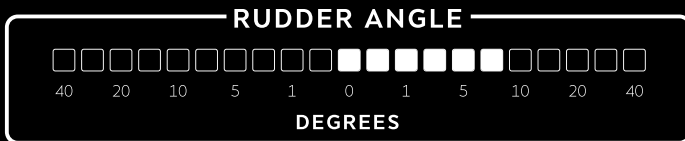




Electrical Solutions & Control Stations

# RUDDER ANGLE INDICATOR

v2.0



*User Manual*





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## I. OVERVIEW

IMED's Rudder Angle Indicator (RAI) displays the rudder angle/order in real time. The design is microcontroller based which makes it easy to configure and eliminates the need for any trim pots, etc. IMED's RAI will work directly off most existing pitch feedback units, basically any potentiometer from 1k $\Omega$  to 100k $\Omega$  and utilizes CAN bus for master/slave setups.

The RAI only needs to be set up once at the time of installation. It then stores all the essential data in the microcontroller's non-volatile memory. The configuration process is simple and makes use of the three push buttons mounted on back of the RAI.

## II. FEATURES AND OPERATION

*Rudder angle indicator features are enabled/disabled via the configuration DIP switch on the back of the board (See Setup section).*

*Flexible sense inputs* Available angle sense inputs: 0-3.3V, 4-20mA, CAN bus

*High intensity LEDs* Best readability under any circumstances with very high maximum brightness.

*On-board dimmer* Automatically follows the dash brightness or can be set individually to optimize visibility. No external components required.

- Customisable setpoints* No more fine tuning or offset adjustments. Simple setup process derives all required parameters. Intuitive adjustment of sensitivity.
  
- Integrated backlight* The standalone version has backlighting included for best night time visibility. Brightness is set automatically.
  
- LED scale* As the measured angle changes, the LED display updates in real time. The scale is divided into areas of different resolution to provide high accuracy where it is required and be fully adjustable to fit the individual vessel.

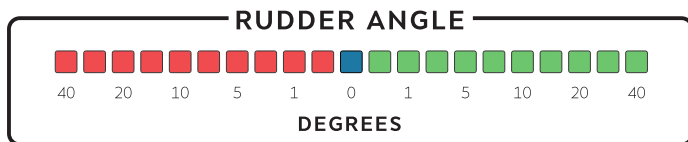


Figure 1  
 IMED RAI User Interface

### III. CONNECTION AND WIRING

*Resolution* For best performance, the potentiometer's movement should have a large span from hard **Port** to hard **Starboard** i.e. having a 10 turn, 10 k $\Omega$  pot, which only does 1 full turn over the full span of the pitch will have less resolution than that of a single turn, 10 k $\Omega$  pot doing close to one full rotation.

The 2nd potentiometer is not required for normal operation. It may be added to further enhance resolution and improve noise immunity (see wiring diagram).

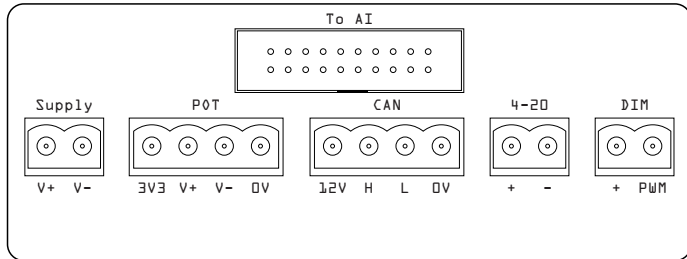


Figure 2.  
Indicator board I/O  
connectors

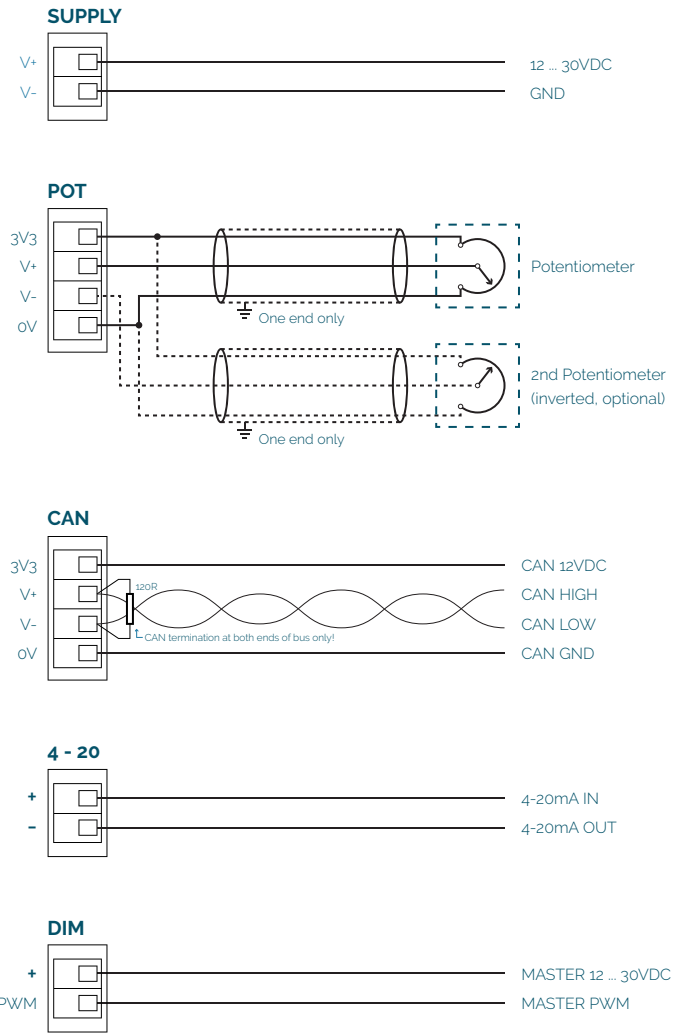
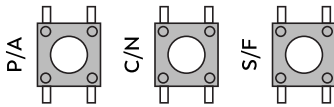


Figure 3  
 Angle indicator  
 wiring diagram

## IV. SETUP

*Mode setup* The PAI has three pushbuttons labelled **P/A** (Pitch at **Astern**), **C/N** (Pitch at **Neutral**) and **S/F** (Pitch at **Feather**). These buttons are used to setup the PAI.

Figure 4.  
Setup buttons on  
IME-AI board



A specific setup procedure must be followed to setup the PAI for use.

*Receipt LED* The **Receipt LED** is located at the back of the PAI on the bottom-left side of the pushbuttons. The receipt LED blinks green three times to indicate when an input has been received. This LED should be used as a visual confirmation of a value being received and saved into the PAI memory.

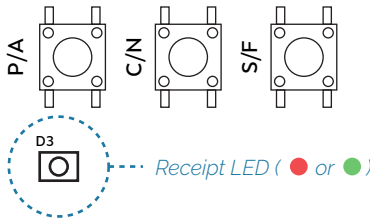


Figure 5.  
Receipt LED location



*DIP switch* The first step of the setup procedure is to configure the board using the 4 DIP switches.

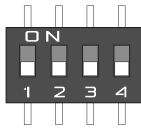


Figure 6.  
DIP switch  
for mode configuration

**Switch 1** selects the dimmer input (external or internal).

- ▶ If internal is used, the LED brightness is controlled with button S5 on the top side of the PCB.
- ▶ In external mode the LED brightness is controlled by an external dimmer connected to the DIM terminals on the I/O board (see Figure 2).

**Switch 2** selects the analogue input: potentiometer or 4-20mA.

**Switch 3** selects whether the unit should act as a master or slave. In slave mode it reads its angle from CAN bus and therefore depends on another master. In master mode the angle is measured directly off the analogue input and then forwarded to the CAN bus.

**Switch 4** enables backlighting.

*Analogue  
input setup*

For the RAI to operate, two points need to be programmed in order to calculate the required offset and gain for the scale. The angle indicator will also negate the signal automatically if required, based on these two inputs. The points are: **Centre** and either **20° Port** or **20° Starboard**. Each point is illustrated in Figure 7, below for a visual reference.

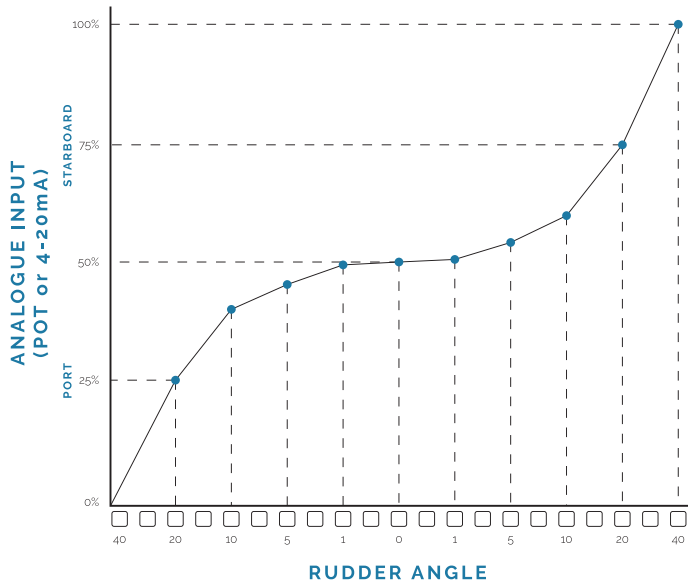


Figure 7.  
Mapping of input signal  
vs. display

- Setup master*
1. Move rudder to **0° Centre** position.
  2. Press and hold button **C/N** until Receipt LED blinks green 3x.
  3. Move rudder to **20° Port** position.
  4. Press and hold button **P/A** until Receipt LED blinks green 3x.
  5. Move rudder to **20° Starboard** position.
  6. Confirm that RAI indicates **20° Starboard** otherwise press and hold button **S/F** until Receipt LED blinks green 3x.

Set up is now finished and the rudder angle indicator is ready for operation in master mode.

- Setup slave*
- If the unit is set to slave mode using **DIP switch #3** no setup is required. The unit will receive all information it needs via CAN bus from the bus master.

## V. TROUBLESHOOTING

*Display current  
DIP switch setting*

It is possible to display the current DIP switch configuration. To do so, press and hold the **P/A** and **S/F** button together.

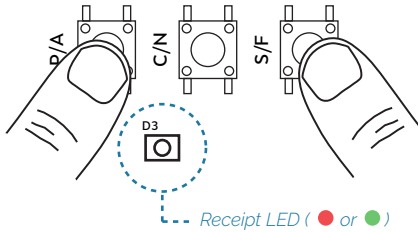


Figure 8.  
Holding P/A and S/F  
for DIP config.

The **Receipt LED** will start indicating the state of each of the 4 DIP switches by blinking green a number of times followed by red once for OFF or twice for ON. The number of green blinks indicates the switch number.

For example, the following DIP switch configuration will give blink sequence:

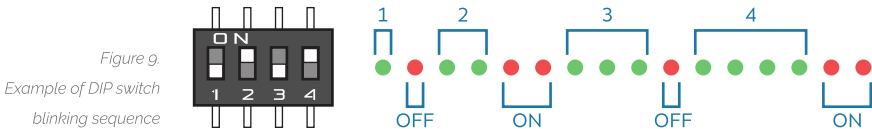


Figure 9.  
Example of DIP switch  
blinking sequence

Single BLUE centre  
LED blinking

This is an indication that the current unit is configured to be a slave (using DIP switch #3, see Figure 6.) and there has no message been received from another master unit for a minimum of 20 seconds.

In this case check the wiring of the CAN bus connection to the master unit and confirm that the master unit is functional.

Also check that there's only one termination resistor (120 Ohm, see Figure 3.) at either end of the bus (2 in total).

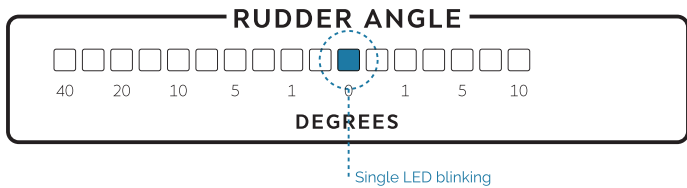


Figure 10.  
Slave mode -  
no message received

Receipt LED  
blinking red 3x during  
analog input setup

This means that the unit is currently configured to be a slave (using DIP switch #3, see Figure 6.) and is therefore not using its analogue inputs. Connect it to a functional master unit via CAN bus to solve this issue or change DIP switch #3 to master mode (OFF position).

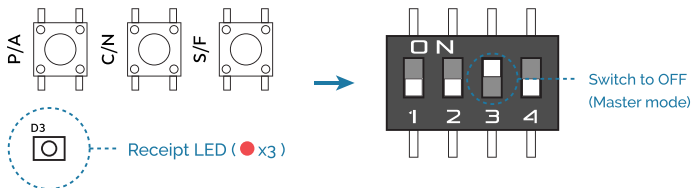


Figure 11.  
Slave mode error

## VII. SPECIFICATIONS

<i>Nominal ratings</i>	Supply voltage:	10 - 30 V
	Input type:	0 - 3.3 V, 4 - 20 mA, CAN
	Operating temperature:	TBD
	Case material:	TBD
Dimensions:	160 mm x 60 mm x 80 mm	

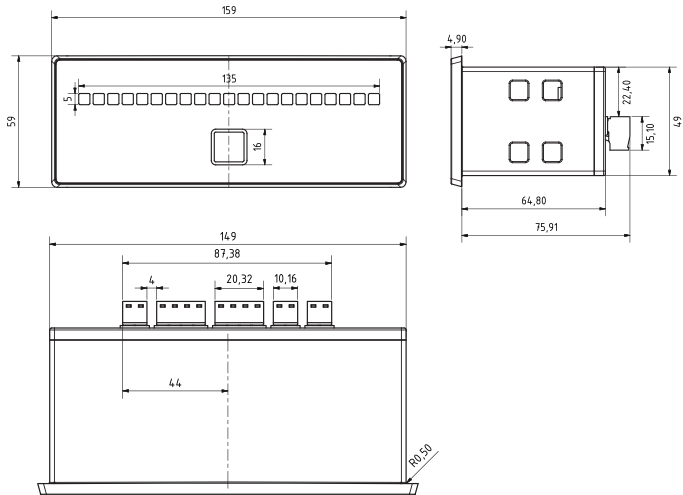


Figure 13  
IME-AI specifications





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