KMC PUBLICATION NO. 1401-8

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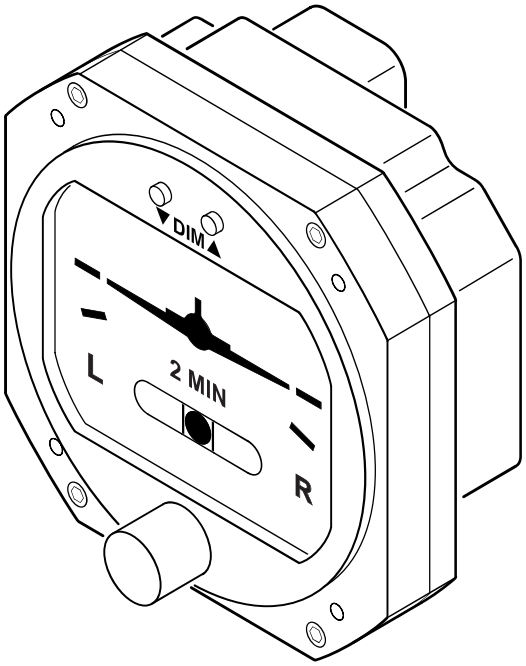
KMC KELLY MANUFACTURING COMPANY

RCA8310 SERIES

ELECTRIC DIGITAL TURN COORDINATOR

INSTALLATION/OPERATION GUIDE



RCA8301-3

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REV B 7/16/2024

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REVISION DETAIL

REVISION	DATE	DETAIL
Initial Release.	06/19/2024	Initial Release.
Rev B	07/16/2024	Update Table 1.1 - Was TSOC113a and AS8034B.

SECTION 1: INSTRUMENT DESCRIPTION

1.1 GENERAL DESCRIPTION

The **RCA8310-3** Digital Turn Coordinator is a fully certified, digital replacement for mechanical turn coordinators or mechanical turn and bank instruments. It is designed to be intuitive to use, and look and react the same as a mechanical gyro instrument.

Because the **RCA8310-3** has no mechanical gyroscope, it is much more stable and reliable than mechanical gyro instruments. It can be set to output all necessary signals for legacy autopilot applications. Optional features, such as Internal Battery Back-up (recommended) and NVIS compatibility are also available.

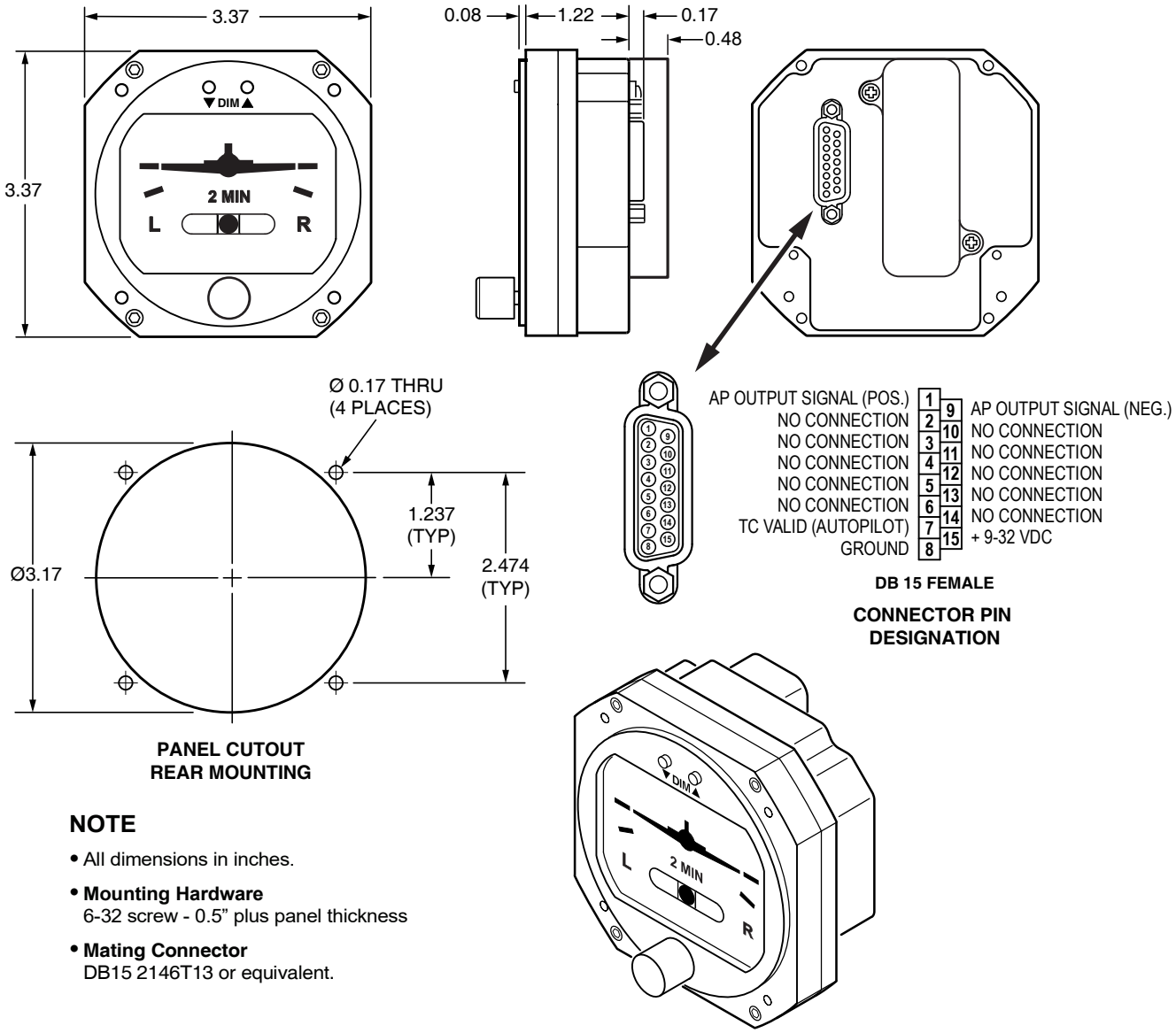
The **RCA8310-3** comes standard with a variety of customizations allowing you to select between three classic/traditional looks: 1) Turn Coordinator 2) Turn and Bank (with doghouse indexes) and 3) Turn and Bank (without doghouse indexes). The autopilot output signals can be disabled if not required. Each configuration displays a ball type inclinometer (slip indicator) to show slip and skid for a coordinated turn.

1.2 PHYSICAL DESCRIPTION

The **RCA8310-3** is a totally digital instrument that fits in the standard 3-inch panel cutout without any special modification to the panel. (See table 1.1 *leading particulars* below).

PART NUMBERS	With Battery: 100-0803-01-01 With Battery & NVIS: 100-0803-01-02 No Battery: 100-0803-01-03 No Battery With NVIS: 100-0803-01-04
OPERATING VOLTAGE	9 to 32 VDC
RUNNING CURRENT	(14VDC SYSTEM) 0.35 AMP MAX (28VDC SYSTEM) 0.20 AMP MAX
CIRCUIT BREAKER SIZE	1 AMP
AUTOPILOT OUTPUT	0-1.6VDC
TC VALID SIGNAL	VALID > 9 VDC INVALID < 1 VDC
OPERATING TEMPERATURE RANGE	-20º TO +55º C
MATING CONNECTOR	DB15 2146T13 OR EQUIVALENT
WEIGHT	6.75 oz
DISPLAY RESOLUTION	320 X 240 Pixels, Backlight, color LCD
BATTERY BACKUP	Rechargeable LiPO, 3.7V 500mAh (1.85 Wh)
BATTERY LIFE	Up to 3 hours
DIMENSIONS/PANEL CUTOUT	SEE FIGURE 1.1
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
SOFTWARE VERSION	Version 8.01
FAA SPECIFICATION CONFORMANCE	TSO-C113b, TSO-C3e, DO-160G, DO-178B Level C and DO347
MEETS OR EXCEEDS	AS8034C and AS8004

TABLE 1.1, LEADING PARTICULARS



NOTE

- All dimensions in inches.
- **Mounting Hardware**
  6-32 screw - 0.5" plus panel thickness
- **Mating Connector**
  DB15 2146T13 or equivalent.

RCA8310-3
SHOWN WITH BATTERY BACKUP

Figure 1.1, General Dimensions

1.3 DISPLAY FEATURES

See Figure 1.2 below for typical display features. RCA8310-3 Turn Coordinator screen.

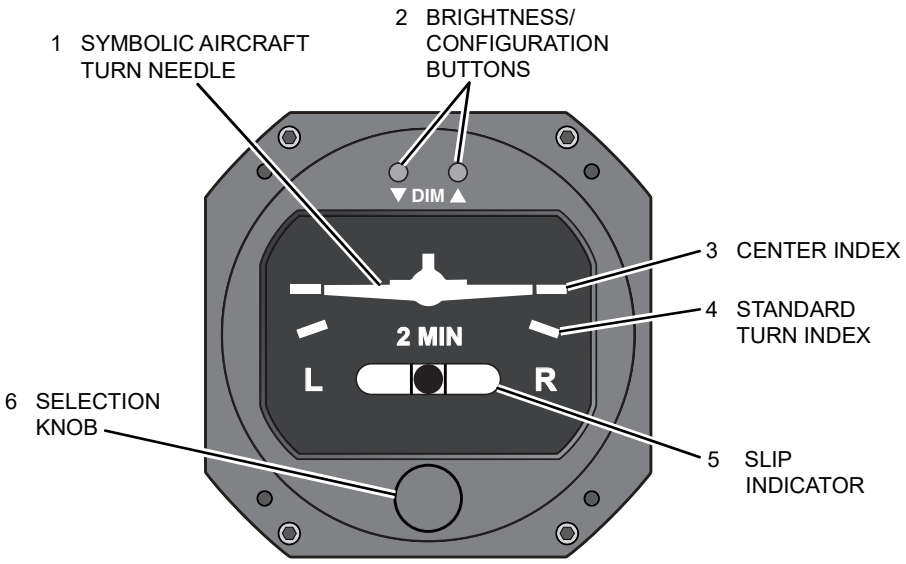


Figure 1.2, Typical Display Features - Turn Coordinator

1. **SYMBOLIC AIRCRAFT TURN NEEDLE**
   Displays the rate of turn represented by the aircraft symbol which rolls (rotates) right or left. (See Figure 1.3 below).

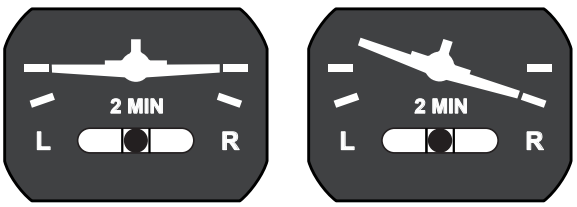
2. **BRIGHTNESS/CONFIGURATION BUTTONS**
   Set the brightness of the screen by pressing the up arrow for higher or down arrow for lower brightness. Press both buttons simultaneously to reset brightness to 100%. Press and hold both buttons simultaneously when power is applied to instrument to access the Configuration Menu.

3. **CENTER INDEX**
   Indicates no turn rate when needle is aligned to this mark.

4. **STANDARD TURN INDEX**
   indicates standard rate of turn when turn needle deflects to this mark.

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

6. **SELECTION KNOB**
   Used to set user configuration menu at startup. Press both brightness buttons on power-up to access menu. Press during flight to show battery and autopilot status.



NO TURN COORDINATED TURN

Figure 1.3, Turn Coordinator Needle Positions

See Figure 1.4 below for typical display features. RCA8310-3 Turn and Bank screen.

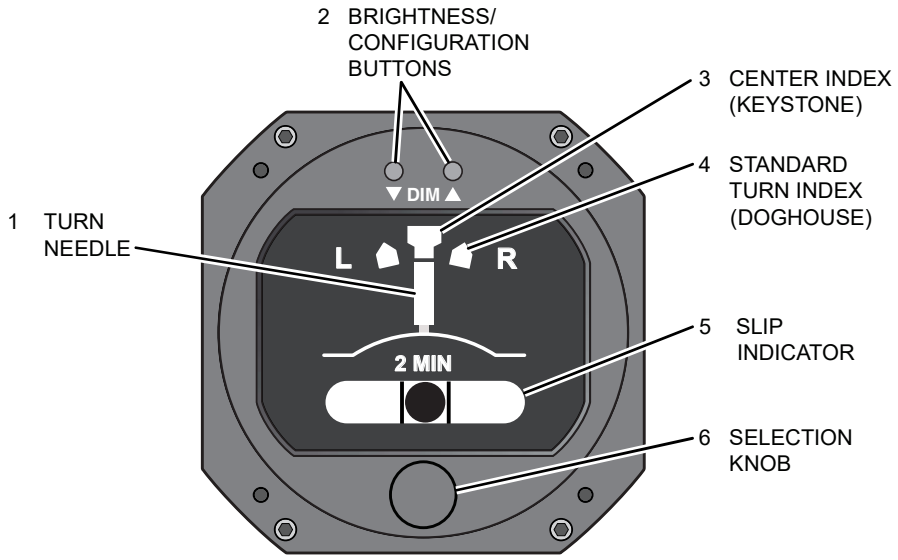


Figure 1.4, Typical Display Features - Turn and Bank

1. **TURN NEEDLE**
   Deflects right or left indicating the rate of turn. (See Figure 1.5 below).

2. **BRIGHTNESS/SETTINGS BUTTONS**
   Set the brightness of the screen by pressing the up arrow for higher or down arrow for lower brightness. Press both buttons simultaneously to reset brightness to 100%. Press and hold both buttons simultaneously when power is applied to instrument to access the Configuration Menu.

3. **CENTER INDEX (KEYSTONE)**
   Indicates no turn rate when Turn Needle is centered on this mark.

4. **STANDARD TURN INDEX (DOGHOUSE)**
   indicates standard rate of turn when turn needle deflects to this mark.

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

6. **SELECTION KNOB**
   Used to set user configuration menu at startup. Press both brightness buttons on power-up to access menu. Press during flight to show battery status.

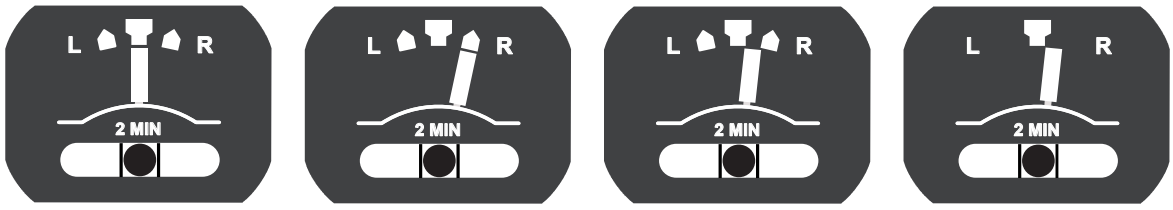


Figure 1.5, Turn and Bank Needle Positions

1.4 STANDARD CONFIGURATIONS

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

Panel Tilt Angle setting	Can be set by customer
Mating Connector	DB15 2146T13 or equivalent
Color Scheme	Standard black and white
Power Failure Indication Flag	Yes
Brightness Adjust	Yes

Table 1.2, Standard Configurations

1.5 OPTIONAL FEATURES

BATTERY BACKUP
Automatically provides up to two hours of battery power in the event of a power loss.

Associated battery messages:
“Batt Pwr” indicates when the unit is operating in the Battery Mode.
(To shutdown Battery Mode, simultaneously press and hold both “Dim” buttons).

A “CHK BATT” warning will appear on the lower left screen which indicates that either the battery has failed the capacity test or is inoperable. (See Section 5.2 Battery Replacement).

To check battery status in flight, press the Selection Knob. Press Selection Knob again to close window.

NVIS COMPATIBLE
Equipped with an internal NVIS compatible filter.

NOTE

- The optional Battery Pack attaches to the rear of the instrument and adds 0.48 inches to the depth of the unit. (See appendix B for replacement intervals).

SECTION 2, INSTALLATION

2.1 GENERAL INFORMATION

The conditions and test 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 for installation in an aircraft. The article may be installed only if performed under 14CFR Part 43 or the applicable airworthiness requirements.

For certain classes of Part 23 aircraft level C of DO-178B certification may not be sufficient - check with your local regulatory authority prior to installation.

2.2 HANDLING

Although the RCA8310 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 9).
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 RCA8310 Series Electric Turn Coordinator uses standard panel cutouts. Refer to Figure 1.1 "General Dimensions" for instrument and cutout dimensions.
2. See table 1.1 "Leading Particulars" for electrical pinout information. **CAUTION:** Do not apply power to Spare pins as damage may occur.
3. Attach aircraft electrical connector to the instrument and insert into the instrument panel cutout (See Figure 1.1).
4. Secure instrument 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, apply power to the instrument and allow it to warm up for 3 minutes.
6. Adjust instrument until the inclinometer is centered. Tighten screws.

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

SECTION 3, INITIAL SETUP/CONFIGURATION

3.1 CONFIGURATION

The **RCA8310** indicator comes standard with multiple configurations and customizable options which will require some minor setup before any flights are performed.

To access the Configuration Menu perform the following procedure:

Apply power to the **RCA8310** while simultaneously holding down the two DIM buttons (located at the top face of the unit) until the RC Allen Logo is displayed. After the Diagnostic process is finished, the Configuration Menu will be displayed as shown in figure 3.1 below.

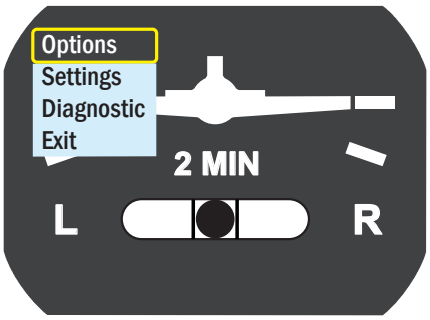


Figure 3.1 Configuration Menu

3.2 CONFIGURATION MENU

The **Configuration Menu** is used to customize Display Options and access Instrument Settings and Diagnostics. Turn the Selection Knob to choose the desired menu topic. Press the Selection Knob to open the sub-menu. This menu displays current settings. To change settings, Turn the Selection Knob to select the settings to be changed and press the Selection Knob again. Turn knob to desired setting and press to select and exit. Turn knob to Exit and push to return to main Configuration Menu. The menu settings are as follows:

OPTIONS

- Display Type – This menu option is used to select the type of display: Turn Coordinator, Turn and Bank with “doghouse” indexes and Turn and Bank without “doghouse” indexes.
- Dial Marking – This menu option changes the dial marking to either “2 MIN” (2-minute) or “4 MIN” (4-minute) (available on the Turn and Bank screen only).
- Auto Pilot Out – This menu option turns the autopilot output on or off.

SETTINGS

- Panel Tilt Set – Set the Panel Tilt Angle in 1 degree increments.
- Auto Pilot Config – Configure autopilot output settings: “% Gain” which increases/decreases output signals amplitude and “Offset“ which adjusts output signals symmetry left to right.
- Reset Battery Health – Used to reset Battery Health when installing a new battery (See Section 5.2 *Battery Replacement*).

DIAGNOSTIC

- Instrument Diagnostics – This selection opens the diagnostics check and displays the instrument Software Version, Panel Tilt, Serial Number, Battery Health and Autopilot Output Voltage.

EXIT

- Exit – select to leave Configuration Menu.

SECTION 4, OPERATION GUIDE

4.1 PRE-FLIGHT PROCEDURES

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

When applicable, check that the Battery Charge Status Indicator displays at least 50% charge to ensure a minimum of 30 minutes of operation in the event of a power failure. Press Selection Knob to open battery status. Press again to exit.

4.2 DIMMER CONTROLS

On startup, the **RCA8310** defaults at 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 1.2 and 1.4 for dimming controls).

4.3 FLIGHT MENU

The Flight Menu appears briefly (for 2 minutes) at startup to display Battery Status, Display Type, and Autopilot On status and can be closed by pressing the Selection Knob. During flight, Press the Selection Knob once to open the Flight Menu press the Selection Knob again to close the window. (See Figure 4.1 *Flight Menu* below).

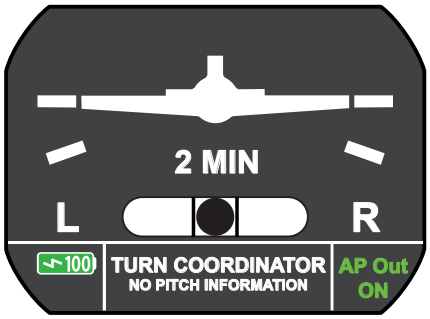


Figure 4.1 Flight Menu

4.4 FLIGHT LIMITATIONS

There are no flight limitations to the **RCA8310** Series Turn Coordinator. The instrument will operate in a full 360 degrees of turn and may be used in light aerobatic type maneuvers.

Extreme rotation speeds may cause the instrument to display a warning message to indicate to the pilot that the instrument may be operating outside the accuracy limits defined by the TSO. This message is displayed when the full scale of the instrument sensors is being exceeded and should go away within 3 to 10 seconds. Neither the display of the warning message, nor the extreme rotation speeds themselves, negatively affect the instrument so it is not necessary to service the instrument in the rare instance that the warning message is observed.

NOTE

This article meets the minimum performance and quality control standards required by a technical standard order (TSO). Installation of this article requires separate approval.

4.5 EMERGENCY PROCEDURES

In the rare event that your **RCA8310** 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.

In a low voltage situation, the **RCA8310** 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.

SECTION 5, GENERAL INFORMATION

5.1 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.

5.2 BATTERY REPLACEMENT

When the "**Chk Batt**" warning appears on the screen, it indicates that either the battery failed the capacity test, there was a problem with the capacity test, or the battery is inoperable. Before replacing the battery, perform another capacity test by completing steps 6 through 9 to re-test the battery. If this does not clear the "**Chk Batt**" message, the battery must then be replaced as soon as possible. (See Figure 5.1 below) (replace battery with P/N 635-0002-01 Battery Assy).

To replace the battery:

1. Remove Battery Cover screws. (QTY: 2)
2. Remove Battery Cover.
3. Disconnect Battery Assembly.
4. Connect new Battery Assembly.
5. Reinstall Battery Cover and screws.
6. Apply power and allow the instrument to run for at least 3 minutes until the Battery Charge Status icon reaches 100%.
7. Adjust DIM buttons so that the screen brightness is at 100%.
8. Once the Battery Charge Status icon reaches 100%, disconnect power to the instrument and allow the instrument to complete the 60 second countdown.
9. Reapply power and check that no battery related messages appear.

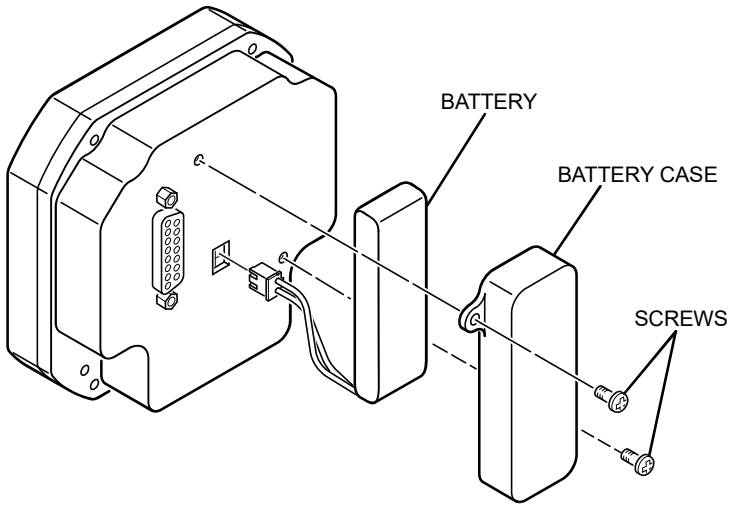


Figure 5.1, Battery Replacement

5.3 FREQUENTLY ASKED QUESTIONS

How long should my Digital Turn Coordinator last?
There isn't a good answer for this question. There are no moving parts in the RCA8310 so there isn't anything to wear out. The RCA8310 should give hundreds of hours of trouble free operation.

At what voltage level will my Digital Instrument become unreliable?
Unlike mechanical instruments, the RCA8310 doesn't have a rotor that is affected by voltage. The RCA8310 will be reliable from 9 to 32VDC.

My inclinometer 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, refer to installation Section 2.4

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

VISIT US AT:
KELLYMFG.COM
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APPENDIX A
Environmental Qualification form

Environmental Qualification: DO-160G Environmental Qualification Form
NOMENCLATURE: ELECTRIC DIGITAL TURN COORDINATOR
MODEL NUMBER: RCA8310-series **TSO NUMBER:** C3e & C113a
MANUFACTURERS SPECIFICATIONS: STP 1508 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 Low Temperature High Temperature Altitude	4.0 4.5.1 4.5.2 & 4.5.3 4.6.1	Equipment tested to Category D1
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

- 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

Instructions for Continued Airworthiness
Document Number: ICA24.008 Rev B

Equipment/Model Number: **RCA8310 series**
Equipment Description: **Electric Digital Turn Coordinator**

1. Description

This document describes the necessary maintenance requirements and instructions necessary to ensure the continued airworthiness of aircraft/rotorcraft with the RCA8310 Electric Digital Turn Coordinator installed.

2. Operation

Operating Instructions for the RCA8310 are detailed in the following document:

- Kelly Manufacturing Company Operation/Installation Guide (Publication No. 1401-8)

3. Equipment Certifications

▪ FAA TSO-C113b ▪ FAA TSO-C3e	▪ AS8034C ▪ AS8004	▪ RTCA DO-160G ▪ RTCA DO-178B Lv. C

3. Servicing

No scheduled service required

4. Maintenance Instructions

Every 12 months:

Check that the RCA8310 Electric Digital Turn Coordinator is responding properly and operating within the guidelines detailed in Kelly Manufacturing Company Publication No. 1401-8. Also verify the following

- No warning/error message exists on the display.
- No drop off or inconsistency in display brightness.

Every 24 months:

Check functional indication accuracy

Note: Indication accuracy can be verified in flight test using the following procedure:

- After take-off and before IFR situations perform two standard turns in opposite directions and verify that the instrument accurately displays the rate of turn.

Service is required if the RCA8310 does not pass this flight test. Instrument service can be performed at Kelly Manufacturing Company service@kellymfg.com

Every 36 months:

Replace Battery Assembly (635-0002-01) on applicable units equipped with a battery backup option. Contact Kelly Manufacturing Company for availability spareparts@kellymfg.com

Airworthiness Limitations

There are no airworthiness limitations for the RCA8310
Reference section 4.4 of Kelly Manufacturing Company Publication 1401-8.

Revision History

A	6/10/2024	Initial Release
B	7/15/2024	Update section 3, was TSO-C113a, and AS8034B

KMC PUBLICATION NO. 1401-8

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