

September 15, 2021

Shaun Williams
Senior Aviation Accident Investigator
National Transportation Safety Board
4760 Oakland Street, Suite 500
Denver, CO 80239
Phone: [REDACTED]

Subj: Mid-Continent Instruments and Avionics Remote Directional Gyro

Mr. Williams,

Acting as "Party Representatives", Jon George, Wichita FSDO, brought to Mid-Continent Instruments a 4305-150 Remote Directional Gyroscope (RDG), serial number 11212178 from accident #CEN21LA232 which occurred on May 15th, 2021 with the intent of evaluating the gyroscopes condition and functionality per the manufacturers design.

The outside of the shipping box was inspected for damage. No significant damage was found. Upon opening the several marks were found where the edges of the unit broke through the internal corrugated wall though not through the outer box wall (see attached pictures).

The unit itself was in good shape with no visible damage. No dents, abrasions, missing paint scratches or broken shock mounts were observed. All "Torque Seal" was in place. The stamped shipping date on the unit indicated it was shipped from Mid-Continent on May 29th, 2009.

Without opening the unit, 28VDC power was applied. The starting current was approximately .75 amps. The unit went "valid" in approximately 30 seconds at which point the running current lowered to approximately .60 amps. The heading was steady and did not drift off of its initial heading. The rotor sounded good with no indication of bearing issues.

In order to proceed, the gyro cover was removed and, using Test Data Sheet TDS190, the unit was ran through the standard acceptance criteria (attached). The RDG passed all testing except the CCW heading stability test should not exceed $\pm 2^\circ$ but was at $+5^\circ$. When the unit was shut down the rotor coasted in excess of 9 minutes which indicates a very free and stable rotor.

When these tests were completed, we allowed the unit's rotor to coast down and we restarted the RDG while connected to the standard system Flux Valve and Sandel Electronic Indicator. Starting on page 5 under "**Indicator Display Sequence**" the pictures show that when power is first applied the indicator compass card text is orange instead of white. Once the compass card aligns with the flux valve the compass card turns white and a three digit heading box appears towards the top of the display. The three digit heading has a red horizontal line through it. Once the gyro rotor speed reaches a specified rate the red line on disappears indicating that the gyro information is valid.



Videos "SandellIndicatorOnPwrUp", which show how the unit indicates a valid signal on/to the indicator by applying a red line over the three-digit heading window, and video "SandellIndicatorHdgBug", to show the heading bug displayed on the indicator, have been made available to you through our drop box.


Mark W Smith
Director of Quality
Mid-Continent Instruments and Avionics

**JON D
GEORGE**

Digitally signed by JON D
GEORGE
Date: 2021.09.17
08:48:15 -05'00'

Jon George
Principle Aviation Safety Inspector
Flight Standards District Office

Test Sheet

GENERAL DESIGN Div. of Mid-Continent Inst. Co. 	4305-150 RDG DUAL VOLTAGE TEST DATA SHEET	TDS190 REV: 3/31/03 By: KT Page 1 of 1
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TEST EQUIPMENT:

- DC Power Supply with Current limited to 1.5 Amp.
- Dual channel oscilloscope, 20 MHz or higher.
- Frequency meter and AC Volt Meter: Fluke 87 Model or equivalent.
- RDG Test Set, Turn Table.

INITIAL HOOKUP: Connect the unit's cable to the test points of test box. Connect scope's channel 1 to GYRO A OUTPUT, channel 2 to GYRO C OUTPUT. Frequency Meter to ROTOR SPEED test points of test box.

TEST PROCEDURES:

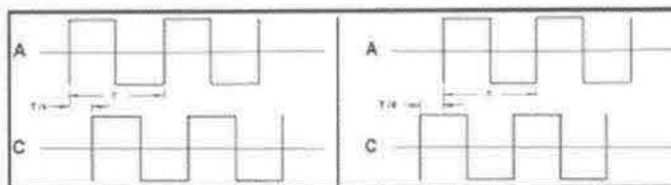
- 1) Prior to power on, check for OPEN continuity between pins 14 and 15.

Note: Record following test results in appropriate voltage column

- 2) **ROTOR STARTING:** 22.0VDC max.
11.0VDC max.
- 3) **CURRENT:** **Note:** Current measured with no load resistor on 10VAC or 26VAC
27.5 VDC Starting: 1.0A max.
Running: 0.9A max.

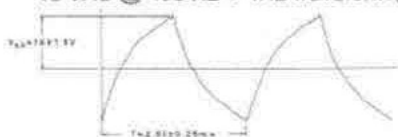
13.75 VDC Starting: 1.8A max.
Running: 1.55A max.

- 4) **GYRO VALID:** Should come on at 6,500 RPM min. within 3 minutes (108 Hz)
- 5) **ROTOR SPEED** (after 5 minutes): 9,000 RPM min. (150 Hz min.)
- 6) **GYRO A AND C OUTPUT** (observed with scope for one revolution @360°/min.)



- 7) **26 VAC @ 400Hz +/-4 Hz square wave.**
-No load: 25.0 to 30.0 VAC. (Pin 3 & 15 ground)
-With 60 Ohm 25 watt load (0.5A): 26.0 VAC +/- 3 VAC

- 8) **10 VAC @ 400 Hz +/-4Hz waveform** (observed with scope):



and RMS voltage (observed with DVM) 10.8±0.6

- 9) **DRIFT TEST:** With oscillation in roll, pitch and yaw in 10 min., the drift in either direction should not exceed 4°.
- 10) **HEADING STABILITY TEST:** With 54 +/-1° tilt and one revolution turn @ 360 +/-30° per min., the drift should not exceed 2° in either direction.

CW
CCW

INSPECTOR:

M. Smith

DATE:

9-15-21

SERIAL #:

11212178