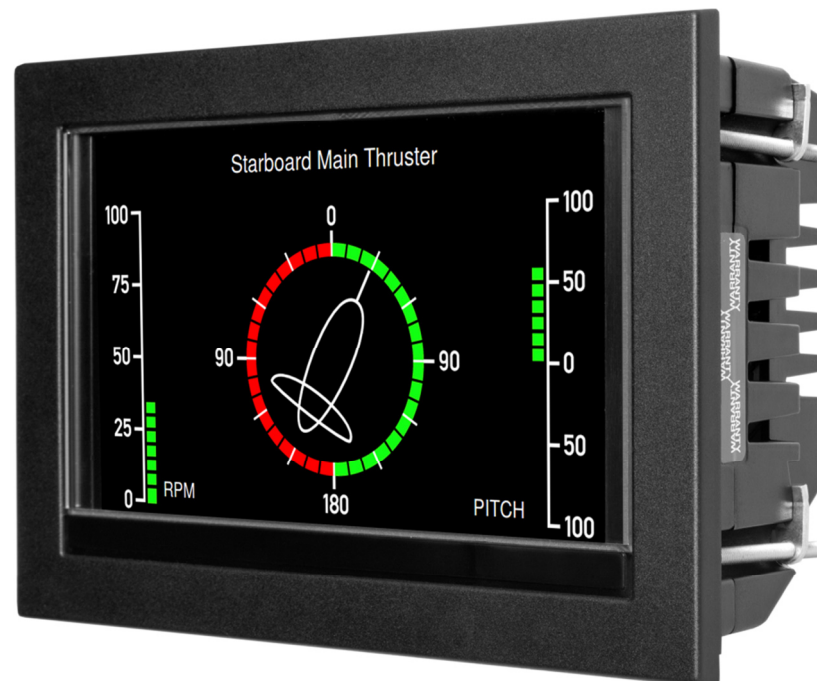


XDi Flexible Display indicator

Designer's Handbook

4189350049B



DEIFA/S



DEIF A/S, Frisenborgvej 33 Tel.: +45 9614 9614, Fax: +45 9614 9615
DK-7800 Skive, Denmark E-mail: deif@deif.com, URL: www.deif.com



Table of contents

Useful reference documents	7
General information	8
Warnings, legal information and safety	8
Warnings and notes	8
Legal information and disclaimer.....	8
Safety issues.....	8
Electrostatic discharge awareness.....	8
Factory settings.....	9
About the Designer's Handbook.....	9
General purpose	9
Intended users	9
Contents and overall structure	9
Introduction	10
Product introduction.....	10
Virtual indicator library.....	11
Product profile (PP).....	11
Virtual indicator (VI).....	11
VI-setup profile (VS).....	12
Library types.....	12
XDi type and related library classes	12
Upload a new library.....	13
Input data for XDi.....	13
Object dictionary – Object index table	13
Data type instance	13
Sourcing data to the XDi	14
CANopen TPDO or RPDO (1)	14
XDi-net as data input (2)	15
DAM-MPDO as data input (3)	16
SDO data transfer (3a)	16
Analogue data input (4)	16
Digital data input (5)	17

NMEA serial data input	17
Change selected input via menu.....	17
Menu structure	18
Surveyor info:.....	19
General menu structure.....	19
Soft keys description (left to right):	20
Submenus.....	20
Installation	22
Unpacking	22
ESD	22
Box content	22
Panel mounting of XDi	22
Cut-out and mounting depth behind panel	22
Waterproof mounting.....	23
Mounting instructions.....	23
Installing a CAN bus system	24
XDi CAN bus ports	24
CAN bus system wiring.....	24
CAN backbone and Termination	24
CAN bus cable recommendation	25
Shielding and grounding of the CAN bus cables	26
XDi power supply and CAN connections.....	27
Strain relief of cable and termination of cable shield.....	27
Supply voltage monitoring:.....	28
Warning/alert output.....	29
First time setup using the wizard.....	29
Rotate the display180°	29
Manual setup procedure	29
Step 1 - Select CAN Node ID.....	29
Step 2 - Select product profile	30
Step 3 - Select virtual indicator	30
Step 4 - Select VI setup profile	31
Skipping the wizard	32

Automated XDi setup via CAN	32
Detailed product description	33
XDi CAN bus	33
Detailed XDi-net/CANopen description	33
XDi-net for easy integration.....	33
CAN NodeID	33
Overall CAN bus parameter settings.....	35
Important XDi-net restrictions:.....	35
The CAN bus mode.....	35
CAN bus changes via menu	36
XL, BW, BRW-2 and TRI-2 with sCAN	36
Extension modules.....	37
AX1 analogue extension module	37
Analogue single input types:.....	38
Analogue scaling	39
Analogue multi-point linearisation	39
AX1 input circuit - principle diagram	41
Input protection	41
Common mode rejection	42
Connecting to the AX1 module.....	44
Configuration of the AX1 module	45
Share analogue data via CAN.....	52
DX1 digital extension module	53
DX1 input circuit - principle diagram	53
Connecting to the DX1 module.....	53
Digital inputs configuration.....	54
Digital dimmer input	58
Relay outputs	59
NX1 NMEA output module	61
Connection and cable for NMEA.....	61
Supported NMEA sentences	61
Accessing XDi menus.....	62
Surveyor information (INFO).....	62

Master reset.....	63
User menu.....	65
Dimmer	65
Normal dimmer function	65
Fixed dimmer level.....	66
Dimmer groups	67
Dimmer setup	69
Day/Night Colour shift	75
Virtual indicator colour modes	75
Auto Day/Night shift mode	78
Warning and sound.....	80
Warning log.....	80
Warning setup.....	81
Sound setup	81
Rotate display	82
Installation menu	83
Accessing the installation menu	83
Restart Setup Wizard	84
Edit virtual indicator.....	84
Text and units.....	84
Warning marks/restricted band.....	86
Indicators	89
Adjust input settings	91
XDi-net – input adjust and special use.....	92
XDi-net adjust menu – prop RPM% set point	92
CANopen MPDO as data source	93
CANopen TPDO/RPDO input adjust	93
PDO converter for azimuth/rudder	93
CANopen Rudder transmitter (for example DEIF RTC 600)	95
PDO converter for pitch %	96
PDO converter for RPM.....	96
Universal PDO converters	98
Advanced CAN functions.....	98

CANopen PDO converter synchronisation via XDi-net	98
AX1 analogue input adjust	100
AX1 analogue input – azimuth/rudder set point 1	100
AX 1 Analogue input for RPM set point	102
DX1 Digital input adjust	103
DX1 digital RPM from pickup	103
External input for control flags	105
AX1 – Analogue input as control	105
DX1 - Universal digital input of a control flag	106
DX1 Relay output adjust	106
Product-related events	106
Relay mode	107
Relay event mode	107
Indicator-related relay setup	110
NX1 NMEA output adjust	112
NMEA0183 setup menu	112
CAN bus changes via menu	115
Service menu	115
Product information page	116
Product configuration page	116
Application examples	117
Application 1 - XDi azimuth system, CANopen and XDi-Net	117
Azimuth and RPM indicator system with set point	117
Azimuth, Pitch and RPM system with set point	119
Application 2 – azimuth CANopen and analogue system	121
Azimuth and RPM indicator system with set point	121
Azimuth, Pitch and RPM system with set point	122
Application 3 – azimuth analogue system using XDi-net	124
Azimuth and RPM indicator system with set point	124
Azimuth, Pitch and RPM system with set point	125
Application 4 – azimuth, RPM pickup analogue system using XDi-net	127
Azimuth and RPM indicator system with set point	127
Azimuth, Pitch and RPM system with set point	128

Application 5 - XDi rudder system using CANopen and XDi-net.....	129
System overview	129
Setup procedure	130
Application 6: XDi rudder system, analogue angle transmitter and XDi-net.....	131
System overview	131
Setup procedure:	131
Application 7 – dimmer control	132
XDi-net, CAN TPDO or analogue dimmer using AX1	132
Push-button dimmer using DX1	133
Application 8 – group dimmer control.....	134
Terminology, Terms and abbreviations	135

Useful reference documents

XDi data sheet	4921250067
XDi-net/CANopen reference manual	4189350066
XDi standard libraries	4189350067
XDi quick start guide	4189350046

General information

Warnings, legal information and safety

Warnings and notes

Throughout this document, a number of warnings and 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.

Warnings



Warnings indicate a potentially dangerous situation, which could result in death, personal injury or damaged equipment, if certain guidelines are not followed.

Notes



Notes provide general information, which will be helpful for the reader to bear in mind.

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 XDi unit, the company responsible for the installation or the operation of the set must be contacted.



The XDi unit is not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Disclaimer

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

Safety issues

Installing and operating the XDi unit 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.



Be aware of the hazardous live currents and voltages.

Electrostatic discharge awareness

The XDi is protected against static electric discharges, but it is recommended to protect the unit against static electric discharges during the installation and when connected to a PC or

laptop for library upgrade.

Once the unit is installed and connected, these precautions are no longer necessary.

Factory settings

The XDi unit is delivered from factory with a preinstalled indicator library with certain default parameter settings. These are not necessarily the correct settings for matching the ship system in question. Precautions must be taken to check the settings before running the ship.

About the Designer's Handbook

General purpose

This Designer's Handbook mainly includes functional descriptions, presentation of the virtual indicator library, description of the installation wizard, and the user and installation menus. The menu functions are supplemented by a number of examples of how to set up and change parameters.

The general purpose of this document is to provide useful overall information about the functionality of the XDi and some application examples. It should also help you get a good understanding of the XDi product series and how you can best utilize it in your own system solutions. Either using a DEIF standard indicator library or have a custom library made to exactly match your needs for indicators and input profiles.



Please make sure to read this document before starting to work with the XDi unit and making system integration. Failure to do this could result in damage to the equipment.

Intended users

This Designer's Handbook is mainly intended for technical users like developers and system integrators. On the basis of this document, you should be able to copy and paste the relevant part into your own product documentation.

Contents and overall structure

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

Introduction

XDi is an illuminated bridge indicator where a high quality display replaces the mechanical scale and pointer combination. A high number of predefined virtual indicators (VIs) can be stored in the built-in memory. VIs are organised in a library structure.

This high flexibility is implemented much in line with the way that we handle our traditional XL family of indicators and in a controlled manor not compromising the ability to make customised indicator libraries and most important, still securing the needed approvals for relevant indicator applications on the ship's bridge. DEIF offers a series of standard libraries with a selection of often-used indicator types and in addition, the opportunity to have customised libraries designed.

Four push-buttons hidden behind the front frame combined with the installation wizard makes it easy to select the right indicator during first time installation and to make necessary parameter adjustment via the user or installation menu.

XDi normally replaces two or more traditional, class-approved, illuminated indicators that are very often part of the safety system on-board the ship. In an emergency, it is very important that such indicators present exactly the expected data type, and it is therefore not allowed to change between presentations of different data types on such indicators during normal operation.

After installation, the front frame is mounted, hiding the four buttons, and the selected virtual indicator will be fixed, most likely for the rest of its life.

Product introduction

The graphical display allows a high flexibility in both design and configuration. The XDi concept is made with easy customisation in mind, making it possible to make highly customised indicators, still based on the type-approved standard XDi platform.

XDi is available in three different physical sizes: XDi 96, XDi 144 and XDi 192, each with performance class:

- Single where indicators in the library is able to present data from one input source*
- Dual, where indicators may present data from a single or two input sources
- Multi, where indicators may present data from multiple data source, normally between 1 and 8.

The basic XDi unit is equipped with two galvanically separated CAN ports as standard data interface.

Adding an AX1 extension module, analogue inputs are available, and by adding a DX1 digital I/O extension module, digital inputs and relay outputs are available.

When other systems like a VDR or integrated navigation system needs data input from an XDi based indicator system, it is possible to add the NX1 NMEA output extension module to output relevant NMEA data sentences.

For technical details about the different extension modules, please see the XDi data sheet.

*) XDi Single is not released for sales, for single data indication, the XDi Dual should be used.

Virtual indicator library

All available virtual indicators in an XDi are located in the preinstalled XDi library. For each virtual indicator, there is also at least one VI-setup profile and one or more product profiles.

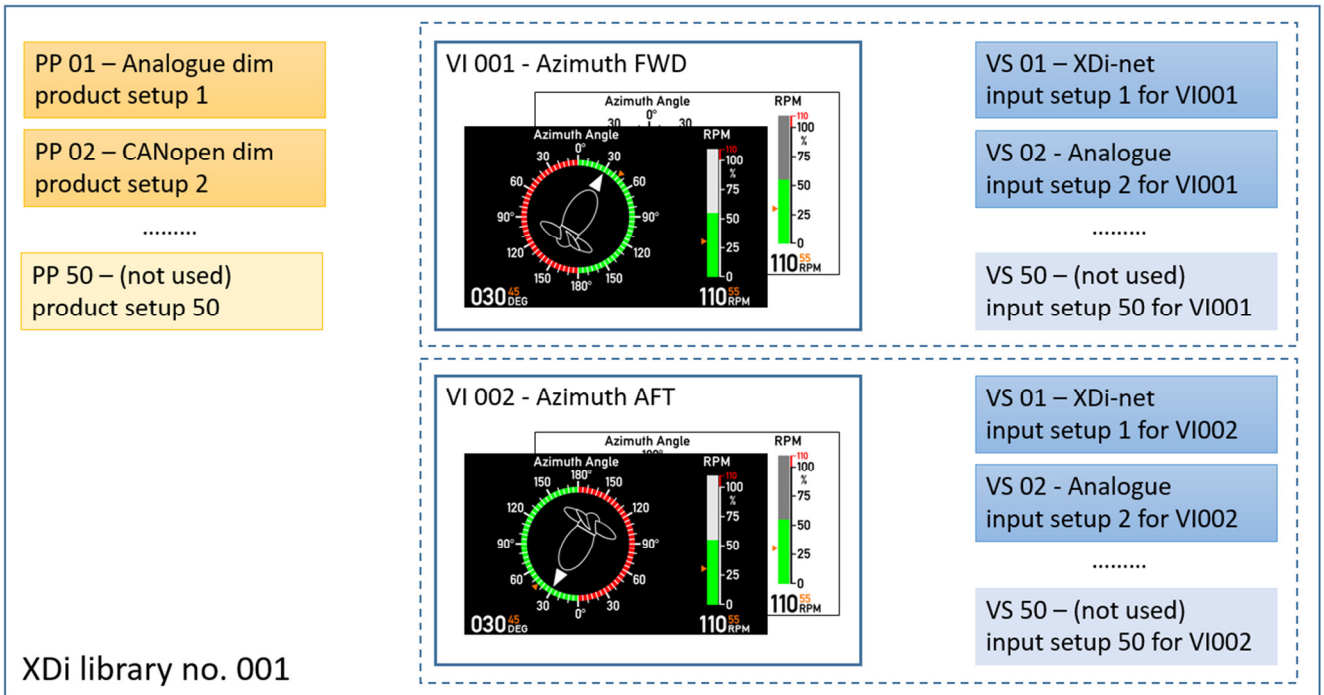


Fig.1 Virtual indicator library structure

It is important to be aware that all virtual indicators in an XDi library are predefined and version controlled to make sure that the requirements for relevant marine approvals are fulfilled. Therefore indicators cannot be changed, rescaled or redesigned via the XDi menu. However, it is possible to make some adjustments during installation, such as adjusting input parameter values or change headlines and/or labels, but no change that conflicts with the marine approvals.

Product profile (PP)

A product profile contains products- and system-related parameters with their default settings.

Parameters like: CAN bus settings, dimmer settings, dimmer group, CAN bus settings, sound and warning settings.

Up to 50 different product profiles can be predefined in a library. The predefined product parameters can be changed or adjusted via the XDi menu.

Note: The Product Profile selection is independent of the selection of virtual indicator and VI-setup.

Virtual indicator (VI)

The virtual indicator VI contains drawings of scales and other indicator elements and defines the graphical layout of the VI, like the example below.

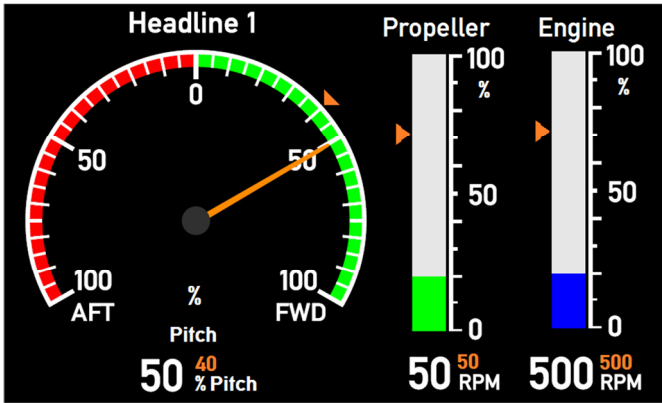


Fig. 2 virtual azimuth indicator

VI-setup profile (VS)

For each VI, at least one VI-setup profile (VS) will be predefined.

The “Virtual Indicator setup” profile is a predefined list of parameters such as: input settings, data scaling, selectable headlines, labels, units and more.

Collecting all the vital indicator parameters in a VS profile makes it simple, secure and easy for the installer to make a complex setup, simply by selecting the right VS.

In the selection menu, each VS has a unique number, name and a detailed help text description that makes the selection easy.

Defining several VI-setup profiles is very handy if a virtual indicator is used in different applications, with different interface requirements, for example presenting data from different propulsion systems with different combination of CAN and analogue data inputs to the same type of indicator.

It is possible to change or adjust most VS parameters from the XDi installation menu.

It is possible to have up to 50 predefined VS profiles for each virtual indicator.

Note: Only one VI-setup profile can be active at any given time.

Library types

XDi libraries may either be a DEIF standard library, containing a selection of commonly used virtual indicator types. DEIF standard indicators always include a day- and a night-design optimised for presentation on the XDi display under all light conditions.

If the DEIF standard design does not fulfil your needs or wants, the XDi concept opens for a flexible pallet of customisation opportunities from small changes like adding a logo on a standard design, making a customised interface profile and all the way to a full-customised design fitting perfectly into your company’s overall product design line.

DEIF stores all libraries in a secure master database, providing the needed version control and design verification to secure that indicator designs follow the appropriate regulations. Once an indicator is finally approved as part of a library, it will be available precisely as approved even years from now when a spare part is needed.

The XDi library may contain up to at least 100 virtual indicators depending on the complexity and number of day/night colour schemes (or even day/dusk/night schemes).

All XDi libraries are defined by a unique owner identification number (Owner ID). DEIF owner ID for standard libraries is 000001, and the owner ID for customised libraries is normally the same as the registered customer number at DEIF.

Each library owner may have up to 999 libraries, each identified by a unique number starting from 1.

A customised library is by default only available for use in XDi units purchased by the library owner, and on request, DEIF can open for sister companies or sub-suppliers to also be able to purchase XDi units with a customised library.

XDi type and related library classes

There is a library type for product size XDi 96 and XDi 144/192 and for each performance class. XDi 144 and 192 both have the same display resolution (WVGA) and can therefore use the same library. XDi 96 has a QVGA display resolution and thus needs its own library. In addition to product size, the libraries are also classified as: Single*, Dual and Multi.

The library needs to be compliant with the size and performance class of the XDi indicator:

		Library class		
		Single*	Dual	Multi
XDi type	Single*	•		
	Dual	•	•	
	Multi	•	•	•

*) XDi single is not available at present.

This means that an XDi Multi will accept all library classes, where a Dual will accept a class “Single” or “Dual” library. Since the Single library class is not available for the moment, any single indicators should be included in a library of class Dual or Multi.

Upload a new library

It is possible to upload a new library via the USB service port on the XDi unit. The library is encrypted and requires a special “XDi update tool” to be installed on your PC or laptop. The tool is available for download at www.deif.com. The zip-package includes a detailed installation and user instruction. If you need further help, please contact DEIF support.

Be aware that the library package selected for an update must match the XDi size and performance class as explained in the previous chapter.

Input data for XDi

Virtual indicators in the XDi library may present data from one or more data sources depending on the XDi performance class (Dual or Multi). The standard XDi unit is designed to receive data via the two CAN bus ports. When an extension module is mounted on the XDi, data can also be received from analogue or digital input data. Input data from an extension module may even be shared on the CAN bus, making the XDi act as a data source for other XDi indicators on the bus.

Utilising this function limits the number of extension modules needed and only one adjustment or calibration of an analogue or digital input is needed in such a CAN base system.

Other devices on the CAN bus may also use CAN data provided by the XDi.

Object dictionary – Object index table

All variable input data types are firmly defined and stored in the manufacture specific part of the CANopen object dictionary. Object index 0x3000 to 0x3FFF.

In the XDi-net specification, all variable data used for indication is structured in a fixed format making it possible to broadcast data without complicated setup.

The detailed description of how XDi utilises CANopen can be found in the “XDi-net/CANopen reference manual”.

Data type instance

To be able to handle several instances of the same data type in a CAN bus system, each defined data type typically contains 15 instances.

An example: in a large system with 15 azimuth thrusters on the same CAN bus, each thruster is using a different instance of the data type “azimuth angle”.

Sourcing data to the XDi

There are five different ways of sourcing measured data into an XDi for presentation on a virtual indicator, see the illustration below.

In the VI-setup profile (VS), each virtual indicator input will be predefined to use a defined data type/instance in the Object index table, and this data type/instance will be pre-set to receive its input data using one of the input methods described below.

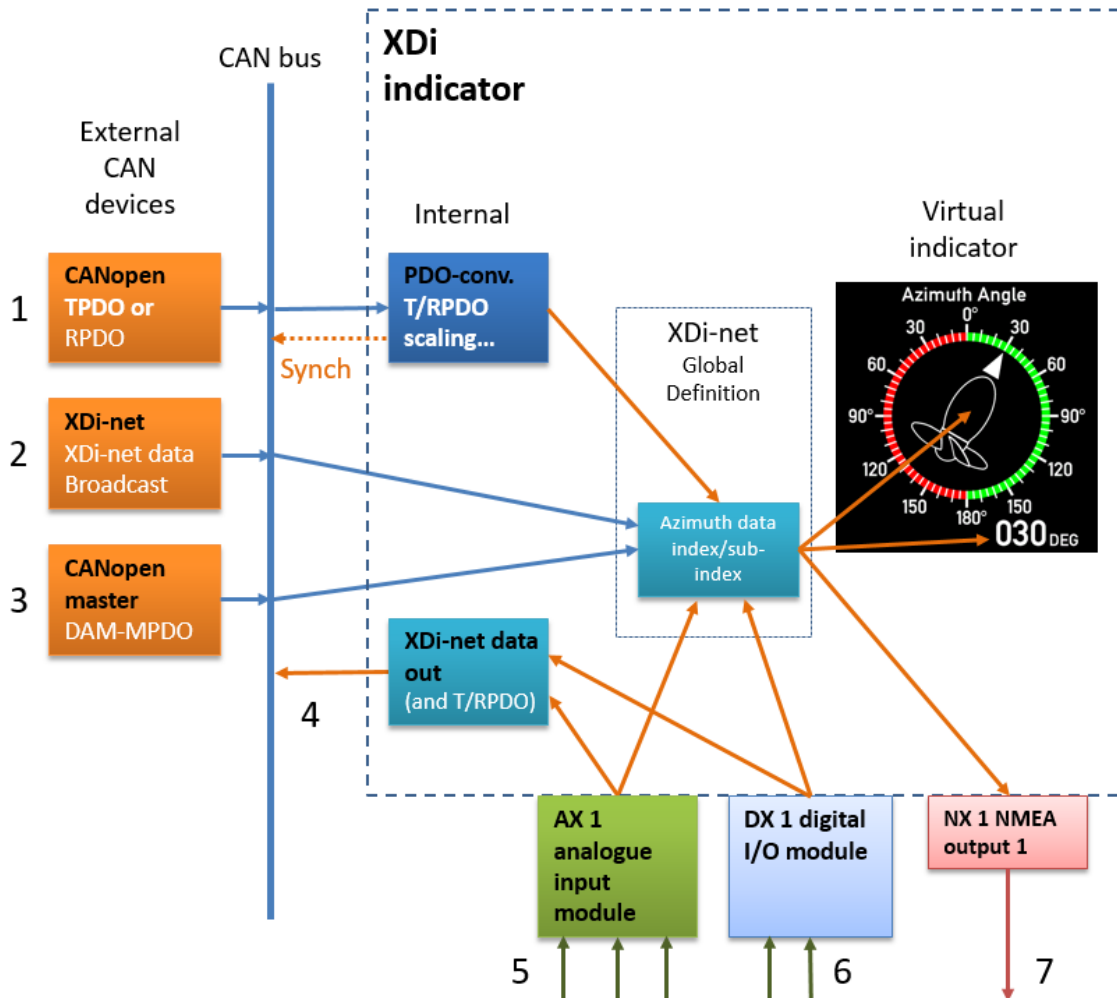


Fig. 3 XDi input output structure

The figure above shows all the different ways input data can be received by an XDi.



The same method applies for dimmer level input data and control for indicator day/(dusk)/night shift.

CANopen TPDO or RPDO (1)

A TPDO (Transmit Process Data Object) contains up to 8 data bytes. A data type is often located in byte 0 and 1 and the rest is not used, but it is possible to have different data types mapped into one TPDO. TPDOs are often used by sensors to transmit data. RPDOs (Receive Process Data Objects) are often used by a CAN controller or master device to send data to a receiving device.

XDi can be set up to use any of the TPDOs or RPDOs as CAN input, but please note that if the XDi-net is active, there are some restrictions on the use of RPDO1. Please see the XDi-net/CANopen reference manual for details.

Example:

The DEIF RTC 600 CAN angle transmitter with the default NodeID=1 is used as angle transmitter for an XDi azimuth indicator.

The azimuth angle between +/-180deg. is transmitted as a signed 16 bit value located in TPDO 1, byte 0 and 1 (TPDO1 for NodeID=1 has COB-ID: 0x180+”RTC600 NodeID”).

The selected VI-setup profile VS 01, for this azimuth indicator, is pre-set to read TPDO1 from node 1.

The relative angle value received as a figure in the range +/-32767 is predefined to be scaled to an absolute value between +/-1800, equal to 180.0 deg. This value is stored in the Object index table where the VI reads the value for presentation on both the round azimuth indicator and in the digital readout.

Data received in a TPDO/RPDO can be either absolute data with a predefined resolution (for example 1800 @ resolution 0.1, equal to 180.0deg.) or data can be relative like in the example above.



It is possible from the installation menu to adjust the TPDO/RPDO settings, for example adjust the zero point, change max/min. values or change direction (CW/CCW) of the data received from a rudder angle transmitter. It is also possible to select another TPDO or RPDO as input.

Synchronisation of adjustments

All XDi units on the same CAN bus have access to read a given TPDO or RPDO.

In case data received in a TPDO needs a correction, for example a zero alignment, this is performed via the installation menu in one XDi on the bus. If this adjustment must apply to all XDi units on the bus using exactly this TPDO, simply press “Yes” to accept synchronisation in the pop-up menu, presented when you leave the installation menu. This will activate a broadcast of changes to relevant XDi units on the CAN bus.

Note: Synchronisation via XDi-net must be set ON in the PP (or via menu) for this to work.

Self-starting devices

If there is no CAN master in the system to start a transmitting device, then the device should be set up as a self-starting device. Alternatively, the XDi can be set up to act as a master, in this case by sending a CAN start command to force passive sensors to start transmitting. Normally, this function is not activated in the product profile, but it can always be activated via the installation menu.

XDi-net as data input (2)

XDi-net is a predefined way of broadcasting data via CANopen, and it requires no complicated setup or specific allocation of NodeIDs. Data is broadcasted using RPDO1 in SAM-MPOD mode (Source Address Mode – Multiplexed PDO). This means that data is sent directly as a defined data type into the Object index table for the indicator to use for its presentation.

For XDi-net to work, “XDi-net variable data ON” must be activated in the PP or manually via the installation menu.

The XDi-net broadcast format is often used to share data between XDi units, for example analogue input data from an AX1 analogue extension module.

Independent of the default data source for a given virtual indicator, it is always possible to shift the data source to XDi-net via the installation menu – “Data adjust”.

The XDi-net broadcast format can also be used to distribute data from a customer CAN controller to all XDi units on the CAN bus, without any complicated NodeID setup.

More information of the XDi-net broadcast format is found in the “XDi-net/CANopen reference manual”, where you will also find examples of transmission formats.

XDi-net restrictions

When “XDi-net variable data” is activated, all RPDO1s (COB-ID 0x200 to 0x27F) are allocated for XDi-net use and must not be used by other applications on the CAN bus.

If “Send XDi-net setup synch data” is active NodeID 127 is reserved and used as parking place for an XDi service unit and then COB-ID: 0x27F, 0x37F, 0x47F and 0x57F (=RPDO1-4) and 0x1FF, 0x2FF, 0x3FF and 0x4FF (TPDO1-4) are all reserved for this function.

XDi-net can be disabled in the product profile or manually via the installation menu to release all RPDO1s and NodeID 127 to be used by other applications.

DAM-MPDO as data input (3)

Destination Address Mode – Multiplexed Process Data Object (DAM-MPDO) is another way of using an RPDO for transmitting multiplexed data. The format is quite similar to the SAM-MPDO described above. Only a single bit in front of the NodeID in byte 0 is shifted to make it a DAM-MPDO.

Data sent in a DAM-MPDO must be in the format given by the Object index location it is sent to, exactly like data sent using the XDi-net format (SAM-MPDO). Data will be stored directly in the destination Object index/Sub-index defined in the message.

Since the XDi-net format and the DAM-MPDO format are so similar, they are considered as one data source type, defined as source “XDi-net”. This means that when the XDi-net is selected as source for a data type presented on an indicator, then a DAM-MPDO may also be used to input data to this indicator.

To activated DAM-MPDO mode, an RPDO must be assigned for DAM-MPDO communication. This can be pre-set in the product profile or manually activated via the installation menu.

Select either: RPDO 2, RPDO 3 or RPDO 4 for this. RPDO 1 may only be selected if XDi-net is deactivated. Please note that “XDi-net” must be selected as source when DAM-MPDO is used, even if XDi-net is deactivated!

The DAM-MPDO format is used by a controller or master to send data to each receiver (CAN node) - one at a time. Only the XDi unit with the specified destination address (NodeID) will accept and use the data. This type of communication requires that the master knows each NodeID on the bus, its type and exact need for data. Obviously, this requires very precise setup of all NodeIDs in a system. Another thing is that the same data type will often be sent to several indicators one by one. This will load the CAN bus much harder than if data was broadcasted using either XDi-net or predefined TPDOs (or RPDOs).

SDO data transfer (3a)

Service Data Object (SDO) is a way to open a “service channel” with handshake, between one CAN device and another. The data format is also a multiplexed format like MPDOs and is normally used to read and write parameters to and from the XDi Object index table. This format can also be used to transfer variable data, but it is not meant for this purpose and should only be used for parameter transfer, for example for automated setup.

Analogue data input (4)

When the AX 1 analogue extension module is snapped on the XDi rear plate, analogue inputs are available. For an AX1 module to work, the analogue input must have been predefined in the selected VI-setup profile (VS).

The VS specifies the data type represented by this analogue input, analogue input type and the scaling of the input value.

Example:

In the VI setup VS01, the data type RPM instance 1 is defined as input for an analogue pointer, and the source for this data type is set up to be: AX1 on slot 1, analogue input 1, set up to: 4-20 mA input and scaled to: +/- 200.0 RPM (4 mA = -200.0 RPM, 12 mA = 0.0 RPM and 20 mA=200 RPM).



Propeller RPM instance 1 is located in Object index/sub-index: 0x3081-0x02 and always defined as absolute value with a resolution of 0.1 RPM, giving a max. of +/-3276.5 RPM.

AX1 has two analogue input ports that can be configured for either current in the range +/-20 mA or voltage in the range +/-30 V. In addition, a third analogue voltage input is available.

Input 1 and 2 are always used as instrument inputs, where input 3 is earmarked for analogue dimmer input, if analogue dimmer is preconfigured in the selected product profile (PP).

All inputs are fully calibrated, so if input 3 is not used for analogue dimmer in the actual XDi product configuration, this input may be configured as a normal voltage input for a virtual indicator, in the VI-setup (VS) profile.

The AX1 module also includes a voltage reference output that may be used as voltage supply for either a dimmer potentiometer or a potentiometer providing input for an indicator, for example a rudder indicator.

The pre-configuration of an AX1 module must be available in the selected VS or PP profile for the module to work, but it is also possible to change some selections and adjust parameters from the XDi menu.

The AX1 electrical details can be found in the XDi data sheet and connection and setup menus are found later in this document.

Digital data input (5)

The DX1 Digital I/O module has two isolated inputs that can be preconfigured as data inputs. It is also possible to preconfigure them as control data inputs.

The digital input can be preconfigured in the VS profile as an RPM pickup input, for example for direct connection to an inductive pickup.

It is either as a single RPM input (one direction) or as a double input (forward/reverse direction). In the VS profile, the input mode and pre-set parameters for converting the input pulses to an RPM value are predefined.

The scaling parameters can be adjusted via the XDi installation menu.

Alternatively, the two digital inputs can also be used for control of special indicator functions, for example control input to hide a data readout or activate a predefined label.

It is also possible to configure the two inputs as a dimmer contact pair, making it possible to step dimmer level up and down and change colour pallet; this must be defined in the PP.

The digital inputs can either be defined as data/control inputs for a virtual indicator in a VS profile or as dimmer contact inputs for the XDi product as defined in the PP. They can of course only have one function at a time.

The DX1 electrical details can be found in the XDi data sheet, and connection and setup menus are found later in this document.

NMEA serial data input

In a future product release, the XDi series will be extended with a new XDi N-version with support for NMEA serial input data (IEC61162-1). This will require a NX2 NMEA extension module.

Change selected input via menu

Inputs for indicators and dimmer input are always predefined as one of the 5 input types described and with parameter pre-sets stored in the respective VI-setup profile (VS) or Product Profile (PP).

In general, a new profile should be defined for every new combination of inputs.

Good profiles makes it very easy afterwards to set up the XDi during installation, simply because all setup parameters are loaded when the basic installation wizard is completed and only some small fine adjustments may be needed via the installation menu.

Menu structure

The XDi wizard and menu system are operated by 4 push-buttons placed beneath the removable front frame. The buttons are only used to set up the product during installation. After the XDi is set up, the buttons are hidden away behind the front frame and they are not used during daily operation.



Fig. 4. When the front frame is removed – the 4 push-buttons are available

The XDi has an installation wizard which starts automatically at first power up and will restart at every power up until the XDi has been set up.

After first time setup, the normal menu structure is available offering “Surveyor info display”, “Master reset” and access to the user and installation menus. Access to these functions requires a simultaneous long push on a combination of two buttons.

The user and installation setup menus are protected by long push on a combination of two push-buttons. This is part of the required protection against unauthorised changing of vital setup parameters.

The menu structure has 2 levels:

User menu level, where information and basic setup parameters, like dimmer setup, are located.

Installation menu where all vital setup parameters are located.



Please note that a single push on the buttons has no effect. These functions are reserved for future XDi versions where operation is allowed as part of daily operation.

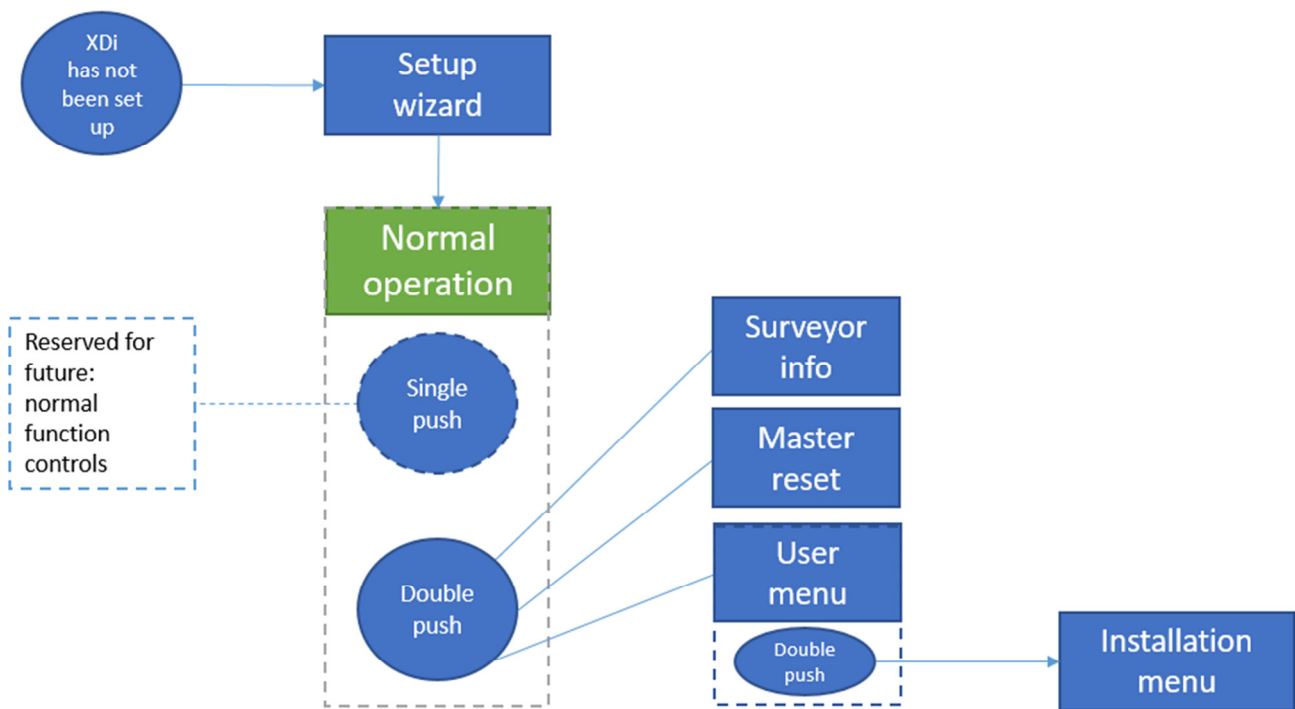
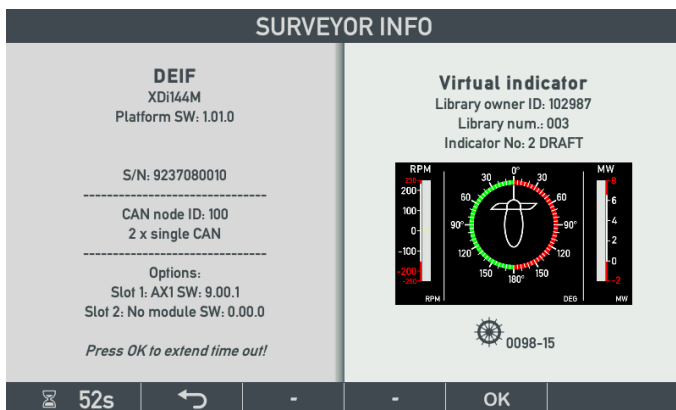


Fig. 5. Diagram illustrating the overall XDi menu structure.

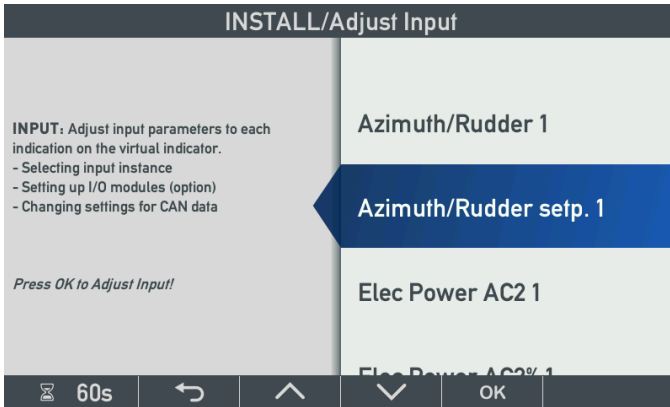
Surveyor info:

It should be highlighted that a simultaneous push on button 1 and 2 (from the left) will reveal the “Surveyor info” page where serial number, MED approval marking, software version and other relevant data are presented.



General menu structure

- The wizard and main menu pages are divided into 2 sections: the right side where you will find the menu with one menu line highlighted in the blue arrow
- the left side pane shows detailed information about the highlighted menu



Timeout: All menus except the start-up wizard have a timeout function. When the timer reaches 0 sec, the system will jump one step back in the menu structure and restart the timer, and in the end the XDi will resume normal operation. Timeout acts like the “return arrow” soft-key.

Soft keys description (left to right):

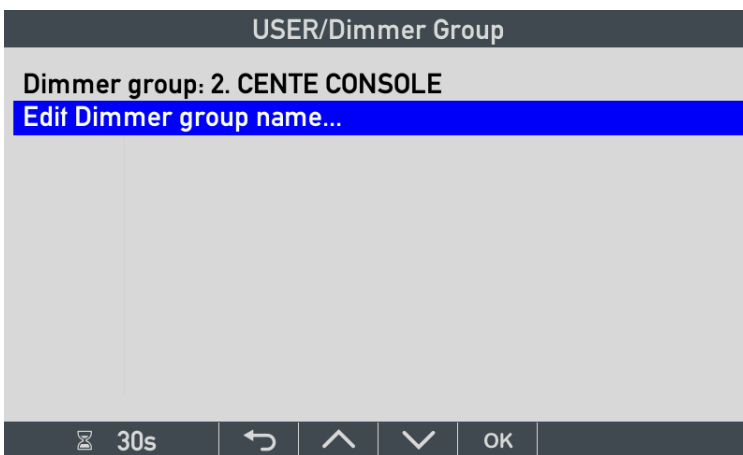
Return arrow: will step back to the present menu or from the top level menu return to normal operation.

Up and down arrows: are used to navigate between menu lines

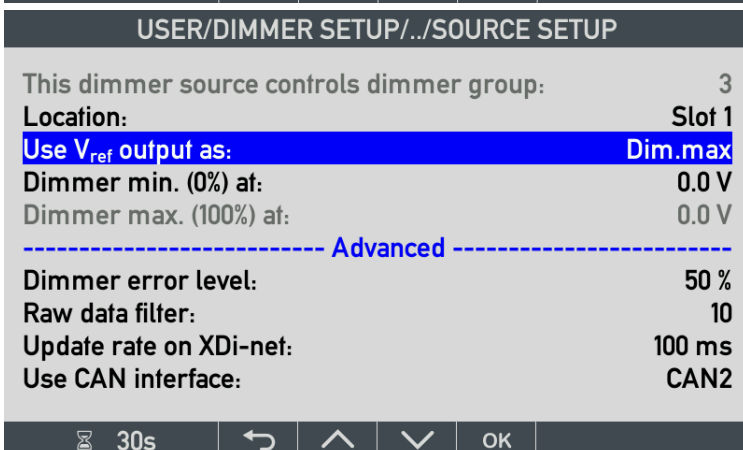
OK: open or accept the highlighted menu or parameter.

Submenus

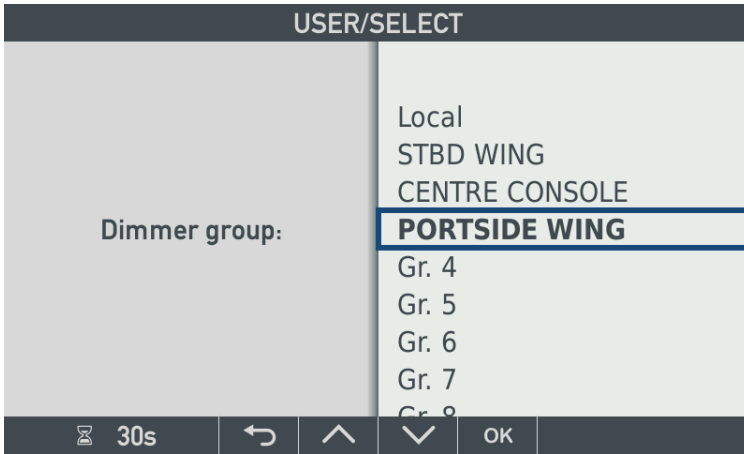
A number of submenus are used in the different menu levels and for different functions. The following pages contain examples of typical submenus and their function.



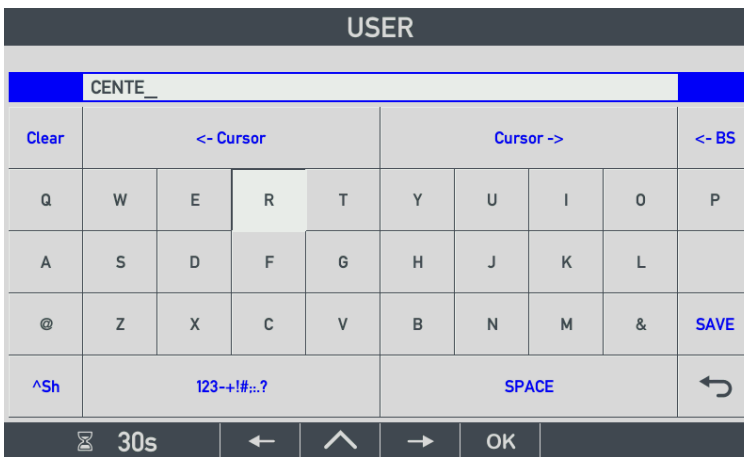
Select and press OK to open the line for editing.



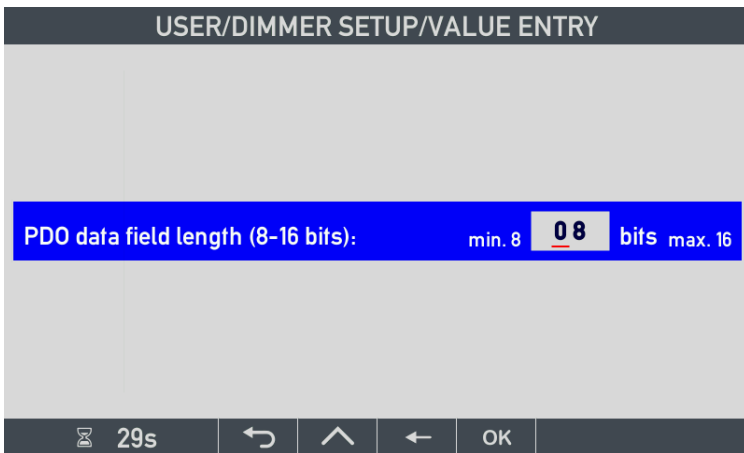
View and change setup parameters.



Select from a list.



Virtual keyboard for entering a new text line



Change a data value

The detailed menu functions are located in the relevant chapters.

Installation

Unpacking

The XDi indicator is delivered in a cardboard box. To protect the indicator, it is important to store it in the box until it is being mounted in the panel.

This will also eliminate the risk of dust, or even worse, metal parts, to enter the cabinet through the airgaps in the rear part of the XDi that may sooner or later damage the unit.

ESD

The indicator is protected against ESD (static electricity). Therefore no special attention to ESD is needed during the mounting and wiring of the indicator.

Box content

The cardboard box contains	Number of items
Quick start guide	1
XDi indicator	1
Terminal block	2
Cable tie	1

Panel mounting of XDi

XDi is mounted from the front where the mounting screws are located beneath the front frame. The special mounting clamps make installation easy.

XDi can be mounted in any angle from horizontal to vertical. It is important that there is space in the cabinet for sufficient airflow around the XDi and that the operating temperature of the unit is not exceeded. Especially when mounted in top of a horizontal panel, the temperature inside the console may be higher than expected, in which case forced air circulation inside the console is recommended.

Overheating will reduce the expected lifetime of the unit.

Cut-out and mounting depth behind panel

XDi type	Panel cut-out	Front size	Free depth below panel surface, XDi without extension module	Free depth below panel surface, XDi with extension module
XDi 96	92 mm (-0.0/+0.8 mm) x 92 mm (-0.0/+0.8 mm)	102 x 102 mm (equal to XL96)	Min. 55 mm Rec. >70 mm	Min. 90 mm Rec. >100 mm
XDi 144	138 mm (-0.0/+1.0 mm) x 92 mm (-0.0/+0.8 mm)	148 x 102 mm (wide as XL144)	Min. 55 mm Rec. >70 mm	Min. 90 mm Rec. >100 mm
XDi 192	186 mm (-0.0/+1.1 mm) x 138 mm (-0.0/+1.0 mm)	196 x 148 mm (wide as XL192)	Min. 60 mm Rec. >75 mm	Min. 95 mm Rec. >105 mm



See the data sheet for detailed 2D drawings.



3D drawings (step files) for use in CAD systems are available on request, please contact DEIF support.

Waterproof mounting

The XDi front, front glass and buttons are waterproof. Therefore, the protection around mounting screws and between the XDi front flange and the surface of the panel where the XDi is mounted are the critical areas to obtain the required IP protection.

The XDi is available with a factory-installed IP66 option for use in wet rooms, like a thruster room.

To obtain IP protection in general, the panel must be flat and smooth (not curved) where the XDi is mounted, and please pay special attention to the accuracy of the cut-out and the tightening of the screws (do not overtighten).

In installations where IP protection is important, the IP66 option is required. If the requirement is IP52 or lower, the standard XDi can be used.

For IP52, the panel surface where XDi is mounted must be completely flat and smooth. In practice, this is often not the case and therefore a water resistant sealant should be used between the XDi front flange and the panel surface to obtain the required protection. Alternatively, use the XDi with the IP66 option.

Mounting instructions

The XDi is very easy to mount:

1. Remove the front frame by gently pulling one corner (the frame is snapped on the front when you receive the XDi unit)
2. Make the cut-out in your panel (see previous section).
3. Connect wires in connectors according to installation instructions.
4. Mount the connectors in the unit.
5. Use the cable tie to fixate the cables to the XDi unit (use cable support and cable relief on long cables inside the panel)
6. Insert the unit from the front of the panel
7. Fixate it firmly by tightening the screws on the XDi front (see the smart-grip function on fig. 6 below).
The recommended screwdriver torque is: 0.5 Nm +/- 0.1 Nm
8. Connect power to the unit
9. Follow the setup wizard instructions
10. Write the assigned CAN Node ID number on the white label on the XDi front.
11. If needed, make setup adjustments
12. Mount the front frame again
13. Installation is completed

The detailed information about connections, wiring and setup can be found in the next chapters of this manual.

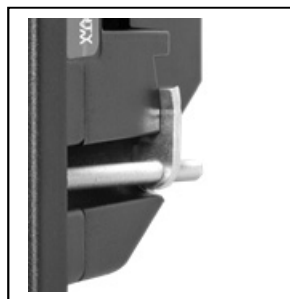


Fig. 6. Mounting screws and smart-grip clamps are pre-mounted on the XDi unit (see picture above).

Installing a CAN bus system

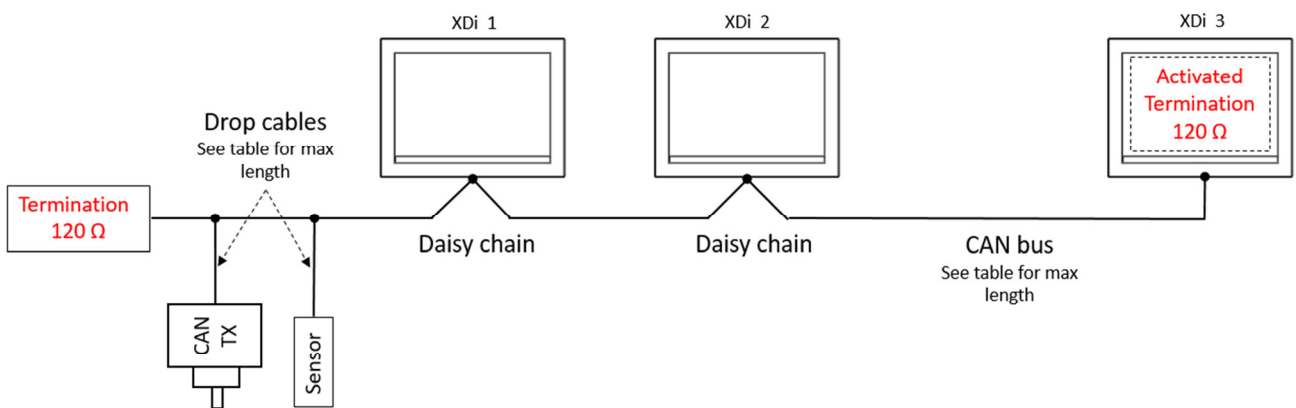
XDi CAN bus ports

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

The following sections describe the basic CAN installation information. For more detailed information, please consult the “XDi-net/CANopen reference manual.

CAN bus system wiring

The XDi 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).



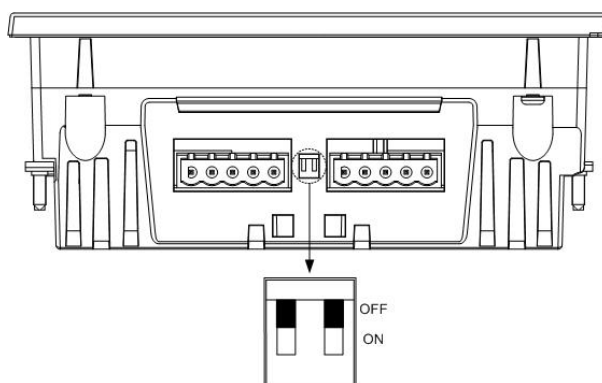
The standard terminal block, with a single row of 5 screw terminals, supplied as standard for the XDi, is most appropriate for drop cable connection. Daisy chaining will require two wires to be mounted in each terminal location.

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

CAN backbone and Termination

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.

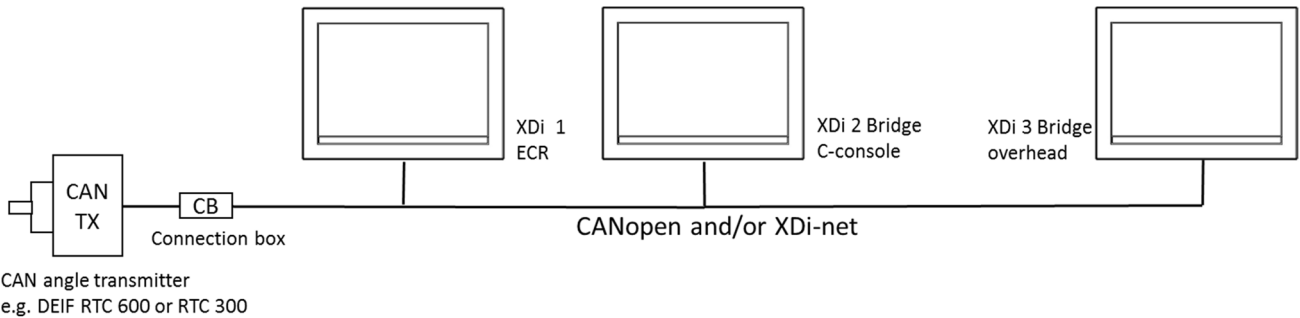




Only two termination resistors can be connected in a CAN bus network. Adding more terminations will overload the CAN drivers, disturb communication and in the long run maybe damage the CAN driver circuit.

Termination example

This example shows a system where it can be considered where to insert the termination. If the total cable from the CAN angle transmitter to the XDi 1 exceeds 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 TX (angle transmitter) to XDi 1 is less than the max allowed drop cable length (10 m @ 125 kbps), then the CAN bus can be terminated by switching ON the internal termination resistor in XDi 1 (left side), and the other termination can be made switching ON the internal termination in XDi 3 (right side).

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 serial-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.

CAN bus cable recommendation

Obtaining the optimal performance and cable length of the CAN bus requires the use of a good shielded CAN bus cable. It may be a shielded single twisted pair, or it may be a single shielded cable containing 2 twisted pairs for respectively data and power supply.

CAN bus bit rate	Theoretical max CAN cable length (optimal installation)	Recommended max CAN cable length (practical installation)	Max. drop cable length	Max. accumulated drop cable length
250 kbps	250 m	150 m	6 m	30 m
125 kbps	500 m	300 m	10 m	60 m
50 kbps	1000 m	500 m	15 m	100 m
20 kbps	2500 m	1000 m *)	20 m	250 m

*) For cable length >1000 m, a CAN buffer or repeaters should be used.

Specifications of the data wire pair (twisted pair):

Gage: Not less than AWG24/0.205 mm² (approx. 90 mΩ/m), thicker cable is 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 MHz

Propagation delay: Maximum 5 ns/m

Recommendation for the power wire pair:

Gage: Not less than AWG20/0.5 mm² (approx. 33 mΩ/m). Where long supply cables are used, thicker wire is recommended and worst case calculations of supply voltage drop in the cable should be made.

Guidelines for selecting CAN bus cable can also be found in ISO11898-2.



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

Shielding and grounding of the CAN bus cables

Cable shield

Where CAN cables are connected, the cable shielded 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.

Grounding of the CAN bus cable

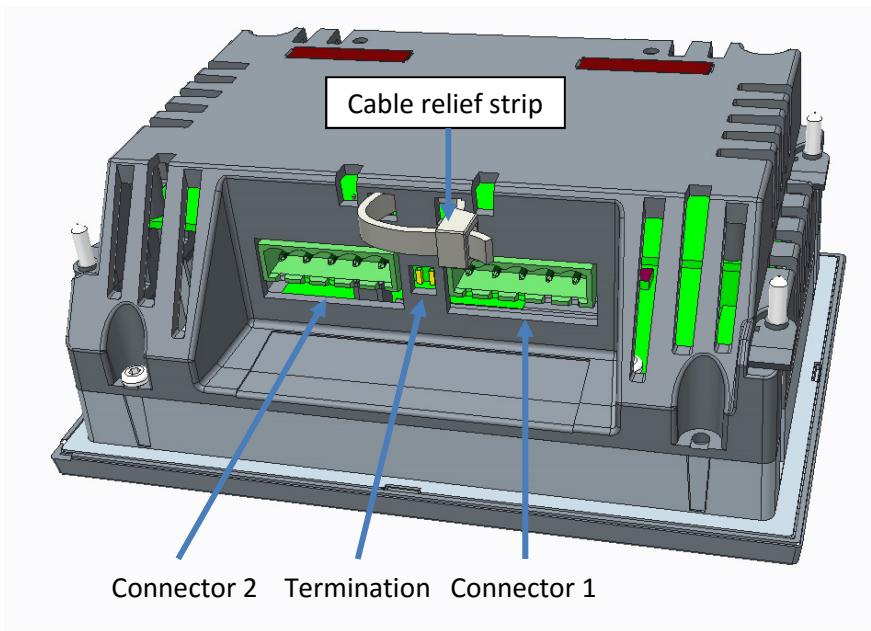
It is recommended only to connect the shield, of the total CAN bus network, to the ship’s ground in one single location.

It is important that the ground connection used is free from noise and transients from other devices using the same ground connection. If a good and noise-free 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 disturbing the CAN bus communication.

XDi power supply and CAN connections

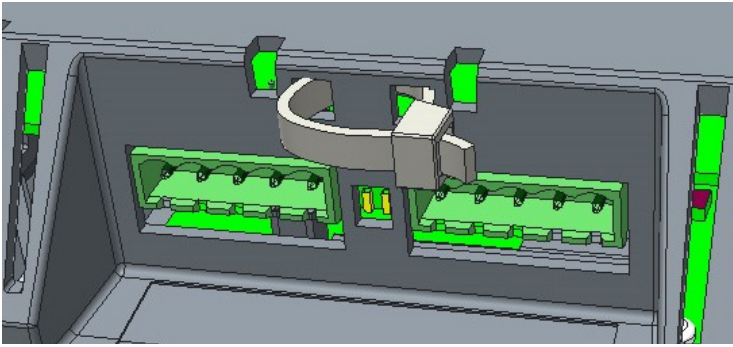


XDi base unit connectors				
Type	Terminal no.	Signal	Marking	Remark
Connector 1	1	CAN 1 connection	CAN 1 GND	Common, should not be connected *)
	2		CAN 1 LOW	
	3		CAN 1 HIGH	
	4	Supply Voltage	+24 V DC	Standard power input
	5		0V	
Dill switch 1	-	ON/OFF	CAN 1 Term	120 Ω termination
Dill switch 2	-	ON/OFF	CAN 2 Term	120 Ω termination
Connector 2	6	CAN 2 connection	CAN 2 GND	Common, should not be connected *)
	7		CAN 2 LOW	
	8		CAN 2 HIGH	
	9	Supply Voltage	+24 V DC	Redundant power input
	10		0 V	

*) The common wire should only be used if an extra dedicated “common” wire is available in the CAN bus cable. This terminal may not be connected to cable shield or ground!

Strain relief of cable and termination of cable shield

When the cable and connectors are mounted on the XDi, the cable should be relieved using a cable strip that can easily be inserted in the small slots (see drawing).



If the CAN bus cable is daisy-chained, the shield of the cable must be electrically connected beneath the strain relief strip and must not be connected to CAN common!

Be aware, that the shield must not touch any other electrical parts or any metal parts around it. It is therefore recommended to connect the two cable shields up against each other and cover the shield joint with a heat shrink hose, before it is fixated below the cable strip. The two shields may be soldered together (with great care), but in protected indoor panels, it should not be necessary.

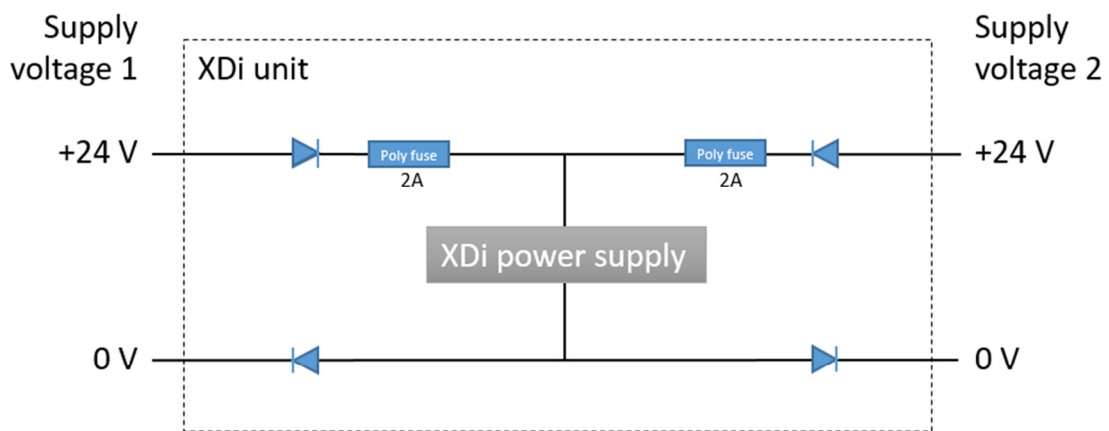
Supply voltage monitoring:

The XDi has two supply voltage inputs, separated by diodes as shown below.

This allows the XDi to be supplied from two independent power sources. Each input is also protected by a polyfuse that will disconnect the XDi unit in case of a short circuit in the internal power supply unit.

A single failure in one of the power source lines will not affect the XDi or the source located on the other side of the separation diodes.

An internal single failure in one of the built-in separation diodes will not affect either the function of the XDi or the rest of the system.



Each supply voltage input is equipped with an isolated voltage monitor circuit. This circuit will detect if the input voltage drops below the minimum recommended supply voltage level.

This level is approximately 18 V DC.

In the product profile or via the menu, it is possible to activate supply voltage monitoring of one or both supply voltage inputs.

If monitoring is active, a warning or alert pop-up will be presented on the display if the input voltage is too low (or missing).

A warning is issued if the only available supply is below the limit and the alert is issued if only one of the two supply inputs is below the limit (or lost). This is of course in a system with redundant power supplies.

A warning or alert beep audio signal can also be activated. (Only issued once when the warning or alert first occurs).



It is recommended always to have at least one power line monitored.

Warning/alert output

Not only warnings for power supply faults, but also all other active warnings and alerts will be sent in an emergency message on CANopen.

In the product profile stored in a customised library, it is also possible to pre-configure one or both relays in the DX1 module to be activated when the XDi detects a warning and/or alert.

First time setup using the wizard

When the XDi unit is received from factory and has not previously been set up, it will automatically start the setup wizard when powered up the first time:



Please note that the library owner, performance class, library number and version of this library are indicated below the headline.

Important: check that the library identification and version are correct before you start to set up the XDi.

Rotate the display 180°.

The XDi display has a wide viewing angle, but depending on the colour pallet used on the virtual indicator, a change of colour may be observed when the display is viewed from below. To compensate for this in installations where the indicator is normally looked at from an angle below the centre line, it is possible to rotate the presentation 180° and install the XDi indicator upside down.

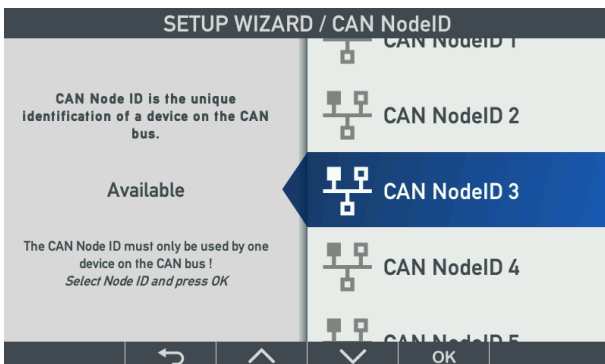
When the recommended DEIF colours are used in the virtual indicator design, the colours are very slightly affected by the change in viewing angle.

For convenience, it is even possible to have this 180° rotation predefined in a customised XDi library, in which case the XDi will start up being rotated 180°.

Manual setup procedure

When you press the “OK” soft-key, the wizard will guide you through the 5 main setup steps.

Step 1 - Select CAN Node ID



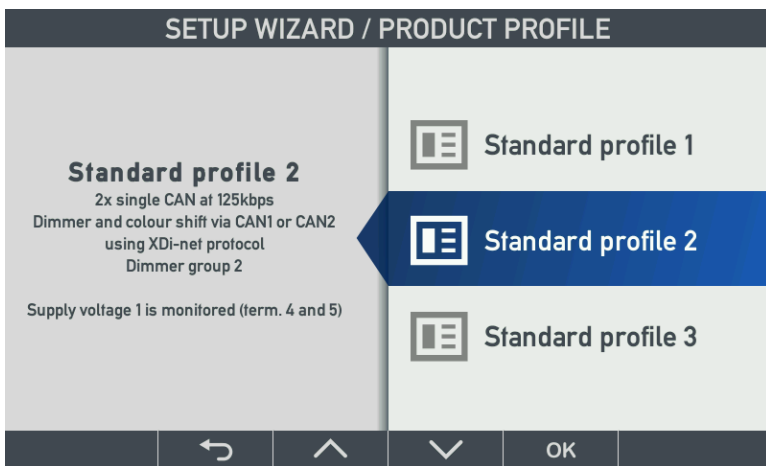
The XDi library contains a default NodeID number, which will be the one suggested at start-up. If this NodeID is already in use, it will be greyed out, and the next available NodeID will be suggested instead.



After selecting the CAN NodeID, write the number on the white label on the XDi front, behind the front frame. This will help you identify the unit in the physical network and be beneficial if an XDi needs to be replaced in a service situation.



Step 2 - Select product profile



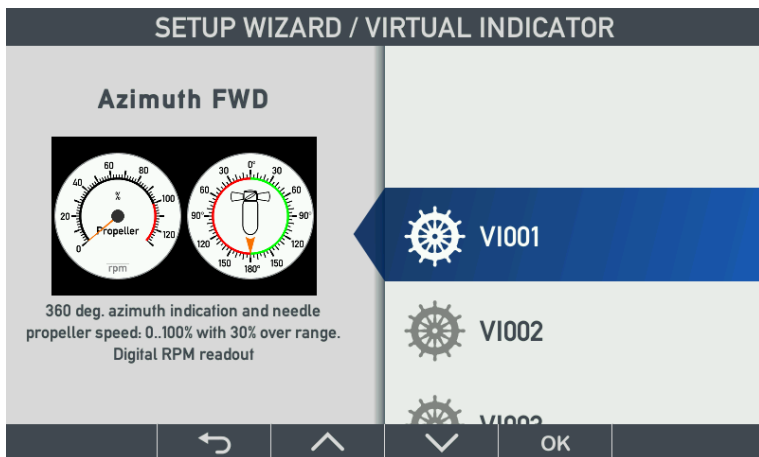
The list of predefined Product Profiles (PP) will be shown. (In this example, there is only one PP).

The PP contains the product-related settings for: dimmer/colour shift, CAN bus, warnings and sound.

The parameters in the selected PP may later be changed via the user or installation menus.

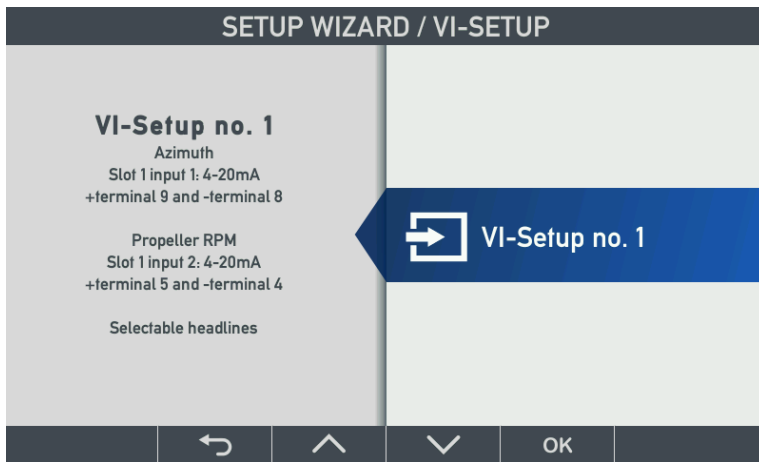
(In this example, there is only one PP).

Step 3 - Select virtual indicator



The XDi is delivered with either a standard DEIF library or a customer library installed. The XDi library can contain a number of predefined virtual indicators which can be selected from this menu. Each virtual indicator is identified by a unique VI-number, and if the indicator is wheel-marked, it will be shown in front of the VI-number.

Step 4 - Select VI setup profile



The Virtual Indicator (VI) setup profile contains pre-set parameters for: input sources, scaling, headlines, labels, units, indicator behaviour and much more.

Selecting a predefined profile makes complex setup simple, secure and easy. The VI setup is related to the VI selected in the previous step, and there may be up to 50 VI setup profiles for each Virtual Indicator to select from. (In this example, there is only one VI setup).

Step 5 - Finish



When the 4 selections are made, you can either finish the wizard and go to normal operation or select one of the detailed setup menus.

Installation menu: change or fine-tune the predefined setup parameters.

User menu: change dimmer, audio and visual settings.

Restart wizard: go back to start and make or change the PP or VI.

In the installation and user menu, it is possible to adjust the pre-set parameters; detailed description of those menus will follow.

Skipping the wizard

If you have entered the setup wizard by accident and want to leave it again, please push OK on each step to jump to the next stage without making any changes and end with accepting “Finish Wizard”.



When you make a new selection in the wizard, all previous parameter adjustments made via menu (or via CAN) will be reset to default settings. For example, if you select a new VI setup profile for a virtual indicator, then manually entered zero adjustments of input data and selection of a headline will be reset to the default value!



If you are not completely sure what you are doing, do not make changes using the wizard or installation menu!

Automated XDi setup via CAN

Instead of making a full manual first time setup, it is possible to use an automated setup via the CAN bus.

To make an automated setup, the XDi must have a unique NodeID assigned, two devices on a CAN bus must never have the same NodeID. As previously described, it is a good idea to make a “NodeID system” to identify each physical XDi location in an installation with a unique NodeID.

The “CAN setup controller” must use a list of all NodeIDs in the installation and the combination of: virtual indicator (VI), VI setup (VS) and Product Profile (PP) to auto-setup. If needed, adjustments of default parameters like selecting another headline from the default headline list can be made. It is even possible to write a new headline text and activate that.

When the NodeID is selected by pressing OK, the XDi will send a message on the CAN bus that tells the controller that a new XDi needs setup, and the controller can take over and complete the setup immediately. The installer will just see the XDi start-up with the selected indicator.

Please see the “XDi-net/CANopen reference manual” for a detailed description of how to integrate automated setup in your CAN bus system.

Detailed product description

XDi CAN bus

All XDi units are equipped with two galvanically separated CAN ports as standard.

Detailed XDi-net/CANopen description

A detailed description of the CANopen and XDi-net implementation is available in: **XDi-net/CANopen reference manual**.

It is recommended to consult this document if you intend to fully utilise the CAN bus.

The following is a short introduction to get started using CAN.

XDi-net for easy integration

If CANopen is new to you, using XDi-net for easy plug and play data sharing via CANopen will be the obvious choice. The only thing you need to do, is to connect the CAN bus following the guidelines for installation and remember the termination and assign a unique node ID for each XDi on the bus, and select appropriate setup profiles that supports the XDi-net. The XDi will take care of the rest.

CAN NodeID

All transmitting devices on a CAN bus must have a unique NodeID assigned to them. Please note, that two devices on the same bus must never have the same NodeID.

The two CAN ports on the XDi will always be assigned the same NodeID, in other words the NodeID is the unique “name” of the XDi.

In the XDi Library, a default NodeID is stored. This is simply to guide the installer to the desired section of NodeIDs for indicators.

Which NodeID should you select?

The importance of selecting a particular NodeID depends very much of the type of CAN communication used by the virtual indicator and the dimmer system.

If automated installation setup is used, the NodeID is the unique identification of each physical device and should be connected to a physical location of the actual device, this will be explained later.

XDi function	Particular NodeID is required for the XDi	NodeID/COBID of the data source must be correctly set up in the XDi	Note:
Use only analogue or digital data inputs.	No Use default	No Use default	No CAN bus connection. However XDi must be assigned a NodeID.
Receive and/or transmit data in XDi-net format.	No (Any will do*)	No (Not used)	XDi-net is independent of NodeID setup.
Receive data in a TPDO or RPDO	No	Yes	XDi must know the COBID of the TPDO or RPDO containing source data. COBID is based on source NodeID.
Receive data in a DAM-MPDO	Yes	No	Data is addressed directly from a CAN controller (source) to each XDi identified by their NodeID.
Automatic setup	Yes	-	A service data channel (SDO) is established between “Master” and one XDi identified by its NodeID, and setup parameters are transferred.

*) Any will do, but two units on the CAN bus must not have the same NodeID.

CANopen uses an arbitration process on the 32 bit header of a CAN frame. The smart thing is, that in case of a data collision, the CAN frame with the lowest header value will continue transmitting, while the one with the highest header value will redraw and try again later. The NodeID is indirectly part of the CAN frame header, and it is possible to give a CAN unit higher priority by selecting a lower NodeID. In most indication systems, using CAN bus, the busload is so low that collisions and thereby priority is not an issue. Anyhow, we recommend that the low NodeIDs are used for controllers and sensors and higher NodeIDs are used for the indicators themselves.

NodeID for automated setup

If you now or later want to include an automated installation-setup function in your CAN-based indicator system, it is a very good idea to make a standardised structure for the use of NodeIDs in your systems. There are 127 available NodeIDs, which is NodeID = 1 to 126, and 127 is in most cases reserved by XDi-net. The NodeID structure or list should reflect the selection of virtual indicator, VI-setup and PP for each XDi node.

Example of a custom NodeID list:

In this example, all indicators are running on the same redundant CAN bus with up to two propulsion systems on the same bus. Data of the same type (for example azimuth angle 1 and 2) are determined by the data type instance, which is then pre-configured in the two VI-setup profiles. The dimmer function is also distributed via CAN bus and is divided into 5 dimmer groups, each pre-configured in a PP, one PP for each dimmer group.

Location	Product profile	Virtual indicator	VI-setup	Indication	NodeID
System controller	-	-	-	No indication – transmits data and setup parameters.	01
Azimuth angle transmitter 1	-	-	-	for example RTC 300 or RTC 600	02
Azimuth angle transmitter 2	-	-	-		03
Reserved....					...
Pitch angle transmitter 1	-	-	-	for example DEIF RTC 300	06
Pitch angle transmitter 2	-	-	-		07
Reserved....					...
Centre console FWD	PP1	VI1	VS1	FWD azimuth, RPM, Pitch 1	20
“ “ “	PP1	VI1	VS2	“ “ “ “ 2	21
Reserved....					...
Centre console AFT	PP2	VI2	VS1	AFT azimuth, RPM, Pitch 1	24
“ “ “	PP2	VI2	VS2	“ “ “ “ 2	25
Reserved....					...
Portside bridge wing	PP3	VI1	VS1	FWD azimuth, RPM, Pitch 1	28
“ “ “	PP3	VI1	VS2	“ “ “ “ 2	29
Reserved....					...
Starboard bridge wing	PP4	VI1	VS1	FWD azimuth, RPM, Pitch 1	32
“ “ “	PP4	VI1	VS2	“ “ “ “ 2	33
Reserved....					...
Engine control room	PP5	VI1	VS1	FWD azimuth, RPM, Pitch 1	36
“ “ “	PP5	VI1	VS2	“ “ “ “ 2	37
Reserved....					...
Centre console FWD	PP1	VI3	VS1	FWD stern thruster % 1	40
“ “ “	PP1	VI3	VS2	FWD stern thruster % 2	41
Reserved....					...
Centre console AFT	PP1	VI4	VS1	FWD stern thruster % 1	44
“ “ “	PP1	VI4	VS2	FWD stern thruster % 2	45
Reserved....					...
Engine control room	PP5	VI3	VS1	FWD stern thruster % 1	48
“ “ “	PP5	VI3	VS2	FWD stern thruster % 2	49
Reserved....					...

Some NodeIDs are reserved in between for future system expansion.

Overall CAN bus parameter settings

Editing the CAN bus parameters list below requires a very good knowledge of CANopen and the special manufacture specific CANopen functions built on top to obtain the XDi-net functions. It is therefore highly recommended to consult the “XDi-net/CANopen reference manual” before making any changes in the CAN setup parameters.

The parameters in the table below are the overall CAN controls, and they will in some cases overrule or limit local CAN setting predefined in a product profile (PP) or a VI-setup profile (VS).

Example: an analogue input is set up to share data on CAN1 and CAN2, and the overall CAN bus mode in the table below is set up to be “Single CAN” (CAN1). Then data is only shared on CAN1.

The default CAN bus parameters are defined in the selected product profile.

CAN function	Available selection	XDi-net ON	XDi-Net OFF	Note
CAN bus mode:	Single CAN, 2 x single CAN, Redundant CAN	2 x single CAN	2 x single CAN	Selecting Single CAN will keep CAN 1 active and close all activities on CAN2.
Bit rate CAN1 (kbps):	20, 50, 125 , 250 (500, 800, 1000)	125	125	500, 800, 1000 kbps is only for short distances.
Bit rate CAN2 (kbps):	20, 50, 125 , 250 (500, 800, 1000)	125	125	125 kbps is normally used for marine CANopen application.
XDi-net functions:	ON/OFF	ON	OFF	All XDi-net functions are disabled.
XDi-net variable data on: (See “Important XDi-net restrictions”)	NO, CAN1, CAN2, CAN1&2	CAN1&2 (not OFF)	NO	Allows for transmission and reception of XDi variable data between XDi units on the CAN bus.
Send XDi-net setup synch data on: (See “Important XDi-net restrictions”)	NO, CAN1, CAN2, CAN1&2	CAN1&2 (not OFF)	NO	XDi will be able to synchronise parameter changes if this function is ON.
Send CAN Heartbeat on:	NO, CAN1, CAN2, CAN1&2	CAN1&2 (not OFF)	NO (All is OK)	Must be ON when XDi-net and/or redundant CAN is used.
Auto start XDi on the CAN bus:	YES/NO	YES	NO (or YES)	Must be ON when XDi-net is active.
Send CAN start command on CAN bus:	NO, CAN1, CAN2, CAN1&2	NO (All is OK)	NO (All is OK)	Used to activate a CAN sensor without built-in auto-start.
DAM-MPDO to be used: (See “Important XDi-net restrictions”)	NON or RPDO2-4	NONE or RPDO2-4	NON or RPDO1- 4	Only used if DAM-MPDO data transfer is used.

Bold is the preferred selection.

Important XDi-net restrictions:

When “XDi-net variable data on” is set to one or both CAN ports, then ALL RPDO1s for all CAN NodeIDs on that CAN bus are reserved for XDi-net functions, and RPDO1 must not be used for other purposes!

When function “Send XDi-net setup synch data on” is set to a CAN port, then TPDO1-4 and RPDO1-4 are reserved for node 127. Node 127 is also used as a “parking” node for the XDi’s service units.

Standard XDi-net is using RPDO1 as mentioned above, but in a custom library, it is possible to move the XDi-net to one of the other RPDOs: RPDO2, RPDO3 or RPDO4. This should only be considered if there is an unsolvable conflict in the user system due to the restrictions on RPDO1.

The CAN bus mode

1. Single CAN mode where only CAN1 is activated.
2. 2 x Single CAN mode, used when data is available on separate CAN bus systems.
3. Redundant CAN mode, primary/secondary CAN bus line.

Two independent CAN lines

This is a very useful feature in applications where two separated CAN buses are used for respectively indication and control, for example where the actual azimuth angle is available on the “indicator bus” and the commanded azimuth angle is available on the “control bus”.

It has also proven to be useful in some applications to separate indicator data and dimmer on separate buses. An example could be a supply vessel with four azimuth thrusters, each with a separate data bus, and with XDi indicators located in respectively centre bridge, port and starboard bridge wing and aft bridge. In this application, dimming must be performed centrally via CAN for all the indicators in the same panel (for example starboard bridge wing).

To achieve this, both CAN ports are used:

CAN1: Handles variable data that is routed individually on separate CAN bus lines to each of the four indicators (one for each thruster).

CAN 2: Handles dimmer data to control all four indicators in the same location. Data is routed on a separate CAN bus line between the four indicators.

In this way, the four CAN data lines are independent and isolated from each other and the CAN dimmer line. See the example in appendix 8.

Redundant CAN

Redundant CAN requires a CANopen master to control the two CAN bus networks and decide which bus should be used. By default, CAN1 is the primary line and CAN2 is the secondary (backup) line.

CAN bus changes via menu

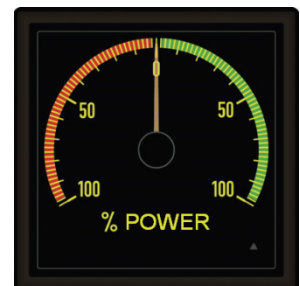
The default CAN bus parameters can be changed manually via the XDi installation menu.

INSTALL / CAN bus setup	
CAN bus mode	2 x single CAN
Bit rate CAN1	125 kbps
Bit rate CAN2	125 kbps
XDi-net functions	ON
XDi-net variable data on	CAN1 & 2
Send XDi-net setup synch data on	CAN1 & 2
Send CAN Heartbeat on	CAN1 & 2
Auto start XDi on the CAN bus	YES
Send CAN start command on CAN bus	NO
DAM-MPDO to be used	NON

59s [Back] [Up] [Down] [OK]

XL, BW, BRW-2 and TRI-2 with sCAN

The traditional DEIF XL indicator with single CAN input (sCAN) is a “listen only” device on the CAN bus, and it is therefore not necessary to assign a unique NodeID for an XL on the bus. Instead, the XL indicator needs to know the CAN data source that will provide the CAN data to be presented. XL with sCAN protocol requires variable data to be transmitted in byte 0 and 1 of TPDO1 for the CAN source identified by its NodeID (source ID). The COBID of the used TPDO1 is: 0x180 + “Source NodeID number”.



The XDi can be configured to use the same sCAN format as the XL family is using.

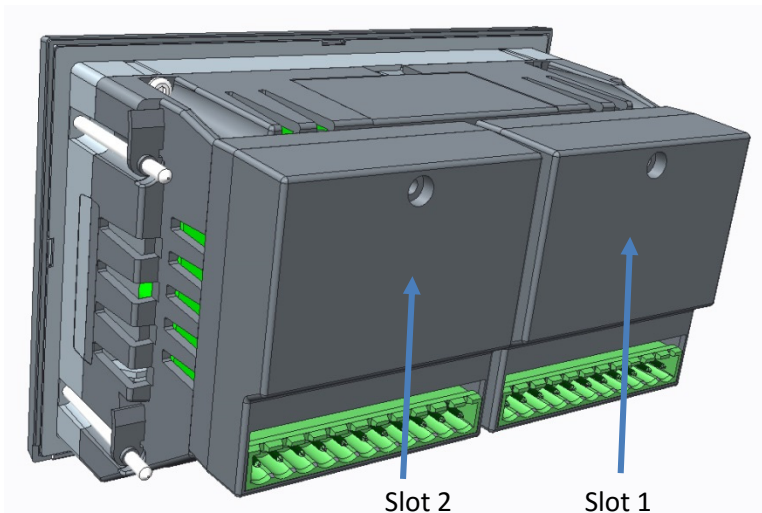
It is also possible to configure the XDi to act as a sCAN data source, for example transmitting its analogue or digital input data in a TPDO1 recognised by the XL family as source data.

It is therefore possible to make a combined system where the XL family of indicators and XDi are using the same CAN data, and the XDi may share additional analogue or digital input data with other XL or XDi units on the bus.

To define such combined system configurations in a combined system requires a good understanding of XL sCAN and XDi, so it is recommended to require some assistance from DEIF when such systems are designed. Application notes may be available from DEIF to help you specify indicators for your combined system.

Extension modules

The input/output capability of an XDi can be extended by adding one or two extension modules on the rear of the XDi unit. XDi 96 has one extension slot, and XDi 144 and XDi 192 have two slots. This is a very flexible way of extending the XDi CAN bus interface with additional analogue or digital inputs.



(Drawing – XDi unit - exploded view main unit with options)

The XDi 96 has one slot for an extension module, where XDi 144 and XDi 192 have two extension slots and can therefore be equipped with two extension modules.

Input can be extended with analogue or digital inputs, and it is possible to have the XDi configured with relay or NMEA0183 (IEC61162-1) output.

Extension modules are in addition to the two CAN bus ports, and input data from the extension module will be shared on the CAN bus as defined in the product or VI-setup profile.

The data sharing on CANopen can either use XDi-Net format and/or CANopen TPDO or RPDO.

The selected virtual indicator using the data from the extension module will scale input data and share them on CAN if it is set up in the VI-setup profile (VS).

This means, that in a system with multiple indicators presenting the same data, only one XDi needs to be equipped with extension module(s) and sharing data on CAN. The rest of the XDi units can receive those shared data via CAN.

If there is more analogue or digital inputs in a system than one XDi can handle, it is possible to make several XDi units with extension modules work together providing all data on CAN for the rest of the indicators to use. This is made very easily when the XDi-net protocol is used, but can also be achieved using TPDO/RPDO data sharing.

Please note, that normally only input data used by the selected virtual indicator is shared on the CAN bus. In customised libraries, it is possible to make an extra invisible input to share a data type that is not used by the virtual indicator itself, but only shared on CAN.

AX1 analogue extension module

The AX1 analogue extension module contains two analogue standard inputs (1 and 2). Each can be configured as voltage (high or low voltage), current (high or low current) or potentiometer input.

In addition, a 3rd voltage input is intended as input for an analogue dimming voltage (range +/-30 V). This input is fully calibrated and may also be used as an extra indicator input (voltage or potentiometer).

The XDi supports up to 7-point linearisation of an un-linear analogue input, normally 2-point is used of 0...X type data and 3-point for -X...0...X data types. (Number of points must be predefined in the VS).

The AX1 module has a very stable reference voltage output +7.3 V DC (7-7.5 V) with a built-in voltage monitor function. This is intended for potentiometer applications, since the variations in the reference voltage will be measured and automatically compensated. Very high accuracy can be obtained. It is even possible to overwrite the reference voltage output by an external voltage between 7.5 V to 30 V DC still monitored and variations are compensated.

In potentiometer mode, it is also possible to enter the potentiometer value, and the XDi will compensate for the error caused by the load of the analogue input.

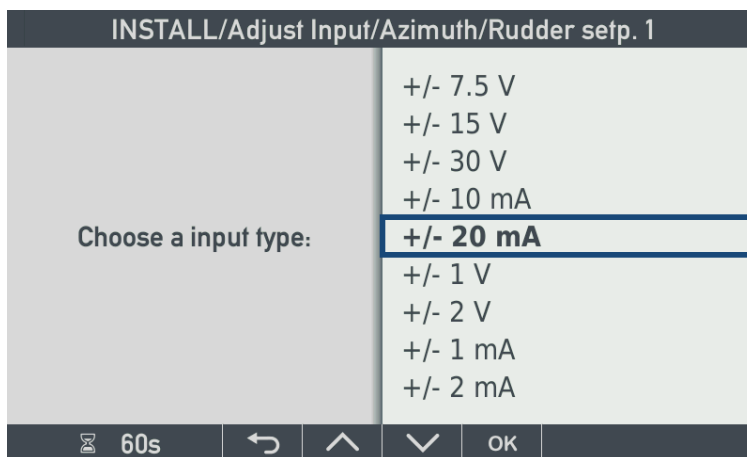
It is possible to adjust key parameters for the analogue input via the XDi menu. This can be used to align the input and scale max/min input correct.

Analogue single input types:

The setup and scaling of the analogue indicator inputs are predefined in the VI-setup profile.

If input 3 is used as dimmer input, the default setup parameters are defined in the selected product profile.

The analogue input types are shown below. Select the input type and value that best fits your application.



Input type can be selected from the XDi menu.

Input type	Input parameter range	AX1 Input to be used	Marking	Input resistance	Note
+/- 7.5 V	+/- 7 500 mV	High voltage input	HVI (1,2 or3)	112 kΩ	Select the range that best matches your input voltage
+/- 15 V	+/- 15 000 mV				
+/- 30 V	+/- 30 000 mV				
+/- 10 mA	+/- 10 000 μA	High current input	HI (1 or 2)	< 65 Ω (50 Ω*)	Select the range that best matches your input voltage
+/- 20 mA	+/- 20 000 μA				
+/- 1 V	+/- 1 000 mV	Low voltage input	LIV (1 or 2)	1 kΩ	The low input is used for both low current and low voltage.
+/- 2 V	+/- 2 000 mV				
+/- 1 mA	+/- 1 000 μA	Low current input			
+/- 2 mA	+/- 2 000 μA				

*) The resistance used to measure the current excl. the resistance in the poly-fuse.

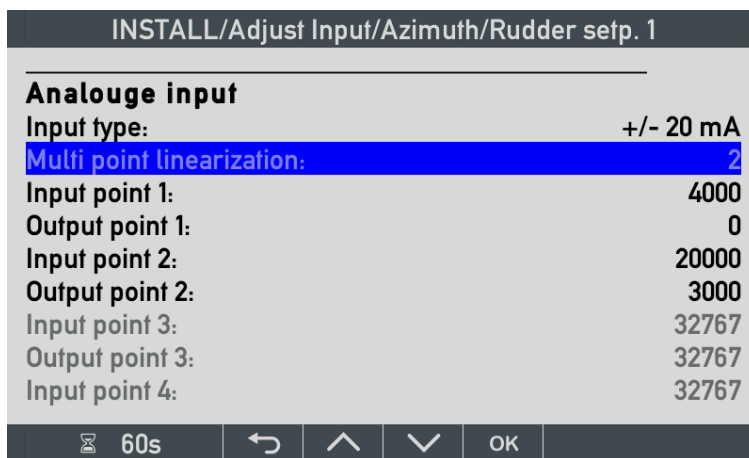
Analogue scaling

In the VS profile, each analogue input used is pre-configured to scale the incoming analogue signal to the correct output values that fit the data type it sources data to.

The example below shows the setup menu for a typical scaling of an analogue RPM 0 to 200.0 RPM input represented by a 4-20 mA input signal. The analogue input is configured in the VS to use 2 point linearisation (or scaling); this requires 2 sets of scaling points:

Input	Value	Note
Input point 1	4 000	in μA equal to 4.000 mA
Output point 1	0	0.0 RPM @ x0.1 res.
Input point 2	20 000	in μA equal to 20.000 mA
Output point 2	3000	300.0 RPM @ x0.1 res.

Input point 1/output point 1 defines that 4000 μA (4 mA) must represent 0.0 RPM, and 20 000 μA (20 mA) must represent 300.0 RPM at the standard RPM resolution of x0.1.



Analogue multi-point linearisation

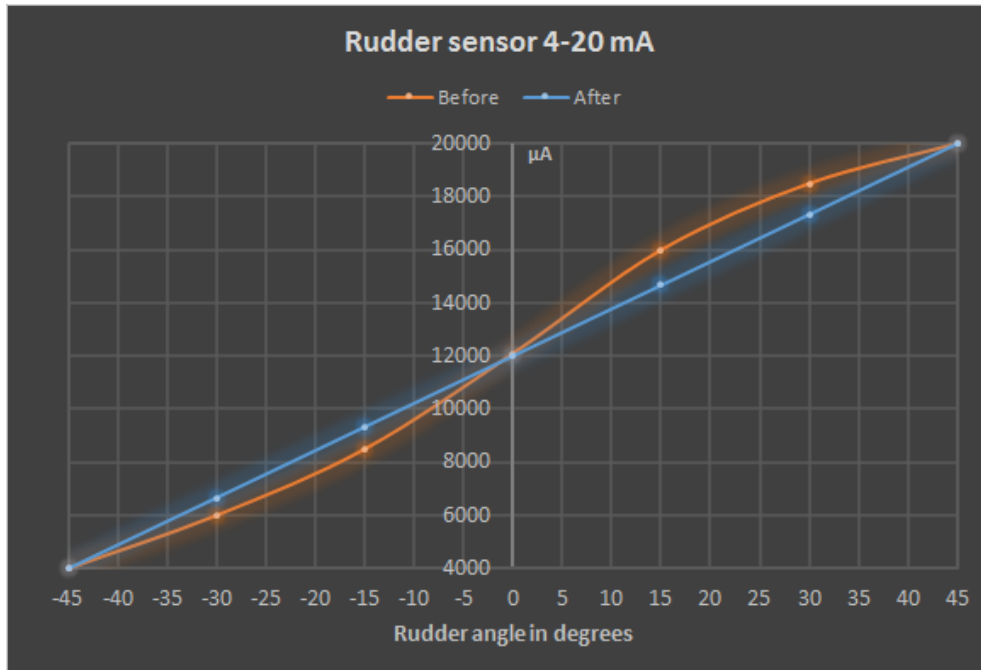
When the analogue input is used for a data type where the output value is type “+/-X”, for example rudder angle, then at least 3-point linearisation is normally used. This means that 3 scaling pairs are active, for example rudder angle: -45° to 0° to +45° to match 4 to 12 to 20 mA.

Input	Value	Note
Input point 1	4 000	in μA equal to 4.000 mA
Output point 1	-450	- 45.0° Rudder angle @ x 0.1 res.
Input point 2	12 000	in μA equal to 12.000 mA
Output point 2	0	0° Rudder angle
Input point 2	20 000	in μA equal to 20.000 mA
Output point 2	450	+ 45.0° Rudder angle @ 0.1 res.

The scaling of input value for respectively 100 % portside (-) rudder angle and 100 % starboard (+) rudder angle can now be adjusted individually in the installation.

The XDi has a very strong multi-point linearisation function that allows for up to 7 calibration points. This strong feature makes it possible to calibrate a non-linear input signal to best match a linear output.

Using a +/-45 degree rudder angle indicator system as example, it is possible to calibrate a uni-lineal rudder angle sensor to comply with the calibration accuracy requirements in ISO 20673 ships and marine technology — electric rudder angle indicator systems.



Example of result of 7-point calibration, the rudder is positioned at every 15 degrees, and the actual current is entered as the input point value for each.

The function is the same as explained for 3 point scaling above.



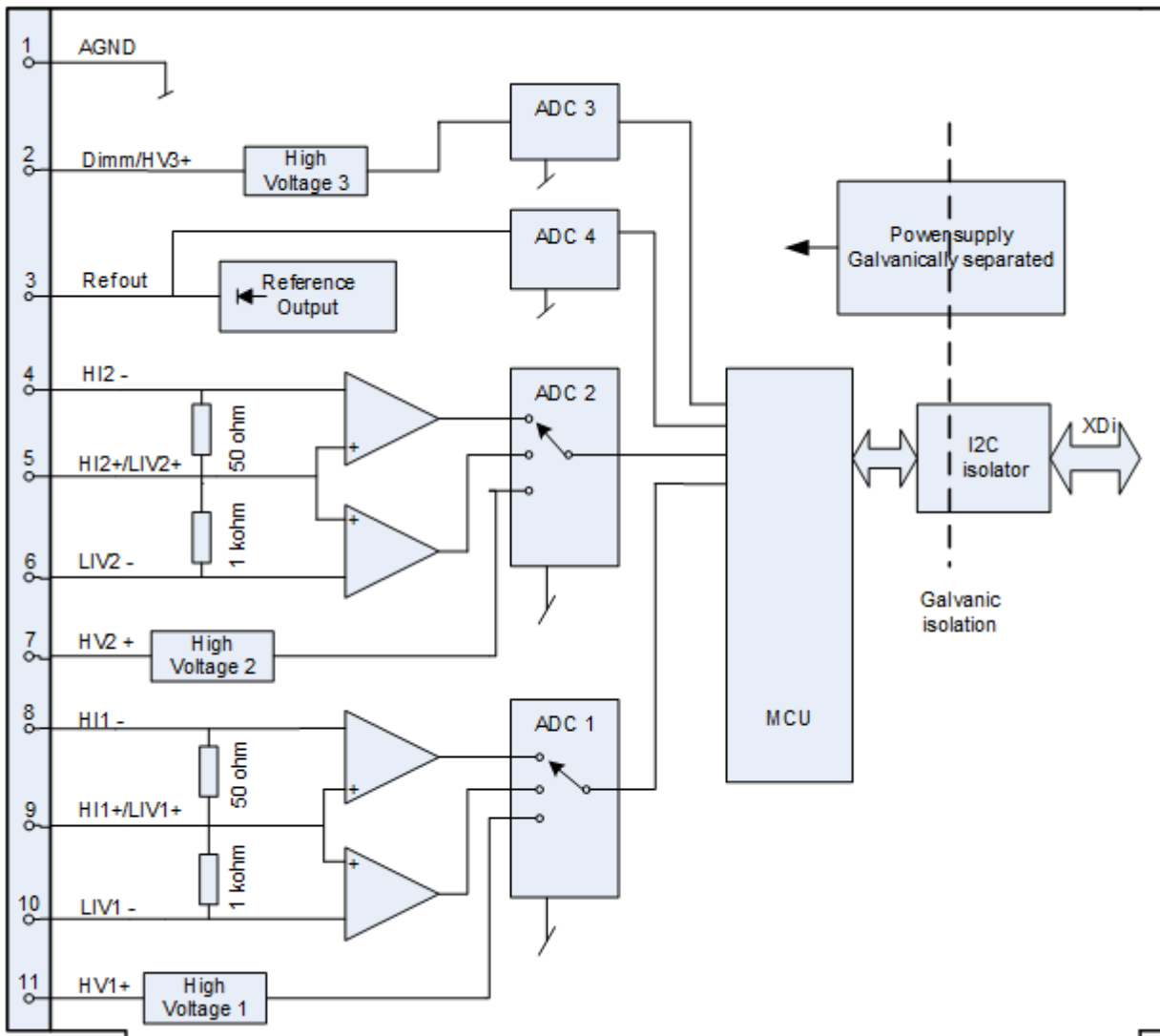
The DEIF RTA 602 analogue rudder sensors (4-20 mA) do not need more than 3 linearisation points to fulfil the accuracy requirements in the ISO standard. That is why DEIF standard libraries do not support more than 3 linearisation points; this also makes installation easier.

In fact in most installations, it is not necessary to make any adjustments in the XDi menu when the RTA 602 is installed and set up.

Pitch application and other

The multi-point linearisation can of course be used for a number of applications; at present it has been used in a customised library for a pitch angle indicator where the pitch input was quite un-linear.

AX1 input circuit - principle diagram



All inputs/outputs on the AX 1 module is galvanically separated from the XDi's supply voltage inputs and also from both CAN ports.

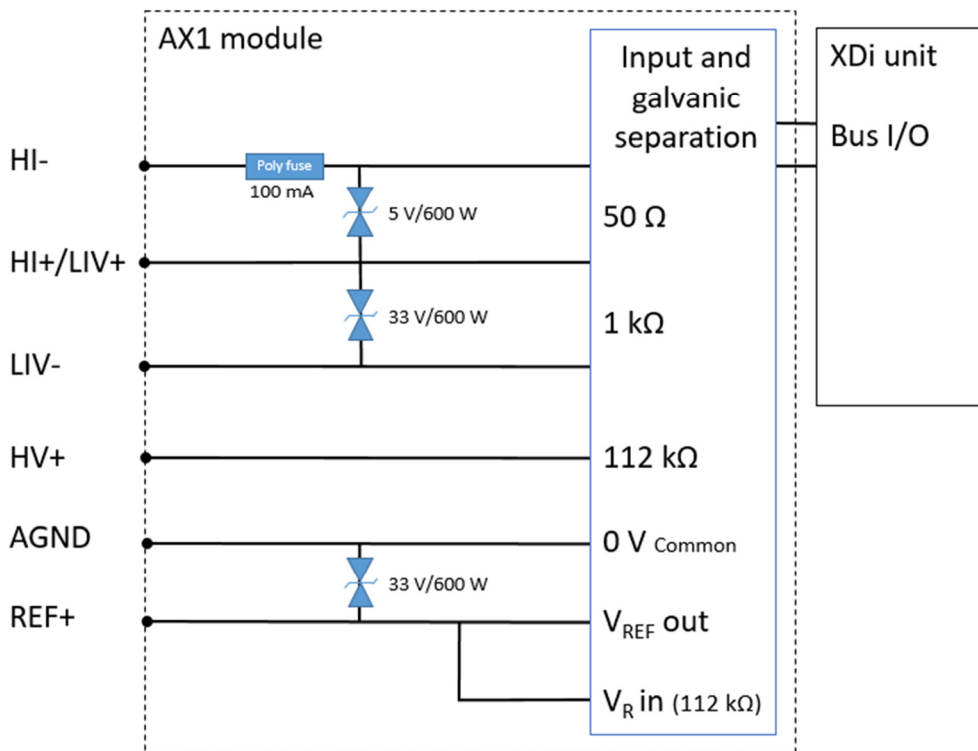
The 2 current inputs/low voltage inputs are both differential inputs.

The 3 high voltage inputs refer to the same common terminal (AGND).

Input protection

AX1 inputs are protected for over-voltage, and the HI (+/- 20 mA) inputs are over-current protected.

The AX 1 module is protected against accidental connection of 24 V supply voltage between any combinations of terminals.



I/Os on the same AX1 module are not galvanically separated, and therefore common mode must be carefully considered when more than one input is used.

Common mode rejection

The common mode potential between inputs and from one input to the analogue common/ground terminal (AGND) must not exceed:

AX1 Inputs:	High current input 1	Low current input 1	Low voltage Input 1	Analogue GND
High current input 2	+/-30 V	+/-30 V	+/-30 V	+/-15 V
Low current input 2	+/-30 V	+/-30 V	+/-30 V	+/-15 V
Low voltage input 2	+/-30 V	+/-30 V	+/-30 V	+/-15 V
Analogue GND	+/-15 V	+/-15 V	+/-15 V	

Common mode voltage will slightly affect the measurements, but within the limits above, the impact will be less than 0.3 % and the overall accuracy will be within class 0.5.

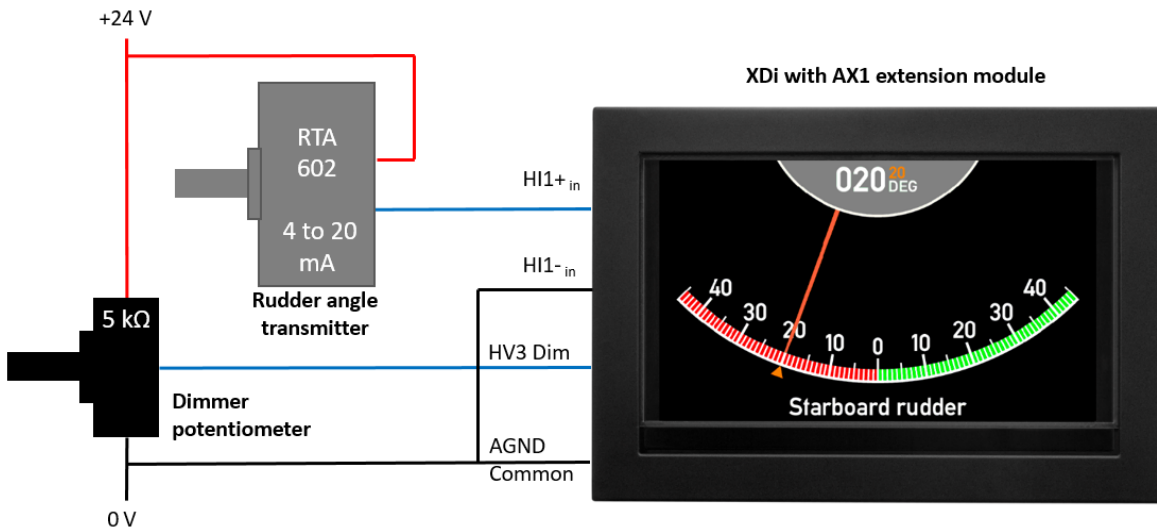
If a common mode voltage between a differential input and AGND exceeds 20 V, the input circuit will be forced out of range, and the measurement will no longer be valid.

Therefore, when more than one type of input is used, it is important to carefully consider the common mode situation.

Analogue current inputs to the AX1 module sometimes come from different devices that are more or less galvanically separated and maybe sourced from different power supplies. This may introduce a DC offset, hum and/or electrical noise between the individual input terminals and also from the inputs to the common analogue ground terminal. This type of common mode interference may disturb the measurements made by the AX1 module.

Connecting the AGND (common) to the common terminals on the analogue sources is a way of eliminating such common mode disturbances.

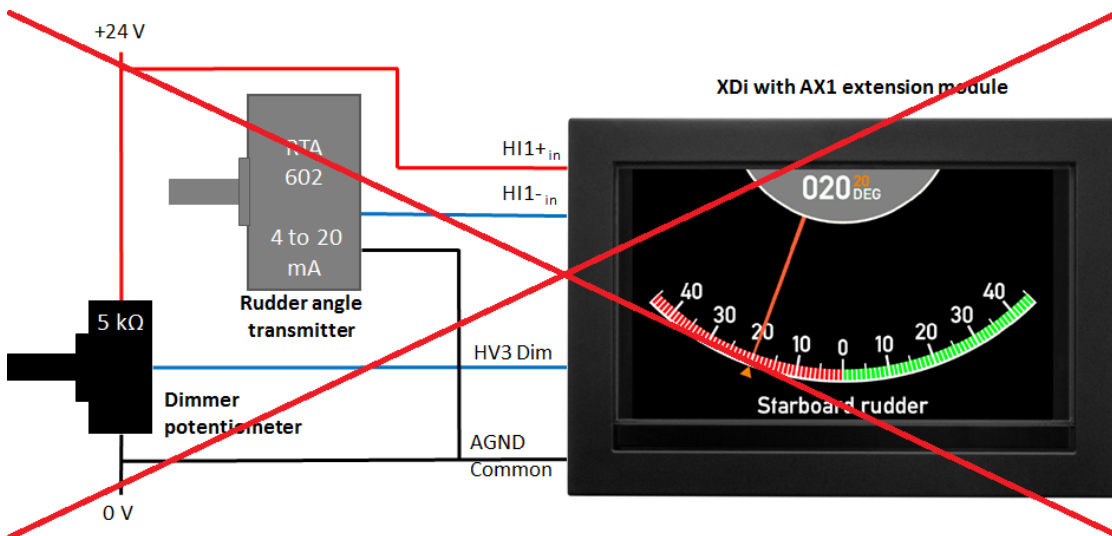
Example: rudder angle indicator system correctly configured



The RAI system is with a DEIF RTA 602 rudder angle transmitter 4 to 20 mA, and with an external dimmer, all is supplied from the same 24 V DC source. When connecting the RTA to +24 V DC and the XDi 4 to 20 mA current input HI1- to AGND (common), the common mode voltage from HI1+ to AGND will in the worst case be approximately 1.2 V and is well within the +/-15 V common mode limit.

Example: incorrect RAI system configured

In this configuration of the RAI system, the RTA is connected to 0 V (AGND), and the XDi 4 to 20 mA current input HI1+ is connected to +24 V. The common mode voltage from HI1+ to AGND (common) will be 24 V, and this exceeds the +/-15 V common mode limit, and the system will not work, and the indicator will constantly be out of range!



The common mode voltage is 24 V in this example, and the current input will not work correctly!

Connecting to the AX1 module

Analogue Extension Module AX1		
Terminal no.	Marking	Remark
1	AGND	Analogue common connection (or ground)
2	DIM/HV3+	Dimmer input configurable in the range, max. 30 V DC, port 3 It can be configured as an extra high voltage indicator input (max. +/-30 V DC), if it is not used for dimmer.
3	REF	REF out typ. 7.3 V DC (min. 7 V...max 7.5 V) and max. 10 mA. This port can also be used as reference potentiometer input, if the external voltage applied is between 7.5 V and 30 V DC.
4	HI2-	Negative input for: High current input (max. +/- 20 mA DC), port 2
5	HI2+/LIV2+	Positive input for: Low voltage, low current or high current, port 2
6	LIV2-/HV2-	Negative input for: Low voltage (max. +/-2 V DC) or Low current (+/- 2 mA DC), port 2
7	HV2+	Positive input for: High voltage (+/-30 V DC), port 1
8	HI1-	Negative input for: High current input (max. +/- 20 mA DC), port 1
9	HI1+/LIV1+	Positive input for: Low voltage, low current or high current, port 1
10	LIV1-/HV1-	Negative input for: Low voltage (max. +/-2 V DC) or Low current (+/- 2 mA DC), port 1
11	HV1+	Positive input for: High voltage (+/-30 V DC), port 1

The input wiring to the AX1 module must be in accordance with this table:

Voltage and current connection			
Terminal no		Signal	Input
+	-		
11	1	High voltage (HV1) input range, max. +/-30 V	Analogue port 1
9	10	Low voltage (LIV1) input range, max. +/- 2 V	
		Low current (LIV1) input range, max. +/- 2 mA	
9	8	High current (HI1) input range, max. +/- 20 mA	
7	1	Hi voltage (HV2) input range, max. +/-30 V	Analogue port 2
5	6	Low voltage (LIV2) input range, max. +/- 2 V	
		Low current (LIV2) input range, max. +/- 2 mA	
5	4	High current (HI2) input range, max. +/- 20 mA	
2	1	Dimmer input/high voltage 3 (DIM/HV3), max. +/-30 V	Analogue port 3
3	1	REF out voltage	



Terminal 1, analogue common (AGND), is used as the common connection for input REF, HV1+, HV2+ and DIM/HV3+ .



IMPORTANT: Only one input signal (voltage or current) must be connected to an input port, so be careful not to connect 2 different sets of input wires to the same input port!

Configuration of the AX1 module

Analogue input ports used as indicator input are pre-configured in the “VI-setup” profile (VS) defined for a virtual indicator (VI); this is also the case if DIM/HV3 is used as indicator input.

The configuration of the analogue dimmer input is pre-configured in the selected Product Profile (PP).



If you by accident select a PP and a VS profile that are both set up to configure the DIM/HV3 input port, then the XDi will assign port 3 as dimmer input as defined by the product profile (PP) and the virtual indicator (VI) will miss the input configuration and indicate that analogue input data is lost!

Menu access: The default settings of the extension module may be changed/adjusted via the XDi menu system.

Adjustment of dimmer settings is located in the “User menu”, and indicator input settings are located in the more protected “Installation menu”.

Via the installation menu, it is possible to adjust the analogue setup parameters, for example calibrate the zero point, adjust max/min scaling values or change direction of the scaling (CW/CCW) and much more.

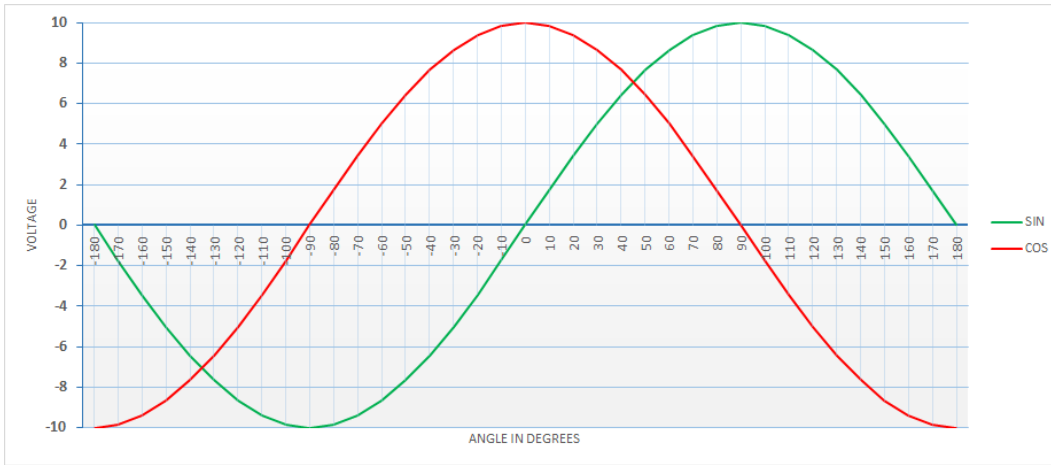
Please see the “Installation menu” section for detailed information.

The available analogue inputs on the AX1 can be configured as follows:

Type	Input	Type	Note
Sin cos input	Port 1 = SIN and Port 2 = COS	High voltage, max. +/-30 V or High current, max. +/-20 mA	Input pair
Single input	Port 1 or Port 2	High voltage, max. +/-30 V or High current, max. +/-20 mA or Low current, max. +/- 2 mA or Low voltage, max. +/- 2 V DC	Low current and Low voltage use the same input connectors.
Single input	Port 3 (Dim)	High voltage, max. +/-30 V DC	Dimmer input. Is fully calibrated and can also be configured as an indicator high voltage input (3).
High accuracy potentiometer input	Port 1, Port 2 or Port 3 (Dim)	High voltage, default 0 to 7.3 V (= Vref) Vref is continuously measured and may be overwritten by an external voltage between +7.5 and +30 V DC	The input to output scaling is made relative to Vref and thereby corrected for drift or fluctuations in the reference voltage also if it is overwritten.

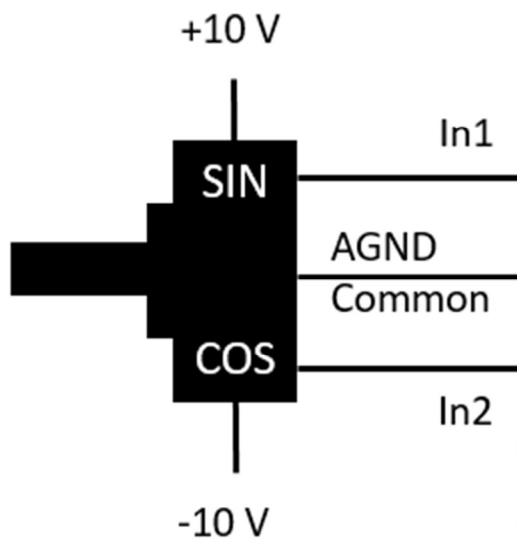
Sin/cos input

Input 1 and 2 can be predefined in the VS as a SIN/COS input pair. This type of input is often used for 360 deg angle measurements, and the input signals are provided by a special double potentiometer, supplied by the same voltage source.

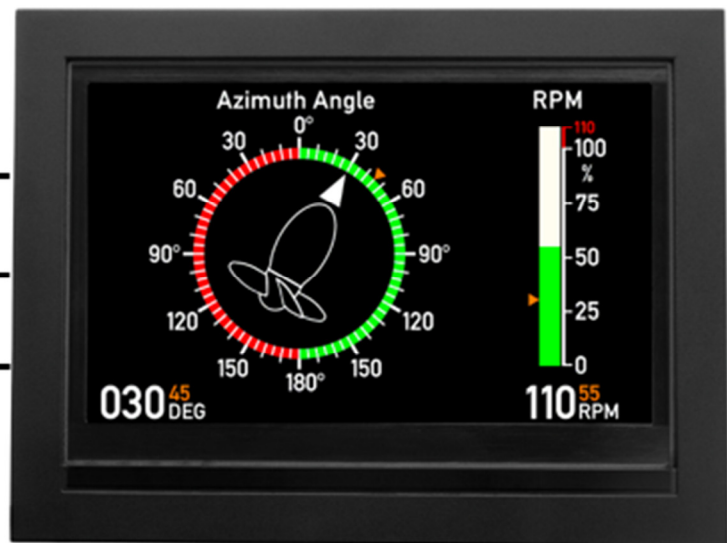


In the VS profile, the sin/cos max input voltage is predefined and will normally be the same as the potentiometer supply voltage or the cos input voltage at 0 deg and 180 deg. (above example +/-10 V). Due to the nature of sin/cos signals, the XDi is able to compensate for a variation in this max voltage to a certain limit. To obtain a good resolution and not risking running the input circuit into saturation, the min. and max. supply voltage must be within some limits.

SIN/COS Potentiometer



XDi with AX1 extension module



Example: In the DEIF standard library for azimuth thruster indication, it is possible to select a VS for sin/cos potentiometer input. This input pair has a predefined potentiometer supply voltage of +/-10 V, but this indicator will also work fine with any potentiometer supply between +/- 6 V and +/-15 V.

The high voltage input resistance of the AX1 module is 112 kΩ, and it is therefore possible to connect the sin and cos potentiometer wiper directly to the input, without any pre-amplifier.

The sin/cos potentiometer resistance should be as low as possible; this will minimise the influence of the internal resistance in the AX1 module.

It is recommended to use a SIN/COS potentiometer in the range of 500 Ω to 2 kΩ.



A sin/cos input pair cannot be changed to single input via the XDi menu or vice versa.

Single high voltage input

The high voltage input can be configured to use full data resolution within the ranges:

+/-7.5 V, +/-15 V or +/-30 V, this secures a very high accuracy in the analogue measurements.

The input is pre-configured to an input range that is scaled to an absolute data range for the selected data type.

Example: +/- 10 V input is scaled to +/-45° rudder angel.

The high input resistance (112k Ω) of this input results in an insignificant load of the voltage source. The internal resistance of the power source and resistance in the signal wires should be as low as possible. If the total source resistance exceeds 100 Ω , adjustment of the input voltage pre-set may be necessary.

Potentiometer used as input source is covered in a separate section.

Single high current input

The high current input can be configured to use an input range between either +/-10 mA or +/-20 mA.

Very often this input type will be pre-configured to 4 to 20 mA.

The high current input is overcurrent-protected by an auto recovery fuse (polyfuse). This slightly affects the input resistance, but has no impact on the measuring accuracy.

The internal resistance is between 55 and 65 Ω , resulting in a max. voltage drop of +/-1.3 V at +/-20 mA. The total voltage drop must be considered when a number of current inputs are serial-connected. In the application note for 4 to 20 mA rudder indicator systems, you will find a detailed description of how to design a current loop system.

Single low current and low voltage input

The low current input can be configured in the range: +/-2 mA.

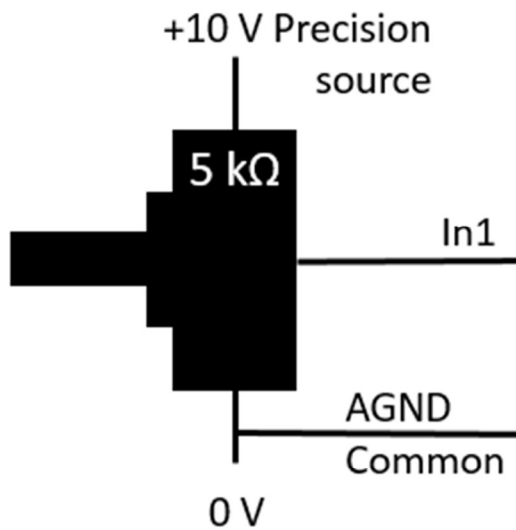
The same input is also used as a low voltage input and can be configured in the range +/-2 V. Please note that the input resistance is only 1 k Ω . This input is designed to withstand accidental connection to the 24 V supply voltage, at least for a short period of time.

High accuracy potentiometer input

When a potentiometer is used as input voltage source for an indicator, there are two important things to be aware of:

- 1) The measuring error caused by the input resistance loading the potentiometer output.
In the system below, the measuring max error of 1.1 % is reached when the wiper is located in the centre position ($\frac{1}{2}$ rotation angle). If the potentiometer resistance is doubled, the max. error is also nearly doubled.
- 2) The precision and stability of the voltage source supplies the potentiometer. If this voltage source is fluctuating, the indication will fluctuate.

Rudder Potentiometer



XDi with AX1 extension module



Ad.1. The XDi has a special function to eliminate the error caused by the input load. From the installation menu, simply enter the potentiometer resistance value and activate the “Potentiometer correction” function.

Ad.2. AX1 has a built-in 7.3 V reference voltage that is very stable and is intended to be used as supply for potentiometer applications.

Rudder Potentiometer



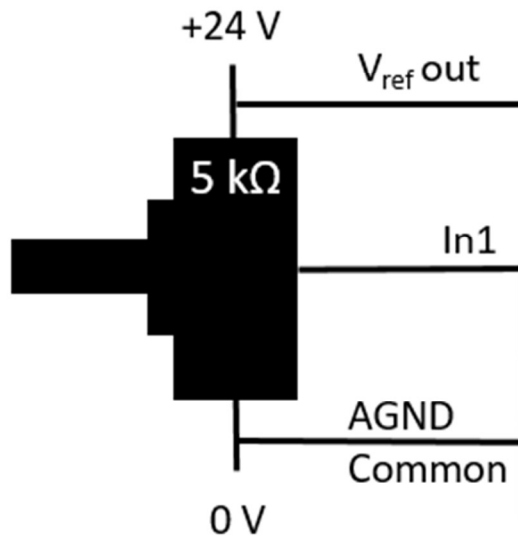
XDi with AX1 extension module



The high-voltage input can be pre-configured as a “ V_{ref} potentiometer input” type; this means that the input data is measured relative to the actual measured reference voltage. This means that any drift or fluctuations in the reference voltage will be corrected.

If there is a need for using another reference voltage than the one provided by the AX1 module, it is still possible to use the correction function simply by overwriting the reference voltage by an external reference voltage. In the example below, the 24 V supply is used as external reference. Since the high-voltage input is pre-configured as a “ V_{ref} potentiometer input”, the input voltage will be measured relative to the external reference voltage, and again, drift and fluctuations will be corrected. This makes it even possible to use a quite fluctuating source such as a 24 V battery as the voltage source for the complete system.

Rudder Potentiometer



XDi with AX1 extension module



Multi-point calibration

All analogue input can utilise up to 7-point linearisation when scaling the input measurements. The number of points must be defined in the VI-setup profile and can't be changed via the menu.

Via the installation menu, it is possible to make a very precise calibration and linearisation of such analogue inputs to obtain very accurate data for the indicator.

By sharing such data via CAN, all other XDi units using the same data will have direct access to those precisely calibrated data. In this way, it is only necessary to make calibration once in the complete system.

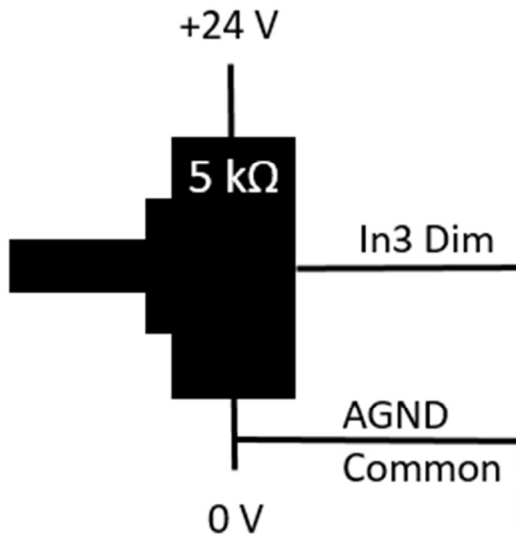
Dimmer input

The dimmer input is a standard high-voltage input and can be configured as previously described. When used as dimmer input, the pre-configuration is located in the Product Profile (PP), and changes can be made via the XDi user menu.

The analogue dimmer input can be configured as a normal voltage input. This means that the dimmer level will be controlled by the voltage at input port 3. The voltage can be generated by a central dimmer controller or by a potentiometer used as variable voltage source, as in the example below.

Independently of the analogue dimmer input configuration, the actual dimmer level can be shared via CAN to control other XDi units forming part of the same dimmer group as the XDi unit with the analogue dimmer input.

Dimmer Potentiometer



XDi with AX1 extension module

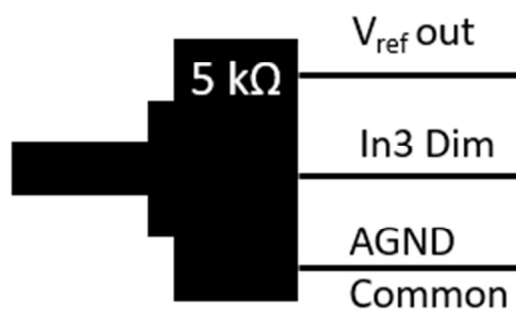


The supply voltage for the potentiometer in this configuration should be relatively stable since changes in this voltage will directly affect the dimmer level. The potentiometer value is not critical in a dimmer application. It is recommended to use a potentiometer in the range 1 to 20 kΩ.

Dimmer input using Vref

To avoid voltage fluctuation affecting the dimmer input, it is possible to use the AX1 V_{ref} output as supply for the dimmer potentiometer. Configured like that the dimmer level will be stable and independent of the supply voltage, and like previously described for the HV input, it is possible to overwrite the reference voltage by an external voltage (7.5-30 V) and still get fluctuations corrected.

Dimmer Potentiometer



XDi with AX1 extension module



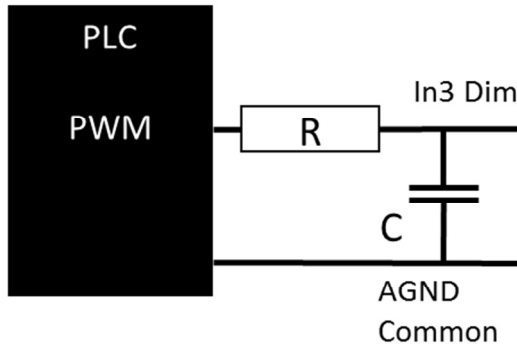
It is recommended to use a potentiometer in the range from 1 to 20 kΩ.

Dimmer input using PWM

The XDi does not directly support PWM (Pulse Width Modulation) input for dimmer control, but it is possible to route the PWM signal through a low pass filter to obtain a DC voltage at the analogue input. The high input impedance (112 kΩ) of the analogue dimmer input limits the load of the RC filter.

The PWM frequency should be as high as possible to be able to filter hard to avoid backlight flicker and still keep a fast response.

PWM dimmer input



XDi with AX1 extension module

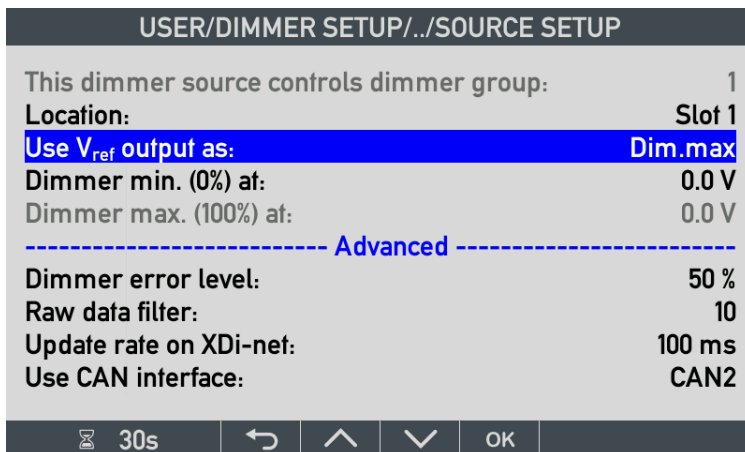


The resistor R should not exceed 5 kΩ, and the capacitor C can be calculated as:

$$C = \frac{10}{2\pi F R} [\mu\text{F}]$$

Where F is the PMW frequency in kHz, resistor in kΩ and the capacitor C in μF, the max/min dimmer input voltage span should be adjusted via the menu to best match the usable voltage range from the PWM signal.

To eliminate flicker, it may be necessary to increase the raw data filter value via the XDi user menu by entering the dimmer source setup menu. Alternatively, the capacity C can be increased.



The raw data filter can be set between 0 and 100 (0 is OFF). The filter value indicates the number of samples used for averaging.

In the example above, a filter value to 100 will increase the averaging time to 10 seconds. (100 samples of 100 ms).

Dimmer error handling

In DEIF standard libraries, the default dimmer setting and behaviour is predefined in the available selection of Product Profiles (PPs). Select a PP that best match the dimmer needs and make necessary parameter adjustments to match the installation using the XDi user menu.

When a customised library is made, it should be considered how the dimmer must behave when for example the potentiometer wiper loses its connection or the dimmer supply fails. If the dimmer input is a traditional input where 0 V equals minimum backlight (0 %) and 24 V is maximum backlight (100 %), then a lost dimmer input will result in a nearly black display.

It is possible to reverse the XDi dimmer input signal, so that 0 V equals max backlight and 24 V is minimum backlight. This secures that the XDi indicator is visible if input is lost.

Alternatively, the dimmer input can be configured with an offset, so that for example 2 V equals minimum backlight, and if the voltage drops below 2 V, then the backlight will shift to a predefined error stage. This could be pre-set at for example 50 % backlight.

The default dimmer settings are all predefined in the product profile (PP).

Share analogue data via CAN

All analogue input data for an indicator can be shared on CAN. Data sharing state is predefined in the VI-setup profile. If sharing is turned off, you may activate it from the installation menu (adjust input).

It is possible to share XDi analogue or digital input data either on: CAN1, CAN2 or CAN1&2 or turn XDi-net sharing OFF.

Data that is shared is the variable XDi-net data defined in the XDi specific object index table, and is in general 2 byte data (I16). Data is always scaled to an absolute or % value with a predefined resolution.

It is also possible to configure the XDi to send variable data from the object index table using a TPDO or RPDO format. Due to the complexity and mapping possibilities, this is not made available from the XDi menu, and it must be preconfigured in the VI-setup profile (VS) to be available.

Special libraries are available where TPDO support is made available. This is intended for system integration with XL indicators using sCAN format, but may be used for other types of system integration. Standard TPDOs intended for XL integration will have their variable data located in byte 0 and 1.

In customised libraries, up to 4 data types (I16 or U16) may be mapped into the 8 byte data field of a TPDO or RPDO.

Please consult the dedicated document: 4189350066A “XDi-net CANopen reference manual“ for details.

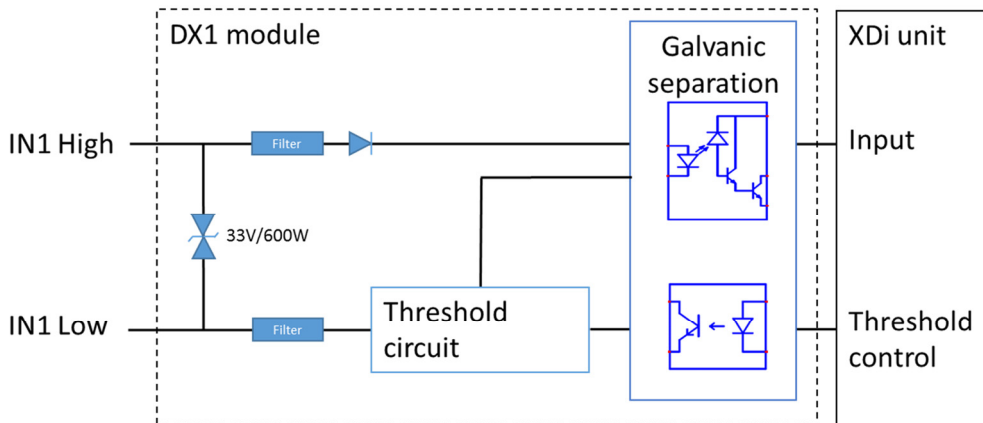
DX1 digital extension module

The digital extension module has two galvanically separated digital inputs and two general-purpose relay outputs.

The digital inputs are primarily intended for use as direct RPM pickup input(s), but may be configured differently.

DX1 input circuit - principle diagram

The two digital inputs are identical, and the principle diagram below illustrates the main function.



The input circuit is protected for over- and reverse-voltage.

The threshold (or trigger) level is set up in the relevant setup profile and can be changed from menu.

The setup will be one of 4 fixed levels, intended for input signals of respectively 5 V, 12 V, 24 V or 30 V.

The input voltage level must not exceed +/-32 V DC.

Please see the XDi data sheet for specific technical data.

Connecting to the DX1 module

DX1 Digital extension module connector		
Pin no.	Marking	Function
1	OUT2 COM	Relay 2 contact, common
2	OUT2 N.C.	Relay 2 contact, normally closed
3	OUT2 N.O.	Relay 2 contact, normally open
4	OUT1 COM	Relay 1 contact, common
5	OUT1 N.C.	Relay 1 contact, normally closed
6	OUT1 N.O.	Relay 1 contact, normally open
7	IN2 LOW	Digital input 2, negative (-)
8	IN2 HIGH	Digital input 2, positive (+)
9	NOT CONN.	The terminal is not connected internally.
10	IN1 LOW	Digital input 1, negative (-)
11	IN1 HIGH	Digital input 2, positive (+)

Digital inputs configuration

The inputs can be configured as:

- Two independent inputs for single direction RPM measurements.
- Input pair for bidirectional RPM measurement.
- Input pair for dimmer control (up/down and colour shift on simultaneous activation)
- Input pair for control purposes* (modes: 4 stage input or set/reset)
- Input pair for counting pulses* (modes: up/down, up with reset, down with reset)
- Two independent control inputs* (modes: H/L control, toggle on flank, 4 stage time-based input)

Note*: The digital input can be configured as a control input. This type of function is only used in special customised libraries, and the function is therefore not described further in this manual.

The DX1 input mode is defined in one of the selected setup profiles.

When the DX module is used as data input for an indicator or mode control of an indicator, the input definition and its pre-set parameters are defined in the VI-setup profile (VS).

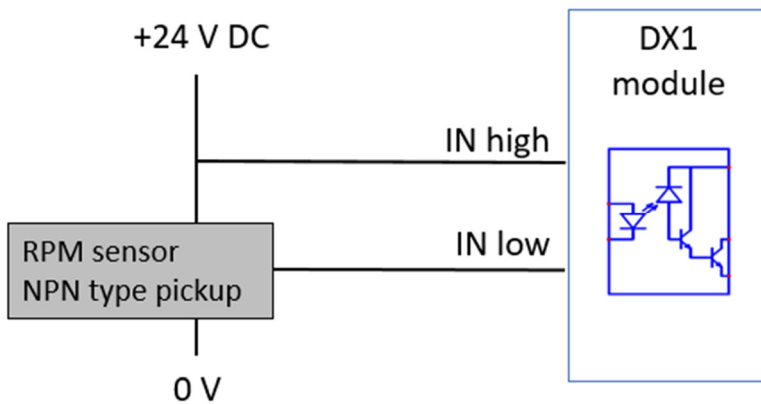
When DX1 is used as dimmer input the definition and pre-sets are located in the Product Profile (PP).

Important: Be careful not to select a VS (indicator input) and a PP (dimmer) both using the same DX1 input(s), if you make such a selection by accident, the PP will have priority and get access to use the DX1 input for dimming, and the indicator input defined in the VS will be disabled, and the indicator will show "Data lost".

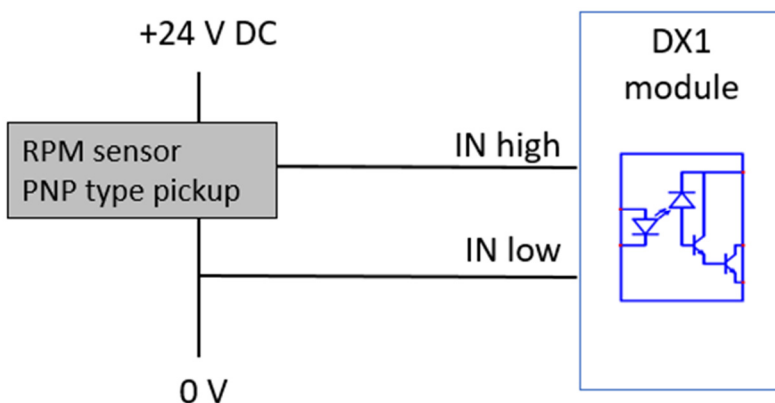
Connecting an RPM pickup

The galvanic separation of the digital inputs makes it easy to connect either an NPN or PNP type inductive pickup sensor. In fact, any type of sensor able to provide digital pulses can be used as RPM input device.

Connecting an NPN type sensor:



Connecting a PNP type sensor:



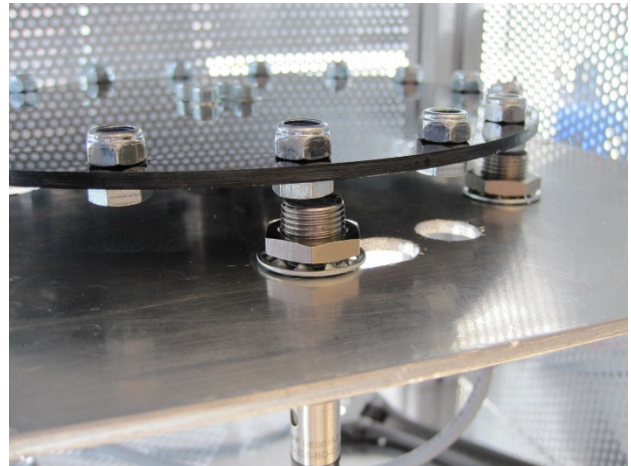
Recommended sensor types

For the practical test of the DX1 RPM function, we have used two different inductive sensors from BALLUFF sensor.

- NPN type: BES 516-329-BO-C-02 BES01EF, normally open, 2 mm sensing distance
- PNP type: BES 516-325-BO-C-02 BES01AZ, normally open, 2 mm sensing distance

The full specification of the tested sensors can be found on www.balluff.com and can be a useful reference for selecting a suitable RPM pickup sensor to use with DX1.

The sensor tests were performed using a specially constructed RPM test machine with a rotary disc where 16 bolts were equally distributed around the edge. One or two pickups can be mounted depending on the actual test, see picture. The test machine is able to rotate the disc at a maximum speed of 5250 RPM, and with 16 bolts this equals a max frequency of 1400 Hz.

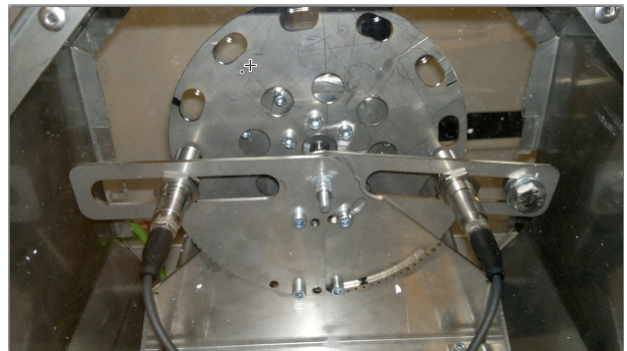


For unidirectional RPM measurements (direction independent) only one sensor is used. For bidirectional RPM measurements both sensors are used. In this case, the sensors are mounted with a mechanical offset, meaning that the pulses from the sensors are also offset in time, making it possible to determine the direction of the movement.

Mechanical RPM system recommendations

The mechanical RPM pickup system can be made in a number of different ways, either with bolts passing the inductive sensor or using a disc with a number of cut-outs along the edge to activate the inductive sensor (see picture).

It is recommended to use as high a number of bolts (or cut-outs) in the disc as possible to obtain the highest possible RPM resolution, but keep in mind that the frequency at max RPM does not exceed the max rating on the pickup sensor or the DX1 input.



The following table contains a guideline for number of bolts or cut-outs dependent on the max. rotation speed.

Max RPM range	Number of bolts (or cut-outs)	RPM resolution	Max frequency
<100	20	0.05	33 Hz
100 to 500	10 to 20	0.05 to 0.10	16.7 to 167 Hz
500 to 5000	6 to 10	0.10 to 0.167	50 to 833 Hz

To get the best possible performance it is important to position the bolts (or cut-outs) with high accuracy on the disc and mount the disc on the shaft using a stable construction to reduce jitter on the measurements. Less than 3 bolts or cut-outs on the disc are not recommended.

RPM pickup cable recommendation

The galvanically separated inputs are well protected and not very sensitive to electrical noise. It is, however, recommended to use a shielded twisted pair cable in installations where long cables are used or where strong electromagnetic disturbance may occur. The shield must only be terminated in one end to a good ground connection and must not be connected to any of the terminals on the XDi.

Tested cable type and length:

The DX1 system test includes a test of both Balluff sensor types connected to the DX1 input using 110 meter shielded twisted pair cable type Belden 9841NH. This test was performed using a rotating disc with an input frequency up to 1400 Hz. (The max available frequency from test machine).

The measurements on input signals and the data presentation on the XDi indicated no problem with this cable length.

The maximum cable length depends on the cable type and the maximum operating frequency, but the conclusion of the test was that 110 meter @ 1400 Hz was not even close to the maximum cable length.

Sharing RPM data from DX1 via CAN

The RPM data calculated based on the pickup signal(s) can be shared on CANopen/XDi-net.

Therefore it is only necessary to connect the RPM pickup to the first XDi in the indicator system. The rest of the XDi units will receive their RPM data via CAN; the easiest way is just to use the XDi-net format, but as for analogue data, the XDi can be configured to send TPDO or RPDO instead or in addition to XDi-net format.

Even XL CAN indicators may be integrated in such a system. It only requires that the XDi unit that is sharing data is configured to support the XL sCAN data format (TPDO type data).

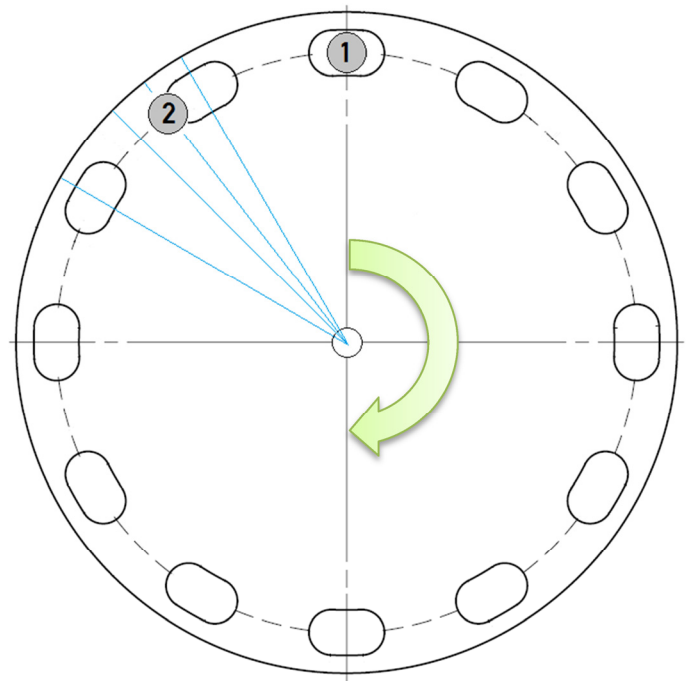
Bidirectional RPM pickup system

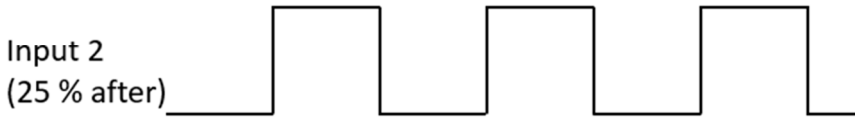
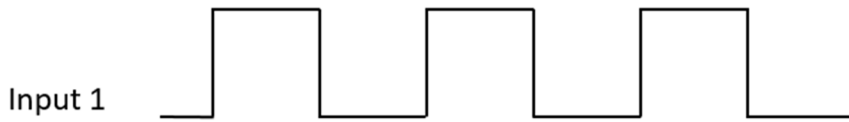
To measure bidirectional RPM rotation it is necessary to configure the virtual indicator to use an RPM input pair. This is defined in the VS profile.

To be able to determine the direction of the rotation, the two pickup sensors must be mounted with a mechanical offset.

The optimal position of the pickup sensors is as illustrated in the drawing.

Sensor no.1 is right at the centre of a cut-out, when sensor no. 2 is located with a 25 % offset. For practical reasons, the two sensors are not located around the same cut-out; this has no influence on the function as long as the offset is correct.

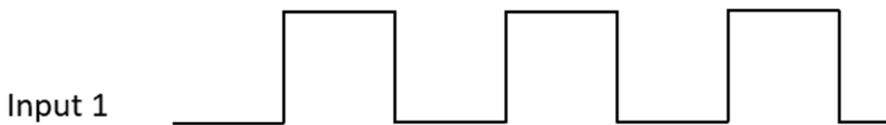




When the disc is rotating

clockwise, the 25 % mechanical offset between the sensors will delay the signal from sensor no. 2 with 25 % of the period time (90 degree phase shift) as illustrated below.

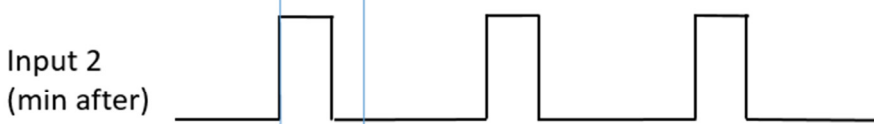
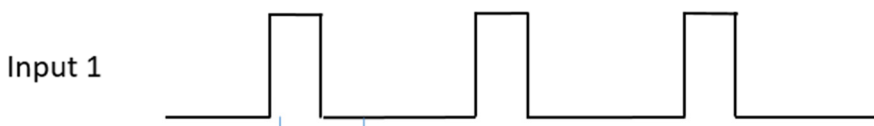
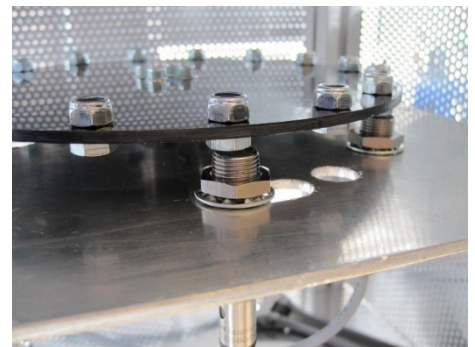
When the disc rotates counterclockwise, the 25 % mechanical offset between the sensors will make the signal from sensor no. 2 arrive 25 % of the period time ahead of the signal from sensor no.1, as illustrated below.



Positioning of the sensors

The signal below is from the test system mentioned before where the disc has 16 bolts and where the size of the bolt head is only 1/4 of the distance between bolts. This results in a pulse shape with 25 % duty cycle.

Depending on the location of sensor no. 2, the signal will be more or less delayed.



The input offset between sensor 1 (input 1) and sensor 2 (input 2) must be between 5 % (min) and 45 % (max) of the period time, for the XDi to be able to determine the rotation direction. In the example above, input 1 is ahead of input 2 and therefore the RPM direction is positive.

To shift the measured direction, simply connect sensor 1 to input 2 and vice versa.

Digital dimmer input

The DX1 inputs can also be configured to act as push-button dimmer inputs. The input is only shared on CAN when it is activated (that is at a change), and therefore it is possible to have more than one push-button dimmer device controlling the dimmer level in the same dimmer group.

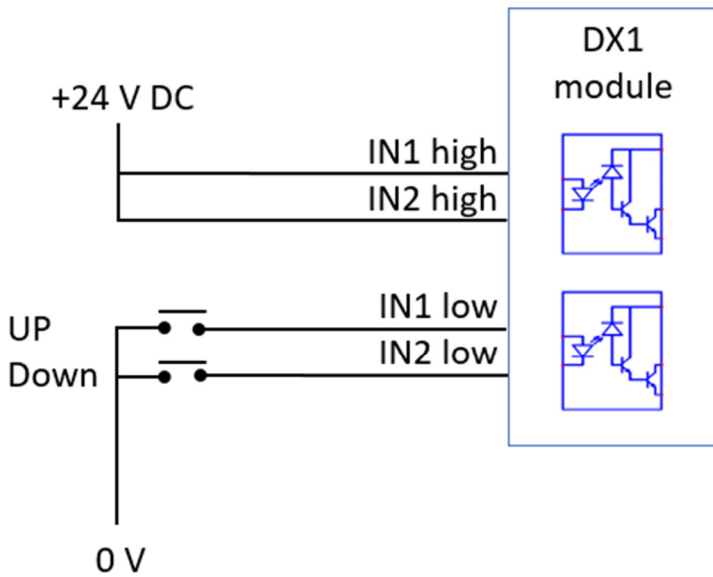
The digital dimmer input must be preconfigured in the selected product profile to be active.

The digital dimmer uses both inputs as an input pair, making it possible to change the dimmer level up or down by activating the input by a connected push-button contact.

The function has 2 modes:

- A. Dimmer up/down, input 1 up and input 2 down.
- B. Dimmer up/down, but with colour shift when input 1 and 2 are activated simultaneously.

Connection of 2 push-button dimmer controls (Mode A or B):

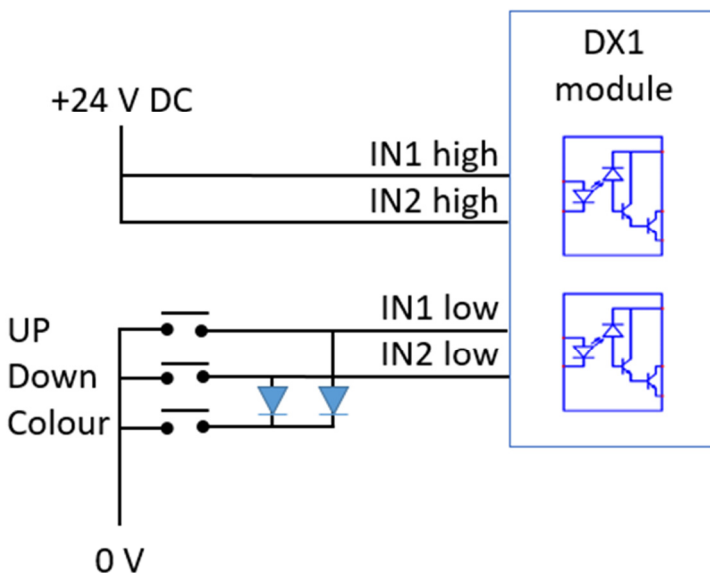


This connection can be used in both dimmer modes.

Mode A: Dim up/down. Day/night colour shift can be automatic at a defined dimmer level.

Mode B: Dim up/down and make a colour shift by a simultaneous push on both push-buttons.

Connection of 3 push-button dimmer/colour controls (Mode B):



This configuration is used for digital dimmer mode B, where there are 3 push-buttons for: Up, Down and Colour shift.

Relay outputs

The relay function makes it possible to design customised virtual indicators with a warning or control function. The two relay outputs can be individually configured to serve the functions described in this chapter.

A relay output can be:

- a) Predefined in the product profile (PP) as product warning or alert outputs.

- b) Predefined in the VI-setup (VS) as an output from a virtual indicator for example set up to be triggered when the pointer enters a restricted section of the scale.
- c) Predefined in the VS to be activated by a control flag.

Please note, that it is possible to activate a relay output function from both PP and VS at the same time. The relay will when activate if either of the selected criteria are true.

Relay mode

Each relay can be predefined to one of the activation modes:

0x00= Normal De-energised (ND) = OFF

0x01 = Normal Energised (NE) = ON

Normal energised mode can be used if the relay output must activate a function either when the XDi supply power is totally lost or when the relay function is true. This function is recommended when the relay functions for warnings and alerts are used.

Timer function

It is possible to define a timer function to control the length of the relay activation or periodically repeat the relay activation if the event is still true. This can be useful if the relay is activating a sound or light signal.

The timing of this function is selectable in steps of 500 msec.

This function can also be disabled.

Functions activated from product profile (PP)

0x00 = Disabled (PP function disabled)

0x01 = Activate on XDi Warning

0x02 = Activate on XDi Alert

0x03 = Activate on XDi Warning & Alert

These functions are self-explanatory.

Functions activated from the VI-setup (VS)

0x00 = Disabled (VS function disabled)

0x01 = Activated inside critical band

0x02 = Activate outside critical band

0x03 = Activate below user def. low value

0x04 = Activate above user def. high value

0x05 = Activate on flag-H (Flag AND mask >=1)

0x06 = Activate on flag-L (Flag AND mask =0)

The relay activation related to critical band can be controlled by one, two, three or all four critical bands for a data type used by the selected virtual indicator.

The alternative to using critical band is to use a single low or high parameter to activate the relay.

Activation using a data flag includes a data-mask where desired flag bit (or bits) are masked "in" using value "1". The relay can be set to either activate when one in-masked flag bit is going 1 or by all in-masked flag bits being 0.

See the XDi data sheet for technical specifications of the relays.

NX1 NMEA output module

The NMEA output module contains one serial output following IEC61162-1 (NMEA0183) and may be used to supply output data like rudder angle and RPM to external devices like integrated navigation system or a VDR.

NX2 NMEA I/O extension module connector		
Pin no.	Marking	Function
1 to 6		Not used – do <u>not</u> connect anything!
7	TX1-B	RS-422 Serial output (NMEA0183/IEC 61162-1)
8	TX1-A	RS-422 Serial output (NMEA0183/IEC 61162-1)
9	Common	Reference GND for NMEA0183 out/RS-422 Do not connect to cable shield or ships ground.
10 and 11		Not used – do <u>not</u> connect anything!

NOTE: NMEA connection A and B are shifted compared to the RS-422 standard.

The NMEA output is a differential output, and the common connector should only be used if there is a separate common connector in the data cable. Common must not be connected to cable shield or ground.

Connection and cable for NMEA

The RS-422 output may be connected to up to 10 standard NMEA inputs complying with ISO 61162-1 (load >1 kΩ). It is recommended to use a shielded twisted pair cable.

Supported NMEA sentences

Only data types used by the selected virtual indicator can be pre-set, in the VS profile, to be packed in to an NMEA sentence and transmitted via the NMEA output.

Data types may be generated from an AX1 or DX1 module or be received via CAN either using XDi-net data format or received in a TPDO.

The following data sentences are supported for variable data:

PRC, RSA, ROR, RPM, TRC, TDR and DCC.

For rudder systems:

RSA actual rudder angle may be used in a CAN-based rudder system to output the rudder angle to the VDR.

For dimming:

The DDC dimmer sentence may be preconfigured in a product profile (PP). The XDi will be transmitted containing the dimmer value and selected colour pallet, for the dimmer group that this XDi is part of.

Accessing XDi menus

The three main menus are accessed by pressing a combination of two push-buttons simultaneously for approximately 5 seconds. When the display writes “Loading”, your selection has been accepted.

The table below shows the valid push-button combination to use to access a menu from normal operation mode.



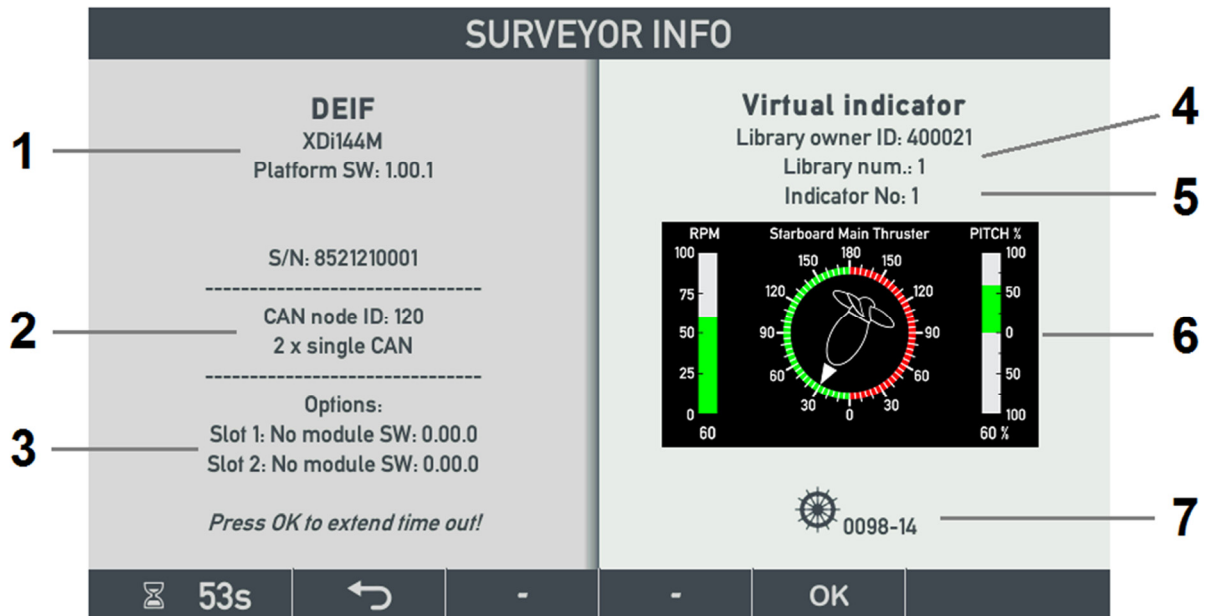
Menu/Function	Button 1	Button 2	Button3	Button 4
Surveyor Info	•	•	-	-
Master reset	•	-	•	-
User Menu	•	-	-	•
Pop-up menu *)				

*) The pop-up menu shows which push-buttons to press simultaneously to access the related menu.

Access to the installation menu requires a “secret” double push-button combination from user menu, see the Installation menu chapter.

Surveyor information (INFO)

Press button 1 and 2 for more than 5 seconds, and the surveyor page will provide information about the XDi and its configuration.



1	Serial number and software information
2	CAN bus settings
3	Information about extension modules (if mounted)
4	Library owner and library number
5	Active virtual indicator number
6	Thumbnail picture of the active virtual indicator
7	Wheel-mark if the active virtual indicator is MED-compliant

Master reset

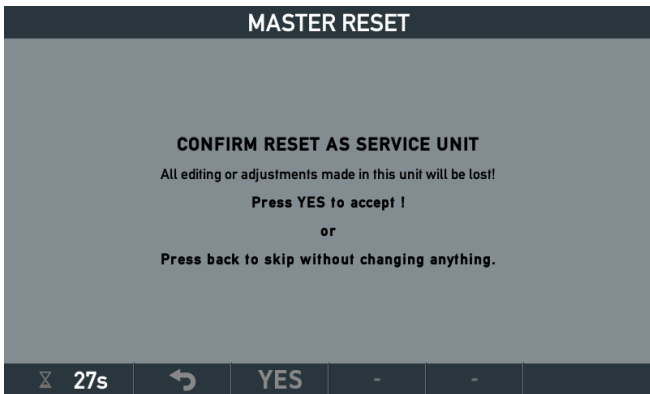
Pres button 1 and 3 for more than 5 seconds, and the master reset menu will appear.



There are 2 levels of master reset:

1. Factory reset: resets all XDi selections and parameters back to the predefined settings it had when it left the factory, and when powered up it will start the setup wizard.
2. Reset as a service unit: in this mode, the unit will be reset to factory settings and parked on the service NodeID 127, ready for fully automated configuration via CAN.

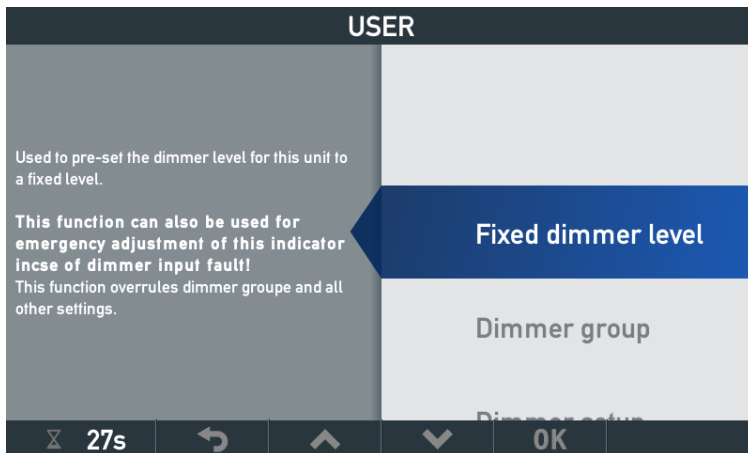
Master reset requires an extra user confirmation (YES) before reset is performed. It is possible to skip without making the master reset, simply push the return soft-key.



Activating the master reset will erase all setup and adjustments made during installation, and all such settings will be lost!

User menu

The user menu gives access to change the predefined basic setup parameters, where advanced installation settings are located in the special installation menu.



The user menu is used for adjusting:

- Dimmer
- Warnings and sound
- Rotation of display

Dimmer

The XDi provides different ways of controlling the dimming of the backlight:

- Dimmer level can be set at a fixed level. Often used if the unit is located in the engine control room.
- Dimmer control value between 0 % and 100 % backlight level sent via the CAN bus.
- Dimmer voltage input via the analogue dimmer input on the AX1 extension module .
- Dimmer step up/down via the digital inputs on the DX1 extension module.

There are also different ways of controlling the Day/(Dusk*)/Night colour:

- Fixed colour
- Automatic colour shift determined by the dimmer level
- Colour shift controlled by an input (normally via CAN)
- Colour shift controlled by DX1 digital inputs

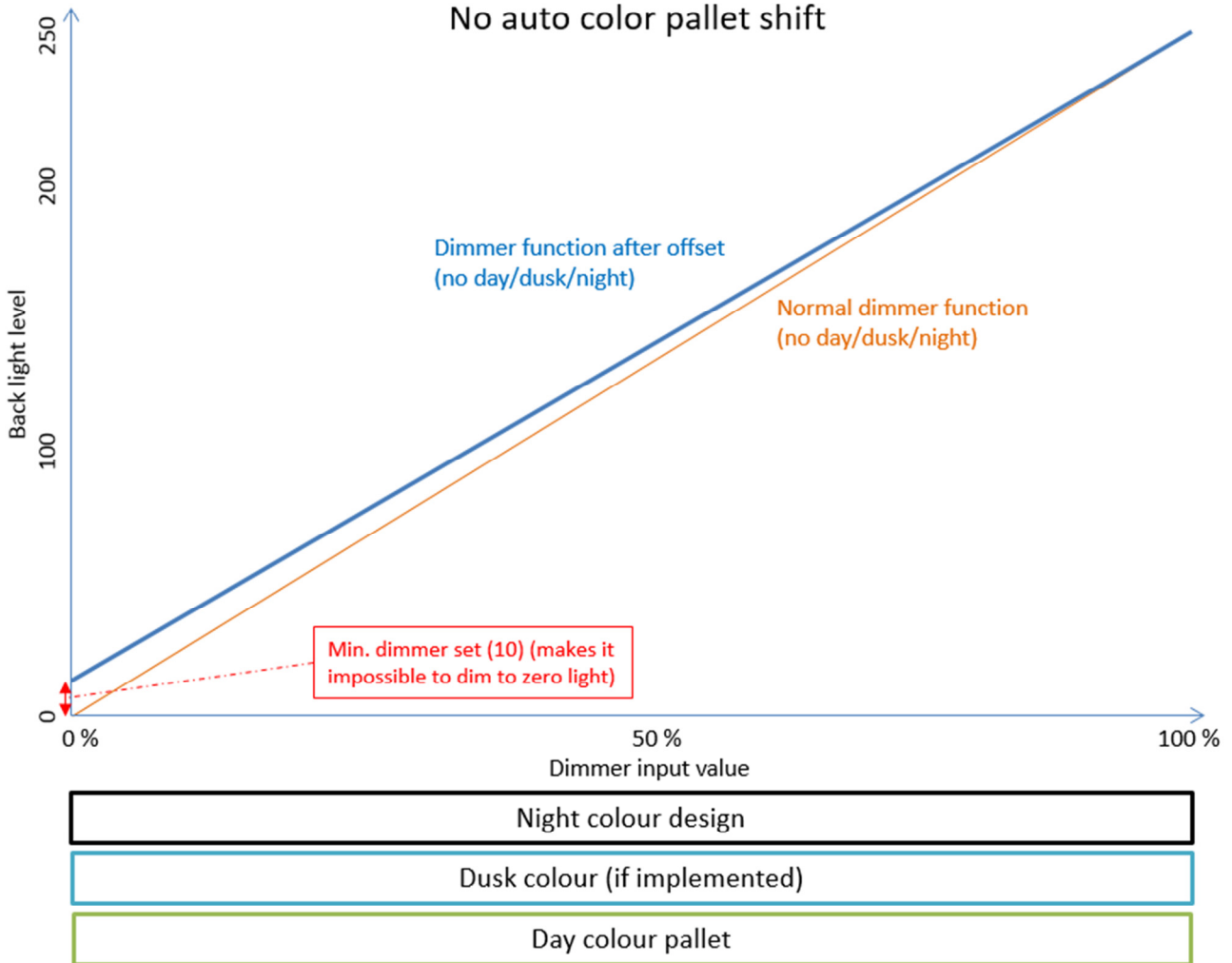
*) In most cases, the XDi only uses day/night colour designs, but in customised libraries "Dusk" may be used. The dimmer and colour settings are predefined in the selected product profile and may be adjusted from the user menu.

Normal dimmer function

The XDi backlight level can be set at any level from 0 to 250.

In normal dimmer mode (without auto colour shift), the dimmer level from 0 to 100 % controls the backlight level range from "Min backlight level". This must be set at the lowest backlight level where the display is still readable in dark night conditions (typically level 10) to "Max backlight level", which is the level used in full daylight. Typically, this parameter is set at max. (level 250).

DIMMER FUNCTION No auto color pallet shift



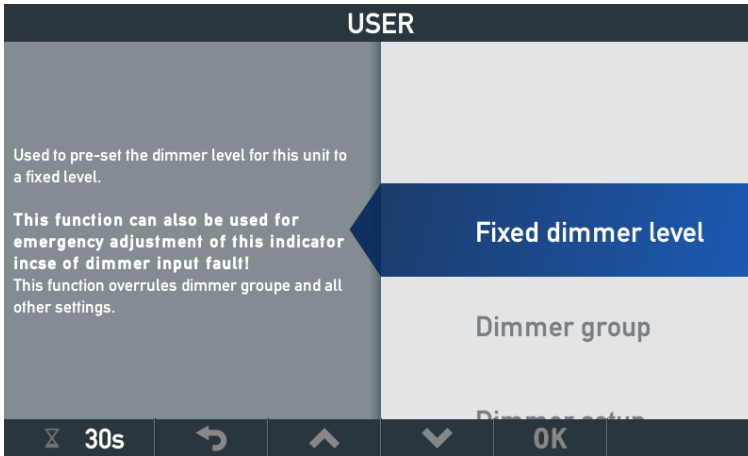
Min and max. backlight level can be used to align backlight on several XDi types (and maybe other displays) controlled by the same dimmer source (see dimmer setup below).

Fixed dimmer level

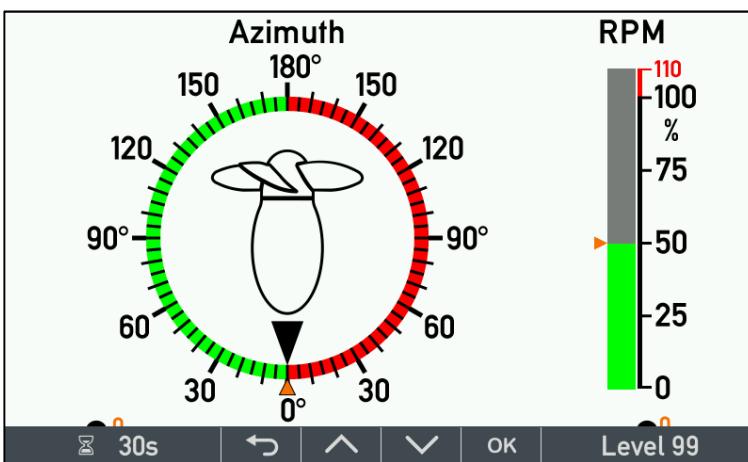
When the XDi is installed in a location where dimmer adjustment is not needed, for example Engine Control Room (ECR), the fixed dimmer function should be used to set the backlight level to a fixed level. It is often a good idea to use the local group setting for indicators using fixed dimmer level, but if a number of XDi units in the ECR are connected via the same CAN bus, it makes sense to place them in a dimmer group and then you only need to adjust the level on one unit to get all of them synchronised.



Reducing the backlight level will increase the lifetime of the backlight LEDs. When the XDi is used in the engine control room or other locations where a fixed dimmer level is used, it is recommended to reduce the dimmer setting to 70-80 %. This will more than double the expected lifetime of the backlight.



Press OK to enter “Fixed dimmer level”, and a new menu will appear showing the actual virtual indicator together with a new soft-key menu for adjusting the fixed dimmer level:



Using the actual indicator design when adjusting the backlight level makes it easier to find the desired level.

Dimmer groups

9 dimmer groups (Gr. 1 to 9) can be controlled via CAN and in addition a “Local” mode, which will not be controlled via CAN.

Parameters for all dimmer groups including the default selected dimmer group are predefined in the Product Profile (PP). Parameters may however be changed and adjusted via the user menu.

The dimmer level will be set to the same for all units in the group. The control method is defined in the PP. A dimmer group can be preconfigured to be controlled by:

1. An XDi-net command
2. A CANopen TPDO or RPDO
3. An analogue dimmer input on one XDi shared using XDi-net protocol (requires AX1 module)
4. A digital input dimming on one (or more) XDi units shared using XDi-net protocol (requires DX1)

A popular system dimmer method is to connect an analogue dimmer control output (for example a potentiometer) to one XDi in the group (3) and then set up the rest in the group to use dimming via XDi-net (1). This is a simple plug and play method.



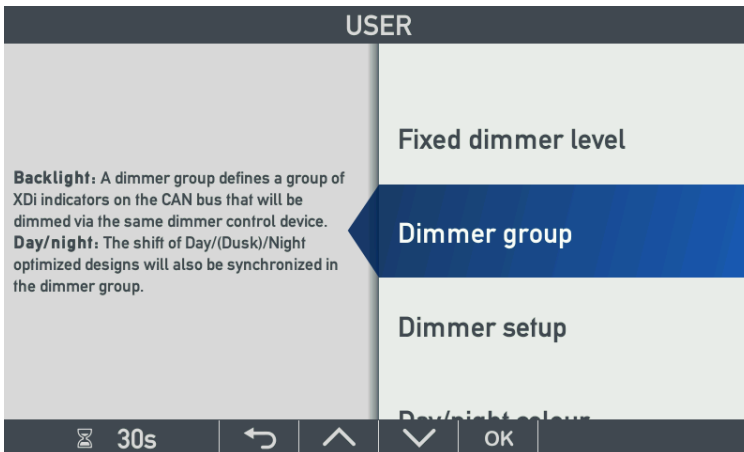
It is important that only one XDi with analogue dimmer control is used in a dimmer group. The analogue dimmer level is shared using periodic transmissions, and if 2 units are controlling the same group, the dimmer level will jump up and down between the 2 incoming levels.

If more than one unit must be able to control a dimmer group, then the digital input (DX1) can be used. This up/down dimmer system will only send a new level on a change (when the input is activated), and it is therefore possible to have two or more XDi units controlling the dimmer level in the group.

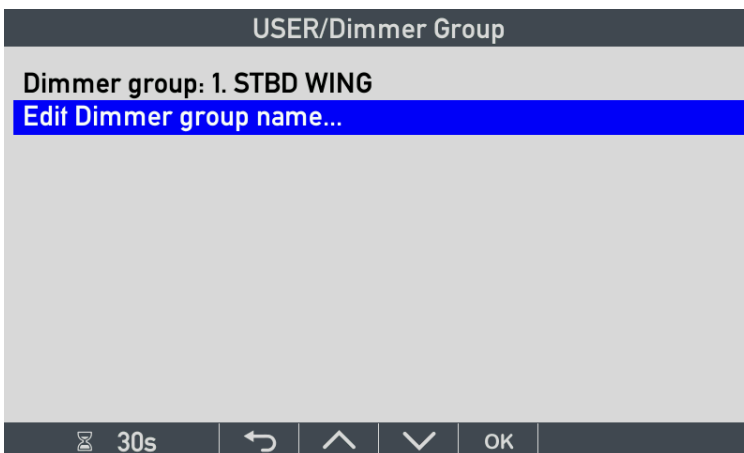
The shift between Day/(Dusk)/Night colour scheme is also part of the dimmer group function.

Changing dimmer group

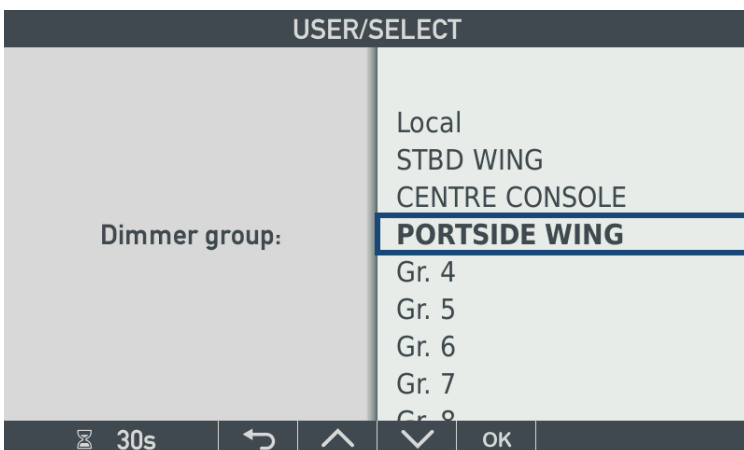
Highlight the “Dimmer group” menu and press OK:



Highlight the “Dimmer group: 1. STBD WING” and press OK.



Select another dimmer group, for example “PORTSIDE WING” by pressing OK.

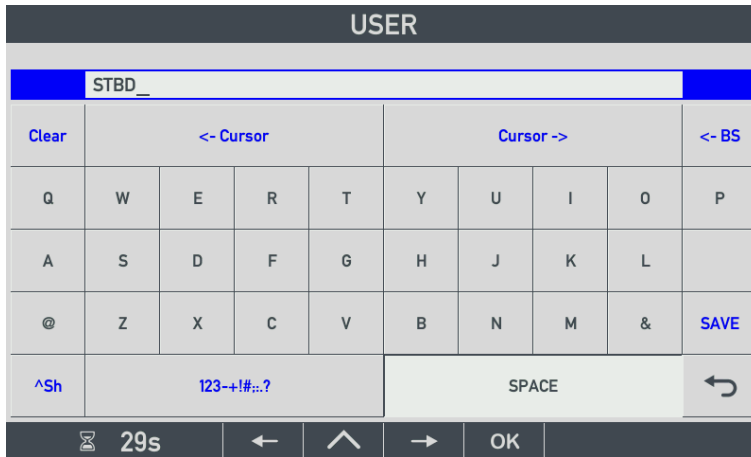


Local mode

In “Local” mode, the XDi will respond to a dimmer command sent to the local dimmer group index or get the analogue or digital dimmer input from an extension module mounted on this XDi unit. In local mode, the XDi will not share analogue or digital dimmer data via XDi-net.

Edit the dimmer group name

In addition to the dimmer group number, each dimmer group may have a describing name. The name will normally be predefined in the PP, but it can also be added or changed via the “Edit dimmer group name...” menu, using the onscreen virtual keyboard.



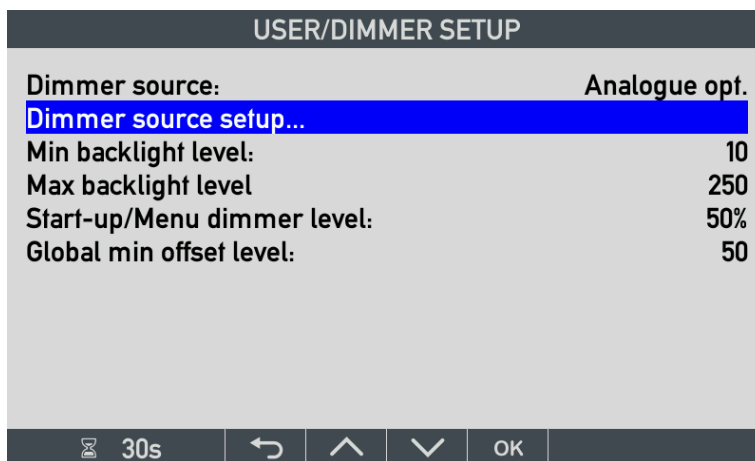
Highlight a key using the arrows and press OK to select.

SAVE: remember to finalise the editing process by selecting the SAVE button, or your changes will be lost.

If this display reaches time-out, it will step one level back and changes will be lost.

Dimmer setup

The predefined dimmer settings from the selected product profile (PP) may be changed via the user menu.



Min backlight level (local) is the backlight level that equals a dimmer value of 0 %. This setting should never be set to 0 since it turns the backlight totally off, and it will no longer be in accordance with regulations for a display-based bridge product. The valid value range is 0-100 out of the total of 250 backlight steps. This is a local setting for the XDi itself and can be used to level minimum backlight level between several XDi units placed next to each other.

Max backlight level (local) is a function that makes it possible to fine-tune the max backlight level equal to 100 %. This is useful to equalise the light level on different XDi units sitting next to each other or to match other screen-based equipment using the same dimmer control input. Default is 250, and valid value range is 50-250 again out of the total of 250 backlight steps.

Start-up/Menu dimmer level is the default dimmer level % if no dimmer input is available and also the minimum level when the menu structure is entered. This should not be set to a value below 20 %.

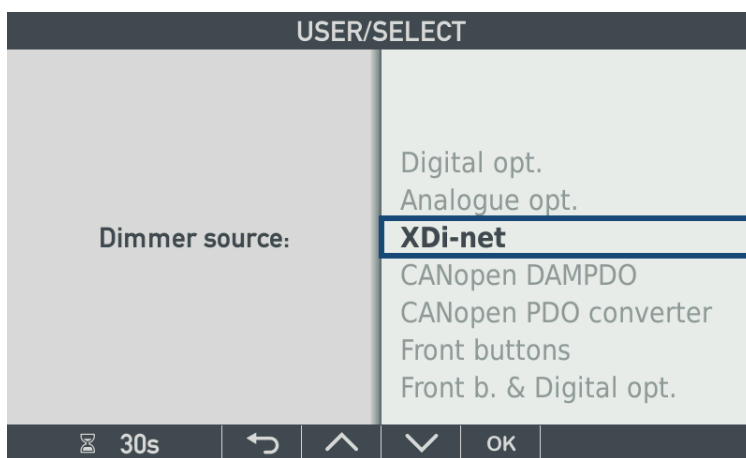
Global min offset level: this function offers the possibility to adjust the minimum backlight level for all XDi units in a dimmer group on the CAN bus. This global minimum level is added to the local minimum dimmer level.

Dimmer source

The dimmer input source is preconfigured in the selected product profile (PP), but it may be manually adjusted during installation.

The dimmer source can be preconfigured in PP to be:

- **Digital option (DX1)** push-buttons connected to the digital inputs.
- **Analogue input (AX1)** voltage source is connected to the Dim/HV3+ input.
- **XDi-net** dimmer signal is broadcasted?? via CAN
- **CANopen PDO converter** is used to convert and un-map TPDO or RPDO dimmer data
- **CANopen DAMPDO** is not used (will be removed), XDi-net also supports DAM-MPDO.
- **Front buttons** for future use only. Buttons are covered behind front frame on the standard XDi.
- **Front b. & Digital opt.** for future use only



It is always possible to shift from a preconfigured dimmer source to XDi-net as dimmer source (and back to the default source). Shifting to another source type than XDi-net requires selection of a PP supporting this type of source.

Analogue or digital dimmer input

When the XDi-net function is enabled the analogue or digital dimmer level used by an XDi unit will normally also be shared via XDi-net with all XDi units being part of the same dimmer group and of course connected to the same CAN bus.

An XDi unit with analogue or digital dimmer input can only control the dimmer group that it is part of via XDi-net.

(Dimmer sharing can be on CAN1, CAN2 or CAN1&2)

Source	Receive from XDi-net	Transmit on XDi-net	Note
Analogue	[Yes ^{3*}]	Yes	Only one XDi with analogue dimmer and sharing data on XDi-net must be part of a dimmer group*)
Digital	Yes	Yes	Data is only sent on a change, and several dimmer controllers can be in the same dimmer group. **)
XDi-net	Yes	No	If "XDi-net variable data on" is active, then an XDi unit can receive dimmer data in the normal XDi-net data format using COBID 0x201 to 0x27F. If only "XDi-net function" is enabled, dimmer data can only be received using XDi-net format using COBID 0x27F (node 127).
PDO converter	[Yes ^{3*}] (Synch)	No (Synch)	All devices on CAN have access to the dimmer data, and they are not retransmitted in XDi-net format. All devices in the group must therefore use PDO converter instead of XDi-net. Setup changes in the PDO converter may be synchronised via CAN.

*) Please note that if more than one XDi in a dimmer group shares its analogue dimmer data via CANopen or XDi-net, then all XDi units in that group will receive different dimmer levels from 2 sources, resulting in a flickering backlight.

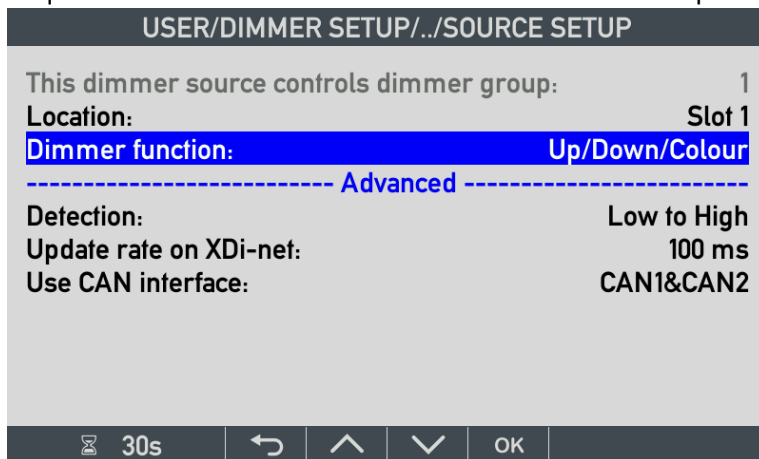
***) This is not the case with XDi units using the digital dimmer input option, since the dimmer command is only sent when there is a change, and that happens when the digital input for example connected to a push-button, is activated.

3*) The XDi is always able to receive XDi-net data when the XDi-net is active.

The dimmer source setup menu is only available if the selected source has parameters that may be changed via menu.

Digital dimmer source setup

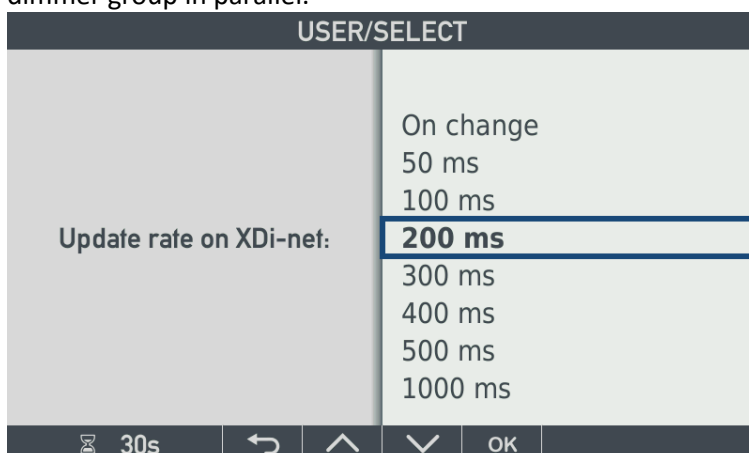
Requires a DX1 module to be mounted on the XDi at the specified slot.



Dimmer function: defines the function of the two digital inputs used for dimmer. Selections are UP/Down or UP/Down/Colour. The functions are described in the DX1 section.

Detection: defines how the signal on the digital input must be detected, either trigger the function on a “Low to High” transition or on a “High to Low” transition. Default is low to high equal to detection when a serial connected contact is pushed to close the circuit.

Update rate on XDi-net: is the repetition rate of dimmer messages being sent on XDi-net (CAN). The DX1 has a setting called “On change”. This setting should be selected if more than one XDi controls the dimmer group in parallel.



The analogue module does not have the setting “On change,” and therefore only one XDi with analogue input can control a dimmer group.

Use CAN interface: if a CAN port is selected, dimmer data is shared on the selected port(s) using XDi-net protocol and at the repetition rated above.

The settings are: NO, CAN1, CAN2 or CAN1&2

Analogue dimmer source setup

For analogue dimmer input, an AX 1 extension module must be mounted in the extension slot specified in the product profile, for example Slot1.

In the example below, the XDi is set up to be part of dimmer group 1 and therefore all the dimmer settings, including the dimmer source setup, relates to this dimmer group.

USER/DIMMER SETUP/./SOURCE SETUP	
This dimmer source controls dimmer group:	1
Location:	Slot 1
Use V_{ref} output as:	Dim.max
Dimmer min. (0%) at:	0.0 V
Dimmer max. (100%) at:	0.0 V
----- Advanced -----	
Dimmer error level:	50 %
Raw data filter:	10
Update rate on XDi-net:	100 ms
Use CAN interface:	CAN2

30s ← ^ v OK

Use V_{ref} output as:

This setting can be used when a dimmer potentiometer is connected using the V_{ref} output as supply (typically 7.3 V).

The reference voltage V_{ref} is internally monitored.

When “Dim.max” is selected, the measured reference voltage will automatically be used as the maximal dimmer voltage, and the dimmer input voltage will be measured relative to this reference. This means that fluctuations in V_{ref} will be corrected.

It is even possible to connect an external voltage source V_{ext} ($V_{ref} < V_{ext} < 30$ V) from V_{ref} to AGND (in parallel) overwriting the internal ref. voltage. V_{ref} is still monitored, and measurements are corrected accordingly.

If the dimmer potentiometer is supplied from a battery source, where the voltage is varying over time, it is recommended to use the “ V_{ref} mode” to eliminate fluctuations in dimmer level caused by this.

The setting can also be: “Dim.min”. In this case, the reference voltage is equal to 0 % dimmer and 100 % can be set to 0 V in which case the dimming will be reversed. The backlight will be a max when the dimmer voltage is 0 V.

This setting is useful to avoid the XDi to go black when dimmer input is disconnected.

Setting “Not used” indicates that the automatic scaling to reference voltage is not in use, and the dimmer input is a normal input.

Dimmer min/max settings:

The min and max dimmer input voltages may be set between 0 and 30 V DC.

Dimmer min. (0 %) voltage and dimmer max. (100 %) voltage can be set up individually, so that the dimmer input can be defined within a range of for example 7 V to 24 V DC.

If $V(\text{Dimmer min}) > V(\text{Dimmer max})$, then the dimmer input function is reversed (the higher the dimmer voltage - the lower is the backlight level).

Dimmer error handling:

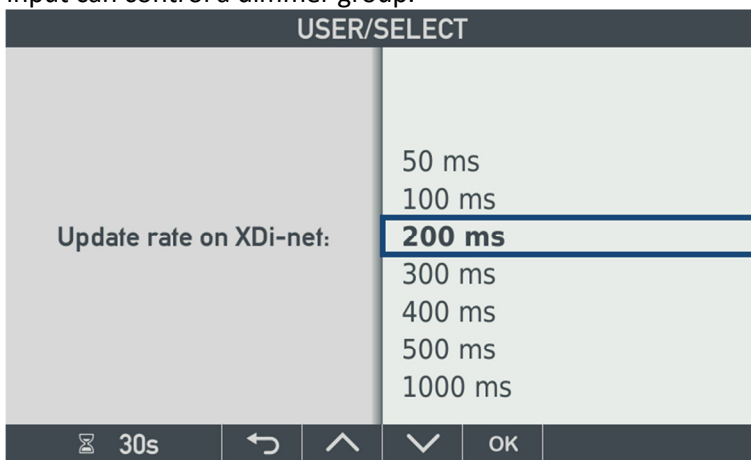
There are 2 ways that the XDi can be set up to handle a disconnection of the analogue dimmer input (for example the wiper inside the potentiometer losing its connection to the resistive layer).

- 1) Set up analogue dimmer in reverse mode as described above, and the dimmer level will go to 100 % when the input voltage drops to 0 V.
- 2) Define the input as a voltage range for example from 1 V to 10 V and add a fixed resistor (1.2 kΩ) from the potentiometer (10 kΩ) to analogue ground (terminal 1) to raise the minimum voltage to 1 V. If the dimmer input loses connection, the voltage will drop to 0 V, and the XDi will activate the dimmer error backlight level at for example 50 % (see below).

The dimmer error level: this is the dimmer level used if the dimmer voltage drops more than 2% outside the defined dimmer low level. When this level is set to 50 %, the backlight will shift to 50 % in a fault situation,

Raw data filter: is an averaging filter that can be adjusted to reduce noise and fast fluctuations on the input voltage. This filter is useful to reduce flicker when a PWM signal with external LP filter is used as analogue dimmer input. The filter range is 0 to 100, and the normal default is 10. Increase this value to reduce flickering.

Update rate on XDi-net: is the repetition rate of dimmer messages being sent on XDi-net (CAN). The AX1 analogue module does not have the setting “On change”, and therefore only one XDi with analogue input can control a dimmer group.



Use CAN interface: See digital dimmer setup above

XDi-net dimming (or DAM-MPDO)

This source type does not need a setup menu.

Dimmer values are received and routed directly into the object index table as defined in the table below, where the actual dimmer value is located in sub-index 0x02 as an unsigned 8 bit parameter (U8).

The data range is 0 to 100 representing the dimmer level of 0-100 % (100 % being max. backlight).

Dimer Group no.	Object index	Sub-index
1	0x3501	0x02
2	0x3502	0x02
3	0x3503	0x02
4	0x3504	0x02
5	0x3505	0x02
6	0x3506	0x02
7	0x3507	0x02
8	0x3508	0x02
9	0x3509	0x02
Local (0xA)	0x350A	0x02

How to send XDi-net data (or DAM-MPDO data) is described in details in the “XDi-net/CANopen reference manual”.

Dimmer PDO converter setup

This requires that a PDO converter is defined in the Product Profile (PP) as input source for each dimmer group that must be supported by the selected PP. In most cases, a TPDO data value is defined for each of the 9 dimmer groups.

Data can either be sent in a separate TPDO for each dimmer group or they can be mapped into one or two TPDOs.

The Dimmer TPDO converter can handle input values from 8 to 16 bytes mapped into a TPDO or RPDO. One TPDO can max handle 8 dimmer groups each using 1 data byte. To support all 9 groups, at least two TPDOs must be used.

USER/DIMMER SETUP/././SOURCE SETUP	
This dimmer source controls dimmer group:	1
PDO value at DIM level 0%:	0
PDO value at DIM level 100%:	100
----- Advanced -----	
Conversion mode:	CAN1 & 2
Source TPDO/RPDO:	0x1A0
PDO data format:	Unsigned
PDO data field length (8-16 bits):	8
Mapped data, LSB located at bit no.:	0

30s ← ^ v OK

PDO value at DIM level 0 % defines the input value that must be converted to 0 %.

PDO value at DIM level 100 % defines the input value that must be scaled to 100 %.

The PDO converter makes a linear scaling of the input value range received to the XDi dimmer range from 0 to 100 %.



Do not change any of the following advanced settings if you are not familiar with CANopen.

Conversion mode: the defined PDO can be received from CAN1, CAN2 or CAN1&2. If the conversion mode is turned off, then the TPDO converter is disabled.

Be aware that the XDi can receive dimmer data sent in XDi-net format even when it is set up to receive dimmer data in a TPDO or RPDO, but since dimmer data from a PDO is not retransmitted on the XDi-net, problems will not occur.

Source TPDO/RPDO: the default COBID of the TPDO or RPDO (0x1A0 in the example above), can be changed.

PDO data format: unsigned/signed, in this case it should not be changed.

PDO data field length (8-16 bit): the PDO converter is able to receive and convert any Unsigned or signed data package between 8 and 16 bit and convert the content to a dimmer value between 0 to 100 %.

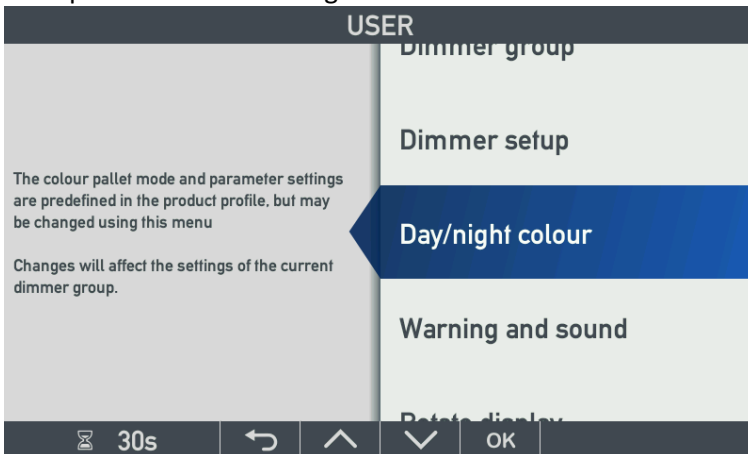
Mapped data, LSB located at bit no.: this value indicates the location of the least significant bit in the data package defined above and mapped into either a TPDO or RPDO. This makes the PDO converter able to identify the mapped data package to use.

Synchronise dimmer group

Changes of dimmer parameters in the PDO converter may be shared with all other XDi indicators in the same dimmer group. Accept synchronisation in the pop-up menu when leaving the setup menu.

Day/Night Colour shift

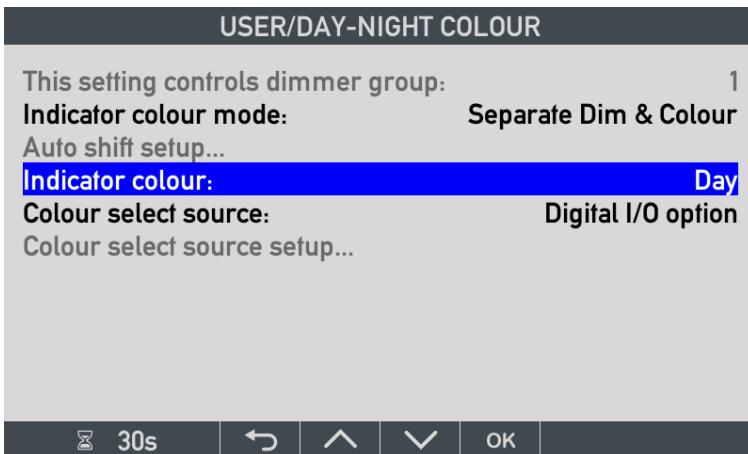
In the XDi library, each indicator will normally be defined with at least day and night colour designs, but it is even possible to add a design for dusk conditions if needed.



The intension of the colour shift in combination with the backlight dimming is to optimise visibility and contrast in any ambient light condition on a ship's bridge.

For example in daytime: black text, scale and pointer boundary on a white background and full backlight will provide a very clear readability. Where during night time, white text and scale, orange pointer on a black background combined with the right dimmer level, provides a clear view even in the darkest night conditions and without jeopardising the night vision of the officers on the bridge.

Dusk may be used to optimise the readability in the grey twilight, but if the virtual indicator is well designed, it is really not necessary.



Virtual indicator colour modes

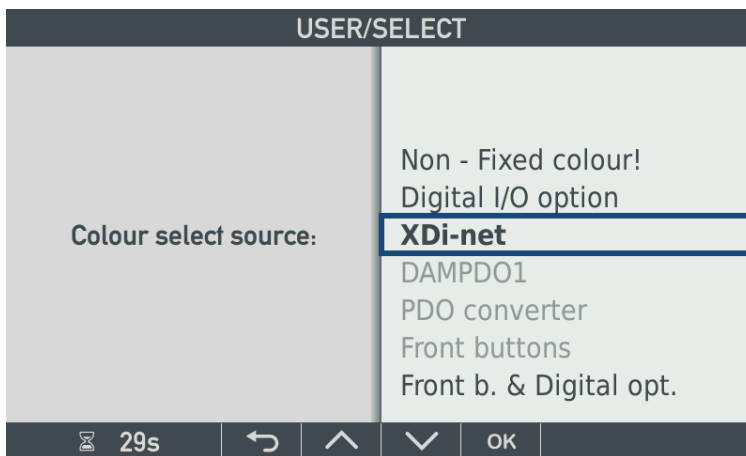
The indicator colour mode can be set to:

1. Separate Dimmer & Colour
2. Auto Day/Dusk/Night
3. Auto Day/Night

Colour shift source in mode 1

In mode 1, the source used to make the colour selection can be:

NONE-fixed colour!	Select this setting if a fixed design is needed (Day, Dusk or Night).
Digital I/O option	Parameter is received from digital input, when the digital input dimmer mode supporting colour shift is selected.
XDi-net (DAM-MPDO)	Parameter is received via CAN using XDi-net format or received in a DAM-MPDO.
PDO converter	Parameter is received via CAN in a TPDO or RPDO, and has to be predefined in the selected PP.
Front buttons Front b.& Digital opt.	Reserved for future XDi-N version (Not available in this version)



Colour shift using XDi-net or DAM-MPDO

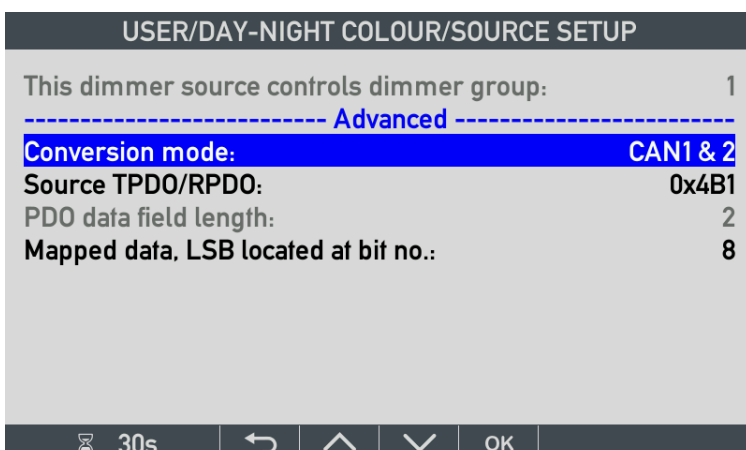
This selection has no setup menu. The colour pallet selection is received in sub-index 0x03 of the dimmer group object index range in the table above. The selection is located in an unsigned 8 bit field using only 2 bits (LSBs). The 2 bit selection values are:

- 00 = Day
- 01 = Night
- 10 = Dusk
- 11 = Reserved

See the “XDi-net/CANopen reference manual” for details.

Colour shift using PDO converter

If the colour shift is defined in the Product Profile (PP) to be received using a TPDO or RPDO, then a PDO converter is used as the input source for colour shift. The PDO converter can select any 2 bits in the 8 byte data package and use them as colour shift input. This means that it is possible to map colour shift parameters for all 9 dimmer groups in one TPDO using only 3 data bytes with data for up to 4 groups in each byte.



The following menu is available:

The PDO may be received via CAN1, CAN2 or both
 The COB-ID of the PDO used for data transfer may be changed.
 Also, the mapping of the 2 input bits in the 64 bit data frame of the TPDO may be changed via menu.

Example 1:

TPDO containing all 9 colour shift parameter set in the 3 first bytes

Byte 0				Byte 1				Byte 3			Byte4	Byte5	Byte6	Byte7	
Gr1	Gr2	Gr3	Gr4	Gr5	Gr6	Gr7	Gr8	Gr9	-	-	-	-	-	-	-
00	00	00	00	00	00	00	00	00	-	-	-	-	-	-	-

Byte 0: Gr. 1 with LSB located at bit 0, Data in bit 0 1
 Gr. 2 with LSB located at bit 2, Data in bit 2 3
 Gr. 3 with LSB located at bit 4, Data in bit 4 5
 Gr. 4 with LSB located at bit 6, Data in bit 6 7
 Byte 1: Gr. 5 with LSB located at bit 8, Data in bit 8 9
 Gr. 6 with LSB located at bit 10, Data in bit 10 11
 Gr. 7 with LSB located at bit 12, Data in bit 12 13
 Gr. 8 with LSB located at bit 14, Data in bit 14 15
 Byte 2: Gr. 9 with LSB located at bit 16, Data in bit 16 17

Example 2:

It is also possible to combine dimmer level and colour shift data in the same TPDO. In this example, data for dimmer group 1 to 4 is located in byte 0 to 4:

Byte 0	Byte 1	Byte 2	Byte 3	Byte4				Byte5	Byte6	Byte7
Dimmer Gr.1	Dimmer Gr.2	Dimmer Gr.2	Dimmer Gr.2	Gr1	Gr2	Gr3	Gr4	-	-	-
0000 0000	0000 0000	0000 0000	0000 0000	00	00	00	00	-	-	-

Byte 0: Dimmer Gr. 1 with LSB located at bit 0, Data in bit 0 to 7
 Byte 1: Dimmer Gr. 2 with LSB located at bit 8, Data in bit 8 to 15
 Byte 2: Dimmer Gr. 3 with LSB located at bit 16, Data in bit 16 to 23
 Byte 3: Dimmer Gr. 4 with LSB located at bit 24, Data in bit 24 to 31
 Byte 4: Colour sh. Gr. 1 with LSB located at bit 32, Data at bit 32, 33
 Colour sh. Gr. 2 with LSB located at bit 34, Data at bit 34, 35
 Colour sh. Gr. 3 with LSB located at bit 36, Data at bit 36, 37
 Colour sh. Gr. 4 with LSB located at bit 38, Data at bit 38, 39

Auto Day/Night shift mode

“Auto Day/Night shift” and “Auto Day/Dusk/Night shift” modes are basically the same mode. The only difference is that Day/Night mode does not have a dusk indicator design implemented in the library. If Day/Dusk/Night is selected in a library without dusk design, the night design will be used instead of the dusk design.

In normal dimmer mode without auto shift, the dimmer level from 0 to 100 % controls the backlight level from min. (typically 10) to max. (typically 250). Where the backlight level range is 0-250. The Auto Day/Night colour shift function makes the dimmer work slightly different, by using the dimmer value from 0 to 100 % to control not only dimmer level but also the display colour. For each display colour (Day/(Dusk)/Night), the XDi is programmed to generate the optimal backlight range.

Auto Day/Night Colour shift

This function is quite advanced and may best be explained by the illustration below:

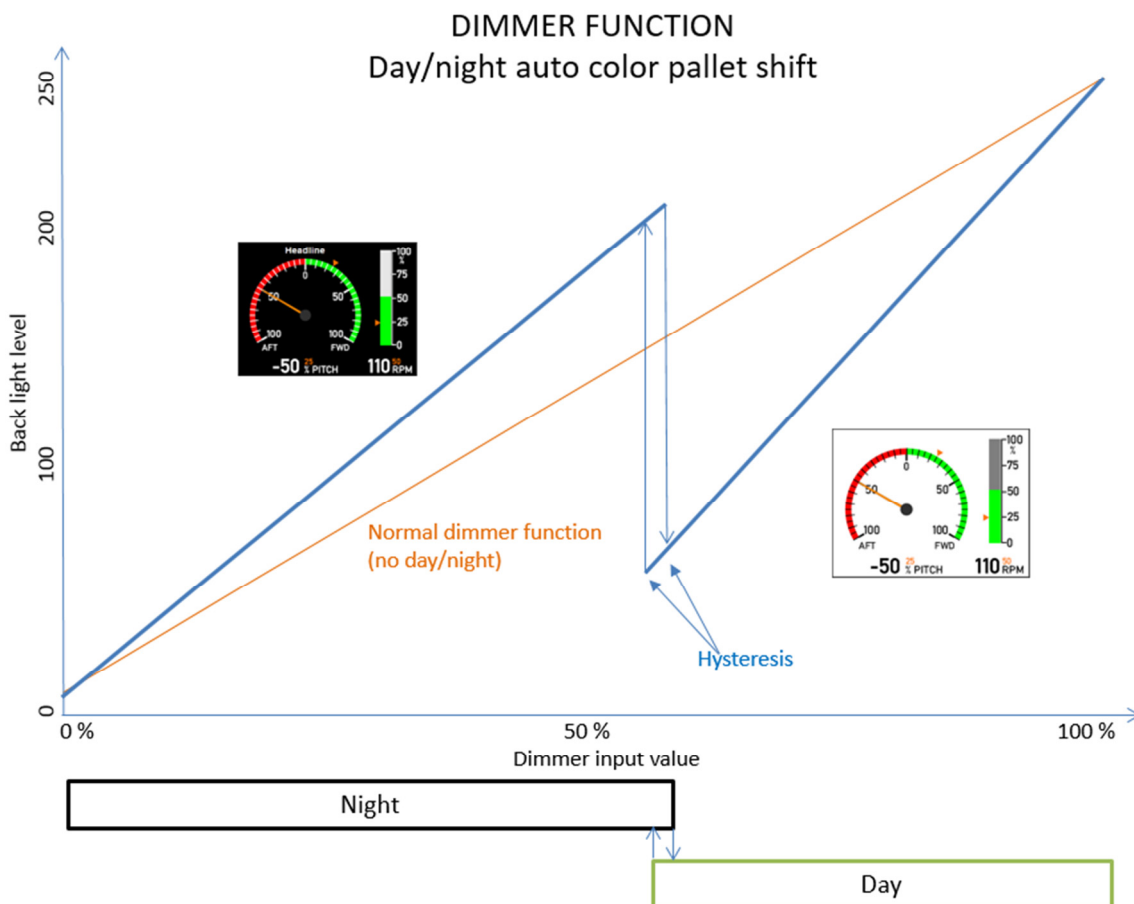


Figure description:

The Day/Night shift point is in this example located at 60 % with a hysteresis of 2 %.

The hysteresis secures that the display will never be flickering between day and night presentations.

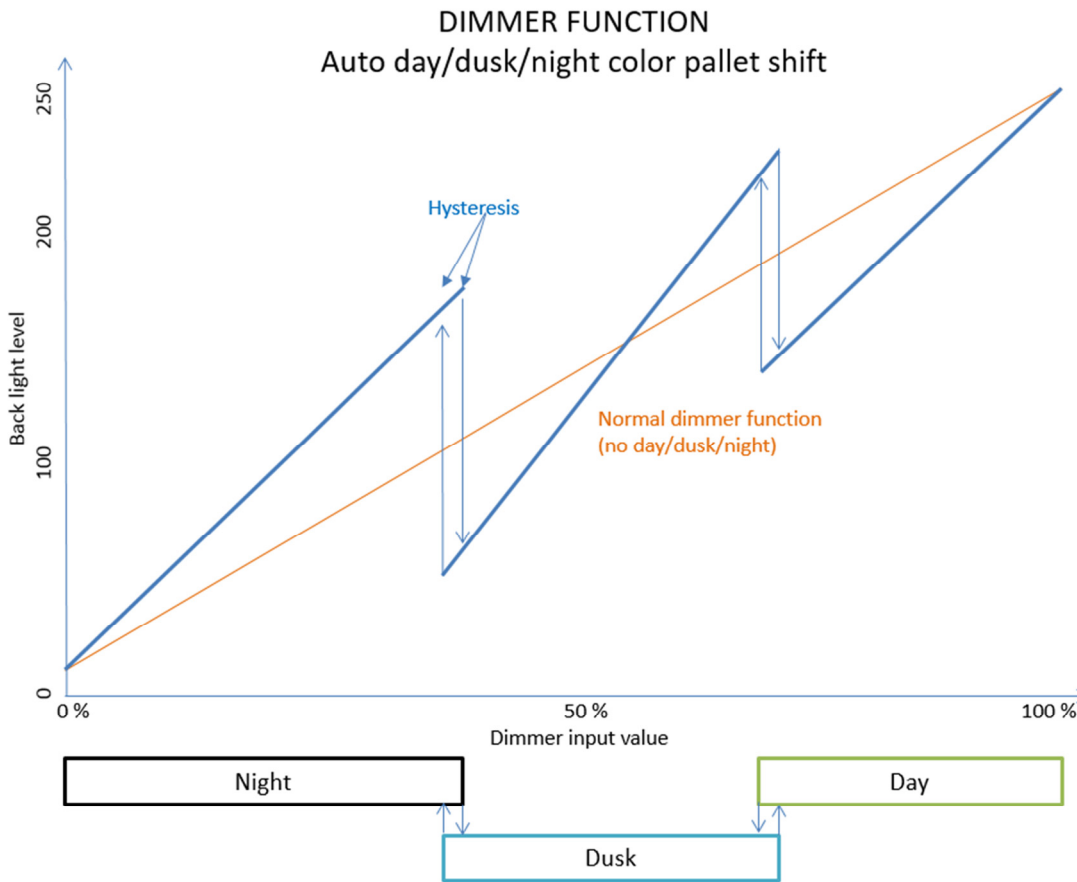
When the dimmer level is increased gradually from dimmer level 0 % to 61 %, the indicator will use the black night design, and the backlight will be increased from 10 to the “Night max” level of setup to 200.

When the dimmer level reaches 62 %, the indicator will shift to the white day design and reduce the backlight level to 50.

Continuing the dimmer level from 62 % to 100 % will increase the backlight level again from 50 to the maximum level setup to be 250.

Auto Day/Dusk/Night Colour shift

This function works similarly, but has an extra step for dusk.



Auto shift setup menu

If auto colour shift is activated, the menu below will be available for fine-tuning the parameters. For example, adjust the backlight levels to best match the actual location of the indicator.

USER/DAY-NIGHT COLOUR/AUTO SHIFT SETUP	
This setting controls dimmer group:	1
Shift to night at input dimmer level:	70 %
Shift to dusk at input dimmer level:	0 %
Shift hysteresis:	2 %
----- Advanced -----	
Day min. backlight level:	150
Dusk max. backlight level:	0
Dusk min. backlight level:	0
Night max. backlight level:	250

⏱ 30s ⏪ ⏩ ⏴ ⏵ OK

In the example above, the indicator is in Auto Day/Night mode, and the shift is at 70 % with a hysteresis at 2 %. This means that the shift will happen at 70 % +/- 2 % depending on the direction of the dimmer adjustment. (The dusk setting is 0 % because it is not used in this mode.)

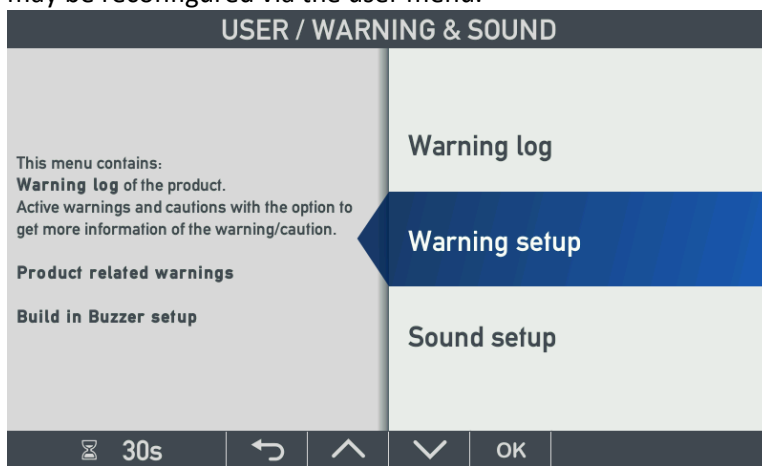
Day min. backlight level at 150 means that the backlight level at dimmer level 70 % will be 150, that is just before the shift to night colour.

When shifted to night colour, the backlight level will automatically be increased to 250 and dimmed down to min. when dimmer level reaches 0 %.

Only the day min. backlight level and the night max. backlight level is used in this example, but if a dusk design is available in the installed XDi library, then the dusk min. and max. levels will also be pre-set and available for editing.

Warning and sound

In addition to the safety functions in the XDi, as data lost indicated by a flashing pointer, bar graph or digital readout or the display watchdog that blanks the display if the micro process freezes, the XDi has some supplementary warning functions that can be activated. This is either as a pop-up or a beep sound when a warning is issued. The default setting of warnings and sound is located in the selected product profile (PP) and may be reconfigured via the user menu.



The XDi is a basic indicator without push-buttons being available in normal operation mode (front frame is in place), and it has no alarms as such. It has 2 levels of warnings, respectively called a warning or a caution.

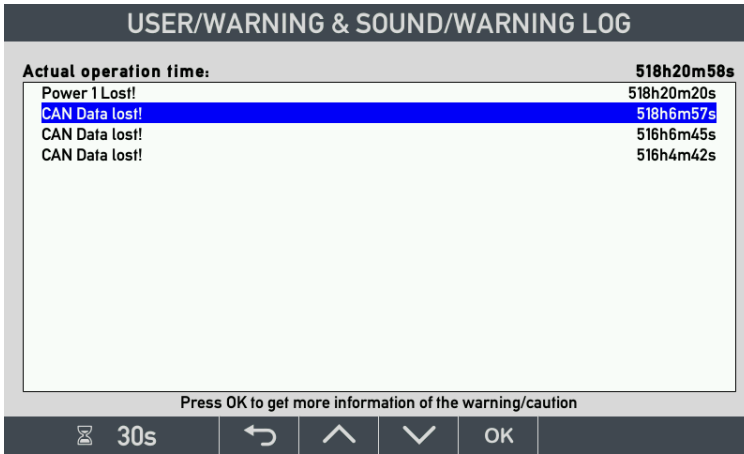
Warnings (most important) are indicated by a small amber-coloured pop-up box in one of the display corners and/or a long beep sound when the error occurs. The pop-up box will stay on the display as long as the error condition exists.

Cautions (least important) are indicated by a small yellow pop-up box in a display corner (not used by warning type pop-up). It will only be visible for a few seconds every 10 seconds and/or sound 3 short beeps the first time it is shown.

There are 3 submenus in the alarm and sound: warning log page, warning setup and sound setup.

Warning log

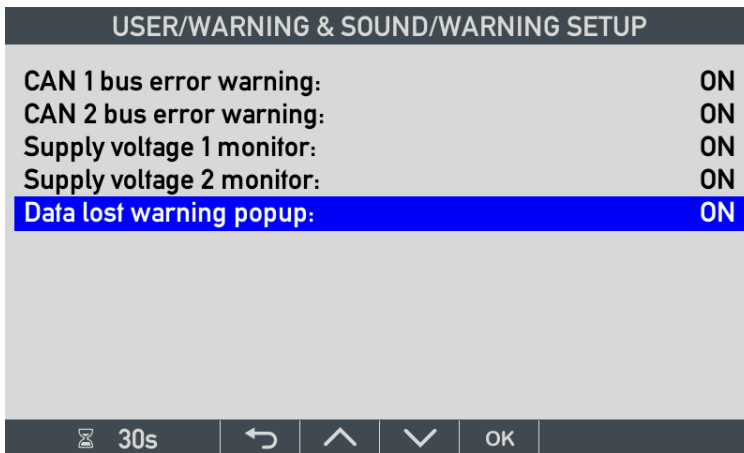
This page contains a list of all registered warning and cautions with a time stamp. Since the XDi does not have a built-in real time clock, the running hour timer is used as time stamp. The actual running time is indicated in the right side above the log list, so it is relatively simple to calculate how long time ago the fault occurred.



In the present XDi version, there is not any additional fault information when OK is pressed.

Warning setup

The menu below makes it possible to adapt the need of warnings to the actual application.



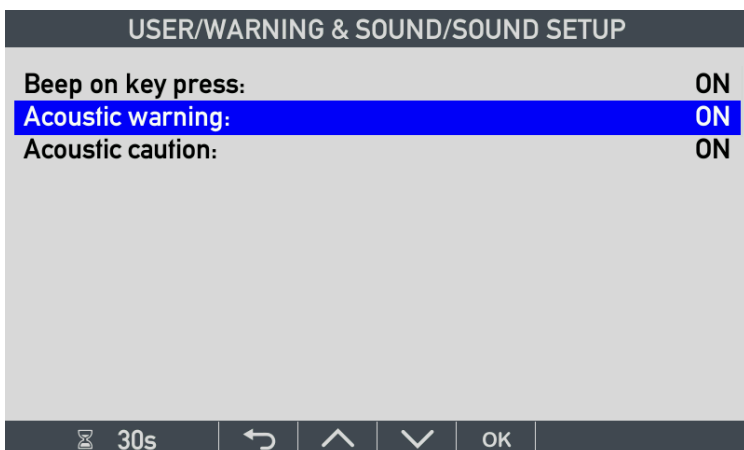
CAN bus error warning indicates a problem on the CAN bus and should be set OFF if CAN bus communication is not used.

Supply voltage monitor is mostly used in systems where redundant power supply is used. In systems with only one power supply, monitoring of the used input should be ON.

Data lost pop-up is a supplement to the flashing pointer, bar graph and/or digital readout. It provides information of the type of problem and should always be ON.

Sound setup

The XDi has a built-in speaker that can provide different sound signals.



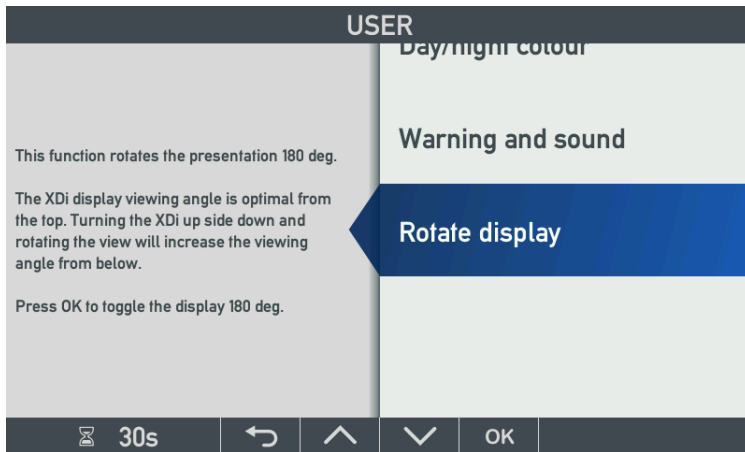
In this menu, it is possible to activate or deactivate beep on key-press. The beep response makes it much easier to operate the menu system during installation and setup. You should keep this function ON.

Warning sound indicates an important fault situation and should be ON if no other systems are monitoring such faults.

Acoustic caution indicates a less important incident, and it may be turned OFF.

Rotate display

Rotating the display 180° is used to optimise the viewing angle when the XDi is mounted in a location where the viewing angle is not optimal.



This function is the same that is available on the start page of the setup wizard where you will also find more information about this function and where to use it.

Installation menu

The Installation menu is dynamic and contains vital setup parameters for the product and selected virtual indicator. The dynamic behaviour means that the menu structure will adapt to the actual selection of virtual indicator and product profile made using the “Setup Wizard”, and it will change if a new product profile or virtual indicator is selected. If a menu selection is not active or selectable, it will be greyed out. Some of the grey menu lines present fixed information and are never active. Occasionally, a parameter may only have one valid parameter value and cannot be changed, even if it is not greyed out.

Due to this dynamic behaviour of the menu structure, not all menu combinations can be covered in this document.

This chapter contains a number of menu examples representing some of the most used menus types. Based on this, it should be relatively simple to use other similar menu types that may be used in your customised library.



IMPORTANT: The installation menu must only be accessed by trained or skilled personnel who know the XDi system and the detailed operation of the XDi device. If CAN bus is used, it is also recommended to consult the “XDi-net/CANopen reference manual”.

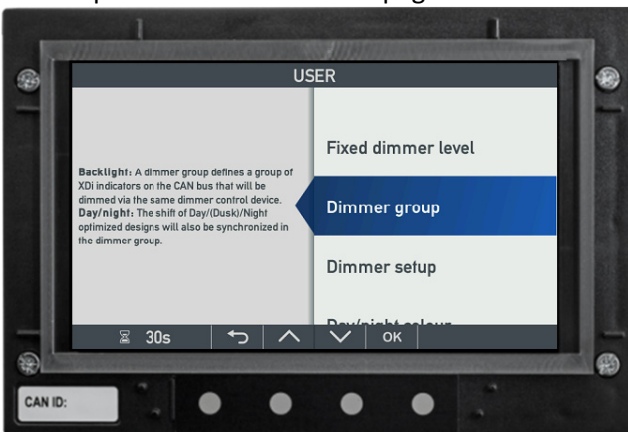


Warning: Changing mode or parameters may jeopardise the operation of the XDi.

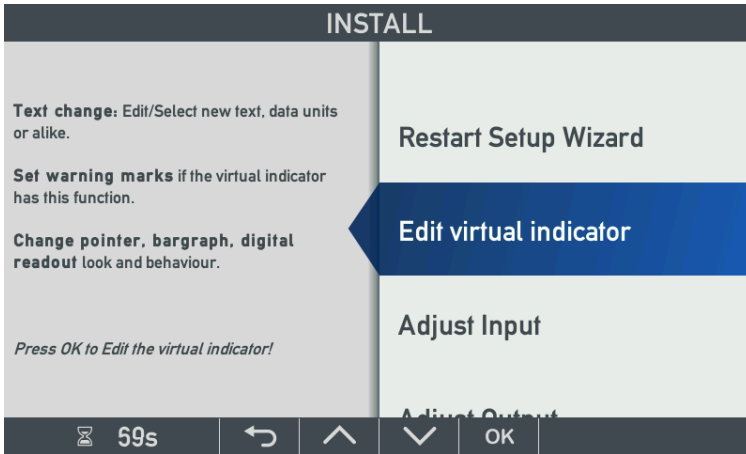
Accessing the installation menu

The installation menu is protected by a “secret” button combination that is only active from the user menu; secret in the way that there is no pop-up help menu to guide you. This is simply to protect the installation menu from unauthorised access.

In other words, the installation menu is a submenu to the “USER MENU” and must be accessed by the secret double-press from a user menu page.



Double press for more than 5 sec.:			
Button 1	Button 2	Button 3	Button 4
-	•	•	-



Restart Setup Wizard

This menu point will restart the setup wizard and make it possible to change CAN NodeID, select a new Product Profile (PP) and/or Virtual Indicator (VI), or maybe change the default input setup by selecting another VS for the selected VI.



IMPORTANT: Restarting the “Setup Wizard” from the installation menu, the previous selections will be the new default and the wizard will not change any selection or parameter setup, but if a new change/selection is made manually in the wizard, all changes made previously via user or Installation menu will be erased!

Please note, that it is not possible to skip the wizard directly using a soft-key (push-button) if it is started by accident.

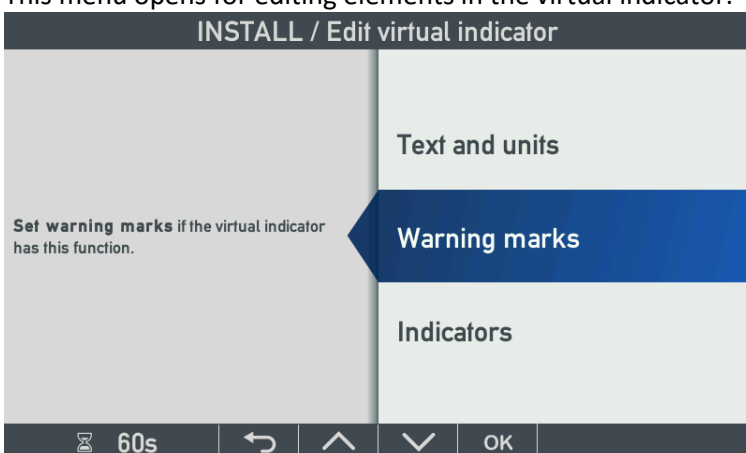
You can remove the power when the wizard is in start screen, and the XDi will start up in normal operation mode again when repowered.

Alternatively, you can just step through all steps pushing only “OK”, then no changes will be made.

See the chapter describing the setup wizard functions for more details.

Edit virtual indicator

This menu opens for editing elements in the virtual indicator.



The following elements must be implemented in the selected virtual indicator for the editing function to work.

Text and units

This menu opens for changing or adding headlines, labels or units (text only) on the selected virtual indicator.

Only selectable text lines (text boxes) embedded in the virtual indicator and predefined in the VI-setup profile (VS) can be changed or added.



It is possible to implement a text box for units in the virtual indicator, but it should be noted that only different representations of the presented unit can be selected; for example RPM, rpm, min^{-1} or 1/min.

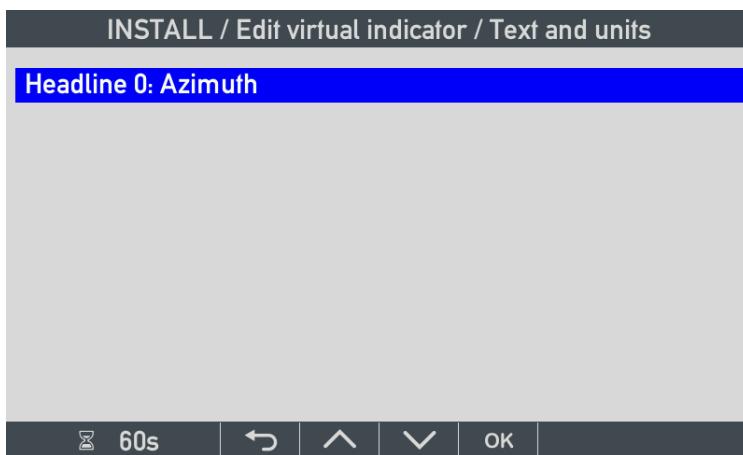
Change of temperature unit from $^{\circ}\text{C}$ to F is not possible using the “Change unit” feature. At present, this shift can only be made by making 2 different virtual indicators for $^{\circ}\text{C}$ and F respectively.

Select new headline

The following is an example of selecting or adding a new headline.

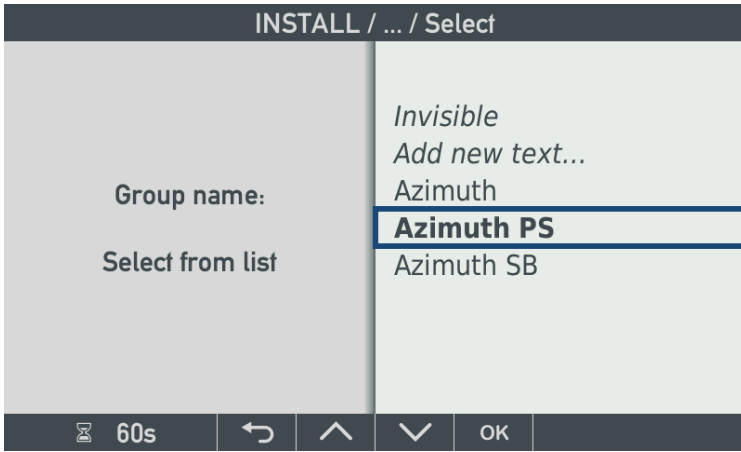


To see or select a new headline, press OK.



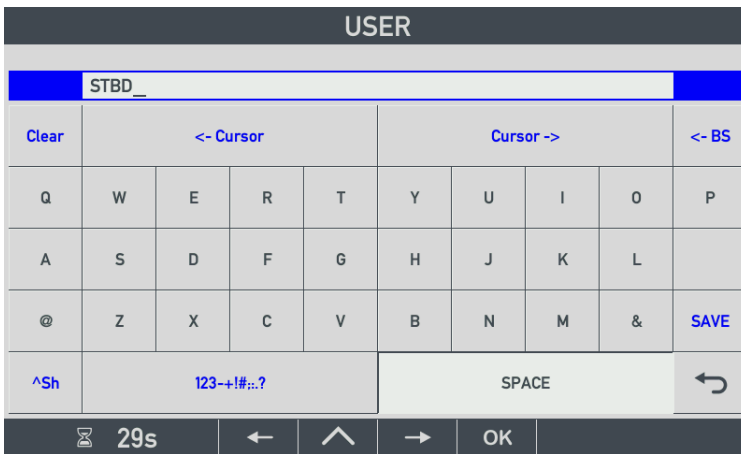
To select or add a new headline, press OK.

(There may be several headlines in one virtual indicator design; the first is headline 0).



Select a new headline from the list and press OK.

Each headline has a list of up to 32 predefined headline texts to choose from. It is always possible to hide the headline by selecting “Invisible”. To add a new headline, press OK on “Add new text”, and the virtual keyboard will appear.



You may add up to 32 new headlines before the “user headline list” is full.

Select new label or unit

If one or more text boxes with labels or units are embedded in the selected virtual indicator, it is also possible to select a new label or unit from a list or to add a new text from the virtual keyboard. The procedure is exactly the same as explained for headlines.

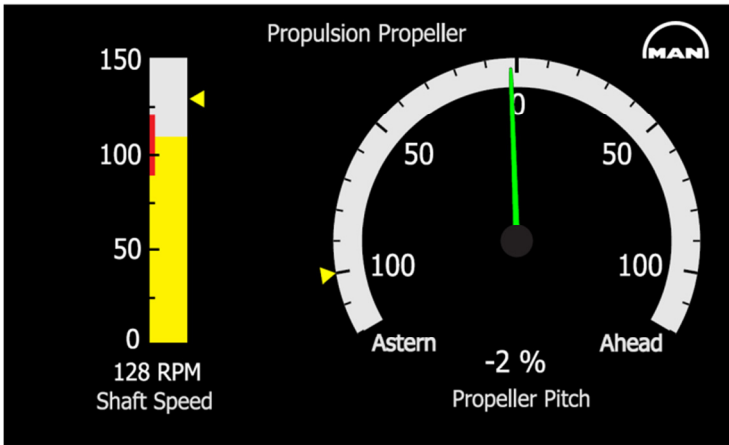


Please note, that the added headlines are stored in the permanent memory of the XDi, but if you restart the setup wizard and select a new VS, the added headlines will be erased.

Warning marks/restricted band

The XDi supports up to 4 restricted bands for each data type presented on an indicator. The restricted bands can be used to indicate warning sectors on an analogue indicator.

Application example: on the RPM indicator for a two-stroke MAN engine, the “Red sector” indication is implemented in the RPM bar graph. The red sector is configured during installation and sea trials, indicating the RPM range where the engine should not normally operate (these restrictions could be due to resonances causing heavy vibrations).



One red sector is activated and shown on the RPM scale.

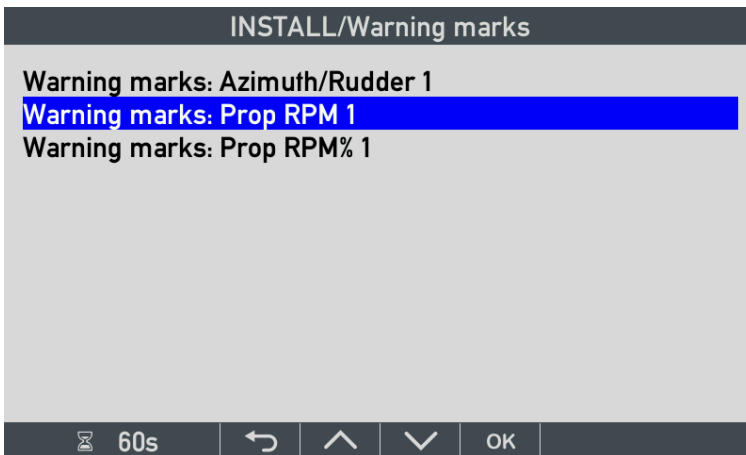
In the virtual indicator, it is also possible to define that the bar graph must shift colour when the input value enters a restricted band, as in this example where the bar graph shifts from green to yellow when RPM is within the restricted band.

The warning marks must be designed in the virtual indicator to be operational.

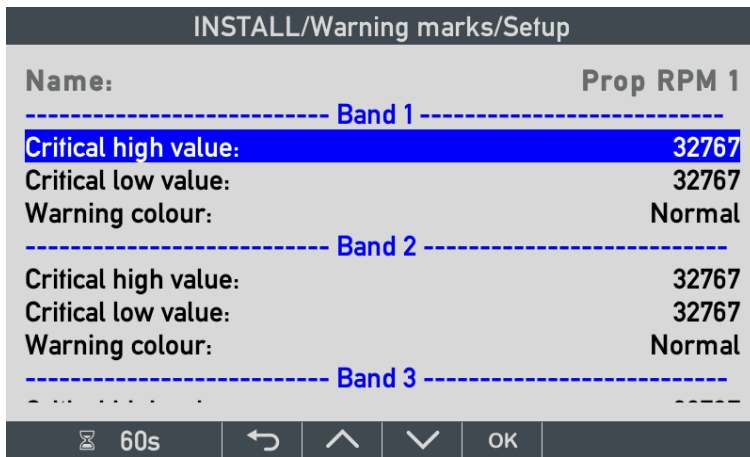
Critical band can also be used to activate the relay outputs if such function is predefined in the VI-setup profile (VS).

Edit warning marks and related critical bands

Below is shown an example where the Propeller RPM indicator has up to 4 critical bands defined.



Select warning marks for Prop RPM 1, press OK.



The critical band is inactive since the high and low value is both 32767 (largest positive value = not available). A critical band is disabled when high and low is the same value.

To activate the band, you must insert the critical band boundary values. If the critical band must be between 238 and 276 RPM, and since RPM is defined with a resolution of 0.1, the value you have to enter is:

Critical high value:	2760
Critical low value:	2380

Warning colour:

The warning colours are defined when the virtual indicator is designed. There are 3 warning levels; each with a predefined colour. The colours may be different in Day, Dusk and Night mode.

The 3 warning levels are:

- Normal (Green)
- Caution (Yellow)
- Warning (Red)

The colours in () are only examples of colours.

The warning marks open for configuration of quite flexible scale markings during installation.

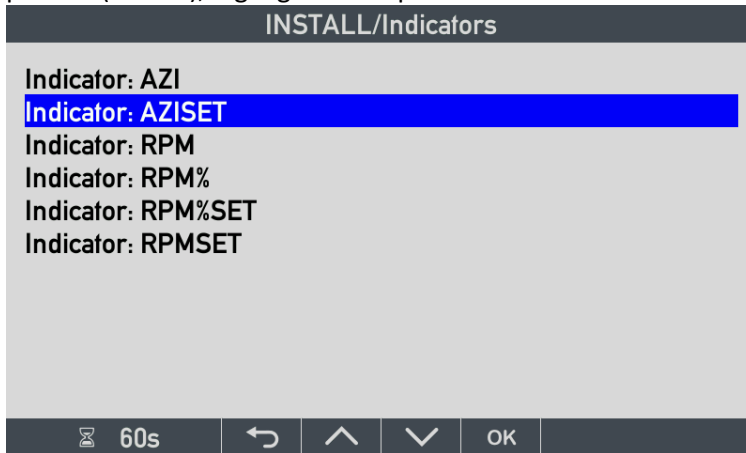
Other applications for critical bands

Critical bands may also be assigned to control the colour of the pointer of an indicator, colour of a bar graph or the colour of a digital readout, but this type of functionality has to be included in the virtual indicator design that is stored in the XDi library.

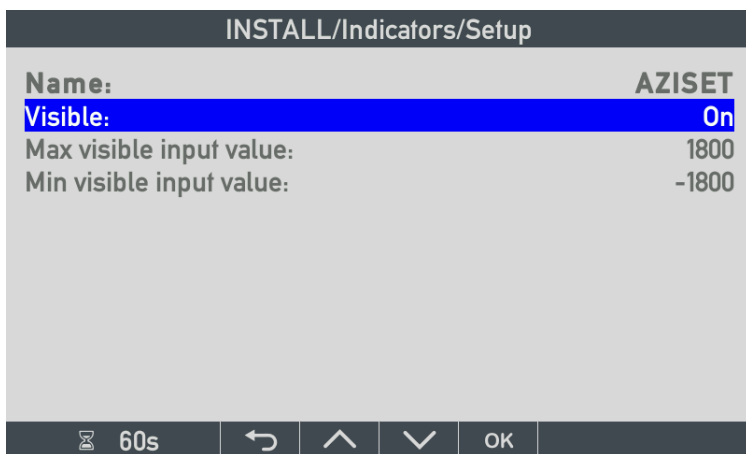
Indicators

The indicator menu makes it possible to change the visibility of each indicator element included in the virtual indicator.

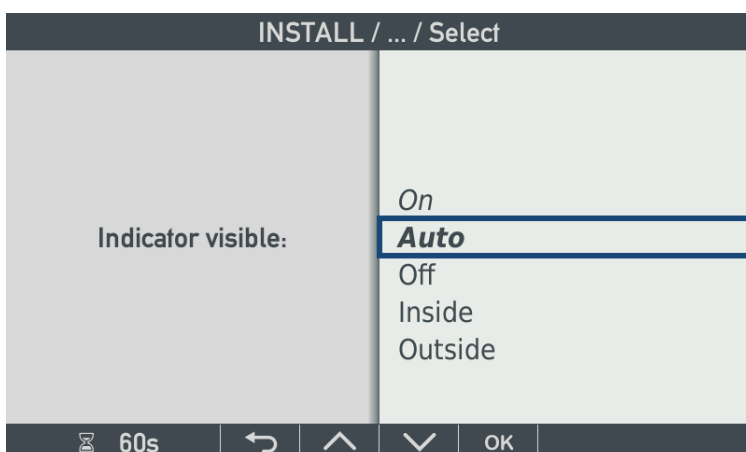
The example VI has 6 indicator elements as shown on the menu. To make a change to the azimuth set point pointer (AZISET), highlight it and press OK.



Press OK to open AZISET for editing.



The indicator is set up to be visible (ON). Press the OK button to open the visibility settings.



The visibility function has 5 modes:

- On:** The pointer and/or digital readout is always visible.
- Auto:** The pointer/readout is controlled by a flag defined in the VS.
- Off:** The pointer/readout is always invisible and inactive (OFF).
- Inside:** The pointer/readout is only visible when inside the set visibility band.

Outside: The pointer/readout is only visible when outside the set visibility band.



IMPORTANT: When a pointer and/or digital readout is invisible, it is also disabled. This means that data lost will not be detected. When the indicator is visible again, all functions are reactivated, and data lost will be detected.

Visibility band:

The boundaries of the visibility band used in the last two modes (inside/outside) are defined by the parameters: Max visible input value and Min visible input value.

To make the azimuth set point pointer and readout only visible when the commanded angle is between +/- 45°, the mode inside must be selected, and the Max visible input value set to +450 (+45.0°), and the Min visible input value set to -450 (-45.0°).

INSTALL/Indicators/Setup	
Name:	AZISSET
Visible:	Inside
Max visible input value:	1800
Min visible input value:	-1800

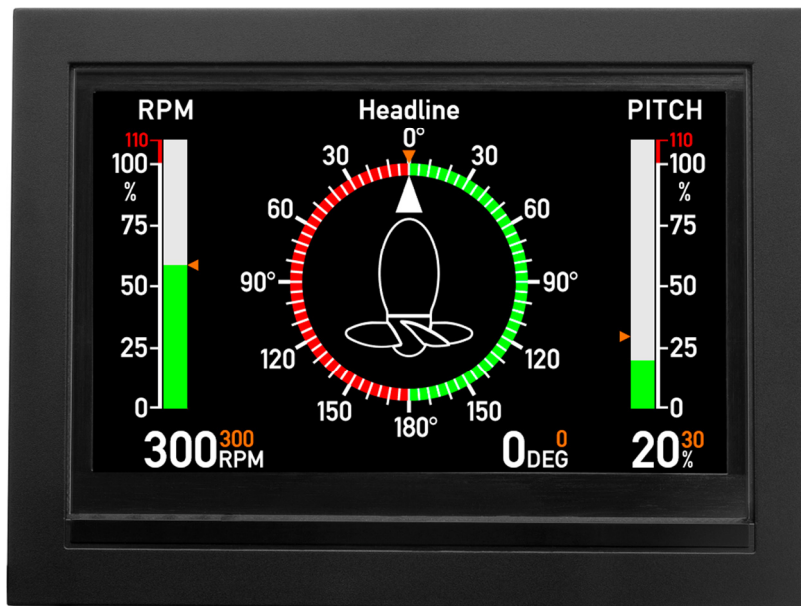
59s ← ^ v OK



IMPORTANT: Pointers, bar graphs and digital readout are an integrated part of the virtual indicator design, and editing might therefore be more or less disabled. This may also be due to MED or other regulations and approvals.

Adjust input settings

The XDi 192 Multi-indicator with DEIF standard azimuth library shown below is used as an example. The virtual indicator below is a multi-type with 6 data inputs: azimuth angle, pitch % and actual and % RPM. The set point (commanded) values are also presented by orange triangle pointers and orange digital readouts.



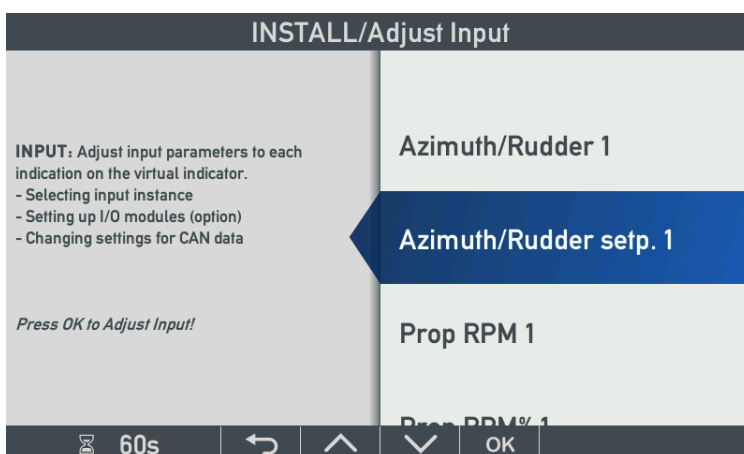
Please note, that set points can be disabled from menu.

The data inputs for the standard indicator used in this example depend on which VI-setup profile (VS) is selected.

The input setup menu examples in this chapter are based on this standard virtual indicator, and some of the default setup profiles are available for this indicator. The intention is to cover the menus for the most important types of analogue, digital and CAN indicator inputs.

The menu principles can be used in general; also for other data types than the ones in the examples.

Each input source for the selected virtual indicator will be available in the “Adjust input” menu and submenus will be active if setup parameters can be adjusted via menu.



In this example, the virtual indicator has 6 inputs, one for each data type indicated on the virtual indicator (XDi type Multi).

The predefined setup parameters for all 6 inputs are defined in the selected VI-setup profile.

In this example the inputs are defined with different types of input sources to illustrate the different type of adjust menus.

Input data sources can be: XDi-net (CAN), DAM-MPDO, PDO converter, Analogue in (AX1), Digital input (DX1).

XDi-net – input adjust and special use

XDi-net adjust menu – prop RPM% set point

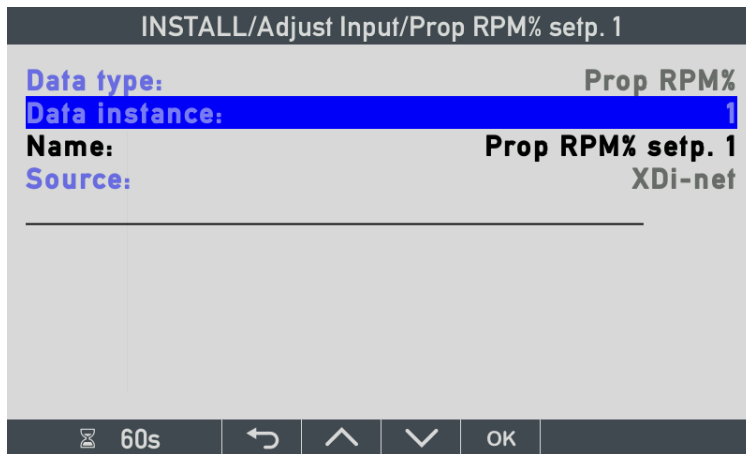
Variable data is stored in the XDi unit as absolute values in a predefined location in the CAM object index table. Details can be found in the XDi-net/CANOpen reference manual.

Data in XDi-net format is transmitted in a Multiplexed PDO (SAM-MPDO), automatically addressed to the right predefined object index location and received by the XDi as a data broadcast.

Using XDi-net format, data is shared on a CANOpen network without the need for a CANOpen master or any complicated NodeID setup.

The device acting as a data source is just broadcasting XDi-net data, and any XDi indicator (receiver) is simply listening for the broadcasted data they need.

This means, that there are no parameters to set up via menu when XDi-net is used as input.



Special use of XDi-net as source

XDi-net is also used as input type if a data type is generated together with another data type. This is for example the case when the following data inputs are used to generate 2 or more data types:

Input type	Data type 1	Data type 2	Data type 3	Data type 4
AX1 analogue input	RPM	% RPM	% Trust	% Power
	Rudder angle	% Rudder		
	Pitch angle	% Pitch		
TPDO converter	RPM	% RPM	% Trust	% Power
	Rudder angle	% Rudder		
	Pitch angle	% Pitch		
DX1 digital input	RPM	% RPM	% Trust	% Power

There can be other data types where the input device is set up to generate both an actual value and scale this value to a % value in addition.

Data is routed internally in the XDi as if it was XDi-net data. To adjust such inputs, it is necessary to enter the adjust menu where the data is generated.

CANopen MPDO as data source

When XDi-net is selected as source, it is also possible to send variable data to an object index/sub-index by use of a DAM-MPDO instead of the XDi-net broadcast format.

This requires that an RPDO is selected for MPDO communication in the CAN setup parameters list (in PP or via CAN setup menu).

Destination Addressed Mode Multiplexed PDOs (DAM-MPDO) means that data is separately sent directly addressed to each XDi identified by its NodeID (address) and then stored in the object index/sub-index defined in the MPDO.

This option is sometimes preferred in networks with a CAN Master controlling all data distribution on the CAN bus network. This method is however requiring much more of the available bus bandwidth.

The data content of the DAM-MPDO is the same as the XDi-net format. The only difference is value of the bit defining the type of MPDO (DAM or SAM), see appendix 1 for details.



IMPORTANT: If RPDO1 is used for DAM-MPDO communication, XDi-net must be disabled (in PP or via CAN setup menu). If instead RPDO2, 3 or 4 is selected for DAM-MPDO transmission, then XDi-net can be active in parallel.

CANopen TPDO/RPDO input adjust

PDO converter for azimuth/rudder

The azimuth angle in the virtual indicator used in this example is predefined in the VS to come from an angle transmitter (encoders) with CANopen interface (for example DEIF RTC 300 or RTC 600). The transmitter sends the angle between $\pm 180^\circ$ represented by a signed 16 bit relative data value packed into a TPDO in byte 0 and 1.

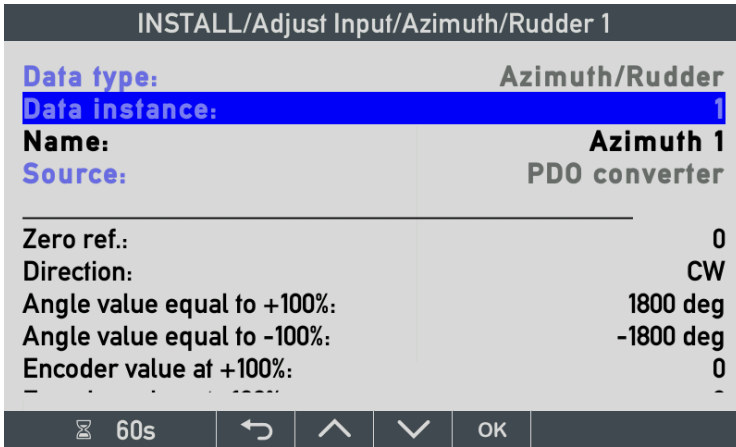
Input data value range is: -32768 to 32767.

To receive a TPDO or RPDO, the built-in tool called a “PDO converter” is used to convert the incoming relative angle value to an absolute angle value between $\pm 180.0^\circ$. That will then be presented on the XDi azimuth indicator. A PDO converter is only available if it is defined as the data source in the selected VS profile.

This type of input can be used for any standard angle transmitter (encoder) with CANopen interface according to “CiA 406 Device profile for encoders”. It will be possible to adapt to most of those CAN transmitters by adjusting the standard parameters in the TPDO converter as explained below, but if this is not possible due to a special configuration of the CANopen angle transmitter, it may be necessary to make a customised VS profile.



Most transmitters on CAN are delivered with auto-start. If the sensor does not use auto-start on CANopen, the XDi can be set up to send out the CANopen start command after boot up. This function is located in the CAN setup menu.



Data type: defines the data type that is used for this indicator and is fixed (cannot be changed via menu).

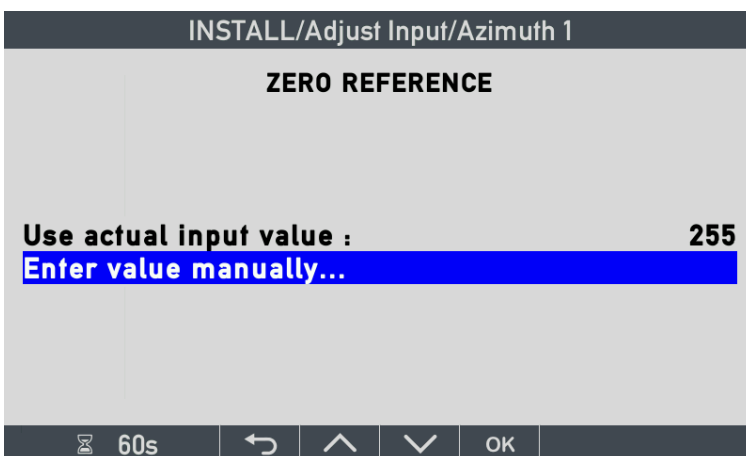
Data instance: is used to separate multiple azimuth transmitters on the same CAN bus. It is a fixed defined number typically between 1 and 15. The “Data type” and “Instance” defines the Obj.index where data is stored. (See the XDi-net reference manual for

Please note, that when several azimuth thrusters are on the same CAN bus, each with one or more XDi indicators connected, it requires a separate VS profile for each instance that the indicator must support. For example, if there are two azimuth thrusters on the same CAN bus, each with one or more XDi units for indication, then the selected VI must have a separate VS profile for instance 1 and instance 2 respectively.

Name: is a unique name for this data type and instance (could be data source name). It makes it easier to identify the data source. The name may be edited from the menu, using the virtual keyboard and can be synchronised via XDi-net.

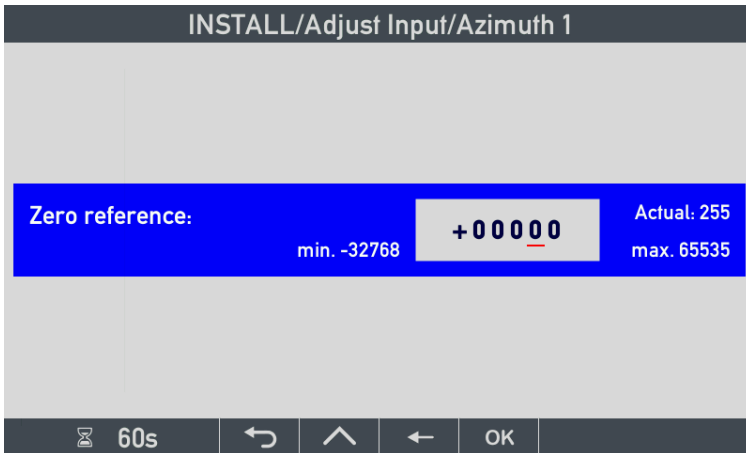
Source: is the input source type that is defined in the selected VS. It is fixed for PDO converters, and if XDi-net and XDi-net variable data are active, it will also be possible to send data using the XDi-net data protocol. This makes it possible to use either PDO or XDi-net format even if the source is a PDO converter. Do not send XDi-net data to this data type/instance in parallel with the TPDO specified in the converter. This will make the azimuth indicator jump between the received values. This function can be useful to establish a backup function in a system, for example if the transmitter fails, a CAN master/controller can send backup data in XDi-net format.

Zero ref.: makes it possible to insert a zero reference (or offset) to the received angle value. Often you will however make the zero angle calibration of the CAN azimuth or rudder transmitter (encoder) instead; it is always good praxis to adjust or calibrate the data source if possible. To zero-adjust DEIF RTC 300 or RTC 600 angle transmitters, please see the quick start guide or the detailed installation instructions.



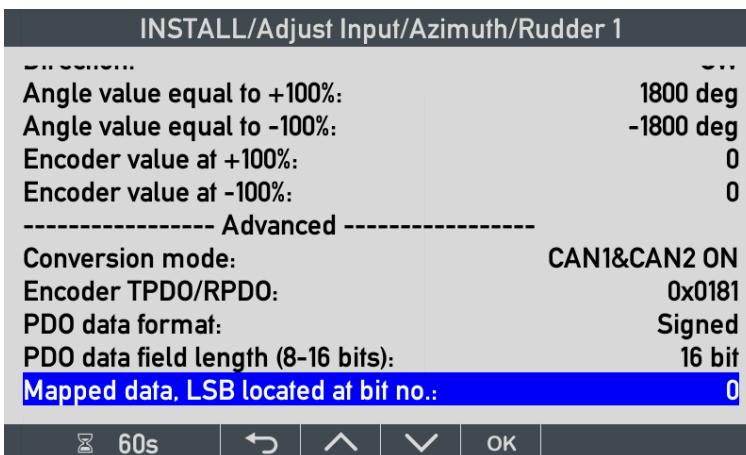
Either set the azimuth physically to 0 degree and press OK to accept the actual value as the new zero reference input value, for example 255 as shown in this case, press OK when “Use actual input value:” is highlighted to accept that actual value 255 is set up as the new zero reference. Please note that it may take a few seconds before the actual value is updated.

Alternatively, select “Enter value manually...” by highlighting and pressing OK. This function can be used if it is not possible to physically set the azimuth at 0 degree, but the offset between physical and transmitter zero is known.



Use the softkeys to enter a new zero reference value. The actual parameter value is also presented in this case for information. This is sometimes very useful when a new value must be entered. Please be aware, that the min/max values that the “value input tool” handles exceed the relevant input values for this data type. In this example, using a signed 16 bit, all values above +32767 are not

Direction: makes it possible to change the measuring direction of the angle transmitter (encoder) between clockwise (CW) and counter clockwise (CCW). In praxis, the sign of the absolute angle will be shifted. This is very useful if the angle transmitter is mounted upside-down.



Angle value equal to + or – 100 % and related encoder values for + or – 100 % are predefined as +/-1800 (+/-180 degree with 0.1 deg resolution). In azimuth mode, this should not be changed.

If this was a rudder angle input, these menu entries are used to scale the angle transmitter input to an actual rudder angle, and if needed also a %Rudder value.

CANopen Rudder transmitter (for example DEIF RTC 600)

If the input was input for a +/-45.0 degree rudder angle indicator, the default settings would be:

Zero ref.:	0
Direction:	CW
Angle value equal to +100%:	450 deg
Angle value equal to -100%:	-450 deg
Encoder value at +100%:	8191
Encoder value at -100%:	-8191

Angle values equal to +100 %: 450 (that is 45 degree with the standard resolution for a rudder that is x0.1 degree).

Angle values equal to -100 %: - 450 (again x0.1 resolution).

The encoder (or CAN rudder transmitter) values must be defined in this case:

Encoder value at +100 %: 8191 (This equals 45.0° shaft angle on a 16 bit encoder – for example RTC 600)

Encoder value at -100 %: -8191 (equals – 45.0°).

If the mechanical rudder system needs calibration, this can be performed using the following procedure:

1. Set Zero: position rudder at 0° and either zero set the encoder acting as source or make zero set via the menu (see Zero reference above).
2. Set rudder to 45° starboard and set the new encoder value (if you are not able to move rudder to 45 deg, just adjust the figures manually. You may also adjust the “Angle value equal to +/-100 %” to for example +/- 40° if the rudder can be physically positioned at this angle, and adjust the encoder values by selecting actual value.
3. Set rudder to 45° portside, and adjust the encoder value at -100 % accordingly.

PDO converter for pitch %

The pitch sensor is also in this example a 16 bit encoder with a CANopen interface. As for the azimuth and rudder described before, this data source is also a PDO converter. The function is similar to the PDO converter described for the rudder above:

INSTALL/Adjust Input/Pitch% 1	
Zero ref.:	0
Direction:	CW
Angle value equal to +100%:	450 deg
Angle value equal to -100%:	-450 deg
Encoder value at +100%:	8191
Encoder value at -100%:	-8191
----- Advanced -----	
Conversion mode:	CAN1&CAN2 ON
Encoder TPDO/RPDO:	0x0182
PDO data format:	Signed

Zero ref.: also for pitch, it is recommended to calibrate the pitch angle transmitter (encoder) if possible. Alternatively, the zero reference can be used to offset the angle transmitter input.

Direction: Works as previously described, it shifts the direction (sign) of the pitch values.

The scaling is set up so that the angle transmitter (encoder) input +/-8191 (equal to +/- 45° rotation angle for a 16 bit transmitter) is scaled to +/-45.0°. Please note, that the data resolution for pitch angle is x0.1, and that it is unfortunately not presented like that in the menu; 450 means 450x0.1=45.0 degrees.

The PDO converter will also output +/- 100.0 % pitch-scaled based on the same inputs.



Very often, only % pitch is presented in the virtual indicator, and the absolute pitch angle in degree is not used. It is however still the pitch type PDO converter that is used, and therefore the “Angle value equal to +100 %” (or ... -100 %) is not of any importance. In such cases, they are often set up to +/- 1000 equal to +/- 100.0.

PDO converter for RPM

The RPM PDO converter follows the same principles as already described. This converter type is also able to calculate actual RPM and %RPM, but in addition it can also calculate: %Thrust (%RPM)² and %Power (%RPM)³ if the indicator needs this data type. The selected VS profile will then contain parameters to configure the PDO converter to make this calculation. (This is quite similar to what is described for the AX1 RPM input adjust a little later in this document)

Most data types in the internal object index table are defined with 0.1 resolution; also RPM as in this case (see the XDi-net/CANopen reference manual for details).

The following example is taken from “DEIF standard azimuth library” where the virtual indicator VI003 is selected, and the setup profile VS02 for CANopen TPDO is selected.



In this example, the default scaling setting in the VS02 profile is changed, so that +/-200 RPM is equal to 100 % (110 % is 220 RPM).

INSTALL/Adjust Input/Prop RPM% 1	
Direction:	CW
RPM value equal to 0%:	0
RPM value equal to +100%:	29785
RPM value equal to -100%:	-29785
PDO value at 0%:	0
PDO value at +100%:	29785
PDO value at -100%:	-29785
----- Advanced -----	
Conversion mode:	CAN1&CAN2 ON
Encoder TPDO/RPDO:	0x0183

Default VS02 settings:

In the VS02 profile, the actual RPM values are set up to be scaled 1:1 (still with resolution 0.1, meaning that the RPM value in the menu is presented as RPMx10).

With the 100 % at 29785, the %PRM bar graph indicator will be at 110 % when the input value is +32765 (the largest valid value – equal to 3275.5 RPM).

Change RPM settings:

To obtain the desired RPM settings of +/-200RPM equal to 100 % and still use the 0.1 RPM resolution of the input value (PDO value), the RPM settings must be changed like this:

RPM value equal to +100 %: 2000
 RPM value equal to -100 %: -2000
 PDO value equal to +100 %: 2000
 PDO value equal to -100 %: -2000

If the RPM value is sent in the TPDO with 1RPM resolution instead, the PDO value setting must be changed to:

PDO value equal to +100 %: 200
 PDO value equal to -100 %: -200

In this case, the XDi will scale the input values still using 0.1RPM internal data resolution for the RPM data type. You cannot change the internal resolution.

The PDO converter will not stop the scaling at 100 %. It will make a linear scaling as long as the result is within the valid limit for that data type.

The presentation can however be limited. In the DEIF standard indicator used as example, the bar graph is limited to 110 % and the digital readout will stop at 200 %. But in a customised indicator, this can be made differently, but the setup is the same.

Universal PDO converters

A number of universal PDO converters are available in the XDi, which can be used to generate any other data type from a TPDO or RPDO. Electrical power could be an example.

The universal converters use the same principles as already described and are also able to calculate both actual and a relative (%) data value.

Advanced CAN functions

The advanced settings should only be changed by system experts who have detailed knowledge of the CAN bus system, protocol and the XDi-net specification. Via this menu, it is possible to adapt the PDO converter settings to other angle transmitters with slightly different CAN settings.

----- Advanced -----	
Conversion mode:	CAN1&CAN2 ON
Encoder TPDO/RPDO:	0x0181
PDO data format:	Signed
PDO data field length (8-16 bits):	16 bit
Mapped data, LSB located at bit no.:	0

Conversion mode: defines which CAN bus contains the azimuth angle TPDO. It may be set to CAN1&CAN2 ON, CAN1 ON, CAN2 ON or OFF. If the converter is set up to OFF then the XDi-net function previously described can be used as input instead. Without interference from the defined TPDO, this one is used for something else in this CAN system.

Encoder TPDO/RPDO: defines the COBID of the TPDO or RPDO that the PDO converter is receiving data from, all valid COBIDs for TPDOs and RPDOs is basically supported. But please note the restrictions on all RPDOs (COBID 0x200 to 0x27F) when XDi-net is active. Please see the XDi-net/CANopen reference manual for details.

PDO data format: can be either type "Signed" or "Unsigned". For CAN angle transmitters (encoders), this defines where the zero point reference point is located after a "zero set" is performed. Transmitters using signed will have zero reference in 0, and unsigned will have zero reference in ½ data range. For example, an unsigned 12 bit will have zero at 2047, and the full data range is 0 to 4095. PDO data for angle can be defined with a resolution

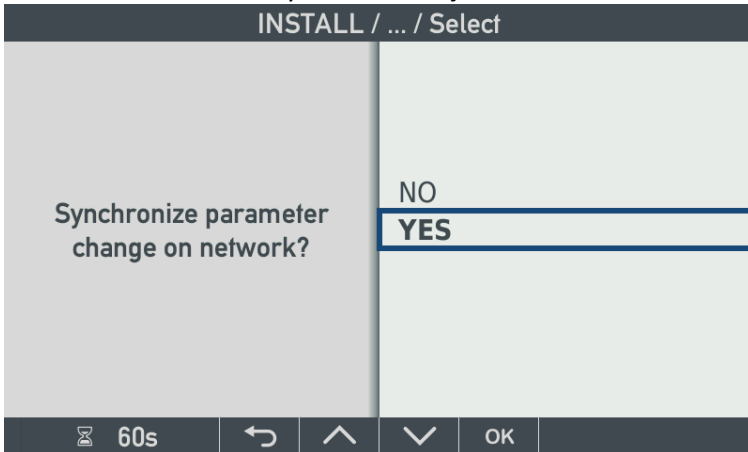
CAN data field length: this must match the CAN data resolution of the used angle transmitter. The XDi supports any resolution from 10 to 16 bits. (DEIF RTC type angle transmitters use full 16 bit resolution for optimal accuracy)

Mapped data, LSB located at bit no.: defines where the 10 to 16 bits of data are located in the 8 byte data frame of a TPDO or RPDO. If data is located in byte 0 and 1, then data is not mapped, and this value is 0. If data however is located in byte 2 and 3, then this parameter must be set up to 16. This makes the converter read data of the specified length starting at bit 16 (LSB location of the 2 byte data).

CANopen PDO converter synchronisation via XDi-net

Data sent in a PDO is already available for all XDi units on the CAN bus and can be received by all XDi units each using a PDO converter. However, if the received data has to be corrected via menu, for example the zero set of the incoming azimuth angle, the change made will in the first place only affect the XDi where the adjustment is made, even though several XDi units on the network need the same adjustment.

To avoid the need of making the same adjustment individually on all the XDi units in a system using the same encoder, XDi has a built-in synchronisation function. When leaving the adjust menu, you will be asked via a “Synch select menu”, where you want the XDi to send a synchronisation message to all other XDi units on the CAN bus to make exactly the same adjustments on all.



Highlight YES and press OK to synchronise.

This function will only work when XDi-net and “Send XDi-net setup synch data” are both active on the CAN bus. This is activated in the Product Profile or may be set up via the CAN setup menu. This is a very useful function which reduces the time it takes to adjust a full system containing several XDi indicators.



IMPORTANT: If you do not know how the CAN system is set up and configured, you should select NO to only make the setup locally. That is also why the default selection is NO.

AX1 analogue input adjust

AX1 analogue input – azimuth/rudder set point 1

In this example, the selected VS profile defined azimuth set point to be an analogue 4-20 mA input, but this can be changed via the installation menu below. The detailed description of the inputs and functions are found in the AX1 Chapter.

INSTALL/Adjust Input/Azimuth/Rudder setp. 1	
Data type:	Azimuth/Rudder
Data instance:	1
Name:	Azimuth/Rudder setp. 1
Source:	Analogue input
<hr/>	
Location:	Slot 1
Mode:	Standard Ain2
Status:	Active
Data value equal to +100%:	1800
Data value equal to -100%:	-1800
<div style="display: flex; justify-content: space-between; align-items: center;"> 60s ← ^ v OK </div>	

Data type and instance is always fixed defined in the VS profile.

Name of the data type (source) may be changed using the text virtual keyboard (highlight and press OK).

The following is fixed defined in the VS:

Source: type of data source

Location: the slot where AX1 extension module is installed (or must be installed).

Mode: input mode is in this case Analogue input 2.

Status: active (must be active or else the interface is not working)

Data value equal to + or – 100 % defines the angle value equal to + or - 100 % rudder angle. %Rudder is not used in this azimuth indicator. In some cases, when the % data is not used, the value 0 is pre-set for both.

INSTALL/Adjust Input/Azimuth/Rudder setp. 1	
Data value equal to -100%:	-1800
Direction:	CW
<hr/>	
Analogue input	
Input type:	+/- 20 mA
Multi point linearization:	2
Input point 1:	4000
Output point 1:	-1800
Input point 2:	20000
Output point 2:	1800
<div style="display: flex; justify-content: space-between; align-items: center;"> 60s ← ^ v OK </div>	

Direction is quite useful if the analogue input is reversed in the actual installation.

Input type: can be changed (see below).

Multi-point linearisation: indicates the number of calibration points that are activated for the input in this VS profile (fixed). In this case, it is 2 point calibration that makes 2 sets of in/out

Analogue single input types

The analogue input types are shown below. Select the input type and value that best fit your application.

INSTALL/Adjust Input/Azimuth/Rudder setp. 1	
Choose a input type:	+/- 7.5 V
	+/- 15 V
	+/- 30 V
	+/- 10 mA
	+/- 20 mA
	+/- 1 V
	+/- 2 V
	+/- 1 mA
	+/- 2 mA
	<div style="display: flex; justify-content: space-between; align-items: center;"> 60s ← ^ v OK </div>

Detailed description is found in the chapter describing the AX1 module.



If the input type is changed, then all used input points must be re-entered.



The input types are described in more details below and in the chapter regarding AX1 module.

Analogue rudder – multi-point linearisation

The RPM input is only using 2 point linearisation (scaling) as shown below.

Analogue input	
Input type:	+/- 20 mA
Multi point linearization:	2
Input point 1:	4000
Output point 1:	-1800
Input point 2:	20000
Output point 2:	1800

Input point 1: when input type is +/-20 mA, this parameter is the input current in μA that must be equal to the

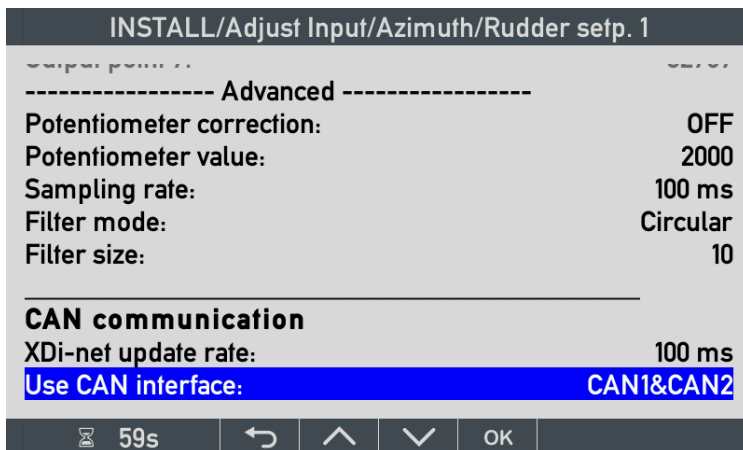
Output point 1: in this case, the angle -1800 at the standard resolution of x0.1 degree.

Input point 2: is the input current in μA equal to the

Output point 2: in this case, the angle 1800 at the standard resolution of x0.1 degree.

(See also AX1 chapter)

When the analogue input is used for rudder applications, 3-point linearisation of the analogue input is normally used. It is however possible to make customised VS profiles with up to 7-point linearisation (see description in the AX1 chapter).



Potentiometer correction: this function is only active if the input is a single high voltage input (HV). When active, the XDi will compensate the measurements for the impact of the AX1 input resistance on the potentiometer output voltage. The potentiometer value is ohm.

Sampling rate is default 100 ms. It may be changed in fixed steps (50, 100, 200, 300, 400, 500, 1000 msec)

The analogue input data is filtered to avoid fluctuations due to signal noise.

Analogue data filter

Filter mode: is the type of filter algorithm used: off, linear or circular.

Linear: is used for normal linear data type where the value is 0 to X or +/-X.

Circular: is used for angular data types where the data range is circular, meaning that there is a “wraparound” between +X and -X, for example the azimuth type indicator input where the +180 and -180 degree is the same value.

In this example, the input current will change abruptly from 20 mA to 4 mA in a split second when the angle is moved from 180° to -179.9°. To handle this, the special circular filtering algorithm is used to have a smooth transition with normal filter function, also when this point is passed.

Filter size: this parameter defines the number of samples used to calculate the average data value. Filter size can be set between 0 and 100, where 0 means no filtering and 100 means that the data value is calculated based on an average of the last 100 samples. If data presentation is fluctuating, the filter value should be increased, but be aware that the higher the filter value, the slower the indicator will react on a change.

Data sharing on XDi-net

CAN communication

The RPM data provided by the digital RPM calculator may be shared on CANopen using the XDi-net protocol.

XDi-net update rate: can be used to change the repetition rate on data sent on the CAN bus. Standard settings are: 50 ms, **100 ms** (default), 200 ms, 300 ms, 400 ms, 500 ms or 1000 ms.

Use CAN interface: defines if and where XDi-net data is transmitted, settings are: OFF, CAN1, CAN2 or CAN1&CAN2. (It is controlling all RPM-based data types setup to be calculated: RPM, %RPM, %Thrust and/or %Power).

AX 1 Analogue input for RPM set point

The AX 1 module has 2 input channels that can be set up in the VS profile to represent any type of data available as an analogue voltage, current or potentiometer input signal type. In this example, input 1 on slot 1 is set up as a 4-20 mA input for propeller RPM set point (commanded RPM). The RPM set point is +/-300 RPM equal to +/-100 % RPM, both represented by the 4-20 mA input signal.

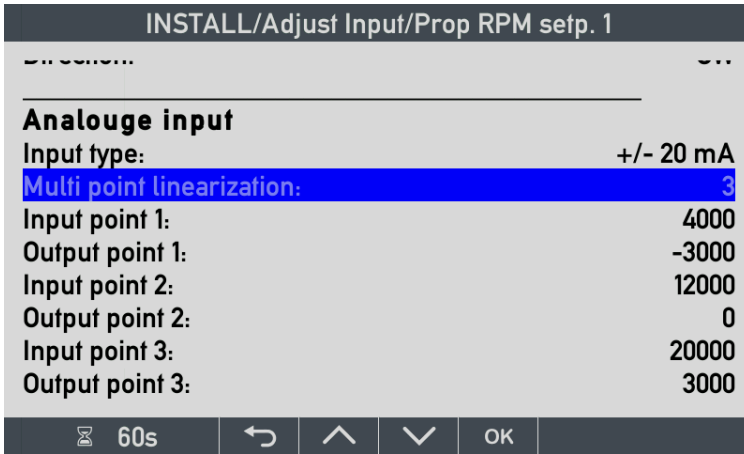
INSTALL/Adjust Input/Prop RPM setp. 1	
Data type:	Prop RPM
Data instance:	1
Name:	Prop RPM setp. 1
Source:	Analogue input
<hr/>	
Location:	Slot 1
Mode:	Standard Ain1
Status:	Active
Data value equal to +100%:	3000
Data value equal to -100%:	-3000
<div style="display: flex; justify-content: space-between; align-items: center;"> 59s ↶ ↵ ↷ OK </div>	

Name: identifies the input parameter, and it may be changed.

Source: analogue input (single). This is fixed defined in the selected VS.

Data value equal to +100 %: is used to calculate the %RPM set point value (and also %Thrust (%RPM)² and %Power (%RPM)³. If those data are used by the indicator and set up in

Direction: CW/CCW can also be set up to change the conversion direction of the analogue input.



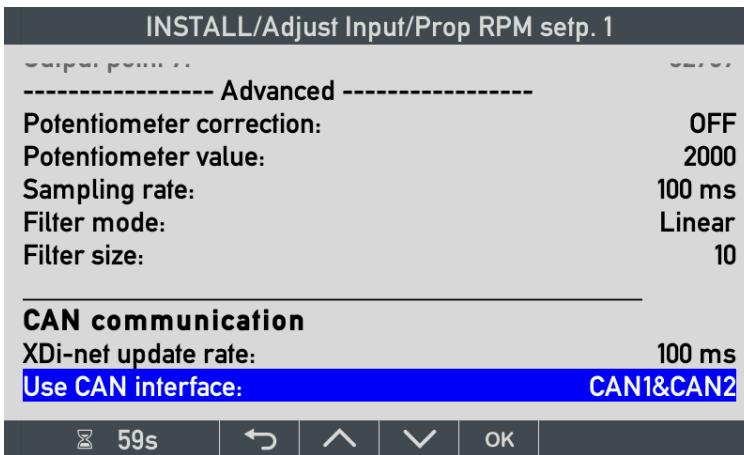
Input type: can be changed. See previous description of AX1 for azimuth.

Multi-point linearisation: RPM is +/- type; therefore 3-point linearisation is used.

Input point 1: 4000 μ A (4 mA) equals the output point 2: -3000 res. x0.1 that is equal to -300.0 RPM.

Input point 2: 12000 μ A is 0 RPM

Input point 3: 20000 μ A is set to



Potentiometer correction: if a potentiometer is used for the analogue set point, this feature may be useful (see previous chapter for details).

Filter mode: in this case, the normal linear filter type is used.

Filter size: can be set between 0 and 100. Increase the filter value to reduce noise and fluctuations in the

See previous chapter (AX1 used for azimuth set point) for more details.

DX1 Digital input adjust

DX1 digital RPM from pickup

A virtual indicator can be configured to receive digital signals directly from one or two RPM pickups as previously described in the DX1 chapter of this document.

The DX1 extension module can be preconfigured in the VS to support either a digital input pair (bidirectional RPM) or as one or two single direction RPM inputs.

In this example, the RPM is a single direction.

The digital RPM function calculates both the actual RPM value based on pulses per 100 revolutions, and it is also able to calculate %RPM value based on a positive or negative RPM scaling value.

The digital RPM function can also calculate %Thrust as $(\%RPM)^2$ and %Power as $(\%RPM)^3$; this is a predefined setting in the VS, only relevant if one of those parameters are used in the virtual indicator.

(No special setup is needed for %Thrust and %Power).

The above RPM-based calculations are handled by one calculator function in the XDi, and therefore adjustments are handled by one setup menu, described below.

INSTALL/Adjust Input/Prop RPM 1	
Data type:	Prop RPM
Data instance:	1
Name:	Prop RPM 1
Source:	Digital input
<hr/>	
Location:	Slot 2
Mode:	Single RPM input D1
RPM value equal to +100%:	27273
RPM value equal to -100%:	0
RPM scaling (Pulses per 100 rev.):	1000
-----
----- .	.
60s	
← ↑ ↓ OK	

Data type and **Data instance** have the same function as described for the azimuth; they define the data type and instance to use.

Name of the data type may be changed via virtual keyboard. Source is in this case the digital input from the DX1 module located in slot 2 on the XDi.

INSTALL/Adjust Input/Prop RPM 1	
Mode:	Single RPM input D1
RPM value equal to +100%:	27273
RPM value equal to -100%:	0
RPM scaling (Pulses per 100 rev.):	1000
RPM direction:	Normal
----- Advanced -----	
Sampling rate:	100 ms
Filter size:	50
<hr/>	
CAN communication	
-----	---
60s	
← ↑ ↓ OK	

Mode: is in this case single RPM input D1, where D1 is short for digital input 1 on the DX1 module.

RPM scaling: defines the number of pulses from the pickup that equals 100 revolutions. In this case, there are 10 bolts in the disk on the shaft, so for each revolution of the propeller shaft, 10 pulses will be generated, which equals 1000 pulses per 100 revolutions.

RPM value equal to +100 %

This input is also controlling the %RPM bar graph, where the default scaling is set up to 3000 RPM with a 0.1 RPM resolution. In the DEIF standard library, the default 3000.0 RPM is equal to a 110 % RPM scale value. This means that 100 % must be set up to 27273 (x 0.1 RPM = 2727.3 RPM).

If the normal max. RPM in this actual installation is 400 RPM equal to 100 %, then the “RPM value equal to +100 %” must be changed to 4000 (x0.1) RPM. The %RPM bar graph will then be able to show RPM overrun up to 440 RPM.

RPM scaling can be set between 60 and 65535.

RPM value equal to -100 %

In this case, it is a single direction input, so this parameter is not used. In case of an RPM bidirectional pair, this value scales the negative %PRM values.

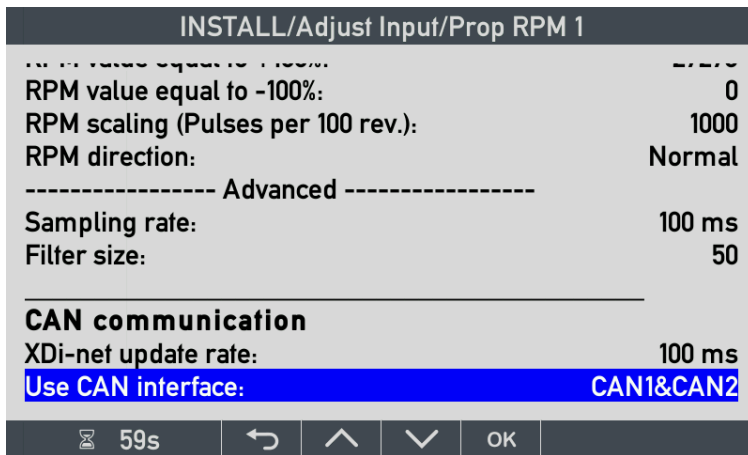
RPM direction: defines the direction of the rpm. In practise, this function shifts the sign of the RPM value. The settings are Normal or Reversed.

Advanced functions:

Sampling rate: function should be self-explanatory. It can be set in predefined steps from 50 ms to 1 sec.

Filter size: this parameter defines the number of samples used to calculate the average data value.

Filter size can be set between 0 and 100, where 0 means no filtering and 100 means that the data value is calculated based on an average of the last 100 samples. If data presentation is fluctuating, the filter value should be increased, but be aware that the higher the filter value, the slower the indicator will react on a change.



CAN communication

The RPM data provided by the digital RPM calculator may be shared on CANopen using the XDi-net protocol.

XDi-net update rate: can be used to change the repetition rate on data sent on the CAN bus. Standard settings are: 50 ms, **100 ms** (default), 200 ms, 300 ms, 400 ms, 500 ms or 1000 ms.

Use CAN interface: defines if and where XDi-net data is transmitted, settings are: OFF, CAN1, CAN2 or CAN1&CAN2. (It is controlling all RPM-based data types setup to be calculated: RPM, %RPM, %Thrust and/or %Power).

Digital RPM data shared in a TPDO

It is also possible to preconfigure the XDi to share digital RPM data using a CANopen TPDO or RPDO, but it must be defined in the VS as a special PDO output. It is even possible to get different data mapped in the same TPDO or RPDO.

External input for control flags

The XDi is able to make some changes of indication based on the status of a control flag. Functions like control of the presentation of a data type, for example shift between presenting set point data (visibility flag ON) and turning set point data presentation OFF (visibility flag OFF = invisible). This has also been used to control a text label or shift text label. The flag can be directly controlled using the XDi-net on CAN, but can also be controlled using other input devices such as: analogue input, digital input or CANopen TPDO or RPDO as input.

AX1 – Analogue input as control

It is possible to configure an analogue input to act as input for a control flag, for example set up AX1 input1 to be scaled so that for example 0 V is equal to flag value 0, and input voltage ≥ 5 is scaled to a flag value 1 (for example input voltage 0 to 4.99 V will give flag value 0, and input 5 to 10 V will give flag value 1). Using this method in fact control flag with several control levels can be controlled by one input where the voltage has several steps. If needed, it can be combined with the multi-point linearisation function to scale the analogue input in up to 7 steps.

This can for example be to externally control the visibility of set point data presented on the virtual indicator, so that set point data is externally controlled to only be shown when there is a change, and then turned off again after a short while or when actual has reached the set point. This has to be controlled via the input by the external control system; it is not performed by the XDi.

More complex control of a flag may require digital input(s) on the DX1 module instead.

The control flag function setup and default settings must be predefined in the VS for the actual virtual indicator.

The setup menu is the standard analogue input adjust menu, presented in another section of this document.

DX1 - Universal digital input of a control flag

Control flags may also be externally controlled using a digital input (DX1). The input can be defined to control a flag in the object index table.

This can be used to control visibility of a data type as described for the AX1 module or other similar control functions. Two digital inputs can also be set up as a pair to control 4 flag levels.

The digital flag setup is able to set a defined object index to a predefined internal control flag value.

This function may be used in customised libraries, and the function depends on the actual indicator application. Therefore it is not described in more details in this manual.

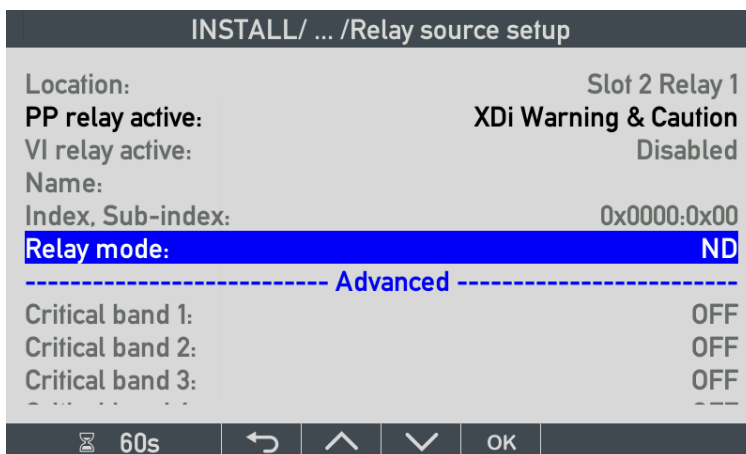
DX1 Relay output adjust

The two relay outputs on the DX1 module can be configured to be controlled either by product-related event, pre-set in the selected PP and/or by an indicator-specific event predefined in the VS profile for the selected virtual indicator.

The product related relay functions are available when a DX1 module is mounted. If the function is disabled in the PP, it can be activated from menu.

The virtual indicator (VI)-related relay functions must be preconfigured in the VS profile for the relay function to be available in the menu. If menu lines are greyed, out it is because they cannot be selected or edited.

It is possible to activate both PP and VI relay control at the same time. If both are active, the XDi performs an “or” function, and if one of the events is true, the relay will be activated. This means that the relay can be activated both if the indicator pointer is within a critical band and if data is lost (warning).



In this example, relay 1 is set up to be activated when a warning or caution event is present in the XDi. The actual warning or caution that will activate the relay depends on which warnings or cautions are activated in the selected PP or set up via the XDi user menu.

The grey functions in the menu will first be active if the “VI relay active” is activated. In this example, the VI-related functions are not predefined in the VS, and the “VI relay active” is therefore greyed out too.

Product-related events

The “PP Relay active” function defines which product-related events the relay must be controlled by (control event).

The following event selections are available: disabled, XDi warning, XDi caution or XDi warning & caution.

It is the same warnings that the XDi presents in an amber (orange) pop-up on the display, and cautions are the ones presented periodically in a yellow pop-up.

Warnings are the reporting of more important issues like CAN bus errors and data lost, but it can also be if the power supply is low in a system with single power supply.

Where cautions are minor issues that may become important if not acted on, for example if one of the power supply lines in a redundant powered system is low or missing. This is not an important problem as long as the second power supply is OK.

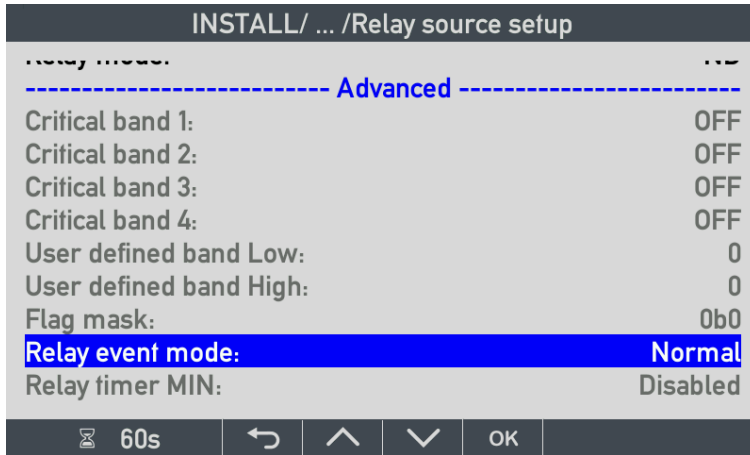
Some of the warning/caution functions can be set ON/OFF in the user menu, and this will affect the relay function accordingly. (Turning off sound on warnings and cautions does not affect the relay function).

Relay mode

The relay mode defines the relay idle state. There are two modes:

- Normal de-energised (ND); the relay is not activated as long as the control event is “False”.
- Normal energised (NE), the relay is activated as long as the control event is “False”.

When NE is used, the relay contact will be activated when the XDi is powered up and as long as the relay control event is “False”. This means that both supply power dropout and control event “True” will change the relay state. This is often used where the relay is used for alarm/warning.

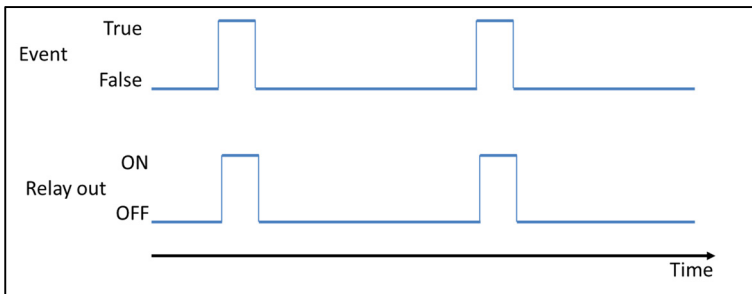


Relay event mode

The relay mode defines how the relay acts on the event that is set up to activate the relay function. Selecting the right mode and timing parameters can adapt the function to different applications.

Normal mode

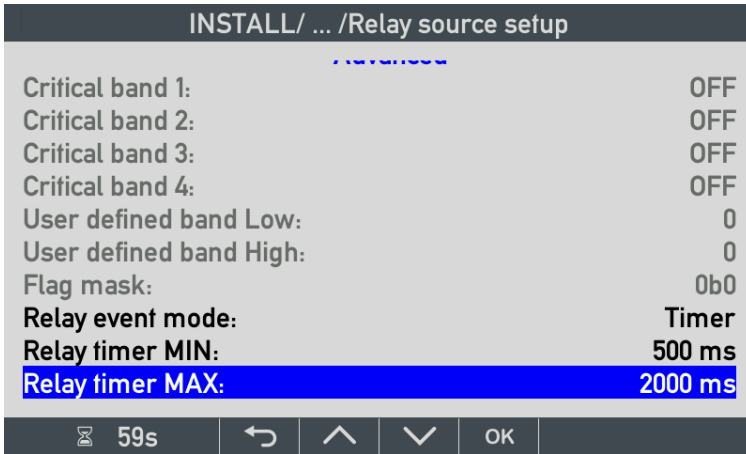
The relay will act directly on the event. When the event occurs (true), the relay will be activated and stay activated as long as the event is true and first deactivate when the event disappears (false).



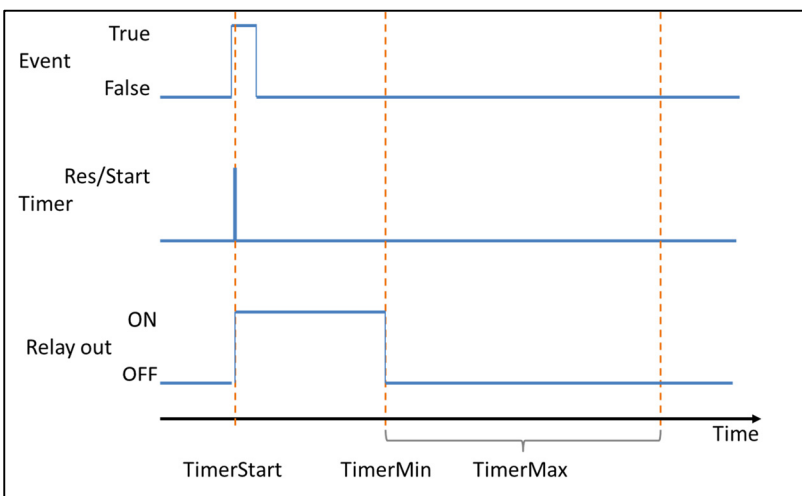
Relay in ND mode

Timer mode

This is a function that runs every time the event occurs, but only once, so the event has to disappear, before the timer function will be able to run again.

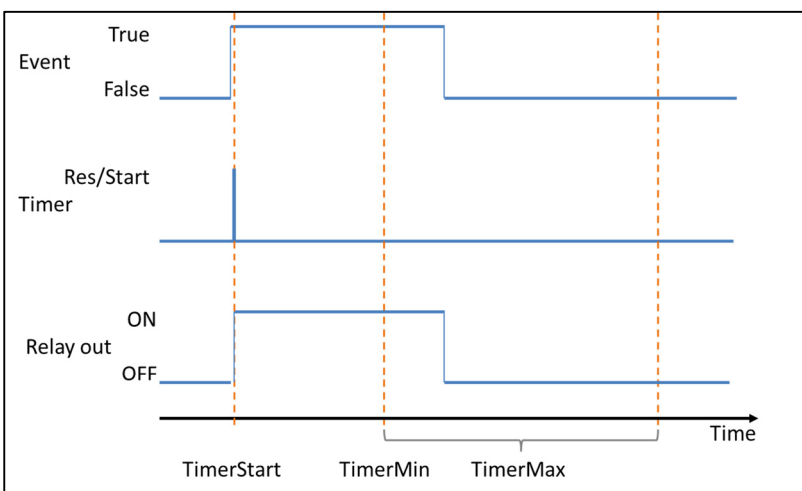


The two timing parameters “Relay timer MIN” and “Relay timer MAX” can be predefined or changed via menu to one of the following selections: disabled, 500, 1000, 1500,....., 10000 msec. (steps of 500 msec.).



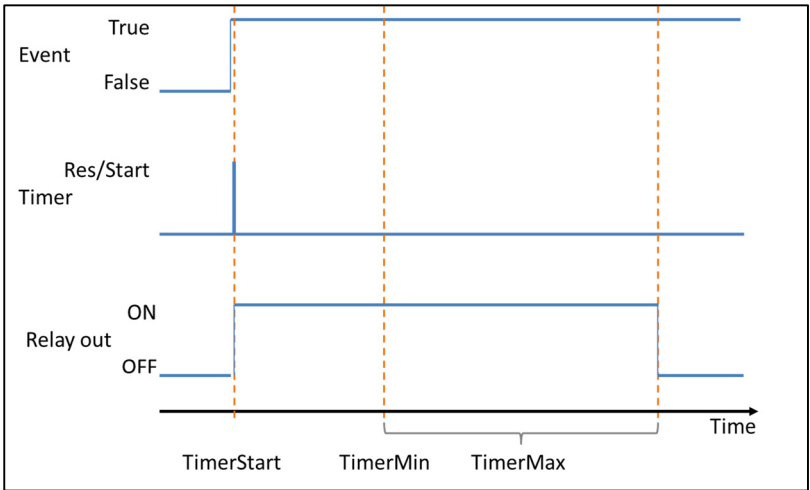
Relay in ND mode.

The timer mode can be used to make a short event activate a longer relay output. This can be useful in a number of situations where the relay is driving a warning lamp or an acoustic alarm. If the short event happens again after “Timer min.”, then the sequence will reappear.



Relay in ND mode.

In this example, the event lasts longer than “Timer Min.”, but it is not longer than the (Timer Min + Timer Max) limit, so the relay output will be equal to the length of the event.



Relay in ND mode.

In this example, the event lasts longer than “Timer Min.+Timer Max” time limit, and the relay output will switch OFF when the time limit is reached.

In general, the timer function can be used to secure a minimum length of the relay output, but also to shorten a very long event.

If “Timer MAX” is disabled (it is the same as 0 msec.), then the relay output will always have the same ON time whenever triggered.

Example: the XDi is set up to monitor power supply 1 and 2 and provide a caution if power is not OK. The DX1 Relay 1 is set up to act on the event “XDi caution” and timer mode is used with setting: Timer Min.: 3000 msec. and Timer Max.: 10,000 msec.

The XDi power supply 1 is shortly interrupted for approx. 1 sec, the XDi issues a caution on the display, and at the same time relay 1 is activated and is ON for 3 sec. before it goes OFF again.

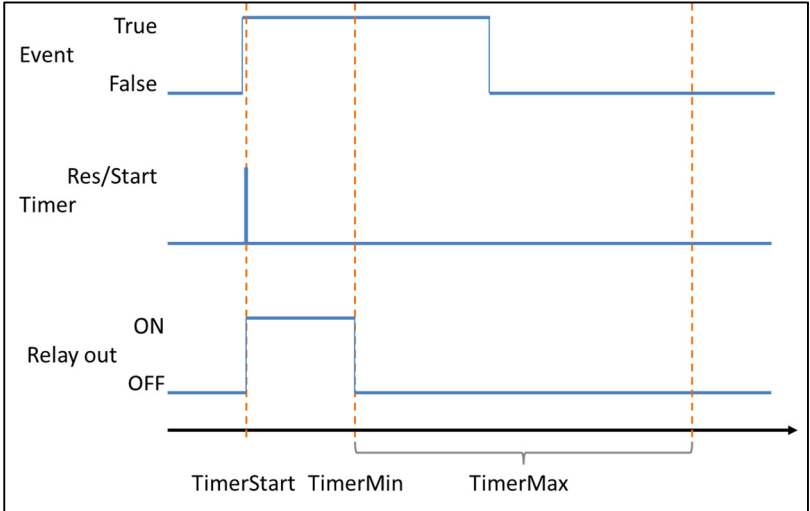
Later that day power supply drops totally out and again the caution is issued, but this time the relay 1 will stay on for 3+10 seconds before it goes OFF again. If the power supply 1 lost event is still there, the caution will be indicated periodically on the XDi display, but the relay output will not go on again before the event has disappeared for a short while and then re-appear.

The timer function will only react once on a given event.

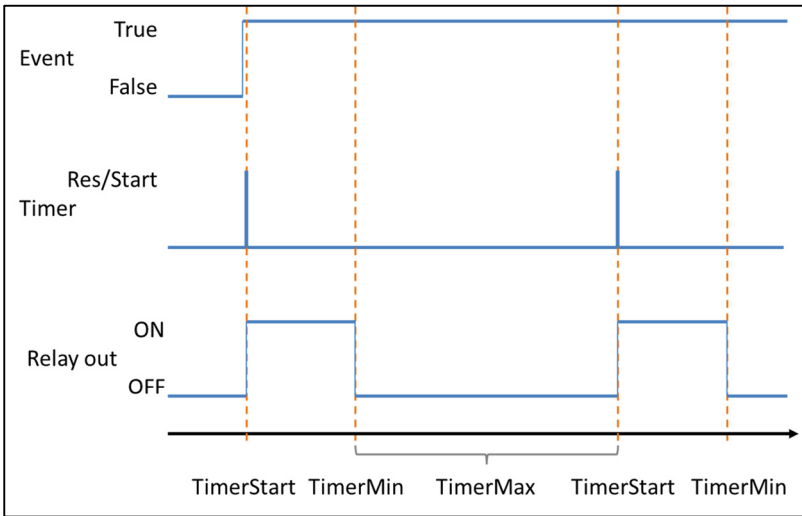
In the above example, if you desire the relay output to periodically repeat the activation as long as the event lasts, then the “Toggle mode” is the right choice, and it will be described in the following.

Toggle mode

The toggle mode is another way of controlling the relay output timing when it is triggered by a given event. For events shorter than “Timer Min.”, the relay output acts like in normal mode event and relay output have the same length. But if the event is longer than “Timer Min.”, then the relay output will be forced OFF when the “Timer Min.” limit is reached.



If the event continues after “Timer Min.” + “Timer Max.” time limit, then the timer will be reset and restarted when this time limit is reached. This activates a new output pulse of a length defined by “Timer Min.”.



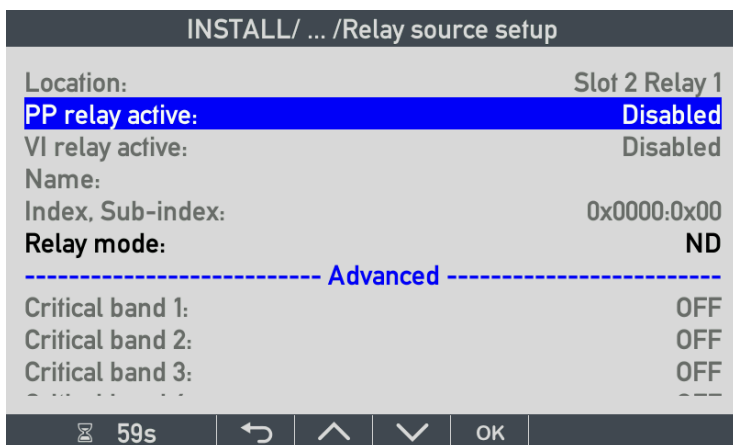
This function will periodically activate the relay output as long as the same event still exists. If the event is shortly interrupted, the toggle function will restart and act as if it was a new event.

Indicator-related relay setup

The relay can also be configured to react on event(s) predefined in the virtual indicator setup profile (VS). The “VI relay function” is only accessible for adjustments in the “Relay source” menu when it is predefined in the selected VS.

The VI relay functions that can be selected in the “VI relay active” menu line are:

- Disabled (the function is inactive)
- Activate inside Critical band
- Activate outside Critical band
- Activate below user def. low value
- Activate above user def. high value
- Activate on flag-H (Flag & mask ≥ 1)
- Activate on flag-L (Flag & mask = 0)



When the “VI relay active” is set up, the “Name” and the “Index, Sub-index” defines which data type or flag is controlling the relay output. Example: we want the relay 1 to be controlled by Propeller RPM instance 1, then the object index will be 0x3081 (Prop. RPM instance 1), and the sub-index 0x02 (actual data) or in the notation

used in the menu: 0x3081:0x02. If the relay should instead react on set point data for propeller RPM 1, then the sub-index must be 0x07.

Activate inside critical band

All normal variable data (like RPM) has up to 4 critical bands where Max and Min. can define warning marks on the indicator scale as previously described. But the same critical bands can also be used to define boundaries for relay functions.

If for example “VI relay active” is set up to “Activate inside critical band” and critical band 1 is set to “ON”, then the relay will activate when the data value is within the boundaries (max/min) of critical band 1. The relay event mode (ND/NE) will define how the output will act as previously described. More than one critical band may be activated at a time.

Activate outside critical band

This function works similar to the function “Activate inside critical band”. In this case, the relay is activated when the data value is outside the active critical band(s). More than one critical band may be activated at a time.

User-defined relay activation band

It is also possible to insert one additional custom relay activation band. The user defined band is activated by inserting the required low and high value defining the band boundaries.

INSTALL/ ... /Relay source setup	
Critical band 1:	OFF
Critical band 2:	OFF
Critical band 3:	OFF
Critical band 4:	OFF
User defined band Low:	0
User defined band High:	0
Flag mask:	0b0
Relay event mode:	Timer
Relay timer MIN:	Disabled
Relay timer MAX:	Disabled

⌚ 60s ← ^ v OK

If the low and high values are the same (for example 0), the user-defined band is disabled. The user-defined band may be used separately or in addition to the 4 critical bands.

Relay controlled by internal flag:

If the predefined index/sub-index is an internal flag, the flag mask is used to determine which bits in the flag the relay must react on. The flag mask value is multiplied with the flag value (using logic “AND” function), and the result controls the relay. This is also a function that must be preconfigured into the VS for a given virtual indicator, and the detailed description will be in the library specification document.

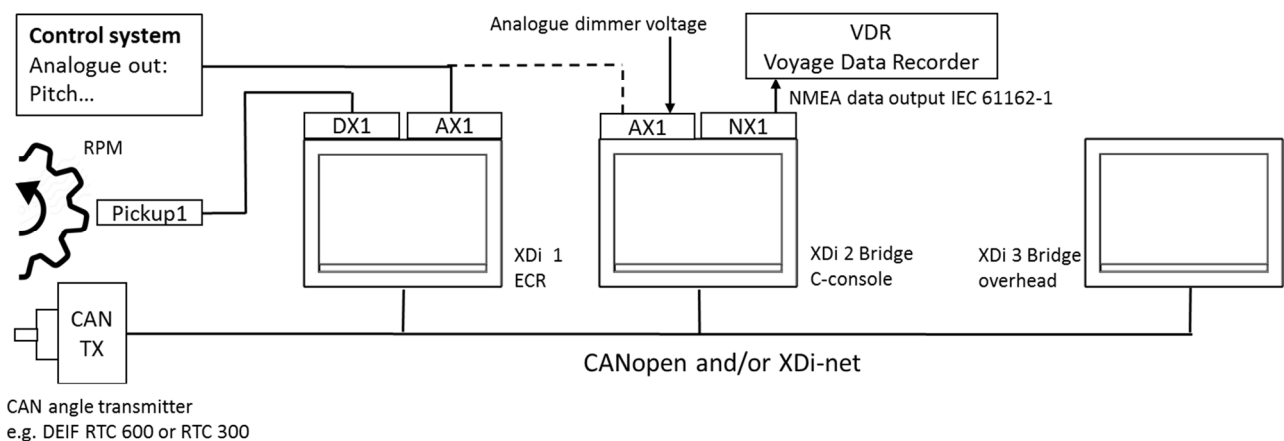
NX1 NMEA output adjust

Some data types, generated by the XDi via analogue or digital input, may be necessary for external systems, such as Voyage Data Recorder (VDR) or the integrated navigation system. The XDi is able to share such data on NMEA0183 with the same high digital data accuracy used in the XDi system. The XDi must have the NX1 NMEA output module installed, and the set up profile (VS) for the selected virtual indicator must be preconfigured to support NMEA output.

This function obviously requires a free slot for the NX1 module, but if data is shared to other XDi units using CAN (for example XDi-net), then one of these other XDi units can be set up as an NMEA output source.

The NX1 module has one NMEA output port. The NX1 module can be mounted in one of the two slots available on XDi 144/192 (only one on XDi 96). It is possible to mount two NX1 modules on XDi144/192 at the same time and route data to each output individually. The same data type can even be shared on both. This can be beneficial if the two systems need galvanic separation of the outputs. (Note that normally, galvanic separation is obtained on the input side).

Example: in an RPM indicator system, the XDi with DX1 extension module is located in the engine control room (ECR) and calculates the RPM value, based on the inductive pickup input signal. RPM data is shared on CAN to 2 XDi indicators on the bridge.



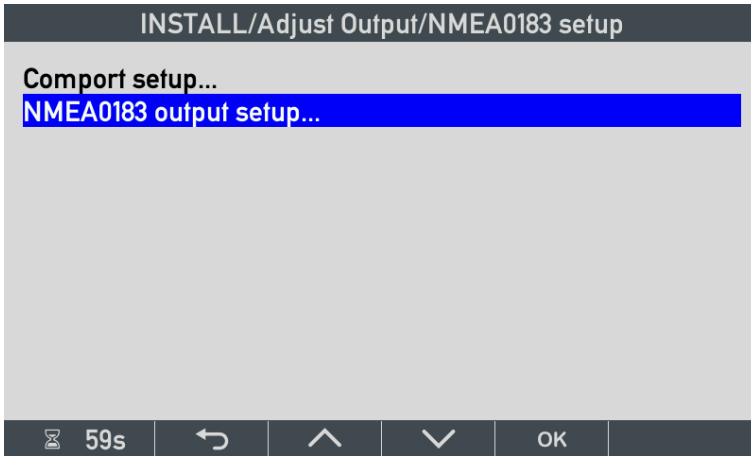
One of these indicators is located in the centre console close to the VDR, which requires the RPM data.

This XDi in the centre console is therefore equipped with a NX1 module connected to the VDR and set up to output RPM data on the NMEA serial data output (RS422 according to IEC61162-1).

The combination of input modules, data sharing on CAN and outputting NEMA data where needed, makes this a very flexible system solution.

NMEA0183 setup menu

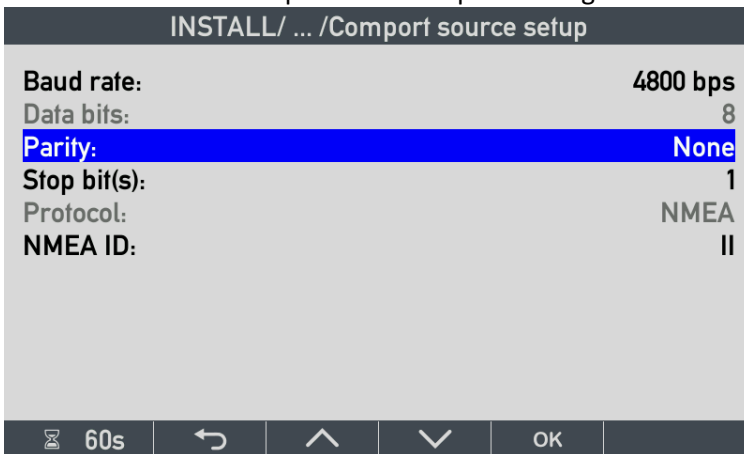
The NX1 module is normally preconfigured in the VS to perform the output tasks required, but if there is a need to make changes, please enter the installation menu and select "Adjust output" and NMEA0183 setup.



If no NX1 module is mounted on the XDi, the NMEA0183 setup menu line cannot be selected (greyed out).

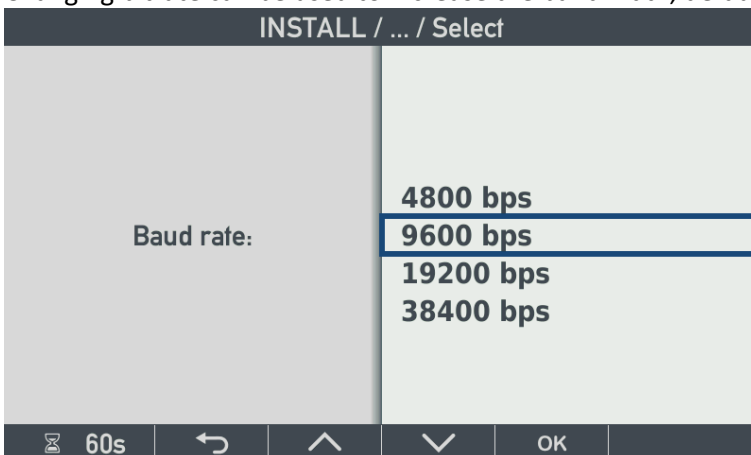
COM port source setup

The RS422 NMEA COM ports are set up according to ISO61162-1/NMEA0183 standard.

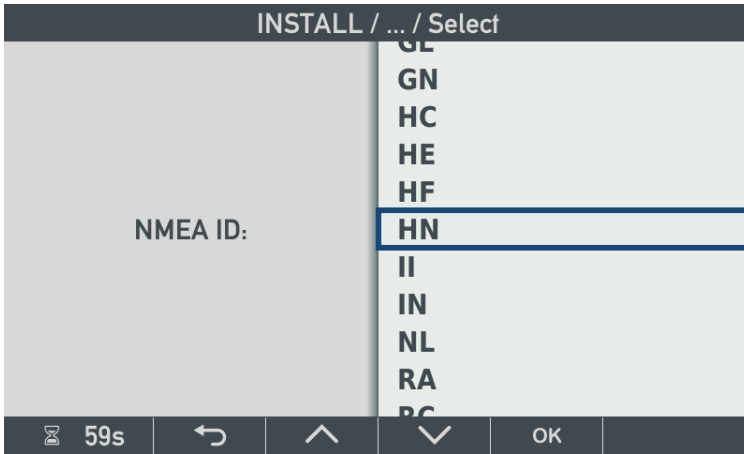


It is possible to change parity and stop bits if required.

Changing bitrate can be used to increase the bandwidth, default NMEA0183 is 4800 bps.

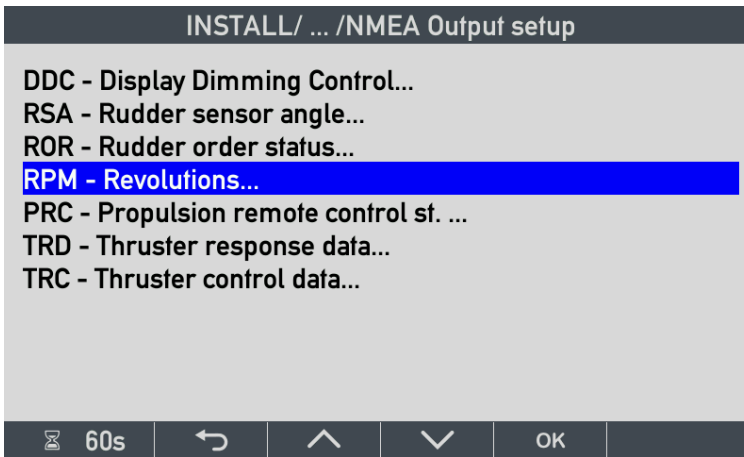


NMEA ID is the NMEA talker ID. This can be changed to one of the other valid NMEA talker IDs. In some cases, the connected system requires a specific talker ID to accept the NMEA data sentence.

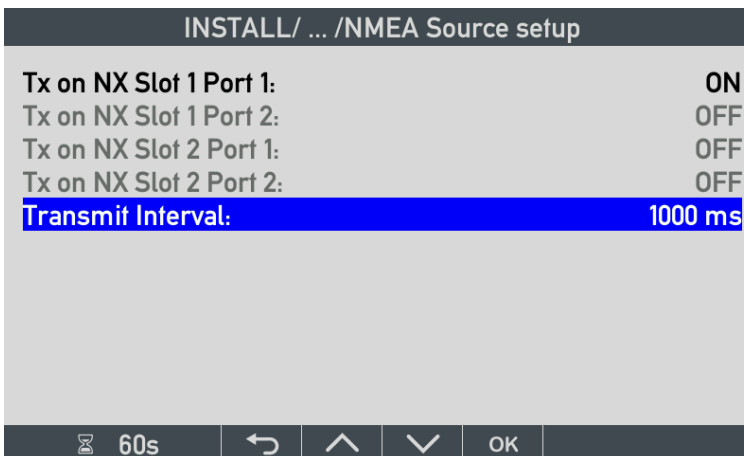


NMEA output setup

To change the default settings of the supported NMEA sentences shown in the menu below, simply highlight the sentence line and press OK to open the setup menu.

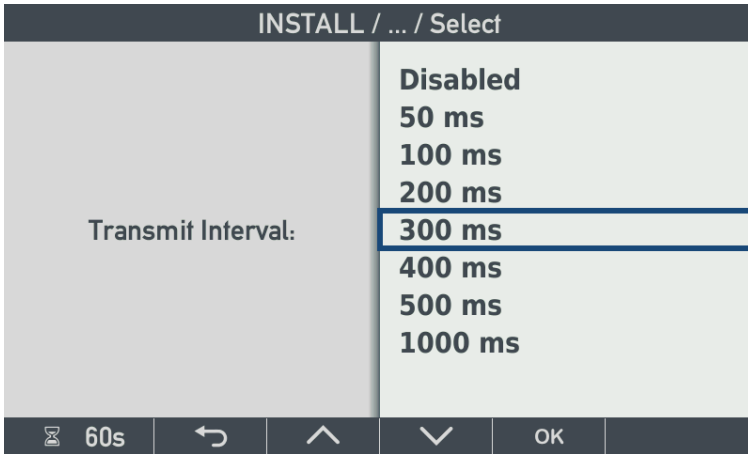


The NMEA sentence RPM is opened for editing by highlighting "RPM – Revolutions"... and press OK.



NX1 has only one NMEA output port, Port 1. The greyed out Port 2 is reserved for future use. In this example, you can only select to send RPM data on "Slot1 Port1". If the NX1 module was mounted in Slot 2, then "Slot2 Port1" can be selected.

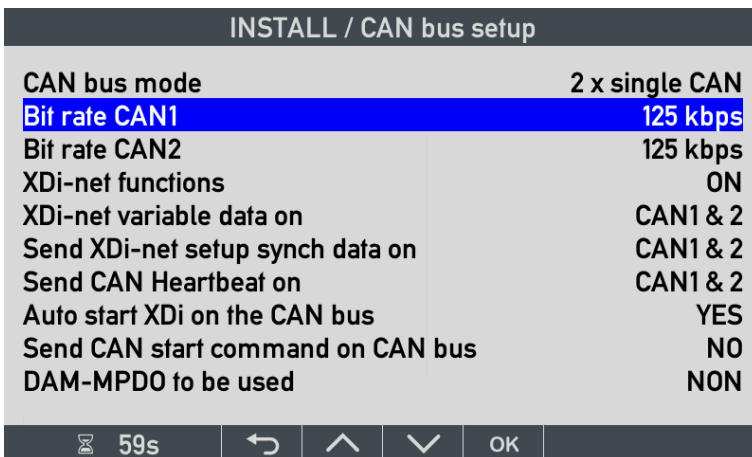
The transmit interval can be changed in fixed steps from 50 msec. to 1 sec.



You must consider the very limited bandwidth of the NMEA0183 port running at 4800 bps. Update every 1 sec. is often used for data not changing much over time.

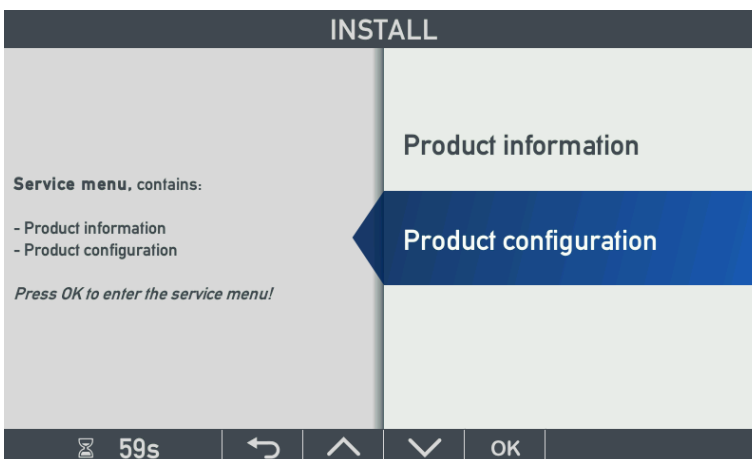
CAN bus changes via menu

The default CAN bus parameters can be changed manually via the XDi installation menu.



Service menu

The service menu consists of two pages, containing product information and setup status that may be quite important to have on hand in case DEIF is contacted in relation with service or support.



Select page and press OK.

Product information page

PRODUCT INFO

DEIF
XDi192M
Platform SW: 1.01.0
Qt App SW: 2.00.3 / r1274
C App SW: 2.00.3 / r3474
S/N: 7799600001

CAN node ID: 30
2 x single CAN

Options:
Slot 1: NX1 SW: 1.00.0 / r2968
Slot 2: No module SW: 0.00.0 / r0

*Press OK to extend time out!
Back: Exit to instrument screen!*

Virtual indicator
Library owner ID: 000001
Library num.: 001 DRAFT
Indicator No: 1 DRAFT

Headline 0° 30° 60° 90° 120° 150° 180°
100 DEG

RPM 100 75 50 25 0
100 RPM

0098-13
Library version: 0 / r3400

60s

The product information page contains information of the product software and installed library.



Please note, that the library version uniquely identifies the full software (Platform, Qt App. and C-App) and library installed in an XDi unit.

The software version of the installed extension module is listed.

The Library **revision** number is only of interest as long the library is under development and where several draft versions may have been generated, before the final version is approved.

When an XDi library is released, the revision number is locked, and when the library is then opened for new additions, the Library version will be increased by one, and the revision number is reset to 0000.

Product configuration page

PRODUCT CONFIGURATION

Wizard Setup

Product profile: 1
CAN node ID: 30
Indicator No: 1
Setup No: 1

*Press OK to extend time out!
Back: Exit to instrument screen!*

60s

This page contains the main XDi setup, NodeID, Product Profile (PP), Virtual indicator (VI) and Virtual indicator setup profile (VS).

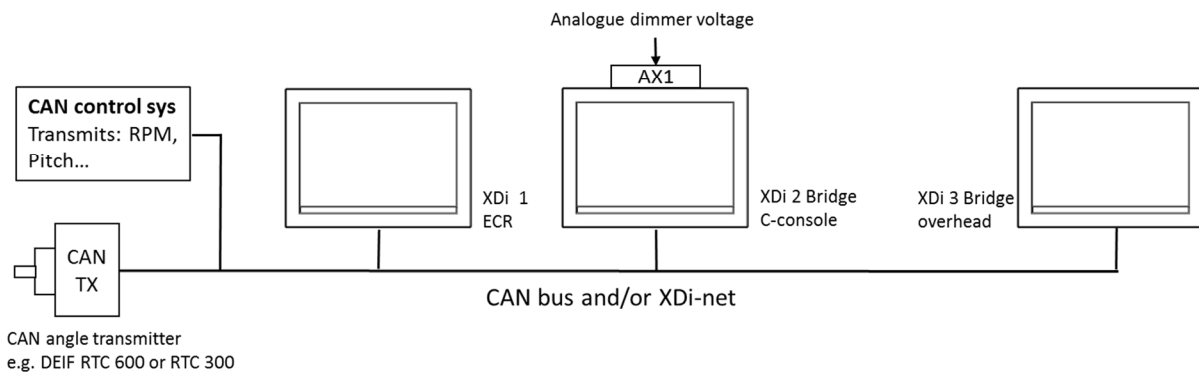
Application examples

In the following is a collection of typical XDi application examples based on XDi indicators using DEIF standard libraries. Due to the high configuration flexibility of the XDi; this will only be an appetiser. More dedicated application examples will be made available in connection with the release of new DEIF standard libraries, and maybe also some to inspire you to have a custom-based library solution.

Application 1 - XDi azimuth system, CANopen and XDi-Net

The azimuth indicator system below is fully CAN-based. When a CAN angle transmitter (encoder) is used as azimuth angle source, data is transmitted in a TPDO.

Data sent from the CAN control system can either be sent in a TPDO, RPDO or as an XDi-net broadcast (plug and play solution). All XDi indicators in this example are using the XDi144/192 Dual or Multi DEIF XDi Standard azimuth library no. 001.



Default setup for the DEIF XDi standard library is to use both CAN 1 and CAN 2, which means that you can select on which bus you want to transmit CAN data. CAN settings can be changed via the XDi installation menu, and each data type can be limited to only one bus, also from the menu.

Select a different NodeID for each of the 3 XDi indicators, and be sure that it is not already used by another CAN device on the bus.

If presentation of set point (commanded value) data is activated in the virtual indicator, data is sent by using either a TPDO or the XDi-net broadcast protocol.

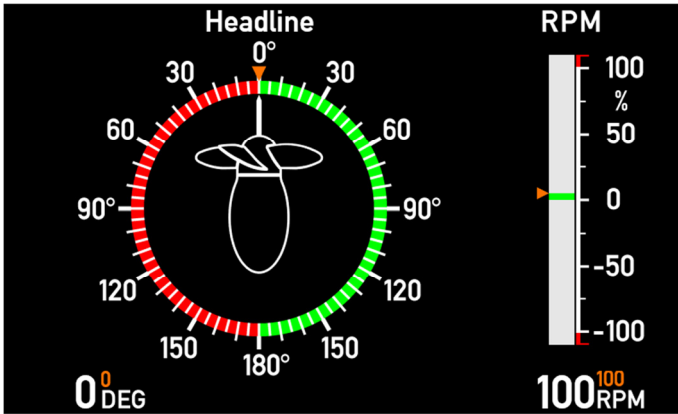


If you do not want set point (commanded value) data to be presented on the selected virtual indicator, you must select "Visible: OFF" in the installation menu "Edit virtual indicator/indicators".

Consult the XDi-net/CANopen reference manual for more information about the use of CANopen and XDi-net.

Azimuth and RPM indicator system with set point

The above system is configured for azimuth angle and RPM/RPM%, with set point (commanded value) for azimuth angle and RPM presented. In this case, it is VI007 Pulling azimuth type with dynamic azimuth pointer and indicating +/- RPM/RPM%.



(Orange set points can be disabled from menu).

XDi units in this system are all Multi-versions, but if there is no need for set point (orange) the Dual version can be used instead.

Dynamic azimuth pointer

The dynamic azimuth pointer is used when the direction of the thrust shifts depending on either RPM or %Pitch. The symbol is only used on indicators, on which the thrust direction can be reversed.

Thruster type	Forward RPM or %Pitch	No RPM or %Pitch (<2 %)	Reverse RPM or %Pitch
Pushing azimuth thruster			
Pulling azimuth thruster			



The dynamic azimuth pointer may also be used in azimuth indicators where +/- %thrust, +/-power or +/-%power controls the arrow in the pointer symbol.

CAN angle transmitter (TPDO) and RPM via XDi-net

XDi device	Selected azimuth indicator	CAN TX azimuth angle		Control sys. RPM/%RPM *		Select VS profile
		Actual	Set point	Actual	Set point	
XDi 1	VI007	XDi-net	XDi-net	XDi-net	XDi-net	VS01
XDi 2	VI007	XDi-net	XDi-net	XDi-net	XDi-net	VS01
XDi 3	VI007	XDi-net	XDi-net	XDi-net	XDi-net	VS01

In the XDi-net broadcast protocol, all data is sent separately using the XDi-net SAM-MPDO format. If all data comes from the CAN control system, it may just use the XDi-net format instead of a TPDO. From the installation menu, it is also possible to set up the XDi to use an RPDO instead of the default TPDO.



Then CAN angle transmitter must use XDi-net protocol (data format +/-1800). Alternatively, the azimuth input should be adjusted to match the selected angle transmitter (encoder). This can be performed via the installation menu.

CAN angle transmitter (TPDO) and RPM via TPDO

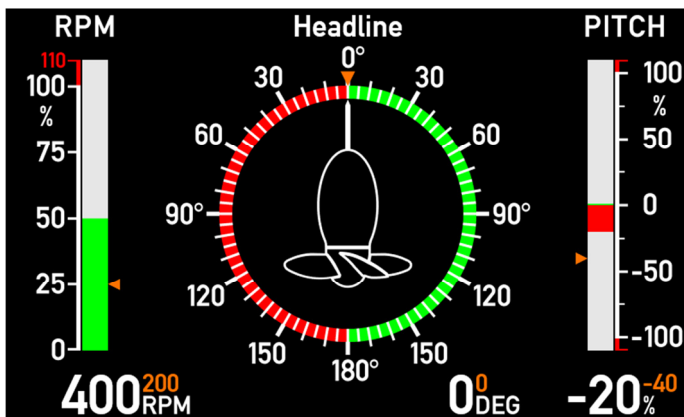
XDi device	Selected azimuth indicator	CAN TX azimuth angle		Control sys. RPM/%RPM *		Select VS profile
		Actual	Set point	Actual	Set point	
XDi 1	VI007	TPDO	TPDO	TPDO	TPDO	VS02
XDi 2	VI007	TPDO	TPDO	TPDO	TPDO	VS02
XDi 3	VI007	TPDO	TPDO	TPDO	TPDO	VS02

When RPM data is sent in a TPDO, then %RPM is calculated based on actual RPM. From the installation menu, it is also possible to set up the XDi to receive data in an RPDO instead of the default TPDO.

Azimuth, Pitch and RPM system with set point

The same system is now set up to support azimuth angle, pitch% and RPM/RPM%, all with set point if required.

In this example, it is VI015 Pushing azimuth type with dynamic azimuth pointer, indicating RPM/RPM% and +/- %Pitch.



All XDi units in this system must be the Multi-version.

CAN angle transmitter (TPDO), RPM and Pitch via XDi-net

XDi device	Selected azimuth indicator	CAN TX azimuth angle		Control sys. RPM/%RPM *		Control sys. Pitch/%Pitch *		Select VS profile
		Actual	Set point	Actual	Set point	Actual	Set point	
XDi 1	VI015	XDi-net	XDi-net	XDi-net	XDi-net	XDi-net	XDi-net	VS01
XDi 2	VI015	XDi-net	XDi-net	XDi-net	XDi-net	XDi-net	XDi-net	VS01
XDi 3	VI015	XDi-net	XDi-net	XDi-net	XDi-net	XDi-net	XDi-net	VS01



In the XDi-net broadcast protocol, all data is sent separately using the XDi-net SAM-MPDO format. If all data including azimuth comes from the CAN protocol system, it makes sense to send all data using the XDi-net format instead of TPDO for azimuth. When the XDi is pre-configured to TPDO, it will also be able to receive data in XDi-net format, because the XDi-net is default active in all DEIF standard libraries. The CAN angle transmitter must use XDi-net protocol (data format +/-1800).



From the installation menu, it is also possible to set up the XDi to use an RPDO instead of the default TPDO.

CAN angle transmitter (TPDO), RPM and Pitch using TPDO

XDi device	Selected azimuth indicator	CAN TX azimuth angle		Control sys. RPM/%RPM *		Control sys. Pitch/%Pitch *		Select VS profile
		Actual	Set point	Actual	Set point	Actual	Set point	
XDi 1	VI015	TPDO	TPDO	TPDO	TPDO	TPDO	TPDO	VS02
XDi 2	VI015	TPDO	TPDO	TPDO	TPDO	TPDO	TPDO	VS02
XDi 3	VI015	TPDO	TPDO	TPDO	TPDO	TPDO	TPDO	VS02

When data is sent in a TPDO, then %RPM is calculated based on actual RPM, and pitch is either sent as a %Pitch value or the %Pitch value can be calculated based on a pitch angle.

From the installation menu, it is also possible to set up the XDi to receive data in an RPDO instead of the default TPDO.



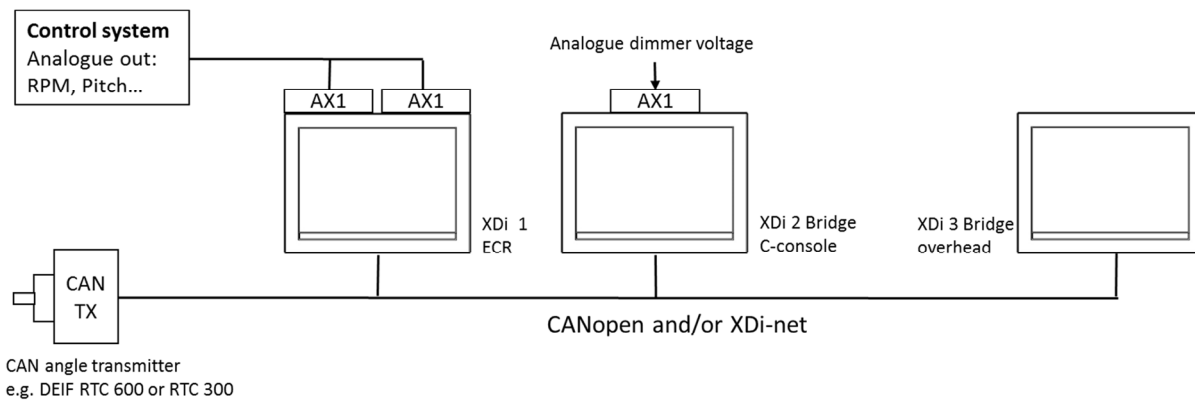
In all DEIF standard libraries, XDi-net is default on. This means that as long as the CAN function “XDi-net variable data on CAN1 & 2” is not deactivated, the XDi unit will also be able to receive data in XDi-net format, in addition to the defined TPDO.

In a fully TPDO- (or RPDO-) based CANopen system where XDi-net functions are not used, it is recommended to disable XDi-net or just the functions not used.

(Normally, XDi-net will just coexist and not affect the CAN system).

Recommendation: it is recommended to read the relevant sections in the XDi-net/CAN open reference manual if you use other CAN devices or controllers on a network, on which the XDi-net is active.

Application 2 – azimuth CANopen and analogue system



The azimuth angle is received from a CAN angle transmitter. All other data types are analogue and are supplied from the control system to the AX1 extension module(s) mounted on the XDi 1. Analogue inputs are default 4 to 20 mA, but this can be changed from the XDi installation menu.

The standard library is set up to share the analogue data via the XDi-net; this means that if analogue signals are connected to one XDi, it will transmit the data on CAN, using the plug and play XDi-net protocol. This makes system integration quite easy: select the right input setup profiles according to the table below and fine-adjust the analogue input on the XDi, to which the analogue signals are connected; then the complete system is set up and ready.

Default setup for the XDi standard library is to use both CAN 1 and CAN 2, which means that you can select on which bus you want to transmit CAN data. CAN settings can be changed via the XDi installation menu, and each data type can be limited to one bus, also from the menu.

If presentation of set point (commanded value) data is activated in the virtual indicator, the additional analogue inputs must be connected.

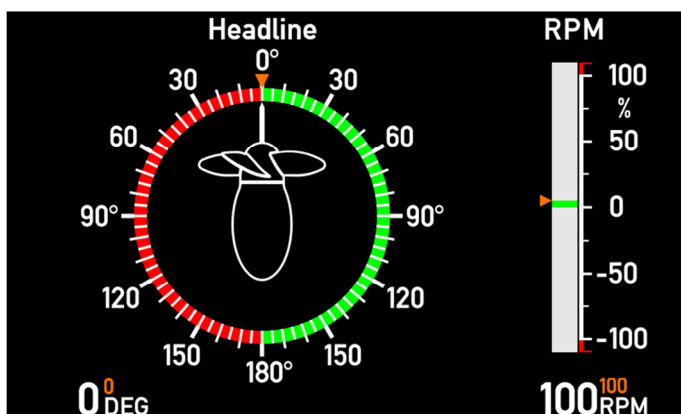
Select a different NodeID for each of the 3 XDi indicators, and make sure that it is not already used by another CAN device on the bus.



If you do not want set point (commanded value) data to be presented on the selected virtual indicator, you must select “Visible: OFF” in the installation menu “Edit virtual indicator/indicators”.

Azimuth and RPM indicator system with set point

This is the system above configured for azimuth angle and RPM/RPN% and with all set point data presented. In this example, it is VI007 Pushing azimuth type with dynamic azimuth pointer and indicating +/- RPM/RPM%.



(Orange set points can be disabled from menu).

XDi units in this system are all Multi-versions, but if there is no need for set point (orange), the Dual version can be used instead.

CAN azimuth encoder, analogue RPM and set points

XDi device	Selected azimuth indicator	CAN TX azimuth angle		Control sys. RPM/%RPM *		Select VS profile
		Actual	Set point	Actual	Set point	
XDi 1	VI007	TPDO	4-20 mA	4-20 mA	4-20 mA	VS03
XDi 2	VI007	TPDO	XDi-net**	XDi-net**	XDi-net**	VS02
XDi 3	VI007	TPDO	XDi-net**	XDi-net**	XDi-net**	VS02

*) The analogue RPM input can calculate %RPM based on actual RPM.

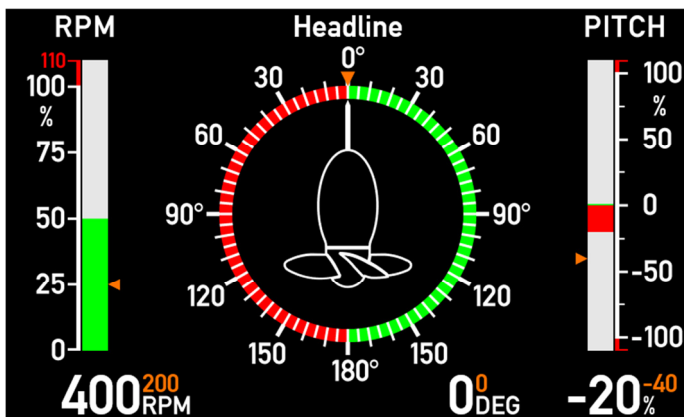
***) You can disable the TPDO input in VS02 to make it only listen on XDi-net (it will function with TPDO active).

All analogue data is default shared via the XDi-net.

Azimuth, Pitch and RPM system with set point

The same CAN/analogue system is now set up to support azimuth angle, pitch% and RPM/RPM%, all with set point if required.

In this example, it is VI015 Pushing azimuth type with dynamic azimuth pointer, indicating RPM/RPM% and +/- %Pitch.



(Orange set points can be disabled from menu)

All XDi units in this system must be the Multi-version.

CAN azimuth, analogue RPM and Pitch

XDi device	Selected azimuth indicator	CAN TX azimuth angle		Control sys. RPM/%RPM *		Control sys. Pitch/%Pitch *		Select VS profile
		Actual	Set point	Actual	Set point	Actual	Set point	
XDi 1	VI015	TPDO	4-20 mA	4-20 mA	XDi-net	4-20 mA	4-20 mA	VS03
XDi 2	VI015	TPDO	XDi-net**	XDi-net**	4-20 mA ***	XDi-net**	XDi-net**	VS04 (VS02 ***)
XDi 3	VI015	TPDO	XDi-net**	XDi-net**	XDi-net**	XDi-net**	XDi-net**	VS02

*) The analogue RPM input can calculate %RPM based on actual RPM, and analogue pitch input is scaled to a %Pitch value. (From the installation menu, an analogue pitch angle input can be scaled to %Pitch for indication). All analogue data is default shared via the XDi-net.

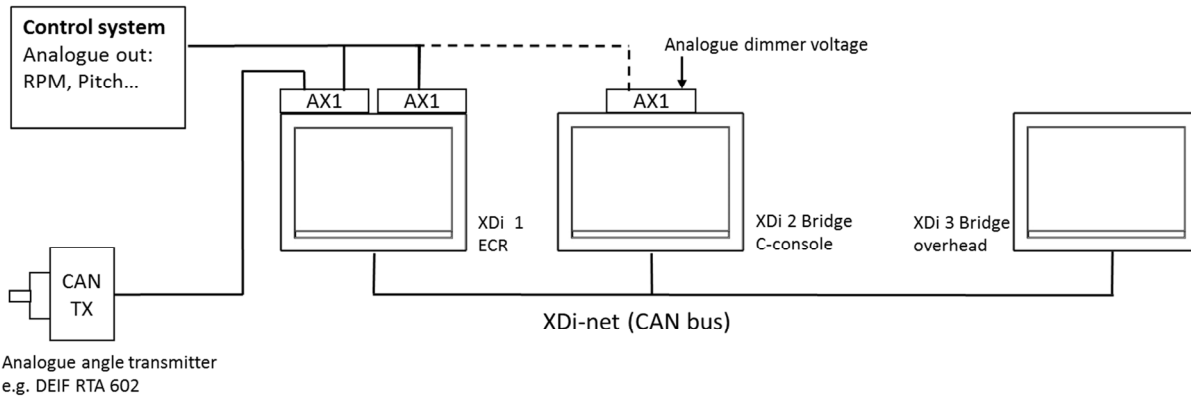
***) You can disable the TPDO input in VS02 to make it only listen on XDi-net (it will function with TPDO active).

***) An AX1 module is needed on the XDi 2 to get the RPM set point. If the RPM set point is not used, then VS02 must be used for the XDi 2.



Presentation of set point (commanded value) for each data type must be activated via the menu; it is by default OFF.

Application 3 – azimuth analogue system using XDi-net



All inputs for this system are analogue, default they are 4 to 20 mA. All data is shared using the XDi-net protocol for easy plug and play system integration.

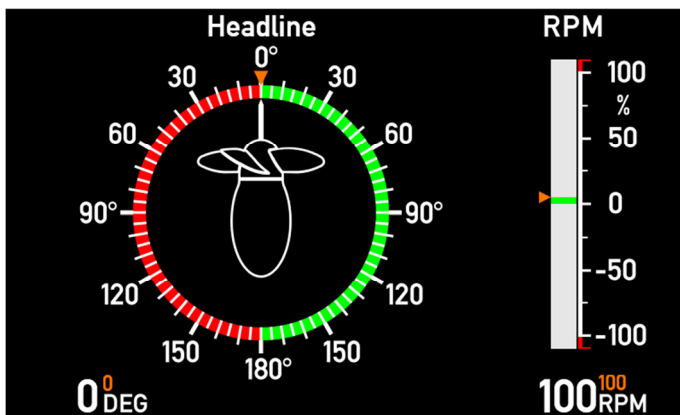
Select a different NodeID for each of the 3 XDi indicators. Make sure that it is not already used by another CAN device on the bus.



If you do not want set point (commanded value) data to be presented on the selected virtual indicator, you must select “Visible: OFF” in the installation menu “Edit virtual indicator/indicators”.

Azimuth and RPM indicator system with set point

This is the system above configured for azimuth angle and RPM/RPN% and with all set point data presented. In this example, it is VI007 Pushing azimuth type with dynamic azimuth pointer and indicating +/- RPM/RPM%.



(Orange set points can be disabled from menu).

XDi units in this system are all Multi-versions, but if there is no need for set point (orange), the Dual version can be used instead.

Normal analogue azimuth and RPM

XDi device	Selected azimuth indicator	CAN TX azimuth angle		Control sys. RPM/%RPM *		Select VS profile
		Actual	Set point	Actual	Set point	
XDi 1	VI007	4-20 mA	4-20 mA	4-20 mA	4-20 mA	VS04
XDi 2	VI007	XDi-net	XDi-net	XDi-net	XDi-net	VS01
XDi 3	VI007	XDi-net	XDi-net	XDi-net	XDi-net	VS01

SIN/COS azimuth angle and normal analogue RPM

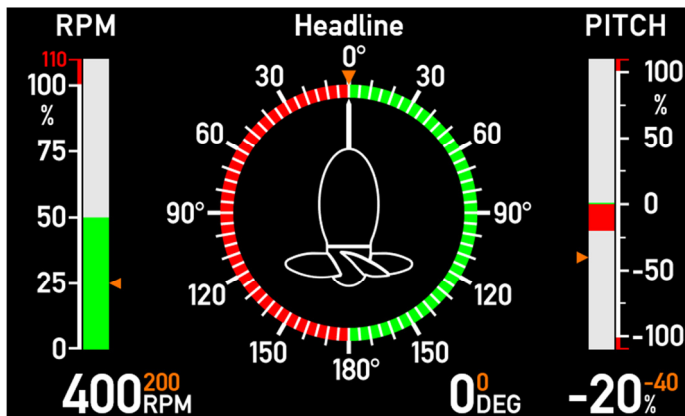
XDi device	Selected azimuth indicator	CAN TX azimuth angle		Control sys. RPM/%RPM *		Select VS profile
		Actual	Set point	Actual	Set point	
XDi 1	VI007	sin cos	4-20 mA	4-20 mA	0 to 10 V*	VS05
XDi 2	VI007	XDi-net	XDi-net	XDi-net	XDi-net	VS01
XDi 3	VI007	XDi-net	XDi-net	XDi-net	XDi-net	VS01

*) sin cos requires two analogue inputs, and therefore voltage input 3 (dimmer) on the second AX1 module (slot 2) is used as RPM set point input. (Voltage input 3 (dimmer) on AX1 in slot 1 is always reserved for dimmer in the DEIF standard libraries).

Azimuth, Pitch and RPM system with set point

The same CAN/analogue system is now set up to support azimuth angle, pitch% and RPM/RPM%, all with set point if required.

In this example, it is VI015 Pushing azimuth type with dynamic azimuth pointer, indicating RPM/RPM% and +/- %Pitch.



(Orange set points can be disabled from menu).

All XDi units in this system must be the Multi-version.

Normal analogue azimuth, RPM and Pitch

XDi device	Selected azimuth indicator	CAN TX azimuth angle		Control sys. RPM/%RPM *		Control sys. Pitch/%Pitch *		Select VS profile
		Actual	Set point	Actual	Set point	Actual	Set point	
XDi 1	VI013 to 020	4-20 mA	4-20 mA	4-20 mA	XDi-net	4-20 mA	XDi-net	VS05
XDi 2	VI013 to 020	XDi-net **	XDi-net **	XDi-net **	4-20 mA ***	XDi-net **	4-20 mA ***	VS08 (VS01***)
XDi 3	VI013 to 020	XDi-net	XDi-net	XDi-net	XDi-net	XDi-net	XDi-net	VS01

*) The analogue RPM input can calculate %RPM based on actual RPM, and analogue pitch input is scaled to a %Pitch value. (From the installation menu, an analogue pitch angle input can be scaled to %Pitch for indication). All analogue data is default shared via the XDi-net.

**) You can disable the TPDO input in VS02 to make it only listen on XDi-net (it will function with TPDO active).

***) An AX1 module is needed on the XDi 2 to get the RPM and pitch set point. If the RPM and pitch set point presentation is not used, then VS02 must be used for the XDi 2.

SIN/COS azimuth and normal analogue RPM and Pitch

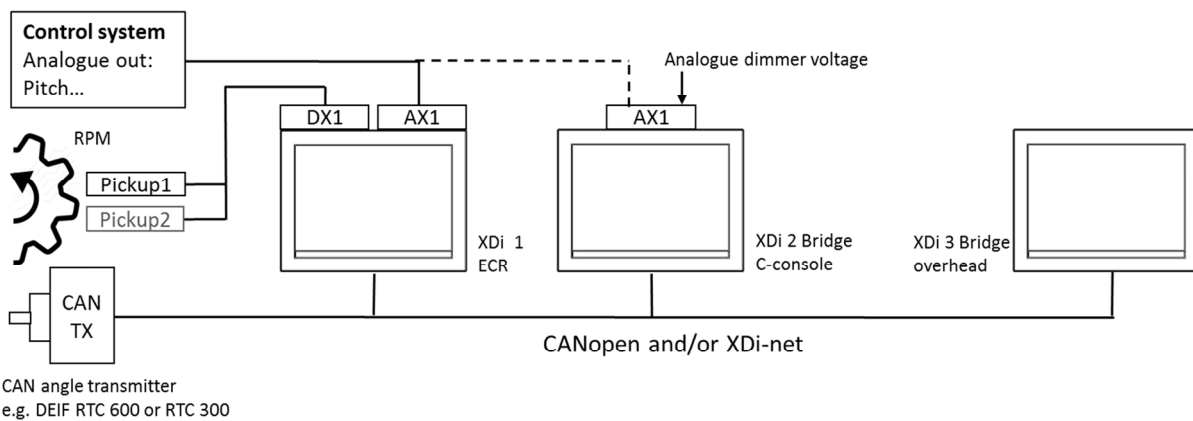
XDi device	Selected azimuth indicator	CAN TX azimuth angle *		Control sys. RPM/%RPM *		Control sys. Pitch/%Pitch		Select VS profile
		Actual	Set point*	Actual	Set point	Actual	Set point	
XDi 1	VI013 to 020	sin cos	0 to 10 V *	4-20 mA	XDi-net	4-20 mA	XDi-net	VS06
XDi 2	VI013 to 020	XDi-net **	XDi-net **	XDi-net **	4-20 mA ***	XDi-net**	4-20 mA ***	VS08 (VS01***)
XDi 3	VI013 to 020	XDi-net	XDi-net	XDi-net	XDi-net	XDi-net	XDi-net	VS01

*) sin cos requires two analogue inputs, and therefore voltage input 3 (dimmer) on the second AX1 module (slot 2) is used as azimuth set point input. (Voltage input 3 (dimmer) on AX1 in slot 1 is always reserved for dimmer in the DEIF standard libraries).

**) You can disable the TPDO input in VS02 to make it only listen on XDi-net (it will function with TPDO active).

***) An AX1 module is needed on the XDi 2 to get the RPM and pitch set point. If the RPM and pitch set point presentation is not used, then VS01 must be used for the XDi 2.

Application 4 – azimuth, RPM pickup analogue system using XDi-net



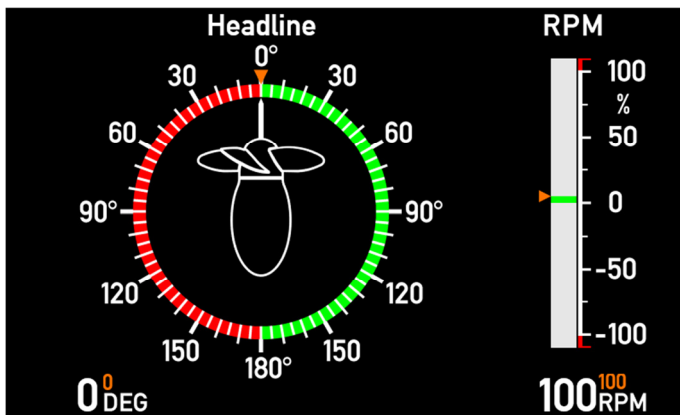
Select a different NodeID for each of the 3 XDi indicators, and make sure that it is not already used by another CAN device on the bus.



If you do not want set point (commanded value) data to be presented on the selected virtual indicator, you must select “Visible: OFF” in the installation menu “Edit virtual indicator/indicators”.

Azimuth and RPM indicator system with set point

This is the system above configured for azimuth angle and RPM/RPN% and with all set point data presented. In this example, it is VI007 Pushing azimuth type with dynamic azimuth pointer and indicating +/- RPM/RPM%.



(Orange set points can be disabled from menu).

XDi units in this system are all Multi-versions, but if there is no need for set point (orange), the Dual version can be used instead.

Normal analogue azimuth and RPM

XDi device	Selected azimuth indicator	CAN TX azimuth angle		Control sys. RPM/%RPM *		Select VS profile
		Actual	Set point	Actual	Set point	
XDi 1	VI007	TPDO	4-20 mA	Digital in	4-20 mA	VS06
XDi 2	VI007	TPDO	XDi-net**	XDi-net**	XDi-net**	VS02
XDi 3	VI007	TPDO	XDi-net**	XDi-net**	XDi-net**	VS02

*) The analogue RPM input can calculate %RPM based on actual RPM. All analogue data is default shared via the XDi-net.

***) You can disable the TPDO input in VS02 to make it only listen on XDi-net (it will function with TPDO active).

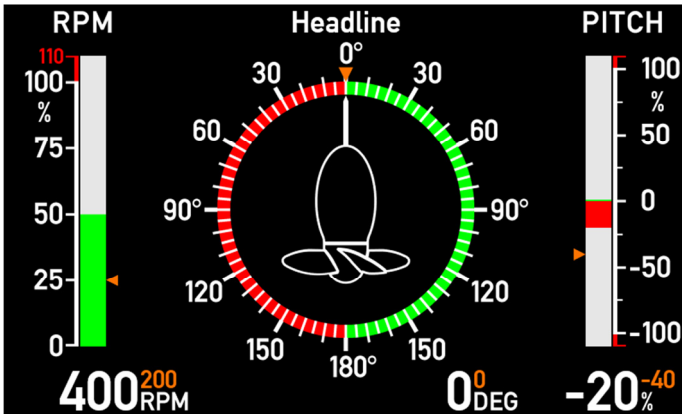


The DX1 module has two inputs. Only one RPM pickup is needed to detect RPM without direction. When the RPM is bidirectional, two RPM pickups are needed, and both digital inputs are required on the DX1 module.

Azimuth, Pitch and RPM system with set point

The same CAN/analogue system is now set up to support azimuth angle, pitch% and RPM/RPM%, all with set point if required.

In this example, it is VI015 Pushing azimuth type with dynamic azimuth pointer, indicating RPM/RPM% and +/- %Pitch.



(Orange set points can be disabled from menu).

All XDi units in this system must be the Multi-version.

Normal analogue azimuth, RPM and Pitch

XDi device	Selected azimuth indicator	CAN TX azimuth angle		Control sys. RPM/%RPM *		Control sys. Pitch/%Pitch *		Select VS profile
		Actual	Set point	Actual	Set point	Actual	Set point	
XDi 1	VI015	TPDO	4-20 mA	Digital in	XDi-net	4-20 mA	XDi-net	VS07
XDi 2	VI015	TPDO	XDi-net**	XDi-net**	4-20 mA ***	XDi-net**	4-20 mA ***	VS08 (VS02***)
XDi 3	VI015	TPDO	XDi-net**	XDi-net**	XDi-net**	XDi-net**	XDi-net**	VS02

*) The analogue RPM input also calculates %RPM based on actual RPM, and the same for analogue pitch where %Pitch is calculated. (From the installation menu, an analogue pitch angle input can be scaled to %Pitch for indication).

**) You can disable the TPDO input in VS02 to make it only listen on XDi-net (it will function with TPDO active).

***) An AX1 module is needed on the XDi 2 to get the RPM and pitch set point. If the RPM and pitch set point presentation is not used, then VS02 must be used for the XDi 2.

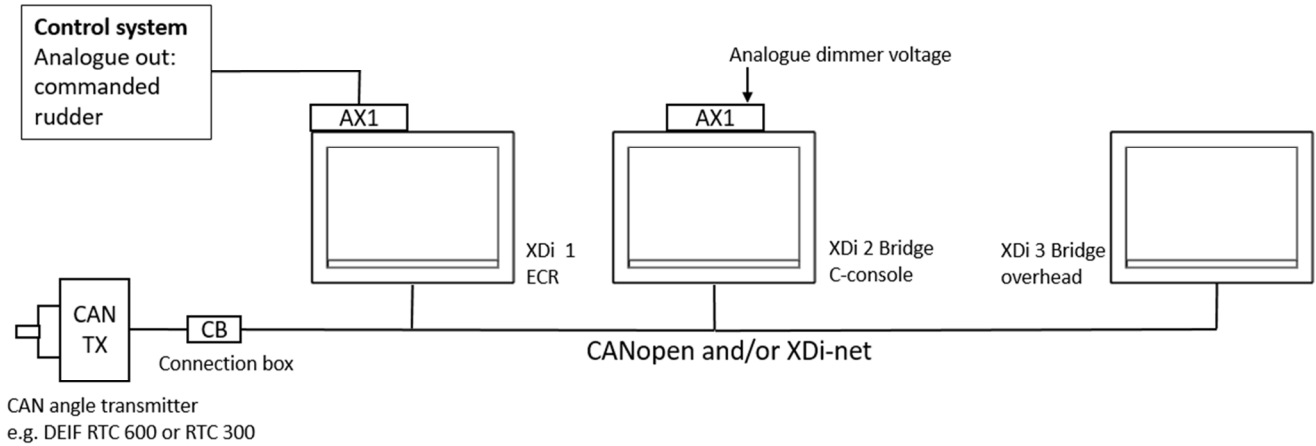


The DX1 module has two inputs. Only one RPM pickup is needed to detect RPM without direction.

Application 5 - XDi rudder system using CANopen and XDi-net

The system below is a CAN-based rudder indicator system using the DEIF Standard XDi Dual rudder library. The indicators are presenting actual rudder angle and the commanded rudder angle. (See DEIF standard XDi rudder libraries for indicator details).

System overview



Select a different NodeID for each of the 3 XDi indicators, and make sure that it is not already used by another CAN device on the bus.

System setup overview

Unit	Description	Node ID	VI no.	VI type	VS no	VS input description	PP	PP description
RTC 600	CAN angle TX using COBID 0x181	1						
XDi 144 D	XDi 1 located in ECR	e.g. 30	003	+/-45° FWD	03	Angle: TPDO1 Comm.: 4-20 mA	06	ECR fixed dimmer. XDi-net active
XDi 144 D	XDi 2	e.g. 31	003	+/-45° FWD	02	Angle: TPDO1 Comm.: XDi-net	02	Analogue dim. gr.1 XDi-net active
XDi 192 D	XDi 3 in overhead panel	e.g. 32	003	+/-45° FWD	02	Angle: TPDO1 Comm.: XDi-net	01	XDi-net dim. gr.1 XDi-net active

By selecting from the standard virtual indicators and standard setup profiles, the system can be configured.

The CAN angle transmitter is preconfigured to NodeID 1 and use TPDO1 for periodic data transmissions (COBID 0x181). All XDi units are using angle data directly from the CAN transmitter by listening for this TPDO1.

The commanded angle value from the steering control is analogue and is connected to AX1 on the XDi in the engine control room (ECR). This XDi is set up to share commanded rudder via XDi-net.

The XDi in the ECR is using a fixed dimmer profile since it is mounted below deck where dimming is not needed (artificial light).

The bridge indicators are dimmed from the analogue input on XDi 2 and shared with XDi 3 via CAN, using dimmer group 1.

A combined power and CAN cable (four wires) can be used to make installation easier.

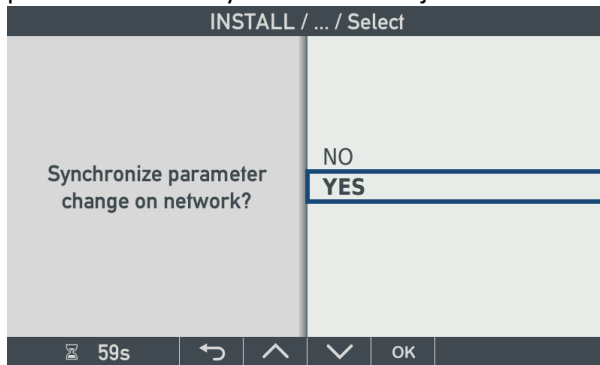
Please follow the guidelines for correct CAN bus installation in this manual.

Especially remember to make correct bus termination in each end of the CAN bus.

Setup procedure

When powered up the first time:

1. Follow the installation wizard to select can Node ID, Product profile (PP), Virtual indicator (VI) and setup profile (VS), and finish the wizard on XDi 1, XDi 2 and XDi 3 (see selection in table).
2. Follow the instructions for electric zero set of the rudder angle transmitter.*)
3. If the min/max rudder angle is inaccurate, it may be due to mechanical inaccuracy or gearing between rudder and transmitter. Choose one of the XDi units and enter the installation menu and select the "Adjust input" menu, and then the rudder angle input (PDO converter adjust). Use the setup menu to calibrate the endpoints one by one (zero should be adjusted first if point 2 was not successful). To share this new calibration with all other XDi units on the CAN bus, you must remember to synchronise parameters when you leave the adjust menu:



Please see chapter "PDO converter for azimuth/rudder" for detailed information on how to make this calibration from menu.

4. If the commanded rudder (set point) needs adjustment, select the rudder set point from the "Adjust input" menu. The calibrated data is shared on XDi-net.
5. Setup is completed.

*) If it is difficult to physically reach the rudder transmitter, the alignment can be made in the indicator itself via the setup menu. The alignment will automatically be shared with all other XDi rudder indicators.

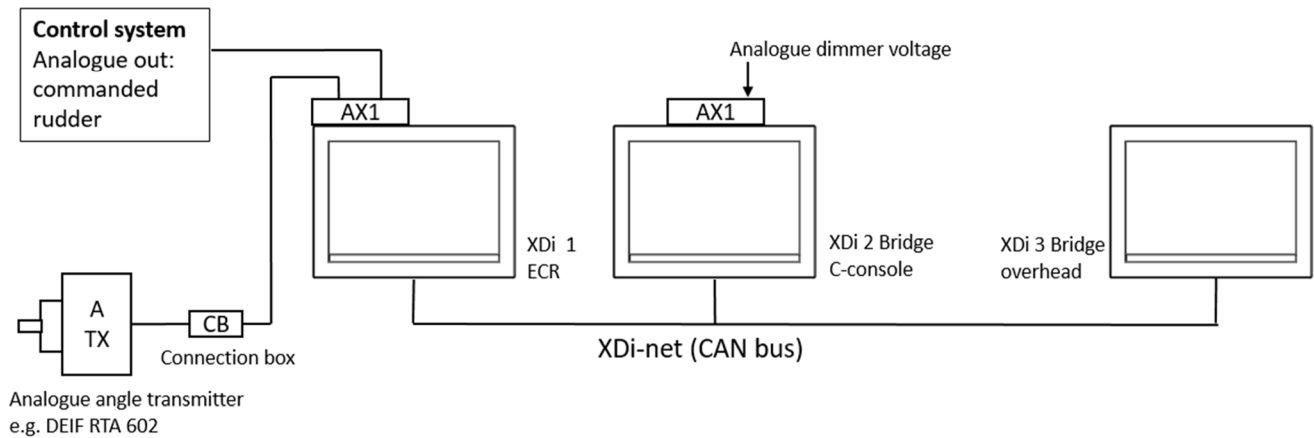
Application 6: XDi rudder system, analogue angle transmitter and XDi-net

The system below is using an analogue 4-20 mA rudder transmitter (for example RTA 602) and three XDi units using the DEIF Standard XDi Dual rudder library.

The indicators are presenting actual rudder angle and the commanded rudder angle.

(See DEIF standard XDi rudder libraries for indicator details).

System overview



Select a different NodeID for each of the 3 XDi indicators, and make sure that it is not already used by another CAN device on the bus.

System setup overview

Unit	Description	VI no.	VI type	VS no	VS input description	PP	PP description
RTA 600	Analogue angle TX with 4-20mA output						
XDi 144 D	XDi 1 located in ECR	003	+/-45° FWD	04	Angle: 4-20 mA Comm.: 4-20 mA	06	ECR fixed dimmer. XDi-net active
XDi 144 D	XDi 2	003	+/-45° FWD	01	Both XDi-net	02	Analogue dim. gr.1 XDi-net active
XDi 192 D	XDi 3 in overhead panel	003	+/-45° FWD	01	Both XDi-net	01	XDi-net dim. gr.1 XDi-net active

By selecting from the standard virtual indicators and standard setup profiles, the system can be configured.

The system is similar to the system in APP.1, but the angle transmitter has analogue output.

Setup procedure:

When powered up the first time:

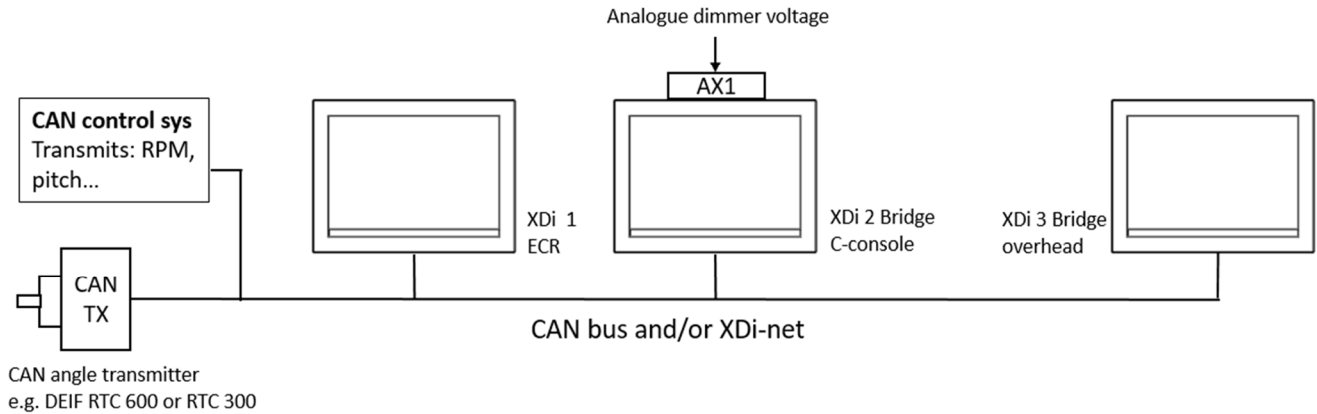
1. Follow the installation wizard to select can Node ID, Product profile (PP), Virtual indicator (VI) and setup profile (VS) and finish the wizard on XDi 1, XDi 2 and XDi 3. (see selection in table)
2. Follow the instructions for electric zero set and min/max adjust of the rudder angle transmitter.*)
3. If the min/max rudder angle is inaccurate, it may be due to mechanical inaccuracy or gearing between rudder and transmitter. Open the installation menu on the XDi where the analogue input is connected, select the "Adjust input" menu, and then the rudder angle input (analogue input adjust). Use the setup menu to calibrate the zero point and endpoints one by one. This XDi shares angle data on XDi-net, so you should select NO to synchronise parameters; it has no effect in this case.

Please see chapter "AX1 analogue input – azimuth/rudder set point" for a detailed description on how to make this calibration from menu.

4. If the commanded rudder (set point) needs adjustment, select the rudder set point from the “Adjust input” menu and make the adjustments; again the calibrated data is shared on XDi-net.
5. Setup is completed.

Application 7 – dimmer control

The dimmer control is independent of the selected virtual indicator, and the dimmer input options are controlled by the selected product profile. The XDi handles nine dimmer groups via CAN, and the local group that is not controlled via CAN.



In DEIF standard libraries, voltage input 3 on the AX1 module in slot 1 is always reserved for analogue dimmer and is not used as input for any of the virtual indicators.

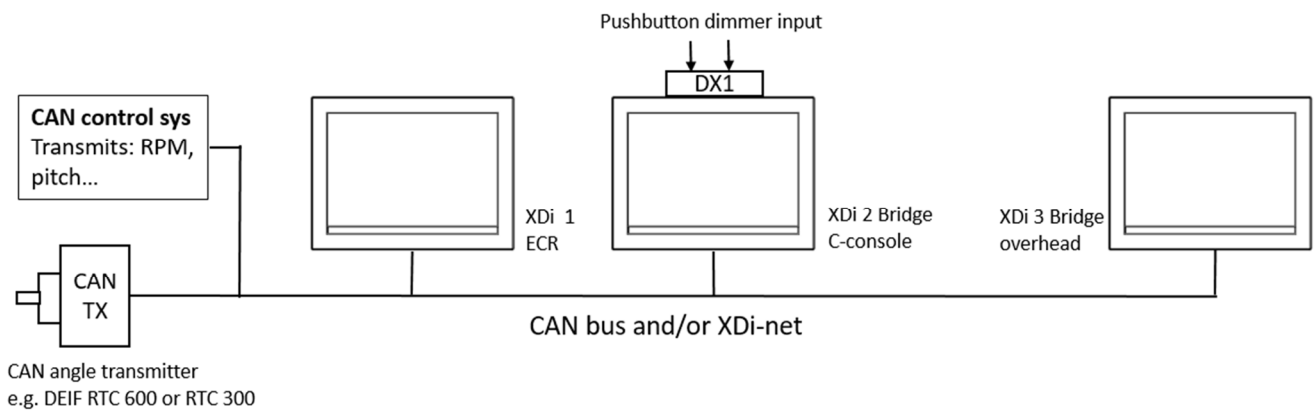
XDi-net, CAN TPDO or analogue dimmer using AX1

Dimmer control type	XDi-net All controlled from central dimmer (AX1 not needed)		Analogue control of XDi units on bridge, fixed dimmer level in ECR		TPDO Bridge controlled from central dimmer ECR is local analogue	
	XDi device	Select PP	Dimmer input	Select PP	Dimmer input	Select PP
XDi 1	XDi-net	PP01	Fixed	PP06	Voltage **	PP05
XDi 2	XDi-net	PP01	Voltage *	PP02	TPDO	PP03
XDi 3	XDi-net	PP01	XDi-net	PP01	TPDO	PP03

*) The input is default set up to use a potentiometer connected to the Vref output on AX1 module terminal 3, but it can easily be reconfigured to a dimmer voltage input instead. The analogue dimmer value is shared on CAN for the actual dimmer group, and since the XDi 3 is part of group 1 (default), its dimmer level will be controlled from the XDi 2 via the XDi-net.

***) This will require an AX1 module mounted on the XDi 1 located in the ECR.

Push-button dimmer using DX1

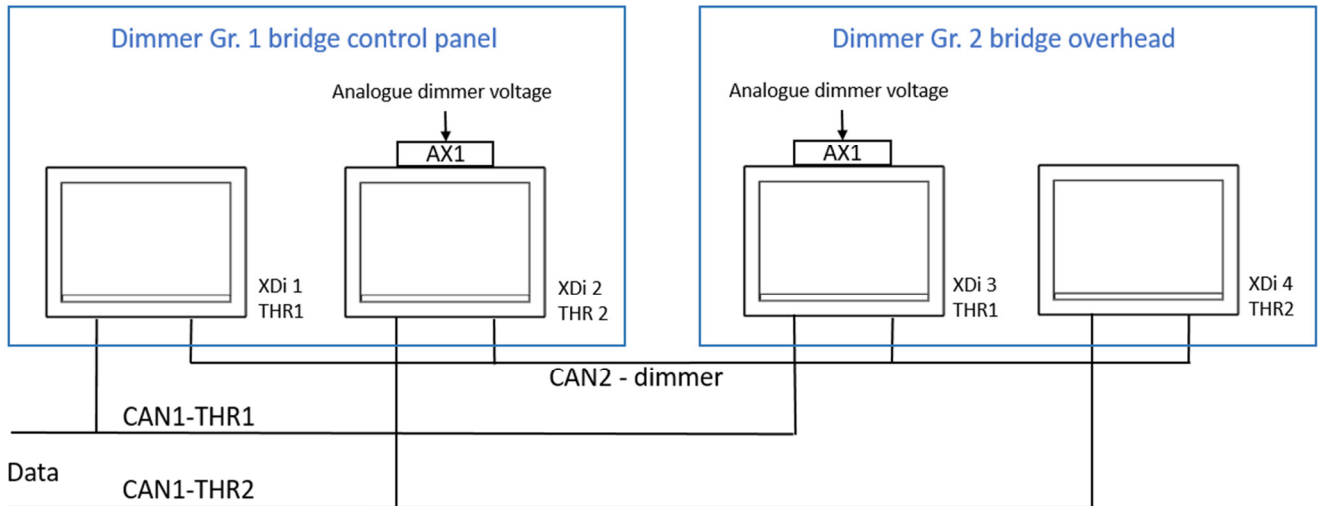


Dimmer control type	Push-button control of XDi units on bridge	
	Fixed dimmer level in ECR	
XDi device	Dimmer input	Select PP
XDi 1	Fixed	PP06
XDi 2	Digital input 1&2	PP04
XDi 3	XDi-net	PP01

Application 8 – group dimmer control

The system in this application note consists of two azimuth thrusters, each with an XDi indicator located in the control panel and one in the overhead console. CAN data is distributed on two separate CAN lines that both use CAN input 1 on the XDi.

One XDi in the console and one in the overhead panel are equipped with an AX1 module for dimmer input. Dimmer level data is shared on CAN 2.



By using the dimmer grouping function, it is possible to individually control the dimmer level of XDi units in the bridge control panel (gr.1) and XDi units in the bridge overhead panel (gr. 2) on the same CAN bus.

Dimmer control type	Analogue control of XDi groups on the bridge		XDi dimmer group selection via user menu	Dimmer source setup
XDi device	Dimmer input	Select PP	Dimmer group	Send analogue dimmer value on
XDi 1 THR 1	XDi-net	PP01	(Default Gr. 1)	-
XDi 2 THR 2	AX1 voltage	PP02	(Default Gr. 1)	CAN 2 *
XDi 3 THR 1	AX1 voltage	PP02	Gr. 2	CAN 2 *
XDi 4 THR 2	XDi-net	PP01	Gr. 2	-

*) The DEIF standard libraries are by default set up to share analogue dimmer data on CAN 1 and CAN 2. As long as dimmer groups are used, it is not necessary to change to CAN 2 only.

In this example, however, it may be more practical only to connect CAN 2 on the two XDi units in the bridge console and similarly only CAN 2 on the two XDi units in the overhead bridge console. If the default dimmer group 1 is used in both locations, it is important to change the default setting of data sharing on the XDi-net, so that analogue dimmer data is only shared on CAN 2, since the indicators are also interconnected on CAN 1.

Fault symptom: If dimmer data is shared on both CAN 1 and CAN 2, and all XDi units are in group 1, then the backlight level will jump between the two dimmer levels and make the backlight flicker.

Terminology, Terms and abbreviations

Abbreviation (short text)	Full text	Explanation
XDi	Flexible Display indicator	Illuminated indicator based on display technology and with a library architecture offering very flexible indicator design, interfaces and CANopen network handling.
CANopen	CANopen	Standard but relative open protocol for communicating via the CAN bus network layer. Contact CiA (CAN in Automation) for more detailed information.
XDi-net	XDi-net	DEIF-specific way to use CANopen and the manufacture-specific section of the object index.
PP	Product profile	Collection of default product specific parameter values like dimmer, CAN-bus settings, sound and visual warnings and alike.
VI	Virtual indicator	Predefined indicator stored in the XDi library.
VS	VI-setup	Collection of default indicator parameter values like input setup parameters for the selected virtual indicator.
Extension Module	Extension module	Physical module to be mounted in one of the extension slots on the rear side of the XDi unit. The XDi 96 only has one extension slot, where XDi 144 and XDi 192 both have 2 extension slots.
AX 1	Analogue input extension module	Analogue interface module that can be snapped on the back of the XDi indicator to add: 2 analogue inputs, 1 dimmer/universal voltage input and a reference voltage output.
DX 1	Digital I/O extension module	Digital interface module that can be snapped on the back of the XDi indicator to add: 2 digital input (often used for RPM pickups) and 2 relay outputs.
NX 1	NMEA output extension module	NMEA interface module that can be snapped on the back of the XDi indicator to add: 1 RS422 NMEA output IEC 61162-1.
L-pan	Left menu pane	The left part of the standard XDi menu screen, often containing added information to the highlighted menu.
R-pan	Right menu pane	Right part of the standard XDi menu screen, often containing the actual menu structure.
Slot	Extension slot	The extension slot is used when mounting an extension module on the XDi, see Extension module.
NMEA	NMEA	NMEA is a serial communication standard using RS422 and in this product compliant with IEC 61162-1.
MED	Marine Equipment Directive	MED-approved products are compliant with relevant standards in the Marine Equipment Directive.

Open source software

This product contains open source software licensed under for example GNU General Public License (GNU GPL) and GNU Lesser General Public License (GNU LGPL). The source code for this software can be obtained by contacting DEIF A/S at support@deif.com. DEIF A/S reserves the right to charge for the cost of the services.