Pilot's Guide for the

Electronic Standby Instrument System

Model GH-3100

GOODRICH Avionics Systems

TP-560
Introduction

YOU HAVE AN IMAGE TO MAINTAIN!

WELCOME

Congratulations on your new purchase of the Goodrich GH-3100 (Software version 1.x) Electronic Standby Instrument System (ESIS). We are pleased to welcome you to the Goodrich family of high quality avionics products that allow pilots to fly more safely and with greater confidence. Compact and lightweight, the GH-3100 enables you to add the latest safety innovations from Goodrich to today's already overcrowded cockpit panels.

BRIGHTER, TOUGHER, SMARTER, BETTER

Standby instrumentation is taking on a whole new attitude – with advanced technologies; solid-state designs; reduced operating costs; and integrated instrumentation. The Goodrich GH-3100 ESIS combines all the important cues – attitude, altitude, airspeed, heading and navigation – in one easy-to-read AMLCD. It's like having a complete standby EFIS suite in a single 3-inch display. Designed by the world's leader in standby instrumentation, the FAA TSO certified GH-3100 offers the ability to visually match the look and format of your aircraft's primary EFIS.

ONE OF THE BEST PARTS – NO MOVING PARTS

The GH-3100 has easy-to-read symbology with digital simplicity assuring precise readings and high reliability. The self-contained inertial measurement cluster eliminates the need for a mechanical gyro. And best of all, it has absolutely no moving parts. The high-performance GH-3100 provides outstanding features such as precision attitude, altitude, airspeed, and heading; reduced pilot workload; and improved flight safety. It combines the strengths of flat panel technology with solid-state sensors to become one of the world's most sophisticated standby instrument systems. The GH-3100 also features a full-color, active matrix LCD; dimmable fluorescent backlighting and a full range of navigation interface capabilities, and the MAG-3000 Magnetometer.

A HISTORY OF LEADING EDGE INNOVATION

In addition to the GH-3100 ESIS, Goodrich Avionics Systems also develops and manufactures the RGC-250 Radar Graphics Computer, Stormscope® weather mapping systems, Skywatch™Traffic Advisory System, TCAS I collision avoidance systems, electromechanical standby attitude indicators and power conversion products. Goodrich also maintains a global support network at a number of factory-authorized service centers worldwide. Goodrich Avionics Systems is a division of Goodrich Corporation of Charlotte, NC.
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Pilot’s Guide for the GH-3100
Electronic Standby Instrument System

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Pilot’s Guide
This Pilot’s Guide provides the flight crew with operation instructions, quick reference troubleshooting assistance and typical display examples so the cockpit crew can quickly and easily operate the GH-3100. Actual appearance of display arrangements and colors are dependent on the unit’s specific configuration as it is applied in specific aircraft installations.

The Model GH-3100 ESIS (Electronic Standby Instrument System) provides backup pitch, roll, and slip/skid information, and backup Air Data information (airspeed, altitude and vertical speed) using internal sensor systems. Also, the system contains interface capabilities that provides Heading and Navigation information.
Equipment Description

Goodrich GH-3000 series ESIS’s are the only electronic standby systems that include a Detachable Configuration Module (DCM), which stores the display’s format configuration. The DCM contains sufficient memory to retain information specific to the hardware and software configuration for each installation, such as panel angle, navigation interface, aircraft heading calibration, and display format. When the GH-3100 is removed from the aircraft, the DCM remains in the aircraft, attached to the aircraft wiring harness that mates with the GH-3100, eliminating the need to re-configure a replaced GH-3100 Line Replaceable Unit (LRU).
The GH-3100 is packaged in a 3 ATI housing, which needs only 11 inches of length behind the instrument panel. At a maximum weight of 4 pounds, the GH-3100 offers exceptional weight savings by combining the functions of three existing instruments into one. The weight decrease is up to half the weight of today’s typical electromechanical systems.
For standby magnetic heading capabilities, the optional MAG-3000 magnetometer can be added. The MAG-3000 is comprised of a 3-axis magnetic sensor that converts magnetic field data into a digital format for the GH-3100 indicator. Heading information is displayed on a horizontal tape at the bottom of the GH-3100 display.

The DCM-3100 is the memory device that stores the indicator’s display configuration. The device remains in the aircraft to allow the removal and replacement of the GH-3100 indicator unit, thus allowing automatic configuration to the replacement unit.
Screen Features

Menu Access

The Model GH-3100 ESIS, regardless of configuration, offers crew members the ability to toggle, adjust and initiate various display elements via a Menu.

To access the Menu, press the **Menu Access Button** located below the Display Screen.

A menu listing will appear along the bottom portion of the Display Screen with four line items visible at a time. Rotate the **Adjustment Knob**, located below and to the right of the Display Screen, to scroll through the Menu and highlight a Menu item.

Menu items that Toggle ON/OFF will indicate opposite the current condition.

Menu Items that are followed by indicate that an associated Sub-Menu will appear when selected.
Menu Access (cont.)

To select a highlighted Menu item, press the **Adjustment Knob** located below and to the right of the Display Screen.

![Push to Select](image)

**Typical Sub-Menu Appearance**

A Sub-Menu provides additional adjustments and selections. To select or adjust a value in the Sub-Menu, rotate the **Adjustment Knob**.

![Rotate to Adjust](image)

To Toggle ON/OFF, initiate a highlighted Menu item, or to finalize an adjusted value, press the **Adjustment Knob**.

![Push to Toggle, Initiate or Finish](image)

Menu access will terminate when a setting is initiated or by pressing the **Menu Access Button**. Menu access termination will occur automatically after 15-20 seconds of inactivity.
Menu Access (cont.)

Press Menu Access Button, Rotate Adjustment Knob to...

FAST ERECT  ...press knob to initiate

SET BRIGHTNESS OFFSET  ...press knob for sub-menu, rotate knob to adjust, press knob to finish

FAST ALIGN  ...press knob to initiate

SET HEADING  ...press knob for sub-menu, rotate knob to set heading, press knob to finish

NAV [ON or OFF]  ...press knob to toggle for opposite of current condition

NAV MODE  ...press knob for sub-menu, rotate knob to select mode, press knob to finish

SET CRS  ...press knob for sub-menu, rotate knob to set course, press knob to finish

ILS [BC or NORMAL]  ...press knob to toggle for opposite of current condition

CRS AUTO CENTER  ...press to initiate

NAV DISPLAYS  ...press knob for sub-menu, rotate knob to select, press knob to finish

BARO TYPE  ...press knob for sub-menu, rotate knob to select type, press knob to finish

IAS TAPE DIRECTION  ...press knob to toggle for opposite of [UP or DOWN] current condition

Note: Menu item appearance is dependent on the unit’s specific configuration. The last selected settings remain after power is cycled. FAST ERECT and FAST ALIGN commands are similar to CAGING an electromechanical attitude indicator. Both commands must be performed when the aircraft is stationary or in straight and level, non-accelerated flight. FAST ALIGN will require straight and level, non-accelerated flight sustained for 90 seconds.
Barometric Setting

The Barometric Setting is indicated at the uppermost, right-hand corner of the Display Screen.

Barometric Setting adjustments are made by rotating the Adjustment Knob located below and to the right of the Display Screen.

To establish Standard Pressure Barometric Setting, (29.92 InHg/1013 HPA or MB), push the Adjustment Knob. STD will be indicated at the Barometric Setting window.

Menu access will allow the flight crew to select barometric types as Inches of Mercury (in), Hectopascals (hPa), or Millibars (mb). See page 5.
Aircraft Attitude Information is provided in the center portion of the Display Screen. Pitch and roll data is generated by internal sensors that produce recognizable attitude indications.

Attitude information is displayed in a manner similar to traditional Artificial Horizon and Slip/Skid Indicators.
Attitude Information (cont.)

An Extended Maneuver indication will appear as a message whenever the GH-3100 detects a long-duration attitude event (e.g. flight for a duration exceeding 6 minutes at a roll angle >7° from level).

Also, the indication will appear when the unit senses it is not within ±8° of the magnetic heading provided by the Magnetometer for an extended period (when the unit is configured for Heading).

These “extended” conditions may increase the possibility for erroneous Attitude and Heading displays.

The GH-3100 will self-correct for small Attitude errors, or the flight crew may initiate a FAST ERECT from the Menu (page 7) when the aircraft has returned to straight and level, non-accelerated flight.

If the GH-3100 continues to display erroneous attitude, the flight crew may then initiate a FAST ALIGN from the Menu (page 7) when the aircraft has returned to straight and level, non-accelerated flight sustained for 90 seconds. The GH-3100 will display the Alignment in Progess Screen (page 19) with a 90 second countdown.

The GH-3100 will self-correct for minor Heading errors, or the flight crew can use the Menu access (page 7) to select “Set Heading...” option to align the Heading Tape to the cockpit compass.
The GH-3100 has the capability to display Air Data Information. Air Data information includes aircraft Altitude, Airspeed, and Vertical Speed information. Airspeed and Altitude information is displayed in a scrolling “Tape” format with “Digital Readout” windows available for airspeed, altitude, vertical speed, and metric equivalent altitude (dependent on unit configuration).

**Altitude Information** is located on the right side of the Display Screen. The appearance of the Digital Readouts and Altitude Tapes is dependent upon the specific configuration for the GH-3100.
**Airspeed Information** is located on the left side of the Display Screen. The appearance of the Digital Readouts and Airspeed Tapes is dependent upon the specific configuration for the GH-3100.

### Possible Airspeed Readouts

- **V_{MO} or M_{MO}**
  - Exceeded Indication
- **V_{MO}** (Red)
  - Red - $V_{ne}$, Power On airspeed and greater
  - Yellow - between $V_{no}$ and $V_{ne}$ Power On
  - Green - $V_{no}$ airspeed and less
- **$V_{NE}$**
  - Color Bars
  - Power Off (Barber Pole)
- **$V_{NE}$**, $V_{no}$ & greater
- **143**
  - between $V_{no}$ & $V_{ne}$
- **261**
  - $V_{MO}$ or $M_{MO}$
  - Exceeded Indication
- **163**
  - $V_{ne}$ & greater
Navigation Information

Navigation Information is displayed in the center portion of the Display Screen, sharing space with the Attitude Information. Navigation displays are designed to visually match the look and format of the primary navigational systems in the cockpit.

Crew member inputs, i.e. frequency and station selections, are made at the source navigational units, with exception to those Navigation items configured for and available through the Menu access (page 5).

**Navigation Mode Indicator:**
- **FMS, FMS1, FMS2, FMS3 or FMS4** (Flight Management System)
- **NAVR or NAVL** (Long Range Navigation System-Right or Left)
- **VOR, VOR1, VOR2 or VOR3** (VHF Omnidirectional Range)
- **ILS, ILS1, ILS2 or ILS3** (Instrument Landing System)
- **ILSx BC** (Back Course)
- **TCN1 or TCN2** (Tactical Air Navigation)
- **GPS, GPS1 or GPS2** (Global Positioning System)
- **NAV TEST**

**TO/FROM Indicator**

**Distance-to-Waypoint or Station**

**Message** (notification of a message that originates from FMS)

**Course Setting**

**Parallel Crosstrack Mode (FMS)**

**Approach Mode (FMS)**

**Way Point Information (FMS)**

**Bearing to Waypoint (BRG) (FMS)**

*Note: Navigational Information appearance is dependent on the unit’s specific configuration.*
Navigation Information (cont.)

Typical ILS Mode Display Screen

- TO/FROM Indicator
- Distance-to-Station (TACAN)
- TACAN Mode Indicator
- Course Setting
- Full Scale Deviation Reference
- Course Deviation Line
- Ground Speed
- Time-to-Station

Typical TACAN Mode Display Screen

- TO/FROM Indicator
- Distance-to-Station (DME)
- TACAN Mode Indicator
- Full Scale Deviation Reference
- Reference
- Course Deviation Line
- Marker Beacon Indicator (OM, MM, IM)
- Ground Speed (DME)
- Time-to-Station (DME)

Marker Beacon Indicator (OM, MM, IM)

ILS Mode Indicator

Course Setting

Glide Slope Indicator (ILS)

Localizer Indicator (ILS)
**Navigation Information** (cont.)

![Typical VOR (with DME) Mode Display Screen]

**Attitude Declutter**, the removal of Navigation Information from the screen, will occur when the aircraft exceeds ±65° of center in roll and/or +30°/-20° of center in pitch. Navigation Information will be restored when the aircraft no longer exceeds these conditions.
Heading Information

When configured for Heading Information, the GH-3100 will display a Heading Tape at the bottom-center portion of the Display Screen.

A DG (directional gyro) indication will appear above the Heading Tape Index Line when there is a temporary loss of the external magnetic source or (MAG-3000) or external heading source.

If the DG indication continues, use the Menu access to select the “Set Heading...” option and align the Heading Tape to the cockpit reference compass. See page 7.

If the GH-3100 is configured for Navigation capabilities and the Menu selections are made for VOR, ILS, FMS/NAV or TACAN, the Course Arrow is indicated on the Heading tape.

The “To” arrow will point up on the Heading Tape at the selected course setting.

The “From” arrow points down on the tape at 180° of the course setting. See page 7 for “Set CRS” and “CRS Auto Center” Menu options.
Start-Up and Self Test

Power ON Self Test Mode

Power application to the GH-3100 starts an automatic process of self-diagnostics prior to normal operations. After power application the Display Screen will be blank approximately 15 seconds while the tests are performed.

Identification Mode

If no failures were detected during the Power ON Self Test Mode, the Identification Screen will appear.

Identification Screen

Aircraft Type for which unit is configured

Operation Counter

Software ID Numbers
Start-Up and Self Test (cont.)

Identification Mode (cont.)

Should the GH-3100 detect a failure, the Identification Screen will appear with either a clearly stated error message or an error code. Failures are either System Failures or Function Failures. System Failures will cease the start-up process, where Function Failures will complete start-up process and allow the system to operate despite the loss of the affected function. See Invalidities (page 20).

Note: Use the provided Notes pages (pages 28-29) to record the date and time and error message/code. Report the information to a Goodrich Avionics Systems authorized dealer or Goodrich Field Service.
Sensor Alignment Mode

If no System Failures are detected, the unit will then display the ATT FAIL indication with the message ALIGNING and a completion timer/counter below the Aircraft Symbol.

Sensor Alignment Mode will reach Normal Operation Mode within three minutes of applying power. During abnormal conditions, such as motion during the Sensor Alignment Mode, the indicator will reset and attempt to reach the Normal Operation Mode within six minutes of applying power.

If sensor alignment is unsuccessful, the message will change to ALIGNMENT FAIL and the system will not enter the operational mode. See Troubleshooting (page 25)

Note: Use the provided Notes pages (pages 28-29) to record the date and time of failure. Report the information to a Goodrich Avionics Systems authorized dealer or Goodrich Field Service as soon as possible.
Normal Operating Mode

While the GH-3100 is operating normally, the system continues to perform diagnostic self-tests to assure the crew of accurate information.

Invalidities are display indications that reveal a loss of information from their associated sources. The invalidities are detected during the GH-3100’s Power ON Self-Test or by the continuous Background Self-Test. They may appear as either of the examples offered here dependent on unit configuration.

Air Data information will revert to normal display when invalidity conditions no longer exist. The GH-3100 will continue to operate, displaying information from sources that are still valid.

Air Speed and Altitude Invalidity

Alternative Appearance of Air Speed and Altitude Invalidity
Normal Operating Mode (cont.)

The **Attitude Failure** indication will appear as **ATT FAIL** in the center of the Display Screen during the system start-up process (see page 19) and/or when the GH-3100’s Background Self-Test detect erroneous attitude information.

Heading Tape Invalidity and Attitude Failure will appear as either of the examples offered here dependent upon unit configuration. The Heading Tape will always appear invalid simultaneously with ATT FAIL. Heading and Attitude Invalidities (internal sensor source) must be reported. Air Data and Navigation information will continue to display if those sources are still valid.

Note: Use the provided **Notes** pages (pages 28-29) to record the date and time of the failure. Report the information to a Goodrich Avionics Systems authorized dealer or Goodrich Field Service as soon as possible.
Normal Operating Mode (cont.)

Navigation Invalidities detected using the GH-3100’s continuous Background Self-Test will cause Navigation Indicators to disappear or display with dashes (color dependent on unit configuration) in the navigation value field.

Because Navigation information displayed on the GH-3100 originates from the aircraft’s primary navigational units, those units must be checked when invalidities occur.

Note: Use the provided Notes pages (pages 28-29) to record the date and time of the failure. Report the information to a Goodrich Avionics Systems authorized dealer or Goodrich Field Service as soon as possible.
Normal Operating Mode (cont.)

Self-testing will recognize and correct internal conditions that may result in Hazardously Misleading Information (HMI). When the GH-3100’s diagnostic capabilities sense these conditions, the unit will automatically intervene to prevent loss of display (blanking).

This action will appear as a momentary flash of a Red X across the screen. No further intervention is required by the flight crew. The Red X will be visible only momentarily and may appear slightly different than illustrated below, depending on unit configuration.

Typical Correction Display

Note: Use the provided Notes pages (pages 28-29) to record the date and time of the failure. Report the information to a Goodrich Avionics Systems authorized dealer or Goodrich Field Service as soon as possible.
Start-Up and Self Test (cont.)

Normal Operating Mode (cont.)

In the event that the GH-3100’s diagnostic capabilities detect an internal condition which cannot be corrected automatically, the system will prompt the flight crew to intervene to prevent any loss of display.

**WARNING**

Power Reset Needed

will appear when the GH-3100 has recognized a need to recycle power. This should be done when the aircraft is in straight and level, non-accelerated flight.

Note: Use the provided Notes pages (pages 28-29) to record the date and time of the failure. Report the information to a Goodrich Avionics Systems authorized dealer or Goodrich Field Service as soon as possible.
Troubleshooting

INVALIDITY indications appear in the AIR DATA and HEADING TAPES. These indications result from the loss of internal sensor information. Information will return when internal corrections occur. Report to Goodrich if invalidities continue or become persistent. See pages 20 and 21.

INVALIDITY indications appear in Navigation data fields or disappear. Typically these indications result from the loss of information provided by the source units. Check those units for operation. Report to Goodrich if indications become persistent. See page 22.

ATTITUDE FAILURE indication appears. The unit’s internal attitude sensors have unsuccessfullly aligned or failed. Alignment can be attempted by recycling unit power, but this MUST be performed when the aircraft is stationary or in straight and level, non-accelerated flight. The indication will also temporarily appear during unit start-up with an additional message “Aligning.” The unit’s Air Data and Navigational information will continue to operate. Report the failure to Goodrich. See page 21.

Obvious discrepancy of pitch/roll indicators to that of true-flight. Initiate FAST ERECT (similar to Caging) when the aircraft is stationary or in straight and level, non-accelerated flight. If condition continues, perform FAST ALIGN (approx. 90 seconds). Initiate either action from the unit’s Menu Access, see page 10. Report to Goodrich if discrepancy becomes persistent.

EXTENDED MANEUVER indication appears. The indication will appear when a long-duration maneuver has been sensed by the unit. See page 10.

VERTICAL SPEED appears as RED digits or AMBER dashes. Red digits appear when the indicator reaches maximum display capability. Amber dashes appear when vertical speed exceeds measurable range of GH-3100.

Identification Screen continues to display at unit start-up. The unit has suffered a System Failure and will not operate. Attempt recycle of power at straight and level, non-accelerated flight to correct condition. See page 18.
Specifications

GH-3100 ESIS and DCM-3100 Detachable Configuration Module
**TSO No.**: C2d, C4c, C6d, C8d, C10b, C34e, C36e, C40c, C46a, C66c, C113, C115b

MAG-3000 Magnetometer
**TSO No.**: C6d
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<tr>
<th>GH3100 Indicator</th>
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<td><strong>Power Requirements</strong></td>
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<tr>
<td><strong>Weight</strong></td>
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<td><strong>Connector (J1)</strong></td>
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<td><strong>Connector (J2)</strong></td>
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<td><strong>Static Air Port:</strong></td>
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<td><strong>Pitot Air Port:</strong></td>
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<td><strong>Service Life</strong></td>
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<td><strong>Schedules Maintenance</strong></td>
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<td><strong>Storage</strong></td>
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<td><strong>Operation Requirements</strong></td>
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<td><strong>Power Requirements</strong></td>
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<td><strong>Weight</strong></td>
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<td><strong>Service Life</strong></td>
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<td><strong>Power Requirements</strong></td>
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<td><strong>Weight</strong></td>
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<td><strong>Connector (P1)</strong></td>
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<td><strong>Service Life</strong></td>
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LIMITED WARRANTY CERTIFICATE
GOODRICH AVIONICS SYSTEMS

Goodrich Avionics Systems (hereinafter called Goodrich) warrants each item of new J.E.T. and Goodrich FlightSystems brand equipment manufactured or sold by Goodrich to be free from defects in material and workmanship, under normal use as intended, for a period of thirty (30) months from date of shipment by Goodrich to an authorized facility, or twenty-four (24) months from date of installation by an authorized facility, whichever occurs first. Goodrich warrants each item of new AIM brand equipment manufactured or sold by Goodrich to be free from defects in material and workmanship, under normal use as intended, for a period of eighteen (18) months from date of shipment by Goodrich to an authorized facility, or twelve (12) months from date of installation by an authorized facility, whichever occurs first. No claim for breach of warranties will be allowed unless Goodrich is notified thereof, in writing, within thirty (30) days after the material or workmanship defect is found.

The obligation of Goodrich shall be limited to replacing or repairing at its factory the equipment found defective under terms of this warranty certificate; providing that such equipment is returned in an approved shipping container, transportation charges prepaid, to Goodrich, Grand Rapids, Michigan, or such other location as Goodrich may authorize. Goodrich reserves the right to have necessary repairs performed by an authorized agency.

This warranty shall not apply to any unit or part thereof which has not been operated, installed or maintained in accordance with Goodrich instructions, or has been repaired or altered in any way so as to adversely affect its performance or reliability, or which has been subjected to mishandling, misuse, negligence or accident.

This warranty is exclusive and is accepted by buyer in lieu of all other guarantees or warranties expressed or implied, including without limitation the implied warranties of merchantability and fitness for a particular purpose. Buyer agrees that in no event will Goodrich's liability for all losses from any cause, whether based in contract, negligence, strict liability, other tort or otherwise, exceed buyer's net purchase price, nor will Goodrich be liable for any special, incidental, consequential or exemplary damages.

Goodrich reserves the right to make changes in design, or additions to, or improvements in its equipment without the obligation to install such additions or improvements in equipment theretofore manufactured.

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