Apollo®
Model SL30 NAV/COMM
Installation Manual

November 1999 560-0404-00
HISTORY OF REVISIONS

<table>
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<th>Revision</th>
<th>Date</th>
<th>Description</th>
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<tr>
<td></td>
<td>11/16/99</td>
<td>Initial release (EN6278).</td>
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IMPORTANT NOTE

“The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those desiring to install this article on or within a specific type or class of aircraft to determine that the aircraft operating conditions are within TSO standards. The article may be installed only if further evaluation by the applicant documents an acceptable installation and is approved by the Administrator.” Follow installation recommendations as noted in AC20-67B, *Airborne VHF Communications Equipment Installations*.

*Source: FAA TSO-C34e, TSO-C36e, TSO-C37d, TSO-C38d, TSO-C40c, TSO-C66c, and TSO-C128.*

ORDERING INFORMATION

To receive additional copies of this publication, order part # 560-0404-00, *Apollo SL30 NAV/COMM Installation Manual*.

REFERENCE PUBLICATIONS

Following are other publications referenced in this guide.

*Apollo SL30 NAV/COMM Operation Manual*, order part # 560-0403-00.
# Apollo SL30 Installation Manual

## Table of Contents

### SECTION 1 - INTRODUCTION

- **ABOUT THIS MANUAL** ................................................................. 1
- **APOLLO SL30 DESCRIPTION** ..................................................... 1
- **FEATURES** .............................................................................. 2
  - General Features ........................................................................ 2
  - Navigation Radio Features .......................................................... 2
  - Comm Radio Features .................................................................... 3
  - Physical Specifications .................................................................. 3
  - NAV Radio Performance Specifications ...................................... 3
  - Comm Radio Performance Specifications ................................... 3
- **SYSTEM INTERFACES** ................................................................. 4
  - Navigation Receiver ...................................................................... 4
  - Comm Transceiver ........................................................................ 4
  - Serial Interface ............................................................................ 4
- **REGULATORY COMPLIANCE** ....................................................... 4
- **UNPACKING THE EQUIPMENT** ..................................................... 5
- **PACKAGE CONTENTS** ................................................................. 5
- **OTHER REQUIRED MATERIALS** .................................................. 6
- **SPECIAL TOOLS REQUIRED** ...................................................... 6
- **LICENSE REQUIREMENTS** ........................................................... 7

### SECTION 2 - INSTALLATION

- **PRE-INSTALLATION INFORMATION** ............................................. 9
- **INSTALLATION OVERVIEW** ....................................................... 9
- **INSTALLATION CONSIDERATIONS** ............................................... 9
  - Mounting Considerations ............................................................. 9
  - Minimum System Configuration .................................................. 9
- **EQUIPMENT MOUNTING** ............................................................ 10
- **ELECTRICAL CONNECTIONS** .................................................... 12
  - Power ...................................................................................... 12
  - Avionics Outputs ......................................................................... 12
  - Serial Interface ............................................................................ 12
  - Speaker and Headphone Outputs ............................................... 12
  - Microphone Inputs ...................................................................... 13
  - Transmit Key Input ...................................................................... 13
  - Intercom Selector Switch ............................................................ 13
  - Remote Flip/Flop Input ............................................................... 13
- **ANTENNA INSTALLATION AND CONNECTIONS** ......................... 13
  - Comm and Nav Antennas .............................................................. 13
  - Use of Splitter and Combiner ....................................................... 14
- **EQUIPMENT INTERFACE** ........................................................... 15
- **LIMITATIONS ON USING A COMPOSITE SIGNAL** ....................... 28
- **POST INSTALLATION CHECKOUT** ............................................... 28
  - Mounting/Wiring Check ............................................................... 28
  - Setup and Checkout .................................................................... 28
  - Final System Check ..................................................................... 32
- **INSTRUCTIONS FOR CONTINUED AIRWORTHINESS** ................ 35
## Table of Contents

**SECTION 3 - SPECIFICATIONS**

- Electrical ........................................................................................................... 37
- Physical .............................................................................................................. 37
- Environmental ................................................................................................... 37
- Avionics Outputs ............................................................................................... 38
- NAV Receiver Performance .............................................................................. 39
  - VOR .................................................................................................................. 39
  - Localizer .......................................................................................................... 39
  - Glideslope ........................................................................................................ 40
  - OBS Resolver .................................................................................................. 40
  - Composite Output ............................................................................................ 40
- COMM Receiver Performance .......................................................................... 41
- COMM Transmitter Performance ...................................................................... 41
- Intercom Performance ...................................................................................... 42
- Control Inputs .................................................................................................... 42
- Antenna Requirements ...................................................................................... 42
  - COMM Antenna .............................................................................................. 42
  - NAV Antenna .................................................................................................. 42
- Serial Interface .................................................................................................. 43
- Rear Connector Pinout ....................................................................................... 43

**SECTION 4 - LIMITATIONS**

- Installation ......................................................................................................... 45
- Operational ......................................................................................................... 45

**APPENDIX A - TROUBLESHOOTING**

- Contacting the Factory for Assistance ............................................................ 47

**APPENDIX B - PERIODIC MAINTENANCE**

- VOR Checks ...................................................................................................... 49
- Equipment Calibration ....................................................................................... 49
  - Reference Oscillator (COMM Only) ................................................................. 49
- Cleaning the Front Panel .................................................................................... 49

**APPENDIX C - ENVIRONMENTAL QUALIFICATIONS**

**APPENDIX D - ACCESSORIES**

- From UPS Aviation Technologies ...................................................................... 53

**APPENDIX E - SERIAL INTERFACE SPECIFICATIONS**

- Input Commands .................................................................................................. 55
- Output Messages ................................................................................................. 55
- Data Format ......................................................................................................... 56
- Message Formats ............................................................................................... 56
- Message Definitions ........................................................................................... 57
  - Input Messages .................................................................................................. 57
  - Remote VOR List ............................................................................................. 58
  - Remote Localizer List ...................................................................................... 59
  - Request Data Output ......................................................................................... 61
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>SET ACTIVE VOR/LOC FREQUENCY AND RECEIVER FUNCTION</td>
<td>62</td>
</tr>
<tr>
<td>SET STANDBY VOR/LOC FREQUENCY AND RECEIVER FUNCTION</td>
<td>62</td>
</tr>
<tr>
<td>SET STANDBY COMM FREQUENCY</td>
<td>63</td>
</tr>
<tr>
<td>SET NAV AUDIO MODE</td>
<td>64</td>
</tr>
<tr>
<td>SET OMNI-BEARING SELECT (OBS) VALUE</td>
<td>64</td>
</tr>
<tr>
<td>DME SENSOR INPUT</td>
<td>64</td>
</tr>
<tr>
<td>OUTPUT MESSAGES</td>
<td>65</td>
</tr>
<tr>
<td>RESET STATUS</td>
<td>65</td>
</tr>
<tr>
<td>CDI, GSI, AND RELATED FLAGS</td>
<td>65</td>
</tr>
<tr>
<td>DECODED OBS SETTING</td>
<td>66</td>
</tr>
<tr>
<td>RADIAL FROM ACTIVE VOR</td>
<td>67</td>
</tr>
<tr>
<td>RADIAL FROM STANDBY VOR</td>
<td>67</td>
</tr>
<tr>
<td>DECODED STATION IDENTIFIER</td>
<td>67</td>
</tr>
<tr>
<td>COMMUNICATIONS ERROR</td>
<td>68</td>
</tr>
<tr>
<td>NAV RECEIVER STATUS</td>
<td>69</td>
</tr>
<tr>
<td>NAV AUDIO MODE</td>
<td>69</td>
</tr>
<tr>
<td>NAV MICROCONTROLLER SOFTWARE VERSION</td>
<td>69</td>
</tr>
<tr>
<td>NAV DSP SOFTWARE VERSION</td>
<td>70</td>
</tr>
<tr>
<td>COMM TRANSCEIVER STATUS</td>
<td>70</td>
</tr>
<tr>
<td>COMM SOFTWARE VERSION</td>
<td>71</td>
</tr>
</tbody>
</table>
# List of Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Package Contents</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Comm Interface Connector Pinout</td>
<td>43</td>
</tr>
<tr>
<td>3</td>
<td>Rear Panel Connector Pinout</td>
<td>44</td>
</tr>
<tr>
<td>4</td>
<td>Troubleshooting Guide</td>
<td>47</td>
</tr>
<tr>
<td>5</td>
<td>Data Output Requests</td>
<td>61</td>
</tr>
</tbody>
</table>

# List of Illustrations

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SL30 Front Panel</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Mounting Frame Assembly</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>Cable Routing</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>Rear Coax Connector Assembly</td>
<td>14</td>
</tr>
<tr>
<td>5</td>
<td>SL30 Comm Wiring Diagram</td>
<td>16</td>
</tr>
<tr>
<td>6</td>
<td>SL30 Comm Typical Audio Panel Connections</td>
<td>17</td>
</tr>
<tr>
<td>7</td>
<td>SL30 NAV Required Connections</td>
<td>18</td>
</tr>
<tr>
<td>8</td>
<td>SL30 NAV Optional Connections</td>
<td>18</td>
</tr>
<tr>
<td>9</td>
<td>SL30 NAV to Mid-Cont MD200-306/307</td>
<td>19</td>
</tr>
<tr>
<td>10</td>
<td>SL30 NAV to Mid-Cont MD200-302/303 Connections</td>
<td>20</td>
</tr>
<tr>
<td>11</td>
<td>SL30 NAV and ACU to Mid-Cont MD200-306/307</td>
<td>21</td>
</tr>
<tr>
<td>12</td>
<td>SL30 NAV to STEC IND-351A Connections</td>
<td>22</td>
</tr>
<tr>
<td>13</td>
<td>SL30 NAV to Bendix/King KN72/203/204/208/208A/209/209A Wiring</td>
<td>23</td>
</tr>
<tr>
<td>14</td>
<td>SL30 NAV to Bendix/King K1202/206/525A/KPI552 Wiring</td>
<td>24</td>
</tr>
<tr>
<td>15</td>
<td>SL30 NAV to Sandel Discrete Connections</td>
<td>25</td>
</tr>
<tr>
<td>16</td>
<td>SL30 NAV to Sandel SN3308 Converter Connections</td>
<td>26</td>
</tr>
<tr>
<td>18</td>
<td>Unit Dimensions</td>
<td>38</td>
</tr>
</tbody>
</table>
SECTION 1 - INTRODUCTION

ABOUT THIS MANUAL

This manual describes the installation of the Apollo SL30 Nav/Comm units. It is intended for use by persons certified by the Federal Aviation Administration (FAA) to install aircraft navigation devices. It includes installation and checkout procedures for the SL30 unit to standards described in FAA advisory circulars AC 20-67B (for Comm).

Section 1 Provides an introduction to the Apollo SL30 unit. TSO certification information is also included in this section.

Section 2 Includes installation and checkout procedures.

Section 3 Includes complete specifications.

Section 4 Includes limitations for the equipment and installation.

Appendix A Includes troubleshooting information.

Appendix B Includes periodic maintenance requirements.

Appendix C Includes the environmental qualification form.

Appendix D Includes information on accessories.

Appendix E Includes serial data specifications.

APOLLO SL30 DESCRIPTION

The Apollo SL30 includes a 760 channel VHF Comm transceiver and 200 channel VOR/LOC/GS navigation receiver with DME display.

The Apollo SL30 is a member of the Apollo slimline series which includes the SL10/15 Audio Selector Panels, SL40 Comm, SL50 GPS, SL60 GPS/Comm, and SL70 Transponder.
Introduction

FEATURES

GENERAL FEATURES
- 32 character high-intensity alphanumeric LED display
- Sunlight readable full alphanumeric display
- Automatic display intensity
- Back-lit buttons
- 200 channel memory (stored alphabetically)
- Remote frequency flip-flop input pin

NAVIGATION RADIO FEATURES
- 200 channel Nav with solid state DSP technology
- VOR/Localizer and Glideslope receivers
- Built-in VOR/Localizer converter
- Frequency range: VOR 108.00 – 117.95 MHz
  Localizer 108.00 – 111.95 MHz
  Glideslope 328.60 – 335.40 MHz
- Digitally decoded OBS setting
- Manual selection of back course approach
- Automatic display of station ID by decoding Morse code
- Interfaces to most CDI (w/resolver), HSI, and autopilot systems
- VOR receiver displays To or From radial of the active channel
- VOR monitor displays From radial of the standby channel
- Back course annunciator output
- LOC enable annunciator output

Figure 1 - SL30 Front Panel
• Internal RF diplexor
• Active and standby flip/flop frequencies
• DME tuning and data display

**COMM RADIO FEATURES**
• 760 communications channels
• Frequency range 118 to 136.975 MHz
• Active and standby flip/flop frequencies
• Volume control
• Tunes to National Weather Service broadcasts
• Transmit status indicator
• Frequency monitor function (listens to standby while monitoring active)
• Emergency channel menu
• Squelch test function
• Stuck Mic time-out
• 12 watt audio amplifier
• Includes two-place VOX intercom

**PHYSICAL SPECIFICATIONS**
• 1.3" (H) x 6.25" (W) x 10.5" (D)
• Weight 2.25 lbs. (unit only)
• Depth 11.452 inches (29.09 cm) behind panel, including mounting frame and connectors

**NAV RADIO PERFORMANCE SPECIFICATIONS**
• Input voltage range 10 to 40 VDC
• Operating temperature range –20°C to +55°C
• Certified TSO C34e (Glideslope receive)
• Certified TSO C36e (ILS Localizer receive)
• Certified TSO C40c (VOR receive)
• Certified TSO C66c (DME display)

**COMM RADIO PERFORMANCE SPECIFICATIONS**
• Input voltage range 10 to 40 VDC
• Operating temperature range –20°C to +55°C
• Transmit power 8 watts (Carrier Power)
• Certified TSO C37d (Comm transmitting)
• Certified TSO C38d (Comm receiving)
• Certified TSO C128 (stuck mic)
SYSTEM INTERFACES

NAVIGATION RECEIVER
The SL30 can be installed in several configurations based upon individual requirements. This includes with or without an external course deviation indicator. The CDI may be discrete, serial, or composite.

COMM TRANSCEIVER
For standalone installations, the Comm requires connections to:
- a standard Comm antenna
- a microphone (or microphones)
- a speaker or headphone
- power input

These items may be installed dedicated to the SL30 Comm, or by connection to an audio panel. The system can be configured to mix the NAV audio with the Comm audio if no external audio panel is used.

SERIAL INTERFACE
- DME – Distance Measure Equipment
- SL/GX – GPS products
- MX – Multi-Function Display

REGULATORY COMPLIANCE
The Apollo SL30 is designed and tested to meet the following TSOs:
- FAA TSO-C37d for Comm transmit
- FAA TSO-C38d for Comm receive
- FAA TSO-C128 for unintentional transmission (stuck mic)
- FAA TSO-C34e for ILS Glideslope receive
- FAA TSO-C36e for ILS Localizer receive
- FAA TSO-C40c for VOR receive
- FAA TSO-C66c for DME display

The Apollo SL30 complies with the FCC requirements specified in:
- CFR 47, Part 87, Aviation Services, Subpart D, Technical Requirements

The Apollo SL30 complies with the FCC requirements specified in:

The Apollo SL30 software is designed and tested to RTCA/DO-178B, level C.

*Note: Unauthorized changes or modifications to the SL30 may void the compliance to required regulatory agencies and authorization for continued equipment usage.*
UNPACKING THE EQUIPMENT

Carefully unpack the equipment. Visually inspect the package contents for any evidence of shipping damage. Retain all shipping containers and packaging material in case reshipment is necessary.

PACKAGE CONTENTS

As shipped from the UPS Aviation Technologies factory, the Apollo SL30 package includes most items necessary for installation other than supplies normally available at the installation shop, such as wire and cable ties, and required input and output equipment. The standard items included in the package are listed in Table 1.

<table>
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<tr>
<th>Part #</th>
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<td>Install kits</td>
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<td>162-0103* or 162-1577**</td>
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<td>162-1008</td>
<td>Right angle coax plug</td>
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<td>202-0001</td>
<td>Cable tie</td>
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<td>204-0037</td>
<td>Edge grommet</td>
<td>6&quot;</td>
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<td>204-2100</td>
<td>Shoulder bushing</td>
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<tr>
<td>221-0400</td>
<td>4-40 x 1/4 SS pan head Phillips machine screw with lock washer</td>
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<tr>
<td>224-0404</td>
<td>4-40 x 1/4 SS flat head Phillips machine screw</td>
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<td>245-0022 or 245-0027</td>
<td>Crimp contact for d-sub, 20 to 24 awg wire</td>
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<td>1</td>
</tr>
<tr>
<td>Accessories</td>
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<tr>
<td>115-0007</td>
<td>NAV signal splitter/combiner</td>
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<tr>
<td>S712-0007-012</td>
<td>Internal 3 amp slow blow fuse</td>
<td>Optional</td>
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Note: Package contents may vary depending on how the unit is ordered.

*Uses pin (crimp contact) P/N 245-0022.

**Uses pin (crimp contact) P/N 245-0027.
OTHER REQUIRED MATERIALS
The SL30 is intended for use with standard aviation accessories. External devices required for various installations are listed below. Depending upon the installation, this will include items such as:

- back course annunciator
- a CDI or HSI
- a Comm antenna
- NAV antenna
- NAV antenna splitter (if dual SL30)
- a microphone(s)
- a speaker or headphone
- audio panel

SPECIAL TOOLS REQUIRED

Crimp Tool
A crimp tool meeting MIL specification M22520/1-01 and a positioner/locater are required to ensure consistent, reliable crimp contact connections for the rear 15-pin and 37-pin connectors. These tools are available from:

For pin P/N 245-0022
Astro Tool Corp. Phone (503) 642-9853
21615 SW TV Highway Fax (503) 591-7766
Beaverton, OR 97006

Crimp tool: Astro Tool part #615708
Positioner: Astro Tool part #616356

For pin P/N 245-0027
ITT Cannon Phone (714) 261-5300
1851 E. Deere Ave. Fax (714) 575-8324
Santa Ana, CA 92705-6500

Insertion tool: ITT part # 274-7006-000 (Desc. CIET-20HD)
Regular duty Crimp tool: ITT part #995-0001-585 (Desc. M22520/1-01)
Regular duty Locator tool: ITT part #995-0001-244 (Desc. TH25)
Heavy duty Crimp tool: ITT part #995-0001-584 (Desc. M22520/2-01)
Heavy duty Locator tool: ITT part #995-0001-604 (Desc. M22520/2-08)
LICENSE REQUIREMENTS

An aircraft radio station license may be required for operation of the SL30 Comm transmitter once installed in the aircraft. An application must be submitted on FCC Form 404, Form 605 or later revised application, which may be obtained from the FCC in Washington, DC, or any of its field offices. Procedures for applications are in CFR 47, Part 87, Aviation Services, Subpart B, Applications and Licenses.
NOTES
SECTION 2 - INSTALLATION

This section describes the installation of the SL30 including mounting, wiring, and connections. A post installation check-out procedure is included at the end of this section.

PRE-INSTALLATION INFORMATION

Always follow good avionics installation practices per FAA Advisory Circulars (AC) 43.13-1B, 43.13-2A, and AC 20-67B, or later FAA approved revisions of these documents.

Follow the installation procedure in this section as it is presented for a successful installation. Read the entire section before beginning the procedure. Perform the post installation check-out before closing the work area in case problems occur.

INSTALLATION OVERVIEW

A successful installation should start with careful planning including determination of mounting location for the SL30, antenna mounting, connections to microphones, speakers, and headphones, cable routing, and other required modifications. Once the mounting location has been determined, prepare the mounting frame for installation. It may be easier to complete the wiring harness and attach the connectors to the mounting frame before installing the mounting frame.

INSTALLATION CONSIDERATIONS

MOUNTING CONSIDERATIONS

The SL30 is designed to mount in the avionics stack in the aircraft instrument panel within easy view and reach of the pilot. The standard package includes a mounting frame for ease of mounting, connections, and service of the unit. Allow an additional one-inch clearance to the rear of the mounting frame for connectors and cables.

For typical installations, the SL30 does not require external cooling. When mounting the unit, leave a clearance of 1/8 to 1/4 inch between avionics to allow for air circulation.

MINIMUM SYSTEM CONFIGURATION

VFR Installation

VFR installation need only include an SL30 with power, audio, and antenna connections. Without an external CDI, no glideslope information is obtainable. However, the unit will maintain full VOR and Localizer functionality including an internal CDI display.

IFR VOR/LOC Installation

IFR installation requires:

- SL30
- External CDI/HSI indicator that meets the following criteria:
  1. The course deviation indicator shall have an input impedance of 1 k ohm ± 10% and a deflection sensitivity of 150 mV ± 10% for full scale deflection.
  2. The valid flag shall have an input impedance of 1 k ohms ± 10%.
3. The valid flag sensitivity shall be 125 mV ± 10% for the flag to leave the stop and 260 mV ± 10% maximum for flag to be fully concealed.

4. The To/From flag shall have an input impedance of 200 ohms ± 10% and a sensitivity of ± 40 mV ± 15% at 25°C with flag fully in view.

5. The OBS resolver should be compatible with a standard 6-wire OBS interface:
   H...........Reference output high
   C...........Reference output low
   D...........S1 COS input high
   E...........S3 COS input low
   F...........S4 SIN input high
   G...........S2 SIN input low

   Any electrical zero crossing will work because the SL30 will calibrate out any errors.

Glideslope Installation
Glideslope installation requires:
- SL30
- External non-numeric glideslope indicator that meets the following criteria:
  1. The glideslope deviation shall have an input impedance of 1 k ohm ± 10% with a deflection sensitivity of 150 mV ± 10% for full scale deflection.
  2. The glideslope valid flag shall have an input impedance of 1 k ohm ± 10%.
  3. The glideslope valid flag sensitivity shall be 125 mV ± 10% for the flag to leave the stop, and 260 mV ± 10% maximum for flag to be fully concealed.

EQUIPMENT MOUNTING

Once the cable assemblies have been made, attach the 15- and 37-pin d-sub and coaxial cable connectors to the rear connector mounting plate and the mounting frame as illustrated in Figure 2 and Figure 3. Route the wiring bundle as appropriate. The rear connector plate should be attached to the mounting frame before installing the frame in the instrument panel. The rear connector plate can be used to tie down the cable assemblies. Use the supplied edge guard to protect the cable from sharp edges. Connect the shield grounds directly to the connector mounting plate.

Once the cable assemblies are complete and the connectors are attached to the mounting frame, install the mounting frame assembly in the instrument panel. Be sure to use low-profile head screws in the side of the mounting frame so the unit will slide in and out freely. Attach the front of the mounting frame to the instrument panel. Use support brackets to attach the rear of the frame to the aircraft.

To install the unit in the mounting frame, make sure the cam lock is rotated so the rear part is up, then slide the unit into the frame and tighten (clockwise) with the 3/32 hex tool. The unit will be pulled into the frame by the cam lock and the connectors will fully engage.

To remove the unit from the mounting frame, use the hex tool and turn the tool counterclockwise. The unit will be pushed out of the frame by the cam lock assembly. No special extraction tools are required.
Figure 2 - Mounting Frame Assembly

Figure 3 - Cable Routing

* The shield pigetails must be less than 1.25 inches, the shorter, the better.
ELECTRICAL CONNECTIONS
The SL30 installation kit includes 15- and 37-pin d-sub shells and crimp contacts. The crimp contacts are specified for 20 to 24 awg wire. Make the crimp connections with a crimp tool as specified on page 6. All wires should be 20 to 24 AWG unless otherwise specified. Wiring diagrams are included in this section.

POWER
The SL30 requires two power connections, one for the Nav side of the unit, the other for the Comm. Make the power connections to the unit using 20 awg wire.

The Comm power input is internally fused at 7 amps. A separate 5 amp circuit breaker or fuse should be installed for downline overload or short circuit protection.

The NAV internal fuse is 3 amps. A separate 2 amp circuit breaker or fuse should be installed for downline overload or short circuit protection.

Note: Circuits should be protected in accordance with guidelines in AC 43.13-1B, chapter 11, section 4.

AVIONICS OUTPUTS
The SL30 includes a complete avionics interface for resolvers, CDI/HSI indicators, autopilot, and back course annunciator. These outputs are to be connected as appropriate for the particular installation. The CDI/HSI outputs may be connected to a dedicated CDI or HSI or to a shared indicator using an appropriate switching relay, such as an Apollo ACU. The avionics outputs available are listed in the Avionics Outputs specification on page 38. Connect the annunciator outputs as necessary.

SERIAL INTERFACE
The SL30 includes an RS-232 serial port for making optional connections. The serial port can be used for connecting to:
- Resolvers or indicators that accept a serial data
- GX series units for Comm/NAV frequency transfers from the database
- MX20 to display VOR data on a map and database interface
- RMI/DME control box allows DME tuning, DME display, and OBI output

When making connections to the SL30, use a three conductor shielded cable. Make RxD, TxD, and signal ground connections to the 37-pin connector. Connect the shield(s) to the rear of the mounting frame on the connector plate. The shield leads must be < 1.25 inches. See Figure 3.

Complete serial interface specifications are included in Appendix E – Serial Interface Specifications.

SPEAKER AND HEADPHONE OUTPUTS
Connect the speaker and headphones to the output pins on the rear connector.
MICROPHONE INPUTS
Microphone input connections should be made using a twisted pair shielded cable. Attach the signal ground to the mic ground pin on the rear connector and connect the shield to the rear connector plate.

TRANSMIT KEY INPUT
The TxKey input on the rear connector must be pulled low to ground to enable the transmitter. This input should be connected to a microphone or yoke mounted momentary push button switch.

INTERCOM SELECTOR SWITCH
The SL30 includes a voice activated intercom function that can be enabled by an external control switch. This is an optional connection.

When making connection for the intercom selection, connect the intercom selection input to a remote mounted normally open switch (an alternate action switch can be used). Connect the other terminal of the switch to ground. The intercom function is enabled when the input is pulled low to ground.

REMOTE FLIP/FLOP INPUT
The SL30 includes a remote flip/flop input. This is an optional input that can be connected to a remote mounted (such as on the yoke) momentary push button switch which pulls the input low to ground. The remote flip/flop input will only toggle the Comm frequencies when Comm frequencies are displayed and will only toggle NAV frequencies when NAV frequencies are displayed.

ANTENNA INSTALLATION AND CONNECTIONS

COMM AND NAV ANTENNAS
The SL30 requires a standard 50Ω vertically polarized Comm antenna and a horizontally polarized NAV/VOR/Localizer/Glideslope antenna. Follow the antenna manufacturer’s installation instructions for mounting the antennas. The Comm antenna should be a standard Comm antenna that operates on Comm frequencies between 118.00 and 137.000 MHz. The NAV antenna should be a VOR/Localizer/Glideslope NAV antenna that receives VOR frequencies between 108 and 117.95 MHz, and localizer frequencies between 108 and 112 MHz and glideslope information between 328.6 and 335.4 MHz.

The NAV and Comm antennas should also be mounted as far apart as practical from the ELT antenna, preferably one on top and the other on the bottom of the aircraft fuselage. Some ELTs have exhibited re-radiation problems generating harmonics that may interfere with GPS signals. This can happen when the Comm (SL40 or any other Comm) is transmitting on certain frequencies such as 121.15 or 121.175 MHz, which may cause the ELT output circuit to oscillate from the signal coming in on the ELT antenna coax.

The antenna coax cable should be made of RG-142B or a comparable quality 50Ω coax. Assembly instructions for the rear coax connector are included in Figure 4.
The SL30 is the smallest, most advanced NAV/Comm unit on the market. Its size dictates room for only one Comm antenna input and one NAV antenna input. It incorporates an internal diplexor circuit. This means that the input VHF signal must not strip the glideslope (330 MHz) signal from the NAV (108 MHz) signal. **Do not install an external diplexor.**

**Dual Antennas**

If separate VOR and glideslope antennas are used on the aircraft, a splitter/combiner must be used.

**Dual SL30s**

If dual SL30s are installed in the aircraft, a splitter must be used.

---

**Figure 4 - Rear Coax Connector Assembly**

**USE OF SPLITTER AND COMBINER**

**Step 1.**

- Slide clamp nut over coax.
- Strip coax as illustrated.
- Cut two 1/4” slits in jacket 180 degrees apart.

**Step 2.**

- Slide braid clamp over end of coax and under the braid.

**Step 3.**

- Insert coax with braid clamp into connector and tighten clamp nut securely.
- Solder the center conductor of the coax to the contact as illustrated.
- Attach the cap and secure tightly.

Assembly instructions for right angle connector part #162-1008
**Dual Antennas and Dual SL30s**

If dual SL30s and separate VOR and glideslope antennas are installed in the aircraft, a combiner and a splitter must be used.

![Diagram of Dual Antennas and SL30s](image)

Installations should use an appropriate splitter/combiner, such as the Mini-Circuits ZFSC-2-1B BNC, available as an option under the UPS Aviation Technologies part number 115-0007. This unit has been fully environmentally qualified for use with single and dual SL30 installations.

**EQUIPMENT INTERFACE**

Figure 9 through Figure 17 illustrate typical equipment configurations. SL30 installation is not limited only to equipment shown. The installer must ensure each article interfaced to the SL30 meets the interface specification listed in this manual.
Notes: 1. Connect cable shields to the rear of the mounting frame, with pigtails < 1.25 inches.
2. Use shielded cable for the microphone connections.
3. Connect shields to ground at both ends of cables.

**Figure 5 - SL30 Comm Wiring Diagram**
Figure 6 - SL30 Comm Typical Audio Panel Connections

Notes: 1. Connect cable shields to the rear of the mounting frame with pigtails ≤ 1.25 inches.
2. Use shielded cable for the microphone connections.
3. Connect shields to chassis ground at both ends of cables.
4. The audio ground and mic ground connections may use a common point at the audio panel.
5. Other equivalent parts may be interfaced to the SL30. See appropriate installation manuals for that equipment.
Installation

NOTES: 1. Connect cable shields to the mounting frame: pigtails < 1.25 inches.
2. Connect shields chassis ground at both ends of each shielded cable.
3. Avionics power leads should use 20 awg wire. All others are specified at 22-24 awg.
4. For NAV antenna location, refer to Figure 3, Cable Routing.

Figure 7 - SL30 NAV Required Connections

NOTES: 1. Connect cable shields to the mounting frame: pigtails < 1.25 inches.
2. Connect shields chassis ground at both ends of each shielded cable.
3. This illustration shows only the 37-pin connector.

Figure 8 – SL30 NAV Optional Connections
NOTES: 1. Use shielded cable for resolver signals
2. Connect cable shields to the mounting frame: pigtails < 1.25 inches
3. Connect shields chassis ground at both ends of each shielded cable
4. Reference the ACU installation manual if installing NAV/GPS source selector

Figure 9 - SL30 NAV to Mid-Cont MD200-306/307
Figure 10 - SL30 NAV to Mid-Cont MD200-302/303 Connections

NOTES:
1. Use shielded cable for resolver signals
2. Connect cable shields to the mounting frame: pigtail < 1.25 inches
3. Connect shields chassis ground at both ends of each shielded cable
4. Reference the ACU installation manual if installing NAV/GPS source selector

* Ground for 14V lighting
**Appropriate Aircraft Bus
NOTES:
1. Use shielded cable for Resolver signals
2. Connect cable shields to the mounting frame: pigtail < 1.25 inches
3. Connect shields: chassis ground at both ends of each shielded cable
4. Reference the ACU installation manual if installing NAV/GPS source selector
5. ILS and spare annunciator relays are only available in the Mod A ACU.
6. Refer to Limitations on Using a Composite Signal paragraph in this chapter

* Ground for 14V lighting
** Appropriate Aircraft Bus
NOTES:
1. Use shielded cable for Resolver signals
2. Connect cable shields to the mounting frame: pigtails < 1.25 inches
3. Connect shields chassis ground at both ends of each shielded cable
4. Reference the ACU installation manual if installing NAV/GPS source selector

Figure 12 - SL30 NAV to STEC IND-351A Connections
**NOTES:**
1. Connect shield grounds to aircraft chassis with as short a conductor as practical.
2. Refer to Limitations on Using Composite Signal paragraph in this chapter.

**Figure 13 - SL30 NAV to Bendix/King KN72/203/204/208/208A/209/209A Wiring**

<table>
<thead>
<tr>
<th>Apollo SL30 Nav/Comm</th>
<th>Bandix/King KN 72</th>
<th>Bandix/King KN 203</th>
<th>Bandix/King KN 204</th>
<th>Bandix/King KN 208</th>
<th>Bandix/King KN 208A</th>
<th>Bandix/King KN 209</th>
<th>Bandix/King KN 209A</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSI Up</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>GSI Down</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>29</td>
</tr>
<tr>
<td>+GS Flag</td>
<td></td>
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<td>-Flag</td>
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<td>-GS Flag</td>
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<td></td>
<td></td>
<td>+Flag</td>
</tr>
<tr>
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<td>S 8 8 4 10 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ILS Energize</td>
</tr>
<tr>
<td>Composite</td>
<td>Y Y 2 6 2 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VOR/LOC Composite In</td>
</tr>
</tbody>
</table>

37-Pin Connector
NOTES: 1. Connect shield grounds to aircraft chassis with as short a conductor as practical.

Figure 14 - SL30 NAV to Bendix/King KI202/206/525A/KPI552 Wiring
NOTES:  
1. Use shielded cable for resolver signals  
2. Connect cable shields to the mounting frame: pigtails < 1.25 inches  
3. Connect shields chassis ground at both ends of each shielded cable  
4. Reference Sandel installation manual for switching NAV signals with GPS  
5. BC annunciator may be implemented in future software revisions of the SN3308. Refer to Sandel installation manual.

Figure 15 - SL30 NAV to Sandel Discrete Connections
NOTES: 1. Use shielded cable for resolver signals
2. Connect cable shields to the mounting frame: pigtails < 1.25 inches
3. Connect shields chassis ground at both ends of each shielded cable
4. Refer to Limitations on Using a Composite Signal paragraph in this chapter

Figure 16 - SL30 NAV to Sandel SN3308 Converter Connections
NOTES: 1. Connect shield grounds to aircraft chassis with as short a conductor as practical.

Figure 17 - SL30 to Collins 331A-6P, 331A-9G and Sperry RD 550A, RD650 Wiring
LIMITATIONS ON USING A COMPOSITE SIGNAL

If an external converter is driven from the composite output in conjunction with a full function CDI/HSI with resolver, the indicator head type, when selected from the Setup Mode during the post installation checkout, should be RESOLVER. In this installation, the composite output will be disabled whenever the VOR monitor mode is active or back course localizer mode is enabled. This will cause the external converter to flag. If the CONVERTER option is selected from the Setup Mode as the indicator head type, neither of these two options is available to the pilot and the composite output should always be valid. The CONVERTER setup option should be used if an external converter is the only indicator interfaced to the SL30.

POST INSTALLATION CHECKOUT

Once the unit is installed, complete the checkout procedure to verify proper operation. Refer to the User’s Guide for operating instructions.

The steps that are not applicable to a particular installation may be skipped. A checkout log sheet is included on page 34 to fill out during the checkout procedure. Make a photocopy of the log sheet for ease of use if desired.

MOUNTING / WIRING CHECK

Verify that all cables are properly secured and shields are connected to the rear of the mounting frame. Check the movement of the aircraft controls to verify that there is no interference.

SETUP AND CHECKOUT

The SL30 has a built-in I/O test mode to simplify system setup and checkout. To operate the SL30 in the Setup Mode, hold down the \( \text{SEL} \) and SYS buttons while switching on the power. You must continue to hold the buttons in until a complete power up is done and SELECT CDI is displayed. To return to normal operation, switch the power off, and then back on.

In the Setup Mode, turn the large knob to view each function. In general, press the SEL button to activate selection, turn the small knob to view each option, and then press ENT to save the displayed value. Pressing SEL again will exit the option without saving any changes.

NAV Setup and Checkout

Indicator Head Type

Set up the SL30 for the indicator head type that it is connected to by using the Setup Mode as follows.

1. Rotate the large knob to the SELECT INDICATOR HEAD TYPE display.
2. Press SEL. The type will flash.
3. Turn the small knob to select desired option: NONE, RESOLVER, CONVERTER, or SERIAL. Selecting the RESOLVER option requires calibration, which is available by turning the large knob CW to the next display. The options are defined as follows:
• **NONE**: No external resolver is supported. OBS mode allows the user to edit the OBS with concentric knobs.

• **RESOLVER**: Auto-decodes resolver setting via six-wire resolver interface. Uses internal DSP to compute course information.

• **CONVERTER**: Disables all internal OBS functions. Disables VOR monitor and BC selection. It allows use of conventional external converter via the composite output pin.

• **SERIAL**: Displays OBS and broadcasts NAV and GS data at 10 Hz rate for use with serial CDI conforming to UPS Aviation Technologies SL30 serial data specification only. See Appendix E – Serial Interface Specifications.

  **Note**: No serial test messages are sent in the Setup Mode while testing CDI and GSI flags.

4. Press ENT to accept and save the selected option.

### Calibrating the Resolver Indicator Head Type

After selecting **RESOLVER** as the indicator head, it is necessary to calibrate the interface between the SL30 and the resolver.

1. After selecting **RESOLVER** as the indicator head type, turn the large knob to the **PRESS SEL TO CALIBRATE RESOLVER** display.

2. Press SEL.

3. Follow the directions on the SL30 display.

  **Note**: The accuracy of the system is dependent on this calibration. Do not rush this step.

4. At the end of the setup, press ENT to store the results.

5. Cycle the power switch (enter the normal mode).

6. Tune a VOR station (any VOR frequency).

7. Press OBS button.

8. Verify that the OBS decodes properly from 0 to 360 degrees.

### Control Test

In the Setup Mode, turn the large knob to reach the **CONTROL TEST** page. This function tests the operation of the front panel controls on the SL30.

1. Press each button. The function name for each control will appear on the display after the button is pressed.

2. Turn the small knob. The numeric values on the right side of the display will change.

### Display Test

In the Setup Mode, turn the large knob to reach the **PRESS SEL TO TEST DISPLAY** page.

1. Press SEL.

2. A series of display tests will be performed to test each LED. Observe the display for any missing LEDs.

3. When the test is completed, the display will return to normal mode.
Installation

Flags Test
The Flags test in Setup Mode sends an active signal for each selected flag so you can test the interface to the connected devices directly from the front panel while you are on the ground. The Flag tests include LOC (Localizer), BC (Back Course), FR (From), TO (TO), NAV (NAV), and GS (Glideslope). When a selection is in large text, an active signal is sent from the SL30.

1. In the Setup Mode, turn the large knob to the Flags Test page.
2. Press SEL. The Localizer (LOC) selection will flash.
3. Turn the small knob to change the selection to large text. Check the attached indicator for the appropriate flag. Turn the small knob one click in either direction to change the selection back to small text.
4. Turn the large knob to the next flag type and turn the small knob to change it to large text.
   You can only select FR or TO as active, not both at the same time.
5. Ensure the flags are reset to all small text when you are finished testing.

CDI Test
This function tests for CDI function and allows for calibration between the SL30 and the attached CDI.

1. In the Setup Mode, turn the large knob to reach the CDI Test page.
2. Press SEL to activate selection. The value will flash.
3. Rotate the small knob to change the value. The values "0-6" may be used to center the CDI needle.
4. Turn the small knob left or right to center the needle.
5. Press ENT when the needle is centered.
6. Turning the small knob left or right past a value of "6" will test the deflection of the CDI needle.

GSI Test
This function tests for GSI function and allows for calibration between the SL30 and the attached GSI.

1. In the Setup Mode, turn the large knob to reach the GSI Test page.
2. Press SEL to activate selection. The value will flash.
3. Rotate the small knob to change the value. The values "0-6" may be used to center the GSI needle.
4. Turn the small knob left or right to center the needle.
5. Press ENT when the needle is centered.
6. Turning the small knob left or right past a value of "6" will test the deflection of the GSI needle.
VHF NAV Checkout

On the Ground
Check the VOR reception with ground equipment, operating VOT or VOR, and verify audio and Morse code ID functions (if possible). Tune a Localizer frequency and verify the CDI needle and NAV flag, and GSI needle GS flag.

Comm Setup and Checkout

Com RF Squelch
This valued is used by the Comm function to control its squelch level. It is usually not necessary to adjust this value from its factory setting.
1. In the Setup Mode, turn the large knob to reach the COM RF SQUELCH page.
2. Press SEL to activate selection. The value will flash.
3. Rotate the small knob to change the level number. The range of the number is 25 to 100.
   \textit{Note: The larger the number the stronger the signal must be in order for the radio to break squelch. The factory default value is 56.}
4. Press ENT to save the value and exit the Setup Mode.

Microphone 1 and 2 Gain
Set the microphone gain for microphones 1 and 2 for values from 0 to 255.
1. In the Setup Mode, rotate the large knob to select MICROPHONE 1 (or 2) GAIN.
2. Press SEL to activate selection. The Mic 1 value will flash.
3. Turn the small knob to change the value.
4. Turn the large knob to the Mic 2 value. Turn the small knob to change the value.
5. Press ENT to accept and save the settings.
\textit{Note: A value of 128 will work well for most headset units.}

Enable weather frequencies
This function determines whether the weather frequencies in common use in North America are displayed, or not.
1. In the Setup Mode, rotate the large knob to select ENABLE WEATHER FREQUENCIES.
2. Press SEL to activate selection. The Yes or No value will flash.
3. Turn the small knob to change the value.
4. Press ENT to accept and save the settings.

VHF Comm Checkout

Receiver / Transmitter Operation
Tune the unit to a local frequency and verify the receiver output produces a clear and understandable audio output. Verify the transmitter functions properly by contacting another station and getting a report of reliable communications. Check the remote flip/flop.
Antenna Check
The antenna $V_{swr}$ can be checked using an inline wattmeter in the antenna coax using frequencies near both ends of the band. The $V_{swr}$ should be < 2:1, and is not to exceed 3:1. A $V_{swr}$ of 2:1 will cause a drop in output power of approximately 12%, and 3:1 causes approximately a 26% drop.

Sidetone Level Adjustment
The sidetone volume was preset at the factory to a typical audio level. The level can be adjusted using one of the built-in system functions. To adjust the sidetone level:
1. Press SYS, rotate the large knob to the COM RADIO INFO: page, and press ENT.
2. Rotate the large knob to the SIDETONE LEVEL: page.
3. Rotate the small knob to adjust the sidetone level. The sidetone level is displayed in a range of 1 to 100, and variable. The sidetone level can be adjusted during transmit.

Transmit Mic Selection
The Transmit Microphone page controls which microphone is permitted to transmit. Choose Mic 1, 2, or both. To select the Transmit Mic control:
1. Press the SYS button and rotate the large knob to TRANSMIT Mic page.
2. Rotate the small knob to select MIC1, MIC2, or MIC1+MIC2.
3. Select an appropriate frequency, key the transmitter, and talk into the microphones to check for the intended operation.

FINAL SYSTEM CHECK
The SL30 functions should be complete at this time. The final check includes verifying VOR and ILS operation. Start with the unit turned on and operating in the normal mode. Refer to the user’s manual for operating instructions.

RS-232 Serial Interface Checks
The interfaces to other equipment, such as the GX series GPS, should be checked as follows:
1. Operate the SL30 and GX unit in normal mode.
2. Press the Direct To button on the GPS unit and select an airport. Press ENT.
3. Operate the SL30 in Comm mode. Press SEL.
4. Verify that the remote frequencies of the airport selected via the GPS unit are displayed on the SL30.

The interface to a DME receiver should be checked as follows:
1. Operate the SL30 in NAV mode and ensure the DME is operating with a valid signal.
2. Press the SEL button to bring up the NAV frequency recall lists.
3. Turn the large knob one click to the left (counterclockwise) to show the DME display prompt.
4. Press ENT to replace the current NAV display with DME data. Verify that DME data is passed to the SL30.

To check the serial data output connections, verify the data from the SL30 can be displayed on the other units, such as the MX series multi-function display. For serial interface checks to a serial CDI consult the CDI installation checkout procedures.
Comm Flight Test Check
A flight test is recommended as a final installation verification. The performance may be verified by contacting a ground station at a range of at least 50nm while maintaining an appropriate altitude and over all normal flight attitudes. Performance should be checked using low, high, and mid band frequencies.

Check the VOR
1. Tune a local VOR station within 50 miles.
2. Verify the audio ident/voice quality.
3. Verify the Morse code decoder IDs the station (95% probability).
4. Fly to and from the station.
5. Verify NAV flag, TO/FR flag, and CDI are operational.
6. Record accuracy in System Log (see manual).

Check the ILS
1. Tune an ILS at the local airport.
2. Verify the audio ident/voice quality.
3. Verify the Morse code decoder IDs the station (95% probability).
4. Fly the approach.
5. Verify NAV flag, GS flag, and CDI and GSI are operational.
### APOLLO SL30 POST-INSTALLATION CHECKOUT LOG

**Date:** ___/___/___  
**By:** ______________

### CONFIGURATION INFORMATION:

- **SL30 NAV/COMM:** 430-6040-3   
- **Mod:** ___   
- **Serial #:** ____________

### TEST MODE CHECKOUT AND SETUP:

**Avionics Outputs:**

- [ ] Resolver   
- [ ] Converter   
- [ ] Serial   
- [ ] None   
- [ ] Calibration (if Resolver)   
- [ ] Control Test   
- [ ] Display Test   
- [ ] NAV Valid flag   
- [ ] GS Valid flag   
- [ ] TO/FROM flag (OFF, TO, FROM)   
- [ ] External annunciator (BC)   
- [ ] CDI (left, mid, right)   
- [ ] GS (up, mid, down)   
- [ ] Enable Weather Freq Yes ___  No___

### VHF NAV CHECKOUT:

- VOR reception with ground equipment   
- [ ] Audio and Morse code ID functions   
- [ ] Verify CDI NAV and GSI GS flags

### VHF COMM CHECKOUT:

- [ ] Receiver / Transmitter operation   
- [ ] Sidetone level set / checked   
- [ ] Antenna check   
- [ ] Transmit Mic selection   
- [ ] Remote flip/flop input

### FINAL SYSTEM CHECK:

- [ ] RS-232 inputs/outputs checked (Optional)   
- [ ] Comm Operation   
- [ ] VOR Check   
- [ ] Station ID   
- [ ] TO/FR   
- [ ] Left/Right (CDI)   
- [ ] Valid Flag (NAV)   
- [ ] Valid Flags (NAV/GS)   
- [ ] Radial (To/From)   
- [ ] Left/Right (CDI)   
- [ ] Station ID   
- [ ] Bearing Error   
- [ ] Up/Down (GSI)   
- [ ] Remote Flip/Flop input   
- [ ] BC Function (Annunciator)

### COMMENTS:
INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

Modification of an aircraft for the installation of the SL30 obligates the aircraft operator to include the maintenance information provided by this section in the operator’s Aircraft Maintenance Manual and the operator’s Aircraft Scheduled Maintenance Program.

1. Maintenance manual information (system description, operation, location, removal, testing, etc.) is contained within this document and any information should be copied to, and/or included with, the operator’s airplane Maintenance Manual.

2. Line Replaceable Unit (LRU) part numbers and other necessary part numbers contained in the installation data package should be placed into the aircraft operator’s airplane Illustrated Parts Catalog (IPC).

3. The specific wiring diagram information, along with the supplemental information described in the Installation Manual, pertaining to the installation of this unit, should be placed into the aircraft operator’s airplane Wiring Diagram Manuals.

4. Scheduled Maintenance Program tasks to be added to the operator’s maintenance program are found in Appendix B – Periodic Maintenance, of this installation manual.
SECTION 3 - SPECIFICATIONS

This section includes detailed electrical, physical, environmental and performance specifications for the Apollo SL30.

ELECTRICAL

Input voltage............................................. 10 VDC to 40 VDC, reverse polarity protected

Input current (VHF navigation input) ........ 325 mA typical, 500 mA max at 13.75 VDC
170 mA typical, 350 mA max at 27.5 VDC

Input current (Comm input) ...................... 270 mA typical, 2 A max at 13.75 VDC, receive
130 mA typical, 900 mA max at 27.5 VDC, receive
2.1 A typical, 3.2 A max at 13.75 VDC, transmit
1.0 A typical, 1.4 A max at 27.5 VDC, transmit
**Note:** receive max at full receive audio, transmit max at 90% modulation at 1000 Hz.

Input power (Comm input) ...................... 3.7 watts typical, receive
28 watts typical, transmit

Internal fuses ........................................... Nav input: 3 amp fast blow, socketed on board
Comm input: 7 amp fast blow, soldered in board

Memory backup ........................................... Internal flash memory

PHYSICAL

Height.................................................... 1.30 inches (3.30 cm)
Width..................................................... 6.25 inches (15.88 cm)
Depth..................................................... 11.452 inches (29.09 cm) behind panel, including
mounting frame and connectors

Weight (without mounting frame) ............ 2.25 lb. (1.02 kg)

ENVIRONMENTAL

The Apollo SL30 is designed and tested to meet appropriate categories of RTCA/DO-160C and RTCA/DO-160D. The Environmental Qualification Form is included in Appendix C.

Operating temperature ......................... -20°C to +55°C
Storage temperature .............................. -55°C to +85°C
Temperature variation .......................... 2°C per minute
Humidity .............................................. 95% at 65°C for 48 hours
Maximum altitude .................................. 25,000 feet
Cooling .................................................. Not required
Specifications

Figure 18 - Unit Dimensions

AVIONICS OUTPUTS

CDI L/R deviation...........................................±150 mV full scale, will drive up to 200-ohm load
TO/OFF/FROM flag ...........................................±250 mV, TO/FROM indication, will drive up to 200-ohm load
Nav valid flag..................................................+300 mV for valid indication, will drive up to 200-ohm load
Nav superflag..................................................Vin - 2 volts minimum for valid, source capability of 400 mA
GSI U/D deviation ...........................................±150 mV full scale, will drive up to 200-ohm load
GS valid flag ...................................................+300 mV for valid indication, will drive up to 200-ohm load
GS superflag ...................................................Vin - 2 volts minimum for valid, source capability of 400 mA
Annunciators...................................................Open collector outputs capable of sinking up to 400 mA for turning on annunciator lamps
  • BC
  • Localizer
Power Control ................................................Open collector output capable of sinking up to 50 mA. Active when unit is powered up.
Specifications

NAV RECEIVER PERFORMANCE

VOR
TSO compliance .................................... TSO-C40c (DO-196)
Applicable documents ............................ RTCA DO-196
Operational class ................................. N/A
Accuracy category ............................... B {-46°C to + 55°C }
Frequency range ................................. 108.00 to 117.95 MHz in 50 kHz increments
Frequency tolerance ............................. 0.0008%
Cross modulation products ................... At least 60 dB down
Receiver sensitivity ............................. 108 MHz –115 dBm typical
117 MHz –117 dBm typical
Course accuracy ................................. RTCA DO-196 two sigma limit: 3°
SL30 performance: less than 0.5° typical
Audio output ...................................... With a 1 kHz tone 30% modulation at least 100 mW
output into 500 ohm loads
Ident/voice ...................................... With 100 mV input, 30% modulation at 1020 Hz,
the ident/voice tone ratio shall not be less than 15 dB
Audio response ................................. Less than 6 dB variation from 350 Hz to 2500 Hz

LOCALIZER
TSO compliance .................................... TSO-C36e (DO-195)
Applicable documents ............................ RTCA DO-195
Operational class .................................. A {manual landing systems}
Accuracy category ............................... B {-46°C to + 55°C }
Frequency range ................................. 108.00 to 111.95 MHz
Frequency tolerance ............................. 0.0008%
Cross modulation products ................... At least 60 dB down
Receiver sensitivity ............................. -110 dBm typical
Centering error ................................. RTCA DO-195 two sigma limit: 6.6% of full scale
SL30 performance: less than 1.0% typical
Audio output ...................................... With a 1 kHz tone 30% modulation at least 100 mW
output into 500 ohm loads
Ident/voice ...................................... With 100 mV input, 30% modulation at 1020 Hz,
the ident/voice tone ratio shall not be less than 15 dB
Audio response ................................. Less than 6 dB variation from 350 Hz to 2500 Hz
GLIDESLOPE
TSO compliance................................. TSO-C34e (DO-192)
Applicable documents .................. RTCA DO-192
Operational class .............................. N/A
Accuracy category ......................... B {-46°C to + 55°C }
Frequency range ..............................329.150 to 335.00 MHz
Frequency tolerance ....................... 0.0008%
Cross modulation products............... At least 60 dB down
Receiver sensitivity ...................... -95 dBm typical
Centering error .............................. RTCA DO-195 two sigma limit: 6.7% of full scale
SL30 performance: less than 2.0% typical

OBS RESOLVER
TSO compliance................................. TSO-C40c (DO-196)
Applicable documents .................. RTCA DO-196
Operational class .............................. N/A
Accuracy category ......................... B {-46°C to + 55°C }
Output signal frequency ................. 300 Hz ± 2 Hz
Output voltage (automatically adjusted during calibration) .......... 5 Vpp to 10 Vpp
Input voltage max (calibrated) .......... 5 Vpp average
Resolver return loss range ............. 50 – 100%
Output loading at max voltage .......... 100 ohms impedance
Resolution ...................................... 0.25° rounded to 1° steps

COMPOSITE OUTPUT

VOR Mode
Band pass frequency ...................... 0 Hz to 15 kHz
Variation over frequency range ........ Less than 2 dB
Output signal voltage ..................... 0.630 V_{RMS} (0.410 V_{RMS} @ 30 Hz, 0.480 V_{RMS} @ 9,960 Hz)
Output loading .............................. 1,000 ohms (max)

LOC Mode
Band pass frequency ...................... 0 Hz to 15 kHz
Variation over frequency range ........ Less than 2 dB
Specifications

Output signal voltage.............................. $0.390\, V_{\text{RMS}}$ ($0.275\, V_{\text{RMS}} @ 90\, \text{Hz}, 0.275\, V_{\text{RMS}} @ 150\, \text{Hz}$)

Output loading....................................... 1,000 ohms (max)

ILS energize signal................................. Sinks up to 400 mA (max)

COMM RECEIVER PERFORMANCE

Class.................................................. D

Frequency range.................................... 118.000 to 136.975 MHz, 760 channels

Sensitivity......................................... $1\, \mu\text{V} (2\, \mu\text{V hard})$ for $6\, \text{dB S+N/N}$ with $30\%$ modulation at 1000 Hz

Selectivity......................................... $< 6\, \text{dB variation at } \pm 7\, \text{kHz}, > 60\, \text{dB at } \pm 22\, \text{kHz}$

Speaker audio output level....................... 12 watts into 4 Ω, 8 watts into 8 Ω

Headphone audio output level.................... 280 mW into 100 Ω, 120 mW into 500 Ω

Distortion......................................... $< 5\%$ at rated output at 1000 Hz

AGC characteristics.............................. $< 3\, \text{db variation in audio output from } 5\, \mu\text{V to } 100\, \text{mV input, } 15\%$ to $90\%$ modulation

Squelch control.................................... Automatic squelch with manual override

COMM TRANSMITTER PERFORMANCE

Class.................................................. 4

Output power ...................................... 8 watts minimum carrier at $>12\, \text{VDC input}$, 6 watts minimum at 10 VDC input (transmit is locked out below 9 volts input)

Frequency range.................................. 118.000 to 136.975 MHz, 760 channels

Frequency tolerance.............................. $\pm 15\, \text{ppm from } -20^\circ\text{C to } +70^\circ\text{C}$

Microphone input.................................. Two inputs, standard carbon or dynamic mic with integrated preamp providing minimum $70\, \text{mv rms into } 1000\, \Omega$ load

Modulation capability............................ $85\%$ with $100\, \text{mv}$ to $1000\, \text{mv rms microphone input}$ at 1000 Hz

Audio frequency distortion...................... $< 10\%$ at $85\%$ modulation at 350 to 2500 Hz

Audio frequency response......................... $< 4\, \text{dB variation with } 350$ to $2500\, \text{Hz, } 85\%$ modulation

Carrier noise level............................... $> 35\, \text{dB down}$

Sidetone output .................................. up to 280 mW into 100 Ω, 120 mW into 500 Ω
Specifications

Duty cycle .......................................................... 100%
Stuck mic time-out .............................................. 35-second time-out, reverts to receive

**INTERCOM PERFORMANCE**

Microphone input ...................................... Two inputs, standard carbon or dynamic mic with integrated preamp providing minimum 70 mv rms into 1000 Ω load
Headphone audio output level .................. 280 mW into 100 Ω, 120 mW into 500 Ω
AGC characteristics ....................................... output varies < 3 dB with input of 100 mv rms to 1000 mv rms

**CONTROL INPUTS**

Transmit key ................................................ Input pulled low to ground to enable the transmitter
Intercom select ............................................... Input pulled low to ground to enable the intercom function
Flip/Flop ............................................................. Remote Comm flip/flop input, connect to a momentary button to ground for remote flip/flop operation.

**ANTENNA REQUIREMENTS**

**COMM ANTENNA**
The Apollo SL30 requires a VHF Comm antenna meeting the following specifications:

- Standard 50 Ω vertically polarized antenna with a VSWR < 2.5:1.

**NAV ANTENNA**
The Apollo SL30 requires a VHF NAV antenna meeting the following specifications:

- Standard 50 Ω horizontally polarized antenna with a VSWR < 3:1
- Capable of receiving VOR/LOC/GS (Recommend Comant Industries P/N CI 157P)
- 108.00 – 117.95 MHz (VOR/LOC)
- 328.60 – 335.4 MHz (GS)

**Note:** Multiple NAV antennas may be used with an RF signal splitter/combiner, part number 115-0007, at the radio. Refer to page 14.
**SERIAL INTERFACE**

RS-232 .................................................... Defined in Appendix E - Serial Interface Specifications

**REAR CONNECTOR PINOUT**

The SL30 includes two rear panel connectors, a 15-pin for the Comm interface connections and a 37-pin for the rear panel connections. The pinout for the connectors is listed in the following tables.

<table>
<thead>
<tr>
<th>Pin #</th>
<th>I/O</th>
<th>Connection</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I</td>
<td>Power +</td>
<td>Main DC power input</td>
</tr>
<tr>
<td>2</td>
<td>I</td>
<td>Reserved</td>
<td>Do not connect</td>
</tr>
<tr>
<td>3</td>
<td>O</td>
<td>Reserved</td>
<td>Do not connect</td>
</tr>
<tr>
<td>4</td>
<td>I</td>
<td>TxKey</td>
<td>Transmit enable key, pulled low to transmit</td>
</tr>
<tr>
<td>5</td>
<td>--</td>
<td>NC</td>
<td>Do not connect</td>
</tr>
<tr>
<td>6</td>
<td>O</td>
<td>Speaker</td>
<td>Speaker terminal output</td>
</tr>
<tr>
<td>7</td>
<td>I</td>
<td>Mic ground</td>
<td>Microphone input ground connection</td>
</tr>
<tr>
<td>8</td>
<td>I</td>
<td>Mic 1</td>
<td>Microphone input #1</td>
</tr>
<tr>
<td>9</td>
<td>I</td>
<td>Power ground</td>
<td>Main power ground input</td>
</tr>
<tr>
<td>10</td>
<td>I</td>
<td>Reserved</td>
<td>Do not connect</td>
</tr>
<tr>
<td>11</td>
<td>O</td>
<td>Reserved</td>
<td>Do not connect</td>
</tr>
<tr>
<td>12</td>
<td>I</td>
<td>Intercom select</td>
<td>Intercom function select, pulled low to turn on the intercom function</td>
</tr>
<tr>
<td>13</td>
<td>O</td>
<td>Audio ground</td>
<td>Speaker and headphone ground connection</td>
</tr>
<tr>
<td>14</td>
<td>O</td>
<td>Headphone</td>
<td>Headphone terminal output</td>
</tr>
<tr>
<td>15</td>
<td>I</td>
<td>Mic 2</td>
<td>Microphone input #2</td>
</tr>
</tbody>
</table>

Viewed from rear of unit
Table 3 - Rear Panel Connector Pinout

<table>
<thead>
<tr>
<th>Pin #</th>
<th>I/O</th>
<th>Connection</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I</td>
<td>Power +</td>
<td>Main DC power input</td>
</tr>
<tr>
<td>2</td>
<td>I</td>
<td>Power ground</td>
<td>Main power ground input</td>
</tr>
<tr>
<td>3</td>
<td>O</td>
<td>Serial ground</td>
<td>RS-232 signal ground</td>
</tr>
<tr>
<td>4</td>
<td>I</td>
<td>RxD1</td>
<td>RS-232 channel 1 serial data input</td>
</tr>
<tr>
<td>5</td>
<td>O</td>
<td>TxD1</td>
<td>RS-232 channel 1 serial data output</td>
</tr>
<tr>
<td>6</td>
<td>I</td>
<td>Test Input</td>
<td>Reserved for manufacturers test</td>
</tr>
<tr>
<td>7</td>
<td>I</td>
<td>OBS_D {S1}</td>
<td>Resolver input pin from Channel D (COS)</td>
</tr>
<tr>
<td>8</td>
<td>I</td>
<td>Flip/Flop</td>
<td>Remote NAV/Comm frequency flip/flop input</td>
</tr>
<tr>
<td>9</td>
<td>O</td>
<td>GSI superflag</td>
<td>GSI high level valid flag output</td>
</tr>
<tr>
<td>10</td>
<td>O</td>
<td>Nav + valid</td>
<td>Nav low level valid flag output</td>
</tr>
<tr>
<td>11</td>
<td>O</td>
<td>+ FROM</td>
<td>+ From flag output</td>
</tr>
<tr>
<td>12</td>
<td>O</td>
<td>+ TO</td>
<td>+ To flag output</td>
</tr>
<tr>
<td>13</td>
<td>O</td>
<td>CDI + Right</td>
<td>CDI + Right output</td>
</tr>
<tr>
<td>14</td>
<td>O</td>
<td>CDI + Left</td>
<td>CDI + Left output</td>
</tr>
<tr>
<td>15</td>
<td>O</td>
<td>Back course</td>
<td>Active low output when reverse sensing is engaged</td>
</tr>
<tr>
<td>16</td>
<td>O</td>
<td>OBS_F {S4}</td>
<td>Resolver input pin from Channel F (SIN)</td>
</tr>
<tr>
<td>17</td>
<td>--</td>
<td>Reserved</td>
<td>Do not connect</td>
</tr>
<tr>
<td>18</td>
<td>--</td>
<td>Reserved</td>
<td>Do not connect</td>
</tr>
<tr>
<td>19</td>
<td>O</td>
<td>Composite Output</td>
<td>VOR/LOC composite signal</td>
</tr>
<tr>
<td>20</td>
<td>O</td>
<td>Audio ground</td>
<td>Audio signal ground pin</td>
</tr>
<tr>
<td>21</td>
<td>O</td>
<td>Reserved</td>
<td>Do not connect</td>
</tr>
<tr>
<td>22</td>
<td>O</td>
<td>Reserved</td>
<td>Do not connect</td>
</tr>
<tr>
<td>23</td>
<td>O</td>
<td>NAV Audio Output</td>
<td>Low level audio output</td>
</tr>
<tr>
<td>24</td>
<td>O</td>
<td>OBS_H {R HI}</td>
<td>Resolver output pin to channel H</td>
</tr>
<tr>
<td>25</td>
<td>O</td>
<td>OBS_C {R LO}</td>
<td>Resolver return signals C</td>
</tr>
<tr>
<td>26</td>
<td>I</td>
<td>OBS_E {S3}</td>
<td>Resolver return signals E</td>
</tr>
<tr>
<td>27</td>
<td>O</td>
<td>Nav superflag</td>
<td>Nav high level superflag output</td>
</tr>
<tr>
<td>28</td>
<td>O</td>
<td>GSI + valid</td>
<td>GSI low level valid flag output</td>
</tr>
<tr>
<td>29</td>
<td>O</td>
<td>NAV - valid</td>
<td>Signal ground for NAV valid flag</td>
</tr>
<tr>
<td>30</td>
<td>O</td>
<td>GSI + Up</td>
<td>GSI +Up output</td>
</tr>
<tr>
<td>31</td>
<td>O</td>
<td>GSI + Down</td>
<td>GSI +Down output</td>
</tr>
<tr>
<td>32</td>
<td>O</td>
<td>GSI - Valid</td>
<td>Signal ground for GS valid flag</td>
</tr>
<tr>
<td>33</td>
<td>O</td>
<td>ILS energize</td>
<td>Active low output when a localizer frequency is tuned</td>
</tr>
<tr>
<td>34</td>
<td>O</td>
<td>OBS_G {S2}</td>
<td>Resolver return signals G</td>
</tr>
<tr>
<td>35</td>
<td>--</td>
<td>Reserved</td>
<td>Do not connect</td>
</tr>
<tr>
<td>36</td>
<td>O</td>
<td>Power control</td>
<td>Power control output sinks up to 50 mA when unit is on</td>
</tr>
<tr>
<td>37</td>
<td>O</td>
<td>Ground (comp)</td>
<td>VOR/LOC composite ground return</td>
</tr>
</tbody>
</table>

Viewed from rear of unit
SECTION 4 - LIMITATIONS

INSTALLATION

For minimum equipment and connections required for VFR or IFR installations, refer to the Minimum System Configuration section on page 9.

Installations of the SL30 Nav/Comm functions are to be made in accordance with AC 20-67B, TSO-C37d, TSO-C38d, TSO-C128, TSO-C34e, TSO-C36e, TSO-C40c, TSO-C66c, FAR Part 21-Subpart O, FAR Part 21-Subpart K, or other appropriate FAA approved guidelines.

OPERATIONAL

An aircraft radio station license may be required with the SL30 for transmitting.

Note: It is recommended that aircraft be equipped with at least two NAV receivers and two Comm transceivers for IFR use. If this practice is followed, the loss of NAV function, Comm function or both will not result in the loss of either of the NAV or Comm functions at the aircraft level. This will support a System Safety Assessment of minor for IFR operations. Refer to AC 23.1309-1C.
APPENDIX A - TROUBLESHOOTING

This appendix provides information to assist troubleshooting if problems occur after completing the installation. Use Table 4 to assist in troubleshooting.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>The SL30 does not power on.</td>
<td>The unit is not getting power.</td>
<td>Check power connections, breakers, and main avionics switch.</td>
</tr>
<tr>
<td>No NAV audio</td>
<td>Output disabled or set to a low level.</td>
<td>Check System page; NAV Options; NAV Audio Level.</td>
</tr>
<tr>
<td>NAV audio in Comm</td>
<td>Mixed with Comm feature.</td>
<td>Check System page; NAV Options; Mix NAV Audio With Com.</td>
</tr>
<tr>
<td>The SL30 does not transmit.</td>
<td>The TxKey input is not being pulled low.</td>
<td>Check the TxKey (mic key) input, pulled low for transmit.</td>
</tr>
<tr>
<td></td>
<td>A weather channel is selected.</td>
<td>Select a different frequency, the unit will not transmit on a weather channel.</td>
</tr>
<tr>
<td></td>
<td>No power to the Comm.</td>
<td>Make sure power input is connected to the Comm 15 pin connector.</td>
</tr>
<tr>
<td></td>
<td>The input voltage is too low.</td>
<td>Increase input supply voltage to &gt; 9 volts DC.</td>
</tr>
<tr>
<td>The sidetone level is too low or too high.</td>
<td>Wrong type of headsets, or level needs adjustment.</td>
<td>See the Sidetone Level Adjustment on page 32.</td>
</tr>
<tr>
<td>The intercom doesn’t function.</td>
<td>Control input not connected.</td>
<td>The intercom select input must be pulled to ground to turn on the intercom function.</td>
</tr>
<tr>
<td></td>
<td>Active frequency signal present.</td>
<td>Change the active frequency. The active frequency has priority.</td>
</tr>
<tr>
<td></td>
<td>No voice activation, or have to talk too loud.</td>
<td>Change the intercom level threshold using the setup function described in the user’s manual.</td>
</tr>
</tbody>
</table>

CONTACTING THE FACTORY FOR ASSISTANCE

If the Apollo SL30 unit fails to operate despite troubleshooting efforts, contact the UPS Aviation Technologies factory for assistance.

UPS Aviation Technologies Inc.
2345 Turner Rd. SE
Salem, Oregon 97302
USA

Phone (503) 581-8101 or 1-800-525-6726

Be prepared with the following information about the installation:

- Installation configuration (accessories, antenna, ...)
- Model number, part number with mod levels, and serial number
Troubleshooting

- Software versions
- Description of problem
- Efforts made to isolate the problem
- other installed avionics
APPENDIX B - PERIODIC MAINTENANCE

The SL30 unit is designed to not require any regular general maintenance except as included in this section.

VOR CHECKS

Even though the SL30 is designed to utilize the most state-of-the-art DSP technology and maintain a very high accuracy and repeatability record, it still must undergo the VOR accuracy checks required for IFR flight. Refer to CFR 14 paragraph 91.171. Every 30 days verify the limits of the permissible indicated bearing error.

The last VOR check information may be entered into the SL30 via the system mode VOR CHECK. See the operator’s manual for details.

EQUIPMENT CALIBRATION

The SL30 design requires very few adjustments or calibration to be made. In fact, there are no internal manual adjustments.

REFERENCE OSCILLATOR (COMM ONLY)

The reference oscillator frequency should be checked approximately every 3 to 5 years to ensure the units transmit frequency is within allowable tolerance.

The oscillator frequency can be checked by connecting the transmitter output through an appropriate load to a calibrated frequency counter. The transmit frequency should be within 15ppm of the selected channel frequency. Contact the UPS Aviation Technologies factory for instructions on adjusting the frequency if required.

CLEANING THE FRONT PANEL

The front bezel, keypad, and display can be cleaned with a soft cotton cloth dampened with clean water. DO NOT use any chemical cleaning agents. Care should be taken to avoid scratching the surface of the display.
APPENDIX C - ENVIRONMENTAL QUALIFICATIONS

The Apollo SL30 has been tested to the following environmental categories per procedures defined in RTCA/DO-160C.

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Section</th>
<th>Description of Conducted Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature and Altitude</td>
<td>4.0</td>
<td>Equipment tested to Category C1</td>
</tr>
<tr>
<td>In-flight Loss of Cooling</td>
<td>4.5.4</td>
<td>No cooling required</td>
</tr>
<tr>
<td>Altitude</td>
<td>4.6.3</td>
<td>Equipment tested to 35,000 feet</td>
</tr>
<tr>
<td>Temperature Variation</td>
<td>5.0</td>
<td>Equipment tested to Category C, 2°C/min</td>
</tr>
<tr>
<td>Humidity</td>
<td>6.0</td>
<td>Equipment tested to Category A, standard humidity environment</td>
</tr>
<tr>
<td>Operational Shocks and Crash Safety</td>
<td>7</td>
<td>Equipment tested for both operational and crash safety shocks. (Equipment operated normally after the crash safety shocks.)</td>
</tr>
<tr>
<td>Vibration</td>
<td>8.0</td>
<td>Equipment tested without shock mounts to Categories B, M, and N</td>
</tr>
<tr>
<td>Explosion Proofness</td>
<td>9.0</td>
<td>Equipment identified as Category X, no test required</td>
</tr>
<tr>
<td>Waterproofness</td>
<td>10.0</td>
<td>Equipment identified as Category X, no test required</td>
</tr>
<tr>
<td>Fluids Susceptibility</td>
<td>11.0</td>
<td>Equipment identified as Category X, no test required</td>
</tr>
<tr>
<td>Sand and Dust</td>
<td>12.0</td>
<td>Equipment identified as Category X, no test required</td>
</tr>
<tr>
<td>Fungus Resistance</td>
<td>13.0</td>
<td>Equipment identified as Category X, no test required</td>
</tr>
<tr>
<td>Salt Spray</td>
<td>14.0</td>
<td>Equipment identified as Category X, no test required</td>
</tr>
<tr>
<td>Magnetic Effect</td>
<td>15.0</td>
<td>Equipment is Class Z</td>
</tr>
<tr>
<td>Power Input</td>
<td>16.0</td>
<td>Equipment tested to Categories A &amp; B</td>
</tr>
<tr>
<td>Voltage Spike</td>
<td>17.0</td>
<td>Equipment tested to Category A</td>
</tr>
<tr>
<td>Audio Frequency Conducted Susceptibility - Power Inputs</td>
<td>18.0</td>
<td>Equipment tested to Categories A &amp; B</td>
</tr>
<tr>
<td>Induced Signal Susceptibility</td>
<td>19.0</td>
<td>Equipment tested to Category Z</td>
</tr>
<tr>
<td>Radio Frequency Susceptibility (Radiated and Conducted)</td>
<td>20</td>
<td>Equipment tested to Category V for conducted, Category U for radiated</td>
</tr>
<tr>
<td>Emission of Radio Frequency Energy</td>
<td>21</td>
<td>Equipment tested to Category Z</td>
</tr>
<tr>
<td>Lightning Induced Transient Susceptibility</td>
<td>22.0</td>
<td>Equipment tested to Categories A3 and B2</td>
</tr>
<tr>
<td>Lightning Direct Effects</td>
<td>23.0</td>
<td>Equipment identified as Category X, no test required</td>
</tr>
<tr>
<td>Icing</td>
<td>24.0</td>
<td>Equipment identified as Category X, no test required</td>
</tr>
</tbody>
</table>

Remarks:
The Apollo SL30 has been tested to the following environmental categories per procedures defined in RTCA/DO-160D.

### Environmental Qualification Form

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Section</th>
<th>Description of Conducted Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature and Altitude</td>
<td>4.0</td>
<td>Equipment tested to Category B1 with</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Operating temp: -20°C to +55°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Short time hi temp: to +70°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ground survival temp: -55°C to +85°C</td>
</tr>
<tr>
<td>In-flight Loss of Cooling</td>
<td>4.5.4</td>
<td>No cooling required</td>
</tr>
<tr>
<td>Altitude</td>
<td>4.6.1</td>
<td>Equipment tested to 25,000 feet</td>
</tr>
<tr>
<td>Temperature Variation</td>
<td>5.0</td>
<td>Equipment tested to Category C, 2°C/min</td>
</tr>
<tr>
<td>Humidity</td>
<td>6.0</td>
<td>Equipment tested to Category A, standard humidity environment</td>
</tr>
<tr>
<td>Operational Shocks and Crash</td>
<td>7</td>
<td>Equipment tested for both operational and crash safety shocks to Category B. (Equipment operated normally after the crash safety shocks.)</td>
</tr>
<tr>
<td>Safety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td>8.0</td>
<td>Equipment tested without shock mounts to Categories R-G, S-M</td>
</tr>
<tr>
<td>Explosion Proofness</td>
<td>9.0</td>
<td>Equipment identified as Category X, no test required</td>
</tr>
<tr>
<td>Waterproofness</td>
<td>10.0</td>
<td>Equipment identified as Category X, no test required</td>
</tr>
<tr>
<td>Fluids Susceptibility</td>
<td>11.0</td>
<td>Equipment identified as Category X, no test required</td>
</tr>
<tr>
<td>Sand and Dust</td>
<td>12.0</td>
<td>Equipment identified as Category X, no test required</td>
</tr>
<tr>
<td>Fungus Resistance</td>
<td>13.0</td>
<td>Equipment identified as Category X, no test required</td>
</tr>
<tr>
<td>Salt Spray</td>
<td>14.0</td>
<td>Equipment identified as Category X, no test required</td>
</tr>
<tr>
<td>Magnetic Effect</td>
<td>15.0</td>
<td>Equipment is Class Z, &lt;0.3 meters</td>
</tr>
<tr>
<td>Power Input</td>
<td>16.0</td>
<td>Equipment tested to Categories A &amp; B</td>
</tr>
<tr>
<td>Voltage Spike</td>
<td>17.0</td>
<td>Equipment tested to Category A</td>
</tr>
<tr>
<td>Audio Frequency Conducted</td>
<td>18.0</td>
<td>Equipment tested to Categories A &amp; B</td>
</tr>
<tr>
<td>Susceptibility - Power Inputs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Induced Signal Susceptibility</td>
<td>19.0</td>
<td>Equipment tested to Category Z</td>
</tr>
<tr>
<td>Radio Frequency Susceptibility</td>
<td>20</td>
<td>Equipment tested to Category V</td>
</tr>
<tr>
<td>(Radiated and Conducted)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emission of Radio Frequency</td>
<td>21</td>
<td>Equipment tested to Category M</td>
</tr>
<tr>
<td>Energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lightning Induced Transient</td>
<td>22.0</td>
<td>Equipment tested to -</td>
</tr>
<tr>
<td>Susceptibility</td>
<td></td>
<td>Categories A3 and B</td>
</tr>
<tr>
<td>Lightning Direct Effects</td>
<td>23.0</td>
<td>Equipment identified as Category X, no test required</td>
</tr>
<tr>
<td>Icing</td>
<td>24.0</td>
<td>Equipment identified as Category X, no test required</td>
</tr>
<tr>
<td>Electrostatic Discharge (ESD)</td>
<td>25.0</td>
<td>Equipment tested to Category A</td>
</tr>
</tbody>
</table>

**Remarks:**

**Manufacturer:**
UPS Aviation Technologies Inc.
2345 Turner Road SE
Salem, Oregon 97302
APPENDIX D - ACCESSORIES

This appendix includes information on accessory items available for the Apollo SL30. Refer to the information that is provided with those items for complete specifications and installation instructions.

FROM UPS AVIATION TECHNOLOGIES

Splitter/Combiner
UPS Aviation Technologies Part #:.....115-0007
Manufacturer........................................Mini-Circuits
Manufacturer Part #:.........................ZFSC-2-1B BNC

The splitter/combiner is used when dual antennas and/or dual SL30s are installed in the aircraft. Refer to page 14.

Internal Fuse
UPS Aviation Technologies Part #:.....S172-0007-012
Description............................................3 amp slow blow fuse
APPENDIX E - SERIAL INTERFACE SPECIFICATIONS

This appendix includes the interface specifications for the RS-232 serial port. The RS-232 port can be used to input active and standby frequencies, and is used to input frequencies from a remote source, such as the SL50/60 and 2001 GPS. The interface format conforms to NMEA 0183 message format specifications.

INPUT COMMANDS

The following input command messages are supported:

- Input airport identifier associated with remote Comm frequency list
- Input Comm frequency data from a remote source
- Input VOR frequency data from a remote source
- End of VOR frequency list from a remote source
- Start of Localizer frequency list from a remote source
- Input Localizer frequency data from a remote source
- Request data output
- Set active VOR/LOC frequency data from a remote source
- Set standby VOR/LOC frequency data from a remote source
- Set standby COMM frequency data from remote source
- Set NAV audio mode
- Set Omni-Bearing Select (OBS) value from remote source
- DME sensor input

OUTPUT MESSAGES

SL30 output messages include:

- Reset status
- CDI, GSI, and flags
- Decoded OBS setting
- Radial from active VOR
- Radial from standby VOR
- Decoded station identifier
- Communications error
- Receiver status
- NAV audio mode
- NAV microcontroller software version
- NAV DSP software version
- Comm transceiver status
- Comm software version
DATA FORMAT
The data format for the serial communication is:

- Baud rate 9600
- Data bits 8
- Stop bits 1
- Parity none

MESSAGE FORMATS
All messages will conform to the NMEA 0183 proprietary message format as follows. All characters will be standard ASCII characters. No binary data characters will be used.

- "$" .................. Start of message character, ASCII "$" (024h).
- "P" .................. Proprietary message identifier.
- "MRR" .............. II Morrow company identifier.
- c..................... Message class identifier. Used to identify a message as either a COMM or a VHF NAV message. Those message types which are also supported by the SL40 VHF Comm Radio Serial Interface will use the “C” identifier to allow the SL30 to accept COMM radio commands from existing products. All other messages will use the “V” identifier to indicate that they relate to a VHF NAV receiver.
- nn ................... Message identifier, two-digit number in ASCII characters.
- d....d ............... Message data characters defined for each message.
- chksum ............. Message checksum, including message identifier through data characters. The two-digit checksum is generated by adding all values of valid characters together, ignoring carry (if any). This value is converted into two encoded hex\(^1\) characters (30h-3Fh).
- <CR> .................. ASCII carriage return (0Dh).
- <LF> ..................... ASCII line feed (0Ah).

The maximum message length, including the start of message character (“$”) and the end of message <CR><LF> sequence, is 25 bytes.

This message format is the same as is used in the SL40 VHF Comm Radio. The SL30 will be able to accept all messages intended for an SL40 without generating a serial communications error. It will ignore all of those messages, the only exception being those messages used to input Comm frequency lists from a remote source.

\(^1\) Encoded hex: each character consists of 4 bits of data placed in the low order nibble +30h. For example, the 8-bit value 5Fh would be encoded as two characters with values of 35h and 3Fh, which map to the ASCII characters “5” and “?", respectively.
MESSAGE DEFINITIONS

INPUT MESSAGES

Remote COMM Frequency Lists
The following two commands work together in allowing remotely connected devices to provide COMM frequency lists associated with an airport to the SL30. The host device should first send the Remote Airport Identifier Name command (message identifier 04), followed by a sequence of Remote Frequency Input commands (message identifier 05). The list type field is used to tie the two commands together. The SL30 will receive up to 10 Comm frequency lists, each containing up to twenty entries.

Remote Airport Identifier Name
This input command provides the airport identifier name that is used to identify to the user which airport facility that the list of frequencies is associated with.

Message format:
“C” ............ Message Class. This is a COMM message.
“04” .......... Message Identifier.
t................ List type: (ASCII) “0”, “1”,…,”9”
aaaa .......... Airport Identifier of the frequency list. Note that if the airport identifier is 3 characters, then the 4th character will be filled with a space. Airport Identifiers are restricted to using ASCII characters 0-9 and A-Z.

Example message:
$PMRRC041SLE<SP><chksum><CR><LF>

Airport Identifier to be associated with list #1, Airport Identifier to display is “SLE “.

Remote Airport Frequency Input
This message is used to input COMM frequency data used for the remote recall function.

The data included is a character defining the list type, a character defining the frequency type (tower, ground, ATIS, ...) and 2 characters defining the frequency. The SL30 module will accept the first 10 frequencies received through the serial port for each airport.

Message format:
“C” ............ Message Class. This is a COMM message.
“05” .......... Message Identifier.
t................ List type: (ASCII) “0”, “1”,…,”9”
f................ Frequency type: 0-Fh; use encoded hex\(^2\) (30h-3Fh).
0 = Tower Frequency (TWR)
1 = Ground (GND)
2 = Automatic Terminal Information Service or ATIS (ATS)

\(^2\) Encoded hex: each character consists of a 4-bit data placed in the low order nibble +30h. For example, the 8-bit value 5Fh would be encoded as two characters with values of 35h and 3Fh, which map to the ASCII characters “5” and “?” respectively.
3 = Air Traffic Frequency (ATF)
4 = Approach (APP)
5 = Arrival (ARR)
6 = Automatic Weather Observing Station (AWS)
7 = Clearance/Delivery (CLR)
8 = Common Traffic Advisory Frequency (CTF)
9 = Departure (DEP)
: = Flight Service Station (FSS)
; = Remote Flight Service Station (RFS)
< = Unicom (UNI)
= = Mandatory Frequency (MF)
> = No type specified
? = undefined

Example message:
$PMRRC0511IT<chksum><CR><LF>

Additional frequency list “1”, ground frequency type, 121.900 MHz.

REMOTE VOR LIST
The following two commands work together in allowing remotely connected devices to provide a list of VOR frequencies to the SL30. The remote device will send a sequence of Remote VOR Input commands (message identifier 20). When all of the VOR Input commands have been sent, the remote device should send a Remote VOR List Trailer command (message identifier 21) to terminate the list. The transmitted list will not be considered complete by the SL30 until it receives the trailer message. The unit will maintain a single remote VOR list, so each list received will replace any previous list. There may be up to twenty entries in the remote VOR list. Any entries past twenty will be ignored.

Remote VOR Input
This input is used to input VOR frequency data used for the remote recall function.

The data consists of five characters for the VOR station identifier followed by two characters defining the VOR frequency.
Message format:
“V” ................ Message Class. This is a VHF NAV message.
“20” .............. Message Identifier.
vvvv ............ VOR station identifier. Note that if the station identifier is less than four
caracters, then the trailing characters will be filled with spaces. Station
Identifiers are restricted to using ASCII characters 0-9 and A-Z.
mk .............. Frequency: m = MHz, where m = desired MHz frequency – 30h, with the
desired frequency ranging from 108 to 117, or 3Ch to 45h; k = kHz, where
k = (desired kHz offset / 25 kHz) + 30h, with desired frequency range of
000 to 975 kHz in 50 kHz steps, or the even numbers from 30h to 56h.
Note that the field will be checked to ensure that it is in range and a valid
VOR frequency. Frequencies used for localizers, which are in the range of
108.10 to 111.95 MHz, will not be accepted in this message type.

Example message:
$PMRRV20UBG<Sp>E@<chksm><CR><LF>

VOR station identifier is “UBG ”, VOR frequency is 117.400 MHz.

Remote VOR List Trailer
This input command marks the end of a VOR list sent by a remote device.

Message format:
“V” ................ Message Class. This is a VHF NAV message.
“21” .............. Message Identifier

Example message:
$PMRRV21<chksm><CR><LF>

Indicates the start of a remote VOR list.

REMOTE LOCALIZER LIST
The following two commands work together in allowing remotely connected devices to provide a
list of localizer frequencies associated with an airport to the SL30. The remote device should first
send the Remote Localizer List Header command (message identifier 22), followed by a sequence
of Remote Localizer Input commands (message identifier 23). The SL30 maintains a single
remote localizer list, so each new list received will replace any previous list. Subsequent
receptions of localizer lists for the same airport are ignored. There may be up to twenty entries in
the remote Localizer list. Any entries past twenty will be ignored.

Remote Localizer List Header
This input command marks the beginning of a Localizer list sent by a remote device. It specifies
the five character airport identifier associated with the localizer frequencies in the list.
Message format:
“V” ............... Message Class. This is a VHF NAV message.
“22” ............... Message Identifier.
aaaa ............... Airport identifier. Note that if the airport identifier is less than four characters, then the trailing characters will be filled with spaces. Airport Identifiers are restricted to using ASCII characters 0-9 and A-Z.

Example message:
$PMRRV22SLE<Sp><chksum><CR><LF>
Indicates the start of a remote localizer list associated with the airport “SLE ”.

Remote Localizer Input
This input is used to input Localizer frequency data used for the remote recall function.
The data consists of three characters to identify the runway associated with the localizer, followed by two characters defining the frequency.

Message format:
“V” ............... Message Class. This is a VHF NAV message.
“23” ............... Message Identifier.
iiii ............... Station or Runway identifier. This field will provide an identifier for the localizer which can be either the actual station identifier or a string indicating the runway associated with the localizer. The station identifier can be up to four characters long. A runway identifier will typically be two numbers that indicate the runway direction followed by the character “R”, “C”, or “L” to differentiate between parallel runways (right, center, and left). Note that if either type of identifier is less then four characters, then the trailing characters will be filled in with spaces. Identifiers are restricted to using ASCII characters 0-9 and A-Z.
mk ................. Frequency: m = MHz, where m = MHz frequency – 30h, with the desired frequency ranging from 108 to 111 MHz, or 3Ch to 3Fh; k = (desired kHz offset / 25 kHz) + 30h, where the desired frequency ranges from 000 to 950 kHz, or the even numbers from 30h to 56h. Note that the field will be checked to ensure that it is in range and a valid localizer frequency. Frequencies used for VORs, which can also be found in the range of 108.10 to 111.95 MHz, will not be accepted in this message type.

Example message:
$PMRRV2331<Sp><chksum><CR><LF>
Identifier is “31 ”, indicating a runway, and the localizer frequency is 110.300 MHz.
**REQUEST DATA OUTPUT**

This input is used to request an output message to be sent by the SL30.

**Message format:**

- "V" ................. Message class. This is a VHF NAV message.
- "24" ............... Message identifier.
- ii .................. Output identifier of requested message, two ASCII characters.
- dd .................. Message data, two encoded hex\(^3\) characters (30h-3Fh), used for specific output request. Set to “00” if not needed. These characters are used for such items as selecting a specific EEPROM address to output.
- a .................. Request type: (ASCII) “0” = output once; “L” = output repeatedly at low speed (1 Hz); “H” = output repeatedly at high speed (10 Hz).

**Table 5 - Data Output Requests**

<table>
<thead>
<tr>
<th>ii</th>
<th>Output</th>
<th>Dd</th>
<th>Data Description</th>
<th>a</th>
</tr>
</thead>
<tbody>
<tr>
<td>“20”</td>
<td>Reset Status</td>
<td>“00”</td>
<td></td>
<td>“0”</td>
</tr>
<tr>
<td>“21”</td>
<td>CDI, GSI, and Flags</td>
<td>“00”</td>
<td></td>
<td>“0”, “L”, “H”</td>
</tr>
<tr>
<td>“22”</td>
<td>Decoded OBS Setting</td>
<td>“00”</td>
<td></td>
<td>“0”, “L”, “H”</td>
</tr>
<tr>
<td>“23”</td>
<td>Radial from Active VOR</td>
<td>“00”</td>
<td></td>
<td>“0”, “L”, “H”</td>
</tr>
<tr>
<td>“24”</td>
<td>Radial from Standby VOR</td>
<td>“00”</td>
<td></td>
<td>“0”, “L”</td>
</tr>
<tr>
<td>“25”</td>
<td>Decoded Station Identifier</td>
<td>“00”</td>
<td></td>
<td>“0”, “L”</td>
</tr>
<tr>
<td>“28”</td>
<td>Receiver Status</td>
<td>“00”</td>
<td></td>
<td>“0”</td>
</tr>
<tr>
<td>“29”</td>
<td>NAV Audio Mode</td>
<td>“00”</td>
<td></td>
<td>“0”</td>
</tr>
<tr>
<td>“30”</td>
<td>NAV Microcontroller Software Version</td>
<td>“00”</td>
<td></td>
<td>“0”</td>
</tr>
<tr>
<td>“31”</td>
<td>NAV DSP Software Version</td>
<td>“00”</td>
<td></td>
<td>“0”</td>
</tr>
<tr>
<td>“35”</td>
<td>Comm Transceiver Status</td>
<td>“00”</td>
<td></td>
<td>“0”</td>
</tr>
<tr>
<td>“36”</td>
<td>Comm Software Version</td>
<td>“00”</td>
<td></td>
<td>“0”</td>
</tr>
</tbody>
</table>

**Example messages:**

```
$PMRRV242100L<chksm><CR><LF>
```

Request periodic output of CDI, GSI, and related flags at low (1 Hz) rate.

```
$PMRRV2432050<chksm><CR><LF>
```

Request a single output of ADC data from channel 5.

---

\(^{3}\) Encoded hex: each character consists of 4 bits of data placed in the low order nibble +30h. For example, the 8-bit value 5Fh would be encoded as two characters with values of 35h and 3Fh, which map to the ASCII characters “5” and “?” respectively.
**SET ACTIVE VOR/LOC FREQUENCY AND RECEIVER FUNCTION**

This message is used to set the active VOR or Localizer frequency as well as the receiver operating function. The SL30 can detect if the supplied frequency corresponds to a VOR or a Localizer channel, so this command will work for both types of NAV aids.

**Message format:**

```
“V” ............... Message class. This is a VHF NAV message.
“27” ............... Message identifier.
mk ............... Active VOR/LOC frequency:
   m = desired frequency in MHz in hexadecimal, where m = desired frequency - 30h, with desired frequency in range of 108 to 117 MHz.
   k = desired frequency in kHz, where k = (desired frequency / 25 kHz) + 30h, with desired frequency in range of 000 to 950 kHz in 50 kHz steps, or the even numbers from 30h to 56h.
a.................. Receiver function: N = normal; M = monitor; 0 = unchanged.
```

**Example message:**

```
$PMRRV27E4N<cr><lf>
```

This example command would set the active VOR frequency to 117.100 MHz. This can be interpreted by noting that the ASCII ‘E’ corresponds with 45h, +30h = 75h, converted to decimal equals 117 for the MHz portion of the command. The kHz portion converts ASCII ‘4’ to 34h, -30h = 4h, x25 kHz steps = 100 kHz. This command would also set the receiver function to normal, leaving the standby channel inactive.

Note: The SL30 will check input frequencies for validity. An RS-232 serial error message output will be generated if the frequency is invalid.

**SET STANDBY VOR/LOC FREQUENCY AND RECEIVER FUNCTION**

This message is used to set the standby VOR or Localizer frequency as well as the receiver operating function. The SL30 can detect if the supplied frequency corresponds to a VOR or a Localizer channel, so this command will work for both types of NAV aids.

**Message format:**

```
“V” ............... Message class. This is a VHF NAV message.
“28” ............... Message identifier.
mk ............... Standby VOR/LOC frequency:
   m = desired frequency in MHz in hexadecimal, where m = desired frequency - 30h, with desired frequency in range of 108 to 117 MHz.
   k = desired frequency in kHz, where k = (desired frequency / 25 kHz) + 30h, with desired frequency in range of 000 to 975 kHz in 50 kHz steps, or the even numbers from 30h to 56h.
a.................. Receiver function: N = normal; M = monitor; 0 = unchanged.
```
Example message:

$PMRRV28?PM<chksm><CR><LF>

This example command would set the standby VOR frequency to 111.800 MHz. This is interpreted by noting that the ASCII ‘?’ corresponds with 3Fh, +30h = 7Bh, converted to decimal equals 111 for the MHz portion. The kHz portion converts ASCII ‘P’ to 50h, -30h yields 20h, x25 kHz steps = 800 kHz. This command would also set the receiver function to monitor, so the receiver would time-multiplex the active and standby VOR channels to track both stations.

Note: The SL30 will check input frequencies for validity. An RS-232 serial error message output will be generated if the frequency is invalid.

SET STANDBY COMM FREQUENCY

This message is used to set the standby COMM frequency.

Message format:

“V” ................ Message class. This is a VHF NAV message.
“29” ............... Message identifier.
mk ................. Standby COMM frequency:
   m = desired frequency in MHz in hexadecimal, where m = desired frequency - 30h, with desired frequency in range of 118 to 136 MHz, or 162 MHz.
   k = desired frequency in kHz, where k = (desired frequency / 25 kHz) + 30h, with desired frequency in range of 000 to 975 kHz in 25 kHz steps.

Example message:

$PMRRV29G4<chksm><CR><LF>

This example command would set the standby VOR frequency to 119.100 MHz. This is interpreted by noting that the ASCII ‘G’ corresponds with 47h, +30h = 77h, converted to decimal equals 119 for the MHz portion. The kHz portion converts ASCII ‘4’ to 34h, -30h yields 4h, x25 kHz steps = 100 kHz.

Note: The SL30 will check input frequencies for validity. An RS-232 serial error message output will be generated if the frequency is invalid.
**SET NAV AUDIO MODE**
This message is used to change the current NAV audio mode. There are three possible settings for this mode. The first is “OFF”, which suppresses all of the NAV audio. The second is “IDENT”, which will suppress the voice portion of the NAV audio signal and emphasize the Morse Code station identifier. The third choice is “VOICE”, which will emphasize voice signal and suppress the Morse Code station identifier.

**Message format:**
- “V” .................Message class. This is a VHF NAV message.
- “31” ...............Message identifier.
- a....................NAV audio mode. “0” = OFF, “I” = IDENT, “V” = VOICE

**Example message:**
$PMRRV31I<chksm><CR><LF>

Set the current NAV Audio mode to IDENT.

**SET OMNI-BEARING SELECT (OBS) VALUE**
This message is used to set the OBS value used by the SL30 as the selected radial for computing the course deviation from a VOR. This message will have no effect unless the SL30 is configured to use the internal OBS source, or a serial OBS source.

**Message format:**
- “V” .................Message class. This is a VHF NAV message.
- “34” ...............Message identifier.
- vvv.................OBS Value in degrees, ranging from “000” to “359”.

**Example message:**
$PMRRV34310<chksm><CR><LF>

Set the OBS value to 310 degrees.

**DME SENSOR INPUT**
This message is used to input the range, ground speed, and ETA decoded from an external DME sensor.
Message format:

“V” ............... Message class. This is a VHF NAV message.
“41” .............. Message identifier.
rrrr.............. Range from DME station in 1/10th of a nautical mile units. The first two
               digits are the 10s and 1s place of the range, and the last digit is the 1/10th's
               place. This field may range in value from 0.0 NM (“0000”) to 999.9 NM
               (“9999”). If the distance from the DME station is greater than 999.9NM,
               the value should be encoded as “----”.

sss............... Ground speed with respect to DME station in knots. This field may range
               in value from 0 knots (“000”) to 999 knots (“999”). If the ground speed
               with respect to the DME station is greater than 999 knots, the value should
               be encoded as “---”.

hmm ............. Time to station in hours and minutes. This field may range in value from 0
               hours and 0 minutes (“000”) to 9 hours and 59 minutes (“959”). If the
               time to the station is greater than 9 hours and 59 minutes, the value should
               be encoded as “---”.

Example message:

$PMRRV410983055147<chksm><CR><LF>
Range from DME station is 98.3 NM, ground speed with respect to station is 55 knots, and the
estimated time to the station is 1 hour and 47 minutes.

OUTPUT MESSAGES

RESET STATUS

This message is sent to indicate to the host that the SL30 is running and ready to accept data on
the serial port. It will be sent once upon startup and when requested by the host.

Message format:

“V” ............... Message class. This is a VHF NAV message.
“20” .............. Message identifier.

Example message:

$PMRRV20<chksm><CR><LF>
SL30 is running and ready to accept serial input.

CDI, GSI, AND RELATED FLAGS

This message outputs the current values of the CDI, GSI, and their related flags. After power up
this message will be output at a 10 Hz rate.
Message format:

“V” .............. Message class. This is a VHF NAV message.
“21” ............. Message identifier.
cc................ CDI deflection. An eight-bit value indicating the amount of deflection of the CDI needle, represented as two encoded hex digits. The CDI deflection is a two's complement signed integer in the range of –100 to 100. –100 indicates full left deflection, 0 indicates no deflection, and 100 indicates full right deflection.

gg .............. GSI deflection. An eight-bit value indicating the amount of deflection of the GSI needle, represented as two encoded hex digits. The CDI deflection is a two's complement signed integer in the range of –100 to 100. –100 indicates full deflection upwards, 0 indicates no deflection, and 100 indicates full deflection downwards.

ff................ Flags. Eight bits for HNAV and VNAV related flags, represented as two encoded hex digits.

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Back Course enable (1 = enabled)</td>
</tr>
<tr>
<td>2</td>
<td>Localizer detect (1 = using localizer)</td>
</tr>
<tr>
<td>3</td>
<td>FROM flag (1 = From)</td>
</tr>
<tr>
<td>4</td>
<td>TO flag (1 = To)</td>
</tr>
<tr>
<td>5</td>
<td>GSI superflag (1 = valid)</td>
</tr>
<tr>
<td>6</td>
<td>GSI valid (1 = valid)</td>
</tr>
<tr>
<td>7</td>
<td>NAV superflag (1 = valid)</td>
</tr>
<tr>
<td>8</td>
<td>NAV valid (1 = valid)</td>
</tr>
</tbody>
</table>

Example message:

$PMRRV21817?:<chksm><CR><LF>

This message indicates a full left CDI deflection (-127), a full up GSI deflection (127), both the GSI and NAV flags/superflags are valid, TO flag set, FROM flag not set, using a localizer, with no back course enable.

**DECODED OBS SETTING**

This message outputs the current OBS setting, which may be read from an external resolver or from user input to the front panel. After power up this message will be sent at a 10 Hz rate.

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4 Encoded hex: each character consists of 4 bits of data placed in the low order nibble +30h. For example, the 8-bit value 5Fh would be encoded as two characters with values of 35h and 3Fh, which map to the ASCII characters “5” and “?”, respectively.

5 The TO and FROM flag can not both be 1, indicating that they are both valid. They can both be zero, indicating that neither is valid. This situation will occur whenever the receiver determines that it is within the “cone of confusion” directly over a VOR, or when no signal is being received.
**Serial Interface Specifications**

**Message format:**

- “V” ............... Message class. This is a VHF NAV message.
- “22” ............... Message identifier.
- v .................... Valid flag. “0” = OBS invalid/not present, “V” = OBS setting is valid.
- ddd ............... Three digit OBS setting, in degrees. Values are in the range of “000” to “359”.

**Example message:**

$PMRRV22V170<chksm><CR><LF>

A valid OBS setting of 170 degrees.

**RADIAL FROM ACTIVE VOR**

This message outputs the current bearing from the active VOR station. This message will be output even when a localizer is being tracked by the NAV receiver. In this case, the bearing will be marked as invalid. After power up this message will be sent at a 10 Hz rate.

**Message format:**

- “V” ............... Message class. This is a VHF NAV message.
- “23” ............... Message identifier.
- v .................... Valid flag. “0” = bearing not valid, “V” = bearing is valid.
- dddf ............... Bearing to a resolution of 1/10th of a degree. ddd = three digit bearing in degrees, ranging from “000” to “359”. f = 1/10th of a degree.

**Example message:**

$PMRRV23V1654<chksm><CR><LF>

A valid bearing of 165.4 degrees FROM the active VOR station.

**RADIAL FROM STANDBY VOR**

This message outputs the current bearing from the standby VOR station. This message will only contain valid data when the standby frequency is a VOR and the unit is in monitor mode. This message will be output even if valid data cannot be provided. In this case, the bearing will be marked as invalid. After power up this message will be sent at a 1 Hz rate.

**Message format:**

- “V” ............... Message class. This is a VHF NAV message.
- “24” ............... Message identifier.
- v .................... Valid flag. “0” = bearing not valid, “V” = bearing is valid.
- dddf ............... Bearing to a resolution of 1/10th of a degree. ddd = three digit bearing in degrees, ranging from “000” to “359”. f = 1/10th of a degree.
Example message:
$PMRRV24V1654<chksm><CR><LF>
A valid bearing of 165.4 degrees FROM the standby VOR station.

**Decoded Station Identifier**

This message outputs the decoded station identifier received on the NAV voice channel. This message will be output even if the station identifier has not been decoded yet. In this case, the message will be flagged as invalid. Note that the validity of this message does not depend on the current NAV audio mode. The decoding is done automatically regardless of this setting. After power up this message will be sent at a 1 Hz rate.

**Message format:**

- “V” ............... Message class. This is a VHF NAV message.
- “25” .............. Message identifier.
- v .................. Valid flag. “0” = identifier is not valid, “V” = decoded station identifier is valid.
- iiiii ................ Decoded station identifier, five characters long. If the decoded identifier is less than five characters in length, then the trailing characters will be filled in with spaces. Identifiers are restricted to using ASCII character 0-9 and A-Z.

Example message:
$PMRRV25VISLE<Sp><chksm><CR><LF>
The decoded station identifier is valid and is “ISLE “.

**Communications Error**

This message is used to indicate a communication error.

**Message format:**

- “V” ............... Message class. This is a VHF NAV message.
- “27” .............. Message identifier.
- e .................. Error code: (ASCII)
  - “0” = input message checksum error.
  - “1” = unknown message.
  - “2” = error or mismatch in message data.

Example message:
$PMRRV271<chksm><CR><LF>
Received an unknown message.
NAV RECEIVER STATUS
This message is used to output the current status of the NAV receiver. It will be output upon request or whenever the status changes.

Message format:
“V” ............... Message class. This is a VHF NAV message.
“28” ............... Message identifier.
mk ............... Active NAV frequency: m = MHz, where m + 30h = desired MHz frequency in the range of 108 to 117 MHz.
k = desired frequency in kHz, where k = (desired frequency / 25 kHz) + 30h, with desired frequency in range of 000 to 975 kHz in 50 kHz steps.
mk ............... Standby NAV frequency: m = MHz, where m + 30h = desired MHz frequency in the range of 108 to 117 MHz.
k = desired frequency in kHz, where k = (desired frequency / 25 kHz) + 30h, with desired frequency in range of 000 to 975 kHz in 50 kHz steps.
s.................. Status: “N” = Normal mode, “M” = Monitor mode

Example message:
$PMRRV28E4?PM<chksm><CR><LF>
Active NAV frequency is 117.100 MHz, Standby NAV frequency is 111.800 MHz, receiver is in monitor mode.

NAV AUDIO MODE
This message is used to output the current NAV audio mode. There are three possible settings for this mode. The first is “OFF”, which suppresses all of the NAV audio. The second is “IDENT”, which will suppress the voice portion of the NAV audio signal and emphasize the Morse Code station identifier. The third choice is “VOICE”, which will emphasize voice signal and suppress the Morse Code station identifier.

Message format:
“V” ............... Message class. This is a VHF NAV message.
“29” ............... Message identifier.
a .................. NAV audio mode. “0” = OFF, “I” = IDENT, “V” = VOICE

Example message:
$PMRRV29I<chksm><CR><LF>
The current NAV Audio mode is “IDENT”.

NAV MICROCONTROLLER SOFTWARE VERSION
This message is used to output the version string for the NAV microcontroller software.
Message format:
   “V” ............... Message class. This is a VHF NAV message.
   “30” ............... Message identifier.
   vvvv ................ Software version in ASCII 
   e ....................... Engineering version flag:
      “R” = Released version.
      “E” = Engineering version.

Example message:
$PMRRV300103E<chksm><CR><LF>

NAV Microcontroller software is version 1.03. It is an engineering version.

**NAV DSP SOFTWARE VERSION**
This message is used to output the version string for the NAV DSP software.

Message format:
   “V” ............... Message class. This is a VHF NAV message.
   “31” ............... Message identifier.
   vvvv ................ Software version in ASCII 
   e ....................... Engineering version flag:
      “R” = Released version.
      “E” = Engineering version.

Example message:
$PMRRV310101R<chksm><CR><LF>

NAV DSP software is version 1.01. It is a released version.

**COMM TRANSCEIVER STATUS**
This message outputs the result of a specific system test.

Message format:
   “V” ............... Message class. This is a VHF NAV message.
   “35” ............... Message identifier.
   mk ................... Active frequency: m = MHz, where m = desired MHz frequency - 30h, 
                       ranging from 118 to 136 MHz, 162 (i.e., 76h to 88h, A2h); 
                       k = (kHz offset / 25 kHz) + 30h, ranging from 000 to 975 kHz in 25 kHz steps.
   mk ................... Standby frequency: m = MHz, where m = desired MHz frequency - 30h, 
                       ranging from 118 to 136 MHz, 162 (i.e., 76h to 88h, A2h); 
                       k = (kHz offset / 25 kHz) + 30h, ranging from 000 to 975 kHz in 25 kHz steps.
   a ....................... Transceiver status:
                       R = Normal receive 
                       M = Monitor receive
T = Transmit enabled  
S = Stuck mic  
F = Comm failure  
s.................. Squelch test setting: (ASCII) 0 = automatic; 1 = test

Example message:
$PMRRV35G4LFR0<chksm><CR><LF>

Active frequency is 119.100 MHz, the standby frequency is 124.550 MHz, receive function, squelch is automatic.

**COMM SOFTWARE VERSION**
This message is used to output the version string for the VHF Comm receiver software.

Message format:
“V”.................. Message class. This is a VHF NAV message.  
“36”............... Message identifier.  
vvvv................ Software version in ASCII

Example message:
$PMRRV300103<chksm><CR><LF>

Comm software is version 1.03.