XL, BW, BRW-2

4189350024P

Illuminated indicators

Installation and commissioning guide

DEIF Improve Tomorrow

1. Overview

This document contains guidelines for mounting, connecting and commissioning the XL or BW/BRW-2 indicators. Wiring diagrams and mounting instructions for each indicator group are documented in separate chapters. The commissioning chapter contains commissioning instructions for all indicator groups based on the input type for the indicator.

1.1 Legal information amd safety

1.1.1 Third party equipment

DEIF takes no responsibility for the installation or operation of any third party equipment.

1.1.2 Disclaimer

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

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

1.1.3 Copyright

1.1.4 Electrostatic discharge

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

1.2 Package contents

The XL/BW/BRW-2 indicators are delivered in a cardboard box. To protect the indicator it is important to store it in the box until mounting.

For the XL types, the box also contains a number of fixing clamps. The exact number of clamps depends on the indicator size and the degree of IP protection.

If the indicator is mounted for IP66 protection, a gasket (blue) for IP66 protection will be included. The contents should be as described in the table below.

For **bulkhead mounted** types (BW/BRW-2), the box also contains a bracket with two 8 x 12 mm screws for fixing the bracket on the bulkhead box (5 mm Allen key).

Summary of package contents for each indicator

Content	XL72	XL96	XL144	XL192	BW144	BW192	BRW-2
Quick guide	1	1	1	1	1	1	1
Indicator	1	1	1	1	1	1	1
Terminals, see note below	2/3	2/3	2/3	2/3	2/3	2/3	2/3
Rear mounted version, fixing clamps IP52/IP66	2/4	2/4	4/8	4/8			
Gasket IP66 option	1	1	1	1			
Front mounted version, frame	1	1	1	1			

Content	XL72	XL96	XL144	XL192	BW144	BW192	BRW-2
Gasket IP66 BW/BRW-2					1	1	1
Rear cover with bracket					1	1	
Screws for rear cover					8	8	
Bracket with 8 x 12 mm screws					2	2	4

NOTE If the indicator is a CANopen input type, a 3-terminal block for illumination input and one CAN cable fixing plate are included.

XL with IP66 protection

When the indicator is to be mounted for IP66 protection, a blue gasket is included.

BW/BRW-2 IP66 protection

A black or blue gasket is always included.

2. XL wiring and installation

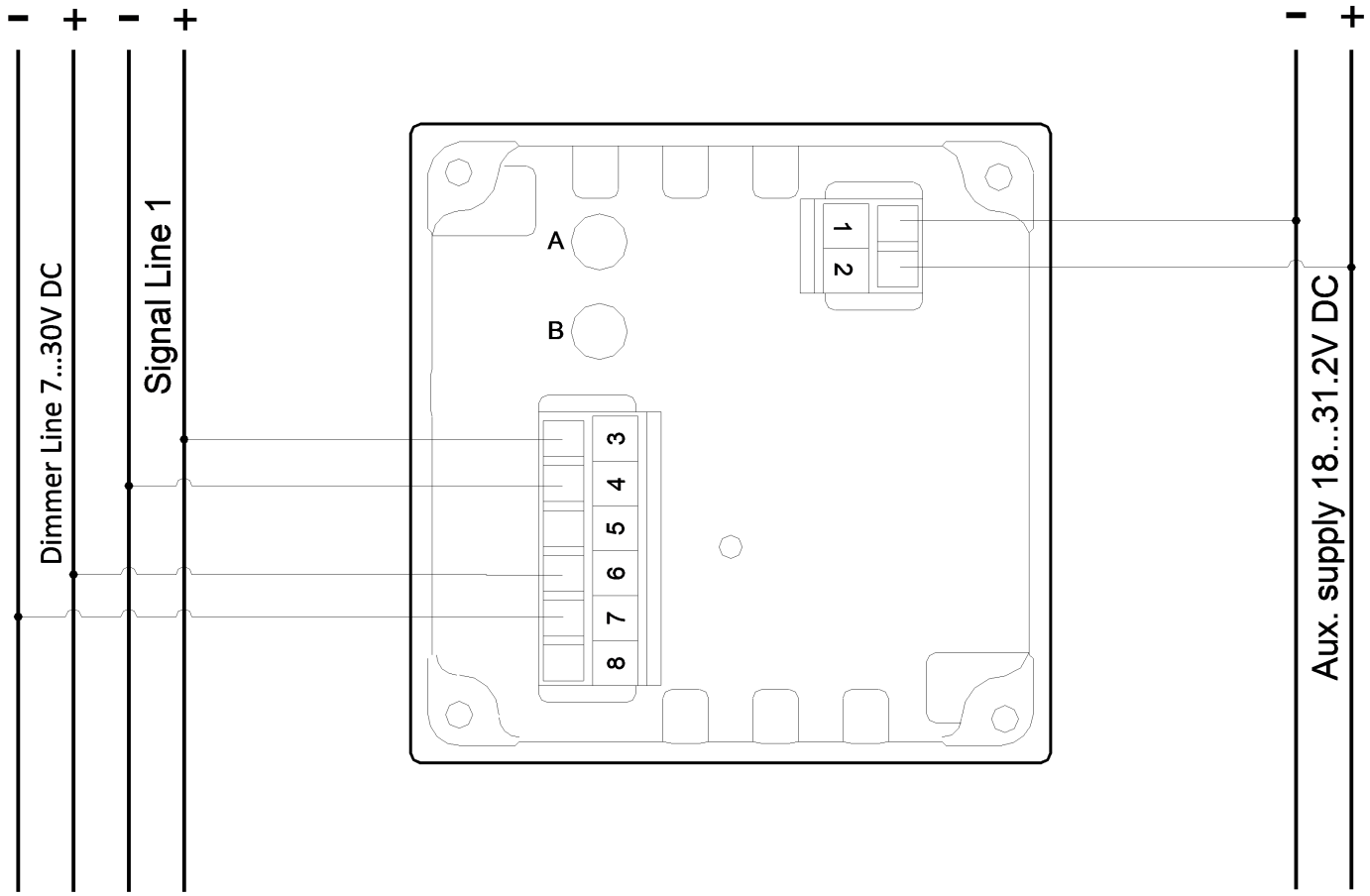
2.1 Wiring

2.1.1 Analogue input indicators

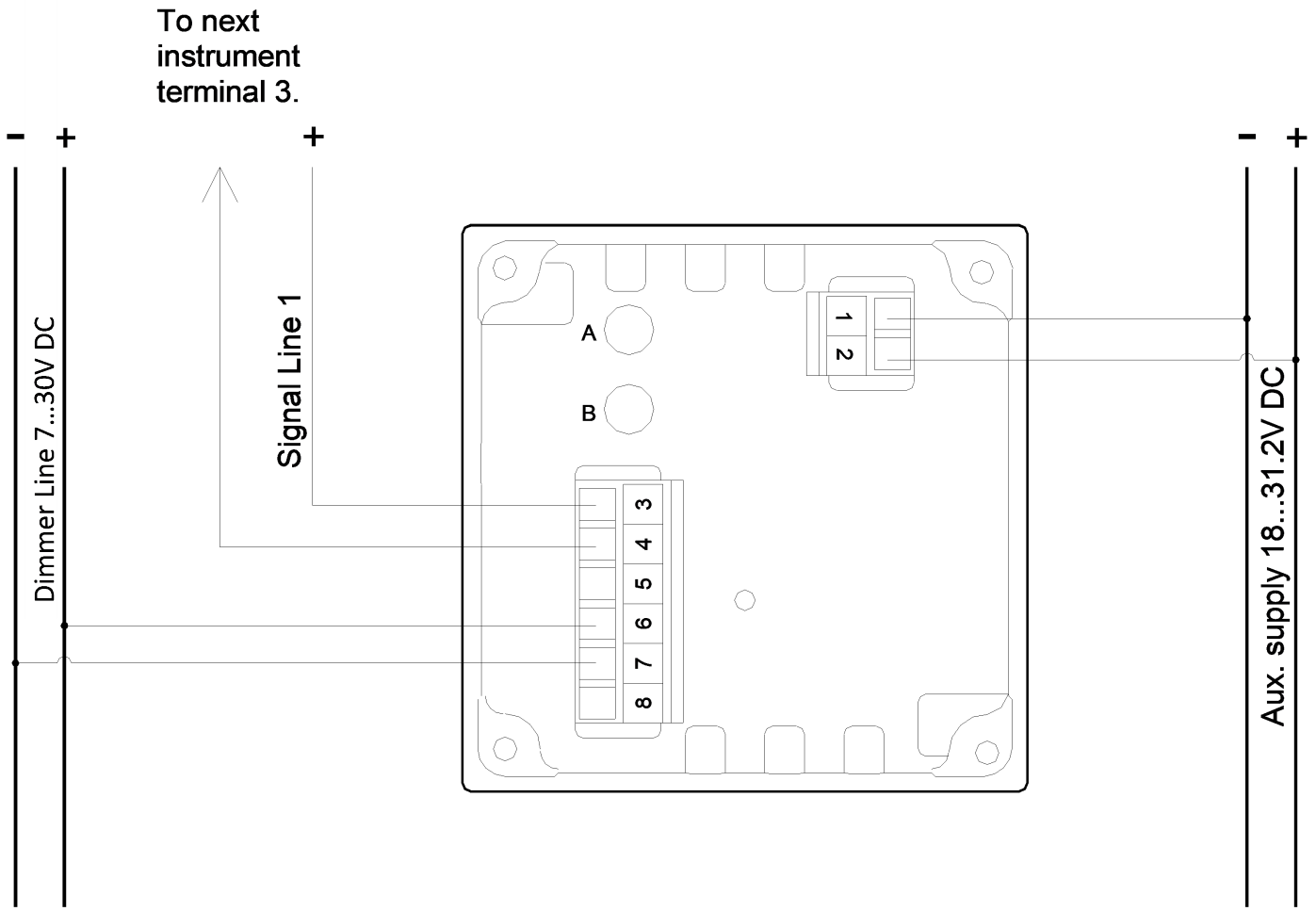
Terminal connections

Pin number	Function		Note
1	Supply voltage	0 V	
2		24 V	
3	Analogue input	Input 1 (Sin)	Input 1 and input common used for single input On 4 to 20 mA, input 1 is CW and input 2 CCW **Note: Input common is mutual for input 1 and input 2**
4		Input common	
5		Input 2 (Cos)	
6	Illumination	Illumination +	Dimmer input. Dimmer range 7 to 30 V DC Consumption max. 30 mA
7		Illumination GND	
8	-	NC	Not connected - can be used freely
A	Analogue adjustment	Max. adjustment	Max. and zero adjustment, sealed by label
B		Zero adjustment	On 360 degree versions, A is EM selection and B is zero adjustment

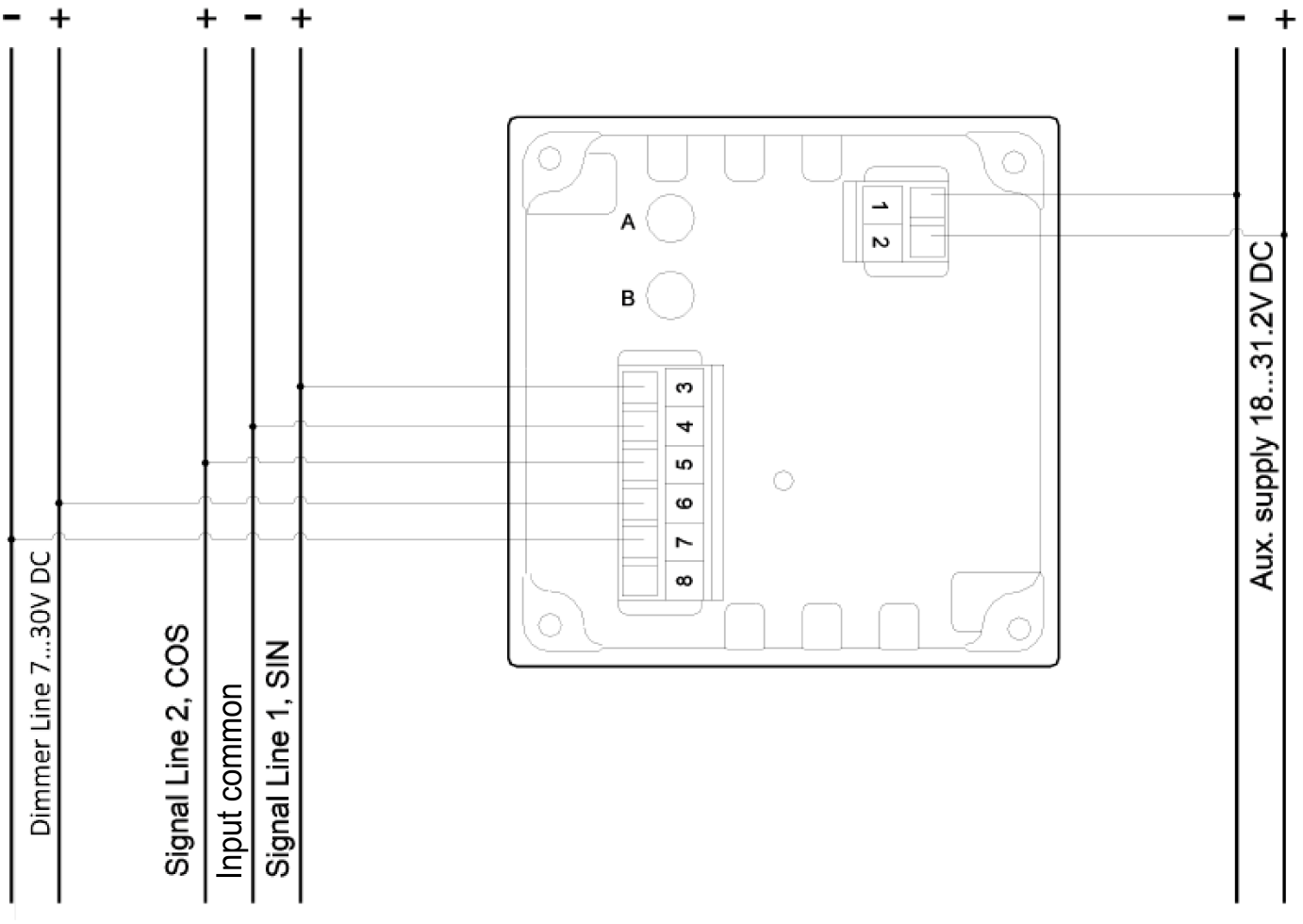
Voltage single input



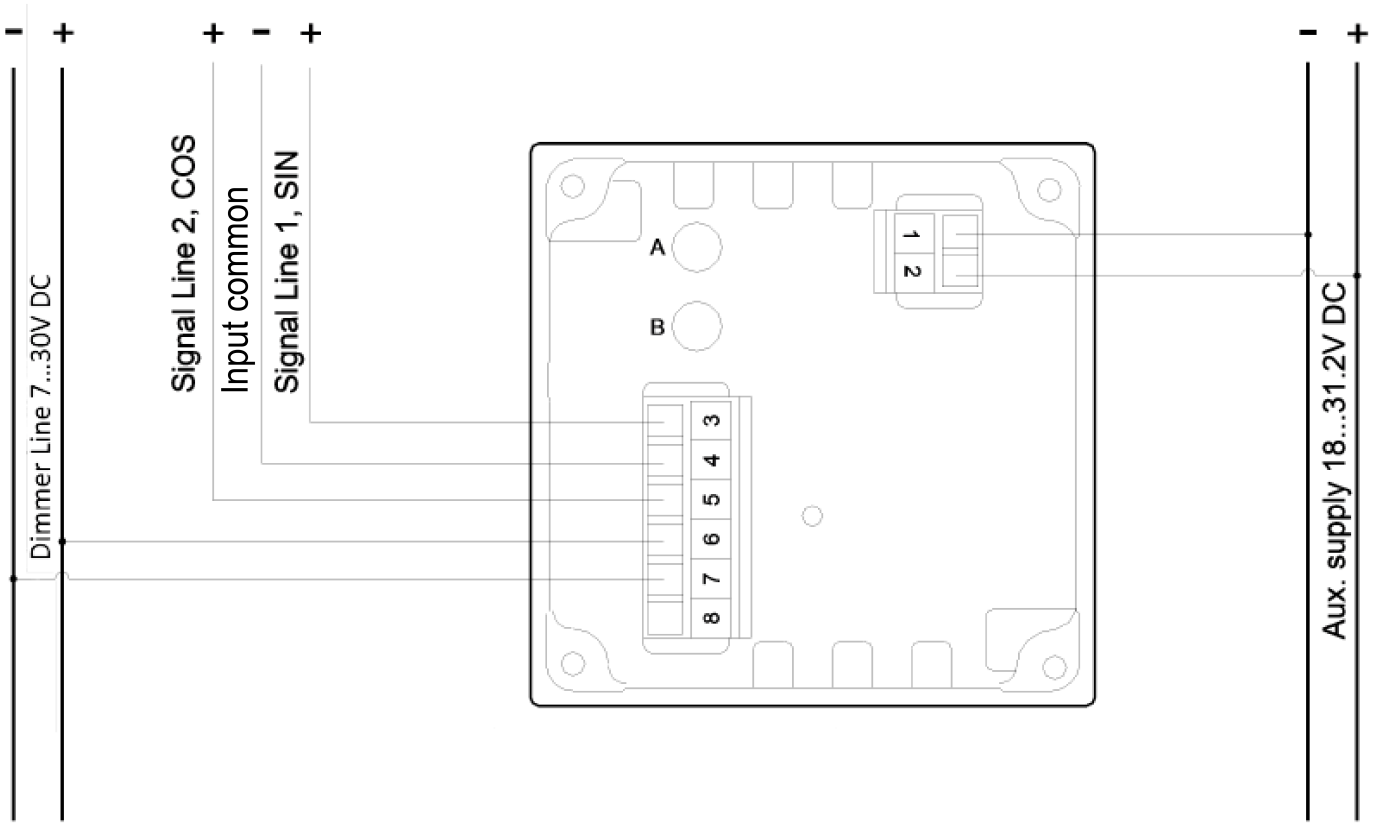
Current single input



Analogue SIN/COS input voltage (dual input)



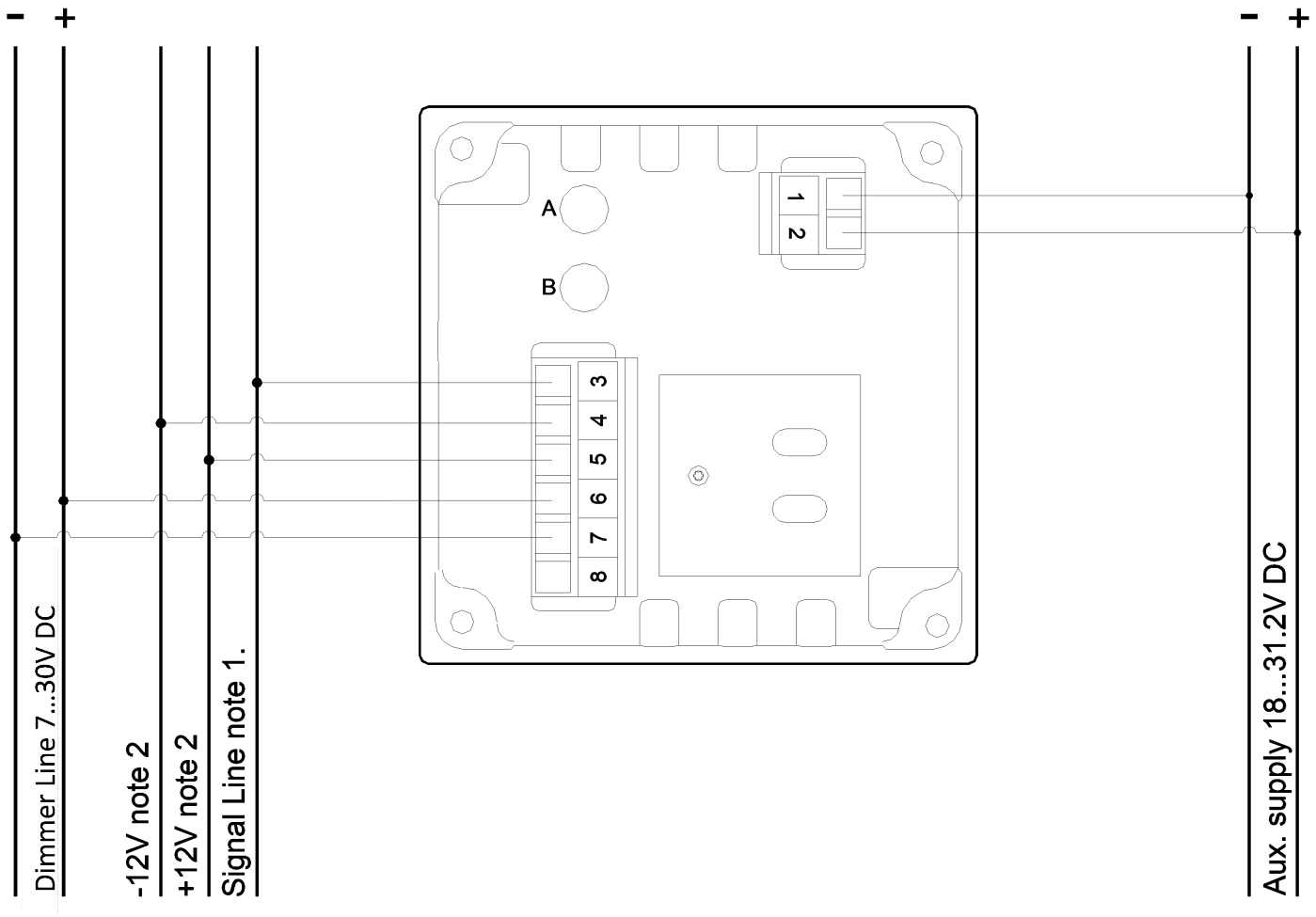
Analogue SIN/COS input current (dual input)



NOTE Only one instrument can be connected in the current loops.

2.1.2 Rudder potentiometer analogue indicator

Special input for direct connection to rudder potentiometer. Be aware that this is not standard functionality.



Note that:

1. The signal line is identical to the signal on the rudder potentiometer wiper.
2. The -12 and +12 V DC (24 V DC) can be the same voltage as the aux. voltage.

As standard the aux. voltage can be between 18...31 Vdc. In cases where the aux. voltage is used for the -12 V and +12 V, this voltage must be stabilised and not higher than 25 V, and the same voltage must be used for supplying the rudder potentiometer itself.

Adjustment

The min. potentiometer (B) can be used to correct the zero position; e.g. if the rudder is located in centre position (0°), then the reading on the indicator can be corrected to indicate 0°.

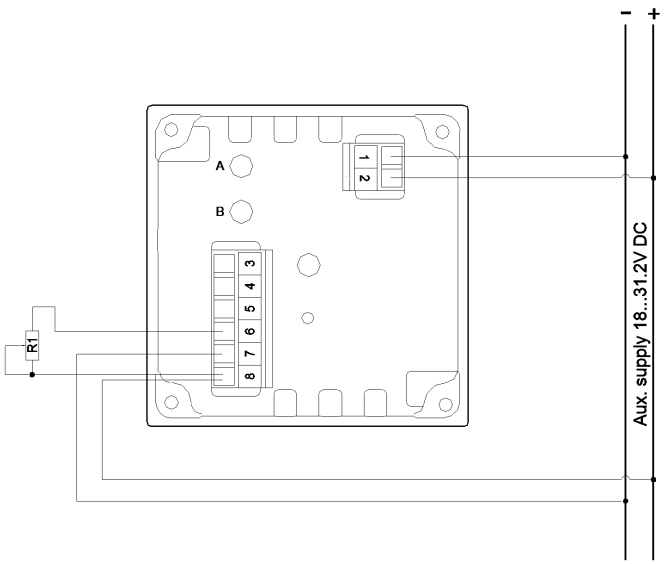
The max. potentiometer (A) can be used to correct the max. position; if the rudder is turned to max. port side or starboard side, then adjust by means of the potentiometer marked A until correct reading on the scale. The max. potentiometer has an extended adjustment range in the above version; the span can be adjusted to cover ±7.5 V to ±12.5 V.

More information
See **Commissioning** for more information about adjusting standard analogue input indicators.

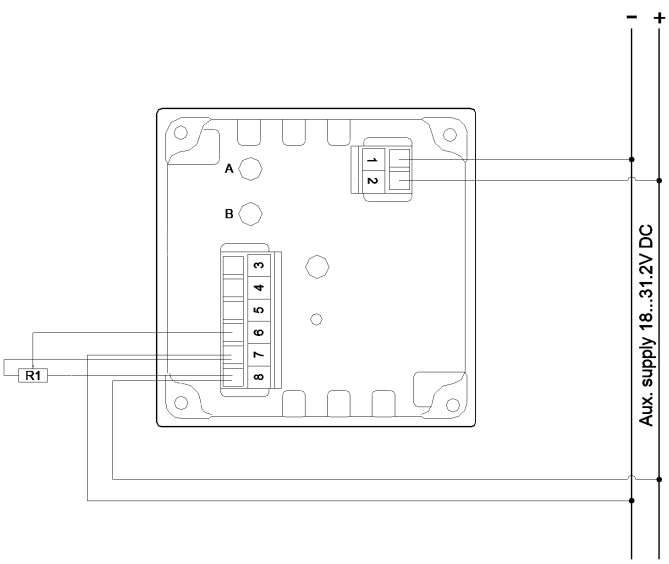
2.1.3 Dimmer setup for analogue indicators

The figures below illustrate the different ways of arranging a local dimmer on the XL indicators.

Method 1



Method 2



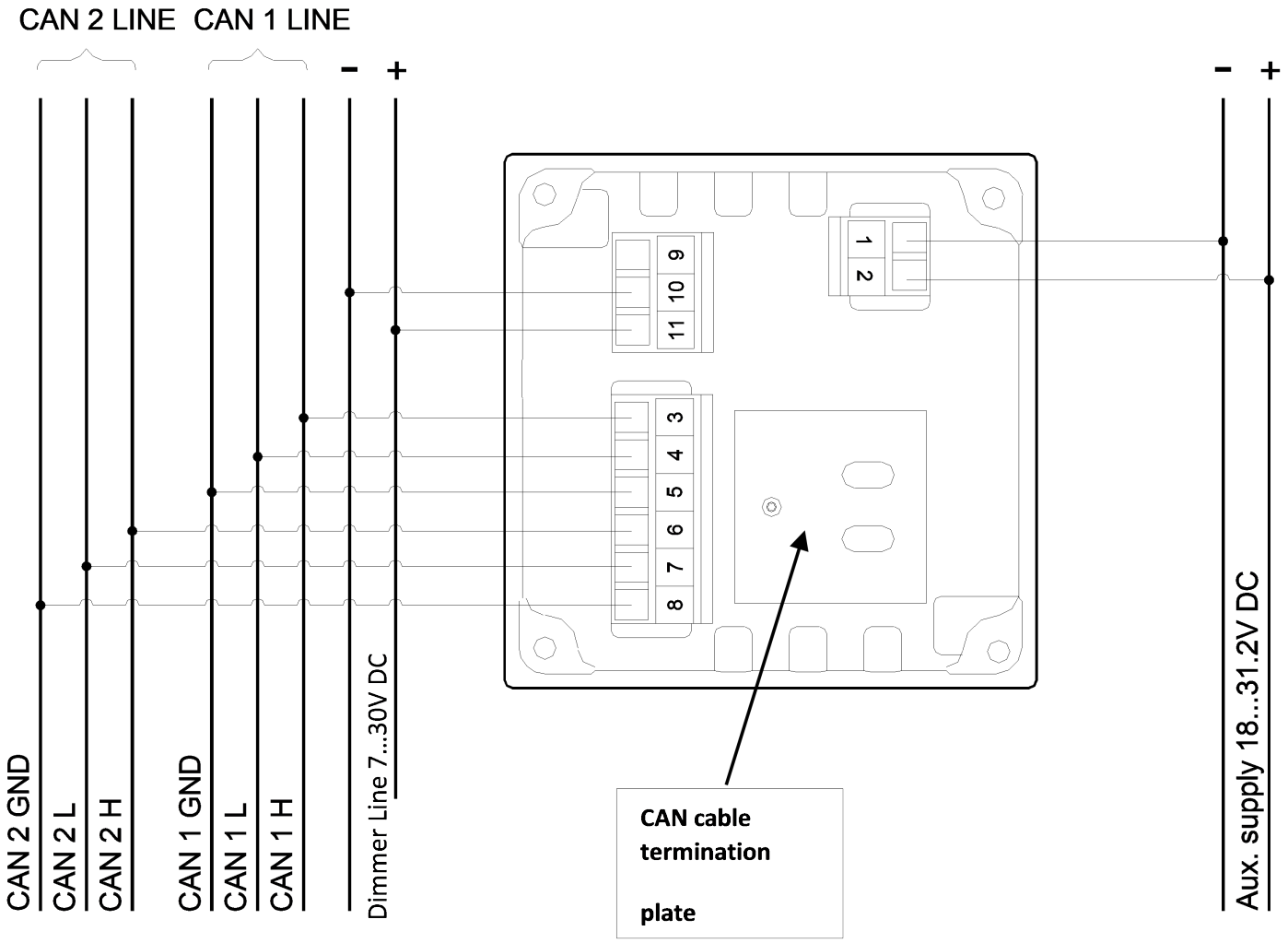
Method 1 illustrates a method for dimmer connection that adds a 10 kOhm potentiometer in series with the illumination input (terminal 6). This method is preferred, if the consumption has to be kept low. However, it is a disadvantage that the illumination cannot be set to total darkness.

Method 2 illustrates a method for dimmer connection that adds a 1 kOhm potentiometer as a voltage divider. This method has the advantage that the illumination can be set to total darkness. The disadvantage is that the consumption of the potentiometer is approximately 24 mA, even if illumination is set to total darkness.

It is also possible to use an external voltage for dimming the illumination. The regulation range from darkness to full illumination is 7 to 30 V DC. The consumption is 30 mA at 30 V DC.

2.1.4 Dual CANopen indicators

Pin number	Function		Note
1	Supply voltage	0 V	Consumption max. 150 mA
2		24 V	
3	CAN connection	CAN 1 H input	CAN 1 line
4		CAN 1 L input	
5		CAN 1 GND	
6		CAN 2 H input	CAN 2 line
7		CAN 2 L input	
8		CAN 2 GND	
9	Illumination analogue dimmer	NC	Dimmer input. Dimmer range 7 to 30 V DC Consumption max. 30 mA
10		Illumination GND	
11		Illumination +	



NOTE The plate shown at the arrow is for fastening the CAN cables with two strips. The strips are not included. Keep the isolation on the cables, so the screens are not mutually connected.

CAN ground

In general, CAN 1 GND and CAN 2 GND should not be connected. In case of noisy environments the cable screen from CAN cable 1 and 2 can be connected to input CAN 1 GND and to input CAN 2 GND on the indicator respectively.

NOTE It is recommended that the two cable screens for CAN 1 and CAN 2 are not connected.

More information

See **Commissioning** for more information about terminating the CANopen line.

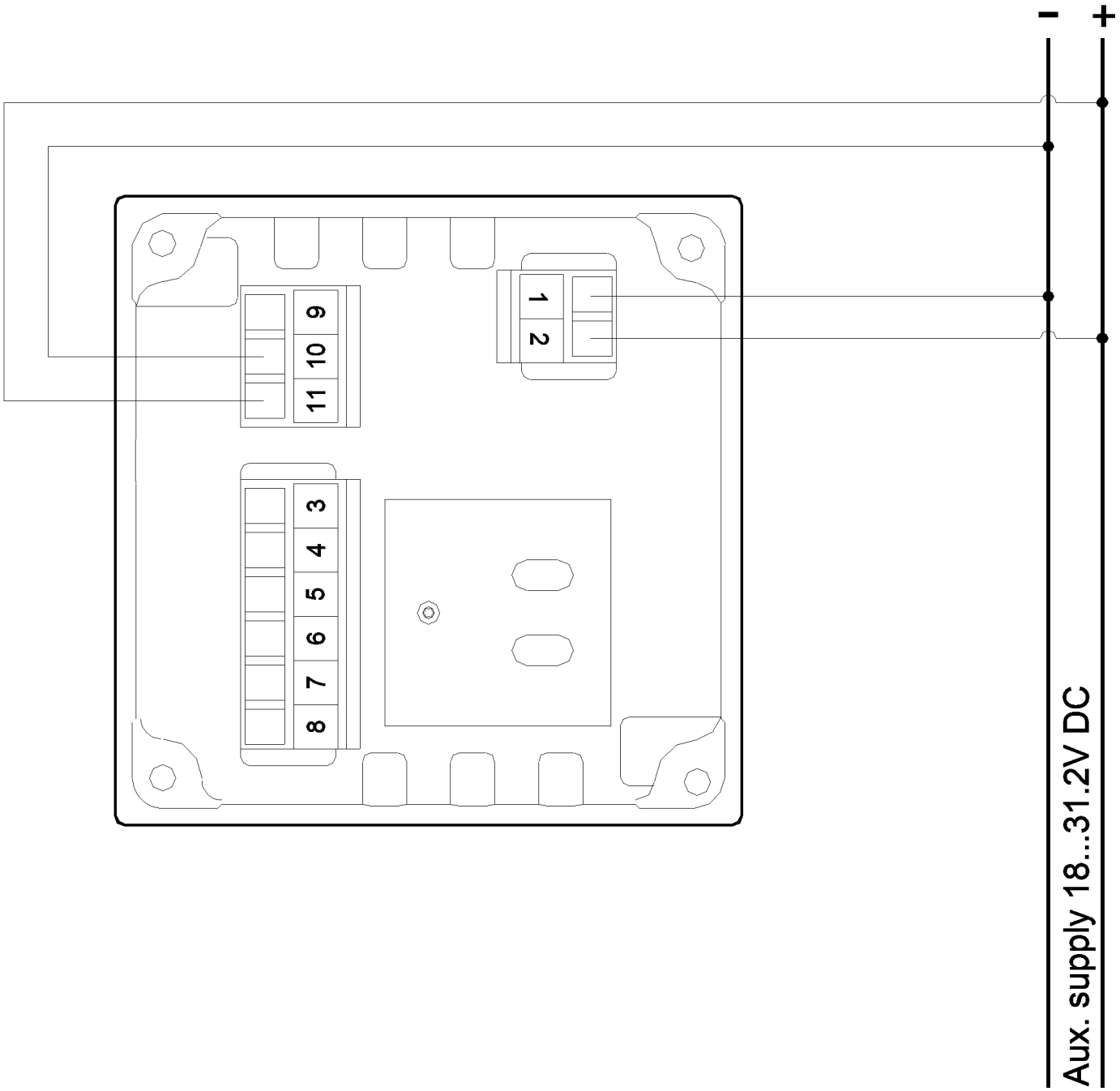
NOTE Remember to terminate both ends of the CANopen line with a 120 Ohm resistor.

2.1.5 Dimmer setup for dual CANopen indicators

The illumination can be controlled from the CANopen line or by the dimmer line on terminals 10 and 11.

To be able to control the illumination over the full range by means of the CANopen line, it is important that the voltage level on terminals 10 and 11 is approximately 24 V. This can be accomplished simply by connecting terminal 10 to terminal 1 and terminal 11 to terminal 2 using the aux. supply voltage as voltage input for the illumination.

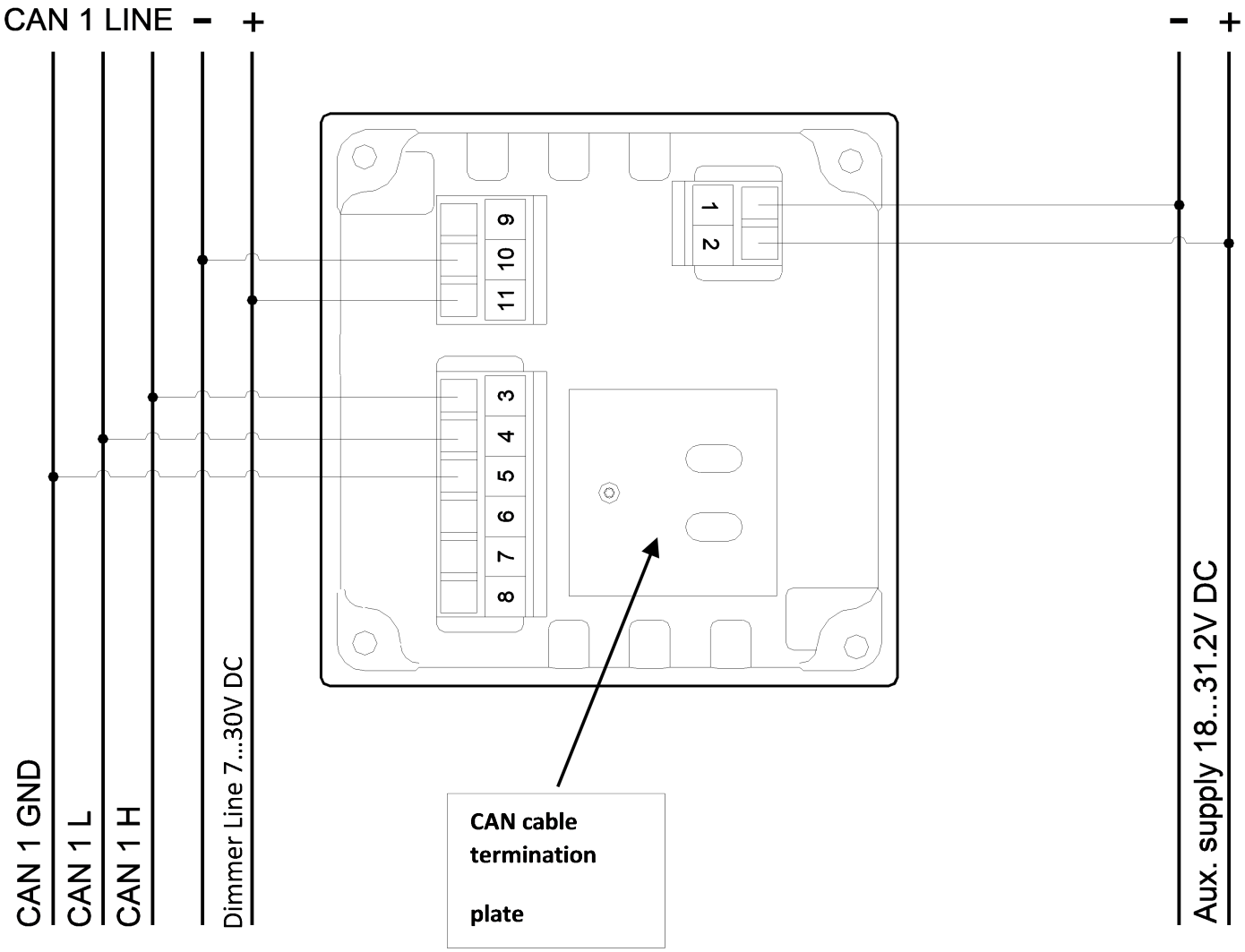
If the illumination is controlled from the dimmer line, the CANopen parameter for illumination must be set to 100 % (factory setting). Because the two systems influence each other, it is possible to adjust the illumination from both sources at the same time.



2.1.6 sCAN input indicators

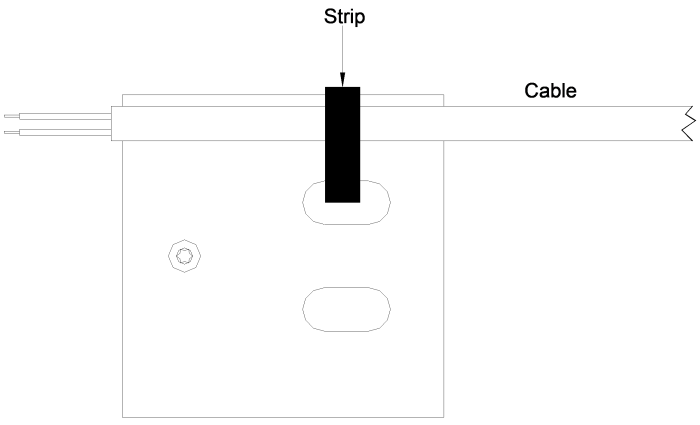
Pin number	Function		Note
1	Supply voltage	0 V	Consumption max. 150 mA
2		24 V	
3	CAN connection	CAN 1 H input	CAN 1 line (sCAN line)
4		CAN 1 L input	
5		CAN 1 GND	
6		Not used	Used for setting of min/zero/max with external switch (Pin 7-8). See section 6 for info.
7		Switch/button	
8		GND	

Pin number	Function		Note
9	Illumination analogue dimmer	NC	Dimmer input. Dimmer range 7 to 30 V DC Consumption max. 30 mA
10		Illumination GND	
11		Illumination +	



Optional calibration switch and resistor not shown, see **Commissioning** for details.

NOTE The plate shown at the arrow is for fastening the CAN cable with a strip. The strip is not included.

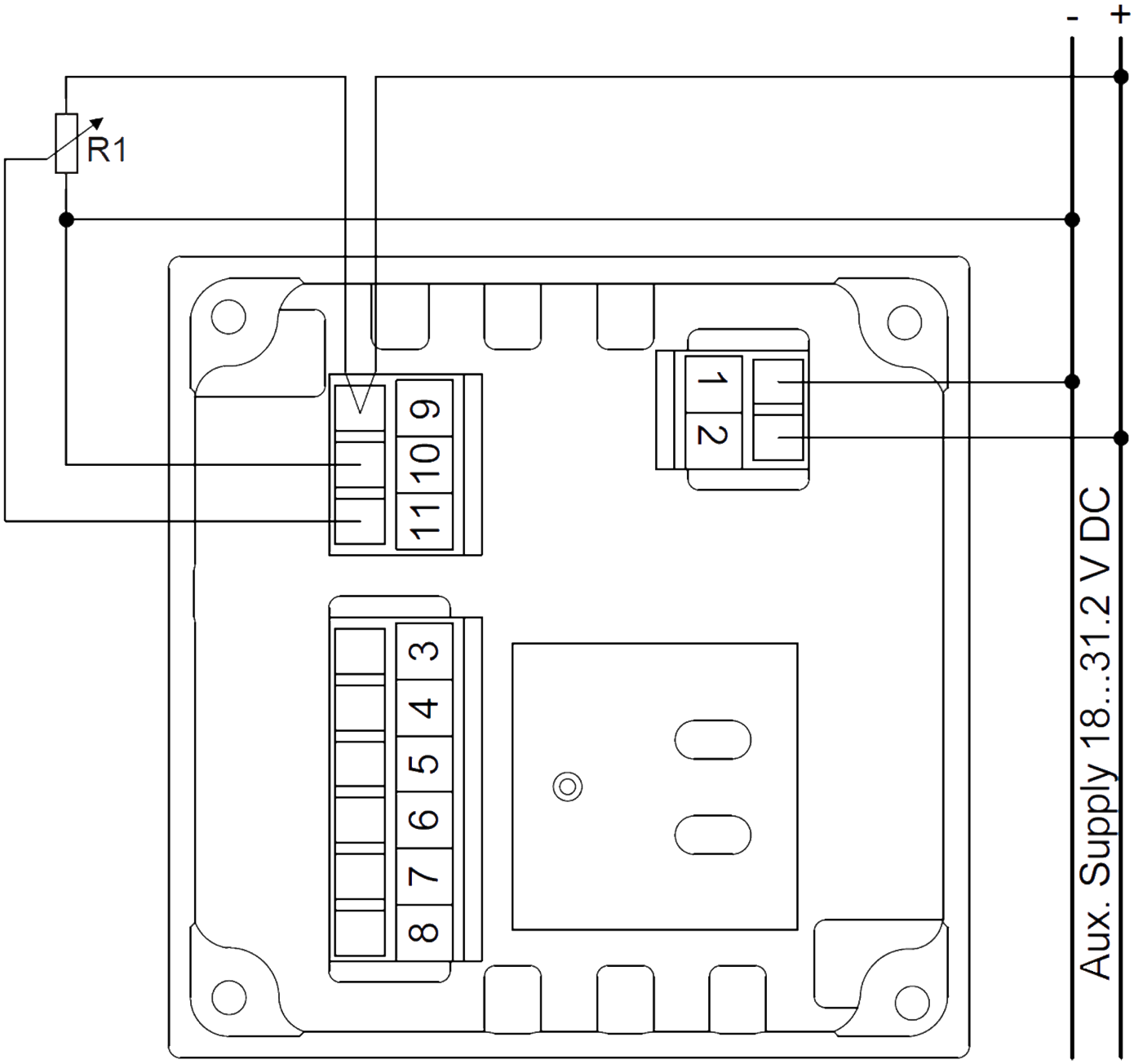


NOTE In general, CAN 1 GND should not be connected. In case of noisy environments, try to connect the cable screen to CAN 1 GND. Please also see **Commissioning**.

2.1.7 Dimmer setup for sCAN indicators

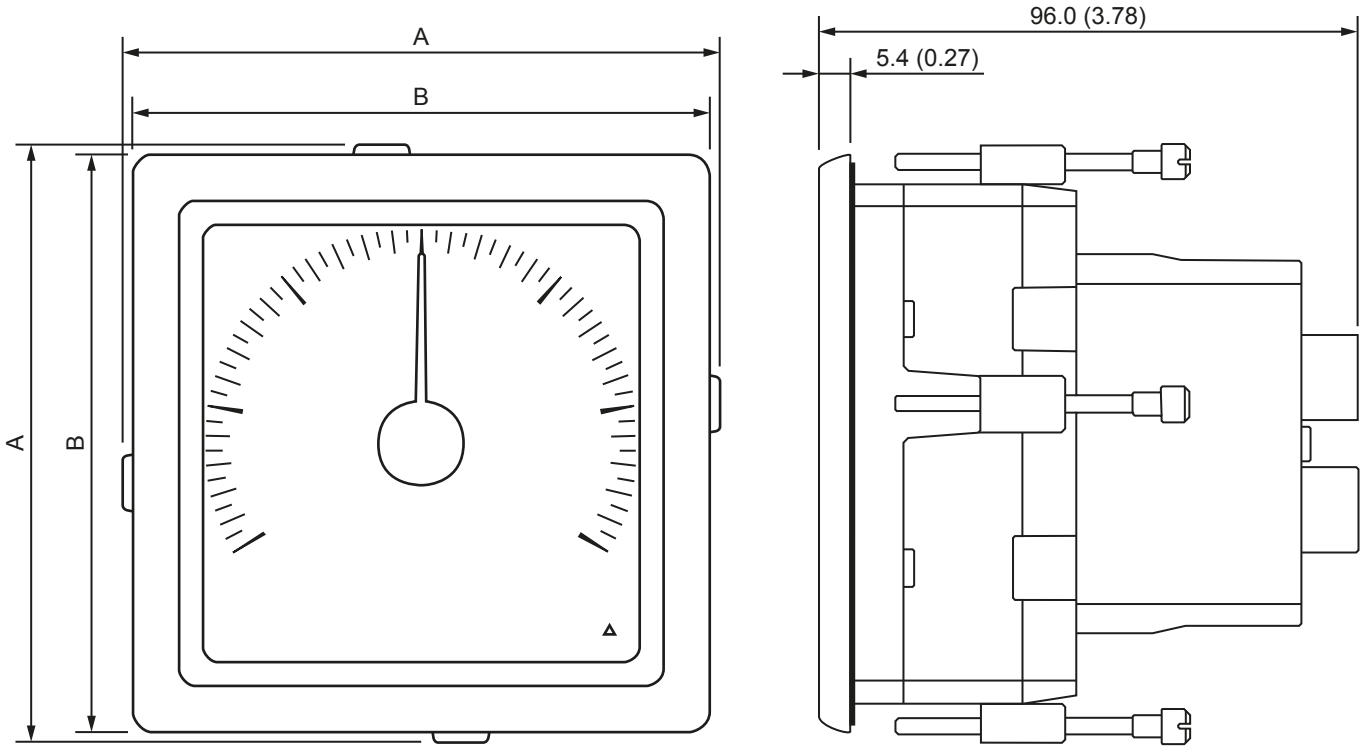
The illumination can only be controlled from the dimmer line on terminals 10 and 11.

A dimmer potentiometer (R1) can control one or several indicators, like the analogue types. As pin 9 is not used internally, it can be used as a wire junction point for easier wiring.



2.2 Dimensions and panel cutout

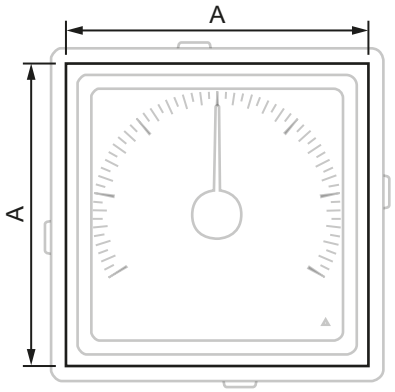
2.2.1 XL dimensions



XL dimensions in millimeters (inches)

Product	A	B
XL72	80.5 (3.17)	77.0 (3.03)
XL96	105.5 (4.15)	102.0 (4.02)
XL144	152.0 (5.99)	148.0 (5.83)
XL192	200.0 (7.88)	196.0 (7.72)

2.2.2 XL panel cutout



XL panel cutout dimensions

Indicator	A	Tolerance
XL72	68.5 (2.697)	-0.0/+0.7 (-0.0/+0.027)
XL96	92.5 (3.642)	-0.0/+0.8 (-0.0/+0.031)

Indicator	A	Tolerance
XL144	138.5 (5.453)	-0.0/+1.0 (-0.0/+0.039)
XL192	186.5 (7.343)	-0.0/+1.1 (-0.0/+0.043)

2.3 Mounting XL indicators

Mounting follows the standard DIN mounting for indicators. Use the fixing clamps to mount the indicator from the rear. Indicators with IP52 protection use two clamps for size 72 and 96 and four clamps for size 144 and 192. If the indicator is mounted according to IP66, use the gasket and all the clamps supplied, so the pressure on the gasket becomes uniform. See appendix for more information about indicator outlines.

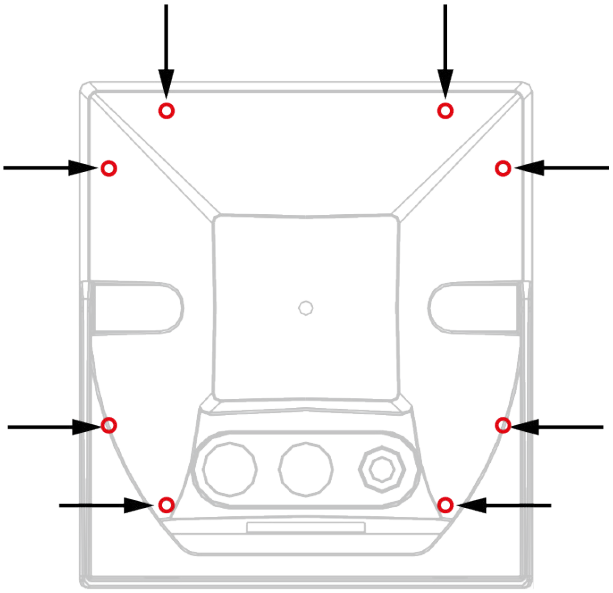
NOTE Mount the included (blue) gasket in the groove on the frame with the flat side in the groove and the rounded side oriented outward. Ensure that the gasket is evenly mounted.

3. BW wiring and installation

3.1 Wiring

To access the terminals, the bulkhead box must be removed by unscrewing the eight screws located on the rear side of the box. To reach the screws, use a torx T10 tool with a long bit (50 mm).

Location of the rear screws on BW144



NOTE BW192 also has eight screws.

Having unscrewed the bulkhead box, the indicator can be taken out of the box. The wiring of the BW terminals is identical to the description for XL instruments.

When the wiring is done, the indicator is remounted in the bulkhead box using the eight screws. Recommended torque for the screws is 0.8 Nm (±0.2). The included (black) gasket/frame is mounted in the groove on the indicator frame with the rubber rim side into the groove.

More information
See **XL wiring and installation, Wiring** for the wiring diagrams that can be used for BW.

3.1.1 Dimmer wiring

In addition to the PG glands, the bulkhead box is equipped with a potentiometer. This potentiometer is used for local dimmer for the indicator.

More information
See **XL wiring and installation, Wiring** for more information about how to wire the dimmer potentiometer.

3.1.2 Cable glands

The bulkhead box is equipped with two PG cable glands:

- BW144: PG9 (cable gauge: 5.0-8.0 mm)
- BW192: PG16 (cable gauge: 8.0-14.0 mm)

On delivery from DEIF, the two PG glands are sealed with protection blind plugs.

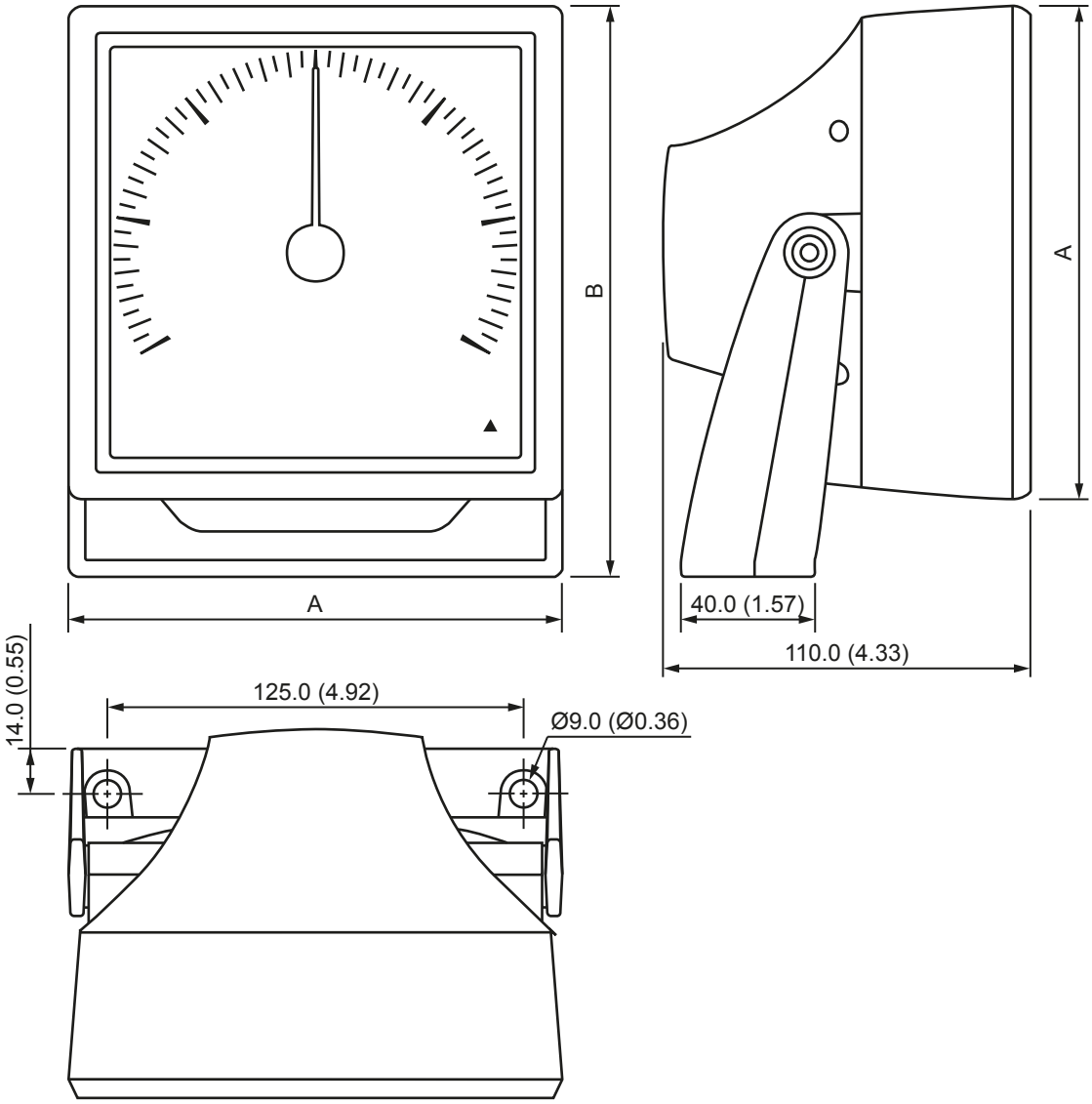
NOTE The PG glands cannot be changed to another size or type, as they are a vital part of the IP66 protection.

If the gauge of the installation cable is different from the above-mentioned, a junction box must be used to accomplish connection to the installation.

NOTE Remember to fasten the nut on the PG glands.

3.2 Dimensions and drilling template

3.2.1 BW dimensions

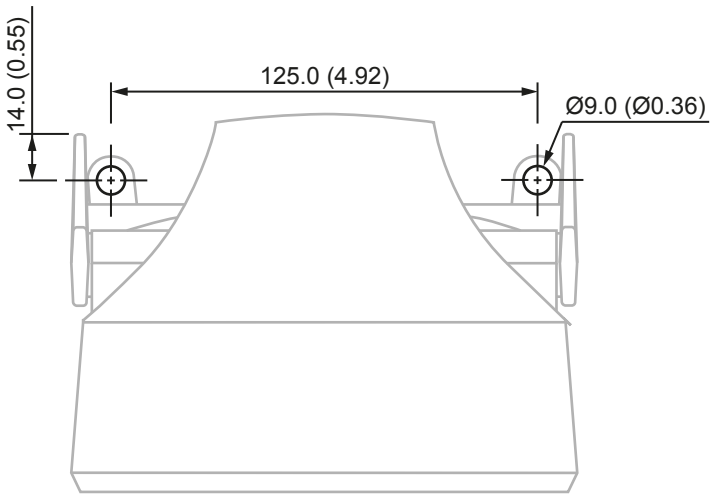


BW dimensions in millimeters (inches)

Product	A	B
BW144	148.0 (5.83)	171.0 (6.73)
BW192	196.0 (7.72)	219.0 (8.62)

NOTE There are two cable glands (PG 9, cable gauge 5 to 8 mm) on the rear of the unit.

3.2.2 Drilling template



NOTE The drawing is only a guideline and is not to scale.

3.3 Mounting BW indicators

To mount the indicator using the bracket, use two appropriate screws. These screws are not included.

The mounting bracket is asymmetrical and can therefore be arranged in two different ways.

NOTE The distances between the bracket screw holes on BW144 and BW192 are the same (125 mm).

4. BRW-2 wiring and installation

4.1 Wiring

4.1.1 Overview

BRW-2 is protected from ESD (static electricity), so no special protection from ESD is needed during mounting.

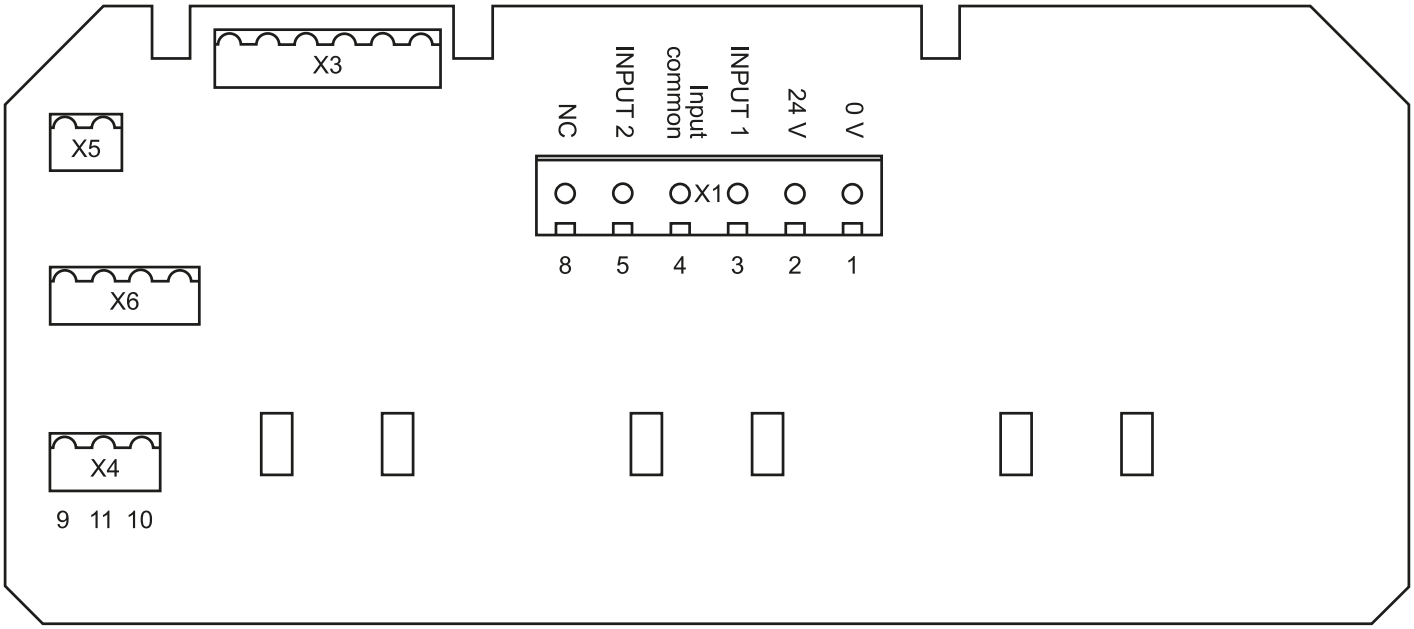
Dismount the potentiometer plate (use a standard 4 mm Allen key), and the connection terminals will be visible. Be careful not to damage the gasket when the potentiometer plate is dismounted from the housing.

Cable dimensions between 0.2 and 2.5 mm2 multi-stranded or max. 4 mm2 single-stranded can be used for the screw terminals. Cable entry is obtained via three PG21 glands. Cable dimensions 13-18 mm is possible with PG21 gland.

NOTE The PG glands cannot be changed to another size or type, as they are a vital part of the IP66 protection.

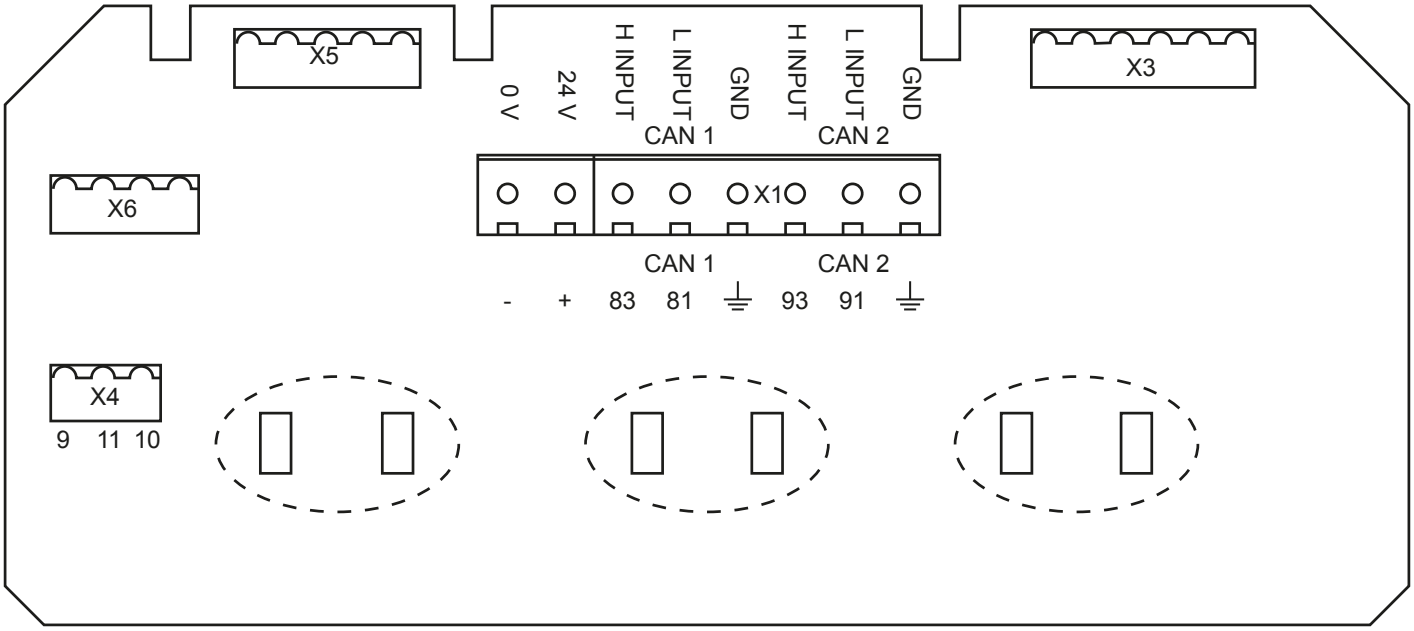
4.1.2 Analogue input terminal overview

Pin number	Function		Note
1	Supply voltage	0 V	
2		24 V	
3	Analogue input	Input 1 (Sin)	Input 1 and input common used for single input On 4 to 20 mA, input 1 is CW and input 2 CCW **Note: Input common is mutual for input 1 and input 2**
4		Input common	
5		Input 2 (Cos)	
8	NC		No connection
9	X4 connector Illumination	Orange wire	Dimmer potentiometer (10 kOhm)
10		Brown wire	
11		Red wire	Wiper on the dimmer potentiometer
A	Analogue adjustment	Max. adjustment	Max. and min. adjustment, sealed by label Located on the rear of the XL192
B		Min. adjustment	



4.1.3 CANopen input terminal connections

Pin no.	Function		Note
GND	CAN connection	CAN 1 GND	CAN 2 line/or for external switch for calibrating sCAN (see user manual)
L input		CAN 2 L input	
H input		CAN 2 H input	
GND		CAN 1 GND	CAN 1 line (sCAN line)
L input		CAN 1 L input	
H input		CAN 1 H input	
24 V	Supply voltage	24 V DC	
0 V		0 V DC	
9	X4 connector Illumination	Orange wire	Dimmer potentiometer (10 kOhm)
10		Brown wire	
11		Red wire	Wiper on the dimmer potentiometer

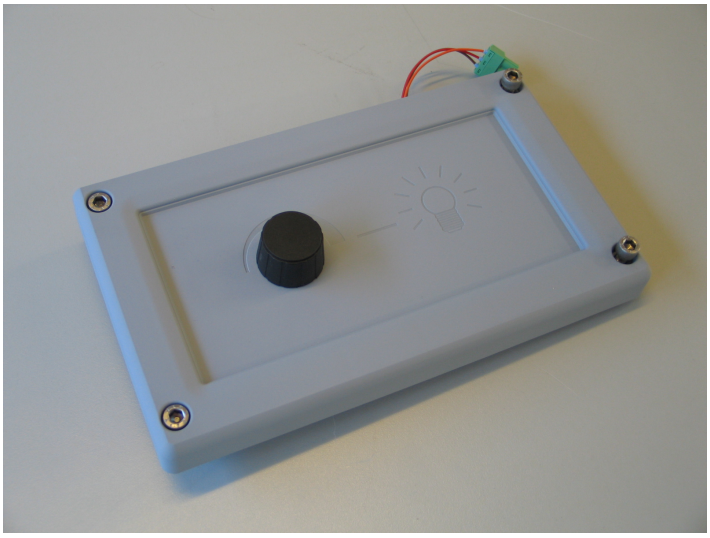


NOTE Use strips to terminate cable shields to PCB to avoid noise (see the dashed circles).
NOTE Jumpers J1 and J2 are used as end resistors (terminations) of CAN 1 and CAN 2. (Not shown on image.)

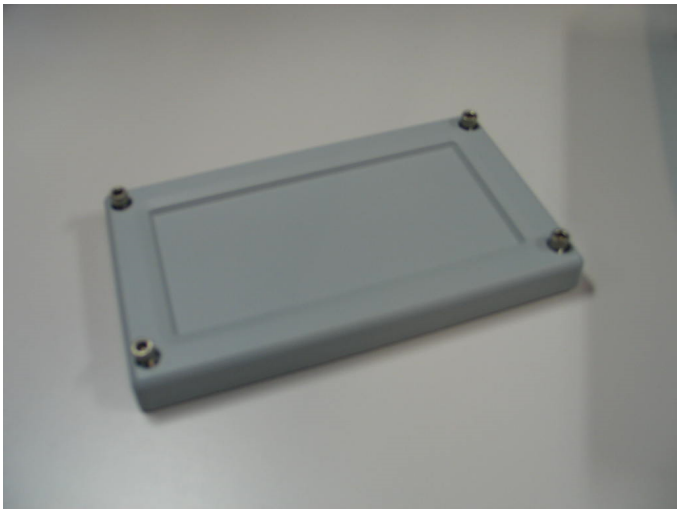
4.1.4 Dimmer wiring

The BRW-2 can be ordered with a built-in dimmer on the front plate for without a built-in dimmer.

Built-in dimmer:



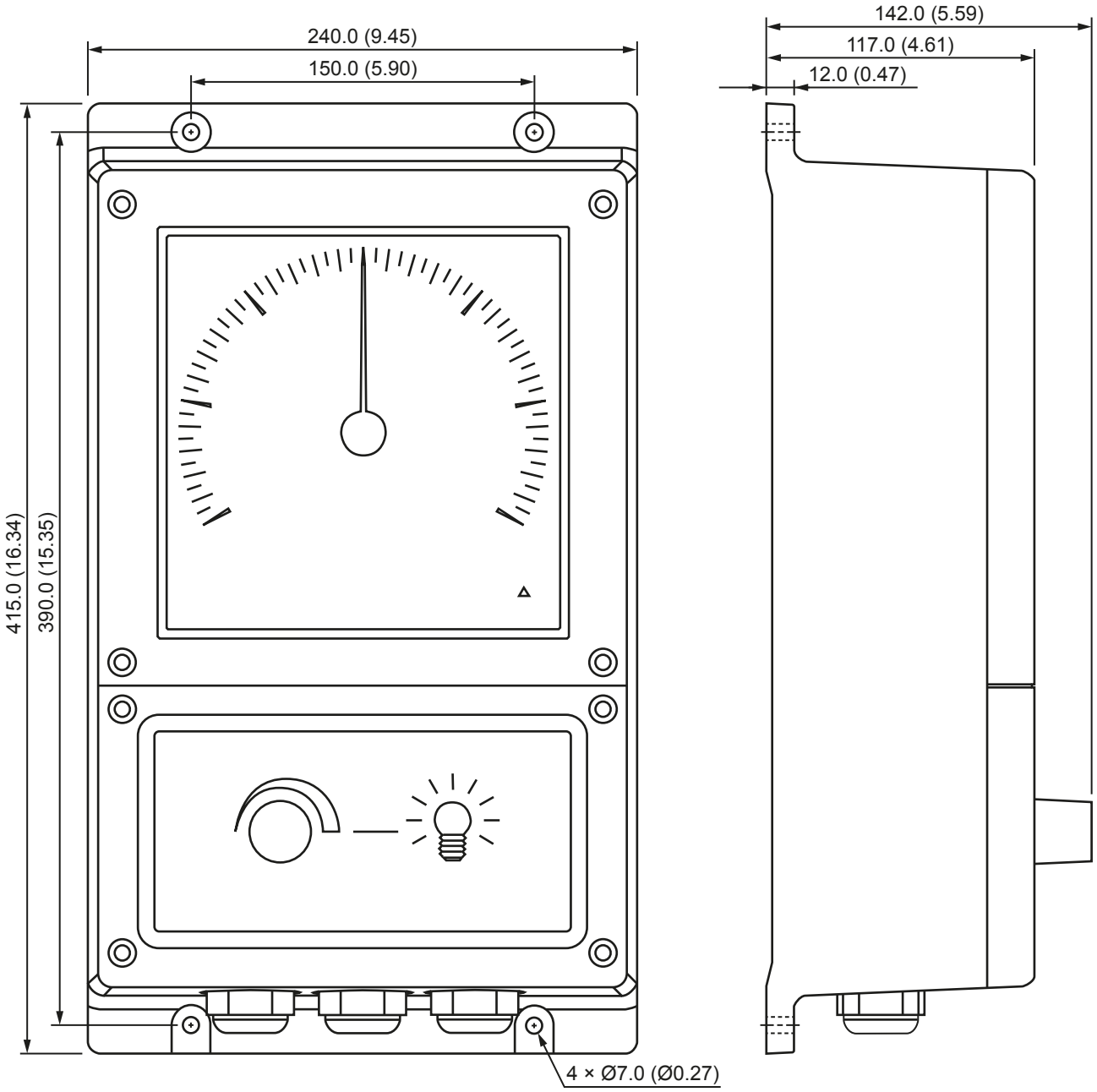
Blank front plate:



If version without built-in dimmer is used, an external dimmer can be connected by using X4 (terminal 9-10-11).

4.2 Dimensions and drilling template

4.2.1 BRW-2

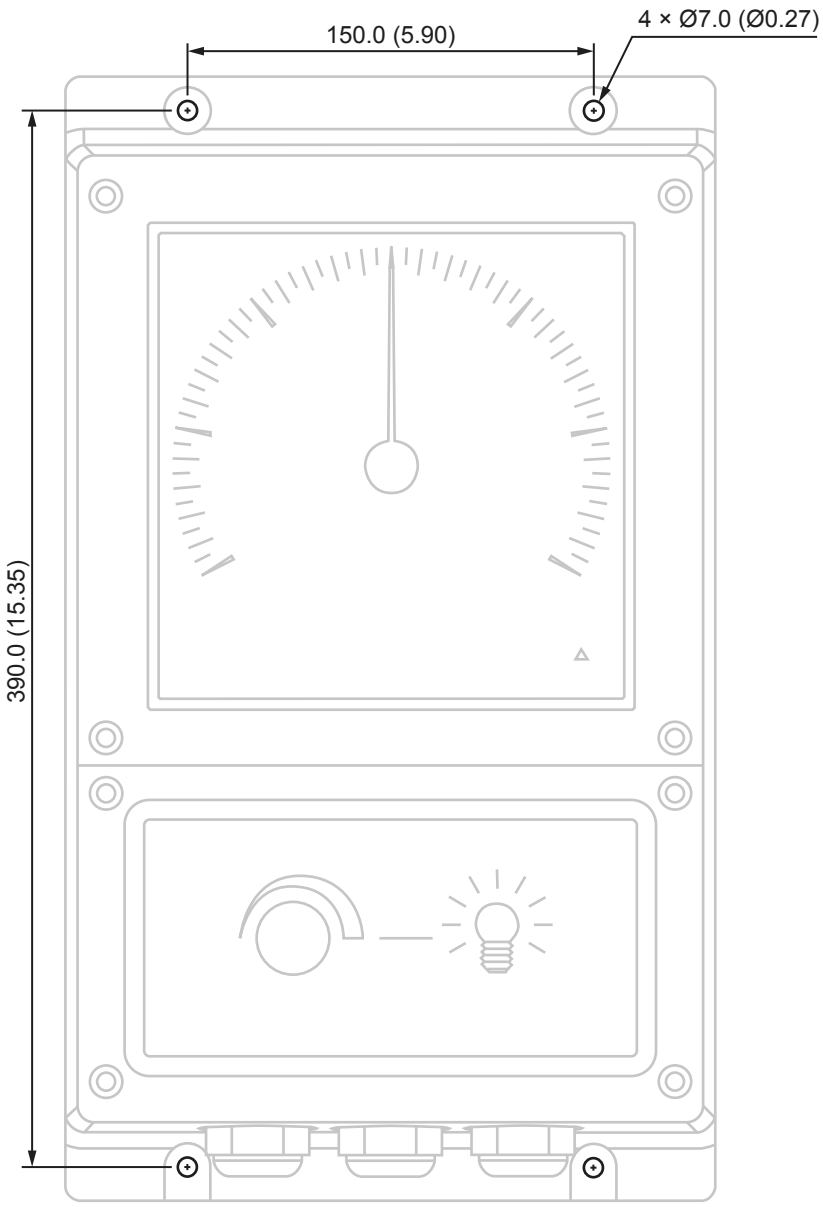


NOTE There are three cable glands (PG 21, cable gauge 13 to 18 mm) on the bottom of the unit.

If BRW-2 is ordered without an internal dimmer, a separate IP66 dimmer box can be ordered. Alternatively, order a dimmer kit for panel mounting.

Item number	Part	Description
2951890010-01	Dimmer box	Waterproof dimmer box for indicators, 10 kOhm potentiometer in IP66 plastic box with PG13.5/PG16 cable glands.
2951890010-02	Dimmer kit	Parts for dimming, dimmer potentiometer (1 kOhm) and fittings for panel mounting.

4.2.2 Drilling template



NOTE The drawing is only a guideline and is not to scale.

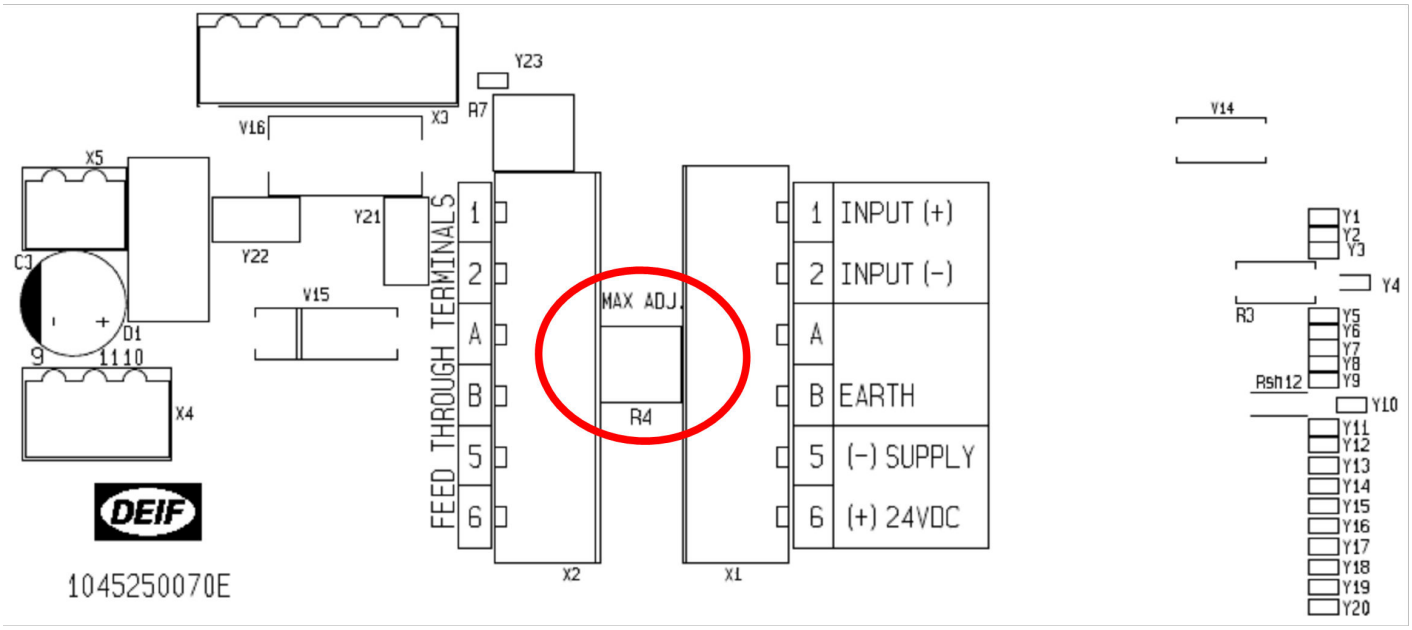
4.3 Replacement of XL192 indicator in BRW-2

4.3.1 Overview

This product is only relevant for replacement of existing BRW-1 products.

Standard voltage for supply and illumination is 24 V DC. Connect the illumination supply 24 V DC to terminals position 5 and 6. For personal protection, the terminal marked “EARTH” must be connected to the ship’s hull. This is also recommended in order to avoid static electricity influencing the instrument accuracy.

The potentiometer marked “MAX. ADJ” located between the two connectors can be used for small adjustments of the deflection of the instrument (ONLY available on the replacement PCB 1045250070C) to fit the scaling of the indicator to the existing installation.



The potentiometer R4 is used for fine adjustment of the deflection. The special replacement type has an accuracy of class 1.0 due to the external adjustment potentiometer R4.

Note that when replacing the XL192 indicator built into the BRW-2, the measuring range is either 0-1 mA or ±1 mA. The measuring range is indicated on the type label on the XL192 indicator.

4.3.2 Replacement instructions

The indicator inside the BRW-2 can be replaced with an XL192 indicator. If the original gasket was damaged an IP66 XL192 should be ordered as a repolacement part.

Tor replace the indicator:

1. Dismount the top frame by removing the four screws from the frame.
2. Take out the XL instrument (and note the measuring range on the product label).
3. Disconnect the mounted cables.
4. Mount the new XL instrument.
5. Mount the cables to the new XL instrument.
6. Place the gasket between the XL instrument and the base.
7. Mount the top frame.
8. Fasten the four screws in the frame. Recommended torque for the screws is 4.5 Nm (±0.2 Nm).

4.3.3 Adjustment help for analogue input indicators

When the XL192 has been removed for adjustment on the rear side, the instrument can be placed in the grooves in the BRW-2 housing, which makes it easier to perform adjustments because the installer has both hands free.

5. Commissioning

5.1 Commissioning preparation

Do not remove the protective plastic from the front window before the installation is approved by the class surveyor.

When the indicator is without power, the pointer position is random. When power is applied to the indicator, the pointer moves randomly for a few seconds. When the pointer settles position adjustment and commissioning can begin.

5.2 Commissioning analogue indicators

The XL and BW/BRW-2 indicators are equipped with an amber LED indicator located in the corner of the scale.

After power-up, the LED flashes once per second, and after two seconds the LED turns off. If there is an internal error (for example, the microprocessor stops) the LED continues flashing. Contact DEIF Customer Service if an internal error occurs.

After power-up and in case of incorrect input signal connected to the indicator (for example, the input signal is below minimum or above maximum) the pointer indicates the out-of-range condition after two seconds by moving pointer to the error position. This continues until the input is adjusted to be within the nominal input range. If the indicator has a 360° scale, the faulty input is also indicated by a flashing error LED.

The working range is -2 % to 102 % of the nominal input range. If the input is outside of the working range the pointer indicates “out of range”.

More information
See **Error handling** for more information about fault indication.

5.2.1 Special 4 to 20 mA functionality

The 4 to 20 mA single version has a special feature that makes it possible to change the pointer deflection from CW (4 to 20 mA on terminals 3-4) to CCW (20 to 4 mA on terminals 5-3).

The selection between the two inputs happens during each power-up of the indicator. During power-up, the two inputs search for a valid input signal. A valid input isgnal is in the range of 5 to 20 mA. When a valid input signal is detected on one of the inputs, the input is used until the indicator is powered off.

Note that:

- Due to product tolerances, the minimum input for valid detection is between 4 and 5 mA.
  - Use 5 mA to ensure detection
- When a valid input is present at both inputs simultaneously, no selection is made.
  - Only attach the input to the desired input terminals.
- At each power-up, the product searches for valid input.
- Even if input terminals 5-4 (CCW) are used, the indicator always starts up with a pointer position at the minimum error position, until the input value is greater than 5 mA.

5.2.2 Adjustment of single analogue input indicators

The zero point can be adjusted by means of the potentiometer named B. With a signal close to minimum input, e.g. -10...0... 10 V input, the corresponding point on the scale is adjusted using -9.5 V as input signal. Then connect +9.5 V to the input and adjust to correct reading by means of the potentiometer named A. Indicators with scale zero at scale midpoint must be adjusted to scale zero with B (zero) adjustment.

When the XL instrument is connected to a rudder transmitter, some adjustment may be necessary to match the indicator precisely to the transmitter. First, turn the rudder to give an input signal close to minimum and adjust the reading on the

scale by means of B (zero), then turn the rudder to give an input close to maximum and adjust the reading by means of A (max.).

NOTE It is not recommended to perform the minimum and the maximum adjustment with an input signal corresponding exactly to min. and max. input. For example, if the input signal is 0 V when adjusting a 0 to 10 V instrument. The potentiometer named B will not give any adjustment below the corresponding zero point on the scale, and there is a risk of adding an unwanted offset causing a linearity error over the whole scale. Similarly for the maximum adjustment.

NOTE Minimum adjustment must be performed before maximum adjustment.

5.2.3 Adjustment functionality

XL type	Potentiometer A	Potentiometer B
240 degree pointer	Maximum (or gain) adjustment Range: Approx. ±20 % of full scale Only use this when the pointer is in maximum position	Zero (or minimum) adjustment Range: Approx. ±10 % of full scale Use this for zero correction in minimum or midpoint position
360 degree pointer	At full CW, the EM (electrical middle) is as standard. At full CCW, the EM changes to +180 degrees of standard.	+/-10 degree digital offset of the pointer/disc. Similar to a mechanical adjustment on a moving coil indicator.

The maximum position is fully CW on CW types and fully CCW on CCW types.

If you need to revert to factory settings on the adjustment, place the potentiometers in the middle position.

5.2.4 Out of range definition

When the input is more than 2 % outside the nominal range (-2 to 102 %), the pointer moves to “out-of-range” position.

More information
See **Appendix A** for examples of out of range pointer positions.

Examples of out of range values

Out of range (low)	Working range	Out of range (high)
< 3.60 mA	3.60 to 4.00 to 12.00 to 20.00 to 20.40 mA	> 20.40 mA
< -0.2 V	-0.2 to 0.0 to 5.0 to 10.0 to 10.2 V	> 10.2 V
< -10.2 V	-10.2 to -10.0 to 0.0 to 10.0 to 10.2 V	> 10.2 V

NOTE The 2 % value is calculated from the maximum input value.

5.3 Commissioning sCAN indicators

The XL and BW/BRW-2 indicators are equipped with an amber LED indicator located in the corner of the scale.

After power-up, the LED is flashing once every second until a valid CAN signal is present. Then the LED turns off.

In the sCAN version, some basic setting can be performed on the system/indicators:

- Zero setting
- Minimum value setting
- Maximum value setting
- CW or CCW pointer movement selection

5.3.1 Start setup mode

The normally unused CAN 2 line is used as a set-up selector. The “CAN 2-L” (terminal 7) must be connected to “CAN 2 GND” (terminal 8) via an external switch and through a 10 k resistor.

When the switch is closed, the indicator is put into set-up mode and the time the switch is closed is used to select the different settings. The time the switch is opened again is used to select and store new values.

Protection of setup:

- Setup switch/input must not be “closed” the first 30 seconds after power-up. If it is “closed”, the calibration function will be inhibited until new power-up without “closed” calibration input.
- Calibration will not react to any input “Close” < 5 seconds (closed 5 seconds without any interruption).
- If the input is “closed” for >20 seconds, the calibration sequence is terminated without storing any change and a new sequence can first be started after an input “open” for at least 5 seconds.

The above should prevent an accidental short-circuit either a short glitch (a wire hitting the terminal) or continuous short-circuit to change any setting.

NOTE A power loss during setup can cause an incorrect setup. If power is lost during setup the process must be restarted.

5.3.2 Synchronise XL indicators over CAN

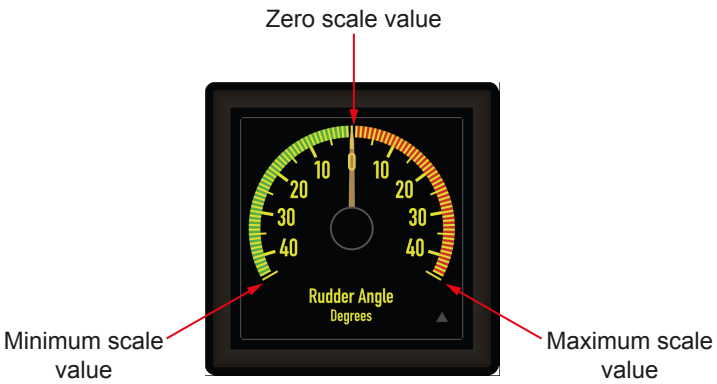
XL indicators using the same CAN-ID (that is listening for data coming from this CAN ID) will automatically be synchronised with the XL where the set-up process is performed.

5.3.3 Replacing indicators in a calibrated system

When an indicator is replaced in a calibrated system, the system has to be recalibrated.

5.3.4 Setup indicators without 360° scales

The indicator scale can be divided into two sections, minimum to zero and zero to maximum.



Set zero position

The sensor/input must be positioned at desired zero value and on the indicator, the set-up switch must be closed:

- After 5 seconds, the indicator pointer will move to 0 degree (just check, no action).
- Between 5 and 10 seconds, the new zero scale value is stored when set-up switch is opened (the LED will flash once for verification).

NOTE When controlled by a processor, a switch close time of 5.5 to 9.5 sec must be used.

If no new value was stored (switch still closed), wait until >20 seconds. Then the calibration sequence will be terminated without storing a new setting and the indicator pointer will move back to the scale position given by the present sensor/ input value (normal mode).

Set minimum position

The sensor/input must be positioned at desired minimum value and on the indicator, the set-up switch must be closed:

- After 5 seconds, the indicator pointer will move to scale zero (just check, no action)
- After 10 seconds, it will move to maximum scale value (check, no action)
- After 15 seconds, it will move to minimum scale value (check, no action)
- Between 10 and 15 seconds, the new maximum scale value is stored when set-up switch is opened (the LED will flash once for verification)

NOTE When controlled by a processor, a switch close time of 15.5 to19.5 seconds must be used.

If no new value was stored (switch still closed), wait until >20 seconds. Then the calibration sequence will be terminated without storing a new setting and the indicator pointer will move back to the scale position given by the present sensor/ input value (normal mode).

Set maximum position

The sensor/input must be positioned at desired maximum value and on the indicator, the set-up switch must be closed:

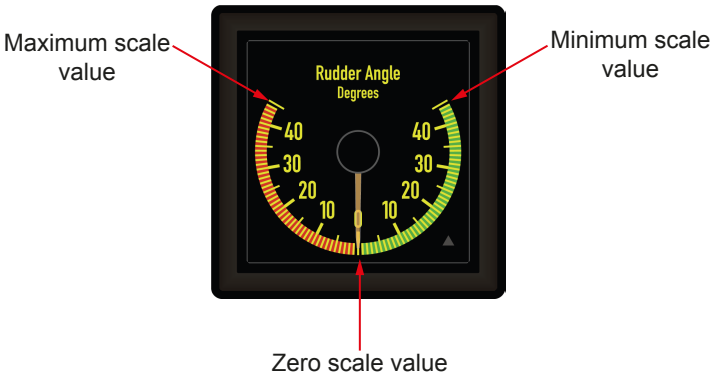
- After 5 seconds, the indicator pointer will move to scale zero (just check, no action)
- After 10 seconds, it will move to maximum scale value (check, no action)
- Between 10 and 15 seconds, the new maximum scale value is stored when set-up switch is opened (the LED will flash once for verification)

NOTE When controlled by a processor, a switch close time of 10.5 to 14.5 seconds must be used.

If no new value was stored (switch still closed), wait until >20 seconds. Then the calibration sequence will be terminated without storing a new setting and the indicator pointer will move back to the scale position given by the present sensor/ input value (normal mode).

Changing pointer rotation

If it is necessary to change the pointer rotation from the default CW to CCW, this can be done by placing the input/sensor maximum value at scale minimum and the input/sensor minimum value at scale maximum.



This could be relevant on rudder indicators where the pointer is “hanging” as shown above, and in systems (same sensor) where they are used together with the “standing” pointer as shown previously.

On both indicators, the shown rudder angle 45 degree port side (red) is set-up as maximum value. This will give the “standing” type CW pointer rotation and the “hanging” CCW pointer rotation.

5.3.5 Setup indicators with 360° scales

Set zero position

The sensor/input must be positioned at desired zero value and on the indicator, the set-up switch must be closed:

- After 5 seconds, the indicator pointer will move to 0 degree (just check, no action).
- Between 5 and 10 seconds, the new zero scale value is stored when set-up switch is opened (the LED will flash once for verification).

NOTE When controlled by a processor, a switch close time of 5.5 to 9.5 sec must be used.

If no new value was stored (switch still closed), wait until >20 seconds. Then the calibration sequence will be terminated without storing a new setting and the indicator pointer will move back to the scale position given by the present sensor/ input value (normal mode).

Set CCW rotation

On the indicator, the set-up switch must be closed:

- After 5 seconds, the indicator pointer will move to scale zero (just check, no action)
- After 10 seconds, the pointer will present input values as CCW
- After 15 seconds, it will move to minimum scale value (check, no action)
- Between 10 and 15 seconds, CCW rotation value is stored when set-up switch is opened (the LED will flash once for verification)

NOTE When controlled by a processor, a switch close time of 10.5 to14.5 seconds must be used.

If no new value was stored (switch still closed), wait until >20 seconds. Then the calibration sequence will be terminated without storing a new setting and the indicator pointer will move back to the scale position given by the present sensor/ input value (normal mode).

Set CW rotation

On the indicator, the set-up switch must be closed:

- After 5 seconds, the indicator pointer will move to scale zero (just check, no action)
- After 10 seconds, the pointer will present input values as CCW
- After 15 seconds, the pointer will present input values as CW
- Between 15 an 20 seconds, CW rotation value is stored when set-up switch is opened (the LED will flash once for verification)

NOTE When controlled by a processor, a switch close time of 15.5 to 19.5 seconds must be used.

If no new value was stored (switch still closed), wait until >20 seconds. Then the calibration sequence will be terminated without storing a new setting and the indicator pointer will move back to the scale position given by the present sensor/ input value (normal mode).

5.4 Commissioning Single and Dual CANopen indicators

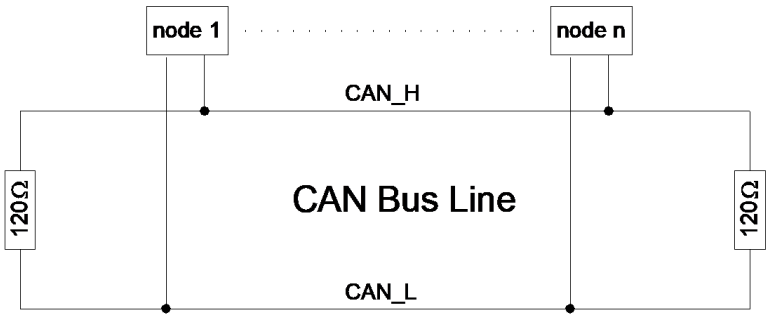
After power-up the LED is flashing once every second, and after two seconds the LED is turned off.

If the LED keeps flashing, there is no communication over both CANopen lines. If the microprocessor stops, the heartbeat signal on the CAN bus is interrupted and the error LED keeps flashing.

The default setup of the CANopen is Baud rate 125 kbit/s, alternatively the Baud rate can be changed to 250 kbit/s. For further information regarding the CAN communication, please see the CAN specification manual at www.deif.com.

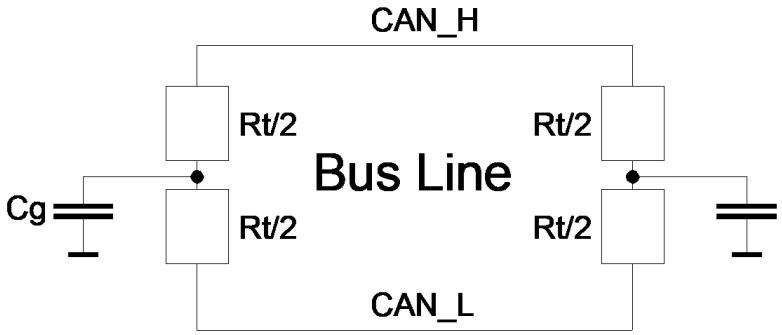
5.4.1 Termination of the CANopen line

To accomplish safe communication over the CANopen line, termination of the cable is very important (see the drawing below). The applied cable must be of the type twisted pair with screen, e.g. 2×2×0, 50 mm2, e.g. LIYCY-P from Solar. The maximum length at Baud rate 125 kbit/s is 500 m, and 250 m at Baud rate 250 kbit/s.



NOTE The cable screen must never be connected to earth.
NOTE In case the communication is interrupted because of noise, connect the cable screen to terminal 5 and also 8, if dual CAN is used, on all instruments in the loop.
NOTE It is recommended that the two cable screens for CAN 1 and CAN 2 are not connected.

If the environment is very noisy (electrical noise), the below-mentioned arrangement can be used for enhanced EMC characteristics.

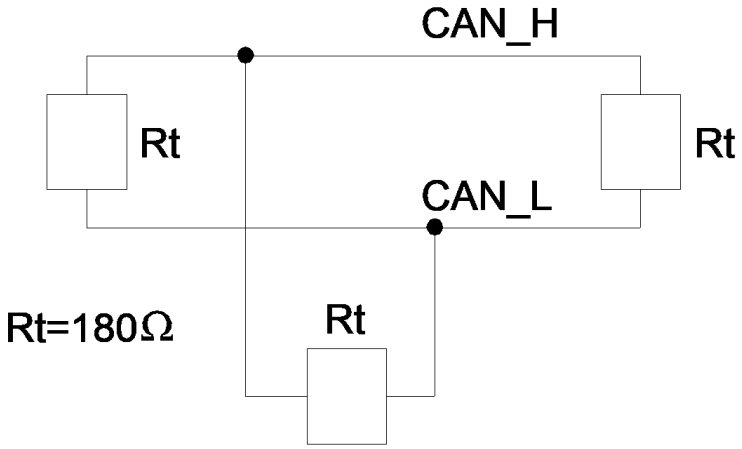


Rt/2 = 60 Ohm, Cg = 10...100nF

The capacitor should be connected to a “quiet” ground level, e.g. the screen of the used cable, that is then connected to the GND input on each illuminator.

NOTE The capacitor must never be connected to any other ground, e.g. the earth or the hull of the ship.

The example below shows how a CAN line different from a single line structure can be arranged. In the example a star topology with three branches is shown. To accommodate such a topology, the multiple termination concepts may be considered. Note the value of the used termination resistors.



5.5 Error handling

5.5.1 Analogue 240° indicators

Indicator status	Error LED	Pointer	Remark
Power-up	Flashes two or three times	Random, then moving to actual value or error position	Pointer moves uncontrollably for a few seconds, this is normal operation
Input within range	OFF	Actual reading	Normal state
Input out of range	OFF Flashes twice when re-entering normal state	In error position 2-3 degrees outside scale arc in relevant side	Pointer stops at scale max./min. for two seconds and moves to error position
Power-down (power off)	OFF	Moves to random position (not locked)	External PSU supervision is recommended
Internal error (watch dog)	Continuous flashing	Random	Unit must be returned to DEIF for service

5.5.2 Analogue 360° indicators

Indicator status	Error LED	Pointer	Remark
Power-up	Flashes two or three times	Random, then moving to actual value or error position	Pointer moves uncontrollably for a few seconds, this is normal operation
Input within range	OFF	Actual reading	Normal state
Input out of range	Continuous flashing	Random, typically last valid reading	As no pointer position can be used as error, LED is flashing instead
Power-down (power off)	OFF	Moves to random position (not locked)	External PSU supervision is recommended
Internal error (watch dog)	Continuous flashing	Random	Unit must be returned to DEIF for service

5.5.3 CAN 240° indicators

Indicator status	Error LED	Pointer	Remark
Power-up	Flashes two or three times	Random, then moving to actual value or error position	Pointer moves uncontrollably for a few seconds, this is normal operation
Input within range	OFF	Actual reading	Normal state
Input out of range	OFF Flashes twice when re-entering normal state	In error position 5 degrees outside scale arc in relevant side	Pointer stops at scale max./min. for two seconds and moves to error position
Missing CAN	Continuous flashing	Moves to error position EM +180°	
Power-down (power off)	OFF	Moves to random position (not locked)	External PSU supervision is recommended
Internal error (watch dog)	Continuous flashing	Random	Recheck that this is not a CAN error Unit must be returned to DEIF for service

5.5.4 CAN 360° indicators

Indicator status	Error LED	Pointer	Remark
Power-up	Flashes two or three times	Random, then moving to actual value or error position	Pointer moves uncontrollably for a few seconds, this is normal operation
Input within range	OFF	Actual reading	Normal state
Input out of range	Flashing	Random, typically last valid reading	As no pointer position can be used as error, LED is flashing instead
Missing CAN	Continuous flashing	Moves to error position EM +180°	Error position is also valid reading
Power-down (power off)	OFF	Moves to random position (not locked)	External PSU supervision is recommended
Internal error (watch dog)	Continuous flashing	Random	Recheck that this is not a CAN error Unit must be returned to DEIF for service

6. Appendix A - Pointer position examples

The pointer positions of the indicators at different inputs depend on the configuration of the indicator. The pointer positions in the example are for an analogue pitch indicator with a range of 4 to 20 mA. The pointer rotates in a clockwise direction when the indicator receives a positive input.

Table 6.1 Pointer positions based on input

Minimum value (4 mA)	Electrical middle (12 mA)	Maximum value (20 mA)
		

Table 6.2 Pointer error positions

Minimum	Electrical middle + 180°	Maximum
		

7. Appendix B: Pointer positions based on input

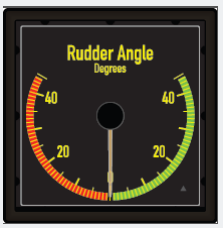
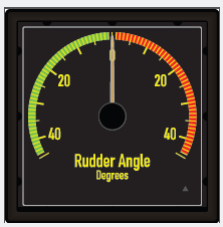
7.1 Standard analogue indicators

Input type	Input 1	Input 2	Pointer position (scale)	STD design: EM=12 Pointer CW
4 to 20 mA	4 mA	-	-45	
0 to 10 V	0 V	-		
-10 to 0 to 10 V	-10 V	-		
4 to 20 mA	12 mA	-	0	
0 to 10 V	5 V	-		
-10 to 0 to 10 V	0 V	-		
4 to 20 mA	20 mA	-	+45	
0 to 10 V	10 V	-		
-10 to 0 to 10 V	10 V	-		

7.2 Rudder indicators

When used in a system with TRI-2, XL must be CCW, or TRI-2 must be 20 to 4 mA and XL CW.

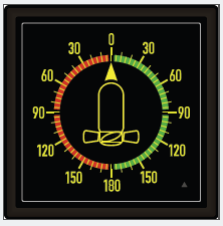
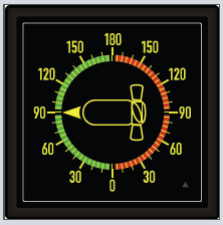
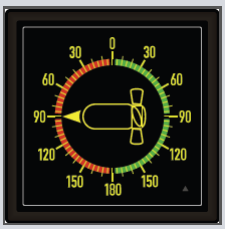
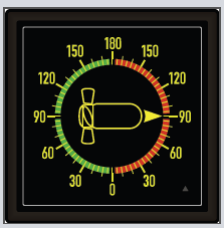
XL 4 to 20 mA can be changed from CW to CCW by the customer, and RT-2 can also be changed from CW to CCW during installation.

Input type	Input 1	Input 2:	Pointer position (scale)	FWD design: EM=6 Pointer CCW1	AFT design: EM=12 Pointer CCW*
4 to 20 mA	-	4 mA	-45		
0 to 10 V	0 V	-			
-10 to 0 to 10 V	-10 V	-			
4 to 20 mA	-	12 mA	0		
0 to 10 V	5 V	-			
-10 to 0 to 10 V	0 V	-			

Input type	Input 1	Input 2:	Pointer position (scale)	FWD design: EM=6 Pointer CCW1	AFT design: EM=12 Pointer CCW*
4 to 20 mA	-	20 mA	+45		
0 to 10 V	10 V	-			
-10 to 0 to 10 V	10 V	-			

*** Note:** Make sure that the pointer rotation matches other indicators/transmitters in the system (TRI-2, RT-2, etc.).

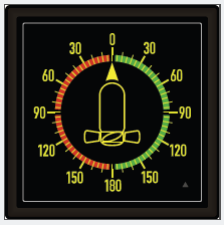
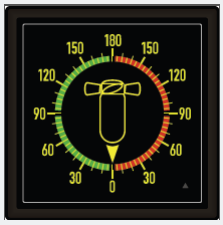
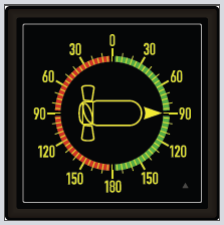
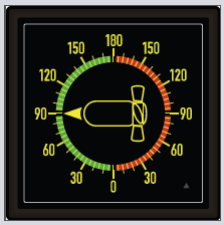
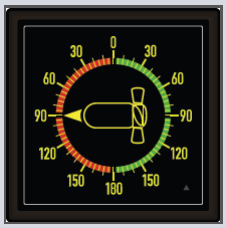
7.3 Standard azimuth indicators

Input type	Input 1	Input 2	Pointer position (scale)	FWD design: EM=12** Pointer CW*	AFT design: EM=6** Pointer CW*
4 to 20 mA	4 mA	-	0		
0 to 10 V	0 V	-			
-10 to 0 to 10 V	-10 V	-			
4 to 20 mA	8 mA	-	+90		
0 to 10 V	2.5 V	-			
-10 to 0 to 10 V	-5 V	-			
4 to 20 mA	12 mA	-	180		
0 to 10 V	5 V	-			
-10 to 0 to 10 V	0 V	-			
4 to 20 mA	16 mA	-	-90		
0 to 10 V	7.5 V	-			
-10 to 0 to 10 V	5 V	-			

*** Note:** Make sure that the pointer rotation matches other indicators/transmitters in the system (RTA-602, etc.).

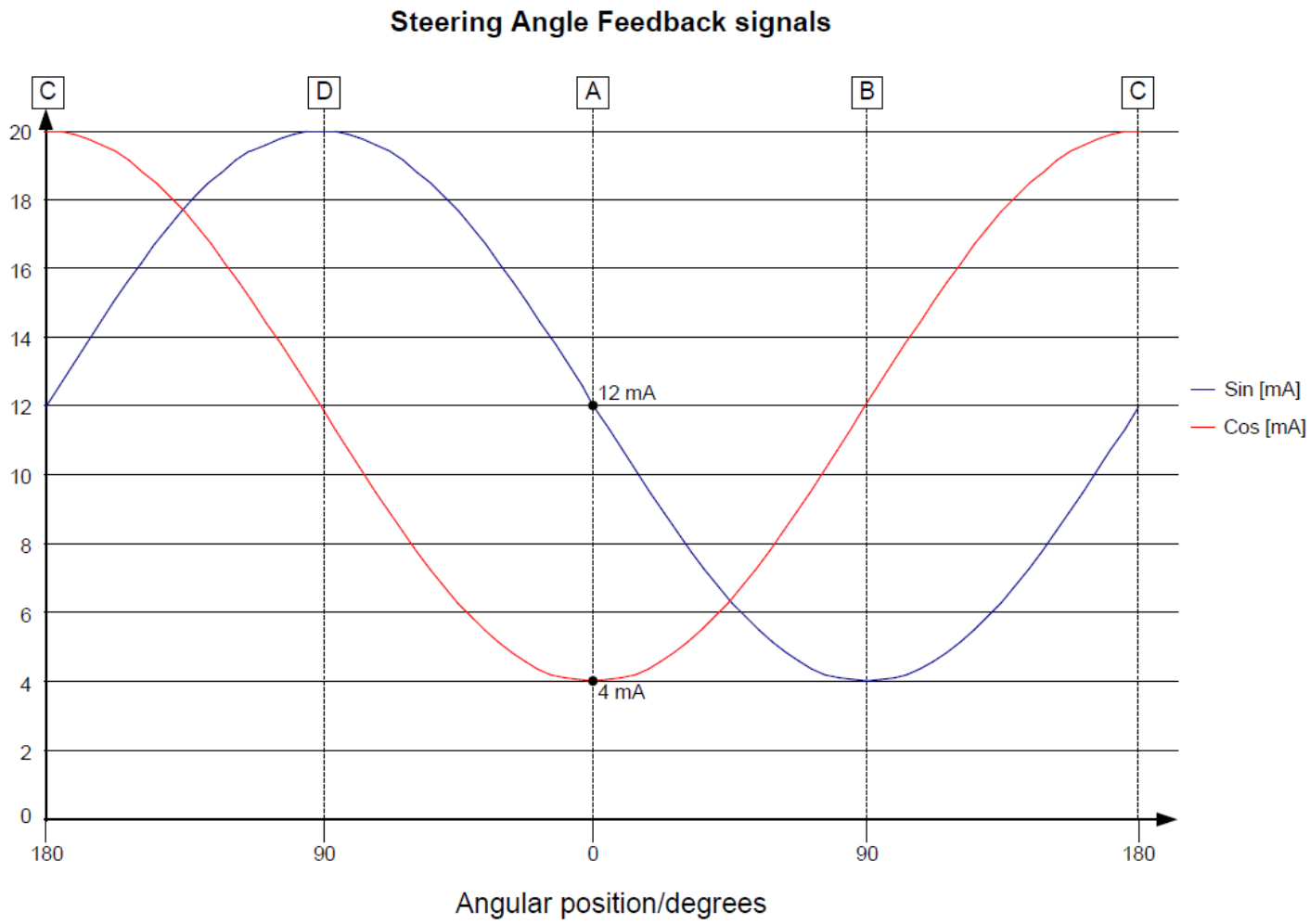
**** Note:** EM can be changed 180 degrees (from 6 →12 or 12 → 6) by turning the rear side adjustment potentiometer A.

7.4 Analogue SIN/COS azimuth indicators

Input type	Input 1	Input 2	Pointer position (scale)	FWD design: EM=12** Pointer CW*	AFT design: EM=6** Pointer CW*
4 to 20 mA	12 mA	4 mA	0 (A)		
0 to 10 V	5 V	0 V			
-10 to 0 to 10 V	0 V	-10 V			
4 to 20 mA	4 mA	12 mA	+90 (B)		
0 to 10 V	0 V	5 V			
-10 to 0 to 10 V	-10 V	0 V			
4 to 20 mA	12 mA	20 mA	180 (C)		
0 to 10 V	5 V	10 V			
-10 to 0 to 10 V	0 V	10 V			
4 to 20 mA	20 mA	12 mA	-90 (D)		
0 to 10 V	10 V	5 V			
-10 to 0 to 10 V	10 V	0 V			

*** Note:** Make sure that the pointer rotation matches other indicators/transmitters in the system (RTA-602, etc.).

**** Note:** EM can be changed 180 degrees (from 6 →12 or 12 → 6) by turning the rear side adjustment potentiometer A.


Steering Angle Feedback signals
C
D
A
B
C
20
18
16
14
12
10
8
6
4
2
0
12 mA
4 mA
Sin [mA]
Cos [mA]
180
90
0
90
180
Angular position/degrees