

**ENSTROM 480B OPERATOR'S MANUAL
AND
FAA APPROVED
ROTORCRAFT FLIGHT MANUAL
SUPPLEMENT
SANDEL® SN3500 EHSI**

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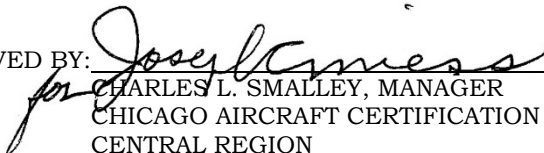
HELICOPTER SERIAL NO. _____

HELICOPTER REGISTRATION NO. _____

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THIS SUPPLEMENT MUST BE CARRIED IN THE HELICOPTER AT ALL TIMES IF EQUIPPED WITH THE SN3500 EHSI INSTALLATION. CHAPTERS 1, 2, 3, AND 4 ARE FAA APPROVED.

FAA APPROVED BY: _____



CHARLES L. SMALLEY, MANAGER
CHICAGO AIRCRAFT CERTIFICATION OFFICE
CENTRAL REGION
FEDERAL AVIATION ADMINISTRATION

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Rev. No.	Date	FAA Approved
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ROTORCRAFT FLIGHT MANUAL SUPPLEMENT
SN3500 EHSI

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SN3500 EHSI

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INTRODUCTION

Intro-1. General

This supplement contains the operating instructions, procedures, and limitations for the Sandel SN3500 Electronic Horizontal Situation Indicator (EHSI) configured with the Sandel SG102 Attitude Heading Reference System (AHRS), the Sandel MT102 Magnetic Transducer Accessory (MTA), and navigation receivers.

The Sandel SN3500 configurations applicable to this supplement are part numbers 4220609-1, 4220609-5, and 4220609-7. Differences in system installation or operation between the configurations are noted where applicable.

The supplement is divided into two basic parts, the FAA approved RFM Supplement and Supplemental Data provided by the Enstrom Helicopter Corporation (Enstrom). Chapters 1, 2, 3, and 4 make up the FAA approved RFM Supplement. It is required by Federal Regulations that this supplement be carried in the helicopter at all times if the SN3500 EHSI is installed.

In this document, the term *SN3500* may be used interchangeably in reference to the complete EHSI system or in reference to the panel mounted EHSI unit.

For additional information regarding the supplement format and text emphasis or definitions, refer to the Basic Flight Manual.

Abbreviations noted in this supplement are listed in Table Intro-1.

Table Intro-1. List of Abbreviations

ACK	Acknowledge
AHRS	Attitude Heading Reference System
CDI	Course Deviation Indicator
CRC	Cyclic Redundancy Check
DG	Directional Gyro

DME	Distance Measuring Equipment
EHSI	Electronic Horizontal Situation Indicator
FAA	Federal Aviation Administration
GPS	Global Positioning System
GS	Glide Slope
HSI	Horizontal Situation Indicator
IFR	Instrument Flight Rules
IN	Inch
ILS	Instrument Landing System
ITAR	International Traffic in Arms Regulations
LBS	Pounds
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LOC	Localizer
MTA	Magnetic Transducer Accessory
NAV	Navigation Receiver (VOR/LOC/GS)
NDB	Non-Directional Beacon
RFM	Rotorcraft Flight Manual
RFMS	Rotorcraft Flight Manual Supplement
RMI	Radio Magnetic Indicator
TFC	Traffic
USB	Universal Serial Bus
VDI	Vertical Deviation Indicator
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VOR	VHF Omnidirectional Range
VORTAC	VHF Omnidirectional Range/Tactical Aircraft Control
WX	Weather

CHAPTER 1. OPERATING LIMITATIONS

1-1. General

This chapter includes operating limitations and restrictions that must be observed during ground and flight operations.

The operating limitations set forth in this chapter are the direct results of design analysis and flight tests. Compliance with these limitations will allow the pilot to derive maximum utility from the helicopter.

1-2. Operational Limits

1. Rotorcraft operation with the SN3500 is limited to VFR only. IFR procedure training is allowed during VFR/VMC.

2. The following publications should be referred to for operating instructions and must be kept accessible to the flight crew at all times:

a. Pilot's Guide, SN3500 Primary Navigation Display with Reversionary Attitude Mode, Document Number 82005-PG, Revision L or later revision.

b. Pilot's Guide Supplement, SN3500 Primary Navigation Display, Document Number 82005-PGSUP, Revision E or later revision.

3. The SN3500 must utilize the approved software version listed in Table 1-1.

4. The SG102 must utilize the approved software version listed in Table 1-1.

Table 1-1. Approved Software Versions

Configuration	Component	Approved Software Version (or later FAA approved version)
4220609-1	EHSI	4.05
	AHRS	1.31
4220609-5 4220609-7	EHSI	A4.07
	AHRS	1.61

5. The “CRC Self Test Failed” message must not appear on power-up if flight operations are predicated on the use of the SN3500.

CHAPTER 2. NORMAL PROCEDURES

2-1. Starting Engine

Add the following steps to para. 2-19, “Starting Engine”, after switching the avionics master switch ON:

1. The SN3500 will perform a power-on self-test and display an introduction screen.
 - a. Verify the software version as listed in Table 1-1.
 - b. Verify the compass card display appears a few seconds after the introduction screen.
2. Keep aircraft stationary during the AHRS initialization period.

CAUTION

The aircraft should be stationary during the AHRS initialization period. The initialization may take up to three minutes after power is applied.

2-2. Engine Runup

Add the following Check to step 11 of para. 2-20, “Engine Runup”:

1. Check the gyro flag (**GYRO INVALID**) is removed from the SN3500 heading display and the compass rose is white after the initialization period.
2. Check the reversionary mode capability (if equipped) by activating the **ATTD IND** switch. Ensure the display information compares identically with the primary attitude indicator. Press the **ATTD IND** switch again to return to HSI mode.

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CHAPTER 3. EMERGENCY PROCEDURES

3-1. General

1. If the SN3500 fails to operate or the display indicates that the heading is invalid, use an alternate heading source for primary heading information.

2. If the AHRS is inoperative or detects an internal error, all SN3500 display outputs will be flagged. Use an alternate heading source for primary heading information.

3-2. Electrical System Failure

1. A power interruption exceeding 30 seconds may cause a loss of AHRS initialization. If a power interruption occurs and the gyro flag appears, use an alternate heading source for primary heading information.

2. In the event of complete electrical system failure, use an alternate heading source for primary heading information.

3-3. Primary Attitude Indicator Failure

CAUTION

If there is no ATTD IND switch located on the instrument panel, the reversionary mode is not enabled. Refer to external visual references and other available information for attitude information in the event the attitude indicator fails to operate.

1. In the event the attitude indicator fails to operate, revert to the SN3500 EHSI, Reversionary Mode, for alternate attitude information.

- a. Press the **ATTD IND** switch on the instrument panel to activate the Reversionary Mode for attitude display on the SN3500.

NOTE

The attitude data source in Reversionary Mode is received from the same AHRS which supplies the HSI heading. During normal flight, if the HSI heading is intermittent, erroneous, or flagged, it may indicate that Reversionary Mode may be unavailable.

CHAPTER 4. PERFORMANCE DATA

4-1. General

Refer to the basic RFM.

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CHAPTER 6. WEIGHT/BALANCE AND LOADING

6-1. General

If any component of the SN3500 EHSI configuration is removed, a new weight and balance should be recalculated per the instructions in Chapter 6 of the basic RFM using the information provided in Table 6-1.

Table 6-1. Weight and Balance Information

<u>Equipment</u>	<u>Weight (lbs)</u>	<u>Arm (in)</u>	<u>Moment (in-lbs)</u>
SN3500 EHSI	3.0	68.2	204.6
SG102 AHRS	2.2	189.7	417.3
SG102 Mounting Base	0.6	189.7	113.8
MT102 MTA	0.4	241.0	96.4

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CHAPTER 7. SYSTEM DESCRIPTION AND OPERATION

7-1. System Description

1. The Sandel SN3500 is an enhanced electronic horizontal situation indicator (EHSI) that displays compass and RMI data on a bright, high-contrast, LED backlit, LCD screen. The SN3500 combines the functions of several electronic navigation sources into one unit. All configurations display navigation information from the Sandel SG102 AHRS and integrated COM and NAV (VOR/LOC/GS) receivers. P/N 4220609-5 and P/N4220609-7 also display navigation information from a GPS receiver and marker beacon receiver.

- a. Traffic (**TFC**) and weather (**WX**) functions are not integrated into any of the configurations.
- b. P/N 4220609-1 is not configured to a GPS receiver; therefore, GPS-based navigation features and the moving map (**MAP**) and range (**↑↓**) functions are not available.

2. Components particular to the EHSI configuration include the SN3500 located in the instrument panel (Figures 7-5 thru 7-7), the SG102 Attitude Heading Reference System (AHRS) located in the baggage box, and the MT102 Magnetic Transducer Accessory (MTA) located in the tailcone. The system also includes inputs from GPS/NAV (if equipped) and VOR/LOC/GS receivers. The system block diagram is shown in Figure 7-1.

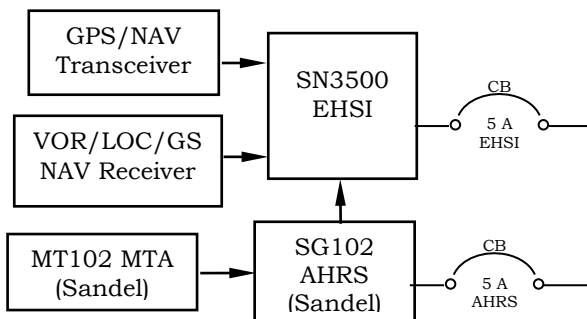


Figure 7-1. SN3500 System Block Diagram

3. As shown from Figure 7-1, the SN3500 is configured to display data from the following sources:

- a. Compass system (via the SG102 AHRS and MT102 MTA) and,
- b. NAV receivers (via the VOR/LOC/GS)

4. The SN3500 layout consists of a three inch display, eleven backlit pushbuttons, two knobs with push-to-select, and one USB connector. The SN3500 controls (noted in bold font) and display features are shown in Figure 7-2 and Figure 7-3.

- a. The display in Figure 7-2 shows that the SN3500 is tuned to VOR signals whereas the display in Figure 7-3 shows the SN3500 is tuned to an ILS signal.

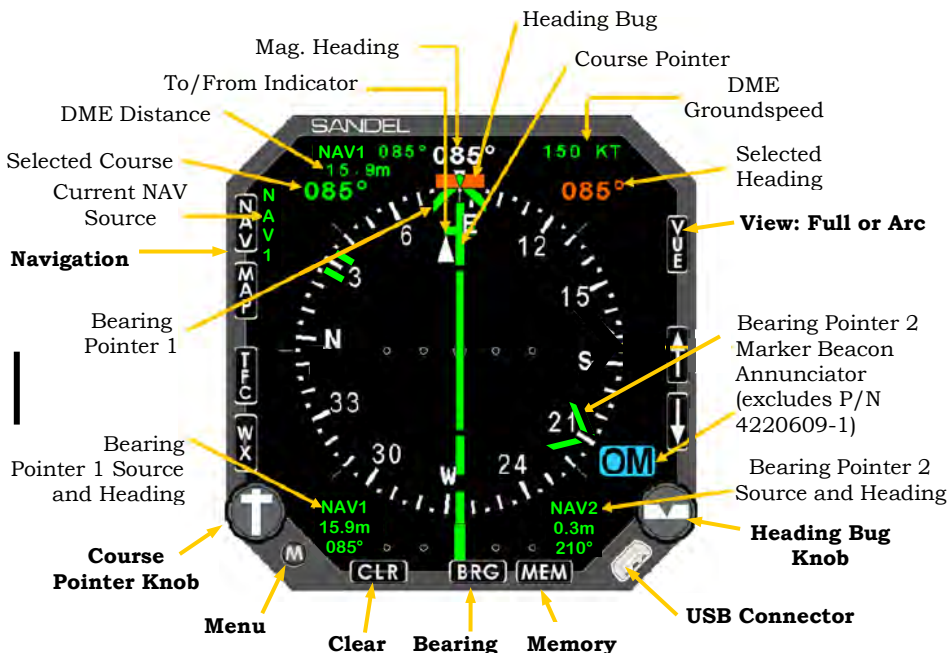


Figure 7-2. SN3500 Controls and Display Area (VOR)



Figure 7-3. SN3500 Display Area (ILS)

- a. The SN3500 display shows several different indicators or symbols and utilizes color coding for related data information. Some typical symbols and color codes are briefly described in Table 7-1.

NOTE

The indicators may display a slightly different symbol type when the VUE control is switched from full view to arc view and when operating in Reversionary Mode (if equipped). Refer to the SN3500 Pilot's Guide for details.

- c. The upper display area presents data from the selected navigation source (VOR/DME) which will generally include bearing, distance, ground speed (if available), and also an annunciation regarding the type of LOC/GS signal being received.
- d. The lower display area presents the data associated with the two bearing pointers, which includes the NAV source, bearing, and distance (if available).

- e. Two different groups of display configuration memories are toggled by pressing the **MEM** button. Refer to the SN3500 Pilot's Guide for additional information regarding the MEM function as well as other display functions and features of the SN3500.

5. With the exception of P/N 4220609-7, the SN3500 is configured with Reversionary Attitude Mode (Reversionary Mode) capability, a feature that provides backup attitude in the event of loss of the primary attitude display.

- a. The attitude display includes a roll index, roll pointer and slip-skid indicator as well as some standard navigation display features of the HSI. The Reversionary Mode controls (noted in bold font) and display features are shown in Figure 7-4.

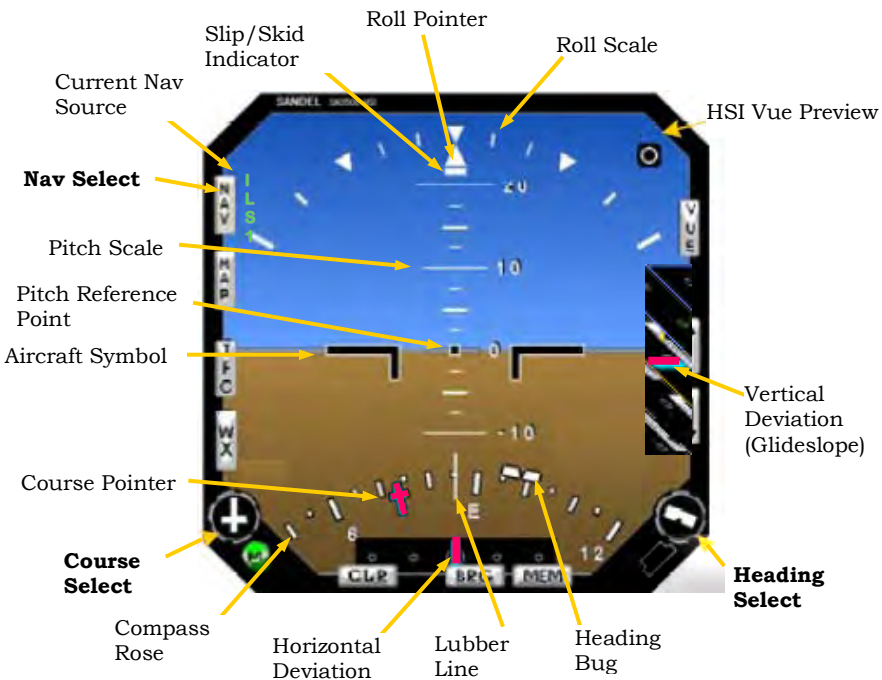








Figure 7-4. SN3500 Reversionary Mode Display

6. Power to the SN3500 system is provided via the avionics master switch (**AVI MSTR**). Power to the SN3500 is provided via the **EHSI** circuit breaker (5 Amp). Power to the SG102 and MT102 is provided via the **AHRS** circuit breaker (5 Amp) located on the left side of the lower panel.

Table 7-1. Sample Indicator Symbols and Color Descriptions

	Lubber Line – Points to the magnetic heading. It is always at the top of the display.
	Heading Bug – Identifies the desired heading and is set by the Heading Bug knob.
	Course Pointer – Identifies the desired course to a VOR NAV source and is set by the Course Pointer knob.
 BRG1  BRG2	Bearing Pointers 1 and 2 – These pointers show the bearing to a VOR. Numeric information assigned with the pointers is displayed in the lower display area. BRG1 symbol is a closed arrow head. BRG2 symbol is an open arrow head. <u>Note</u> : Bearing pointer tails are 180° from the arrow head. The tail of BRG1 is a single line and the tail of BRG2 is a double line.
	Back Course – Appears if flying a back course approach and the course pointer is set for a front course, and the course pointer is more than ±90° from the lubber line.
White	Compass rose, To/From indicator, ACK soft-key
Orange	Heading bug data
Green	Navigation receiver data
Red	Flags indicating failed glide slope or CDI data
Amber	Compass rose when AHRS has failed
Magenta	LOC1/ILS1 (CDI and VDI) indicators

7-2. Basic Operation

The following content covers basic operational procedures. Refer to the applicable SN3500 pilot's guide (para. 1-2) for additional detail regarding the SN3500 operation.

7-3. Power-Up

The SN3500 system is powered on when the avionics master switch (**AVI MSTR**) is turned ON after engine start. The system is ready when the compass card display appears.

7-4. NAV Source Selection

1. Press the **NAV** button to cycle through the available, primary NAV sources. The current NAV source selection will be annunciated next to the NAV button.

- a. If the selected NAV source is a VOR receiver tuned to a localized frequency, the annunciation will be LOC1.
- b. If a valid glide slope signal is detected, the annunciation will be ILS1.
- c. Distance, bearing, and groundspeed will be displayed in the upper display area if available.

7-5. Bearing Pointer Selection and Heading Bug Control

1. Press the **BRG** button to cycle through the available pointer selections (bearing pointer 1 only, bearing pointer 2 only, both bearing pointers 1 and 2, or disabled).

- a. The arrow head (and tail) of each bearing pointer and its associated numeric display will appear.
- b. If data for the bearing pointer is invalid, "---" is displayed in the numeric display and the associated bearing pointer is removed from the screen.

2. To select the NAV source for the bearing pointer:
 - a. Press **M** to activate menu mode.
 - b. Press **BRG** to display the BRG menu.
 - c. Rotate the left knob to select BRG1 or BRG2.
 - d. Rotate the right knob to select the desired NAV source option.
 - e. Press **M** to exit the menu.

2. Rotate the Heading Bug knob to set the desired heading bug position on the compass rose. To rapidly set the heading bug to the aircraft's current heading, press and release the Heading Bug knob.

7-6. Reversionary Mode

The Reversionary Mode (if equipped) is activated by the **ATTD IND** annunciator switch located on the instrument panel (Figure 7-5 or Figure 7-6).

1. Press the **ATTD IND** switch to activate the reversionary mode.
 - a. The **NAV** button function is the same as in HSI mode.
 - b. The **BRG** button is inactive.
 - c. The **VUE** button is inactive.

NOTE

Whenever upward pitch attitude exceeds +30° or whenever downward pitch attitude exceeds -20°, the display will de-clutter by removing all navigation information. Red chevrons will appear pointing in the direction of level pitch.

2. Press the **ATTD IND** switch again to cancel Reversionary Mode and resume the standard HSI display.

7-7. Compass Rose View

1. Press **VUE** to switch between the 360-degree full view and 70-degree arc views.

7-8. Display Brightness

To increase the display brightness, press and hold the **CLR** button to steadily increase the display brightness.

Increasing or decreasing the display brightness or button backlight brightness is also controlled through the menu as follows:

1. Press **M** to activate the menu mode.
2. Rotate the left knob until BRT (for display brightness) or BTN (for button brightness) is highlighted.
3. Turn the right knob to increase or decrease the brightness to the desired level.
3. Press **M** to exit the menu and return to normal operation.

7-9. Flags and Abnormal Conditions

Abnormal conditions or flags may be associated with a failed navigation receiver or failed AHRS and are accompanied by a failed equipment message.

1. To access the message flags:
 - a. Press and hold the **M** button until the message display appears. A list of both current and prior messages (if applicable) will display.
 - b. Press **M** to exit the message display.
 - c. Press and hold the **M** button again to show only the current messages.
 - d. Press **M** to exit the message display.

2. Refer to the SN3500 Pilot's Guide for additional information regarding flags and abnormal condition displays.

7-10. Error Messages

Error messages, which are considered critical, are annunciated on-screen permanently until acknowledged.

1. Acknowledge the message alert by pressing the flashing **ACK** soft-key.

2. Refer to the SN3500 Pilot's Guide for additional information regarding message identification and descriptions.

7-11. Inactive Functions

TFC and **WX** are inactive functions. In addition, **MAP** and **↑↓** are inactive functions for P/N 4220609-1. Inadvertent operation of the respective buttons will cause an annunciation as described below.

In each case, press the **CLR** button to cancel the annunciation.

1. **MAP**: A map symbol with a red slash through it will be annunciated next to the **MAP** button. Press the **CLR** button to cancel the function.

2. **TFC**: The message "NOT INSTALLED" will be annunciated on the display. Press the **CLR** button to cancel the function.

3. **WX**: The message "NOT INSTALLED" will be annunciated on the display. Press the **CLR** button to cancel the function.

4. **↑↓**: The range scale will be annunciated in the upper right hand side of the display. Press the **CLR** button to cancel the function.

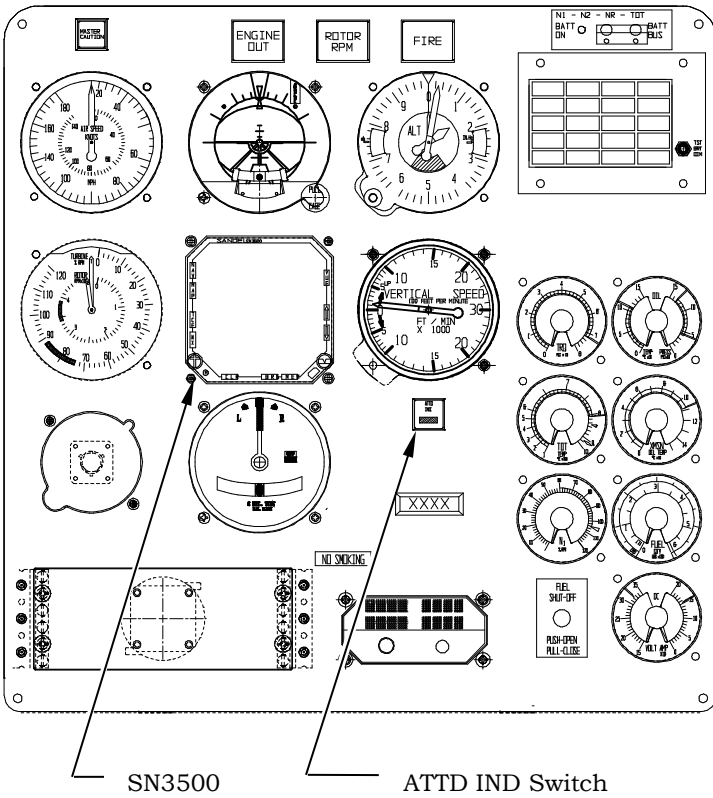


Figure 7-5. Instrument Panel Layout – P/N 4220609-1

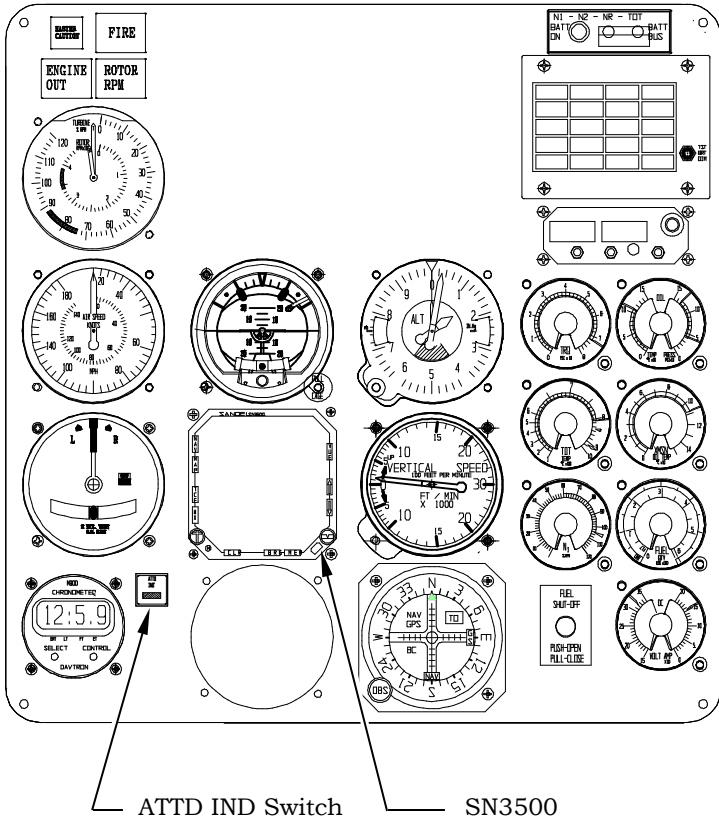


Figure 7-6. Instrument Panel Layout – P/N 4220609-5

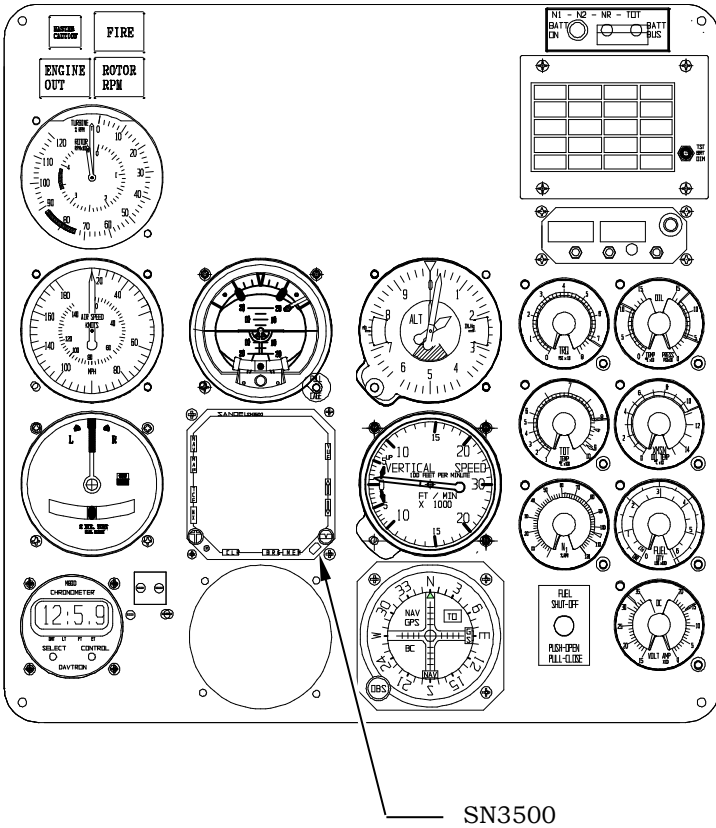


Figure 7-7. Instrument Panel Layout – P/N 4220609-7