Description

IMED’s Pitch Angle Indicator (PAI) is a propeller pitch angle display unit. The angle is displayed using high intensity LEDs for clear visibility in outdoor helm stations. The design is microcontroller based which makes it easy to configure and eliminates the need for any trim pots etc. IMED’s PAI will work directly off most existing propeller pitch feedback units, basically any Potentiometer from 1k to 100k.

The PAI needs to be set up only the first time it is installed. 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 provided on the PAI itself. LEDs can be dimmed by using an external dimmer. This feature makes the PAI user friendly during night time.
Operation

As the propeller pitch varies from ‘A stern’ to ‘Feather’, LEDs on the PAI display the pitch in real time. While the propeller is in travel, i.e. past ‘Ahead’ but before ‘Feather’, the travel direction is also shown by a blinking LED on the PAI. To indicate an error in the mechanical components, if the propeller is stationary in this zone for more than two seconds, both travel LEDs blink simultaneously. Display of the PAI is given below in *figure 1*.

![Figure 1 - PAI Display](image)

The PAI has two modes of operation:

- Normal mode
- Detail mode

Generally operation under both modes is similar. The difference is when the propeller is between ‘Neutral’ and ‘Ahead’ points.
Under ‘Normal’ mode the display between these two points follows a linear gradient. This is illustrated graphically in *figure 1* below.

When the unit is setup for ‘Detail’ mode, it can be trimmed to provide a more detailed view of the propeller’s travel section which is used regularly. This is done by setting up another arbitrary point, ‘Point A’ after ‘Neutral’. The travel between ‘Neutral’ and this point is displayed on the first three green LEDs. And from ‘Point A’ to ‘Ahead’, is displayed over the next seven green LEDs. Operation under detail mode is illustrated below in *figure 2*. 

Figure 2 - Normal mode operation

Figure 3 - Detail mode operation
**Configuration**

The PAI has three pushbuttons labelled ‘A’ (Astern), ‘N’ (Neutral) and ‘F’ (Feather). These buttons are used to setup the PAI. These buttons are shown in *figure 3* below.

![Figure 3 - Pushbuttons for setup](image)

For some inputs multiple buttons need to be pressed at the same time. For initial setup all five points given under the ‘Detail’ mode operation must be setup. These points are given below:

- Astern
- Neutral
- Point ‘A’ (Arbitrary point only used in ‘Detail’ mode)
- Ahead
- Feather

*For more information on these points, refer to *figure 2* in the ‘Operation’ section.*

A “Receipt LED”, located at the back of the PAI, lights up 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. The location of this “Receipt LED” is shown below in *figure 4*.

![Figure 4 - Receipt LED](image)
Setup Procedure

As mentioned above, the PAI unit has two modes of operation, ‘Normal’ and ‘Detail’ mode. For initial setup, the unit must be setup to function in the ‘Detail’ mode.

➢ The procedure for ‘Detail’ mode setup is as follows:

Step 1  Move propeller to Astern.

Step 2  Press and hold button ‘A’ until the receipt LED turns on.

Step 3  Move propeller to Neutral.

Step 4  Press and hold button ‘N’ until the receipt LED turns on.

Step 5  Move propeller to ‘Point A’ (refer figure 2).

Step 6  Press and hold buttons ‘A’ and ‘N’ together until the receipt LED turns on.

Step 7  Move propeller to Ahead.

Step 8  Press and hold buttons ‘F’ and ‘N’ together until the receipt LED turns on.

Step 9  Move propeller to Feather.

Step 10 Press and hold button ‘F’ until the receipt LED turns on.

➢ To operate the unit in ‘Normal’ mode:

Press and hold buttons ‘F’, ‘N’ and ‘A’ together until the receipt LED turns on.

Once the unit is operating in ‘Normal’ mode, it can be changed to operate in ‘Detail’ mode again. To do this repeat Steps 5 and 6 of the ‘Detail’ mode setup, given above.
Connections

The PAI has a 6-way screw terminal. The part is highlighted in **figure 6** above. The terminals are labelled and each label is detailed below:

- **P-** Negative supply for PAI Potentiometer
- **PW** Connect to potentiometer’s wiper terminal (Variable 0V to 4.5V) \((I = \text{negligible})\)
- **P+** Positive (Regulated 4.5V) supply for RAI Potentiometer \((I_{\text{max}} = 4.5\text{mA})\)
- **Dim** LED Negative – connect to 0V for full brightness or via resistor or dimmer for selectable brightness \((I_{\text{max}} = 0.5\text{A})\).
- **V-** 0V (or Negative)
- **V+** +24 V DC Power Supply \((I_{\text{max}} = 0.5\text{A})\)
  - **External 2A fuse on the V+ line is recommended for wiring protection**

Below in **figure 7** is the electrical wiring diagram for the RAI and the potentiometer. A screened cable should be used for all connections to minimise any stray noise/signals getting to the RAI.

**Figure 6 - Screw Terminal for wiring connections**

**Figure 7 - Electrical Wiring Diagram**

**IMPORTANT**

*For best performance the potentiometer’s movement should have a large span from Astern to Feather. i.e. having a 10 turn, 10 K pot, which only does 1 full turn over the full span of the propeller’s pitch will not work as well as having a single turn, 10 K pot doing close to one full rotation.*

‘P-’ and ‘P+’ connections for the potentiometer can be swapped and this may need to be done for correct operation. The PAI will only function if ‘PW’ is at lowest voltage when the pitch is fully Astern and highest voltage when the pitch is full Feather.
Parallel Operation

It is possible to run up to 3 PAIs off the same potentiometer so propeller pitch can be displayed at separate locations (e.g. Port and Stbd helm stations) at the same time. Careful attention must be given to wiring for a parallel operation. **Wrong wiring may result in permanent damage to the RAIs.** Figure 9 below shows wiring diagram for paralleling three PAIs.

![Figure 8 - Wiring diagram for Paralleling three PAIs](image-url)
Dimensioned Drawings *(All dimensions in mm)*

**Figure 9 - Dimensioned drawing of the PAI**
Ordering Information

Part Number: **IME-PAI**

‘X’ (LED Standoff): Refer *figure 9* in ‘Dimensioned Drawings’

Example:

*For a PAI with 9mm LED Standoffs: IME-PAI 9*

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**FOR ORDERING OR FURTHER INFORMATION PLEASE CONTACT IMED LTD.**

- **E-mail:** sales@imed.co.nz
- **Ph.:** +64 9 373 2422
- **Web:** www.imed.co.nz