3, Lib 1	
	XDi 192 N	2951270040-01	Owner 3, Lib 1	
Option for XDi-N	NX2 ext. module	NMEA i/o		1
	IP66 front	IP66 from front		
	AX1 ext. module	analogue input (dimmer)		*
	Front frame	without buttons		
	5-pole plug	double screw terminals		
		double spring terminals		
Indicator 2	Second unit, no NMEA interface			
Second indicator (XDi-net)	XDi 96 N	2951270020-01		
	XDi 144 N	2951270030-01	Owner 3, Lib 1	
	XDi 192 N	2951270040-01	Owner 3, Lib 1	
Option for XDi-N	NX2 ext. module	NMEA i/o		0
	IP66 front	IP66 from front		
	AX1 ext. module	analogue input (dimmer)		*
	Front frame	without buttons		
	5-pole plug	double screw terminals		
		double spring terminals		

*) AX1 can only be ordered for XDi 144/192 N. The XDi 96 N has one extension slot that is occupied by the NX2 module.

11.3 Accessories

It is possible to order most of the options separately as accessories.

11.3.1 XDi-N accessories

Type	Product name	Order number
Extension	AX1 analogue inputs for example used for analogue dimmer input	2951260090-05
modules	DX1 digital inputs and relay outputs	2951260090-06
	NX1 NMEA output, extra NMEA output and 2 external button inputs	2951260090-07
	NX2 NMEA i/o, extra NMEA in/outputs and 2 external button inputs	2951260090-17
Front frame	Front frame XDi 96 without buttons (for example for overhead mounting)	2951260090-11
without	Front frame XDi 144 without buttons (for example for overhead mounting)	2951260090-12
buttons	Front frame XDi 192 without buttons (for example for overhead mounting)	2951260090-13
Front frame	Front frame XDi 96 with 4 buttons*	2951260090-14
without	Front frame XDi 144 with 4 buttons*	2951260090-15
buttons	Front frame XDi 192 with 4 buttons*	2951260090-16
Plugs	2 pcs 5-pole plug with double screw terminals	2951260090-08
	2 pcs 5-pole plug with double spring terminals	2951260090-09
	2 pcs 5-pole plug with single screw terminals*	2951260090-10

*) Is delivered as standard with XDi-N