ATTITUDE AND DIRECTION

1. DESCRIPTION

This section contains information pertaining to those portions of the system which use magnetic, gyrosopic, and inertia forces. Included is the magnetic compass, turn coordinator, attitude indicator, magnetometer, and GRS 77 attitude reference and heading system. (See Figure 34-001)

For information pertaining to the horizontal situation indicator (HSI), see Dependent Position Determining. (Refer to 34-50)

A. Magnetic Compass

The magnetic compass, mounted to the fuselage above the windshield, contains a circular compass card, visible through the compass case window, suspended in alcohol solution. The compass is equipped with compensating magnets and has two adjusting set screws, one for North-South adjustment and one for East-West adjustment. These set screws are located behind the access plate on the compass face. Light is integral and controlled by the instrument light rheostat on the bolster switch panel.

B. Turn Coordinator

The turn coordinator is an electrically driven rate gyro and slip/skid coordinator which provides roll axis information to the pilot and autopilot. The turn coordinator is mounted either in the instrument panel to the left of the HSI (Serials 22-0002 thru 22-0820 w/o PFD) or behind the RH bolster panel (Serials 22-0435 thru 22-0820 w/ PFD, Serials w/ System 55X and Perspective Avionics). 28 VDC for roll rate gyro operation is supplied through the 2-amp TURN COORD #1 circuit breaker on the Essential Bus and the 2-amp TURN COORD #2 circuit breaker on the Main Bus 2.

C. Attitude Indicator

The attitude indicator is an electrically driven gyro that displays a pictorial horizon and provides the pilot with a visual indication of the airplane’s pitch and roll attitude by sensing pitching and rolling movements about the airplane’s lateral and longitudinal axis. The attitude indicator is mounted either in the instrument panel directly in front of the pilot (Serials 22-0002 thru 22-0820 w/o PFD) or on the LH bolster panel (Serials 22-0435 thru 22-0820 w/ PFD, 22-0821 & subs, 22T-0001 & subs). 28 VDC for attitude gyro operation is supplied through the 3-amp ATTITUDE #1 circuit breaker on the Essential Bus and the 3-amp ATTITUDE #2 circuit breaker on the Main Bus 2.

D. Magnetometer

Serials 22-0435 thru 22-0820 w/ PFD, 22-0821 & subs w/o Perspective Avionics: A magnetometer assembly provides three axis magnetic field vector measurements and outside air temperature (OAT) data. The magnetometer assembly is mounted outboard in the wing. 28 VDC for the redundant power circuits is supplied through the 5-amp PFD#1 circuit breaker on the Essential Bus and the 5-amp PFD#2 circuit breaker on the Main Bus 2.

Serials w/ Perspective Avionics: A GMU 44 magnetometer, mounted outboard in the wing, provides three axis magnetic field vector measurements and interfaces with the GRS77 AHRS. A second magnetometer, located adjacent to the first, may be installed by option. 28 VDC for the standard magnetometer is supplied through the 5-amp PFD#1 circuit breaker on Essential Bus 1. 28 VDC for the optional magnetometer is supplied through the and 5-amp PFD#2 circuit breaker on Main Bus 2.

The GMU 44 magnetometer is integral to the Perspective Integrated Avionics system. For an overview of the Perspective Avionics system, refer to Chapter 42, Integrated Modular Avionics. (Refer to 42-00)

E. GRS77 Attitude and Heading Reference System (AHRS)

Serials w/ Perspective Avionics: The GRS 77 AHRS, located behind the LH instrument panel, provides aircraft attitude and heading information to the PFD and primary GIA 63 integrated avionics unit. The AHRS contains advanced sensors (including accelerometers and rate sensors) and interfaces with the magnetometer to obtain magnetic field information, air data computer to obtain air data, and both GIA 63 integrated avionics unit to obtain GPS information. A second AHRS, located behind the LH instru-
The AHRS may be installed by option. 28 VDC for the standard AHRS is supplied through the 5-amp AHRS 1 circuit breaker on Essential Bus 1. 28 VDC for the optional AHRS is supplied through the 5-amp AHRS 2 circuit breaker on Main Bus 2.

The GRS 77 AHRS is integral to the Perspective Integrated Avionics system. For an overview of the Perspective Avionics system, refer to Chapter 42, Integrated Modular Avionics. (Refer to 42-00)
## 2. TROUBLESHOOTING

<table>
<thead>
<tr>
<th>Trouble - Magnetic Compass</th>
<th>Probable Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive card error.</td>
<td>Compass not properly compensated.</td>
<td>Compensate instrument.</td>
</tr>
<tr>
<td></td>
<td>External magnetic interference.</td>
<td>Locate magnetic interference and eliminate if possible.</td>
</tr>
<tr>
<td>Excessive card oscillation.</td>
<td>Insufficient fluid.</td>
<td>Replace instrument.</td>
</tr>
<tr>
<td>Card sluggish.</td>
<td>Weak card magnet.</td>
<td>Replace instrument.</td>
</tr>
<tr>
<td></td>
<td>Excessive pivot friction or broken jewel.</td>
<td>Replace instrument.</td>
</tr>
<tr>
<td>Liquid leakage.</td>
<td>Loose bezel screws.</td>
<td>Replace instrument.</td>
</tr>
<tr>
<td></td>
<td>Broken cover glass.</td>
<td>Replace instrument.</td>
</tr>
<tr>
<td></td>
<td>Defective sealing gaskets.</td>
<td>Replace instrument.</td>
</tr>
<tr>
<td>Defective light.</td>
<td>Burned out lamp or broken circuit.</td>
<td>Check lamp or continuity of wiring.</td>
</tr>
<tr>
<td>Card sticks.</td>
<td>Altitude compensating diaphragm collapsed.</td>
<td>Replace instrument.</td>
</tr>
<tr>
<td>Card does not move when compensating screws are turned.</td>
<td>Gears that turn compensating magnets stripped.</td>
<td>Replace instrument.</td>
</tr>
<tr>
<td>Compass swings erratically when radio transmitter is keyed.</td>
<td>Normal.</td>
<td>-</td>
</tr>
<tr>
<td>Excessive drift in either direction.</td>
<td>Excessive vibration.</td>
<td>Tighten mounting screws.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trouble - Turn Coordinator</th>
<th>Probable Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turn coordinator incorrect sensitivity.</td>
<td>Out of calibration.</td>
<td>Replace instrument.</td>
</tr>
<tr>
<td>Turn coordinator/roll computer ball not centered when airplane is correctly trimmed.</td>
<td>Instrument not level in panel.</td>
<td>Level instrument.</td>
</tr>
<tr>
<td>Noisy gyro.</td>
<td>High voltage.</td>
<td>Check system voltage at connector.</td>
</tr>
<tr>
<td>In cold temperatures, turn coordinator/roll computer wing pointer fails to respond or is sluggish.</td>
<td>Oil in indicator too thick.</td>
<td>Replace instrument.</td>
</tr>
<tr>
<td></td>
<td>Insufficient bearing end play.</td>
<td>Replace instrument.</td>
</tr>
<tr>
<td></td>
<td>Low voltage.</td>
<td>Check system voltage at connector.</td>
</tr>
</tbody>
</table>
### Trouble - Attitude Indicator

<table>
<thead>
<tr>
<th>Probable Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizon bar does not settle.</td>
<td>Defective instrument. Replace instrument.</td>
</tr>
<tr>
<td></td>
<td>Excessive vibration. Tighten mounting screws.</td>
</tr>
<tr>
<td>Horizon bar oscillates or vibrates excessively.</td>
<td>Excessive vibration. Tighten mounting screws.</td>
</tr>
</tbody>
</table>
## Serials w/ Perspective Avionics:

<table>
<thead>
<tr>
<th>Trouble</th>
<th>Probable Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDG FAIL annunciation.</td>
<td>Interference from nearby metal objects.</td>
<td>Ensure metal objects (tool boxes, power carts, etc.) are not interfering with the magnetometer and aircraft is not in hangar, near other buildings, parked over metal drainage culverts or on hard surfaces that may contain steel reinforcements. Cycle power after moving aircraft away from metal objects to determine if metal objects were the source of the interference. Allow up to five minutes for the heading to reinitialize.</td>
</tr>
<tr>
<td>Interference from cell phone.</td>
<td>Ensure that a cell phone or a device using cell phone technology is not turned on (even in a monitoring state) in the cabin.</td>
<td></td>
</tr>
<tr>
<td>Aircraft not stationary.</td>
<td>Ensure the aircraft is stationary if GPS is not available. Aircraft movement (rocking the wings or moving the tail) may cause the heading to fail if it believes the aircraft is in motion without GPS input.</td>
<td></td>
</tr>
<tr>
<td>Interference from onboard electrical components.</td>
<td>Perform a Magnetometer Interference Test to check for interference from onboard electrical system components (e.g. NAV lights). Pay particular attention to any new electrical devices that have been installed since the aircraft was new. Correct any discrepancies that do not allow this test to pass before continuing.</td>
<td></td>
</tr>
<tr>
<td>Faulty connection between GRS 77 and GMU 44.</td>
<td>Check the wiring and any in-line connectors between the GRS and GMU for faults.</td>
<td></td>
</tr>
<tr>
<td>GMU 44 requires calibration.</td>
<td>Perform Adjustment/Test - GMU 44 Magnetometer Calibration. (Refer to 34-20)</td>
<td></td>
</tr>
<tr>
<td>Faulty GMU 44.</td>
<td>Replace GMU 44. (Refer to 34-20)</td>
<td></td>
</tr>
<tr>
<td>Faulty GRS 77.</td>
<td>Replace GRS 77. (Refer to 34-20)</td>
<td></td>
</tr>
<tr>
<td>Trouble</td>
<td>Probable Cause</td>
<td>Remedy</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>ATTITUDE FAIL annunciation.</td>
<td>Interference from cell phone.</td>
<td>Ensure that a cell phone or a device using cell phone technology is not turned on (even in a monitoring state) in the cabin.</td>
</tr>
<tr>
<td></td>
<td>Software or configuration error.</td>
<td>Check PFD Alert Window for PFD, MFD or GRS configuration, software, or failed data path error messages. Correct any errors before proceeding.</td>
</tr>
<tr>
<td></td>
<td>Aircraft not stationary.</td>
<td>Ensure the aircraft is stationary if GPS is not available. Aircraft movement (rocking the wings or moving the tail) may cause the heading to fail if it believes the aircraft is in motion without GPS input.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check if GPS has acquired at least four satellites, has a 3D navigation solution, and a DOP of less than 5.0.</td>
</tr>
<tr>
<td></td>
<td>Interference from nearby metal objects.</td>
<td>Check for metal objects (tool boxes, power carts, nearby large steel structures, etc.) around aircraft that could be interfering with magnetometer.</td>
</tr>
<tr>
<td></td>
<td>Faulty connector or wiring.</td>
<td>Check GRS 77 connector for security and that proper wire harness strain relief is provided.</td>
</tr>
<tr>
<td></td>
<td>GRS 77 not secured properly.</td>
<td>Verify GRS 77 is secured tightly to mounting rack and that mounting rack is not loose. (CAUTION - do not loosen mounting rack hardware to airframe shelf or aircraft will need to be re-leveled and the PITCH/ROLL OFFSET procedure performed).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Perform Engine Run-Up Test to check if engine vibration is causing GRS 77 to go offline.</td>
</tr>
<tr>
<td></td>
<td>Faulty GRS 77.</td>
<td>Replace GRS 77.</td>
</tr>
<tr>
<td></td>
<td>Faulty configuration module.</td>
<td>Replace configuration module.</td>
</tr>
</tbody>
</table>
3. MAINTENANCE PRACTICES

A. Magnetic Compass - Serials 22-0002 thru 22-0820 (See Figure 34-201)

**WARNING:** When performing Operational Test - Magnetic Compass Calibration, use a non-magnetic or plastic screwdriver.

1. Removal - Magnetic Compass
   (a) Set BAT 1, BAT 2, and AVIONICS switches to OFF positions.
   (b) Pull INSTRUMENT LIGHTS circuit breaker.
   (c) While supporting compass assembly, remove screws and nuts securing compass to compass bracket.
   (d) While supporting compass, loosen forward headliner. (Refer to 25-10)
   (e) Disconnect electrical connector, then remove compass assembly from airplane.

2. Installation - Magnetic Compass
   (a) Connect electrical connector.
   (b) While supporting compass, install forward headliner. (Refer to 25-10)
   (c) Install screws and nuts securing compass to compass bracket.
   (d) Reset INSTRUMENT LIGHTS circuit breaker.
   (e) Perform Operational Test - Magnetic Compass Calibration. (Refer to 34-20)

3. Removal - Magnetic Compass Bracket
   (a) Perform Removal - Magnetic Compass Assembly. (Refer to 34-20)
   (b) Remove velcro used for securing calibration card to headliner, exposing screw.
   (c) Remove screws securing compass bracket to cabin ceiling, then remove compass bracket from airplane.

4. Installation - Magnetic Compass Bracket
   (a) Position compass bracket over mounting holes on roll cage structure and cover with forward headliner.
   (b) Install screws securing compass bracket to cabin ceiling.
   (c) Secure velcro to headliner, then attach calibration card.
   (d) Perform Installation - Magnetic Compass Assembly. (Refer to 34-20)

5. Operational Test - Magnetic Compass Calibration
   (a) Place the airplane in as realistic flight environment as possible.
   (b) Verify that doors are closed, flaps are in retracted position, engine is running, and airplane is in level flight attitude.
   (c) Set BAT 1, BAT 2, ALT 1, ALT 2, PITOT HEAT, and all radio switches to ON positions.
   (d) Set all other cockpit controlled electrical switches should be in OFF positions.

**WARNING:** When performing Operational Test - Magnetic Compass Calibration, use a non-magnetic or plastic screwdriver.

(e) Remove screws securing access plate to compass housing to reveal adjustment screws.
(f) Set adjustment screws of compensator on zero. Zero position is indicated when dot of screw is aligned with dot on compass frame.
(g) Taxi airplane to compass rose.
(h) Align centerline of airplane on magnetic North heading. Adjust N-S set screw until compass reads North.
(i) Align centerline of airplane on magnetic East heading. Adjust E-W set screw until compass reads East.
(j) Align centerline of airplane on magnetic South heading, then note resulting South error. Adjust N-S set screw until one-half of error is removed.
(k) Align centerline of airplane on magnetic West heading, then note resulting West error. Adjust E-W set screw until one-half of error is removed.
(l) Align centerline of airplane in successive magnetic 30-degree headings and record compass readings on appropriate deviation card. Deviations must not exceed 10 degrees on any heading.
(m) Set BAT 1, BAT 2, ALT 1, ALT 2, PITOT HEAT, and all radio switches to OFF positions.
B. Magnetic Compass - **Serials 22-0821 & subs, 22T-0001 & subs** (See Figure 34-201)

**WARNING:** When performing Operational Test - Magnetic Compass Calibration, use a non-magnetic or plastic screwdriver.

1. Removal - Magnetic Compass
   - (a) Set BAT 1, BAT 2, and AVIONICS switches to OFF positions.
   - (b) Pull INSTRUMENT LIGHTS circuit breaker.
   - (c) While supporting compass, loosen forward headliner. *(Refer to 25-10)*
   - (d) While supporting compass assembly, remove screws, washers, and nuts securing compass to forward headliner.
   - (e) Disconnect electrical connector, then remove compass assembly from airplane.

2. Installation - Magnetic Compass
   - (a) Connect electrical connector.
   - (b) Install screws, washers, and nuts securing compass to forward headliner.
   - (c) While supporting compass, install forward headliner. *(Refer to 25-10)*
   - (d) Reset INSTRUMENT LIGHTS circuit breaker.
   - (e) Perform Operational Test - Magnetic Compass Calibration. *(Refer to 34-20)*

3. Removal - Magnetic Compass Bracket
   - (a) Remove screw and washer securing compass bracket to cabin ceiling, then remove compass bracket from airplane.

4. Installation - Magnetic Compass Bracket
   - (a) Position compass bracket over mounting hole in forward headliner.
   - (b) Install screw and washer securing compass bracket to cabin ceiling.

5. Operational Test - Magnetic Compass Calibration
   - (a) Place the airplane in as realistic flight environment as possible.
   - (b) Verify that doors are closed, flaps are in retracted position, engine is running, and airplane is in level flight attitude.
   - (c) Set BAT 1, BAT 2, ALT 1, ALT 2, PITOT HEAT, and all radio switches to ON positions.
   - (d) Set all other cockpit controlled electrical switches should be in OFF positions.

**WARNING:** When performing Operational Test - Magnetic Compass Calibration, use plastic adjustment tool included with new compass.

- (e) Adjust compass for zero magnetic corrections. The level of magnetic correction is indicated on top of the compass. Zero correction is indicated when spindle markings align with markings on top of compass to form a line.
- (f) Taxi airplane to compass rose.
- (g) Align centerline of airplane on magnetic North heading. Adjust N-S set screw until compass reads North.
- (h) Align centerline of airplane on magnetic East heading. Adjust E-W set screw until compass reads East.
- (i) Align centerline of airplane on magnetic South heading, then note resulting South error. Adjust N-S set screw until one-half of error is removed.
- (j) Align centerline of airplane on magnetic West heading, then note resulting West error. Adjust E-W set screw until one-half of error is removed.
- (k) Align centerline of airplane in successive magnetic 30-degree headings and record compass readings on appropriate deviation card. Deviations must not exceed 10 degrees on any heading.
- (l) Set BAT 1, BAT 2, ALT 1, ALT 2, PITOT HEAT, and all radio switches to OFF positions.
Figure 34-201
Magnetic Compass Installation - Serials 22-0002 thru 22-0820 (Sheet 1 of 2)

EFFECTIVITY:
Serials 22-0002 thru 22-0820

LEGEND
1. Bracket
2. Screw
3. Velcro
4. Card Holder
5. Calibration Card
6. Plastic Cover
7. Compass
8. Nut
9. Connector
Figure 34-201
Magnetic Compass Installation - Serials 22-0821 & subs, 22T-0001 & subs (Sheet 2 of 2)

DETAIL B
Serials 22-0821 & subs, 22T-0001 & subs.

LEGEND
1. Bracket
2. Screw
5. Calibration Card
7. Compass
8. Nut
9. Connector
10. Washer

EFFECTIVITY:
Serials 22-0821 & subs, 22T-0001 & subs
C. Turn Coordinator - Serials 22-0002 thru 22-0820 w/o PFD (See Figure 34-202)

(1) Removal - Turn Coordinator
   (a) Set BAT 1, BAT 2, and AVIONICS switches to OFF positions.
   (b) Pull TURN COORDINATOR circuit breaker.
   (c) Remove LH kick plate. (Refer to 25-10)
   (d) Disconnect instrument light connector and cable assembly from back of turn coordinator.
   (e) While supporting turn coordinator, remove screws and washers securing unit to instrument panel.
   (f) Remove turn coordinator from airplane.

(2) Installation - Turn Coordinator
   (a) Position turn coordinator in instrument panel, then install screws and washers.
   (b) Connect connector and cable assembly.
   (c) Reset TURN COORDINATOR circuit breaker.
   (d) Perform Operational Test - Turn Coordinator. (Refer to 34-20)
   (e) Install LH kick plate. (Refer to 25-10)

(3) Operational Test - Turn Coordinator
   (a) Set BAT 1 switch to ON position.
   (b) Verify failure warning flag is out of view.
   (c) When gyro reaches operational speed, verify airplane indicator is positioned horizontally and slip indicator ball is centered.
   (d) Set BAT 1 switch to OFF position.
D. Turn Coordinator - Serials 22-0435 thru 22-0820 w/ PFD, Serials w/ System 55X and Perspective Avionics (See Figure 34-203)

(1) Removal - Turn Coordinator
   (a) Set BAT 1, BAT 2, and AVIONICS switches to OFF positions.
   (b) Pull TURN COORDINATOR circuit breaker.
   (c) Remove RH kick plate. (Refer to 25-10)
   (d) Disconnect instrument light connector and cable assembly from back of turn coordinator.
   (e) While supporting turn coordinator, remove screws and washers securing unit to bracket.
   (f) Remove turn coordinator from airplane.

(2) Installation - Turn Coordinator
   (a) Position turn coordinator in bracket, then install screws and washers.
   (b) Connect connector and cable assembly.
   (c) Reset TURN COORDINATOR circuit breaker.
   (d) Perform Operational Test - Turn Coordinator. (Refer to 34-20)
   (e) Install RH kick plate. (Refer to 25-10)

(3) Operational Test - Turn Coordinator
   (a) Set BAT 1 switch to ON position.
   (b) Verify failure warning flag is out of view.
   (c) Set BAT 1 switch to OFF position.
Figure 34-202
Turn Coordinator Installation - Serials 22-0002 thru 22-0820 w/o PFD (Sheet 1 of 2)

LEGEND
1. Screw
2. Washer
3. Turn Coordinator
4. Connector, (lighting)
5. Nut Clip

DETAIL A
Serials 22-0002 thru 22-0434, 22-0435 thru 22-0820 w/o PFD.

SR22_MM34_1550A
Figure 34-203
Turn Coordinator - Serials 22-0435 thru 22-0820 w/ PFD, Serials w/ System 55X and Perspective Avionics (Sheet 2 of 2)

LEGEND
1. Screw
2. Washer
3. Turn Coordinator
5. Nutclip
6. Nut
7. Bracket

DETAIL B

CIRRUS AIRPLANE MAINTENANCE MANUAL MODELS SR22 AND SR22T

EFFECTIVITY:
Serials 22-0435 thru 22-0820 w/ PFD, Serials w/ System 55X and Perspective Avionics

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E. Attitude Indicator - Serials 22-0002 thru 22-0820 w/o PFD (See Figure 34-204)

(1) Removal - Attitude Indicator
   (a) Set BAT 1, BAT 2, and AVIONICS switches to OFF positions.
   (b) Pull INSTRUMENT LIGHTS circuit breaker.
   (c) Remove glareshield. (Refer to 25-10)
   (d) Disconnect electrical connector.
   (e) While supporting attitude indicator, remove screws and washers securing unit to instrument panel.
   (f) Cap off fittings on back of attitude indicator to prevent possible contamination and remove attitude indicator from airplane.

(2) Installation - Attitude Indicator
   (a) Position attitude indicator in instrument panel and secure with screws and washers.
   (b) Connect electrical connector.
   (c) Reset INSTRUMENT LIGHTS circuit breaker.
   (d) Perform Operational Test - Attitude Indicator. (Refer to 34-20)
   (e) Install glareshield. (Refer to 25-10)

(3) Operational Test - Attitude Indicator
   (a) Set BAT 1 switch to ON position.
   (b) Verify gyro flag is out of view.
   (c) As gyro speeds up, the attitude indicator will stabilize.
   (d) After 2-3 minutes, pull PULL TO CAGE knob on attitude indicator.
   (e) Verify attitude indicator is stabilized with artificial horizon resting horizontally.
   (f) Set BAT 1 switch to OFF position.
**F. Attitude Indicator - Serials 22-0435 thru 22-0820 w/ PFD, 22-0821 & subs, 22T-0001 & subs (See Figure 34-205)**

1. **Removal - Attitude Indicator**
   - (a) Set BAT 1, BAT 2, and AVIONICS switches to OFF positions.
   - (b) Pull INSTRUMENT LIGHTS circuit breaker.
   - (c) Remove LH kick plate. (Refer to 25-10)
   - (d) Disconnect electrical connector.
   - (e) While supporting attitude indicator, remove screws and washers securing unit to bolster panel.
   - (f) Cap off fittings on back of attitude indicator to prevent possible contamination and remove attitude indicator from airplane.

2. **Installation - Attitude Indicator**
   - (a) Position attitude indicator in bolster panel and secure with screws and washers.
   - (b) Connect electrical connector.
   - (c) Reset INSTRUMENT LIGHTS circuit breaker.
   - (d) Perform Operational Test - Attitude Indicator. (Refer to 34-20)
   - (e) Install LH kick plate. (Refer to 25-10)

3. **Operational Test - Attitude Indicator**
   - (a) Set BAT 1 switch to ON position.
   - (b) Verify gyro flag is out of view.
   - (c) As gyro speeds up, the attitude indicator will stabilize.
   - (d) After 2-3 minutes, pull PULL TO CAGE knob on attitude indicator.
   - (e) Verify attitude indicator is stabilized with artificial horizon resting horizontally and slip indicator ball is centered.
   - (f) Set BAT 1 switch to OFF position.
Figure 34-204
Attitude Indicator Installation - Serials 22-0002 thru 22-0820 w/o PFD (Sheet 1 of 2)

DETAIL A

LEGEND
1. Screw
2. Washer
3. Attitude Indicator
4. Knob

Serials 22-0002 thru 22-0434, 22-0435 thru 22-0820 w/o PFD.

EFFECTIVITY:
Serials 22-0002 thru 22-0820 w/o PFD
Attitude Indicator Installation - Serials 22-0435 thru 22-0820 w/ PFD, 22-0821 & subs, 22T-0001 & subs (Sheet 2 of 2)

EFFECTIVITY:
Serials 22-0435 thru 22-0820 w/ PFD, 22-0821 & subs, 22T-0001 & subs
CIRKUS AIRPLANE MAINTENANCE MANUAL MODELS SR22 AND SR22T

G. Magnetometer/OAT Sensor - Serials 22-0435 thru 22-0820 w/ PFD, 22-0821 & subs w/o Perspective Avionics (See Figure 34-206)

CAUTION: When performing maintenance practices on the magnetometer/OAT sensor, use a non-magnetic screwdriver. Use brass screws and washers to secure the magnetometer.

1) Removal - Magnetometer/OAT Sensor
   a) Set BAT 1, BAT 2, and AVIONICS switches to OFF positions.
   b) Serials 22-0002 thru 22-2437: Remove wing access panel RW14. (Refer to 06-00)
   c) Serials 22-2438 & subs: Remove wing access panel RW12. (Refer to 06-00)
   d) Remove nut and washer securing OAT sensor to access panel.
   e) Cut cable tie securing J734 connector to tie down.
   f) Disconnect J734 connector from P734 connector on wire harness.
   g) Remove screws and washers securing magnetometer to standoffs. Remove magnetometer/OAT sensor from airplane.

2) Installation - Magnetometer/OAT Sensor
   a) Acquire necessary tools, equipment, and supplies.
   b) Position magnetometer to standoffs with arrow pointing forward. Secure with screws and washers.
   c) Apply Loctite® to OAT sensor threads.
   d) Position OAT sensor to access panel and secure with washer and nut. Torque nut to 50-100 in-lb (5.6-11.3 Nm).
   e) Connect J734 connector to P734 connector on wire harness.
   f) Install cable tie securing J734 connector to tie down.
   g) Serials 22-0002 thru 22-2437: Install wing access panel RW14. (Refer to 06-00)
   h) Serials 22-2438 & subs: Install wing access panel RW12. (Refer to 06-00)
   i) Perform Functional Test - Magnetometer Calibration. (Refer to 34-20)

3) Functional Test - Magnetometer Calibration

   Note: The following procedure must be used to recalibrate the magnetometer. The magnetometer must be recalibrated whenever it is loosened, removed, replaced, whenever the PFD is replaced, and any time an IRU calibration is performed.

   Prior to calibrating magnetometer, verify that doors are closed, flaps are in retracted position, engine is running, and airplane is in level flight attitude.

   Note: If compass rose is not available, a calibrated boresight compass may be used.

   a) Acquire necessary tools, equipment, and supplies.

<table>
<thead>
<tr>
<th>Description</th>
<th>P/N or Spec.</th>
<th>Supplier</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boresight Compass</td>
<td>±1° accuracy</td>
<td>Any Source</td>
<td>Calibrate magnetometer.</td>
</tr>
</tbody>
</table>

   Note: Using the boresight compass for calibration requires two technicians.
(b) Set BAT 1, BAT 2, ALT 1, ALT 2, PITOT HEAT, and all radio switches to ON positions.
(c) Set all other cockpit controlled electrical switches to OFF positions.
(d) Place airplane in as realistic flight environment as possible.
(e) Serials w/ PFD software 530-00159-000 Rev 01 or lower: Perform Functional Test - IRU Calibration (Refer to 31-60)
(f) Continue powering PFD to keep it aligned.
(g) Taxi airplane to compass rose, if available.
(h) If using compass rose for calibration:
   1 Align centerline of airplane on magnetic North heading (±1°).
(i) If using boresight compass for calibration:

**WARNING:** Use of a boresight compass requires two technicians. Do not stand or let anyone else stand close to the arc of the airplane's propeller while conducting test.

1 With outside technician standing 20-30 ft (6-9 m) in front of airplane and through the use of hand signals, have outside technician direct technician at controls to move airplane so propeller spinner and vertical stabilizer align with magnetic North.
(j) On PFD, simultaneously press and hold top left, and 3rd down from top left keys until countdown timer in lower left corner of display indicates zero.
(k) After System Setup page appears, press [Perform Mag Cal].
(l) Press [Calibrate Heading] and wait until DONE is displayed.
(m) As indicated by boresight compass or compass rose, align centerline of airplane on each consecutive 30° heading (±1°) and continue to press [Calibrate Heading] after holding this position for each heading, waiting until DONE is displayed after each step of calibration procedure.

After last heading calibration point (330°) is completed, MAG CAL COMPLETE: RETURN TO PFD is displayed.

**Note:** On last heading calibration point (330°) it may take up to a minute for DONE to be displayed. Do not allow airplane to move from the 330° position until DONE is displayed.

(n) Press [Back To PFD] when complete.

**CAUTION:** PFD unit must be powered off and then powered up to retain these calibration settings.

(o) To retain calibration settings, power down PFD unit and then power PFD unit back up until initial countdown timer goes to zero. Calibrated PFD screen will be displayed at this point.
(p) Align centerline of airplane with consecutive 90° headings starting with North heading as indicated on boresight compass or compass rose and verify the accuracy of PFD heading display is within ±4° of boresight compass or compass rose.
(q) Set BAT 1, BAT 2, ALT 1, ALT 2, PITOT HEAT, and all radio switches to OFF positions.
Figure 34-206
Magnetometer/OAT Sensor Installation - Serials 22-0435 thru 22-0820 w/ PFD, 22-0821 thru 22-2437 (Sheet 1 of 2)

EFFECTIVITY:
Serials 22-0435 thru 22-0820 w/ PFD, 22-0821 thru 22-2437
Figure 34-206
Magnetometer/OAT Sensor Installation - Serials 22-2438-3026 & subs w/o Perspective Avionics (Sheet 2 of 2)

EFFECTIVITY:
Serials 22-2438-3026 & subs w/o Perspective Avionics

15 Jun 2010
H. GMU 44 Magnetometer - *Serials w/ Perspective Avionics* (See Figure 34-207)

**CAUTION:** When performing maintenance practices on the magnetometer, use a non-magnetic screwdriver. Use brass screws and washers to secure the magnetometer.

1. **Removal - GMU 44 Magnetometer**
   - (a) Set BAT 1, BAT 2, and AVIONICS switches to OFF positions.
   - (b) Remove wing access panel RW12. *(Refer to 06-00)*
   - (c) Remove cable tie securing magnetometer connectors to wing.
   - (d) Disconnect magnetometers from wire harness.
   - (e) Remove screws securing magnetometer mounting plate to wing.
   - (f) Remove screws, washers, and nuts securing magnetometer to mounting plate. Remove magnetometer from airplane.

2. **Installation - GMU 44 Magnetometer**
   - (a) Position magnetometer to mounting plate so that arrow will point forward when installed in wing. Secure with screws, washers, and nuts.
   - **Note:** Ensure arrow on magnetometer is pointing forward in airplane and non-magnetic hardware is used to secure magnetometer to mounting plate.
   - (b) Position magnetometer mounting plate to wing and secure with screws.
   - (c) Connect magnetometers to wire harness.
   - (d) Install cable tie securing magnetometer connectors to wing.
   - (e) Install wing access panel RW12. *(Refer to 06-00)*
   - (f) If GMU 44 has been replaced with a new or different unit, or original unit has been repaired, perform Adjustment/Test - GMU 44 Magnetometer Software Loading. *(Refer to 34-20)*
   - (g) Perform Adjustment/Test - GMU 44 Magnetometer Calibration. *(Refer to 34-20)*

3. **Adjustment/Test - GMU 44 Magnetometer Software Loading**
   - **Note:** No software loading is required if original GMU 44 is reinstalled.
   - If GMU 44 was replaced with a new, repaired, or exchanged unit, load software from the Cirrus Perspective software loader card.
   - (a) Connect 28 ±1 VDC external power to external power receptacle.
   - (b) Pull STARTER and FUEL PUMP circuit breakers.
   - **CAUTION:** Failure to remove database cards may result in cards becoming corrupted.
   - (c) Remove SD cards from top and bottom slots of MFD and PFD.
   - (d) Insert Cirrus Perspective software loader card into top slot of PFD.
   - (e) Power on PFD and MFD in Configuration mode.
     1. While holding far right softkey on PFD and MFD, set BAT 1 and AVIONICS switches to ON positions.
     2. When “INITIALIZING SYSTEM” appears in upper left corner of displays, release softkeys.
     3. On PFD, press [NO] softkey at “DO YOU WANT TO UPDATE SYSTEM FILES?” prompt.
     4. On PFD, press [NO] softkey at “DO YOU WANT TO UPDATE SYSTEM SPLASH SCREEN?”
(f) After System Status page appears on PFD, use inner [FMS] knob to select System Upload page.

(g) Press inner [FMS] knob to activate cursor.

(h) Rotate inner [FMS] knob to display list of AIRFRAME choices, highlight “AHRS ADC Options” in pop-up window, and press [ENT] key.

(i) In FILE box, rotate inner [FMS] knob to display list of FILE choices. In pop-up window, highlight AHRS/ADC configuration file that matches aircraft configuration, and press [ENT] key.


**Note:** Pressing [ENT] key will check and uncheck highlighted software box.

(k) Using [FMS] knob and [ENT] key, select GMU (1 or 2) - Software file.

(l) Once files are selected, press [LOAD] softkey.

(m) When upload is complete, press [ENT] key to select OK in UPLOAD COMPLETE window.

(n) Set BAT 1 and AVIONICS switches to OFF positions.

**CAUTION:** Wait for “flash” of display screens or 5 seconds to ensure backup capacitors have discharged before removing software loader card.

(o) Remove Cirrus Perspective software loader card from PFD.

(p) Insert SD cards into top and bottom slots of MFD and PFD.

(q) Reset STARTER RELAY and FUEL PUMP RELAY circuit breakers.

(r) Disconnect 28 ±1 VDC external power from external power receptacle.

(4) Adjustment/Test - GMU 44 Magnetometer Calibration

**Note:** The following procedure must be used to recalibrate the magnetometer. The magnetometer must be recalibrated whenever it is loosened, removed or replaced.

Prior to calibrating magnetometer, verify that doors are closed, flaps are in retracted position, engine is running, and airplane is in level flight attitude.

**Note:** If compass rose is not available, a calibrated boresight compass may be used.

(a) Acquire necessary tools, equipment, and supplies.

<table>
<thead>
<tr>
<th>Description</th>
<th>P/N or Spec.</th>
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<tbody>
<tr>
<td>Boresight Compass (if compass rose is unavailable)</td>
<td>±1° accuracy</td>
<td>Any Source</td>
<td>Calibrate magnetometer.</td>
</tr>
</tbody>
</table>

**Note:** Using the boresight compass for calibration requires two technicians.

(b) Align aircraft to a heading of magnetic north (+/-5°) at a magnetically clean calibration site.

(c) Pull PFD#1, PFD#2, MFD#1, MFD#2 circuit breakers.

(d) Power on PFD and MFD in Configuration mode.

1 While holding far right softkey on PFD and MFD, set BAT 1 and AVIONICS switches to ON positions.

2 When “INITIALIZING SYSTEM” appears in upper left corner of displays, release softkeys.

(e) Using [FMS] knobs, select GRS page group on PFD and MFD.
(f) On MFD and PFD, Select GRS/GMU Calibration page.

Note: This page requires a keystroke password to complete the procedure.

(g) On MFD and PFD, press the following softkeys in sequence: 9, 10, 11, 12 (right-most soft-key).

(h) On PFD, select GRS77 #1 in SELECT GPS UNIT window.

(i) On MFD, select GRS77 #2 in SELECT GPS UNIT window.

(j) Complete the following procedure concurrently on both displays:
   1. Select MAGNETOMETER in the SELECT PROCEDURE window, then press [ENT] key.
   2. In the BEFORE CALIBRATION window, follow displayed checklist items and press [ENT] key as each item is completed or confirmed.
   3. When CALIBRATE field is blinking, press [ENT] key to begin procedure.

(k) Follow the instructions on the flight displays. Alternate between turning aircraft to the right (approximately 30° at a time) and holding current heading when directed to HOLD POSITION.

(l) Repeat turn and hold procedure until both PFD and MFD have displayed that either the calibration has passed successfully or failed. In the event of a failed calibration, repeat calibration procedure.

(m) When both PFD and MFD display CALIBRATION SUCCESSFUL, press [ENT] key on each display.

(n) Pull PFD#1, PFD#2, MFD#1, MFD#2 circuit breakers.

(o) Reset PFD and MFD circuit breakers to restart displays in normal operating mode.

(p) Press reversionary mode switch. Verify MFD and PFD both display valid AHRS information.
Figure 34-207
Magnetometer Installation - Serials w/ Perspective Avionics

EFFECTIVITY:
Serials w/ Perspective Avionics

34-20
Page 27
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I. GRS 77 AHRS 1 / GRS 77 AHRS 2 - Serials w/ Perspective Avionics (See Figure 34-208)

(1) Removal - GRS 77 AHRS 1 / GRS 77 AHRS 2
   (a) Set BAT 1, BAT 2, and AVIONICS switches to OFF positions.
   (b) Pull AHRS 1 or AHRS 2 circuit breaker.
   (c) Remove PFD. (Refer to 31-60)
   (d) Disconnect electrical connectors from AHRS.
   (e) Loosen screws securing AHRS to rack. Remove AHRS from airplane.

(2) Installation - GRS 77 AHRS 1 / GRS 77 AHRS 2
   (a) Position AHRS to rack and secure one end with screws, leaving opposite end unsecured.
      Torque screws to 22 to 25 in-lb (2.49 to 2.82 Nm).
   (b) Using a feeler gage at the unsecured end, verify gap between AHRS and rack equals 0.01 to 0.07 inch (0.25 to 1.78 mm). If gap is within tolerance, secure loose end with screws.
      Torque screws to 22 to 25 in-lb (2.49 to 2.82 Nm).
   (c) Connect electrical connectors to AHRS.
   (d) Install PFD. (Refer to 31-60)
   (e) Reset AHRS 1 or AHRS 2 circuit breaker.
   (f) If GRS 77 has been replaced with a new or different unit, or original unit has been repaired, perform Adjustment/Test - GRS 77 Software Loading. (Refer to 34-20)
   (g) If rack was loosened during procedure:
      1 Perform Adjustment/Test - GRS 77 AHRS Pitch/Roll Offset Calibration. (Refer to 34-20)
      2 Perform Adjustment/Test - GMU 44 Magnetometer Calibration. (Refer to 34-20)
      3 Perform Adjustment/Test - GRS 77 Engine Run-Up Vibration Test. (Refer to 34-20)

(3) Adjustment/Test - GRS 77 Software Loading

   Note: No software loading is required if original GRS 77 is reinstalled. This does not include units that were returned for repair as the software and configuration files are deleted during the repair testing process.

   If GRS 77 was replaced with a new, repaired, or exchanged unit, load software from the Cirrus Perspective software loader card.

   No software loading is required if the GRS 77 configuration module was replaced. However the GRS77 Pitch/Roll Offset and GMU44 Magnetometer Calibration Procedures will need to be performed.

   (a) Connect 28 ±1 VDC external power to external power receptacle.
   (b) Pull STARTER and FUEL PUMP circuit breakers.

   CAUTION: Failure to remove database cards may result in cards becoming corrupted.

   (c) Remove SD cards from top and bottom slots of MFD and PFD.
   (d) Insert Cirrus Perspective software loader card into top slot of PFD.
   (e) Power on PFD and MFD in Configuration mode.
      1 While holding far right softkey on PFD and MFD, set BAT 1 and AVIONICS switches to ON positions.
      2 When “INITIALIZING SYSTEM” appears in upper left corner of displays, release softkeys.
      3 On PFD, press [NO] softkey at “DO YOU WANT TO UPDATE SYSTEM FILES?” prompt.
4. On PFD, press [NO] softkey at “DO YOU WANT TO UPDATE SYSTEM SPLASH SCREEN?”

(f) After System Status page appears on PFD, use inner [FMS] knob to select System Upload page.

(g) Press inner [FMS] knob to activate cursor.

(h) Rotate inner [FMS] knob to display list of AIRFRAME choices, highlight “AHRS ADC Options” in pop-up window, and press [ENT] key.

(i) In FILE box, rotate inner [FMS] knob to display list of FILE choices. In the pop-up window, highlight AHRS/ADC configuration file that matches the number of units in aircraft, and press [ENT] key.


(k) Using [FMS] knob and [ENT] key, select GRS (1 or 2) - Software file.

**Note:** Pressing [ENT] key will check and uncheck highlighted software box.

(l) Once files are selected, press [LOAD] softkey.

(m) When upload is complete, press [ENT] key to select OK in UPLOAD COMPLETE window.

(n) Set BAT 1 and AVIONICS switches to OFF positions.

**CAUTION:** Wait for “flash” of display screens or 5 seconds to ensure backup capacitors have discharged before removing software loader card.

(o) Remove Cirrus Perspective software loader card from PFD.

(p) Insert SD cards into top and bottom slots of MFD and PFD.

(q) Reset STARTER RELAY and FUEL PUMP RELAY circuit breakers.

(r) Disconnect 28 ±1 VDC external power from external power receptacle.

(4) Adjustment/Test - GRS 77 AHRS Pitch/Roll Offset Calibration

(a) Level aircraft to within 0.25° of zero pitch and zero roll.

(b) From level position, tilt aircraft nose up 1.2° ± 0.05°.

(c) Pull PFD#1, PFD#2, MFD#1, MFD#2 circuit breakers.

(d) Power on PFD and MFD in Configuration mode.

1. While holding far right softkey on PFD and MFD, set BAT 1 and AVIONICS switches to ON positions.

2. When “INITIALIZING SYSTEM” appears in upper left corner of displays, release softkeys.

(e) On MFD and PFD, use [FMS] knobs to select GRS page group.

(f) On MFD and PFD, select GRS/GMU Calibration page.

**Note:** This page requires a keystroke password to complete the procedure.

(g) On MFD and PFD, press the following softkeys in sequence: 9, 10, 11, 12 (right-most softkey).

(h) On PFD, select GRS77 #1 in the SELECT GPS UNIT window.

(i) On MFD, select GRS77 #2 in the SELECT GPS UNIT window.

(j) Complete the following procedure concurrently on both displays:

1. Select PITCH/ROLL OFFSET in the SELECT PROCEDURE window, then press [ENT] key.

2. Follow displayed checklist items and press [ENT] key as each item is completed or confirmed.

3. When CALIBRATE field is blinking, press [ENT] key to begin procedure.
4 After several seconds, a new checklist appears in lower half of display. Press [ENT] key as each item is confirmed.

5 When CONFIRM AIRCRAFT IS LEVEL field is blinking, press [ENT] key to continue.

6 Verify CALIBRATION SUCCESSFUL is highlighted on bottom of display, then press [ENT] key.

(k) Pull PFD#1, PFD#2, MFD#1, MFD#2 circuit breakers.

(l) Reset PFD and MFD circuit breakers to restart displays in normal operating mode.

(5) Adjustment/Test - GRS 77 Engine Run-Up Vibration Test

Note: Perform this procedure to verify AHRS mounting is sufficiently rigid and insensitive to vibration.

(a) Start the engine in accordance with Pilot's Operating Handbook procedures.

Note: If needed, advise the Control Tower or Ground Control you may temporarily not be able to receive or transmit on your COM radios during this procedure before restarting the system in config mode.

(b) Power on PFD and MFD in Configuration mode.

1 While holding far right softkey on PFD and MFD, set BAT 1 and AVIONICS switches to ON positions.

2 When “INITIALIZING SYSTEM” appears in upper left corner of displays, release softkeys.

Note: Engine instruments may be monitored on this page during this procedure.

(c) On PFD, use inner [FMS] knob to select GRS/GMU Calibration page.

(d) On MFD and PFD, press the following softkeys in sequence: 9, 10, 11, 12 (right-most softkey).

(e) In SELECT GRS UNIT window, use [FMS] knob and [ENT] key to select the GRS 77 to be tested.

(f) Move cursor to SELECT PROCEDURE window and use [FMS] knob and [ENT] key to select ENGINE RUN-UP TEST.

(g) Follow checklist items displayed on PFD, and press [ENT] key as each one is completed or confirmed.

(h) When CALIBRATE field is blinking, press [ENT] key to begin test.

(i) Gradually increase power from idle to full throttle and back to idle over a period of 1 to 2 minutes.

(j) Once engine is returned to an idle setting, press [ENT] key to indicate engine run-up is complete. The TEST COMPLETE field will stop blinking.

(k) On PFD, verify GRS 77 installation has passed engine run-up vibration test. If test fails:

1 Verify security of GRS77 and/or GMU44 mounting hardware.

2 Verify electrical connector is firmly attached to GRS 77.

3 Repeat engine-run-up vibration test.
(6) Adjustment/Test - GRS 77 AHRS Earth Magnetic Field Update
   (a) Acquire necessary tools, equipment, and supplies.

<table>
<thead>
<tr>
<th>Description</th>
<th>P/N or Spec.</th>
<th>Supplier</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth Magnetic Field Update</td>
<td></td>
<td>Garmin International, Inc. Olathe, KS 66062 888-606-5482</td>
<td>Update IGRF magnetic field model.</td>
</tr>
</tbody>
</table>

   (b) Insert IGRF Model Update Card into top slot of PFD.
   (c) Power on PFD and MFD in Configuration mode.
       1. While holding far right softkey on PFD and MFD, set BAT 1 and AVIONICS switches to ON positions.
       2. When “INITIALIZING SYSTEM” appears in upper left corner of displays, release softkeys.
   (d) Press [FMS] knob to activate cursor.
   (e) Using [FMS] knob, highlight “GRS1 MV DB” in LRU field.
   (f) Verify IGRF part number and version require updating.
   (g) Press [FMS] knob to deactivate cursor.
   (h) Rotate inner [FMS] knob to select Software Upload page in the SYSTEM group.
   (i) Press [FMS] knob to select “GRS77 IGRF software” in FILE List.
   (k) Select OK and press [ENT] key at “Begin File Upload?”
   (l) Monitor upload status as it progresses.
   (m) After files finish loading, press [ENT] key at “File Upload Complete”.
   (n) Press [FMS] knob to deactivate cursor.
   (o) Rotate inner [FMS] knob to select System Status page.
   (p) Press [FMS] knob to activate cursor.
   (q) Using [FMS] knob, select “GRS1 MV DB” in LRU field.
   (r) Verify IGRF part number and version have been updated to the latest version.
**NOTE**

⚠️ Torque screws 22 to 25 in-lb.

⚠️ With one end of AHRS secured and opposite end unsecured, use a feeler gage at unsecured end to verify gap between AHRS and rack equals 0.01 to 0.07 inch (0.25 to 1.78 mm).

**LEGEND**

1. GRS 77 AHRS 1
2. GRS 77 AHRS 2
3. Rack
4. Wedge
5. Screw
6. Washer
7. Nut
8. Bolt

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**Figure 34-208**

GRS 77 AHRS Installation - Serials w/ Perspective Avionics