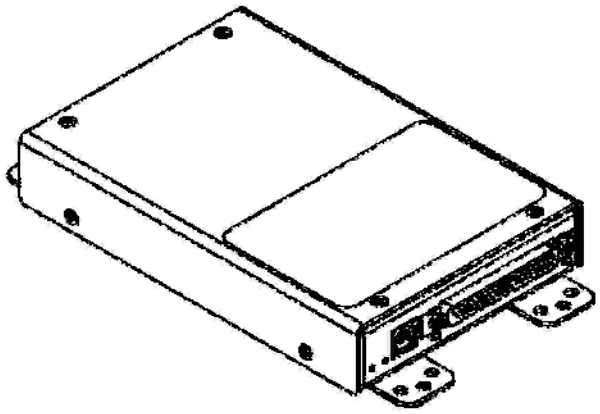
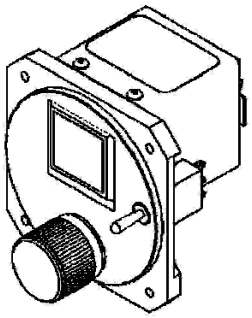
# Steering Assist Module (SAM)
# GPSS Converter/Annunciation System

Installation Manual

PN 0025-0107 REV C

April 9, 2007





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### Limited Warranty

This product is warranted to be free of defects in materials or workmanship for one year from the date of purchase. Within this period, Icarus and Centurion will repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor, provided that the customer shall be responsible for any transportation, removal and re-installation cost. This warranty does not cover failures due to abuse, misuse, accident, or unauthorized alteration or repairs.

In no event shall Icarus or Centurion be liable for any incidental, special, indirect, or consequential damages, whether resulting from the use, misuse, or inability to use this product, or from defects in the product. Some states do not allow the exclusion of incidental or consequential damages, so the above limitations may not apply to you.

# *TABLE OF REVISIONS*

| *REV* | *DATE* | *ECO* | *DESCRIPTION* |
|---|---|---|---|
| *A* | 09/25/06 | | Initial Release |
| *B* | 12/06/06 | ECO-606 | Installation Diagram and other minor updates |
| *C* | 04/09/07 | ECO-607,608 | Installation Diagram updates + support for Garmin W series GPS |

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# 1 Introduction and Product Overview

## *1.1 About this Document*

This document describes the installation and installation verification procedures for the Icarus Instruments/Centurion Consulting SAM GPSS Converter/Annunciation System. Installation should be performed by a qualified avionics installation facility.

All equipment interfaced with this product must be FAA approved.

Major sections of this document include:

| | |
|---|---|
| 1 | An Introduction and overview of the SAM system and certification |
| 2 | Installation Instruction for the SAM system |
| 3 | Post Installation Configuration, Calibration and Verification |
| 4 | Troubleshooting |
| 5 | Periodic Maintenance |
| A | Certification Information; Environmental Qualification, STC data, ICA Installation form |
| B | Installation Diagrams |
| C | Mounting Templates |
| D | Configuration/Calibration Map |
| E | Configuration Log Form |

## *1.2 Related Documents*

PN 0025-0104 Rev A or later, SAM Pilot's Operating Handbook
PN 0025-0131 Rev A or later, SAM Approved Model List
PN 0025-0106 Rev A or later, SAM Instructions for Continued Airworthiness
PN 0025-0105 Rev A or later, SAM Aircraft Flight Manual Supplement

## *1.3 Acronyms and Definitions*

The following acronyms are used in this document:

**AML -** Approved Model List
**DG -** Directional Gyro
**HSI -** Horizontal Situation Indicator
**ICA -** Instructions for Continuous Airworthiness
**GPS** - Global Positioning System
**GPSS** - GPS Steering
**SAM** - Steering Assist Module
**STC** -Supplementary Type Certificate

## *1.4 SAM Description*

The Steering Assist Module (SAM™) is a GPSS and Annunciator product consisting of a remote mounted computer, a panel mounted sunlight-readable transflective LCD Display, rotary knob, and audio toggle switch. There are multiple panel-mounting options for the display, rotary knob, and audio toggle switch, including a standard 2 ¼" round mount, a ½ ATI (King DME style) mount, and discrete components.

Two models are available; SAM001 provides GPSS and Annunciator capabilities and model SAM002 is available without GPSS functionality for pilot's who desire the audible waypoint alerts, altitude alerts, and system alerts.

Model SAM001 provides GPS Roll Steering (GPSS) by converting a GPS ARINC 429 provided Roll Steering command to a heading error signal that emulates the existing heading error signal normally provided by the DG or HSI to the autopilot.

Models SAM001 and SAM002 are capable of providing verbal and visual annunciation of information such as waypoint passage, altitude targets and systems warnings (low voltage, low vacuum, check engine, check fuel, check oil pressure, stall and check gear) provided the appropriate inputs are interfaced and configured as described in this manual.

### 1.4.1 SAM Features

SAM features include:

- GPS Roll Steering (also known as GPSS or GPS Steering) via existing autopilot heading input (Model **SAM001** only)
- A/C and D/C heading type supported (Model **SAM001** only)
- Audio (voice/tone) and visual annunciation of GPS waypoint passage
- Audio (voice/tone) and visual altitude alert functionality
- Audio (voice/tone) and visual annunciation of vacuum, oil pressure, engine, fuel, gear, stall system alerts when interfaced to appropriate equipment.
- Sunlight-readable, backlit, transflective 0.83" diagonal 64x32 pixel LCD display
- 14/28VDC Power (10-32VDC)
- ARINC 429 input for GPS data
- RS232 input for serial encoder using Garmin UPSAT (Apollo) or ICARUS format with 10 or 100 Ft resolution (required for altitude alerter functions and gear alert)

### 1.4.2 SAM Compatibility

Model SAM001 provides GPS Roll Steering (GPSS) by emulating the existing heading error signal normally provided by the DG or HSI to the autopilot. Any autopilot, AC (400Hz to 5Khz) or DC, that meets the specifications in section 1.5, with a functioning heading mode that supports a DG or HSI heading bug is compatible with SAM.

Roll Steering information is provided to SAM by a GPS with ARINC 429 output. The Garmin 155, 300, 400, 500, and 480 series all provide a compatible roll steering output as does the King KLN 900 and KLN 90B (Must conform with Bulletin NO. KLN 90B-

SW4[1]). Early models of the CNX-80 may not support ARINC-429 output, check with the installation manual. Other GPS receivers with ARINC 429 output may be compatible but it is the installer's responsibility to verify the appropriate labels are supported and a thorough functional test should be performed on the installed system to ensure compatibility.

### 1.4.3 System Interfaces

SAM includes the following interfaces:

**ARINC 429** - A High/Low Speed ARINC 429 input is used to interface with a GPS to provide GPSS computation and Display/Annunciation of GPS data. Note: GAMA Flight Plan data require to support waypoint annunciations.

**Heading Error Input/Output/Reference** – A heading error output signal is provided to interface with an AC or DC autopilot heading error input. In heading mode a solid-state switch channels the heading error input signal to this output to allow normal heading mode operation of the autopilot. In GPSS mode this output emulates the DG/HSI heading error signal to provide roll steering functionality when the autopilot is in heading mode.

Heading Error Input connects to the Heading Error Output from the Directional Gyro or HSI Heading system.

A Heading Reference Input is required for AC heading sources to provide the appropriate phase output during GPSS steering.

A calibration procedure allows the emulated GPSS Heading Error signal to match the existing aircraft DG or HSI Heading Error signal.

**RS232 Serial Altitude Input** - Serial Altitude input is supported for both the ICARUS and Garmin UPSAT (Apollo) formats. Serial input is optional but required for Altitude Alert functionality.

**Barometer Correction Input** - Altimeters with Baro Correction Potentiometers are supported and allow automatic setting of Barometric pressure for Altitude Alerts. A calibration procedure is performed as part of the installation for the specific Altimeter. Baro input is optional.

**Digital Inputs** - Digital inputs are optionally available to interface with various aircraft systems to provide audio and visual alerts.

[1]KLN 90B units require software bulletin SW4 to adequately support roll steering. A brief summary of supported units that will work with SAM include: KLN 90B units P/N 066-04031-1121, -1221, -1321, -1421, -1521, and -1621, S/N 27146 and above (or below if modified per SW4 and labeled "SW MOD 21/10"), and P/N 066-04031-2121, -2221, -2321, and -2421, S/N 82063 and above (or below if modified per SW4 and labeled "SW MOD 22/02"). See SW4 for additional details.

**Audio Output** – Audio output interfaces with the aircrafts audio panel to provide aural annunciations.

**Audio Mute Input** – An audio mute input is provided to allow manual or automatic muting of the aural annunciations.

**Dimmer Input** – The dimmer input allows the SAM display to track the aircrafts dimmer bus.

## *1.5 SAM Specifications*

This section includes electrical, physical, environmental and interface specifications for the SAM system.

### 1.5.1 Electrical

| | |
|---|---|
| Input Voltage: | 10 to 32VDC per DO-160E CAT B |
| Input Current: | 250MA Typical, 500 mA MAX @14VDC |
| | 150MA Typical, 400 mA MAX @28VDC |

### 1.5.2 Physical

**Weight**

| | |
|---|---|
| Computer PN 0025-5001 or PN 0025-5002: | 0.9 LBS MAX |
| Display: PN 0025-5003[2]: | 0.2 LB MAX |
| 1" Square Mount PN 0025-2006: | 0.05 LB MAX |
| 2 ¼" Round Mount PN 0025-2008: | 0.12 LB MAX |
| ½ ATI (King DME) Mount PN 0025-2007: | 0.11 LB MAX |
| Audio Switch: PN 0025-5005 | 0.02 LB MAX |
| Rotary Switch PN 0025-5004 | 0.05 LB MAX |

**Dimension**

| | |
|---|---|
| Computer PN 0025-5001 or PN 0025-5002: | 7.86"Lx4.43"Wx1.22"H MAX |
| Display: PN 0025-5003: | 1.94"Lx1.43"Wx1.51H MAX |
| 1" Square Mount PN 0025-2006: | 0.325"Lx1.43"Wx1.43"H MAX |
| 2 ¼" Round Mount PN 0025-2008: | 0.50"Lx2.51"Wx2.51"H MAX |
| ½ ATI (King DME Mount) PN 0025-2007: | 0.50"Lx3.55"Wx1.58"H MAX |
| Audio Switch: PN 0025-5005 | |
| Rotary Switch PN 0025-5004 | |

[2] Display requires a mounting option – PN 0025-2006, 2007 or 2008

### 1.5.3 Environmental

The SAM system is designed and tested to meet the DO-160E qualifications as listed in Appendix A1 – Certification, Environmental Qualification.

| | |
|---|---|
| Operating Temp: | -20°C to +55°C |
| Storage temperature | -55°C to +85°C |
| Temperature variation | 5°C per minute |
| Humidity | 95% at 50°C |
| Maximum continuous altitude | 35,000 ft |
| Cooling | Not required |

### 1.5.4 System Interfaces

#### ARINC 429 Inputs

Electrical: ARINC 429 High or Low Speed with odd parity or without parity

Protocol: ARINC 429 and GAMA 429

#### Heading Error Signal Output

Analog switching selects between DG/HSI Heading Error Signal input or GPSS Output. GPSS Output is configurable to AC or DC and calibrated to match the existing heading device output.

Maximum DC voltage swing: +/- 12VDC referenced to aircraft ground. AC output is 24VAC P-P MAX (40VAC P-P Reference), transformer isolated, 10K Impedance.

**NOTE:** Some autopilots have a DC offset in the heading error signal. For AC signals, an isolation transform decouples the error signal. For DC signals, the voltage swing including the offset cannot exceed the maximum output specified above. For heading mode the input is limited to +/-15V for both AC and DC signals.

#### Heading Error Signal Input

+/-15V (AC or DC) Maximum input range referenced to aircraft ground.

Input Load: 100K Ω Minimum

#### Heading Reference Signal Input

+/-20V (40V P-P) AC Maximum input range referenced to aircraft ground. Used for AC Heading Reference. 400 Hz to 5KHz.

Input Load: 10K Ω

## RS232 Serial Altitude Input

Electrical: RS232

Protocol: Serial Altitude Input supporting ICARUS or Apollo (Garmin UPSAT) Serial Altitude formats in 10 or 100 Ft resolution.

## Barometer Correction Input

Input Range: 0-28VDC

Input Load: >100K Ω

## Digital Inputs

| | |
|---|---|
| Digital Input Range: | 0VDC to 36VDC |
| Digital Threshold Voltage - High: | > 3.0 VDC |
| Digital Threshold Voltage - Low: | < 2.0 VDC |
| Input Load: | 100K Ω Minimum |

**NOTE:** All floating inputs should be disabled in software to prevent unwanted annunciations. See the configuration section for more information. Inputs do not have internal pull-up resistors therefore connections to open collector drivers require an external pull-up if not placed in parallel with an existing pull-up or annunciator.

## Audio Output

Transformer Isolated Low-level Audio output.

Load: 600 Ω

## Audio Mute Input

The Audio Mute Input is used by the SAM Mute/Repeat Audio Control switch. In addition this input provides a mechanism for an external system to Mute the SAM system. This feature can be used by a higher priority system, such as a TAWS or TCAS system to mute SAM during higher priority audio annunciations.

Input Level: TTL input with a 22KΩ pull-up to +5VDC.
Input States: High (or open) = Not Muted
Low (or GND) = Muted

**NOTE:** Diode Isolation should be used to allow continued operation of the SAM Mute/Repeat switch.

**Dimmer Input**

Input Range: 0-28VDC

Input Load: >100K Ω

## *1.6 Regulatory Compliance*

Models SAM001 and SAM002 are STC approved, see Appendix A2 – Certification, STC Permission, STC Data for STC approval.

Models SAM001 and SAM002 conform to DO-160E environmental categories listed in Appendix A1 – Certification, Environmental Qualification.

Models SAM001 and SAM002 software has been developed in accordance with DO-178B level D.

## *1.7 Packing Contents*

Carefully unpack the contents, perform a visual inspection and note any missing or damaged components.

As shipped from the factory, the SAM package will include items necessary for a normal installation with the exception of supplies normally provided by the installation shop including wire, circuit breakers, mounting screws, ty-wraps, etc. and required or optional systems to be interfaced with the SAM unit.

Package contents will vary depending on mounting and optional equipment ordered. Be certain you have received the correct mounting option for the installation.

### 1.7.1 Packing Contents: Model SAM001, PN 0025-5100

Model SAM001, PN 0025-5100 is the fully functional system with GPSS. Items included in the package include:

| Part Number | QTY | DESCRIPTION |
|---|---|---|
| 0025-5001 | 1 | ASSEMBLY, COMPUTER, WITH GPSS (SAM001) |
| 0025-5003 | 1 | ASSEMBLY, DISPLAY |
| 0025-5004 | 1 | ASSEMBLY, ROTARY SWITCH |
| 0025-5005 | 1 | ASSEMBLY, AUDIO SWITCH |
| 0025-5012 | 1 | INSTALLATION KIT |

In addition sections 1.7.3 and 1.7.4 specify mounting and optional components that may be part of the package.

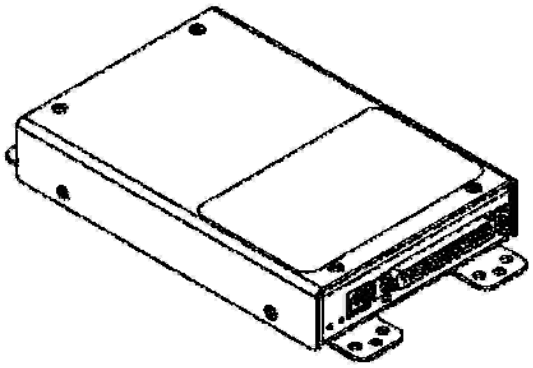
### 1.7.2 Packing Contents: Model SAM002, PN 0025-5200

Model SAM002, PN 0025-5200 includes all SAM functionality listed in section 1.4.1 without the GPSS feature for installations that do not require or desire GPSS. Items included in the package are listed below:

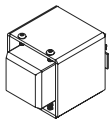
| Part Number | QTY | DESCRIPTION |
|---|---|---|
| 0025-5002 | 1 | ASSEMBLY, COMPUTER, WITHOUT GPSS (SAM002) |
| 0025-5003 | 1 | ASSEMBLY, DISPLAY |
| 0025-5004 | 1 | ASSEMBLY, ROTARY SWITCH |
| 0025-5005 | 1 | ASSEMBLY, AUDIO SWITCH |
| 0025-5012 | 1 | INSTALLATION KIT |

In addition sections 1.7.3 and 1.7.4 specify mounting and optional components that may be part of the package.

**Packing Contents SAM001/SAM002:**



PN 0025-5001, 0025-5002:



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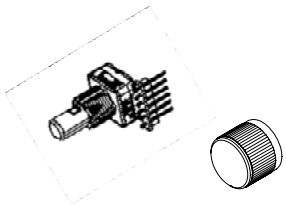

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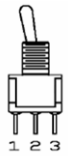



PN 0025-5005:

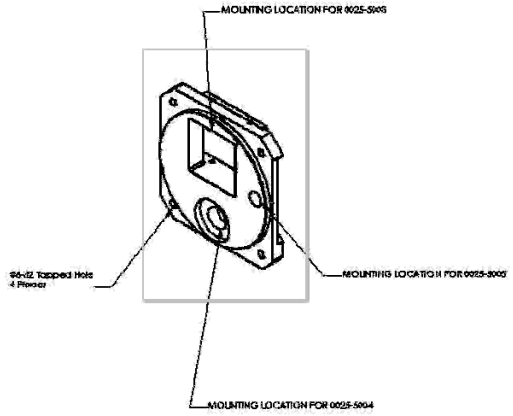
### 1.7.3 Packing Contents: Mounting Options

SAM includes three possible mounting options to allow flexibility in mounting the display and controls in a convenient location on the instrument panel. The package will include one of the mounting options.

| Part Number | QTY | DESCRIPTION |
|---|---|---|
| 0025-5006 | 1 | ASSEMBLY, MOUNTING OPTION – 1"x1" |
| 0025-6007 | 1 | ASSEMBLY, MOUNTING OPTION – 2 ¼" ROUND |
| 0025-5008 | 1 | ASSEMBLY, MOUNTING OPTION - ½ ATI |

**NOTE:** Only one mounting option is required for installation. The mounting option may be pre-installed on the display from the factory.

**Mounting Options:**

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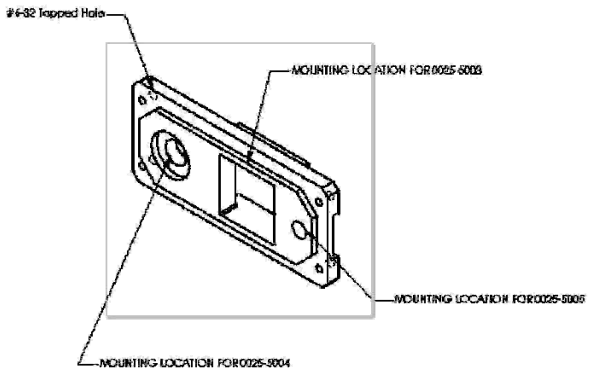
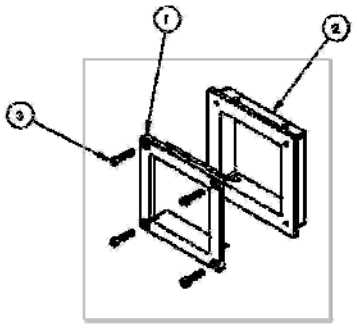



PN 0025-5008:



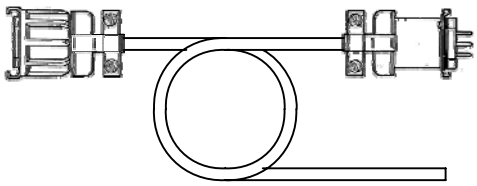

PN 0025-5006:

### 1.7.4 Packing Contents: Optional Components

Optional heading cable partial assemblies may be included in the package. These options decrease installation times by providing a pre-wired "T" harness to pick off heading and reference information from the heading source. Options include:

| Part Number | QTY | DESCRIPTION |
|---|---|---|
| 0025-5009-X | 1 | ASSEMBLY, HEADING CABLE, 52D254 |
| 0025-5010-X | 1 | ASSEMBLY, HEADING CABLE, 52D54/52D154 |
| 0025-5011-X | 1 | ASSEMBLY, HEADING CABLE, G502A/RCA110-2/6406 |

**NOTE:** Heading Cables are optional and intended to reduce installation time only.



PN: 0025-5009-X

# 2 Installation

## *2.1 Installation Overview*

This section covers Models SAM001 and SAM002 installation including physical mounting, wiring, and interconnections. Section 3 covers configuration and verification.

Acceptable avionics installation practices per FAA Advisory Circulars (AC) 43.13-1B, 43.13-2A, or later FAA approved revisions of these documents should be followed.

Read the entire section before beginning the installation.

Refer to AC 43.13-2A, Chapter 1 and Chapter 2 for structural integrity considerations of the SAM installation.

Although the SAM electrical load is small, an electrical load analysis should be accomplished in accordance with AC 43.13-1B, Chapter 11. Results should be documented on FAA Form 337.

Careful planning of the installation should include the following:

- Determination of the mounting location(s) for the SAM Display/Controls
- Determination of the mounting location of the SAM Computer

- Determination of the cable routing requirements
- Determination of other required modifications required including access to the Heading Error Signal and any other devices that will be interfaced with the SAM System.

## *2.2 Standard Supplies Required*

Standard installation supplies are expected to be supplied by the installing agency including:

- Wire
  - Single Conductor (MIL-W-22759/16 or equivalent)
  - Shielded (MIL-C-27500 or equivalent)
- Standard AN/MS Mounting Fasteners Including:
  - Screws (MS35206)
  - Flat and Lock Washers (AN960,MS35338)
  - Nuts/Nutplates (MS35649)
- Circuit breaker (Klixon 7277-2-2 or equivalent)
- Tie wraps and/or lacing cord
- Ring terminals (for grounding)
- Solder Sleeves (Sumitomo LC-2/LC-3 or equivalent) for terminating shields

## *2.3 Special Tools Required*

### 2.3.1 HD D-Sub Crimper

High Density D-Sub connectors require an appropriate crimper. The following crimpers are recommended:

| Manufacture | Crimping Tool | Positioner | Insertion/Extraction Tool |
|---|---|---|---|
| Military | M22520/2-01 | M22520/2-09 | M81969/1-04 |
| Positronic | 9507 | 9502-3 | M81969/1-04 |
| Daniels | AFM8 | K42 | M81969/1-04 |
| AMP | 601966-1 | 601966-6 | 91067-1 |

Other equivalent crimpers designed for high density D-Sub 22-28AWG pins may be used. For reference part numbers for High Density D-sub Male pins include: Military:M39029/58-360, AMP:204370-2, Positronic:M39029/58-360, ITT Cannon:030-2042-000.

### 2.3.2 FCI/Berg Mini-PV$^{tm}$ Crimper

The Rotary knob header mates with a high retention force FCI/Berg Mini-PV$^{tm}$ female header. The installation kit comes with contacts crimped on short wires eliminating the need for a non-standard crimper.

If field fabrication is desired the contact is an FCI/Berg P/N 48254-000 Mini-PV$^{tm}$ or equivalent. The FCI/Berg HT-0095 hand crimp tool or equivalent should be used. If required the extraction tool is an FCI/Berg HT-0080 or equivalent.

## *2.4 Installation Considerations*

### 2.4.1 Mounting

The SAM system has two mounting considerations; the remote computer, and the display/controls. Both have been designed for mounting flexibility. The computer may be mounted on its bottom or side without regard to orientation either behind the instrument panel or in an avionics bay. The display and controls should be mounted on the instrument panel within the field of view and reach of the pilot. There are three mounting options for the display and controls: Integrated 2 ¼" round mount, Integrated ½ ATI (King DME style 8 sided) mount, and discrete mounted display and controls.

> **NOTE:** When you inventory the package, ensure you have the appropriate mounting option for the aircraft.

The Display and Control location should be carefully considered. Preferred locations are to the right or left of the standard T instruments. Other locations may be used but should be evaluated for field of view and accessibility by the pilot.

#### 2.4.1.1 Field of View

SAM is primarily an audio/verbal product but does have a small display and placement of the display should be evaluated for placement based on field of view. AC 23.1311-1B provides guidance on the placement of electronic displays in aircraft and since SAM provides aural annunciations in addition to visual annunciations placement is allowed as follows: 35 degrees horizontal from the centerline of the basic T or pilot centerline. This is approximately +/- 21" from the centerline based on a 30" viewing distance. Vertical mounting can be from just below the basic T to the glareshield.

Deviations from this guidance will require additional FAA approval.

### 2.4.2 Aural Annunciation Conflicts

When a SAM system is installed in an aircraft with other aural annunciations such as TAWS or TCAS the installer shall prevent SAM annunciations from blocking higher priority annunciations. A mute input (see section 2.6.3.10) is provided to facilitate this task. Alternatively the installer may limit the maximum volume of the SAM system to allow the other higher priority systems to be heard over the SAM system.

SAM has the ability to provide secondary aural annunciations for existing aircraft systems. The installer is responsible for ensuring conflicts between the primary system and SAM do not cause the primary system to become unclear. This is particularly important in the case where the primary stall and gear warning systems are already provided through the pilot headphones.

### 2.4.3 Wiring

Installed wiring shall be in accordance with AC 43.13-1B Chapter 11.

See Appendix B – Installation Wiring Diagrams for the appropriate wiring connections. Wire shall be 22 to 24 AWG unless otherwise specified.

### 2.4.4 Cooling

The SAM system has no special cooling requirements. Installation should be kept away from sources of high heat.

## *2.5 Equipment Mechanical Mounting*

### 2.5.1 SAM Computer Mechanical Mounting

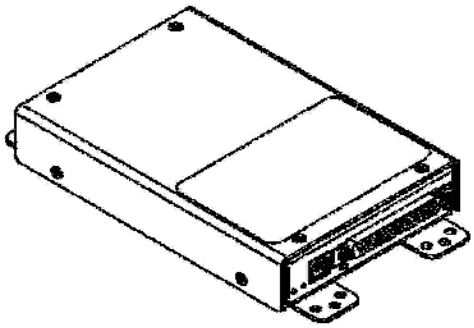
Appendix C – Mounting Templates, provides mounting cut-outs for the three display options as well as dimensions for mounting the computer.

The SAM computer can be mounted in any orientation in an avionics bay, shelf, or other suitable structure. Be certain to allow a minimum of 3" space for the connector backshell and harness when selecting a location. AC 43.13-2A Chapter 2 can be used as a reference in selecting a suitable location.

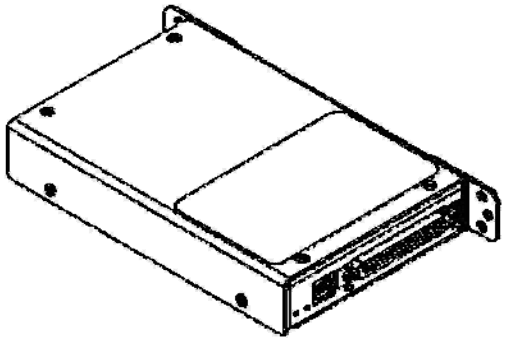
The SAM computer comes with 4 mounting tabs mounted to the bottom of the enclosure. These tabs may be removed and two of the tabs place on the side of the enclosure in the provided screw holes to allow for an alternate vertical mounting[3] with a smaller footprint.

> **WARNING**: Mounting tab and other enclosure screws should be MS24693-1 only. Use of screws longer than 3/16" will cause permanent damage to the electronics and void the warranty.

[3] DO-160E Helicopter Vibration curves are only run with mounting tabs mounted on the bottom of the enclosure.



**Mounting Tabs – Bottom**



**Mounting Tabs - Side**

The following hardware is recommended for attachment of the computer to a suitable structure:

| QTY | Description | Part Number |
|---|---|---|
| 4 | 8-32 x ½" Pan Head Screw | MS35206-245 |
| 8 | #8 Flat Washer | AN960-8L |
| 4 | 8-32 Locknut | AN365-832A |

Self locking nut plates may be substituted for AN365-832A Locknuts. Equivalent AN or MS hardware in 6-32 or 8-32 sizes may also be used and lengths adjusted as required for structure.

### 2.5.2 SAM Display Mechanical Mounting

The SAM display should be mounted on the instrument panel in the pilot's primary field of view as discussed in section 2.4.1.1. The label on the display enclosure must be oriented up for proper viewing. The display mounting option determines the mounting technique used for the display. See the appropriate section below for more details on the particular mounting option and Appendix C for mounting dimensions.

#### 2.5.2.1 2 ¼" Round Display Mounting

The 2 ¼" Round Display may be mounted in a standard 2 ¼" MS33638 style mounting. Mount using MS35214-27, 6-32 Instrument mounting screws or equivalent.

#### 2.5.2.2 ½ ATI (3.195" x 1.22" 8 Side Cutout) Display Mounting

The 3.195"x1.22" 8 sided cutout will fit the King KN63 KDI 572/573/574 style mounting hole found in many instrument panels. Mount using appropriate 4-40 mounting screws such as MS24693.

#### 2.5.2.3 1" Square Display Mounting

For limited panel space installations a 1"x1" square mounting option is available that fits in a 1"x1" square hole. Display mounting is accomplished using the supplied 2-56 MS24693 mounting screws. The square mounting has a display frame that measures

1.4”x1.4” and will require a panel this size or larger to accommodate it. This display option requires mounting of the audio and rotary switches in a location near the display.

### 2.5.3 SAM Unit Removal and Replacement

#### 2.5.3.1 Unit Removal

The SAM computer is fastened to the airframe via standard AN/MS mounting fasteners (MS35206 Screws, AN960 flat and MS35338 lock washers and MS35649 nuts and/or nutplates. Removal is accomplished as follows:

1. Verify Aircraft Master Switch is off and remove the 62 pin latching connector by depressing spring latch while pulling and gently rocking connector until removed.
2. Using hand tools remove fasteners.

The SAM Display is mounted to the instrument panel. Display fasteners vary depending on the mounting option and can include standard MS35214, MS24693 screws. Removal is accomplished as follows:

1. Verify power is removed from the system and remove the 15 pin latching connector by depressing spring latch while pulling and gently rocking connector until removed.
2. Using hand tools remove fasteners.

#### 2.5.3.2 Unit Replacement

Installation is accomplished with the aircraft master switch in the off position by re-install the display and/or computer in their original location using the same fasteners as removed.

#### 2.5.3.3 Unit Functional Test

If any component of the SAM system is removed and reinstalled, verify the SAM system power-up self-test sequence is successfully completed and no failure messages are annunciated. Section 3.5 should be used if any modifications have been made that might affect the operation or configuration of SAM.

If the SAM system computer (PN 0025-5001 or 0025-5002) is removed for repair and reinstalled or replaced with a different unit, then follow section 3 of this manual. Use the previously recorded configuration log form to configure the newly installed unit.

If any work has been done on the aircraft that could affect the system wiring, or any interconnected equipment such as the replacement of a DG or HSI, GPS, audio panel or warning system a verification using Section 3.5 should be performed.

If maintenance is performed on the autopilot or heading source (DG or HSI) a re-calibration of the SAM heading system may be required as described in the Configuration and Calibration procedures contained in Section 3.3.

## 2.6 Equipment Wiring

The SAM installation kit includes two high density D-sub connectors and a 6 Pin FCI female header. The connector pinouts are shown in sections 2.6.1 and 2.6.2. Crimp connections should be made using the crimp tools specified in section 2.3. Contacts supplied with the installation kit are as specified below.

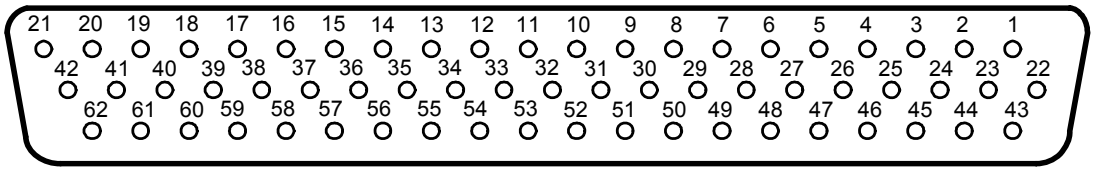
**NOTE:** The rotary switch contacts in the installation kit are provided pre-terminated to a length of wire to eliminate the need for a non-standard crimper.

| | | **Connector** | | **Contact** | |
|---|---|---|---|---|---|
| Used ON | Ref | P/N | Description | P/N | Description[4] |
| Computer | P1 | ODD62M10JVL0 | HD DB-62 Male | M39029/58-360 | 22-28 AWG HD Male Contact |
| Display | P101 | ODD15M10JVL0 | HD DB-15 Male | M39029/58-360 | 22-28 AWG HD Male Contact |
| Rotary Switch | J1 | 65039-031 | FCI 6 Pos Mini-latch PV Header | 48254-000, 48257-000, or equiv | 22-26 AWG FCI Mini-PV Gold Contact |

[4] Wire size references are based on manufactures recommendations only. AWG 22-24 are the only supported wire sizes for this installation.

### 2.6.1 SAM Computer P1 Pin-Outs

The SAM computer interconnect is made via a standard HD D-Sub 62 pin male connector.



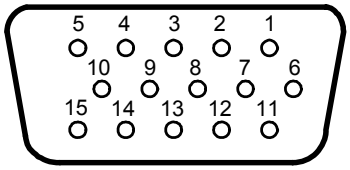

Rear View of Connector

| P1 Pin-Out | | | | |
|---|---|---|---|---|
| **Pin** | **Name** | **Description** | **I/O** | **Reference** |
| 1 | POWER IN | Aircraft Power In (10-32VDC) | I | 2.6.3.1 |
| 2 | AIRCRAFT GROUND | Aircraft Ground | I | 2.6.3.1 |
| 3 | DIMMER | Aircraft Dimmer (5/14/28VDC) | I | 2.6.3.3 |
| 4 | GND 2 | Shield Ground | O | 2.6.3.2 |
| 5 | HDG OUT LO | Heading Error Signal Output | O | 2.6.3.4 |
| 6 | HDG OUT HI | Heading Error Signal Output | O | 2.6.3.4 |
| 7 | GND 3 | Shield Ground | O | 2.6.3.2 |
| 8 | HDG IN LO | Heading Error Signal Input | I | 2.6.3.4 |
| 9 | HDG IN HI | Heading Error Signal Input | I | 2.6.3.4 |
| 10 | GND 4 | Shield Ground | O | 2.6.3.2 |
| 11 | HDG REF LO | Heading Reference Input | I | 2.6.3.4 |
| 12 | HDG REF HI | Heading Reference Input | I | 2.6.3.4 |
| 13 | GND 5 | Shield Ground | O | 2.6.3.2 |
| 14 | ANALOG IN7 | Reserved | I | 2.6.3.14 |
| 15 | BARO IN | Analog Baro Input (28VDC MAX) | I | 2.6.3.5 |
| 16 | GND 6 | Shield Ground | O | 2.6.3.2 |
| 17 | AUDIO INP LO | Reserved | I | 2.6.3.14 |
| 18 | AUDIO INP HI | Reserved | I | 2.6.3.14 |
| 19 | GND 7 | Shield Ground | O | 2.6.3.2 |
| 20 | AUDIO OUT LO | Audio Annunciation Output | O | 2.6.3.6 |
| 21 | AUDIO OUT HI | Audio Annunciation Output | O | 2.6.3.6 |
| 22 | DI #1 | Landing Gear Input (Left) | I | 2.6.3.7 |
| 23 | DI #2 | Landing Gear Input (Nose) | I | 2.6.3.7 |
| 24 | DI #3 | Landing Gear Input (Right) | I | 2.6.3.7 |
| 25 | DI #4 | Vacuum Input #1 or Left | I | 2.6.3.7 |
| 26 | DI #5 | Engine Warning Input | I | 2.6.3.7 |

| P1 Pin-Out | | | | |
|---|---|---|---|---|
| **Pin** | **Name** | **Description** | **I/O** | **Reference** |
| 27 | DI #6 | Stall Warning Switch Input | I | 2.6.3.7 |
| 28 | DI #7 | Low Fuel Warning Input | I | 2.6.3.7 |
| 29 | DI #8 | Oil Pressure Warning or GPSS Disengage Input | I | 2.6.3.7 |
| 30 | DI #9 | Vacuum Input #2 or Right | I | 2.6.3.7 |
| 31 | DI #10 | Gear Throttle/System Warning Input | I | 2.6.3.7 |
| 32 | SEROUT SPARE | Reserved | O | 2.6.3.14 |
| 33 | SERIN SPARE | Reserved | I | 2.6.3.14 |
| 34 | SEROUT SPARE | Reserved | O | 2.6.3.14 |
| 35 | SERIN SPARE | Reserved | I | 2.6.3.14 |
| 36 | GND 8 | Shield Ground | O | 2.6.3.2 |
| 37 | 429 RX1 A | ARINC 429 RX1 A | I | 2.6.3.8 |
| 38 | 429 RX1 B | ARINC 429 RX1 B | I | 2.6.3.8 |
| 39 | 429 RX2 A | Reserved | I | 2.6.3.14 |
| 40 | 429 RX2 B | Reserved | I | 2.6.3.14 |
| 41 | GND 9 | Shield Ground | O | 2.6.3.2 |
| 42 | SER ALT IN | RS 232 Serial Altitude Input | I | 2.6.3.9 |
| 43 | SEROUT SPARE | Reserved | O | 2.6.3.14 |
| 44 | GND MUTE/RPT | GROUND | O | 2.6.3.10 |
| 45 | MUTE | Mute, GND to Mute | I | 2.6.3.10 |
| 46 | REPEAT | Repeat, GND to Repeat | I | 2.6.3.10 |
| 47 | ROT MOM GND | Rotary Switch Ground | O | 2.6.3.11 |
| 48 | ROT MOM | Rotary Switch Mom SW | I | 2.6.3.11 |
| 49 | ROT QDA | Rotary Switch QDA | I | 2.6.3.11 |
| 50 | ROT QDB | Rotary Switch QDB | I | 2.6.3.11 |
| 51 | 5VDC | Rotary Switch and Aux +5VDC | O | 2.6.3.11, 2.6.3.12 |
| 52 | ROT GND | Rotary Switch GND | O | 2.6.3.11 |
| 53 | GND 10 | Shield Ground | O | 2.6.3.2 |
| 54 | ANNUN SW | Annunciator SW | I | 2.6.3.13 |
| 55 | GND 11 | Shield Ground | O | 2.6.3.2 |
| 56 | ANNUN CLK- | Annunciator CLK - | O | 2.6.3.13 |
| 57 | ANNUN CLK+ | Annunciator CLK + | O | 2.6.3.13 |
| 58 | GND 12 | Shield Ground | O | 2.6.3.2 |
| 59 | ANNUN SIO- | Annunciator Serial - | O | 2.6.3.13 |
| 60 | ANNUN SIO+ | Annunciator Serial + | O | 2.6.3.13 |
| 61 | ANNUN +5VDC | Annunciator +5VDC | O | 2.6.3.13 |
| 62 | ANNUN GND | Annunciator GND | O | 2.6.3.13 |

### 2.6.2 SAM Display P101 Pin-Outs

The SAM display interconnect is made via a standard HD D-Sub 15 pin male connector.




Rear View of Connector

| P101 Pin-Out | | | | |
|---|---|---|---|---|
| **Pin** | **Name** | **Description** | **I/O** | **Reference** |
| 1 | ANNUN +5VDC | Annunciator Power In (+5VDC) | I | 2.6.3.13 |
| 2 | ANNUN GND | Annunciator Ground | I | 2.6.3.132.6.3.11 |
| 3 | ANNUN SW | Annunciator SW | O | 2.6.3.13 |
| 4 | ANNUN CLK+ | Annunciator Clk + | I | 2.6.3.13 |
| 5 | ANNUN CLK- | Annunciator Clk - | I | 2.6.3.13 |
| 6 | ANNUN SIO+ | Annunciator SIO + | I | 2.6.3.13 |
| 7 | ANNUN SIO- | Annunciator SIO - | I | 2.6.3.13 |
| 8 | JMP 1 | Jumper Pin 8, 9 | I | 2.6.4 |
| 9 | JMP 1 | Jumper Pin 8, 9 | O | 2.6.4 |
| 10 | JMP 2 | Jumper Pin 10, 11 | I | 2.6.4 |
| 11 | JMP 2 | Jumper Pin 10, 11 | O | 2.6.4 |
| 12 | JMP 3 | Jumper Pin 12, 13 | I | 2.6.4 |
| 13 | JMP 3 | Jumper Pin 12, 13 | O | 2.6.4 |
| 14 | AUX +5VDC | Annunciator Power OUT (+5VDC) | O | 2.6.4 |
| 15 | GND | Aux GND | O | 2.6.4 |

### 2.6.3 P1 Functional Descriptions

#### 2.6.3.1 Power

Aircraft power from 10 to 32VDC are provided to the SAM Computer via the following:

P1-1 – Power
P1-2 – GND

#### 2.6.3.2 Shield Grounds

Shield Ground provisions may be used interchangeably and include the following pins:

P1-4,7,10,13,16,19,36,41,53,55,58 – Shield Ground

### 2.6.3.3 Dimmer

Display backlight brightness can be calibrated to track 5, 14, or 28VDC aircraft dimmer bus by connection to P1-3. See post installation dimmer calibration procedure for dimmer calibration.

### 2.6.3.4 Heading Error Signal (SAM 001)

The aircraft's heading source (DG, HSI) heading error signal is routed through SAM for switching the autopilot heading error signal source between the heading source or GPSS functionality. Additionally for AC heading sources the AC heading reference signal is also provided for use by GPSS.

The following connections are used for HDG:

**P1-5, P1-6 –** Heading Error Signal output to autopilot.
In Heading Mode P1-8, P1-9 are passed through to P1-5 and P1-6. In GPSS mode outputs are 10K Ω transformer isolated for A/C heading signals, or driven by a low impedance DC amplifier for D/C signals

**P1-8, P1-9 –** Heading Error Signal input from heading source (DG/HSI)

**P1-11, P1-12 –** Heading Reference Input from autopilot or aircraft heading reference source (AC Heading Sources only).
This 10K Ω impedance reference is used as a GPSS heading error signal reference.

See wiring diagrams for typical wiring with popular heading sources. Calibration is accomplished as described in the post-installation section.

### 2.6.3.5 BARO IN

Analog input is provided for barometer altimeter if available in the installation via P1-15. The input is wide-range (0-28VDC) and should be calibrated as described in the post-installation section.

### 2.6.3.6 AUDIO OUT

Audio Output is provided for voice and tone alerts on P1-20 and P1-21. The output is a fully isolated 600 Ω output that should be interfaced with the un-switched audio input of the audio system. Alternately a switched input may be used with a placard indicating the input is associated with SAM voice alerts.

### 2.6.3.7 Digital Inputs

Wide range (0-36VDC) inputs are provided to allow audio alert functionality of existing aircraft systems. All digital inputs are >100K Ω impedance and designed so they can be placed in parallel with existing systems. Inputs can be tied to existing contact closure outputs, annunciator lights, etc.

**NOTE**: Some existing systems use open collector outputs to drive annunciator lights tied to the aircrafts dimmer or aircraft power. In these instances a simple pull-up to the aircraft power will be required. See wiring diagrams for example of EDM-700 engine monitor using pull-up resistors.

Inputs are configured as described in the post-installation section and can be configured to alert on either a high or low logic level. Logic levels are defined as <2.0VDC for low and >3.0VDC for high. The system inputs and mapping are as follows:

| Discrete Inputs | | |
|---|---|---|
| **Pin(s)** | **Function** | **Description** |
| P1-22,23,24 | Landing Gear Input<br>(Left, Nose, Right) | These inputs are provided to allow for voice based gear alerts. They may be tied to a convenient location such as the existing gear warning horn connector, gear light, or gear switch. **NOTE:** for single light systems (e.g. single engine Cessna's, Pipers, etc) the three inputs must all be tied to the single light. |
| P1-25,30 | Vacuum Input<br>(#1 or Left) and (#2 or Right) | These inputs are typically placed in parallel with a low vacuum warning annunciator light. |
| P1-26 | Engine Warning Input | This input may be tied to an engine monitor that provides an engine warning light output or contact closure. |
| P1-27 | Stall Warning Switch Input | This input should only be connected to the stall warning system when the certified system does not provide audio into the headphone system. The system can be configured to act as a repeater of the certified system to provide stall warning annunciations via the headphones. |
| P1-28 | Low Fuel Warning Input | This input may be tied to an engine monitor or fuel flow device that provides a low fuel warning light output or contact closure. |
| P1-29 | Low Oil Pressure Warning Input OR GPSS Disengage (V1.3 or later SW) | An oil pressure switch with a specified threshold may be used to alert of low oil pressure. This input can be tied to the oil pressure switch used to drive a Hobbs or hour meter although the pressure setting of these |

| Discrete Inputs | | |
|---|---|---|
| **Pin(s)** | **Function** | **Description** |
| | | switches may be very low. Also with V1.3 or later SW may be configured as a GPSS Disengage input for use with Garmin GNS-430W/530W or similar systems requiring a GPSS disconnect during certain phases of operation. |
| P1-31 | Gear Throttle/System Warning Input | This input should only be used if the certified system does not provide audio into the headphone system. When connected, the system can be configured to act as a repeater of the certified gear warning system that will provide gear warning annunciations through the headphones. |

**CAUTION**: In all cases SAM alerts are considered secondary to the aircrafts primary system and in no case can the primary system be disabled or altered as part of the SAM installation including removal of an existing primary system audio alert. The installer is responsible for ensuring SAM alerts do not conflict with existing aircraft systems. See section 2.4.2 for a discussion of aural annunciation conflicts.

### 2.6.3.8 GAMA/ARINC 429 GPS Input

A GPS that provides ARINC 429 Output is required for proper operation of the SAM system. P1-37 and P1-38 should be interfaced to a GAMA or ARINC 429 output. GAMA Waypoint transfer protocol is required for waypoint annunciations. High or low speed data is supported with no parity or odd parity. The following labels are supported by SAM:

| **Label Number** | **Description** | **SAM 001** | **SAM002** |
|---|---|---|---|
| 121 | Horizontal Steering Command | Required | Ignored |
| 012 or 312 | Ground Speed | Required | Displayable |
| 003 or 116 | Cross Track Error | Required | Displayable |
| 013 or 313 | Ground Track | Displayable | Displayable |
| 320 | Magnetic Heading | Displayable | Displayable |
| 314 | True Heading | Displayable | Displayable |
| 125 or 150 | GMT | Displayable | Displayable |
| 002 or 252 | Time to Waypoint | Displayable | Displayable |
| 001 or 251 | Distance to Waypoint | Displayable | Displayable |
| 352 | Time to Destination | Displayable | Displayable |
| 351 | Distance to Destination | Displayable | Displayable |
| 114 | Desired Track | Displayable | Displayable |
| Waypt Transfer Protocol | Flight plan data | Displayable | Displayable |

### 2.6.3.9 RS232 Serial Altitude Input

P1-42 is for RS232 serial altitude input from an altitude serializer or altitude encoder with serial output. UPS-AT and Icarus (Garmin) data formats are supported. A 10' resolution encoder is desirable if the decision height alert is to be set to the nearest ten feet. High quality ten foot encoders are made by Trans-Cal and Sandia.

### 2.6.3.10 Mute/Repeat

A mute repeat switch is interfaced through the following:

P1-44 – Ground, connected to switch common
P1-45 – Mute, connected to non momentary side of switch. Also provides mechanism to allow an external system such as a TAWS system to mute SAM.
P1-46 – Repeat, connected to momentary side of switch

**NOTE**: If a higher priority voice alert system such as a TAWS or TCAS system is installed the higher priority system can mute SAM audio alerts by bringing pin P1-45 low (to ground). If multiple systems are required to interface with SAM, diode isolation via a standard 1N4006 or similar can be used.

See Installations diagrams for additional information.

### 2.6.3.11 Rotary Switch

The SAM rotary switch is interfaced through the following pins:

P1-47 – Ground
P1-48 – Mom SW
P1-49 – QDA
P1-50 – QDB
P1-51 - +5VDC
P1-52 - Ground

The SAM display has a provision to pass through signals that are the preferred way to wire the display. See wiring diagrams for additional information.

The SAM rotary switch mates with a high retention force FCI/Berg Mini-PV$^{tm}$ female header. The installation kit comes with contacts crimped on short wires eliminating the need for a non-standard crimper and shrink tubing to be used for strain relief. If the female header does not have position number 1 marked it should be marked in the field to allow for proper orientation on the rotary switch. Heat shrink tubing should be used over the headers for additional strain relief.

### 2.6.3.12 AUX +5VDC

P1-51 is typically used to provide power for the rotary switch but may also be used to provide power for a BARO potentiometer or digital input pull-up if required. MAX current draw should be limited to 25 mA. The 5 VDC line is fused with a 250 mA re-settable fuse.

### 2.6.3.13 SAM Display / Annunciator

The SAM display is interfaced to the SAM computer through the following pins:

P1-54 – Annunciator SW → P101-3
P1-56 – Annunciator CLK- → P101-5
P1-57 – Annunciator CLK+ → P101-6
P1-59 – Annunciator SIO- → P101-7
P1-60 – Annunciator SIO+ → P101-6
P1-61 – Annunciator +5VDC → P101-1
P1-62 – Annunciator GND → P101-2

**NOTE**: Twisted/Shielded pairs are required due to the speed of some of these signals. Shields should be grounded on the computer and display sides.

### 2.6.3.14 Reserved

Pins labeled "Reserved" are for future use and should not be connected.

## 2.6.4 P101 Functional Descriptions

The SAM display/annunciator should be wired as shown in the wiring diagrams and section 2.6.3.13. In addition to the SAM computer to display wiring there are additional pins made available to simplify some installations by providing a convenient location to terminate the Rotary Switch. These connections include the following:

### Jumpers

The following pins are simple connections between two pins that can be used to bring other harness wires such as the rotary switch into a common harness. Their use is optional. The following pins are interconnected:

P101-8↔P101-9
P101-10↔P101-11
P101-12↔P101-13

### AUX +5VDC Out

P101-14 provides an alternate AUX +5VDC output for use with the rotary switch.

### AUX GND

P101-15 provides an alternate AUX GND output for use with the rotary switch.

## 2.7 Weight and Balance

A W&B computation is required following the installation of the SAM system. Follow the guidelines in AC 43.13-1B, Chapter 10, section 2. Appropriate entries should be made in the equipment list indicating items added, removed, or relocated along with the date the work was accomplished.

The following table shows the weights and center of gravity location. GG references are as measured from the front of the units.

**NOTE**: Only include the computer and the appropriate installed display option from the table below. The display option includes the mount, display and switches weights.

| Description | Part Number(s) | Weight lbs | CG[5] location |
|---|---|---|---|
| Computer | 0025-5001, 0025-5002 | 0.9 lbs | 3.25” |
| Display Options: | | | |
| 2 ¼ “ round Mount with Display and Switches installed | 0025-2008 + 0025-5003 + 0025-5004 + 0025-5005 | 0.4 lbs | 0.75” |
| ½ ATI Mount with Display and Switches Installed | 0025-2007 + 0025-5003 + 0025-5004 + 0025-5005 | 0.4 lbs | 0.75” |
| 1” Square Mount with Display installed. Also includes switches that will be installed near the display on the instrument panel | 0025-2006 + 0025-5003 + 0025-5004 + 0025-5005 | 0.3 lbs | 0.5” |

## 2.8 Electrical Load Analysis

An electrical load analysis should be completed in accordance with AC 43.13-1B, Chapter 11.

The following values should be used for SAM:

Input Current: 250MA Typical, 500 mA MAX @14VDC
150MA Typical, 400 mA MAX @28VDC

## 2.9 Aircraft Specific Instructions for Continued Airworthiness (ICA)

Each aircraft must have an aircraft specific installation datasheet completed as described in the ICA PN 0025-0106. For convenience a copy of the datasheet is included in Appendix A3 –ICA Installation Datasheet.

[5] Measured from the front of the unit (J1 location on computer, face of instrument on display)

# 3 Post Installation Configuration, Calibration and Verification

Once the SAM system has been installed it must be configured for the specific installation and then verified for proper operation. Steps not applicable to a particular installation or model of the product (SAM001 and SAM002) may be skipped. A configuration log sheet is included in Appendix E to be filled out during the configuration and verification. This log sheet should be kept as part of the aircraft records. Additionally a copy of the log sheet should be included with a unit that is returned to the factory.

## *3.1 Physical Installation*

Verify that the system is securely mounted and that all cables are properly secured and installed as described in this document. Ensure power and ground are applied to the appropriate pins prior to power-up.

## *3.2 Power-on self test*

The system runs through self-diagnostic testing on power-up. Verify that the system does not display a failure indication when turned on.

## *3.3 Configuration and Calibration Overview*

Prior to operation the system must be configured. Enter configuration/calibration mode by pressing and holding the rotary knob while applying power via the avionics master switch. The knob must be held in until "CAL:Dsplay" appears on the screen.

Calibration/configuration mode consists of the following nine menus:

- Dsplay
- Audio
- Volts
- GPSS
- ARINC
- Dscrte, Misc
- Flash
- RunSam.

Use the rotary knob to configure the product by setting parameters on each menu. The menus are presented in this document in the order they appear when using the product. Many of the parameters have default values that in some cases should not be changed unless recommended by the factory. Sub-menu parameters that are in **bold** (not ***italic***) are recommended to be reviewed and changed as needed for the installation.

After choosing a menu item, make a parameter selection by stepping through the parameters under that menu. After the last parameter in one menu is customized, the display proceeds to the next menu until you complete all nine menus. Most of the

parameters take effect immediately with the exception of:ARINC parameters, AltRes and SerFmt which require a save-to-flash and power cycle to become effective.

**IMPORTANT**: To save the customization, you must use the "CAL:Flash" function to save those modifications for the next power cycle.

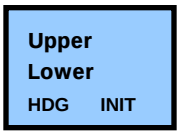
After configuring and calibrating SAM, use the rotary knob to navigate from one parameter to another to view or modify the parameters. Use Appendix D – Configuring/Calibration map to help navigate these parameters.

Please use the supplied Configuration and Verification Log Form to record all of the parameters that you determine are appropriate for a given installation. If a unit is returned to the factory for repairs, the calibration parameters might be lost, so having this data on file with the aircraft documentation is essential.

## *3.4 Configuration and Calibration Menus*

Abbreviations used in this section include:

**Upper:Lower** – shows what to expect on the upper and lower display lines



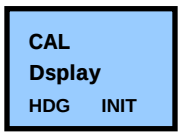
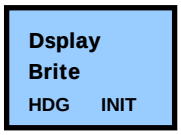
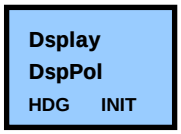

**CW/CCW** – clockwise or counterclockwise rotary knob turn 

**P** – push of the rotary knob 

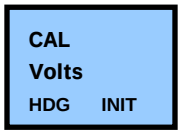
**PCW/PCCW** – while pushing in on the rotary knob, turn the knob clockwise or counterclockwise 

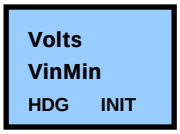
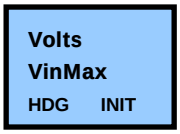
The following sections describe the Configuration and Calibration menus.

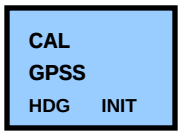
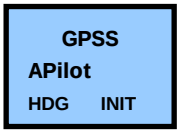
**P** while applying power via the avionics master switch to enter the main menu loop: (next page)

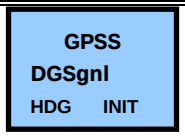
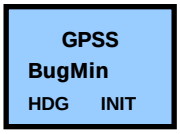
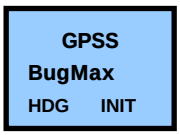
| Main Menu Loop Parameters (CW/CCW to view parameters) | Sub Menu (P to select sub-menu parameter) |
|---|---|
| **Dsplay**<br>LCD display configuration and calibration<br>  <br> | **Brite** -Select the dimmer mode (aircraft dimmer tracking or manual) and calibrate auto dimming<br>  <br><br>**NOTE:** Most aircraft dimmer systems are not regulated requiring this procedure to be performed with a ground supply or ground run of the engine while performing the calibration.<br><br>**Procedure**: In the first Brite parameter use **P** to toggle between **Dimmer:Auto** and **Dimmer:Manual**. For Auto, **CW** advances to **MaxDim:x.xx Volt**. Set the aircraft dimmer bus to just below the maximum brightness, and then **P** to capture the voltage. **CW** then advances to **MinDim:y.yy Volt**. Set the aircraft dimmer bus to just above the minimum brightness, and then **P** the knob. **CW** to return to the Brite function, and **CW** to advance to…<br><br>**DspPol** - Selects the display style for managing the display brightness.<br>  <br><br>**NOTE:** Of the display polarity options below only a handful are of general interest (in **Bold**). The default of NoFlip will provide maximum brightness in daylight by allowing the ambient light provide the lighting and in night viewing by allowing the maximum backlight through. For a more pleasant night display the characters can be inverted. In this case the useful options depend on the dimmer bus behavior in daytime operations. For aircraft with a dimmer bus that is typically turned down or off during daytime operations the LowInv option provides this ability. HiInv allows dimmer systems that are typically at maximum voltage for daytime use to provide this capability. Once selected the effect of a selection can be immediately observed by varying the dimmer bus to determine if it has the expected results.<br><br>**Procedure:** There are 8 combinations of pixel inversion and whether to cause pixel flip beyond the dimmer minima/maxima. **P** to enter this parameter. Selections take effect immediately. |

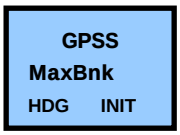
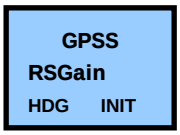
| Main Menu Loop Parameters (CW/CCW to view parameters) | Sub Menu (P to select sub-menu parameter) |
|---|---|
| | • **NoFlip** – black letters on the backlight colored background (default)<br>• NoFInv – backlight colored letters on a black background<br>• Low – NoFlip and invert the display below the minima<br>• **LowInv** – backlight colored letters on a black background and invert for daylight mode with maximum white backlight below the minima threshold<br>• Hi - NoFlip and invert the display above the maxima<br>• **HiInv** – backlight colored letters on a black background and invert for daylight mode with maximum white backlight above the maxima threshold<br>• Bth - NoFlip and invert the display below the minima and above the maxima<br>• BthInv - NoFInv and invert the display below the minima and above the maxima<br><br>**PCW** to return to **Dsplay:DspPol**, and **CW** to advance to…<br><br>***Refrsh*** **-** FACTORY OPTION do not change from the default of 64 unless requested to do so by the factory<br><br>**PCW** to return to **CAL:Dsplay** or **CW** to advance to…<br><br>***White*** **-** FACTORY OPTION do not change from the default of 64 unless requested to do so by the factory<br><br>**PCW** to return to **CAL:Dsplay** or **CW** to advance to…<br><br>***Green*** – FACTORY OPTION do not change from the default of "03 00" unless requested to do so by the factory.<br><br>**PCW** to return to **CAL:Dsplay** or **CW** to advance to…<br><br>***Cyan*** – FACTORY OPTION do not change from the default of "00 00" unless requested to do so by the factory.<br><br>**CW** to return to **CAL:Dsplay**, and **CW** to advance to… |

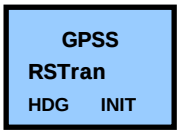
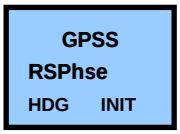
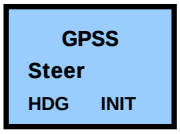
<table>
<tr><th>Main Menu Loop Parameters (CW/CCW to view parameters)</th><th>Sub Menu (P to select sub-menu parameter)</th></tr>
<tr><td>Audio<br>Audio output configuration<br>  </td><td>AudLow – Low volume limit setting<br>  <br>Procedure: CW/CCW to Select the absolute volume level (0 to 255) corresponding to the pilot-selected low volume level of 1. Default is 40. The value is voiced to help selection.<br><br>NOTE: This value should be left at the default unless a slightly higher or lower pilot adjustable minimum is desired. The value should never be set so low the pilot is able to use the volume control to turn off aural annunciations.<br><br>PCW to return to Audio:AudLow, and CW to…<br><br>AudHi – High volume limit setting<br>  <br>Procedure: CW/CCW to select the absolute volume level (0 to 255) corresponding to the pilot-selected high volume level of 32. Default is 230. PCW to return to Audio:AudHi, and CW to…<br><br>MuteRm – Allows selection of the time between tone reminders while the mute switch is selected.<br>  <br>NOTE: Default is 300 seconds while a value of 0 turns mute reminding off. Mute reminding should be turned off if the mute input is used by another system such as a TAWS or TCAS system.<br><br>Procedure: P to change digits, CW/CCW to select the value, and PCW to return to Audio:MuteRm. CW returns to CAL:Audio, and CW to advance to…</td></tr>
<tr><td>Volts<br>Voltage Alert limits configuration<br>  </td><td>NOTE: For proper voltage alerting the minimum and maximum alert voltages should be set based on the aircraft nominal voltage. The following limits are recommended for most installations:<br><br><table><tr><td></td><td>VinMin</td><td>VinMax</td></tr><tr><td>14VDC System</td><td>12.0</td><td>15.5</td></tr><tr><td>28VDC System</td><td>24.0</td><td>34.0</td></tr></table><br>These values may be set manually as described below or a</td></tr>
</table>

| Main Menu Loop Parameters (CW/CCW to view parameters) | Sub Menu (P to select sub-menu parameter) |
|---|---|
| | shortcut of rolling the VinMin and VinMax fully CCW and pushing will select the 14VDC default values and rotating fully CW and pushing will select the 28VDC defaults.<br><br>**VinMin** – The low avionics bus voltage alert threshold<br>  <br>**Procedure: CW/CCW** then **P** to select the low voltage threshold that alert will be issued to the pilot. **PCW** to return and **CW** to…<br><br>**VinMax**– The high avionics bus voltage alert threshold<br>  <br>**Procedure: CW/CCW** then **P** to select the high voltage threshold that alert will be issued to the pilot. **PCW** to return and **CW** to…<br><br>***VinGn*** – FACTORY OPTION – do not change. Any changes from the factory default value will cause voltage calibration errors.<br><br>**Procedure: PCW** to return and **CW** to…<br><br>***VinOff*** – FACTORY OPTION – do not change. Any changes from the factory default value will cause voltage calibration errors.<br><br>**Procedure: PCW** to return and **CW** to **CAL:Volts** and **CW** to… |

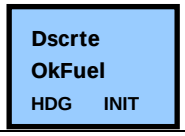
| Main Menu Loop Parameters (CW/CCW to view parameters) | Sub Menu (P to select sub-menu parameter) |
|---|---|
| **GPSS**<br>GPSS Roll Steering configuration and calibration<br>  | **NOTE:** This is the main configuration and calibration required for roll steering functionality. Prior to calibration based on autopilot and heading system documentation determine the following:<br>1. Autopilot Type, Rate or Attitude based.<br>2. Heading Error Signal type, AC or DC.<br>3. Heading Bug offset that produces maximum bank (from documentation or test flight if not available in documentation – this is typically 20 to 30 degrees).<br>4. Maximum bank angle for Attitude based autopilots (from documentation or test flight).<br><br>**APilot** – Select Autopilot type AC/DC or none<br>  <br><br>**CAUTION**: Incorrectly selecting AC or DC autopilot type may damage the connected systems. The default for all units is "SAM II" to minimize this possibility. Improper selection of rate versus attitude will affect roll steering performance.<br><br>**CAUTION**: For SAM 002 systems the only valid option is "SAM II". Selection of other options may cause system instability.<br><br>**Procedure: CW/CCW** to choose the autopilot type. Choices are:<br>• SAM II – No autopilot connected (or SAM 002 without GPSS roll steering)<br>• AttdAC – Attitude-based A/C autopilot<br>• AttdDC – Attitude-based D/C autopilot<br>• RateAC – Rate-based A/C autopilot<br>• RateDC – Rate-based D/C autopilot<br><br>**PCW** to **CAL:GPSS** and **CW** to **CAL:GPSS** then **P** to **GPSS:APilot** and **CW** to…<br><br>**DGSgnl** –Semi-automated heading error signal calibration procedure<br><br>**NOTE:** The autopilot should be on and in heading mode for this procedure. Some autopilots may require normal battery operating voltage for accurate results. This may be accomplished with a ground supply or ground run of the |

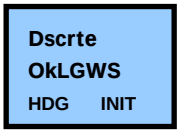
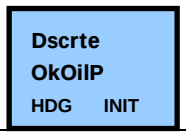
| Main Menu Loop Parameters (CW/CCW to view parameters) | Sub Menu (P to select sub-menu parameter) |
|---|---|
| | engine during this procedure.<br>  <br>**Procedure: P** to select this 11-point calibration of the heading bug. Set the DG or HSI heading bug to the value indicated in the upper display (from the lubber line), **P** to sample, and **CW** to advance to the next heading bug point. The setting points are: {60°, 30°, 20°, 10°, 5°, 0°, -5°, -10°, -20°, -30°, -60°}. The most critical calibrations are +/- 20 degrees from the lubber line. Aligning a convenient heading such as north on the heading card with the lubber line will allow a more accurate calibration.<br><br>**CW** from the last setting point returns to **GPSS:DGSgnl**, and **CW** to…<br><br>**BugMin** – Heading bug offset compensation<br>  <br>**Procedure: P** to select this optional tool that allows corrections of small errors in heading sources (DG or HSI).<br><br>**NOTE:** This calibrates SAM to the heading bug offset that produces the minimum heading error signal. This option is not normally required and should only be used if trouble is found during flight test verification. Leave at 0 if not used.<br><br>While adjusting the heading bug, use the heading bug voltmeter in the upper display to find the lowest voltage. Then use **CCW/CW** to select in lower display the heading bug value within a range of +/-5°. **P** and hold to sample ("Done" in upper) and then while still pushing in the knob, **CW** to **GPSS:BugMin**, and **CW** to…<br><br>**BugMax** – Sets the heading bug offset that produces the maximum bank<br>  <br>**Procedure: P** to select the max rate turn (rate-based A/P) or maximum bank (attitude-based A/P). This step is used to set the heading bug offset that provides the maximum turn rate (Near Standard rate for Rate based A/Ps) or Bank Angle (Typically about 20°-22° degrees for Attitude based A/Ps). Set this based on autopilot documentation or a test |

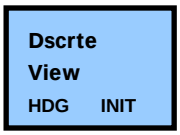
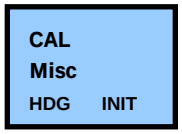
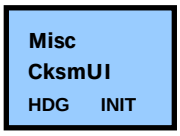
| Main Menu Loop Parameters (CW/CCW to view parameters) | Sub Menu (P to select sub-menu parameter) |
|---|---|
| | flight. The test flight determines the heading bug offset required to maintain either:<br>1. A standard rate turn for a rate based A/P, or<br>2. The Maximum bank angle for an attitude based A/P.<br>Use **CCW/CW** to select the angle, from 5° to 60° (default 20°).<br><br>**PCW** to return to **GPSS:BugMax**, and **CW** to…<br><br>**MaxBnk** – Set the maximum autopilot bank angle (Attitude based A/P only)<br><br>  <br><br>This is the maximum bank angle an autopilot will provide. Set this based on the autopilot installation/users guide, or a test flight.<br><br>**Procedure:** Use **CCW/CW** to select the angle, from 5° to 30° (default 20°).<br><br>**PCW** to return to **GPSS:MaxBnk**, and **CW** to…<br><br>**RSGain** – Optional - Roll steering gain setting<br><br>  <br><br>Optional parameter allows minor gain adjustments to the roll steering output after test flying.<br><br>**Procedure:** Use **CCW/CW** to select a multiplier to be used against the steering value in thousandths. The default is 1.000x and maximum is 2.000x.<br><br>**PCW** to return to **GPSS:RSGain**, and **CW** to…<br><br>**RSOffs** – Optional – Roll steering offset setting<br><br>  <br><br>Optional parameter allows minor offset adjustments to the roll steering output after test flying.<br><br>**Procedure:** Use **CCW/CW** to select the number of degrees of offset to use in hundredths of a degree, from -9.99° to 9.99°. Default is 0°. |

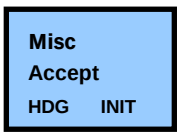
| Main Menu Loop Parameters (CW/CCW to view parameters) | Sub Menu (P to select sub-menu parameter) |
|---|---|
| | **PCW** to return to **GPSS:RSOffs**, and **CW** to… |
| | ***RSTran*** – FACTORY OPTION – do not change from default of 0.0°.<br>  <br>**Procedure: PCW** to return, and **CW** to… |
| | **RSPhse** – Roll Steering command phase selection<br>  <br>Allows inversion output between the GPS horizontal steering commands and the autopilot.<br><br>**Procedure: CCW/CW** to choose either 30° (normal) or 330° (inverted). To aid selection, the autopilot is fed a signal that corresponds to the phase. 30° should produce a right hand roll of the ailerons with the autopilot on and in heading mode. If a left hand roll is produced select 330°.<br><br>**PCW** to return to **GPSS:RSPhse**, and **CW** to… |
| | **Steer** – Flight and Ground test tool – verification of roll steering bank angle<br>  <br>This tool that outputs a manual steering command to the autopilot similar to rolling the heading bug back and forth in heading mode.<br><br>**Procedure:** Use **CCW/CW** to select a steering value, from -30° to +30°. To be effective, this tool requires a GPS ground speed. The intended function of this feature is to allow flight and ground test verification of the roll steering bank angle after BugMax and MaxBnk are properly set. The RSgain and RSoffset values can be adjusted to compensate for small errors that are shown.<br><br>**NOTE:** During flight testing the typical procedure will require multiple test using the Steer function to determine actual bank angle and then making RSgain and RSoffset adjustments followed by cycling between GPSS and back to HDG mode to make the new values active. A power-up will |

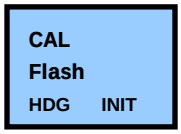
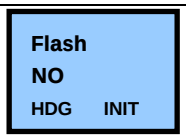
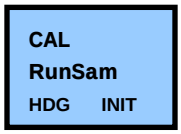
| Main Menu Loop Parameters (CW/CCW to view parameters) | Sub Menu (P to select sub-menu parameter) |
|---|---|
| | also make the new values active.<br><br>**PCW** to return to **GPSS:Steer**, and **CW** to…<br><br>**RSDiag** – flight and ground test tool – shows steering command from autopilot and corresponding output from SAM<br><br>GPSS<br>RSDiag<br>HDG INIT<br><br>**Procedure:** This is a simple diagnostic tool to display in realtime, the GPS-provided horizontal steering command on Upper in hundredths of a degree, and a value representing the digital output to the autopilot displayed as a hexadecimal number. It can be used to verify that SAM is receiving an appropriate horizontal steering command from the GPS and is outputting a value that changes with horizontal steering bank angle changes.<br><br>**PCW** to return to **GPSS:RSDiag**, and **CW** to… |
| **ARINC**<br>ARINC 429 speed and parity configuration<br><br>CAL<br>ARINC<br>HDG INIT | **A429Pa** – ARINC 429 parity<br><br>ARINC<br>A429Pa<br>HDG INIT<br><br>**Procedure: CW/CCW** to select ARINC 429 bus parity as either Odd or None. Typically None – set to GPS ARINC 429 output setting.<br><br>**PCW** to return and **CW** to…<br><br>**A429Sp** – ARINC 429 speed<br><br>ARINC<br>A429Pa<br>HDG INIT<br><br>**Procedure: CW/CCW** to select ARINC 429 bus speed, either Hi or Lo. Set to match the GPS ARINC 429 output setting.<br><br>**PCW** to return and **CW** to **CAL:ARINC** and **CW** to… |
| **Dscrte**<br>Discrete input configuration<br><br>CAL<br>Dscrte<br>HDG INIT | **NOTE:** This section allows discrete inputs to be configured to allow a pilot alert based on either a low or high voltage input. See wiring diagrams for pin-outs associated with specific input.<br><br>The upper line shows the discrete name followed by “Ok:X” where X is the current state of that discrete - typically “N” for |

| Main Menu Loop Parameters (CW/CCW to view parameters) | Sub Menu (P to select sub-menu parameter) |
|---|---|
| | 'Normal 0 or low voltage', or "I" for 'Inverted 1 or high voltage'. For OkVac, "M" indicates conflicting discrete inputs for multi-vacuum input cases.<br><br>To configure a discrete you need to match the "OK:X" N or I with the Invt or Norm option when the input is in a **non**-alerting mode.<br><br>**OkVac** – Vacuum discrete inputs<br><br>  <br><br>**Procedure: CW/CCW** to choose one of the following:<br>• Norm – One vacuum system, normal, non-alerting condition for digital 0 (<2.0VDC).<br>• Invt – One vacuum, normal, non-alerting condition for digital 1 (>3.0VDC).<br>• NLtRt – Two vacuums, left and right, normal, non-alerting condition for digital 0.<br>• ILtRt – Two vacuums, left and right, normal, non-alerting condition for digital 1.<br>• NOneTw – Two vacuums, one and two, normal, non-alerting condition for digital 0.<br>• IOneTw – Two vacuums, one and two, normal, non-alerting condition for digital 1.<br>• Off – vacuum alert mechanism disabled.<br><br>**PCW** to return, and **CW** to…<br><br>**OkEng** – Configure the engine discrete input.<br><br>  <br><br>**Procedure: CW/CCW** to choose one of the following:<br>• Norm – normal, non-alerting condition for digital 0.<br>• Invt – normal, non-alerting condition for digital 1.<br>• Off – this alert mechanism disabled.<br><br>**PCW** to return, and **CW** to…<br><br>**OkFuel** – Configure the fuel discrete input.<br><br>  <br><br>**Procedure: CW/CCW** to choose one of the |

| Main Menu Loop Parameters (CW/CCW to view parameters) | Sub Menu (P to select sub-menu parameter) |
|---|---|
| | following:<br>• Norm – normal, non-alerting condition for digital 0.<br>• Invt – normal, non-alerting condition for digital 1.<br>• Off – this alert mechanism disabled.<br><br>**PCW** to return, and **CW** to…<br><br>**OkStll** – Configure the stall discrete input.<br>  <br>**Procedure: CW/CCW** to choose one of the following:<br>• Norm – normal, non-alerting condition for digital 0.<br>• Invt – normal, non-alerting condition for digital 1.<br>• Off – this alert mechanism disabled.<br><br>**PCW** to return, and **CW** to…<br><br>**OkGear** – Configure the gear discrete inputs.<br>  <br>**Procedure: CW/CCW** to choose one of the following:<br>• Norm – normal, non-alerting condition for digital 0.<br>• Invt – normal, non-alerting condition for digital 1.<br>• Off – this alert mechanism disabled.<br><br>**PCW** to return, and **CW** to…<br><br>**OkLGWS** – Configure the landing gear warning system discrete input.<br>  <br>**Procedure: CW/CCW** to choose one of the following:<br>• Norm – normal, non-alerting condition for digital 0.<br>• Invt – normal, non-alerting condition for digital 1.<br>• Off – this alert, non-alerting mechanism disabled.<br><br>**PCW** to return, and **CW** to…<br><br>**OkOilP** (and GPSS/VLOC) – Configure the oil pressure discrete input OR GPSS Disengage (VLOC) input.<br>  |

| Main Menu Loop Parameters (CW/CCW to view parameters) | Sub Menu (P to select sub-menu parameter) |
|---|---|
| | **Procedure: CW/CCW** to choose one of the following:<br>• Oil Norm – normal condition for Oil digital 0.<br>• Oil Invt – normal condition for Oil digital 1.<br>• Off – this alert mechanism disabled.<br>• VLCNrm – GPSS Disengage for digital 0 (GNS-430W/530W). SW V1.3 or later required.<br>• VLCInv – GPSS Disengage for digital 1. SW V1.3 or later required.<br><br>**PCW** to return, and **CW** to…<br><br>**View** – Selects a diagnostic tool that displays a hexadecimal code for a concatenation of all discrete inputs in real-time.<br>  <br><br>**Procedure:** The bits are coded as follows:<br>• 0x0001 – Fuel discrete<br>• 0x0002 – Oil Pressure or GPSS Disengage discrete<br>• 0x0004 – Vacuum 2 or right discrete<br>• 0x0008 – LGWS discrete<br>• 0x0010 – Gear discrete<br>• 0x0020 – Gear discrete<br>• 0x0040 – Stall discrete<br>• 0x0080 – Engine discrete<br>• 0x0100 – Gear discrete<br>• 0x0200 – Vacuum 1 or left discrete<br>• "All Lo" or "All Hi" indicate 0x0000 and 0x3FF respectively<br><br>**PCW** to return, and **CW** to… |
| **Misc**<br>Miscellaneous operational parameters<br>  | **CksmUI** – View the SAM firmware checksum #1<br>  <br><br>**Procedure: PCW** to return, and **CW** to…<br><br>**CksmRP** – View the SAM firmware checksum #2<br>  <br><br>**Procedure: PCW** to return, and **CW** to… |

| Main Menu Loop Parameters (CW/CCW to view parameters) | Sub Menu (P to select sub-menu parameter) |
|---|---|
| | **Factry** – Reset configuration parameters to factory defaults<br>  <br>**Procedure: CW** to PshKnb, and then **P** to restore factory defaults. When completed, SAM will reboot.<br><br>**AltRes** – Sets the altitude encoder resolution to 10 or 100 ft<br>  <br>**Procedure: CW/CCW** to select the altitude encoder resolution, either 10 ft or 100 ft. Then, **PCW** to return and **CW** to…<br><br>**Baro** – Calibrate an external barometer source<br>  <br>**Procedure:** (**NOTE**: To de-select this feature, P to select this tool, and while displaying 29.92, use PCW to return)<br>**CCW**, and then **CCW/CW** to choose the lowest barometer value (27.50 to 29.00), set the external barometer to that value, and **P** to sample that voltage. The voltage appears on the lower display. **CW** to choose the highest barometer value (30.50 to 32.00). **P** and hold to sample and then while still pushing in the knob, **CW** to return, and **CW** to…<br><br>**SerFmt** – choose the serial altitude encoder input format<br>  <br>**Procedure: CW/CCW** to select one of "None", "Icarus" or "UPSAT". **PCW** to return, and **PCW** to **CAL:Misc**, and then **CW** to **CAL:Flash**.<br><br>**Manufc**– for factory use only.<br>  <br>**Procedure: PCW** to return, and **CW** to…<br><br>**Accept** – for factory use only. **NOTE:** Accidental entry into this menu will require a power cycle to exit with subsequent loss of non flashed configuration parameters.<br>  |

| Main Menu Loop Parameters (CW/CCW to view parameters) | Sub Menu (P to select sub-menu parameter) |
|---|---|
| | **Procedure: PCW** to return, and **CW** to… |
| **Flash**<br>Save configuration changes<br>  | Save recent modifications to flash memory.<br>  <br>**Procedures: P** to enter this function, then **CW** to select PshKnb, and **P** to save changes to flash memory – when completed, "Done" appears.<br>**PCW** to return and **CW** to… |
| **RunSam**<br>Enter normal SAM operational mode<br>  | Enter normal SAM operational mode.<br><br>This is useful for testing including flight testing after making configuration changes. |

## *3.5 Verification*

Ground and flight tests are required to ensure the SAM system is fully functional and configured as expected for the installation.

### 3.5.1 Ground Test

The Pilots Guide should serve as a reference during test procedures. Test procedures may be performed in any order.

| Test Procedure Number | Test | Results |
|---|---|---|
| G1 | Inspect installation for control placement and general workmanship | |
| G2 | Power on the system and verify self test based on lack of "Fail" or "Warn" in the upper display line and HDG displayed in the lower left hand corner of the display. | |
| G3 | Adjust Audio Volume for comfortable listening level in pilot headphones. Be sure to press the rotary button after setting the volume level to make the setting persistent after the next power cycle. | |
| G4 | Verify ARINC 429 communication during GPS self-test by selecting GPSS mode and obtaining GPSS annunciation. | |
| G5 | Verify Altitude Information is received (if connected) by selecting Altitude in the upper or lower default display | |

| Test Procedure Number | Test | Results |
|---|---|---|
| G6 | Verify any discrete inputs that can be verified on the ground.<br><br>**NOTE:** Stall and Landing Gear Warning alerts are available immediately, other alerts will not be available until approximately 3 minutes after power-up. The "Dscrte : View" diagnostic tool described in section 3.3 can be used for diagnosing wiring issues with discrete signals.<br><br>**NOTE:** SAM has knowledge of the aircrafts mode of operation (Pre-Flight, Flight, Post-Flight) based on groundspeed being above a threshold (25Kts) for at least 30 seconds. Some of the alerts such as Vacuum, Oil, Engine, Fuel, etc. may not be available Post-flight. When testing the alert functions, be certain you have not allowed the groundspeed to exceed 25Kts for > 30 seconds. This can happen by leaving the GPS in Self-test mode for over 30 seconds and then returning to normal GPS mode. | ☐ 1 - LANDING GEAR<br>☐2 - LANDING GEAR LIGHT/SW NOSE<br>☐3 - LANDING GEAR LIGHT/SW RIGHT<br>☐4 - VACUUM WARN LIGHT/SW 1<br>☐5 - ENGINE WARN LIGHT/SW<br>☐ 6 - STALL WARN SW<br>☐7 - FUEL WARN LIGHT/SW<br>☐8 - OIL WARN LIGHT/SW ( or HOBBS SW)<br>☐9 - VACUUM WARN LIGHT/SW 2<br>☐10 – LANDING GEAR WARNING HORN |
| G7 | Power on the system in Configuration/Calibration mode and turn on the autopilot to heading mode. Use the "GPSS : Steer" tool described in section 3.3 to verify proper direction of aileron movement (-30° to the left +30° to the right). This tool is used as a ground functional test with expected results similar to moving the heading bug back/forth from the lubber line when in heading mode. If the aileron movement is not in the expected direction the "GPSS RSPhse" setting is used to correct the direction. Note: the GPS must be outputting a groundspeed[6] for proper operation. | |

[6] Garmin 430/530 and 430/530W receivers will output 150kts after power-on during the "Instrument Panel Self-Test" screen (the screen with CDI ½ up and ½ left, etc). The Garmin 480 must be placed into autopilot test mode – see section 3.3.1.1.7 of the installation manual for more details. The 480 will also allow you to manually enter a bank angle and may be used in lieu of the SAM "GPSS Steer" command.

### 3.5.2 Flight Test

This document and the pilots guide should serve as a reference during test procedures. All tests will be conducted in a safe manner following all appropriate aircraft operational limits and regulations. Tests may be conducted in any order and some tests may be performed on the ground.

<table>
<tr><th>Test Procedure Number</th><th>Test</th><th>Results</th></tr>
<tr><td>F1</td><td>During normal flight verify normal operation of autopilot with SAM in “HDG” mode.</td><td></td></tr>
<tr><td>F2[7]</td><td>This optional procedure will fine-tune the GPSS performance and produce the best steering performance. It should be performed if over or undershooting occurs in a 90 degree change in flight plan.<br><br>Power on SAM in configuration/calibration mode and select the “GPSS : Steer” tool described in section 3.3 to verify autopilot bank angle. In smooth air, engage the autopilot in heading mode and note bank angle at the points selected. Adjust the GPSS : Gain and GPSS : Offset parameters (from section 3.3) to adjust for small variations between selected and actual bank angle. Switch to GPSS and back to HDG mode to load the new parameters and then re-check the bank angle.<br><br>NOTE: The autopilot will limit to either a</td><td>Bank Angle<br>Selected / Actual<br>20° _____°<br>10° _____°<br>0° _____°<br>-10° _____°<br>-20° _____°</td></tr>
</table>

[7] Prior to performing F2 the “GPSS BugMax” parameter should be set to approximate the heading bug offset from the lubber line that provides the maximum bank angle for the autopilot as determined by flight testing (or from the service manual). Also for an attitude based autopilot “GPSS MaxBnk” should be set to the maximum bank angle that can be obtained by the autopilot. Setting these parameters will generally obtain satisfactory GPSS performance.

<table>
<tr><th>Test Procedure Number</th><th>Test</th><th>Results</th></tr>
<tr><td></td><td>maximum bank angle for Attitude based autopilots or a % of Standard Rate turn for Rate based autopilots. For Rate based autopilots make sure to do the test at a cruise setting to make sure the bank angle is not limited by your speed. The following is an approximate table of bank angle versus airspeed for a standard rate turn:<br><br>
<table>
<tr><th>Airspeed</th><th>Bank Angle Std Rate Turn</th></tr>
<tr><td>50</td><td>8</td></tr>
<tr><td>100</td><td>16</td></tr>
<tr><td>125</td><td>20</td></tr>
<tr><td>150</td><td>25</td></tr>
<tr><td>175</td><td>30</td></tr>
<tr><td>200</td><td>35</td></tr>
<tr><td>250</td><td>47</td></tr>
</table>
</td><td></td></tr>
<tr><td>F3</td><td>During normal flight with the GPS tracking a valid flight plan (a GPS “T” type of approach is an excellent test) engage SAM in GPSS mode by pushing the display button. Verify proper operation including turns.</td><td></td></tr>
<tr><td>F4</td><td>If installed, verify Altitude Alerts work as expected by setting an initial target altitude (on the ground at pre-flight or in the air) and climbing to and then through the altitude. You should receive an “Approaching” annunciation at the threshold set based on your climb rate (see the Pilots Handbook for details on setting this), the default is approximately 400 feet prior to the target. Continue to climb through the target and verify you get the “Check Altitude” annunciation 150feet (200 with a 100ft resolution encoder) above the target.</td><td></td></tr>
<tr><td>F5</td><td>If installed and not previously verified, verify Gear Throttle Warning system repeater operates as expected.</td><td></td></tr>
<tr><td>F6</td><td>If installed and not previously verified, verify Stall Warning system repeater operates as expected. (May be performed on ground)</td><td></td></tr>
</table>

| Test Procedure Number | Test | Results |
|---|---|---|
| F7 | If installed and not previously verified, verify Engine Warning repeater functions as expected by temporarily changing an alarm threshold in the engine monitor to produce a warning. (May be performed on ground) | |
| F8 | If installed and not previously verified, verify Fuel Warning repeater functions as expected by temporarily changing and alarm threshold in the fuel flow/measurement monitor to produce a warning. (May be performed on ground) | |
| F9 | If installed and not previously verified, verify Altitude Alert features work as expected. | |
| F10 | If installed and not previously verified, verify Vacuum (both if two are installed) Warning repeater functions as expected by producing low vacuum on the ground or in flight. | |
| F11 | If installed and not previously verified, verify Low Oil Pressure warning repeater functions as expected (May be performed on ground – Ground run of engine required to test normal condition) | |

# 4 Troubleshooting

| Troubleshooting | | |
|---|---|---|
| **Malfunction** | **Probable Cause** | **Corrective Action** |
| SAM Display fails to power on, SAM Computer power LED **is not** illuminated | • Power is not available at Computer P1 | • Check Circuit Breaker or Fuse. Verify Avionics Master is on and P1 is fully engaged. Power should be available at P1 pin 1 and Ground at P1 pin 2. |
| SAM Display fails to power on, SAM Computer power LED **is** illuminated | • Power and/or Signals are not available at Display P101<br>• SAM Computer Failure | • Verify P1 and P101 are fully engaged. Verify wiring per installation diagram<br>• Verify Computer Status LED is flashing about once per second. If not remove and replace SAM Computer. |
| SAM Display annunciates "FAIL" | • Internal Built-in Testing has discovered a SAM Computer problem | • Remove and replace the SAM Computer |
| Depressing SAM Display does not engage roll steering OR SAM annunciates GPSS Disengaged. Lower left hand corner of display indicates: RDY2[8] | • GPS roll steering command is not being received | • GPS is not operational<br>• GPS may not be in mode required to provide roll steering command. Typically a GPS only provides a roll steering command in test mode on the ground or when flying above some groundspeed threshold.<br>• Verify GPS wiring and ARINC 429 Speed is configured correctly. |
| Depressing SAM Display does not engage roll steering OR SAM annunciates GPSS Disengaged. Lower left hand corner of display indicates: RDY3[8] | • GPS ground speed is not above 25 knots. | • GPSS operation requires a groundspeed greater than 25 knots to function. |
| SAM annunciates GPSS Disengaged. Lower left hand corner of display indicates: RDY4[8] | • GPS cross-track distance has exceeded a pre-determined threshold. | • GPSS operation requires the aircraft to be within a specific distance based on groundspeed (at 120 knots the threshold is 1.5 nm, and at 213 knots the threshold is 2.5nm) to function. Reset the GPS or hand fly the |

[8] Only applies to Model SAM 001, SAM 002 does not have GPSS capability

| | | |
|---|---|---|
| | | aircraft back within the threshold to resume GPSS steering. |
| After autopilot or heading source maintenance or replacement GPSS tracking is not accurate. [8] | • Heading System Calibration required. | • Following autopilot or heading (DG/HSI) Maintenance SAM heading calibration should be performed. |

In addition to the above table SAM provides several tools to aid in troubleshooting installation errors. See section 3.3 for details.

# 5 Periodic Maintenance

The SAM system does not require periodic maintenance. The design requires no internal manual adjustments.

## *5.1 Display Cleaning*

The front bezel, knob, and display should normally be cleaned with a soft cotton cloth dampened with clean water.

Care should be taken to minimize the chance of scratching the display. If required, a plastic window cleaner/polish may be carefully used on the display by applying the cleaner to a soft cloth. Do not spray cleaner directly on the display as this may contaminate the electronics.

# Appendix A1 – Certification, Environmental Qualification

The All components of the SAM System have been tested to the following environmental categories per procedures defined in RTCA/DO-160E. Tests were conducted from March 2006 to July 2006.

***SAM Environmental Qualification Form***

| *Environmental Tests* | *RTCA/DO-160E Section* | *Conducted Test Category* |
|---|---|---|
| Temperature and Altitude | | |
| Low Temp | 4.5.1 | Qualified by test to Category (A4)(C1) [1] |
| High Temp | 4.5.2 & 4.5.3 | Qualified by test to Category (A4)(C1) |
| In-Flight Loss of Cooling | 4.5.4 | Qualified by test to Category X Not applicable, cooling not required |
| Altitude | 4.6.1 | Qualified by test to Category |
| Decompression | 4.6.2 | Qualified by test to Category |
| Overpressure | 4.6.3 | Qualified by test to Category |
| Temperature Variation | 5 | Qualified by test to Category B |
| Humidity | 6 | Qualified by test to Category A |
| Operational Shocks & Crash Safety | 7 | Qualified by test to Category D |
| Vibration | 8 | Qualified by test to Category (S U2) , Curve(s) (M F F1) [2] |
| Explosion Proofness | 9 | Identified as Category X , no test performed |
| Waterproofness | 10 | Identified as Category X , no test performed |
| Fluids Susceptibility | 11 | Identified as Category X , no test performed |
| Sand and Dust | 12 | Identified as Category X , no test performed |
| Fungus Resistance | 13 | Identified as Category X , no test performed |
| Salt Spray | 14 | Identified as Category X , no test performed |
| Magnetic Effects | 15 | Equipment qualified by test to Z |
| Power Input | 16 | Qualified by test to Category Z |
| Voltage Spike | 17 | Qualified by test to Category A |
| Audio Frequency Conducted Susceptibility | 18 | Qualified by test to Category B |
| Induced Signal Susceptibility | 19 | Qualified by test to Category AC |
| Radio Frequency Susceptibility | 20 | Qualified by test to Conducted T [3] Radiated T |

[1] LCD Display operation is limited to -20°C and -25°C for short term operation.
[2] Helicopter Vibration testing Category U2, Curves F,F1 requires the Computer (PN 0025-5001 or PN 0025-5002) Bottom Mounting option. Side mounting was not tested.

| *Environmental Tests* | *RTCA/DO-160E Section* | *Conducted Test Category* |
|---|---|---|
| Emission of Radio Frequency Energy | 21 | Qualified by test to Category H |
| Lightning Induced Transient Susceptibility | 22 | System<br>Pin Injection XX , no test performed<br>Cable Bundle XX , no test performed<br>Burst X , no test performed |
| Lightning Direct Effects | 23 | Identified as Category X , no test performed |
| Icing | 24 | Identified as Category X , no test performed |
| Electrostatic Discharge | 25 | Qualified by test to Category A |
| Fire, Flammability | 26 | Identified as Category X , no test performed |

[3] SAM Computer PN 0025-5001 and 0025-5002 has been tested to Category R. The Display PN 0025-5003 has been tested to Category T.

## *Environmental String*

The environmental string corresponding to the categories identified in the table above follows

**(A4)(C1) X B A D (S U2) (M F F1) X X X X X X Z Z A B AC T T H XX XX X X X A X**

## *Temperature-Altitude Summary*

| Parameter | Value | Units |
|---|---|---|
| Operating Low Temperature | -20 | Deg. C |
| Operating High Temperature | +55 | Deg. C |
| Short Term Operating Low Temperature | -25 | Deg. C |
| Short Term Operating High Temperature | +70 | Deg. C |
| Loss of Cooling Temperature | N/A | Deg. C |
| Ground Survival Low Temperature | -55 | Deg. C |
| Ground Survival High Temperature | +85 | Deg. C |
| Altitude | 35 | Feet x 1000 |
| Altitude | 10.7 | Meters |
| Temperature Variation | 5 | Deg. C/Min. |

# Appendix A2 – Certification, STC Permission, STC Data

Centurion Consulting, Incorporated here by grants permission to all Aviation Authority approved installers to use data from STC SA00243BO and amendments to modify aircraft.

See the following documents for additional STC data:

STC SA00243BO
PN 0025-0131 Approved Model List for the SAM system STC SA00243BO.
PN 0025-0106, SAM Instructions for Continuous Airworthiness
PN 0025-0105 SAM Aircraft Flight Manual Supplement

**NOTE:** Document 0025-0106, Instructions for Continuous Airworthiness, requires the installer to fill out an aircraft specific datasheet and include the ICA with datasheet as part of the permanent aircraft records. The datasheet and instructions for completion are included as Appendix A3.

# Appendix A3 –ICA Installation Datasheet

**Aircraft Make: _____ Aircraft Model: _____**

**Aircraft Registration: _____ Aircraft SN: _____**

| **Equipment Locations** |
| --- |
| SAM Computer PN 0025-5001 or 0025-5002:<br><br>SAM Display PN 0025-5003:<br><br>SAM Audio and Rotary Switches PN 0025-5005/0025-5004: (if different than Display location) |
| **Wiring Harness Routing** |
| |
| **Aircraft Specific Wiring** |
| |

**DATASHEET INSTRUCTIONS**

For each installation, complete this data sheet as follows:

1. Complete the aircraft make, model, and registration number and serial number sections.
2. Describe the location of the SAM Computer and SAM Display in sufficient detail, using station location numbers or other common reference points. For example, "SAM Computer located behind the instrument panel on the right hand side below the glove box." "SAM Display mounted on the instrument panel to the left of the airspeed indicator." The use of sketches is recommended for difficult to describe locations and may be attached and referenced as additional sheets. If the rotary and audio toggle switches are not mounted with the display their location should also be identified.
3. Describe or sketch the wire harness routing. For example "Wring harness follows existing bundles across the bottom of the instrument panel."
4. Provide a aircraft specific wiring diagram. This may be a drawing, sketch, or marked up installation diagram showing aircraft specific aspects of the installation such as heading system wiring, GPS, Encoder, Audio Panel and Warning system interfaces.

Include a copy of the ICA with the completed installation Datasheet as part of the aircraft records

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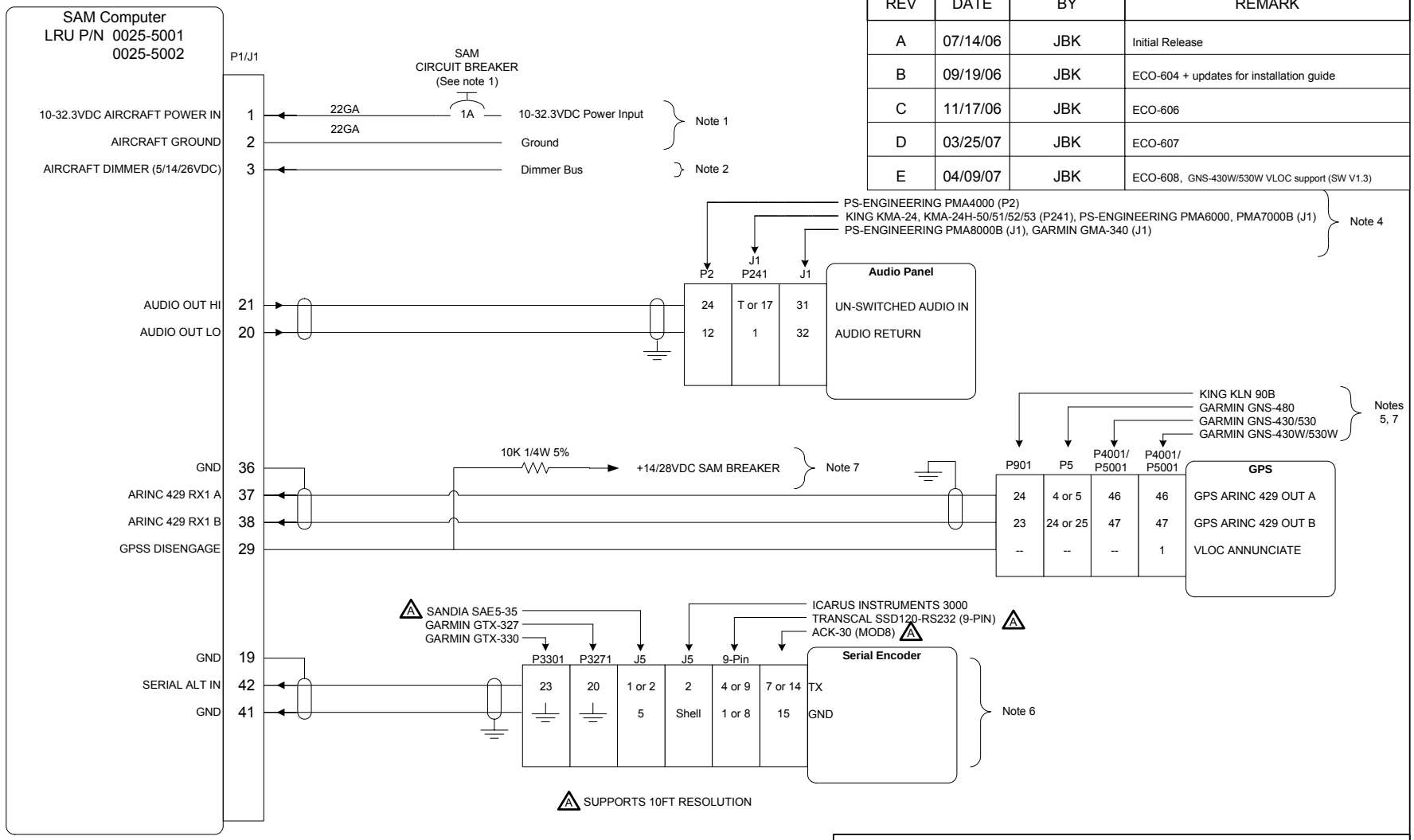
| REV | DATE | BY | REMARK |
|---|---|---|---|
| A | 07/14/06 | JBK | Initial Release |
| B | 09/19/06 | JBK | ECO-604 + updates for installation guide |
| C | 11/17/06 | JBK | ECO-606 |
| D | 03/25/07 | JBK | ECO-607 |
| E | 04/09/07 | JBK | ECO-608, GNS-430W/530W VLOC support (SW V1.3) |




**Notes:**

**1.** Power input shall be protected by a 1 to 2 Amp in-line circuit breaker or fuse. Aircraft Power and Ground shall be 22GA Minimum, Mil-22759/16.
**2.** Dimmer input compatible with 5/14/28V DC Dimmer systems. See Installation guide for Calibration procedure.
**3.** All wire shall be 24 AWG or larger Mil-22759/16 and/or Mil-27500/18 unless otherwise noted. Maximum harness length 30 ft (9 m)
**4.** The Audio output may be connected to an un-switched audio input on the audio switching panel. If possible an unused input should be utilized, otherwise use a 600 Ohm voltage divider to attach multiple devices. Although less desirable, a switched audio input may also be used but a placard shall be provided stating SAM Alerts are only available when the switched input is selected.
**5.** The ARINC 429 Output of the GPS shall be connected as shown to provide roll-steering and waypoint information. Parallel connection of ARINC 429 Receivers are allowed if required. ARINC 429 High and Low speeds are supported. Waypoint annunciation requires the GPS be configured to output GAMA format data.
**6.** A Serial Altitude data source (Encoder) is required to provide Altitude Alerting functionality. ICARUS and Apollo formats are supported. A 10 Foot resolution encoder is preferred, configure the Encoder to 10 Foot resolution if available.
**7.** GPSS DISENGAGE feature required by some GPS receivers such as the Garmin 430W/530W – see installation guide for configuration information. 10K Pull-up resistor is only required if NOT parallel with an existing annunciator since SAM discrete inputs do not have internal pull-ups. This input can be configured to disengage GPSS on a high or low voltage at this input.

Icarus Instruments, Inc
Centurion Consulting, Inc

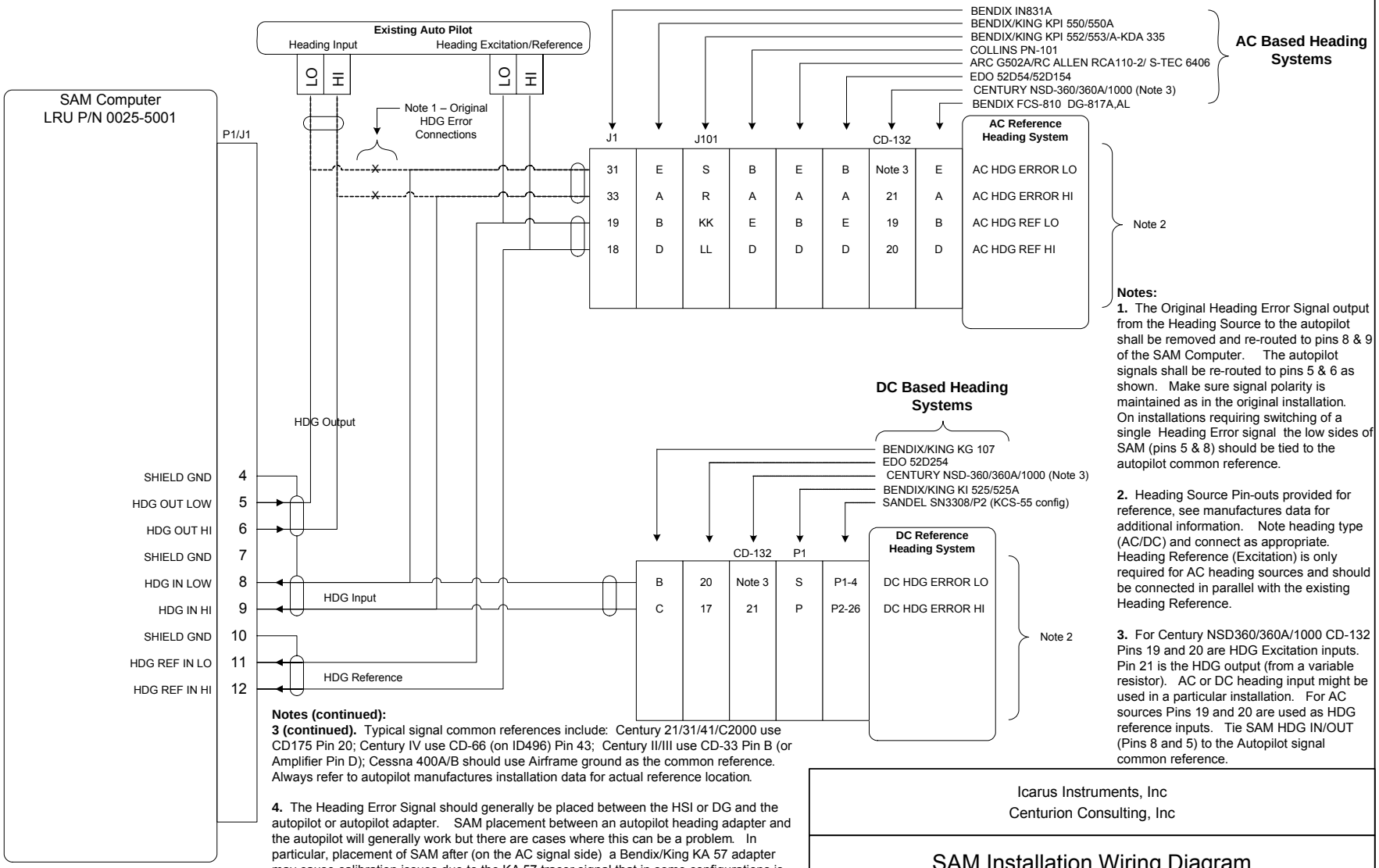
# SAM Installation Wiring Diagram

POWER/DIMMER/AVIONICS

| SIZE | FSCM NO | DWG NO | REV |
|---|---|---|---|
| A | | 0025-0130 | E |

| SCALE | DRAWN BY | SHEET |
|---|---|---|
| NONE | JBK | 1 OF 6 |

| REV | DATE | BY | REMARK |
|---|---|---|---|




**Notes:**

**1.** The Original Heading Error Signal output from the Heading Source to the autopilot shall be removed and re-routed to pins 8 & 9 of the SAM Computer. The autopilot signals shall be re-routed to pins 5 & 6 as shown. Make sure signal polarity is maintained as in the original installation. On installations requiring switching of a single Heading Error signal the low sides of SAM (pins 5 & 8) should be tied to the autopilot common reference.

**2.** Heading Source Pin-outs provided for reference, see manufactures data for additional information. Note heading type (AC/DC) and connect as appropriate. Heading Reference (Excitation) is only required for AC heading sources and should be connected in parallel with the existing Heading Reference.

**3.** For Century NSD360/360A/1000 CD-132 Pins 19 and 20 are HDG Excitation inputs. Pin 21 is the HDG output (from a variable resistor). AC or DC heading input might be used in a particular installation. For AC sources Pins 19 and 20 are used as HDG reference inputs. Tie SAM HDG IN/OUT (Pins 8 and 5) to the Autopilot signal common reference.

**Notes (continued):**

**3 (continued).** Typical signal common references include: Century 21/31/41/C2000 use CD175 Pin 20; Century IV use CD-66 (on ID496) Pin 43; Century II/III use CD-33 Pin B (or Amplifier Pin D); Cessna 400A/B should use Airframe ground as the common reference. Always refer to autopilot manufactures installation data for actual reference location.

**4.** The Heading Error Signal should generally be placed between the HSI or DG and the autopilot or autopilot adapter. SAM placement between an autopilot heading adapter and the autopilot will generally work but there are cases where this can be a problem. In particular, placement of SAM after (on the AC signal side) a Bendix/King KA 57 adapter may cause calibration issues due to the KA 57 tracer signal that in some configurations is imposed on the heading error signal. The symptom of this condition will be a calibration that does not approach zero volts with a heading error of zero.

**5.** Verify the maximum DC voltage swing from airframe ground is +/-15VDC (or 30VAC P-P). Active clamping will limit the input to +/- 15V.

6. See installation manual PN 0025-0107, section 3.4 for required GPSS calibration procedures prior to ground and flight testing.

Icarus Instruments, Inc
Centurion Consulting, Inc

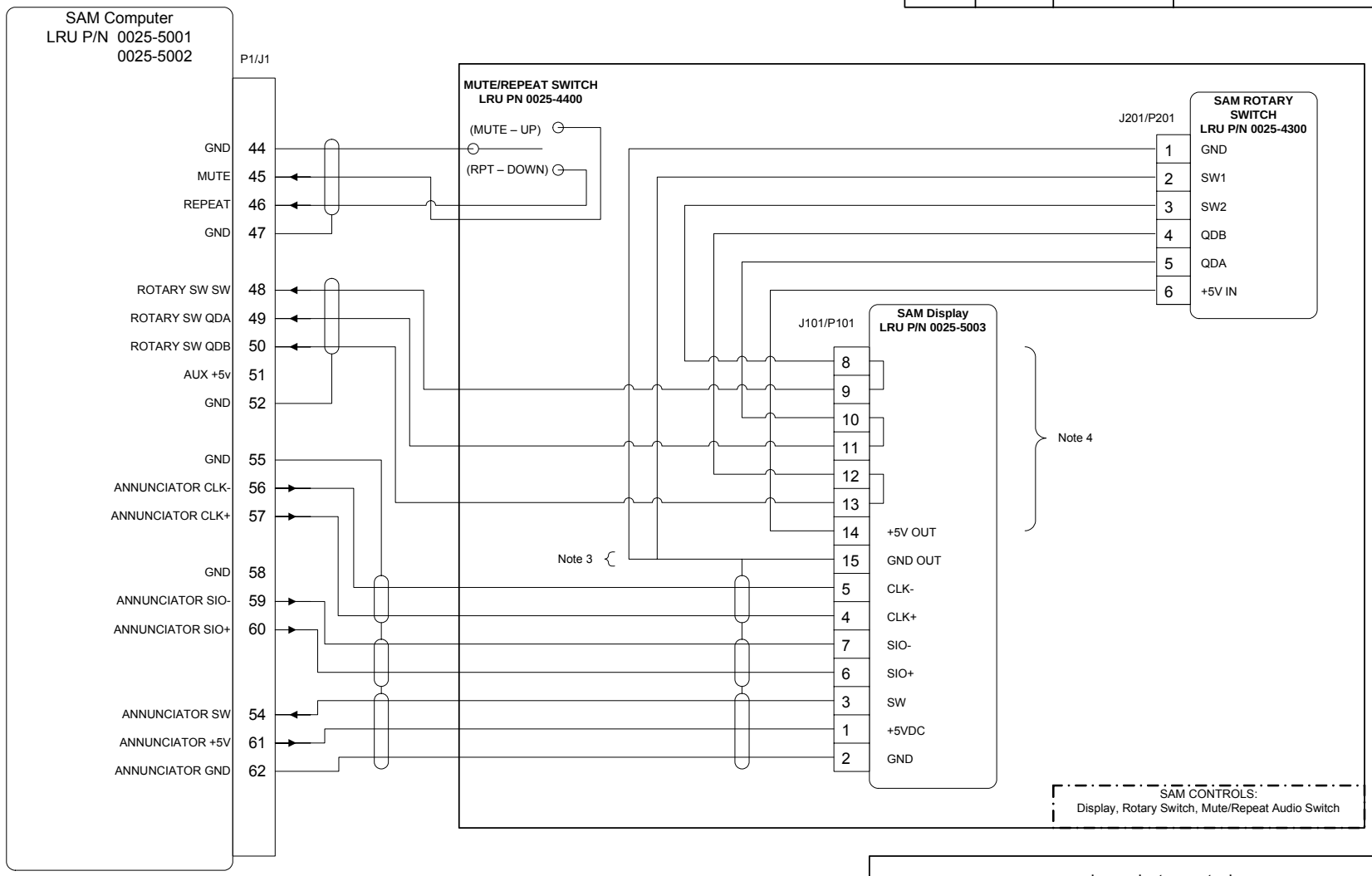
# SAM Installation Wiring Diagram

HEADING SOURCES

| SIZE | FSCM NO | DWG NO | REV |
|---|---|---|---|
| A | | 0025-0130 | E |

| SCALE | DRAWN BY | SHEET |
|---|---|---|
| NONE | JBK | 2 OF 6 |

| REV | DATE | BY | REMARK |
|---|---|---|---|




**Notes:**

**1.** Display Harness Shields must be grounded on computer and display side for proper EMI performance. Display side grounding may use either pin 2 or 15 of P101.

**2.** P101-45 Mute may be used by systems that provide higher priority audio alerts to mute the SAM system. Grounding or setting pin 45 to a TTL low level will Mute SAM Audio alerts. Diode isolation should be provided if another system is connected to this pin via at TTL interface.

**3.** Multiple grounds must be spliced as shown. An LC-2 solder sleeve or equivalent are recommended.

**4.** P101 includes loopback pins to allow convenient termination of the Rotary Switch (PN 0025-4300) connector pigtails. For installations using discrete components that are not adjacent to each other see the 'SAM CONTROLS – ALTERNATE ROTARY KNOB WIRING' page.

Icarus Instruments, Inc
Centurion Consulting, Inc

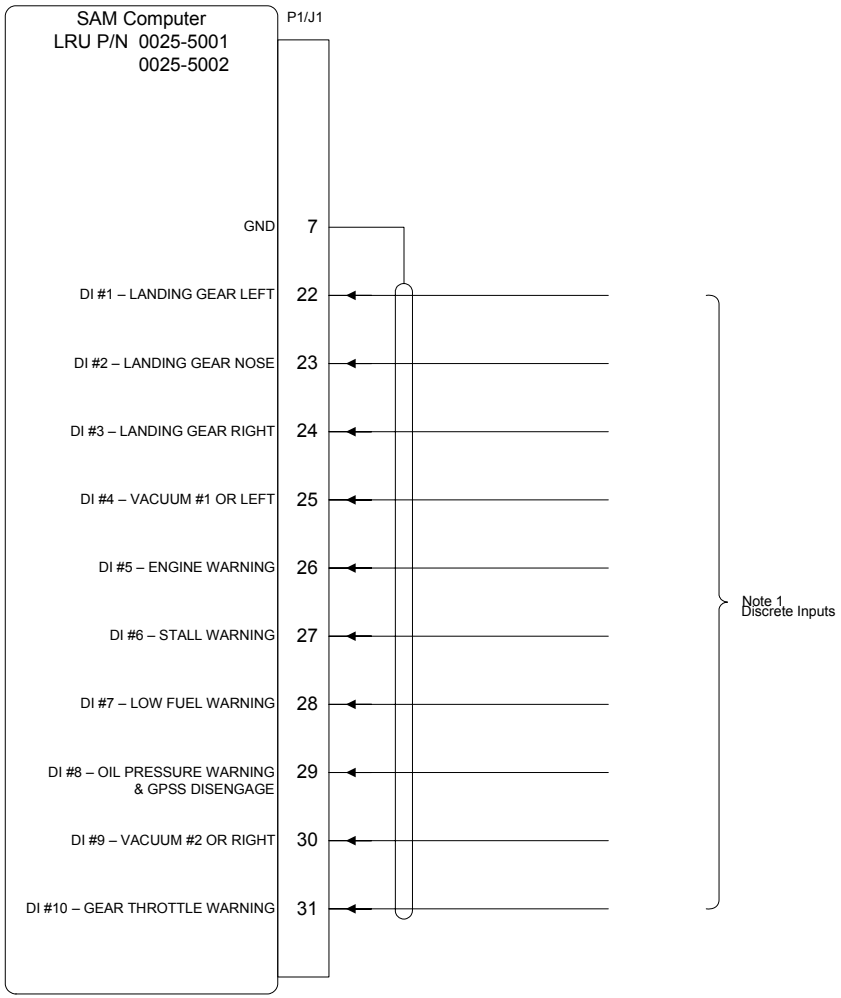
# SAM Installation Wiring Diagram

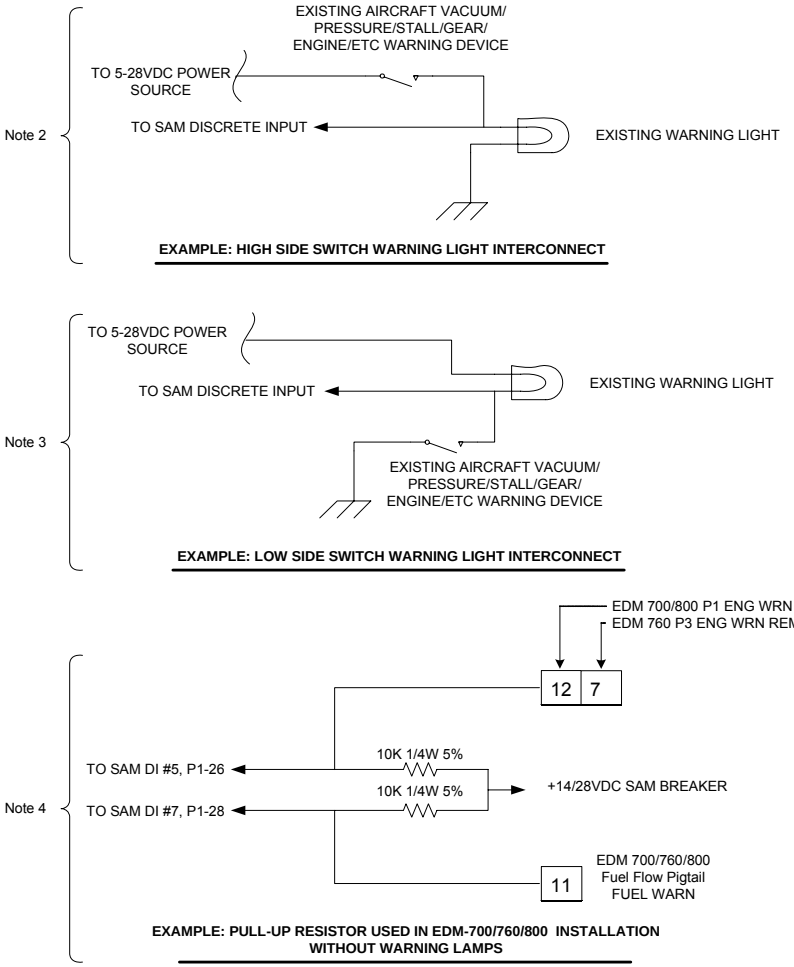
SAM CONTROLS

| SIZE | FSCM NO | DWG NO | REV |
|---|---|---|---|
| A | | 0025-0130 | E |

| SCALE | DRAWN BY | SHEET |
|---|---|---|
| NONE | JBK | 3 OF 6 |

| REV | DATE | BY | REMARK |
|---|---|---|---|




**Notes:**

**1.** Digital Input lines may optionally be connected to various aircraft systems to provide alerts related to changes in the input voltage. The inputs accepted are wide range and compatible with TTL Level Digital signals as well as 14/28V switched aircraft level signals. The "ON" or alert state is selectable between high and low voltage states as described in the configuration section of the installation manual.

**2,3,4.** Discrete input wiring examples representative of typical warning lamp and systems. Consult the manufactures information for additional details on specific installations.

**5.** SAM Alerts based on discrete inputs are considered secondary to the primary systems they are monitoring. They are intended to provide additional audio alerting capability to aircraft that don't already have this capability. In particular Gear and Stall warning systems should only be used when the existing certified system does not provide adequate audio alerting through the pilots headphones.

**6.** Landing Gear Up Light provisions (P1-22, 23, 24) are provided for gear warning based on both altitude and/or gear throttle warning (P1-31) inputs. If used the gear light inputs must all be terminated even in cases where a single light is used. In the case of a single gear-up light all three inputs (P1-22, 23, 24) should be tied together.

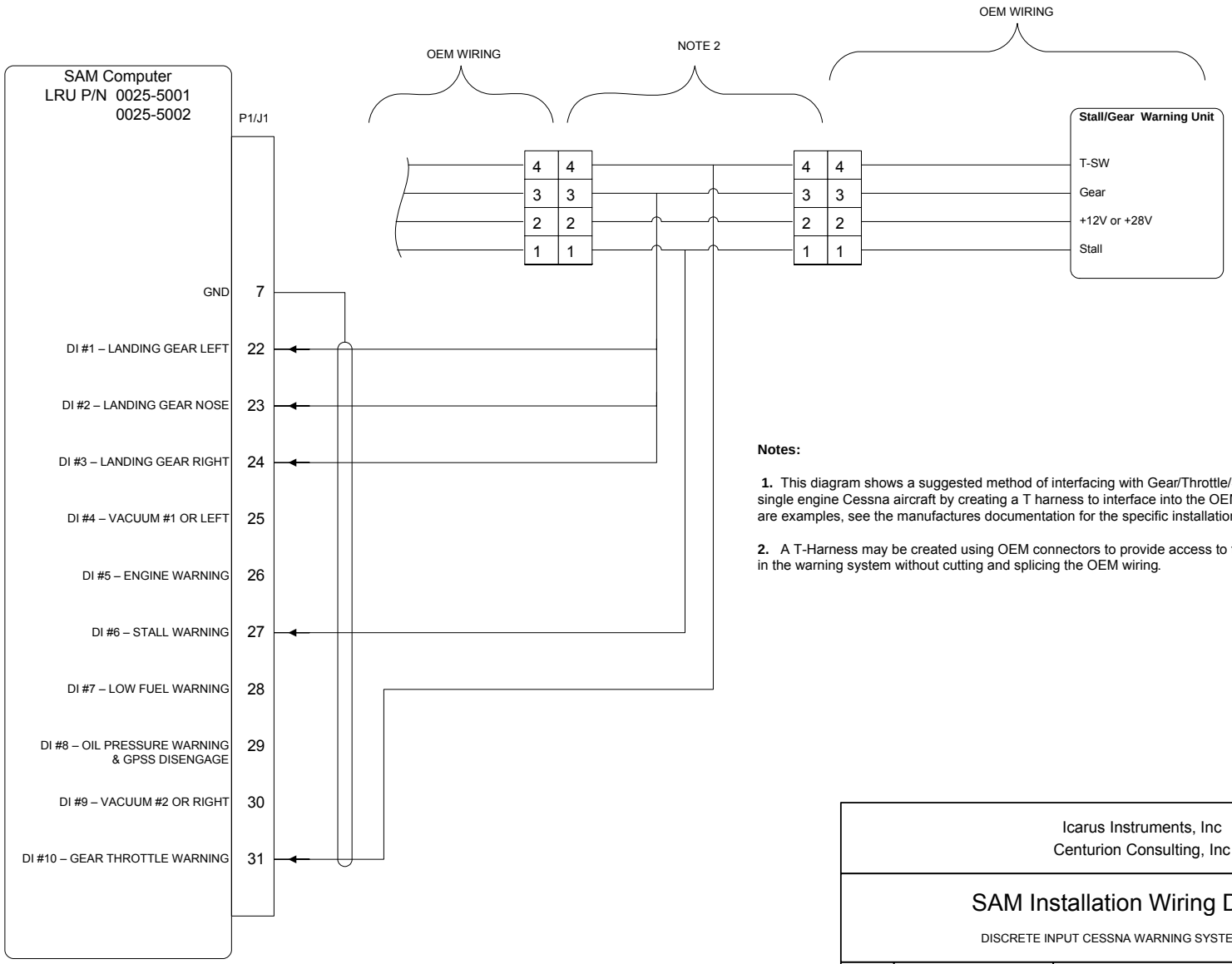
Icarus Instruments, Inc
Centurion Consulting, Inc

# SAM Installation Wiring Diagram

DISCRETE INPUTS

| SIZE | FSCM NO | DWG NO | REV |
|---|---|---|---|
| A | | 0025-0130 | E |
| SCALE NONE | DRAWN BY JBK | SHEET 4 OF 6 | |

| REV | DATE | BY | REMARK |
|---|---|---|---|




**Notes:**

**1.** This diagram shows a suggested method of interfacing with Gear/Throttle/Stall system on a typical single engine Cessna aircraft by creating a T harness to interface into the OEM wiring. Pin numbering are examples, see the manufactures documentation for the specific installation.

**2.** A T-Harness may be created using OEM connectors to provide access to the appropriate connections in the warning system without cutting and splicing the OEM wiring.

Icarus Instruments, Inc
Centurion Consulting, Inc

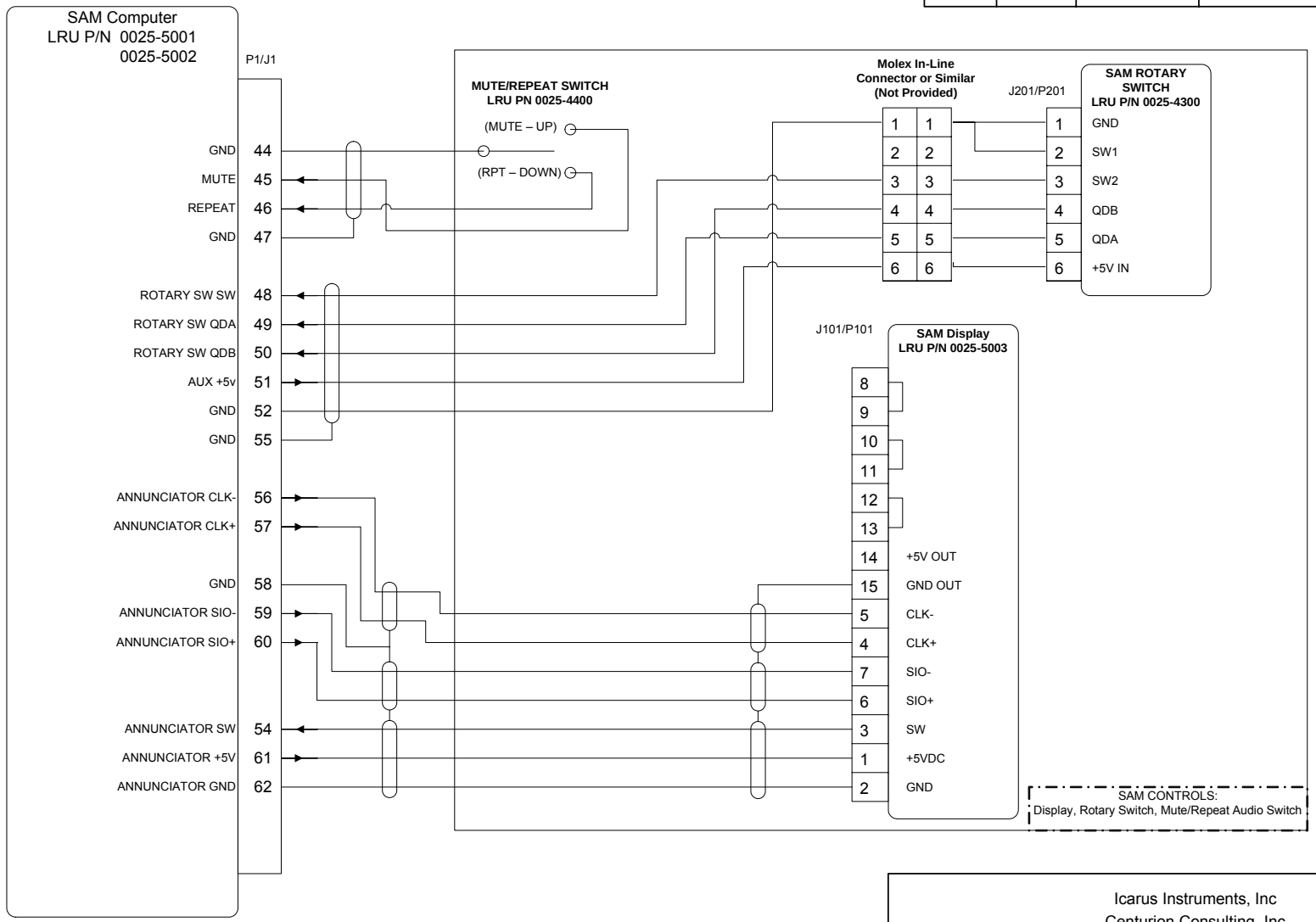
# SAM Installation Wiring Diagram

DISCRETE INPUT CESSNA WARNING SYSTEM EXAMPLE

| SIZE | FSCM NO | DWG NO | REV |
|---|---|---|---|
| A | | 0025-0130 | E |

| SCALE | DRAWN BY | SHEET |
|---|---|---|
| NONE | JBK | 5 OF 6 |

| REV | DATE | BY | REMARK |
|---|---|---|---|




Notes:

1. This diagram shows an alternate means of wiring the SAM controls for installations that require the rotary knob to be installed in a location that is not adjacent to the display. A Molex or similar connector is required to terminate the rotary switch pigtail wires for J201.

2. A Molex or similar connector may optionally be used on the mute/repeat switch to allow easy removal of an integrated display mount.

Icarus Instruments, Inc
Centurion Consulting, Inc

# SAM Installation Wiring Diagram

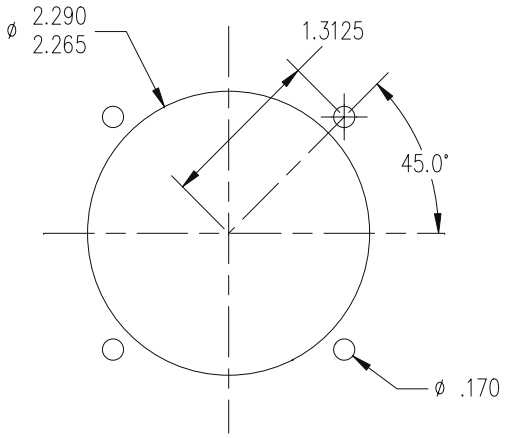
SAM CONTROLS – ALTERNATE ROTARY KNOB WIRING

| SIZE | FSCM NO | DWG NO | REV |
|---|---|---|---|
| A | | 0025-0130 | E |

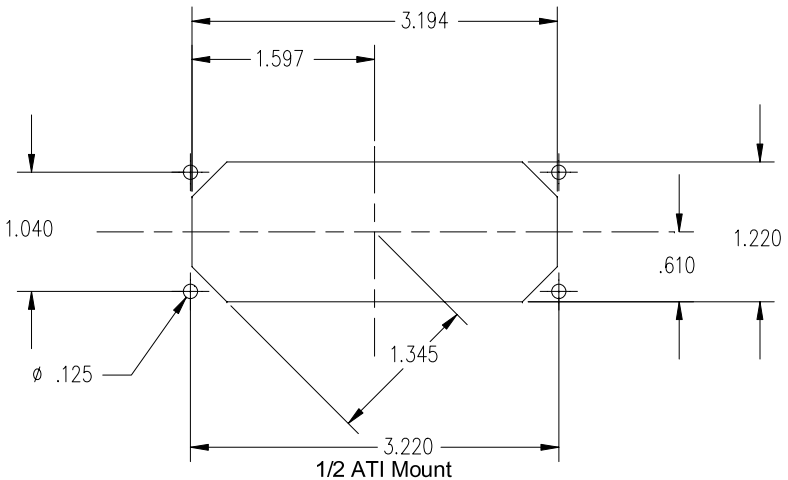
| SCALE | DRAWN BY | SHEET |
|---|---|---|
| NONE | JBK | 6 OF 6 |

# Appendix C – Mounting Templates

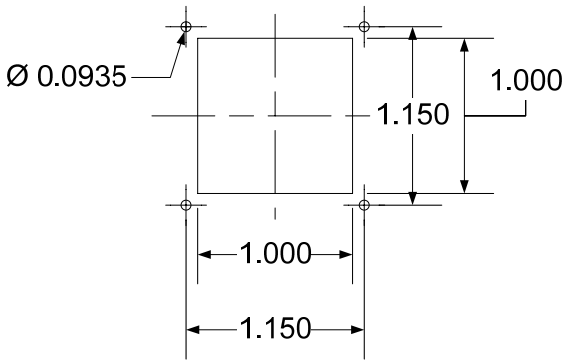
SAM Display Mounting Panel Cut-outs.



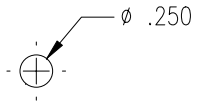

2 1/4" Round Mount
Panel Cut-Out



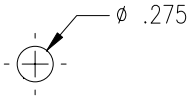

1/2 ATI Mount
Panel Cut-Out




1" Square Mount
Panel Cut-Out



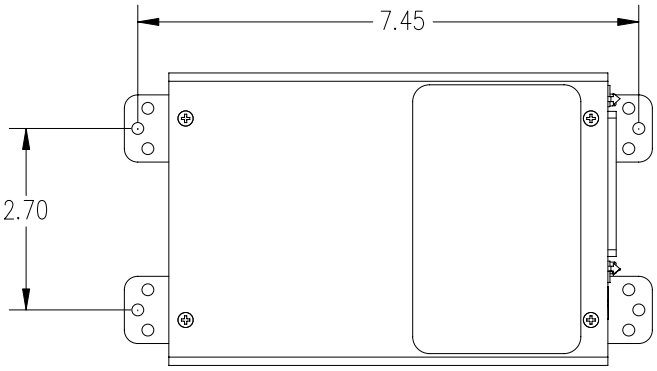

Mute/Repeat SW
Panel Cut-Out



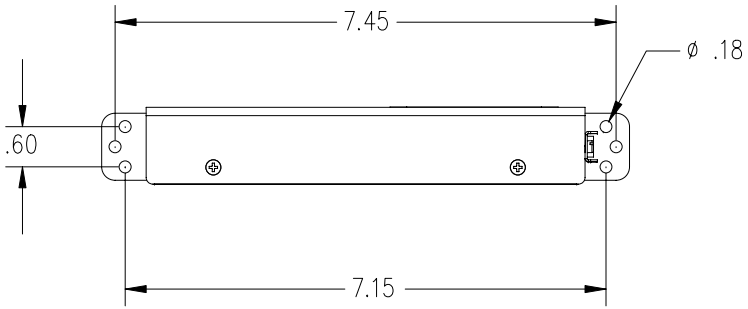

Rotary SW
Panel Cut-Out

NOTE: Not to scale, Units=Inches unless otherwise specified. Square Mount requires separate mounting of Mute/Repeat and Rotary Switches

SAM Computer Mounting




MOUNTING HORIZONTAL




MOUNTING VERTICAL

# Appendix D – Configuring/Calibration map

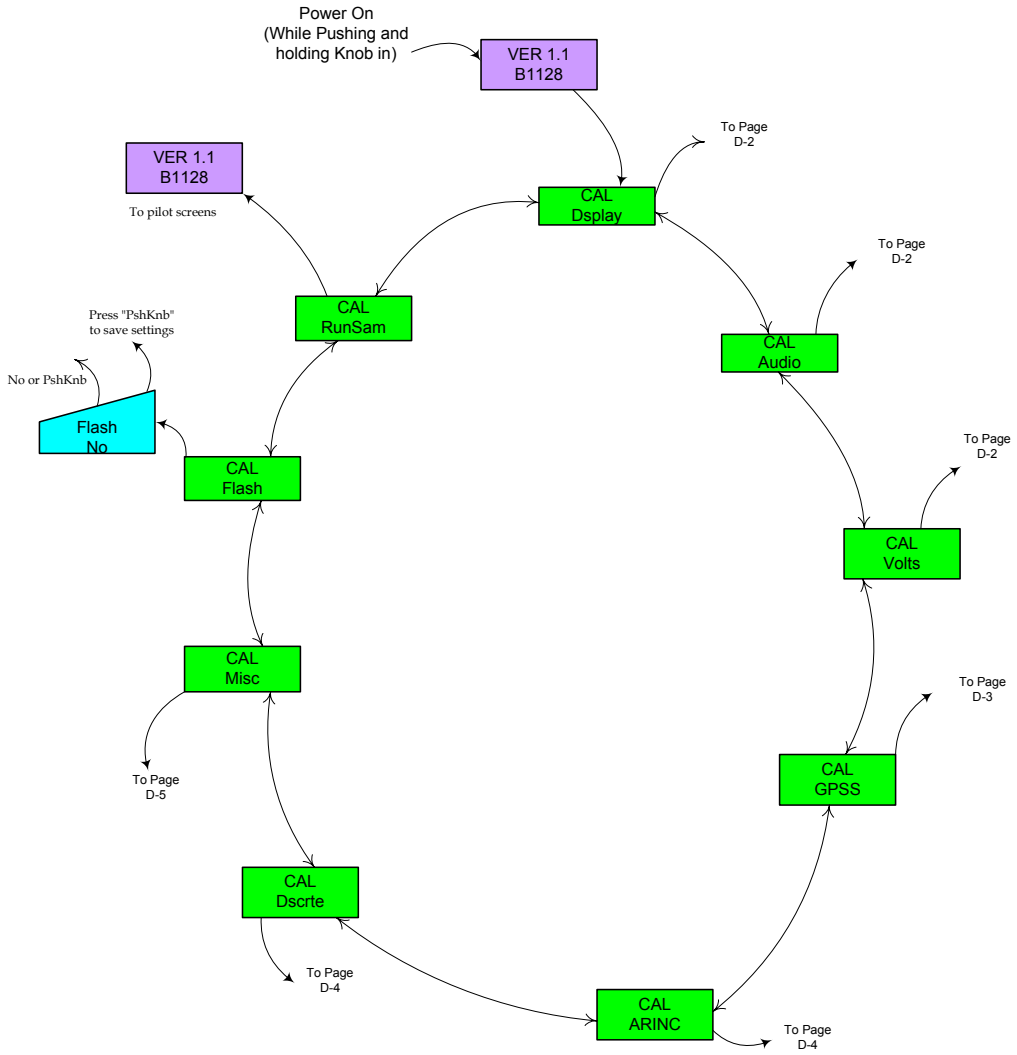
**Calibration Mode and Submode Rings**

Knob Turn = Orbit CAL mode/submode rings
Knob Push = Choose current CAL screen for edit

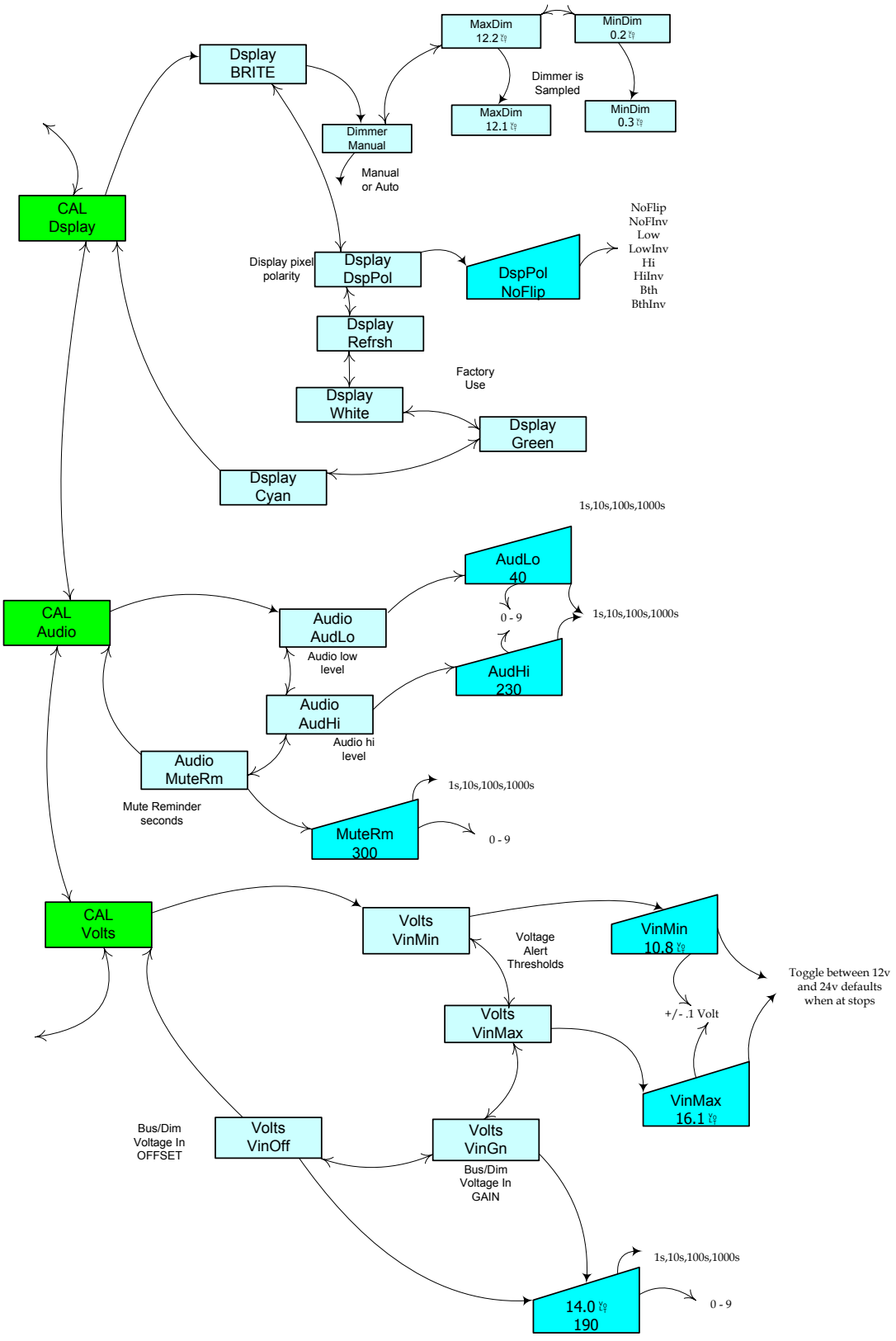
**For edit screens:**

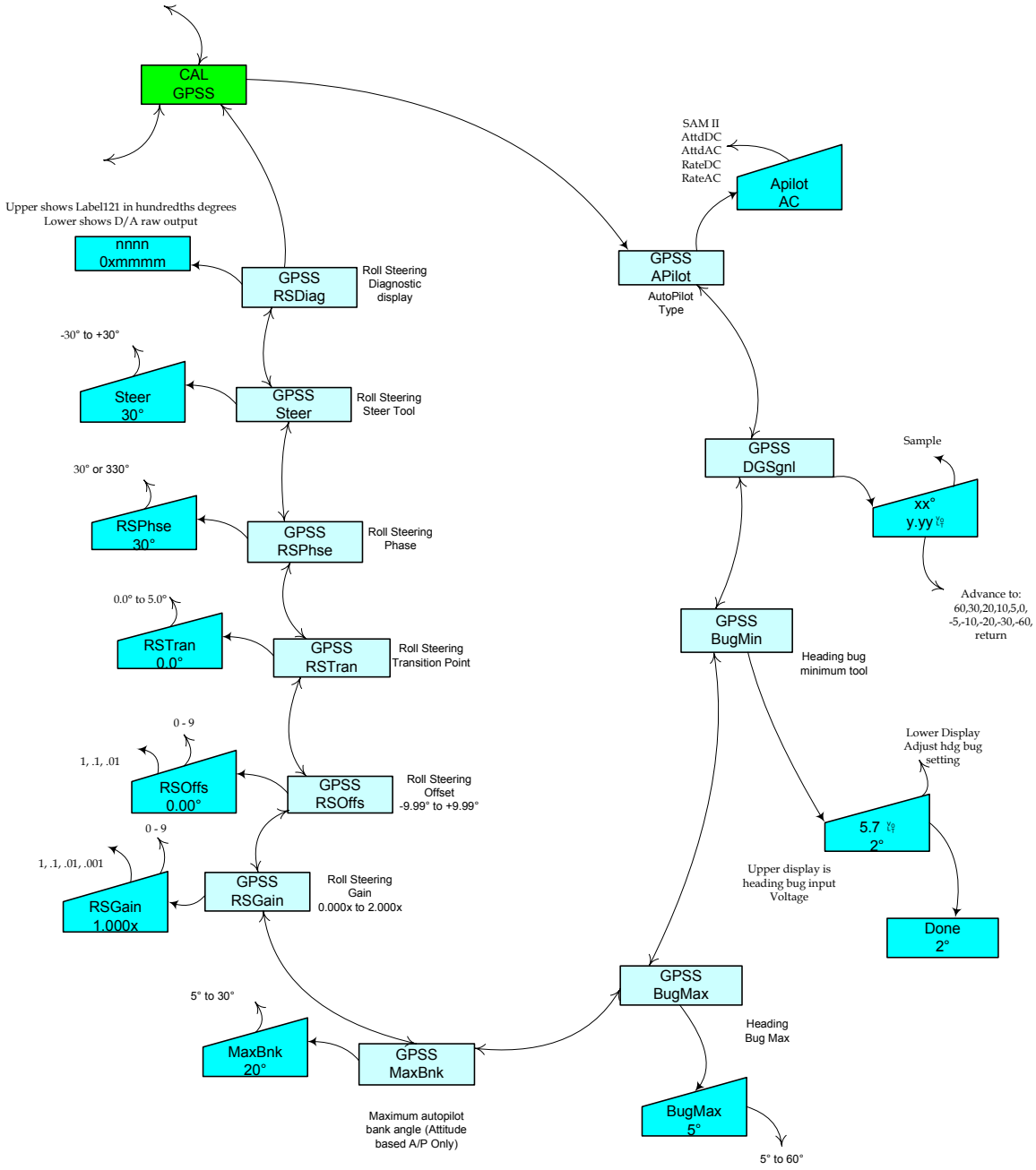
Knob Turn = scroll thru values
Knob Push = Choose units for value or Select value
CW Pushing Turn = Up one level, to the CAL Submode ring
CCW Pushing Turn = Up two levels, to the CAL mode ring

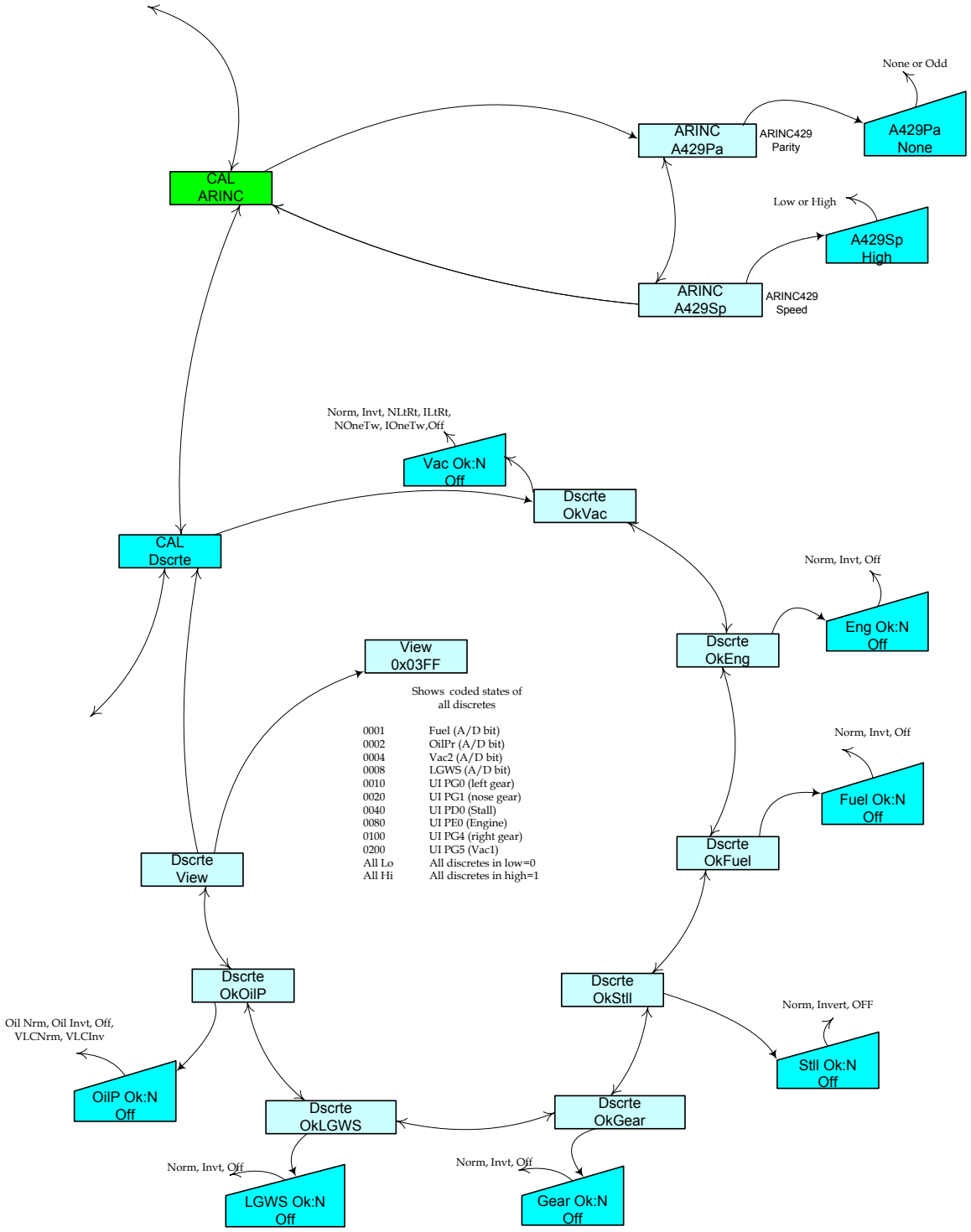
Steering Assist Module
Calibration Mode Main Ring of Screens

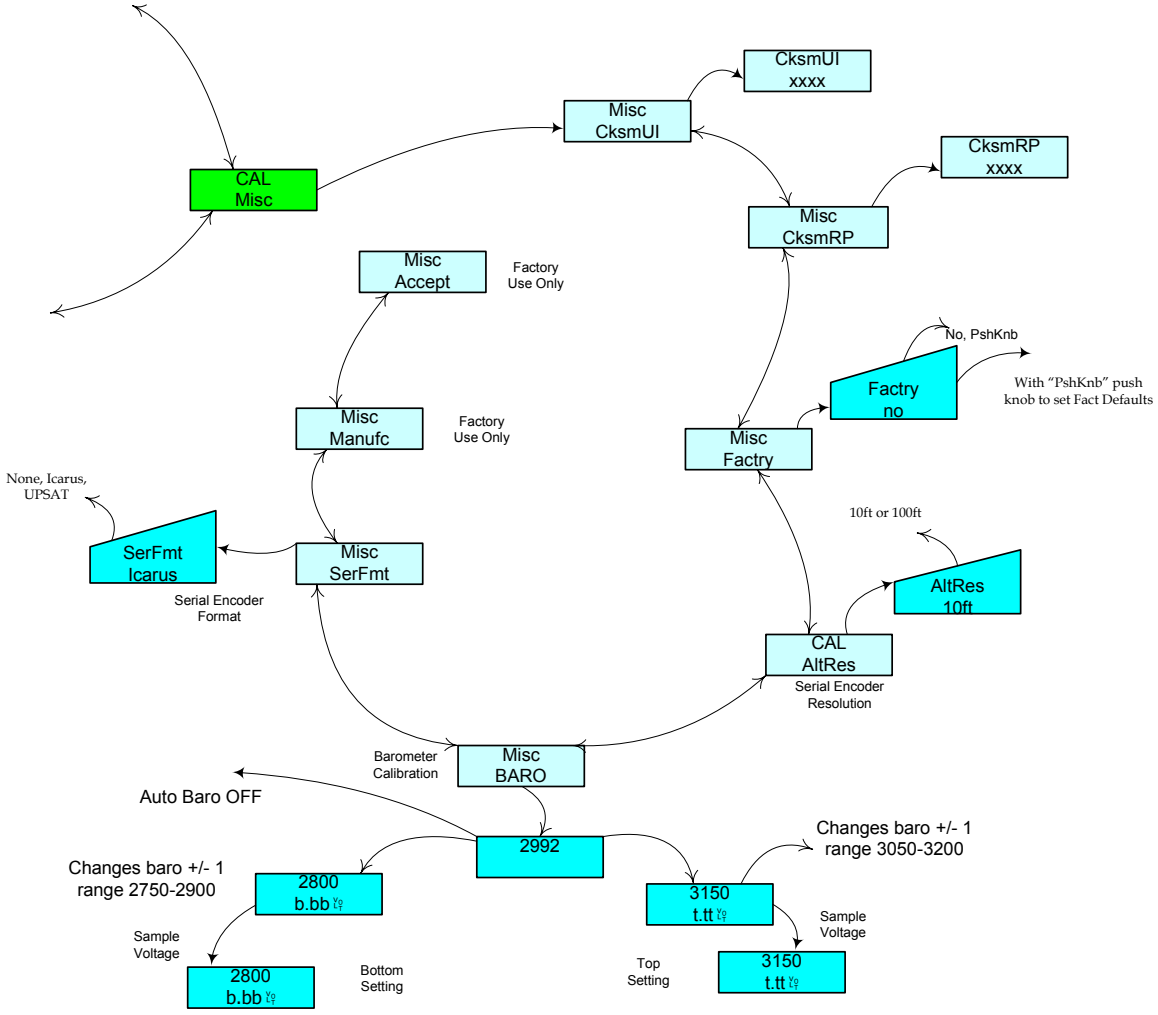


# Steering Assist Module
## Calibration Mode sub-Screens, page D-2




CAL
GPSS
SAM II
AttdDC
AttdAC
RateDC
RateAC
Apilot
AC
Upper shows Label121 in hundredths degrees
Lower shows D/A raw output
nnnn
0xmmmm
GPSS
RSDiag
Roll Steering
Diagnostic
display
GPSS
APilot
AutoPilot
Type
-30° to +30°
Steer
30°
GPSS
Steer
Roll Steering
Steer Tool
GPSS
DGSgnl
Sample
xx°
y.yy
30° or 330°
RSPhse
30°
GPSS
RSPhse
Roll Steering
Phase
Advance to:
60,30,20,10,5,0,
-5,-10,-20,-30,-60,
return
0.0° to 5.0°
RSTran
0.0°
GPSS
RSTran
Roll Steering
Transition Point
GPSS
BugMin
Heading bug
minimum tool
0 - 9
1, .1, .01
RSOffs
0.00°
GPSS
RSOffs
Roll Steering
Offset
-9.99° to +9.99°
Lower Display
Adjust hdg bug
setting
5.7
2°
0 - 9
1, .1, .01, .001
RSGain
1.000x
GPSS
RSGain
Roll Steering
Gain
0.000x to 2.000x
Upper display is
heading bug input
Voltage
Done
2°
GPSS
BugMax
5° to 30°
MaxBnk
20°
GPSS
MaxBnk
Heading
Bug Max
BugMax
5°
Maximum autopilot
bank angle (Attitude
based A/P Only)
5° to 60°


CAL
ARINC
ARINC
A429Pa
ARINC429
Parity
None or Odd
A429Pa
None
ARINC
A429Sp
ARINC429
Speed
Low or High
A429Sp
High
CAL
Dscrte
Dscrte
OkVac
Norm, Invt, NLtRt, ILtRt,
NOneTw, IOneTw,Off
Vac Ok:N
Off
Dscrte
OkEng
Norm, Invt, Off
Eng Ok:N
Off
View
0x03FF
Shows coded states of
all discretes
0001 Fuel (A/D bit)
0002 OilPr (A/D bit)
0004 Vac2 (A/D bit)
0008 LGWS (A/D bit)
0010 UI PG0 (left gear)
0020 UI PG1 (nose gear)
0040 UI PD0 (Stall)
0080 UI PE0 (Engine)
0100 UI PG4 (right gear)
0200 UI PG5 (Vac1)
All Lo All discretes in low=0
All Hi All discretes in high=1
Dscrte
OkFuel
Norm, Invt, Off
Fuel Ok:N
Off
Dscrte
View
Dscrte
OkOilP
Dscrte
OkStll
Norm, Invert, OFF
Stll Ok:N
Off
Oil Nrm, Oil Invt, Off,
VLCNrm, VLCInv
OilP Ok:N
Off
Dscrte
OkLGWS
Dscrte
OkGear
Norm, Invt, Off
LGWS Ok:N
Off
Norm, Invt, Off
Gear Ok:N
Off


CksmUI
xxxx
Misc
CksmUI
CksmRP
xxxx
CAL
Misc
Misc
CksmRP
Misc
Accept
Factory
Use Only
No, PshKnb
Factry
no
With "PshKnb" push
knob to set Fact Defaults
Misc
Manufc
Factory
Use Only
Misc
Factry
None, Icarus,
UPSAT
10ft or 100ft
SerFmt
Icarus
Misc
SerFmt
AltRes
10ft
Serial Encoder
Format
CAL
AltRes
Serial Encoder
Resolution
Barometer
Calibration
Misc
BARO
Auto Baro OFF
2992
Changes baro +/- 1
range 3050-3200
Changes baro +/- 1
range 2750-2900
2800
b.bb
3150
t.tt
Sample
Voltage
Sample
Voltage
2800
b.bb
Bottom
Setting
Top
Setting
3150
t.tt

# Appendix E – Configuration Log Form

This form should be used to record configuration parameters for an installation and saved for future use including re-configuring the system if it has been returned to the factory for any reason.

| AIRCRAFT REGISTRATION: #_____ | **SAM Configuration and Verification Log** | DATE: ___/___/___<br>BY: _____ |
|---|---|---|

COMPUTER: PN: 0025-500_ (1 or 2) SN: _____ MOD LEVEL: _____

DISPLAY: PN 0025-5003 SN: _____ MOD LEVEL: _____

MOUNTING OPTION: ☐ 2 ¼" Round PN 0025-2008 ☐ ½ ATI PN 0025-2007 ☐ 1" Square PN 0025-2006

SW Version: V__.___ BL_____

Autopilot Model: _____/Type: ☐ Rate Based ☐ Attitude Based

Autopilot Heading Excitation: ☐ AC ☐ DC

Heading Source:

AC Sources:
- ☐BENDIX/KING KPI 550/550A
- ☐BENDIX/KING KPI 552/553/A-KDA 335
- ☐COLLINS PN-101
- ☐ARC G502A/RC ALLEN RCA110-2/ S-TEC 6406
- ☐EDO 52D54/52D154
- ☐Other:_____

DC Sources:
- ☐EDO 52D54/52D154
- ☐EDO 52D254
- ☐CENTURY NSD-360/360A/1000 (DC or AC)
- ☐BENDIX/KING KI 525/525A
- ☐SANDEL SN3308/P2 (KCS-55 config)
- ☐Other:_____

GPS Model: _____, ARINC 429 Speed: ☐ Low ☐ High

Altitude Serializer Model: _____, Resolution: ☐ 10 ft ☐ 100 ft

Format: ☐ Icarus (Garmin) ☐ UPSAT (Apollo)

Baro Altimeter Potentiometer Input: ☐ YES ☐ NO

Digital Inputs:
- ☐ 1 - LANDING GEAR LIGHT/SW LEFT
- ☐2 - LANDING GEAR LIGHT/SW NOSE
- ☐3 - LANDING GEAR LIGHT/SW RIGHT
- ☐4 - VACUUM WARN LIGHT/SW 1
- ☐5 - ENGINE WARN LIGHT/SW
- ☐ 6 - STALL WARN SW
- ☐7 - FUEL WARN LIGHT/SW
- ☐8 - OIL WARN LIGHT/SW ( or HOBBS SW)
- ☐9 - VACUUM WARN LIGHT/SW 2
- ☐10 – LANDING GEAR WARNING HORN

Audio Output:

☐ Interfaced with un-switched audio input ☐ Interfaced with switched input _____

Audio Mute Input: ☐ Not Connected ☐ Interfaced with _____

Dimmer Input: ☐ Not Connected ☐ Aircraft Dimmer Bus

Configuration log form continued:

**Software Configuration and Calibration Parameters:**

Display : Dimmer: ☐ Manual ☐ Automatic (Requires Min/Max dimmer calibration)

Display : DspPol: ☐ NoFlip ☐ LowInv ☐ HiInv ☐ Other_____

Volts: VinMin: ☐ Set to 12.0V for 14V system ☐ Set to 24.0V for 28V system

Volts: VinMax: ☐Set to 15.5V for 14V system ☐ Set to 34.0V for 28V system

GPSS: APilot: ☐ SAM II ☐ AttdAC ☐ AttdDC ☐ RateAC ☐ RateDC

GPSS: DGSgnl (from the lubber line):

| | | | |
|---|---|---|---|
| 60°: | _____ | -60°: | _____ |
| 30°: | _____ | -30°: | _____ |
| 20°: | _____ | -20°: | _____ |
| 10°: | _____ | -10°: | _____ |
| 5°: | _____ | -5°: | _____ |
| 0°: | _____ | | |

GPSS: BugMax: _____ GPSS: MaxBnk: _____

GPSS: RSGain: _____ GPSS: RSoff: _____

GPSS: RSPhse: _____

ARINC: A429Pa: ☐ Odd ☐ None ARINC: A429Sp: ☐ Low ☐ High

Dscrte: OkVac: ☐ Norm ☐ Invt ☐ NLtRt ☐ILtRt ☐NOneTw ☐ IOneTw ☐ Off

Dscrte: OkEng: ☐ Norm ☐ Invt ☐ Off Dscrte: OkFuel ☐ Norm ☐ Invt ☐ Off

Dscrte: OkStll: ☐ Norm ☐ Invt ☐ Off Dscrte: OkGear: ☐ Norm ☐ Invt ☐ Off

Dscrte: OkLGWS: ☐ Norm ☐ Invt ☐ Off Dscrte: OkOilP: ☐ Norm ☐ Invt ☐ Off

Misc: AltRes: ☐ 10ft ☐ 100ft Misc: Baro: ☐ Calibrated ☐ Not used

Misc: SerFmt: ☐None ☐Icarus ☐UPSAT

| Ground Tests Compete | Flight Tests Complete |
|---|---|

Comments: