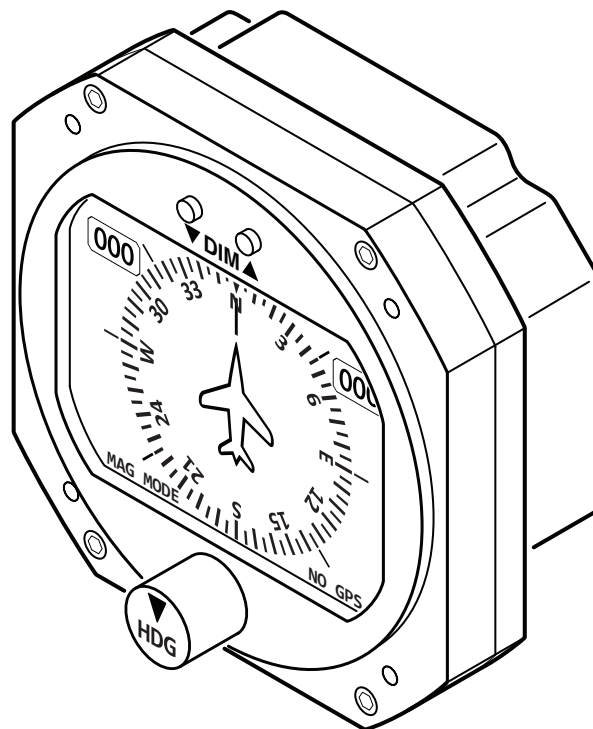




RCA1510 SERIES

ELECTRIC DIGITAL HEADING INDICATOR

INSTALLATION/OPERATION GUIDE



RCA1510-3
P/N 103-0503-03-01
P/N 103-0503-03-02

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REVISION DETAIL

REVISION	DATE	DETAIL
A	06-27-2017	Initial Release
B	01-24-2018	Changed Circuit Breaker Amperage to 1 amp and software version to 5.0.5 (Page 2). Added Quick-Set Heading Bug feature reference (Page 6) .
C	07-12-2018	Corrected P/N on Cover Page.
D	07-31-2018	Update to reflect new software change, pin-out information, GPS input information and Continued Airworthiness information.
E	09-13-2018	Changed Section 3.2 title from "Magnetic Calibration" to "Initial In-Flight Magnetic Calibration".

SECTION 1: INSTRUMENT DESCRIPTION

1.1 GENERAL DESCRIPTION

The heading indicator (also called an HI) is a flight instrument used in an aircraft to inform the pilot of the aircraft's heading. It is sometimes referred to by its older names, the directional gyro or DG. The heading is indicated on a display, which consists of a circular compass card calibrated in degrees. A heading marker (bug) is used to mark on the dial the desired heading which is set by turning a knob on the front of the instrument. It is a primary instrument for flight in IMC (Instrument Meteorological Conditions). Heading indicators also have significant applications under VFR (Visual Flight Rules).

The **RCA1510** Electric Digital Heading Indicator utilizes an internal magnetic compass to determine aircraft heading. In flight, GPS information is added for a more stabilized and accurate heading reading.

With a GPS signal, the **RCA1510** acts like a "Magnetic Track" instrument. It is permissible to install the **RCA1510** without a GPS signal and utilize the instrument exclusively as a "Magnetic Heading" type indicator (See Section 3.5).

Because the **RCA1510** has no mechanical gyroscope, it is much more accurate than traditional heading indicators. Unlike a mechanical gyroscopic unit, the **RCA1510** is not affected by drifting or wandering. The unit is designed to work without GPS input if the GPS signal is lost.

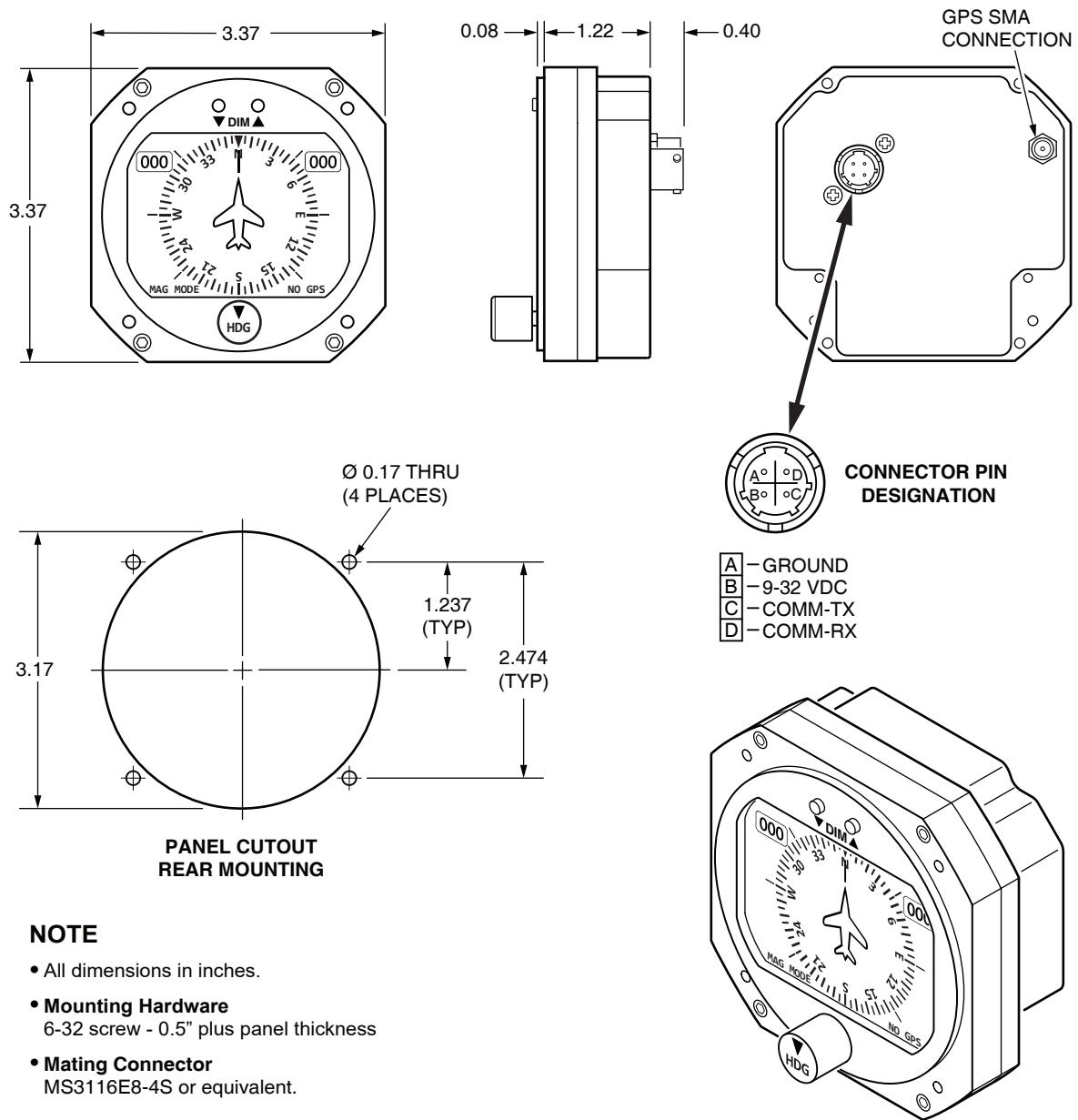
1.2 PHYSICAL DESCRIPTION

The **RCA1510** is a self-contained multi-volt electric digital instrument that can be installed in a standard three-inch panel mount. GPS connection can be achieved either from an independent antenna or from the Aircraft's GPS system. Refer to table 1.1 below for leading particulars.

The display is a 3-inch LCD screen that shows a circular compass that rotates against a stationary aircraft pointer and is intended to be intuitive in use. There are two windows that show a numerical readout of the heading bug setting (in yellow) and true heading (in white). See Figure 1.2 for display features.

<u>OPERATING VOLTAGE</u>	9 to 32VDC
<u>STARTING CURRENT</u>	9VDC: 0.18 to 0.22 AMPs MAX
<u>RUNNING CURRENT</u>	(14VDC SYSTEM) 0.20 AMP MAX (28VDC SYSTEM) 0.15 AMP MAX
<u>CIRCUIT BREAKER SIZE</u>	1 AMP
<u>ACCURACY</u>	2 DEGREES
<u>OPERATING TEMPERATURE RANGE</u>	-20° TO +55° C
<u>MATING CONNECTOR</u>	MS3116E8-4S OR EQUIVALENT
<u>WEIGHT</u>	6.75 oz
<u>DIMENSIONS/PANEL CUTOUT</u>	SEE FIGURE 1.1
<u>EYE VIEWING ANGLE ENVELOPE</u>	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
<u>SOFTWARE VERSION</u>	5.0.6
<u>FAA SPECIFICATION CONFORMANCE</u>	TSO-C6e, TSO-C113a, DO-160G and DO-178B Level C
<u>MEETS OR EXCEEDS</u>	AS8034B and AS8013A

TABLE 1.1, LEADING PARTICULARS



**PANEL CUTOUT
REAR MOUNTING**

NOTE

- All dimensions in inches.
- **Mounting Hardware**
6-32 screw - 0.5" plus panel thickness
- **Mating Connector**
MS3116E8-4S or equivalent.

Figure 1.1, General Dimensions

1.3 DISPLAY FEATURES

See Figure 1.2 below for typical display features. RCA1510-3 shown.

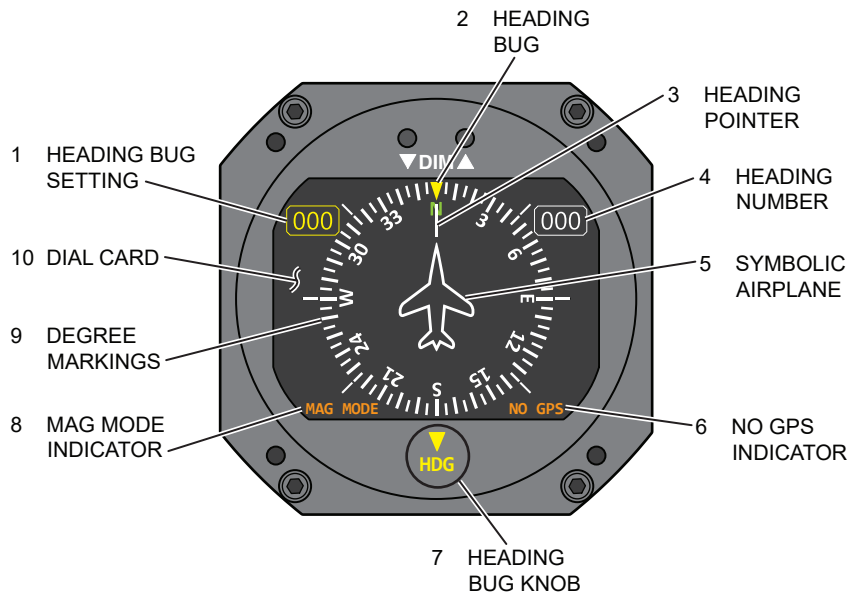


Figure 1.2, Typical Display Features

1. HEADING BUG SETTING

The Heading Bug Setting shows the numerical reading of the desired heading as set by the Heading Bug Knob.

2. HEADING BUG

The Heading Bug is a pointer that is set to the desired heading on the compass dial. It rotates with the dial.

3. HEADING POINTER

The Heading Pointer is a stationary pointer that indicates the direction of flight against the compass dial.

4. HEADING NUMBER

The heading number is the numerical reading of the actual heading of the aircraft.

5. SYMBOLIC AIRPLANE

The Symbolic Airplane represents the orientation of the aircraft in relation to the direction indicated on the compass dial.

6. NO GPS INDICATOR

The NO GPS Indicator illuminates to show that the GPS signal is not available.

7. HEADING BUG KNOB

The Heading Bug Knob is used to adjust the desired heading set on the compass dial.

8. MAGNETIC MODE INDICATOR

The MAGNETIC MODE Indicator shows that the instrument is operating as a "Magnetic Heading" instrument caused by there being no GPS signal or the aircraft speed is below 10 knots.

9. DEGREE MARKINGS

The Degree Markings shows the compass heading in degrees on a rotating dial for analog viewing.

10. DIAL CARD

The Dial Card is a rotating circular compass that aligns the actual heading with the Heading Pointer.

SECTION 2, INSTALLATION

2.1 GENERAL INFORMATION

The conditions and tests required for TSO approval of this article are minimum performance standards. Those installing this article, on or in a specific type or class of aircraft, must determine that the aircraft installation conditions are within the TSO standards. TSO articles must have separate approval for installation in an aircraft. The article may be installed only in accordance with the applicable airworthiness requirements and, if applicable, the requirements of 14 CFR part 43.

2.2 HANDLING

Although the RCA1510 Series instruments are totally electronic, improper handling can cause damage. Please observe the following precautions while handling.

1. Do not drop, jar or shake instrument. Store instrument in shipping container until installation.
2. Instruments 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. Avoid touching the screen. This is the most vulnerable part of the instrument. Improper handling and cleaning can cause permanent scratching of the screen surface (See *Instrument Care* on Page 8).
4. To prevent further damage, a malfunctioning instrument should be handled as carefully as a new instrument. Most malfunctioning instruments can be repaired and returned to service. Contact Kelly Manufacturing Company for repair and warranty information.

2.3 PRE-INSTALLATION INSPECTION

1. When the instrument is first received, inspect container for any shipping damage.
2. Carefully remove the instrument from shipping container and retain container for later storage or shipping.
3. Inspect the instrument for any signs of damage. Contact your Shipper to file any claim due to shipping damage.
4. Check labeling on the instrument to assure that the instrument panel tilt angle is correct for your aircraft.

2.4 INSTALLATION

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

1. The RCA1510 uses standard panel cutouts. Refer to Figures 1.1 "General Dimensions" for instrument and cutout dimensions.
2. Attach power connection. Instrument Pinout is: A = GND, B = PWR, C = COMM-TX, D = COMM-RX. **CAUTION:** Do not apply power to COMM pins as damage may occur. See table 1.1 "Leading Particulars" for additional electrical information.
3. If required, attach GPS input using one of the following methods;

GPS Antenna: Utilize the **RCA1510** internal GPS receiver by connecting an active GPS WAAS antenna (1575.42 MHz, 26.5 dB, 3.5/5 volts) to the SMA connector.

Serial Port Communication Pins: Utilize an external GPS receiver by connecting the serial data output of the GPS receiver to the **RCA1510** pin A (Ground) and pin D (Comm-Receive) (See Figure 1.1).

4. Insert instrument into panel cutout (See Figure 1.1) and secure with supplied screws. Use 6-32 *UNC-2b* screws or equivalent. Screw length should not exceed .5 inches plus bezel and panel thickness. Do not tighten.
5. With the aircraft on level surface, use a bubble level on the instrument bezel to level and tighten screws.

Do Not modify the instrument in any way. Any modifications will void the warranty and revoke the FAA certifications.

SECTION 3, OPERATION GUIDE

3.1 PRE-FLIGHT PROCEDURES

During pre-flight procedures, the instrument must be provided with adequate electrical power under normal vibration conditions (engine running). A red "X" appears across the screen indicating that the instrument is booting up. When the X disappears, the instrument is ready. The startup process should be completed within three minutes.

3.2 INITIAL IN-FLIGHT MAGNETIC CALIBRATION

To produce accurate information, after the installation or when deviations in the heading are noticed, the instrument needs to be compensated for the aircraft magnetic field, this deviation can also be the result of installing a new instrument close to the heading indicator, or any change in the aircraft that can affect the magnetic field.

The procedure to compensate the instrument to eliminate the magnetic interference from the aircraft is:

1. When in flight and at least 3 min after turning on the instrument.
2. Press and hold the two DIM buttons at the same time until the message "Gathering Mag Data" is shown on the display (approx 10 sec). 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 deg turns to the right and two 360 deg turns to the left.
4. When the 10 minutes time is over, the instrument will show the message "Mag Data SAVED"
5. Turn the instrument off and on. The message will disappear and the instrument is calibrated for the magnetic field of the aircraft. (hard iron correction)

NOTE

During the calibration procedure, the instrument could behave erratically due to the calibration process.

HOW MAGNETIC CALIBRATION WORKS

The magnetic calibration procedure has the goal of finding the magnetic field of the aircraft. During the magnetic calibration procedure, the instrument senses what part of the magnetic field rotates together with the instrument, and considers this the magnetic field of the aircraft. This magnetic field is then subtracted from the measured magnetic field, to obtain the earth's magnetic field used to calculate the heading.

3.3 IN-FLIGHT PROCEDURES - HEADING BUG SETTING

The Heading Bug can be set any time before or during flight. Push the Heading Bug Knob in and turn to the desired heading as shown in the Heading Bug Setting window and on the Heading Dial. The Heading Bug pointer will rotate with the Compass Dial Card until a new heading is desired. (See Figure 3.1, Heading Bug Setting). To use the **Quick-Set Heading Bug**, double-push the HDG knob to set the Bug to the current heading.

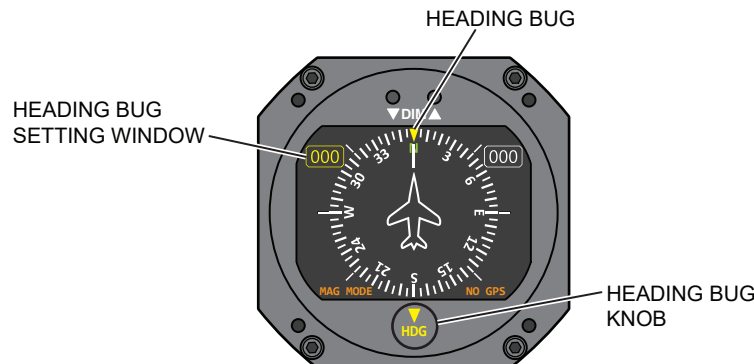


Figure 3.1, Heading Bug Setting

3.4 IN-FLIGHT PROCEDURES - DIMMER

On startup, the RCA1510 defaults to its maximum brightness. You may adjust the screen brightness at any time with the DIMMER PUSH BUTTONS (DIM).

Press and hold the DIM (▼) or BRIGHTEN (▲) PUSH BUTTONS until you reach the desired setting and release, or tap each button for incremental steps (See figure 3.2 for dimming controls).

Quickly pressing both buttons simultaneously will reset the screen to maximum brightness.

NOTE

If you press both buttons simultaneously and hold them down for 10 seconds, you will enter the Magnetic Calibration Mode.

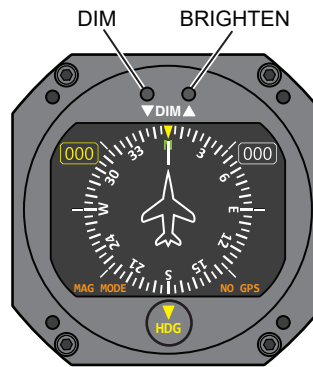


Figure 3.2, Dimmer Controls

3.5 MAG MODE / NO GPS INDICATORS

On startup, the MAG MODE and NO GPS indicators will be illuminated. The MAG MODE light indicates that the instrument is operating as a “Magnetic Heading” type indicator. The NO GPS indicator will go out when a GPS signal is acquired. Once the aircraft reaches a speed of 10 knots or more, the GPS input becomes active and the MAG MODE indicator will go out.

In the event that the instrument loses GPS signal in flight, the NO GPS and MAG MODE Indicators will illuminate. The **RCA1510** will continue to work as a “Magnetic Heading” instrument.

3.6 FLIGHT LIMITATIONS

There are no flight limitations to the **RCA1510**. The instrument will operate in a full 360 degrees pitch and roll 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 Acc (acceleration) Limit” warning notice at the bottom of the screen. The instrument should automatically reset the display within 3 to 10 seconds. This situation is due to the speed the processor repaints the display. This will not affect the heading information.

3.7 EMERGENCY PROCEDURES

In the rare event that your RCA1510 does not reset itself, you will need to pull power to the unit and reset the circuit breaker. This will restart the unit and you can continue on without damage to the unit. You do not need to be flying level while the unit resets.

In a low voltage situation, the RCA1510 will show a “Low Voltage” warning notice at the bottom of the screen. This notice will appear when the voltage goes below 11 volts. This notice will also indicate the amount of voltage the instrument is receiving. At 8.5 volts, a red “X” will appear across the screen indicating that the instrument reading is unreliable.

It is recommended that you install the Kelly Manufacturing **ESP-1** (Emergency Standby Power) backup battery unit. This will ensure that your instrument will have power in the event of Aircraft power failure. Contact your R.C. Allen/Kelly Mfg. distributor for additional information about this product.

SECTION 4, GENERAL INFORMATION

4.1 Flight Testing and Adjustments

After flight testing and evaluation, additional calibration may be required depending on the users application. Communicate flight test data with Kelly Manufacturing Company to determine appropriate adjustments.

4.2 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.

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, alcohol 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.

4.3 Frequently Asked Questions

How long should my Digital Heading Indicator last?

There isn't a good answer for this question. There are no moving parts in the RCA1510 so there isn't anything to wear out. The RCA1510 should give hundreds of hours of trouble free operation.

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 R.C. 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 or download a form from the Support page on our web site at: kellymfg.com/support.html.

Email us for more information: SERVICE@KELLYMFG.COM.

Or, Visit our Web Site: kellymfg.com

APPENDIX A

Environmental Qualification: DO-160G Environmental Qualification Form

NOMENCLATURE: ELECTRIC DIGITAL HEADING INDICATOR

MODEL NUMBER: RCA1510-series

TSO NUMBER: C6e & C113a

MANUFACTURERS SPECIFICATIONS: STP 1502 Rev. A

MANUFACTURER: Kelly Manufacturing Company


ADDRESS: 555 S. Topeka, Wichita, KS 67202

REVISION & CHANGE NUMBER OF DO-160: Rev. G **DATES TESTED:** 4/26/16 thru 5/24/16

CONDITIONS	SECTION	DESCRIPTION OF TESTS CONDUCTED
Temperature and Altitude	4.0	Equipment tested to Category D1
Low Temperature	4.5.1	
High Temperature	4.5.2 & 4.5.3	
Altitude	4.6.1	
Temperature Variation	5.0	Equipment tested to Category C
Humidity	6.0	Equipment tested to Category A
Operational Shocks and Crash Safety	7.0	Equipment tested to Category B
Vibration	8.0	Equipment tested to Category U2 curve F & F1
Explosive Atmosphere	9.0	Equipment identified as category X, no test performed
Waterproofness	10.0	Equipment identified as category X, no test performed
Fluids Susceptibility	11.0	Equipment identified as category X, no test performed
Sand and Dust	12.0	Equipment identified as category X, no test performed
Fungus	13.0	Equipment identified as category X, no test performed
Salt Fog Test	14.0	Equipment identified as category X, no test performed
Magnetic Effect	15.0	Equipment tested to Category Z
Power Input	16.0	Equipment tested to Category BXX
Voltage Spike	17.0	Equipment tested to Category A
Audio Frequency Susceptibility	18.0	Equipment tested to Category Z
Induced Signal Susceptibility	19.0	Equipment tested to Category ZC
Radio Frequency Susceptibility (Radiated and Conducted)	20.0	Equipment tested for Conducted Susceptibility to Category W Equipment tested for Radiated Susceptibility to Category F
Emissions of Radio Frequency Energy	21.0	Equipment tested to Category M
Lightning Induced Transient Susceptibility	22.0	Equipment tested to Pin Injection Test: Waveform set B, Level 3 Cable Bundle Test: Waveform set H, Level 3 Multiple Burst: Level 3 [B3H3L3]
Lightning Direct Effects	23.0	Equipment identified as category X, no test performed
Icing	24.0	Equipment identified as category X, no test performed
Electrostatic Discharge	25.0	Equipment tested to Category A
Fire, Flammability	26.0	Equipment identified as category X, no test performed

REMARKS
<ul style="list-style-type: none"> ▪ In the power input test, equipment was tested to subparagraph 16.5.1.4 b, requirement for equipment with digital circuits ▪ Equipment also tested to (and passed) section 20, SW/CW radiated susceptibility @100V/m from 100MHz to 1GHz

APPENDIX B

<p>Instructions for Continued Airworthiness</p> <p>Document Number: ICA17.005</p> <p>Revision: B</p>					
<p>Equipment/Model Number: RCA1510 series</p> <p>Equipment Description: Electric Digital Heading Indicator</p>					
<p>1. Description</p> <p>This document describes the necessary maintenance requirements and instructions necessary to ensure the continued airworthiness of aircraft/rotorcraft with the RCA1510 Electric Digital Heading Indicator installed.</p>					
<p>2. Operation</p> <p>Operating Instructions for the RCA1510 are detailed in the following document:</p> <ul style="list-style-type: none"> ▪ Kelly Manufacturing Company Operation/Installation Guide (Publication No. 1401-5) 					
<p>3. Equipment Certifications</p> <table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; vertical-align: top; padding: 2px;"> <ul style="list-style-type: none"> ▪ FAA TSO-C6e ▪ FAA TSO- C113a </td> <td style="width: 33%; vertical-align: top; padding: 2px;"> <ul style="list-style-type: none"> ▪ AS8013A ▪ AS8034B </td> <td style="width: 33%; vertical-align: top; padding: 2px;"> <ul style="list-style-type: none"> ▪ RTCA DO-160G ▪ RTCA DO-178B Lv. C </td> </tr> </table>			<ul style="list-style-type: none"> ▪ FAA TSO-C6e ▪ FAA TSO- C113a 	<ul style="list-style-type: none"> ▪ AS8013A ▪ AS8034B 	<ul style="list-style-type: none"> ▪ RTCA DO-160G ▪ RTCA DO-178B Lv. C
<ul style="list-style-type: none"> ▪ FAA TSO-C6e ▪ FAA TSO- C113a 	<ul style="list-style-type: none"> ▪ AS8013A ▪ AS8034B 	<ul style="list-style-type: none"> ▪ RTCA DO-160G ▪ RTCA DO-178B Lv. C 			
<p>3. Servicing</p> <p>No scheduled service required</p>					
<p>4. Maintenance Instructions</p> <p>Every 12 months:</p> <p>Check that the RCA1510 Electric Digital Heading Indicator is responding properly and operating within the guidelines detailed in Kelly Manufacturing Company Publication No. 1401-5. Also verify the following:</p> <ul style="list-style-type: none"> ▪ No warning/error message exists on the display. ▪ No drop off or inconsistency in display brightness. <p>Every 24 months:</p> <p>1) Check functional indication accuracy</p> <p>Note: Indication accuracy can be verified in flight test using the following procedure:</p> <ul style="list-style-type: none"> ▪ After take-off and before IFR situations perform two turns in opposite directions of at least 15 degrees ▪ Return aircraft to level flight/cruising speeds for a minimum of 2 minutes. ▪ Verify the RCA1510 indicates heading within two degrees. <p>Service is required if the RCA1510 does not pass this flight test. Instrument service can be performed at Kelly Manufacturing Company service@kellymfg.com</p> <p>2) Contact Kelly Manufacturing Company with serial number of the unit to determine if update to the World Magnetic Module is required for the GPS of the unit.</p>					
<p>July 31, 2018</p>		<p>Page 1 of 2</p>			

Instructions for Continued Airworthiness

Document Number: ICA17.005

Revision: B



Airworthiness Limitations

There are no airworthiness limitations for the RCA1510
Reference section 3.6 of Kelly Manufacturing Company Publication 1401-5.

Notes

Revision History

Revision	Date	Detail
A	6/30/2017	Initial Release
B	7/31/2018	Section referenced under Airworthiness Limitations was section 3.4