KELLY MANUFACTURING COMPANY

KMC PUBLICATION NO. 1404

KMC 2000-2

DIGITAL ATTITUDE INDICATOR

WITH MAGNETIC HEADING & SLIP/SKID INDICATORS

OPERATION GUIDE

KELLY MANUFACTURING COMPANY
555 SOUTH TOPEKA
WICHITA, KS 67202

(316) 265-6868
FAX (316) 265-6687
KELLYMFG.COM

Rev A

TABLE OF CONTENTS

REVISION DETAIL

REVISION	DATE	DETAIL
A	06/19/2014	Initial Release

SECTION 1: INSTRUMENT DESCRIPTION

1.1 GENERAL DESCRIPTION

An attitude indicator, also known as a gyro horizon or artificial horizon, is an instrument used in an aircraft to inform the pilot of the orientation of the airplane relative to the earth. It indicates pitch (fore and aft tilt) and bank (side to side tilt), and is a primary instrument for flight in instrument meteorological conditions. Attitude indicators also have significant applications under visual flight rules.

The **KMC 2000-2** Digital Electronic Attitude Indicator receives digital information from a series of accelerometers which is processed to actuate a display that has two dimensions of freedom, simultaneously displaying pitch and bank. The display is colored to indicate the horizon as the division between the two colored segments (blue for sky and black for ground), and is intended to be intuitive to use. The actual bank angle is calibrated around the circumference of the instrument dial. The pitch angle is indicated by a series of calibration lines, each representing 5° or 10° of pitch.

On the attitude indicator you will see two yellow horizontal lines with a dot between them. The horizontal lines represent the wings and the dot represents the nose of the aircraft. If the symbolic airplane dot is above the horizon line (more blue background) - the aircraft is nose up. If the symbolic airplane dot is below the horizon line (more black background) - the aircraft is nose down. When the dot and wings are on the horizon line, you are in level flight. If the lines representing the wings roll to the left or the right, the aircraft is probably starting a turn.

The magnetic direction indicator gives the pilot a general heading in relation to magnetic north. This is used as a reference and does not indicate true geographical north. The pilot should be aware of the difference of magnetic heading versus true heading in the area of operation in order to compensate as required.

The slip/skid indicator is a digital version of the traditional glass and ball inclinometer. The ball gives an indication of whether the aircraft is slipping, skidding or in balanced flight. The ball's movement is caused by the force of gravity and the aircraft's centripetal acceleration. When the ball is centered in the middle, the aircraft is in coordinated flight. If the ball is on the inside (wing down side) of a turn, the aircraft is slipping. And finally, when the ball is on the outside (wing up side) of the turn, the aircraft is skidding.

1.2 PHYSICAL DESCRIPTION

The **KMC 2000-2** is a direct reading attitude indicating instrument which provides a real-time visual display of aircraft pitch and roll in reference to the horizon. The instrument utilizes a series of accelerometers and complex mathematical formulas to determine pitch and roll. The attitude indicator is not required to conform to FAA TSO certification with light sport aircraft.

The instrument also has an integrated magnetic direction indicator to comply with the ASTM required equipment for night flight in a Light Sport Aircraft. An additional digital slip/skid indicator is also displayed. Refer to table 1 below for leading particulars.

ACCURACY	1° MAXIMUM IN ROLL AND PITCH
OPERATING TEMPERATURE RANGE	-30° TO +50° C
EYE VIEWING ANGLE ENVELOPE	Horizontal Left and Right: 35° Left, 35° Right Vertical Up and Down: 35° Up, 35° Down Minimum distance from display surface: 6 inches Maximum distance from display surface: 48 inches
FAA /EASA SPECIFICATION CONFORMANCE	NONE

Table 1.1, Leading Particulars

1.3 DISPLAY FEATURES

See Figure 1.2 below for typical display features.

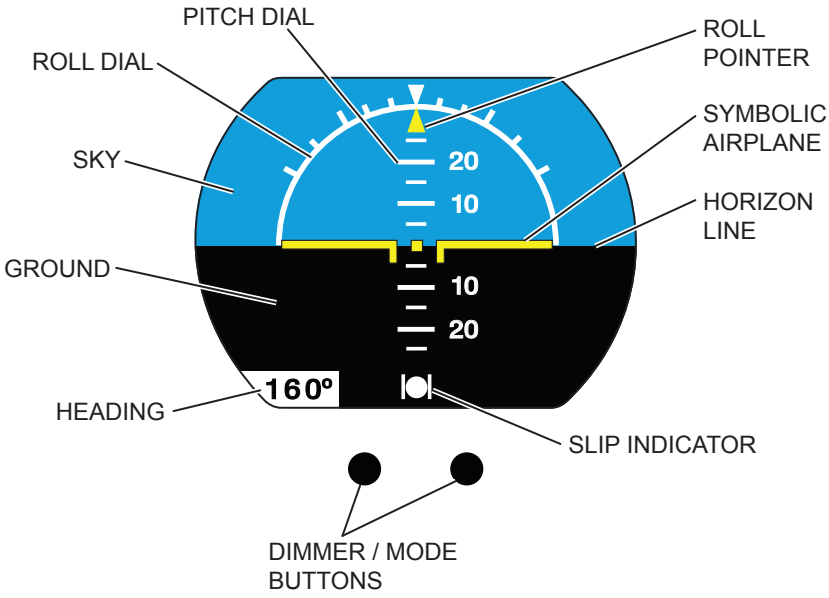


Figure 1.1, Display Features

ROLL DIAL
The Roll Dial shows the degree of roll against the Roll Pointer.

PITCH DIAL
Indicates the pitch angle as determined by the Symbolic Airplane dot.

ROLL POINTER
The Roll Pointer points to the degree of roll against the Roll Dial.

SYMBOLIC AIRPLANE
Represents the orientation of the aircraft's wings and nose in relation to the horizon. The dot represents the nose of the aircraft and indicates Pitch. The wings indicate roll.

HORIZON LINE
The line where the ground (black) meets the sky (blue) indicates earth horizon relative to aircraft pitch and roll.

SLIP INDICATOR
Also referred to as an Inclinometer, the Slip Indicator measures the relative strength of the force of gravity and the force of inertia caused by a turn; thus indicating whether the aircraft is slipping or skidding.

DIMMER / MODE BUTTONS
Individual buttons will dim (left button) or brighten (right button) the display screen when pressed individually. Press and hold both buttons simultaneously to change screen mode.

HEADING
Indicates current magnetic heading.

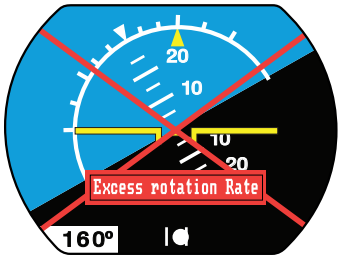
SECTION 2: OPERATION

2.1 PRE-FLIGHT

The following describes the start-up process:

ICON LOGO SCREEN

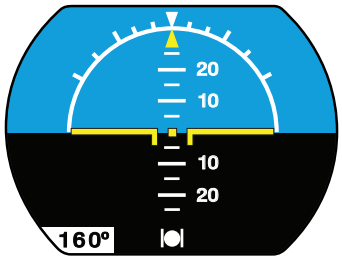
When power is applied to the instrument, the *ICON logo* splash screen is shown. This indicates that the instrument is powering up.



ERROR SCREEN

After a few seconds, the *Error* screen may appear momentarily.

While the instrument is calculating pitch and roll angles, and magnetic heading, the *Error* screen may be displayed. The red “X” and the “Excess rotation Rate” warning indicates that the instrument reading is not reliable.



INSTRUMENT SCREEN

When the instrument is fully functional, the standard attitude indicator screen will appear. This includes the magnetic direction indicator in the lower left corner and the slip indicator in the lower center.

Figure 2.1, Startup Screens

2.2 SCREEN MODES

At any time, you may change to any of the 3 screen modes. Press and hold BOTH Dimmer/Mode buttons simultaneously to scroll through the 3 screens; the *Instrument* screen, the *ICON Logo* screen, the *Instrument Data* screen and back to the *Instrument* screen. The instrument continues to run in the background so flight data will not be lost.

NOTE

You can instantly return to the Instrument Screen from the *ICON Logo* and *Instrument Data* Screens by pressing any one of the two Brightness/Mode buttons.

INSTRUMENT SCREEN ICON LOGO SCREEN INSTRUMENT DATA SCREEN

Figure 2.2, Screen Modes

2.3 DIMMER CONTROLS

The screen brightness can be modified by using the Dimmer/Mode buttons. When in the *Instrument* screen, press the left button to dim the screen. To brighten the screen, press the right button. You can tap the buttons to move up or down in stepped intervals of brightness or hold the button down until the desired brightness is reached.

NOTE

The instrument can only be dimmed or brightened while in the Instrument mode. However, once you have dimmed the instrument, all modes will be dimmed accordingly. Pushing the Dim (left) or Brighten (right) button will put you into the *Instrument* screen mode and will adjust the screen as needed.

2.4 INSTRUMENT CARE

The most easily damaged part of your instrument is the screen. Special care should be taken when cleaning the screen to prevent scratches and other damage. Avoid touching the screen at all times.

To clean light spots and dust, use a soft, lint free cotton cloth slightly moistened with distilled water.

For harder to clean spots, use a 50/50 solution of isopropyl alcohol and distilled water. Vinegar may also be used in a 50% solution with water. You may also use cleaners approved for LCD TV's and laptop computer screens.

Always apply the cleaner to the cloth and not the screen.

-CAUTION-

- **Do Not** use paper towels, facial tissue or napkins. These products are made from recycled paper and may contain metals and wood chips that will scratch the screen.

- **Do Not** use acetone or cleaners containing ammonia.

By avoiding all screen contact and by using proper cleaning methods, the user will be rewarded with many years of service.

2.5 FLIGHT LIMITATIONS

There are no flight limitations to the **KMC 2000** attitude indicator. The instrument will operate in a full 360 degrees of turn and may be used in light aerobatic type maneuvers.

Extreme turns may cause the instrument display to temporarily disable itself. This is indicated by a red "X" across the screen and an "Exceed Bank Angle" warning notice at the bottom of the screen (see figure 2-1 *Error* screen). This means that the instrument reading is temporarily not reliable. The instrument should automatically reset the display within 3 to 10 seconds. This situation is due to the speed the processor repaints the display. The attitude sensors are not affected and there is no action required by the pilot.

2.6 SERVICE

The KMC 2000-2 is totally digital and uses no moving parts as with traditional mechanical gyroscopic instruments. Because of this, there is no service schedule.

Service is only required when indication accuracy exceeds the tolerance listed in Table 1, or there are discrepancies with the modes/functions detailed in this Operation Guide.

SECTION 3: TROUBLESHOOTING

3.1 INSTRUMENT MAGNETIC COMPENSATION

The KMC 2000-2 senses the earth's magnetic field for the magnetic direction indicator. Because the engine and other instruments generate electrical fields that may interfere with the magnetic field, The instrument has been calibrated to compensate for this electrical interference to enhance accuracy.

If, in the unlikely event that the magnetic direction indicator becomes erratic or when deviations in the heading is noticed, due to new electrical interference, the instrument can be re-calibrated.

Refer to the following steps to re-calibrate the magnetic heading:

1. When in flight and at least 3 minutes after turning on the instrument.

2. Press and hold the two buttons at the same time until the message "Gathering Mag Data" is shown on the display (approximately 10 seconds). Note that the display will rotate through the 3 screen modes until the message appears. This operation resets any previous compensation and the instrument begins to gather data for 10 minutes to perform the magnetic compensation.

3. During the 10 minutes the instrument is gathering data, perform two 360 degree turns to the right and two 360 degree turns to the left.

4. When the 10 minutes time is over, the instrument will show the message "Mag Data SAVED".

5. This message will remain visible until the instrument has been restarted. The instrument is now calibrated for the magnetic field of the aircraft (hard iron correction).

NOTE

During the re-calibration process, the instrument could behave erratically and may not be relied on for accurate directional indication.