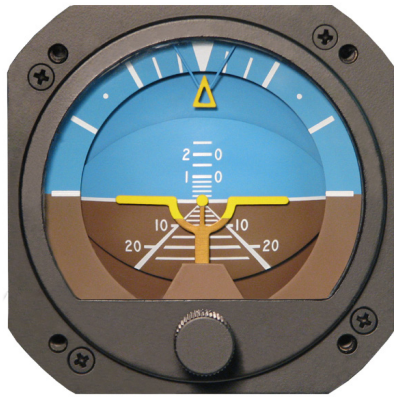
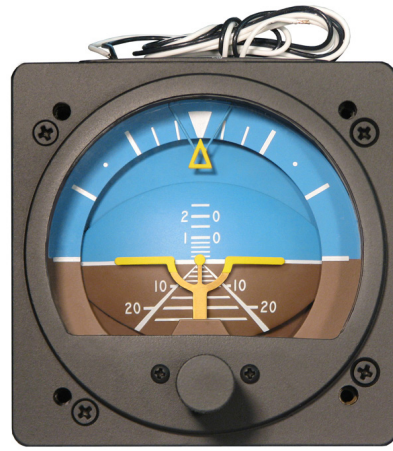




# RCA22 SERIES VACUUM HORIZON GYRO INSTALLATION/OPERATION GUIDE



RCA22-7



RCA22-11



RCA22-7F



RCA22-11F

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## REVISION DETAIL

REVISION	DATE	DETAIL
A	01/15/2019	Initial Release.
B	05/05/2025	Added: Instructions for Continued Airworthiness. (Appendex A, page 9)

## SECTION 1: INSTRUMENT DESCRIPTION

### 1.1 GENERAL DESCRIPTION

A vacuum attitude indicator, also known as a horizon gyro 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 gyroscope actuates 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 (typically, blue for sky and brown 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.

The vacuum powered gyroscope rotor not only has the mass to create the gyroscopic effect, it has impeller blades which creates airflow. This airflow from the impeller works with gravity-actuated vanes that direct “jets” of air to automatically level the gyro.

Attitude indicators can only tolerate a specific range of bank angles. If the aircraft rolls too steeply - while performing aerobatics, for example - the attitude indicator can “tumble” and become temporarily unusable. The **RCA22** Series instrument will however, gradually re-erect back to level after a tumble within 3 minutes.

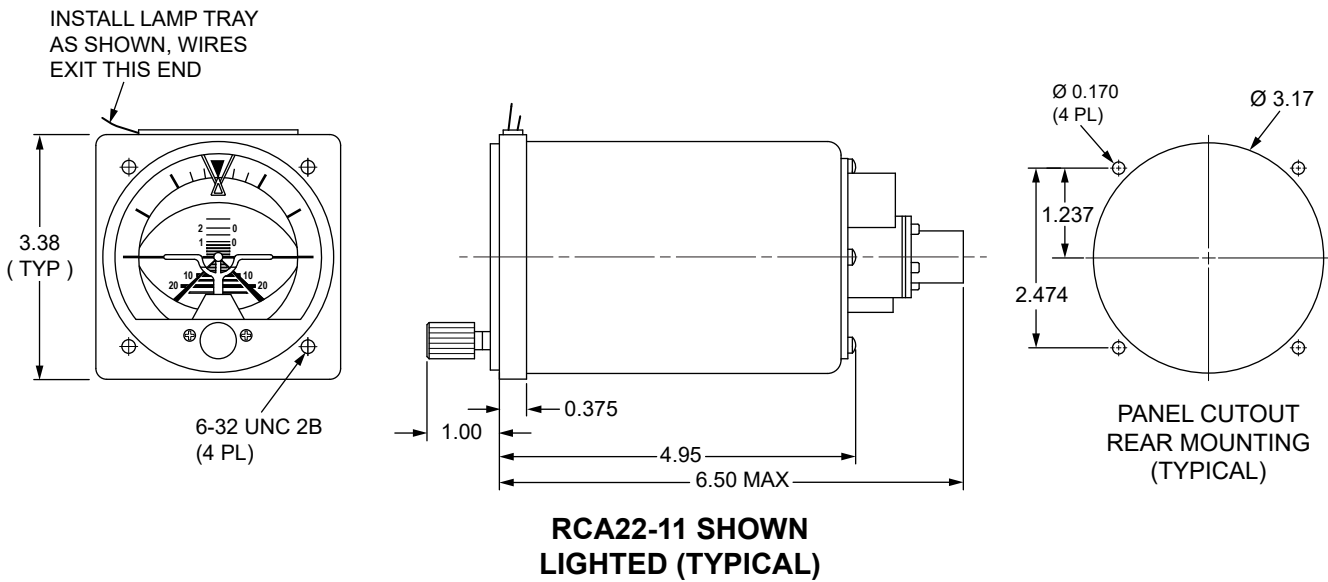
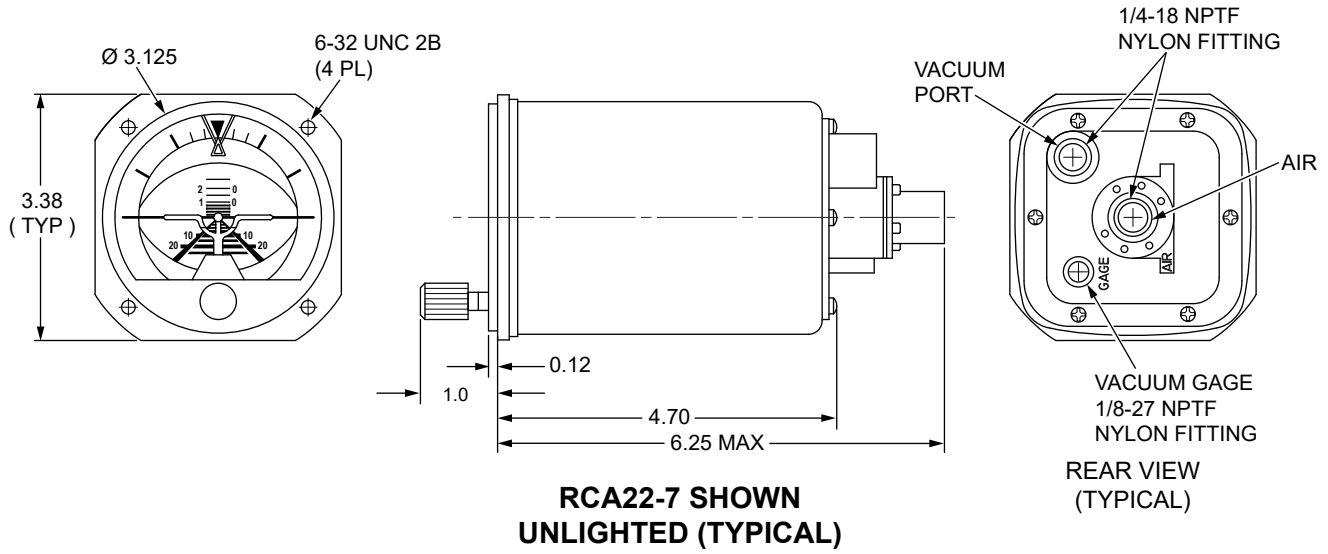
On the attitude indicator you will see two yellow horizontal lines with a dot between them. The horizontal lines represent the wings and the dot represents the nose of the aircraft. If the symbolic airplane dot is above the horizon line (more blue background) - the aircraft is nose up. If the symbolic airplane dot is below the horizon line (more brown 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.

### 1.2 PHYSICAL DESCRIPTION

The RCA22 Vacuum Horizon Gyro is a direct reading instrument which provides a visual display of aircraft pitch and roll in reference to the horizon. Refer to table 1.1 below for leading particulars.

<u>VACUUM REQUIREMENTS</u> .....	STARTING VACUUM.....	2 in. of Hg. max
	OPERATING VACUUM.....	4.5 in. to 5.5 in. of Hg
<u>ILLUMINATING VOLTAGE</u> .....	14 VDC SYSTEM.....	0 to 14 VDC
	28 VDC SYSTEM.....	0 to 28 VDC
	5 VDC LIGHTING SYSTEM.....	0 to 5 VDC
		Specify Aircraft Lighting Voltage at time of order
SETTLING ERROR .....		1° MAXIMUM IN ROLL AND PITCH
OPERATING TEMPERATURE RANGE.....		-30° TO +70° C
DIMENSIONS .....		SEE FIGURE 1
PANEL CUTOUT.....		SEE FIGURE 1
FAA SPECIFICATION CONFORMANCE.....	MEETS OR EXCEEDS .....	TS0-C4c
AERONAUTICAL STANDARD.....	MEETS OR EXCEEDS .....	AS396B

TABLE 1.1, Leading Particulars



**NOTE:**

- All dimensions are in inches.
- **Screw length:** 0.38 plus bezel & panel thickness.
- **Light wiring:** White - power, Black - Ground.

Figure 1.1, General Dimensions (Typical)

**1.3 DISPLAY FEATURES**

See Figure 1.2 below for typical display features. Colors and graphics vary with each model (RCA22-7 shown).

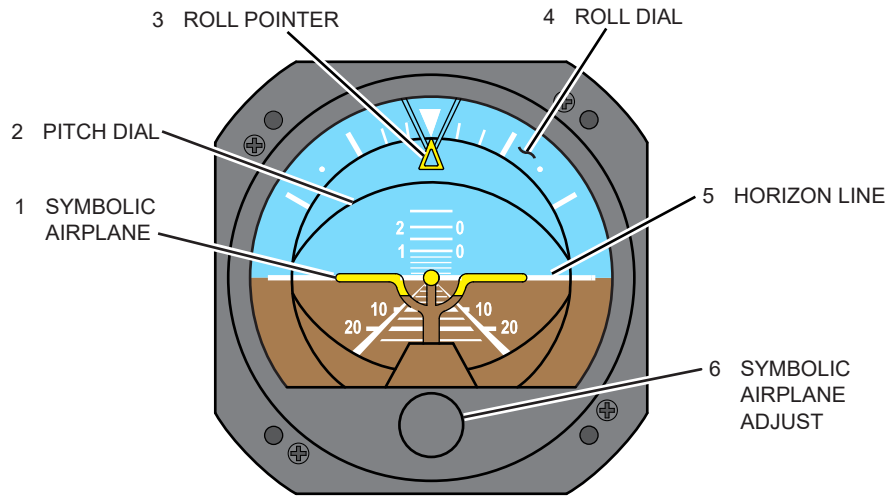


Figure 1.2, Typical Display Features

**1. 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.

**2. PITCH DIAL**

Indicates the Pitch angle as determined by the Symbolic Airplane dot.

**3. ROLL POINTER**

Whether fixed or movable (depending on indicator style), the Roll Pointer points to the degree of roll against the Roll Dial.

**4. ROLL DIAL**

Whether fixed or movable (depending on indicator style), The Roll Dial shows the degree of roll against the Roll Pointer.

**5. HORIZON LINE**

Indicates earth horizon relative to aircraft pitch and roll.

**6. SYMBOLIC AIRPLANE ADJUST**

Adjusts the Symbolic Airplane to compensate for viewing parallax. Adjust Symbolic Airplane so that it is visually aligned with the horizon from pilot’s normal sitting position.

**1.4 OPTIONS AND CONFIGURATIONS**

For available options and configurations, refer to Table 1.2, below.

Panel Tilt Calibration	0° to 18°, set to customer requirements
Lighting	Select models (user specified voltage)
Slip Indicator	Optional add-on for lighted instruments only
Color Scheme	Available in Various color schemes
Display pointer style	Fixed or Movable (select models)
Vacuum Warning Flag	Denoted by an “F” after the model number
Symbolic Airplane Adjust	All models

Table 1.2, Options and Configurations

## SECTION 2, INSTALLATION

### 2.1 GENERAL INFORMATION

The conditions and tests required for the TSO approval of this article are minimum performance standards. It is the responsibility of those installing this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the TSO standards. TSO articles must have a separate approval installation in an aircraft. Installation must only be performed under 14CFR Part 43 or the applicable airworthiness requirements.

### 2.2 HANDLING

#### **-CAUTION-**

Gyroscopic instruments are easily damaged by improper handling. Please follow all handling precautions to prevent damage to the gyro.

Gyros are very delicate instruments. Please observe the following precautions while handling.

1. A high gyroscope failure rate can be attributed to poor handling. Do not drop, jar or shake instrument. Store instrument in shipping container until installation. Avoid placing instrument on hard surfaces. Place on padded surface only.
2. Gyros should be transported in the original shipping container when moved to and from aircraft. If container is not available, carefully carry by hand in upright position.
3. Never move the instrument while the gyro is still spinning. Excessive movement while gyro is spinning may damage gimbal bearings.
4. To prevent further damage, a malfunctioning instrument should be handled as carefully as a new instrument. Most malfunctioning gyros can be repaired and returned to service. Contact Kelly Manufacturing Co. for repair information.

### 2.3 PRE-INSTALLATION INSPECTION

1. When instrument is first received, inspect container for any shipping damage.
2. Carefully remove instrument from shipping container and retain container for later storage or shipping.
3. Inspect instrument for any signs of damage. Contact your Shipper to file any claim due to shipping damage.

### 2.4 INSTALLATION

#### **NOTE**

Before installation, check labeling on the instrument to assure that the lighting voltage and panel tilt angle is correct for your aircraft.

Install the instrument on the aircraft by using the aircraft manufacturer's recommendations and by the following steps:

1. The **RCA22** Series Horizon Gyro uses the standard 3 1/8 inch panel cutout. Refer to figure 1.1 "General Dimensions" for instrument and cutout dimensions.
2. With the aircraft on level surface, level the instrument using an "L" bubble level on the lip of the bezel at the bottom of the glass and adjust the instrument until the bubble is centered.
3. Secure instrument with user supplied screws. Use 6-32 UNC-2b screws or equivalent. Screw length should not exceed 0.38 inches plus bezel and panel thickness.
4. Attach vacuum hoses (See figure 1.1). Use 1/4 - 18 NPTF fittings for Vacuum (pump) and Air (filter) ports.
5. On lighted instruments, attach wiring as required. For lighted models with mating connectors, the pinout is: A=+POS VDC lighting, B=No Connection, D=GROUND VDC Lighting, E=No Connection, H=No Connection.
6. Apply power to instrument. Observe that the lighting (if installed) is working properly.

## SECTION 3, OPERATION

### 3.1 PRE-FLIGHT PROCEDURES

During pre-flight procedures, the attitude gyro must be provided with adequate vacuum pressure under normal vibration conditions (engine running). Allow a minimum of three minutes for the gyro to settle to true level.

Adjust the "Symbolic Airplane" to visually align the "wings" with the horizon line. This adjustment compensates for viewing parallax error (pilot's viewing angle).

### 3.2 IN-FLIGHT PROCEDURES

You may also adjust the Symbolic Airplane indicator at any time.

### 3.3 FLIGHT LIMITATIONS

It is not recommended to perform aerobatic maneuvers while using the **RCA22** Series Horizon Gyro. Extreme maneuvers will cause the instrument to show an error and will become unreliable as a reference to the horizon. Damage to the instrument may also occur under these conditions.

### 3.4 EMERGENCY PROCEDURES

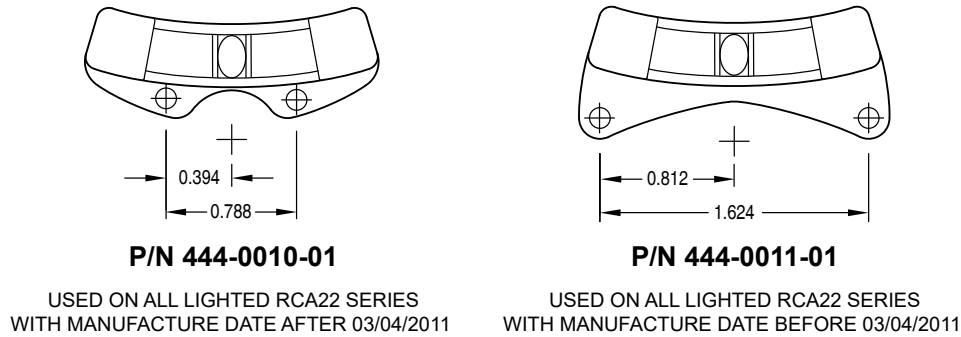
In the event that the Vacuum Warning Flag comes into view (if equipped), the accuracy of the instrument becomes unreliable until the flag moves back out of view. The Vacuum Warning Flag is actuated by the amount of vacuum pressure to the instrument and will display in the "off" position when less than 3.6 Hg. is available to the instrument. A thorough check of the instrument vacuum source is recommended if this situation should occur.



## SECTION 4, SLIP INDICATOR INSTALLATION

### 4.1 LEGACY INSTRUMENTS

P/N 444-0010-01 is used for all new lighted **RCA22** Series Horizon Gyros. When ordering to retrofit an older instrument, note that instruments manufactured before March 4, 2011 have a different screw spacing and use P/N 444-0011-01. Refer to illustration below for proper part number selection.



*Figure 4.1 Slip Indicator Selection*

### 4.2 INSTALLATION

The Optional Slip Indicator can be installed on the instrument before or after the instrument has been installed on the aircraft. Before installation, assure that the instrument or aircraft is level (left and right) using a bubble level.

1. Remove two screws on the face of the instrument.
2. Align Inclinator with holes and replace screws. Do not tighten.
3. Adjust the Inclinator until the bubble is centered and tighten screws just enough to secure Inclinator. Do not over tighten.

## ***Frequently Asked Questions***

### How long should my gyro last?

There are many factors that determine the life of a gyro. We have seen gyros with everything from corrosion from sea air to excessive bearing wear from rough landings. Ideally you should receive hundreds of hours of use, but it is completely dependent on how the unit is treated and the environment in which it is used. If a gyro sits stationary for a long period of time, the bearings become unusable. The gyro should be run at least once a month to keep the bearings lubricated.

### My instrument is showing a climb/dive, what can I do?

You can check your aircraft owner's manual or contact the aircraft manufacturer to determine if your aircraft's instrument panel is tilted (pitched fore and aft). The tilt angle is any deviation from vertical of your instrument panel in level flight. Your instrument needs to be calibrated to compensate for this angle.

### My instrument is showing a turn in level flight, what can I do?

It is very important to have the instrument level (left and right) in your panel. If the instrument is not level, it will show a turn when in level flight. To level the instrument place an "L" bubble level on the lip of the bezel at the bottom of the glass and adjust the instrument until the bubble is centered.

### How do I get my instrument repaired?

For any overhaul or repair questions you can contact Kelly Manufacturing Company. Our Service Center can repair or refurbish any RC Allen instrument. The only thing really required is information. You can send us your instrument with a letter giving us your name, return shipping address, phone number and a brief description of what is wrong with the instrument. Email us for more information: [SERVICE@KELLYMFG.COM](mailto:SERVICE@KELLYMFG.COM).

For repair information,  
Contact:  
Phone: (316)265-6868)  
Fax: (316)265-6687  
Email: [service@kellymfg.com](mailto:service@kellymfg.com)

**APPENDIX A**  
**Instructions for Continued Airworthiness**  
**Document Number: ICA19.002 Rev A**

Equipment/Model Number: <b>RCA22 series</b>		
Equipment Description: <b>Vacuum Horizon Indicator</b>		
<i>1. Description</i>		
This document describes the necessary maintenance requirements and instructions necessary to ensure the continued airworthiness of aircraft/rotorcraft with the RCA22 series Vacuum Horizon Indicators installed.		
<i>2. Operation</i>		
Operating Instructions for the RCA22 series are detailed in the following document: <ul style="list-style-type: none"> <li>▪ Kelly Manufacturing Company Operation/Installation Guide (Publication No. 1405)</li> </ul>		
<i>3. Equipment Certifications</i>		
▪ FAA TSO-C4c	▪ AS369B	
<i>3. Servicing</i>		
No scheduled service required		
<i>4. Maintenance Instructions</i>		
Every 12 months:		
Check that the RCA22 Vacuum Horizon is responding properly and operating within the guidelines detailed in Kelly Manufacturing Company Publication No. 1405. Also verify the following <ul style="list-style-type: none"> <li>▪ Failure flag (when applicable) is pulled out of view when vacuum is applied and drops down into view when vacuum is shut off.</li> </ul>		
Every 24 months:		
Check functional indication accuracy		
Note: Indication accuracy can be verified in flight test using the following procedure: <ul style="list-style-type: none"> <li>▪ After take-off and before IFR situations perform two turns in opposite directions of at least 15 degrees.</li> <li>▪ Return aircraft to level flight/cruising speeds for a minimum of 2 minutes.</li> <li>▪ Verify the RCA22 indicates level in pitch and roll within two degrees.</li> </ul>		
Service is required if the RCA22 does not pass this flight test. Instrument service can be performed at Kelly Manufacturing Company <a href="mailto:service@kellymfg.com">service@kellymfg.com</a>		
<i>Airworthiness Limitations</i>		
There are no airworthiness limitations for the RCA22 series Reference section 3.3 of Kelly Manufacturing Company Publication 1405.		

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