IMED ⟫
Electrical Solutions & Control Stations

RUDDER
ANGLE
INDICATOR

RUDDER ANGLE

| 40 | 20 | 10 | 5 | 1 | 0 | 1 | 5 | 10 | 20 | 40 |

DEGREES

User Manual

RUDDER A
10

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 rudder feedback units, basically any potentiometer from 1kΩ to 100kΩ 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.
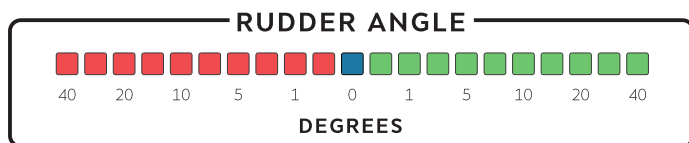
Figure 1.
IMED RAI User Interface

RUDDER ANGLE

| 40 | 20 | 10 | 5 | 1 | 0 | 1 | 5 | 10 | 20 | 40 |

DEGREES

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 kΩ pot, which only does 1 full turn over the full span of the rudder will have less resolution than that of a single turn, 10 KΩ pot doing close to one full rotation.

Attention: Care must be taken in placement of the rudder potentiometer to ensure that change in rudder angle from **Center** to **20° Port** and from **Center** to **20° Starboard** are equivalent changes in the span of the potentiometer.

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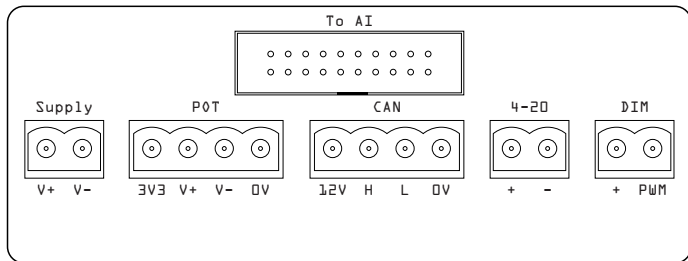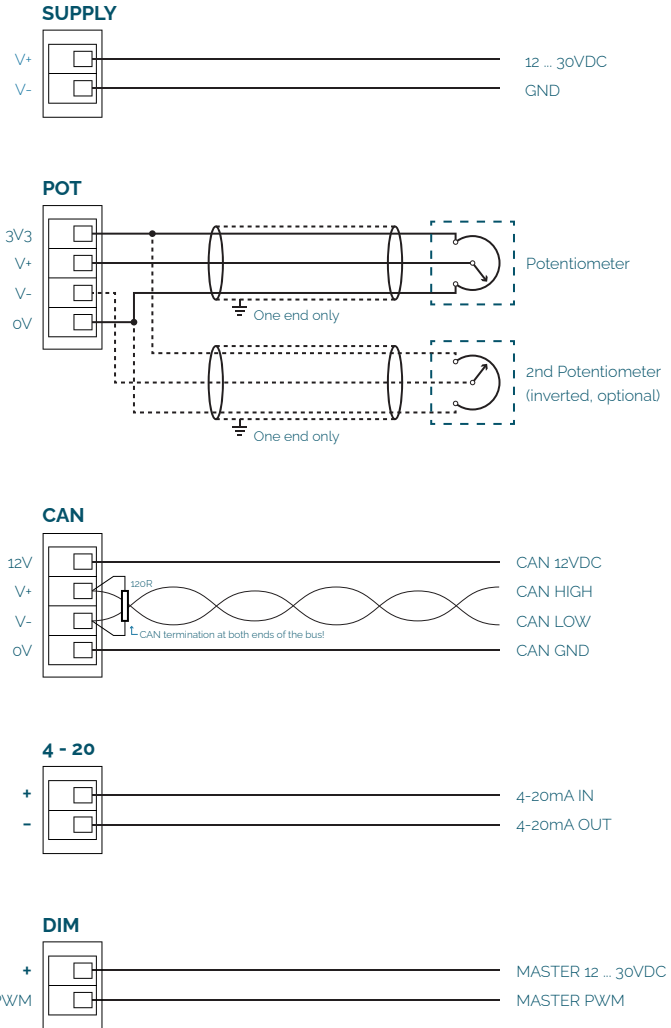
Figure 2.
Indicator board I/O
connectors

SUPPLY

| V+ | | 12 ... 30VDC |
| V- | | GND |

POT

3V3
V+
V-
0V

One end only

Potentiometer

One end only

2nd Potentiometer
(inverted, optional)

CAN

12V — CAN 12VDC
V+ — CAN HIGH
V- — CAN LOW
0V — CAN GND

120R
CAN termination at both ends of the bus!

4 - 20

| + | | 4-20mA IN |
| – | | 4-20mA OUT |

DIM

| + | | MASTER 12 ... 30VDC |
| PWM | | MASTER PWM |

Figure 3.
Angle indicator
wiring diagram

IV. SETUP

Mode setup

The RAI has three pushbuttons labelled **P/A** (Rudder at **Port**), **C/N** (Rudder at **Center**) and **S/F** (Rudder at **Starboard**). These buttons are used to setup the RAI.

Figure 4.
Setup buttons on
IME-AI board
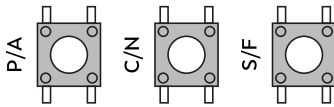
A specific setup procedure must be followed to setup the RAI for use.

Receipt LED

The **Receipt LED** is located at the back of the RAI 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 RAI memory.
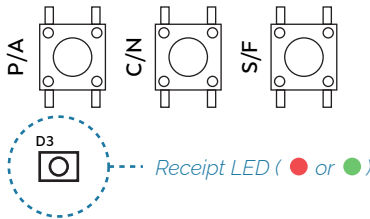

Receipt LED (🔴 or 🟢)

Figure 5.
Receipt LED location

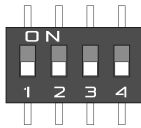The first step of the setup procedure is to configure the board using the 4 DIP switches.

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, or by connecting an external 1 way IME-BTN to the 10 way header P3. If a third party button is used, connect between pin 1 and 2 of P3.
  ▶ 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 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.
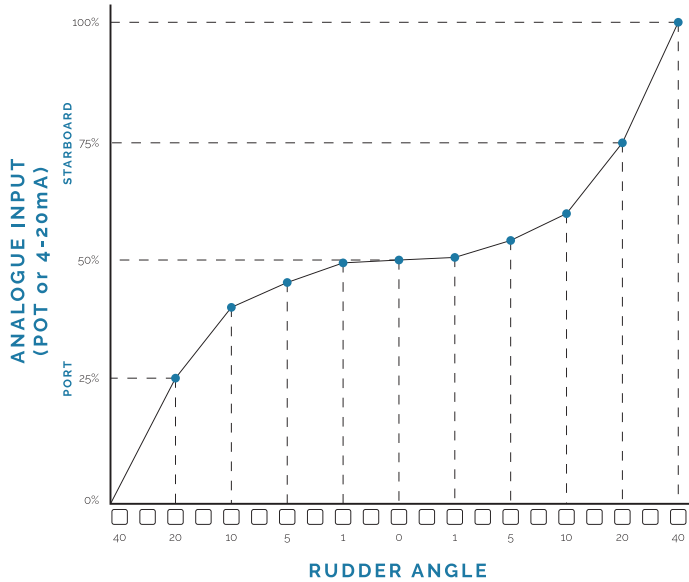

Figure 7.
Mapping of input signal
vs. display

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.

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.
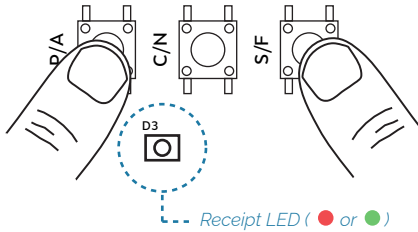

Figure 8.
Holding P/A and S/F
for DIP config.

Receipt LED (● or ●)

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.

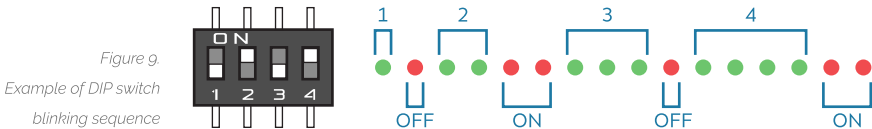For example, the following DIP switch configuration will give blink sequence:

Figure 9.
Example of DIP switch
blinking sequence

1   2   3   4
OFF   ON   OFF   ON

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).
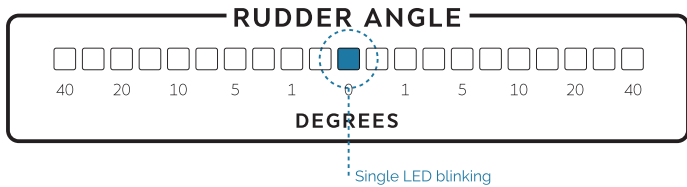

Figure 10.
Slave mode -
no message received

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).
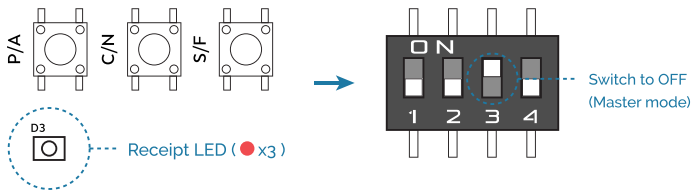

Figure 11.
Slave mode error

VII. SPECIFICATIONS

Nominal ratings

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
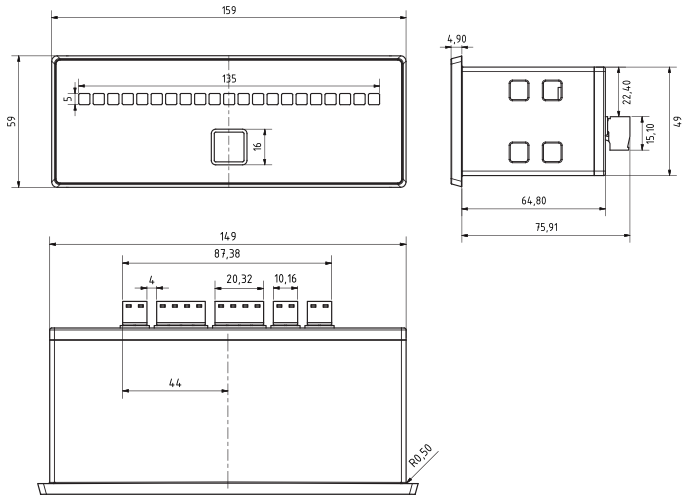
Figure 13.
IME-AI specifications

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