



# SwiftBroadband Installation Manual

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| ISSUE | DATE        | ECP              | DESCRIPTION OF CHANGE  |
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| 1.0   | 16 Nov '07  | 05/328           | Original   |
| 1.1   | 17 July '08 | 08/010           | Various product pre-release changes  |
| 1.2   | 22 May '09  | 09/117           | <u>Additions</u><br>References to HPA-7450 throughout;<br><u>Changes</u><br>Figure captions to include section references;<br>Call LED colour reference from yellow to green - Table 4-1, p19;<br>Details of pins MP2C and MP4H from GND to Reserved - Table 8-2, p50;<br>Heading of Section 13.2 Pre-Flight Functional Tests to Post-Installation Tests - p78.<br><u>Deletions</u><br>Outline Drawings and Wiring Diagrams – added to Section 2, p12 as reference documents |
| 1.3   | 16 July '09 | 09/244           | Corrections to HLD J2 and J3 Connector Labels and definitions  |
| 1.4   | 15 Dec '09  | 09/497           | Incorporated internal review comments.<br>Added CS installation aspects (ISDN and POTS) plus general review.<br>Corrected steering label descriptions and added ISDN Nera handset termination clause.  |
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| 1.6   | 21 July '10 | 10/104           | Date of release corrected from 31 May 2009 to 21 July 2010.  |
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| 2.1   | 15 Oct 13   | 13/123           | Clarified multi-modem in section 4. Added specification section for 4-modem system (section 18.3). Elaborated on 3 <sup>rd</sup> party LAN access in Section 5.9.3. Clarified options listed in section 6.3. Added 4-modem SDU and updated HPA cooling requirements. Modified ARINC-429 Date and Time labels to be optional.   |
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|     |              |        |  |
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## TABLE OF CONTENTS

|  | PAGE      |
|--|-----------|
| <b>1. INTRODUCTION.....</b>  | <b>11</b> |
| 1.1 USER DOCUMENTS .....   | 11        |
| 1.2 TEXT CONVENTIONS USED IN THIS DOCUMENT .....                         | 12        |
| <b>2. REFERENCE DOCUMENTS .....</b>                                      | <b>12</b> |
| <b>3. WARNINGS .....</b>   | <b>14</b> |
| 3.1 RADIATION .....  | 14        |
| 3.2 POWER CABLE INSTALLATION .....                                       | 14        |
| 3.3 SYSTEM CABLE INSTALLATION .....                                      | 14        |
| 3.4 HARDWARE INSTALLATION.....   | 14        |
| <b>4. SWIFTBROADBAND (SBB) SYSTEM DESCRIPTION .....</b>                  | <b>15</b> |
| 4.1 AERONAUTICAL EARTH STATION (AES) COMPONENTS.....                     | 15        |
| 4.1.1 SDU-7320/SDU-7330 Satellite Data Unit (SDU).....                   | 16        |
| 4.1.2 HPA-7400 and HPA-7450 High Power Amplifiers (HPA) .....            | 21        |
| 4.1.3 Diplexer/Low Noise Amplifier (DLNA).....                           | 23        |
| 4.1.4 HLD-7260 High Power/Low Noise Amplifier and Diplexer (HLD).....    | 24        |
| 4.1.5 High Gain and Intermediate Gain Antenna (HGA and IGA) Options..... | 25        |
| <b>5. INSTALLATION OVERVIEW AND PLANNING .....</b>                       | <b>26</b> |
| 5.1 INSTALLATION OVERVIEW .....  | 26        |
| 5.2 INSTALLATION PLANNING .....  | 26        |
| 5.2.1 AES Antenna Location.....  | 26        |
| 5.2.2 SDU-7320/SDU-7330 and CM Installation.....                         | 26        |
| 5.2.3 DLNA Installation.....   | 27        |
| 5.2.4 HLD-7260 Installation.....   | 27        |
| 5.2.5 HPA-7400/HPA-7450 Installation .....                               | 28        |
| 5.3 GENERAL ELECTRICAL REQUIREMENTS.....                                 | 29        |
| 5.4 COAXIAL CABLE TORQUEING AND VSWR LIMITS.....                         | 29        |
| 5.5 POWER SUPPLY ROUTING.....  | 29        |
| 5.5.1 Operating Voltages.....  | 31        |
| 5.5.2 System Power Requirements.....                                     | 31        |
| 5.6 USE OF NAVIGATION DATA SOURCES .....                                 | 32        |
| 5.6.1 Navigation Data Sources.....                                       | 32        |
| 5.6.2 Configuring ARINC-429 labels on the Satcom System .....            | 33        |
| 5.6.3 Using SRU-7200/MSU-7250 Data.....                                  | 33        |
| 5.6.4 ARINC-429 label sets.....  | 34        |
| 5.6.5 Internal GPS.....  | 36        |
| 5.6.6 Configuring for Navigational sources input .....                   | 36        |
| 5.6.7 Monitoring configured ARINC-429 Data.....                          | 38        |
| 5.7 ANTENNA ALIGNMENT .....  | 38        |
| 5.8 COAXIAL CABLE LOSS LIMITS.....                                       | 38        |
| 5.8.1 Limits for Passive Inter-Modulation (PIM).....                     | 40        |
| 5.9 USER EQUIPMENT INSTALLATION .....                                    | 40        |
| 5.9.1 ISDN Terminal Equipment.....                                       | 40        |
| 5.9.2 POTS Phone Equipment .....   | 40        |
| 5.9.3 Ethernet with Power-over-Ethernet (PoE) Interface .....            | 41        |
| 5.10 TRANSMIT-MUTE (RADIO SILENCE) INPUT .....                           | 41        |
| 5.11 REMOTE STATUS PANEL.....  | 42        |
| 5.12 MODEM ANTENNA SUPPLY VOLTAGE .....                                  | 42        |
| 5.13 SATCOM CONSOLE .....  | 42        |
| <b>6. TOOLS REQUIRED FOR INSTALLATION.....</b>                           | <b>44</b> |
| 6.1 TOOLS REQUIRED FOR SDU AND HPA INSTALLATION .....                    | 44        |
| 6.2 EQUIPMENT REQUIRED FOR SDU INSTALLATION .....                        | 45        |
| 6.3 EQUIPMENT REQUIRED FOR HPA-7400/HPA-7450 INSTALLATION .....          | 46        |
| 6.4 TOOLS REQUIRED FOR DLNA AND HLD-7260 INSTALLATION.....               | 47        |
| 6.5 EQUIPMENT REQUIRED FOR DLNA INSTALLATION.....                        | 47        |
| 6.6 EQUIPMENT REQUIRED FOR HLD-7260 INSTALLATION .....                   | 48        |

|  |           |
|--|-----------|
| <b>7. OUTLINE DRAWINGS.....</b>  | <b>49</b> |
| 7.1 SDU-7320 .....   | 49        |
| 7.2 SDU-7330 .....   | 49        |
| 7.3 CONFIGURATION MODULE (CM).....   | 49        |
| 7.4 CM INSTALLATION BRACKET .....  | 49        |
| 7.5 HPA-7400 .....   | 49        |
| 7.6 HPA-7450 .....   | 49        |
| 7.7 HLD-7260 .....   | 49        |
| 7.8 DLNA.....  | 49        |
| <b>8. CONNECTOR DRAWINGS AND PIN-OUTS .....</b>                              | <b>50</b> |
| 8.1 ARINC 600 CONNECTOR .....  | 50        |
| 8.1.1 Connector Description and Part-numbers .....                           | 50        |
| 8.1.2 ARINC 600 Connector Pin-numbering.....                                 | 51        |
| 8.2 SDU-7320/SDU-7330 ARINC 600 CONNECTOR .....                              | 52        |
| 8.2.1 SDU-7320/SDU-7330 ARINC 600 Connector Pin-out.....                     | 52        |
| 8.2.2 SDU-7320/SDU-7330 ARINC 600 Coaxial Connectors .....                   | 57        |
| 8.3 CONFIGURATION MODULE (CM) CONNECTOR.....                                 | 58        |
| 8.3.1 Connector and Mating Plug .....  | 58        |
| 8.3.2 Connector Pin-outs .....   | 58        |
| 8.4 HPA-7400/HPA-7450 ARINC 600 CONNECTOR.....                               | 59        |
| 8.4.1 HPA-7400/HPA-7450 ARINC 600 Connector Pin-outs.....                    | 59        |
| 8.4.2 HPA-7400/HPA-7450 Coaxial Connectors.....                              | 61        |
| 8.5 HLD-7260 CONNECTORS .....  | 62        |
| 8.5.1 HLD-7260 Power/BITE J4.....  | 62        |
| 8.5.2 HLD-7260 TX IN Coaxial Connector J3.....                               | 63        |
| 8.5.3 HLD-7260 RX OUT Coaxial Connector J2.....                              | 63        |
| 8.5.4 HLD-7260 ANTENNA Coaxial Connector J1.....                             | 63        |
| 8.5.5 HLD-7260 Fan Module Connector J5.....                                  | 63        |
| 8.6 SDU REMOTE PANEL .....   | 63        |
| 8.7 MAINTENANCE PORT ETHERNET 100BASE-T .....                                | 64        |
| 8.8 RJ-45 CONNECTOR DRAWING .....  | 64        |
| 8.9 RJ-11 CONNECTOR DRAWING .....  | 64        |
| <b>9. WIRING DIAGRAM .....</b>   | <b>65</b> |
| <b>10. SERVICE ACTIVATION .....</b>  | <b>66</b> |
| <b>11. CONFIGURING THE AES .....</b>   | <b>67</b> |
| 11.1 LOGIN VIA THE SATCOM CONSOLE.....                                       | 67        |
| 11.2 RESTORE ADMINISTRATOR PASSWORD TO DEFAULT PASSWORD .....                | 69        |
| 11.3 CONFIGURING ANTENNA ALIGNMENT .....                                     | 69        |
| 11.4 SELF-STEERING ANTENNAS.....   | 70        |
| 11.4.1 Mini-M/Aero-I/IGA-5006 Antenna .....                                  | 70        |
| 11.5 RF CABLE LOSS REGISTRATION.....   | 71        |
| 11.6 SRU-7200 INSTALLATION AND CALIBRATION .....                             | 71        |
| 11.7 DIAGNOSTICS TESTS ON AN INSTALLED SYSTEM .....                          | 71        |
| 11.8 NETWORK SETTINGS.....   | 72        |
| 11.9 PRESERVATION OF CONFIGURATION DATA .....                                | 72        |
| <b>12. SETTING UP USER EQUIPMENT.....</b>                                    | <b>73</b> |
| 12.1 CONFIGURING FOR ISDN TERMINALS .....                                    | 73        |
| 12.2 CONFIGURING FOR TELEPHONE (POTS) HANDSETS .....                         | 73        |
| 12.3 CONFIGURATION TO ENABLE IP-CAPABLE DEVICES ON SATCOM TERMINAL LAN ..... | 74        |
| <b>13. SYSTEM VERIFICATION.....</b>  | <b>78</b> |
| 13.1 WIRING VERIFICATION.....  | 78        |
| 13.2 POST-INSTALLATION TESTS .....   | 78        |
| 13.2.1 Antenna Steering Check.....   | 79        |
| 13.2.2 Voice Call Quality Check.....   | 79        |
| 13.2.3 Data Call Quality Check.....  | 79        |
| 13.2.4 Interference Check.....   | 79        |
| 13.3 IN-FLIGHT FUNCTIONAL TESTS.....   | 79        |
| <b>14. TROUBLESHOOTING .....</b>   | <b>80</b> |

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|   |           |
|---|-----------|
| <b>15. COMPONENT REMOVAL .....</b>  | <b>90</b> |
| 15.1 SDU-7320/SDU-7330 REMOVAL .....  | 90        |
| 15.2 HPA-7400/HPA-7450 REMOVAL .....  | 90        |
| 15.3 CM REMOVAL.....  | 90        |
| 15.4 HLD-7260 REMOVAL.....  | 90        |
| 15.5 DLNA REMOVAL .....   | 90        |
| <b>16. MAINTENANCE AND INSPECTION.....</b>                                      | <b>91</b> |
| 16.1 SDU-7320 / SDU-7330.....   | 91        |
| 16.1.1 <i>Scheduled Maintenance</i> .....                                       | 91        |
| 16.1.2 <i>Inspection</i> .....  | 91        |
| 16.2 HLD-7260 .....   | 91        |
| 16.2.1 <i>Scheduled Maintenance</i> .....                                       | 91        |
| 16.2.2 <i>Inspection</i> .....  | 91        |
| 16.3 HPA-7450 / HPA-7400 .....  | 92        |
| 16.3.1 <i>Scheduled Maintenance</i> .....                                       | 92        |
| 16.3.2 <i>Inspection</i> .....  | 92        |
| <b>17. PRODUCT DISPOSAL .....</b>   | <b>93</b> |
| <b>18. SERVICE BULLETINS .....</b>  | <b>93</b> |
| <b>19. DISCONTINUED PRODUCTS .....</b>  | <b>93</b> |
| <b>20. SPECIFICATIONS.....</b>  | <b>94</b> |
| 20.1 SDU-7320 ONE AND TWO-MODEM VARIANTS .....                                  | 94        |
| 20.2 SDU-7330 ONE AND TWO-MODEM VARIANTS.....                                   | 94        |
| 20.3 SDU-7330 FOUR-MODEM VARIANT .....  | 95        |
| 20.4 HPA-7400 .....   | 95        |
| 20.5 HPA-7450 .....   | 95        |
| 20.6 HLD-7260 .....   | 96        |
| <b>21. APPENDICES.....</b>  | <b>97</b> |
| 21.1 APPENDIX A – SDU-7330 (4CH) DO-160G ENVIRONMENTAL QUALIFICATION FORM ..... | 97        |
| 21.2 APPENDIX B – HPA-7450 DO-160G ENVIRONMENTAL QUALIFICATION FORM .....       | 98        |

**LIST OF FIGURES**

|  | <b>PAGE</b> |
|--|-------------|
| Figure 1-1: Satcom System Manuals .....  | 11          |
| Figure 4-1: SDU-7330 and SDU-7320 Satellite Data Units .....                           | 17          |
| Figure 4-2: SDU-7320 front panel .....   | 18          |
| Figure 4-3: External Configuration Module holder .....                                 | 20          |
| Figure 4-4: HPA-7400/7450 High Power Amplifier .....                                   | 21          |
| Figure 4-5: DAU-7060 Diplexer/Low Noise Amplifier, as an example .....                 | 23          |
| Figure 4-6: HLD-7260 High Power/Low Noise Amplifier and Diplexer.....                  | 24          |
| Figure 5-1: HPA/HLD Fan configuration.....   | 29          |
| Figure 5-2: SRU-7200 Satcom Reference Unit and MSU-7250 Magnetic Sensor Unit .....     | 33          |
| Figure 5-3: RF Coaxial Cable Loss Limits. ....   | 39          |
| Figure 5-4: DC Power Routing from HPA-7400/7450.....                                   | 42          |
| Figure 5-5: Antenna Voltage selection.....   | 42          |
| Figure 8-1: SDU & HPA ARINC-600 Connector Pin Numbering (viewed from the rear) .....   | 51          |
| Figure 8-2: HLD MIL-C-26482 12-10 Pin Configuration (view towards the connector) ..... | 62          |
| Figure 8-3: SDU Remote Panel LED and Reset Switch wiring example.....                  | 64          |
| Figure 8-4: RJ-45 ISDN & Ethernet Socket and Plug .....                                | 64          |
| Figure 8-5: POTS RJ-11 Socket and Plug .....   | 65          |
| Figure 11-1: Satcom Console [Connection Monitor] page .....                            | 67          |
| Figure 11-2: Satcom Console [Login] dialogue .....                                     | 68          |
| Figure 11-3: Satcom Console [Installation] page. ....                                  | 68          |
| Figure 11-4: Satcom Console [System - Restore Defaults] page. ....                     | 69          |
| Figure 11-5: Index Marks for Antenna Alignment, HGA-7000 example.....                  | 69          |
| Figure 11-6: Satcom Console – System menu Diagnostics page.....                        | 71          |
| Figure 11-7: Network Settings.....   | 72          |
| Figure 11-8: Download Configuration .....  | 72          |
| Figure 11-9 10: Upload Configuration .....   | 73          |
| Figure 12-1: Windows Start Menu.....   | 75          |
| Figure 12-2: Windows Control Panel. ....   | 75          |
| Figure 12-3: Windows Network Connections. ....   | 76          |
| Figure 12-4: Windows LAN Properties .....  | 76          |
| Figure 12-5: Internet Protocol Properties.....   | 76          |
| Figure 12-6: IP Properties General tab .....   | 77          |

**LIST OF TABLES**

|  | <b>PAGE</b> |
|--|-------------|
| Figure 1-1: Satcom System Manuals .....  | 11          |
| Figure 4-1: SDU-7330 and SDU-7320 Satellite Data Units .....                           | 17          |
| Figure 4-2: SDU-7320 front panel .....   | 18          |
| Figure 4-3: External Configuration Module holder .....                                 | 20          |
| Figure 4-4: HPA-7400/7450 High Power Amplifier .....                                   | 21          |
| Figure 4-5: DAU-7060 Diplexer/Low Noise Amplifier, as an example .....                 | 23          |
| Figure 4-6: HLD-7260 High Power/Low Noise Amplifier and Diplexer.....                  | 24          |
| Figure 5-1: HPA/HLD Fan configuration.....   | 29          |
| Figure 5-2: SRU-7200 Satcom Reference Unit and MSU-7250 Magnetic Sensor Unit .....     | 33          |
| Figure 5-3: RF Coaxial Cable Loss Limits. ....   | 39          |
| Figure 5-4: DC Power Routing from HPA-7400/7450.....                                   | 42          |
| Figure 5-5: Antenna Voltage selection.....   | 42          |
| Figure 8-1: SDU & HPA ARINC-600 Connector Pin Numbering (viewed from the rear) .....   | 51          |
| Figure 8-2: HLD MIL-C-26482 12-10 Pin Configuration (view towards the connector) ..... | 62          |
| Figure 8-3: SDU Remote Panel LED and Reset Switch wiring example.....                  | 64          |
| Figure 8-4: RJ-45 ISDN & Ethernet Socket and Plug .....                                | 64          |
| Figure 8-5: POTS RJ-11 Socket and Plug .....   | 65          |
| Figure 11-1: Satcom Console [Connection Monitor] page .....                            | 67          |
| Figure 11-2: Satcom Console [Login] dialogue .....                                     | 68          |
| Figure 11-3: Satcom Console [Installation] page. ....                                  | 68          |
| Figure 11-4: Satcom Console [System - Restore Defaults] page. ....                     | 69          |
| Figure 11-5: Index Marks for Antenna Alignment, HGA-7000 example.....                  | 69          |
| Figure 11-6: Satcom Console – System menu Diagnostics page.....                        | 71          |
| Figure 11-7: Network Settings.....   | 72          |
| Figure 11-8: Download Configuration .....  | 72          |
| Figure 11-9 10: Upload Configuration .....   | 73          |
| Figure 12-1: Windows Start Menu.....   | 75          |
| Figure 12-2: Windows Control Panel. ....   | 75          |
| Figure 12-3: Windows Network Connections. ....   | 76          |
| Figure 12-4: Windows LAN Properties .....  | 76          |
| Figure 12-5: Internet Protocol Properties.....   | 76          |
| Figure 12-6: IP Properties General tab .....   | 77          |



## ACRONYMS AND ABBREVIATIONS

| <i>Acronym or Abbreviation</i> | <i>Definition</i>                              |
|--------------------------------|--|
| 2-wire                         | Two Wire POTS interface/device                 |
| AES                            | Aeronautical Earth Station                     |
| AHRS                           | Attitude and Heading Reference System          |
| ARINC                          | Aeronautical Radio, Inc.                       |
| AWG                            | American Wire Gauge                            |
| BITE                           | Built-in Test Equipment                        |
| bps                            | Bits per second                                |
| BSU                            | Beam Steering Unit                             |
| CM                             | Configuration Module                           |
| CTS                            | Clear To Send                                  |
| DC                             | Direct Current                                 |
| DHCP                           | Dynamic Host Configuration Protocol            |
| DLNA                           | Diplexer/Low Noise Amplifier                   |
| DNS                            | Domain Name Server                             |
| FAA                            | Federal Aviation Authority                     |
| GNSS                           | Global Navigation Satellite System             |
| 3GPP                           | 3 <sup>rd</sup> Generation Partnership Project |
| GPS                            | Global Positioning System                      |
| HGA                            | High Gain Antenna                              |
| HLD                            | High power/ Low noise amplifiers and Diplexer  |
| HPA                            | High Power Amplifier                           |
| IGA                            | Intermediate Gain Antenna                      |
| IMSI                           | International Mobile Subscriber Identifier     |
| IRS                            | Inertial Reference System                      |
| ISDN                           | Integrated Digital Services Network            |
| LAN                            | Local Area Network                             |
| LED                            | Light Emitting Diode                           |
| LRU                            | Line Replaceable Unit                          |
| MCU                            | Modular Concept Unit                           |
| MSISDN                         | Mobile Station International PSTN/ISDN Number. |
| MSU                            | Magnetic Sensor Unit                           |

---

| <i>Acronym or Abbreviation</i> | <i>Definition</i>                               |
|--------------------------------|---|
| PC                             | Personal Computer                               |
| PoE                            | Power-over-Ethernet                             |
| POTS                           | Plain Old Telephone System                      |
| PSTN                           | Public Switched Telephone Network               |
| RF                             | Radio Frequency                                 |
| RNC                            | Radio Network Controller                        |
| RTS                            | Request To Send                                 |
| RX                             | Receive   |
| SAS                            | Satellite Access Station                        |
| SBB                            | SwiftBroadband                                  |
| SDU                            | Satellite Data Unit                             |
| SRU                            | Satcom Reference Unit                           |
| TCP/IP                         | Transmission Control Protocol/Internet Protocol |
| TX                             | Transmit  |
| UDI                            | Unrestricted Digital Interface                  |
| USIM                           | Universal Subscriber Identity Modules           |
| VSWR                           | Voltage Standing Wave Ratio                     |
| WOW                            | Weight-On-Wheels                                |

---

## 1. INTRODUCTION

This manual provides installation and maintenance instructions for the Cobham SwiftBroadband (SBB) Aeronautical Earth Station (AES) System. This manual covers the installation of:

- SDU-7320, 2MCU 1 or 2-Modem Satellite Data Unit (SDU)
- SDU-7330, 3MCU 1, 2 or 4-Modem Satellite Data Unit (SDU)
- HPA-7400 or HPA-7450, 2MCU Multi-modem High Power Amplifier (HPA)<sup>1</sup>
- HLD-7260, Compact 20 W Single-modem High Power/Low Noise Amplifier and Diplexer (HLD)

This manual must be read in conjunction with Installation Manuals for other installed AES units in the intended installation, such as the antenna.

Specific installation details will have to be derived by the installer for each different aircraft type, using this manual as a guideline, while adhering to standard aircraft practices and, in particular, Reference [1] or its equivalent.

The number of SDU modems is determined by the number of modem cards installed in the SDU. The number of SDU modems is indicated by a dash number appended to the part number, i.e. 677-A0188-001 is the single modem 3MCU SDU and 677-A0183-002 is the two-modem 2MCU SDU.

### 1.1 User Documents

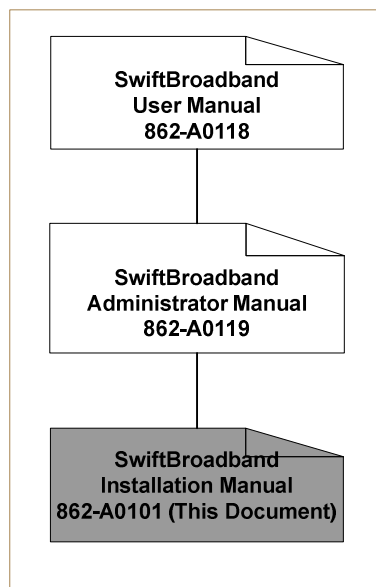


Figure 1-1: Satcom System Manuals

- The **SwiftBroadband Installation Manual** (This document). Contains information relevant to the installation of the Satcom System.
- The **SwiftBroadband Administrator Manual** contains procedural detail used by administrators to configure/maintain the system. The detail of certain steps in the procedures can be embodied in the SDU Console help screens.
- The **SwiftBroadband User Manual** (see [26]) contains procedural detail needed to enable end users to connect and transfer IP data. The detail of the steps (within the procedure) are exposed or referred to from within the manual (Limited access to "Satcom Console")

<sup>1</sup> The HPA-7400 requires a Type-F DLNA for multi-modem operation.

## 1.2 Text Conventions used in this document

The following conventions apply to all paragraph text contained within this document.

All references to Satcom Console pages are in bracketed italics. All references to clickable hyperlinks and action buttons that exist on the various Satcom Console pages will be in italicized font. All references to textual page sections within the various Satcom Console pages have the beginning of every word capitalized.

Examples follow:

- *[System - Restore Defaults]* in section 11.2 of this document refers to the Satcom Console *[Restore Defaults]* page called from the *[System]* page.
- The *Restore Defaults* link was clicked to open the Satcom Console *[System - Restore Defaults]* page.
- General Configuration is a section inside the Satcom Console *[Installation - Circuit Switching]* page.

Section 5.6.4 and 5.6.6.2 have unique conventions.

## 2. REFERENCE DOCUMENTS

- [1] AC 43.13-1/2, Acceptable Methods, Techniques, and Practices – Aircraft Inspection, Repair and Alterations, U.S. Dept. of Transportation, FAA.
- [2] ARINC Specification 600-12, Air Transport Avionics Equipment Interfaces, November 10, 1998. Attachment 18, Page 64.
- [3] ARINC Specification 429P1-15, Mark 33 Digital Information Transfer System (DITS), Parts 1, 2 & 3, Aeronautical Radio Inc. Sept 1, 1995.
- [4] ARINC Characteristic 705-5, Attitude and Heading Reference System, Aeronautical Radio Inc., Apr 30, 1985.
- [5] ARINC Characteristic 704-7, Inertial Reference System, Aeronautical Radio Inc. March 19, 1999.
- [6] ARINC Characteristic 743A-4, GNSS Sensor, Aeronautical Radio, Inc., 27 Dec 2001.
- [7] ARINC Characteristic 741P1-9, Aviation Satellite Communication System, Part 1, Aircraft Installation Provisions, Aeronautical Radio Inc, Nov 1997.
- [8] RTCA/DO-160D, Environmental Conditions and Test Procedures for Airborne Equipment, RTCA, Inc. Dec 1997.
- [9] RTCA/DO-160E, Environmental Conditions and Test Procedures for Airborne Equipment, RTCA, Inc. Dec 2004.
- [10] RTCA/DO-160G, Environmental Conditions and Test Procedures for Airborne Equipment, RTCA, Inc. 2010.
- [11] RCTA/DO-178B, Software Considerations in Airborne Systems and Equipment Certification, RTCA. Inc. 1992
- [12] 862-A0059\_IM, HGA-6000 High Gain Antenna System Installation Manual
- [13] 862-A0043\_IM, HGA-7000 High Gain Antenna System Installation Manual,
- [14] 862-A0087\_IM, HGA-7001 High Gain Antenna System Installation Manual

- [15] 677-A0181\_IM, Aero IGA-5001, Installation Manual
- [16] 862-A0060\_IM, HGA-8000 High Gain Antenna System Installation Manual
- [17] 677-A0183\_OD, Aero SDU-7320, SwiftBroadband Satellite Data Unit, Outline Drawing
- [18] 677-A0188\_OD, Aero SDU-7330, SwiftBroadband Satellite Data Unit, Outline Drawing
- [19] 677-A0188-004\_OD, Aero SDU-7330, 4ch, Outline Drawing
- [20] 780-A0550\_OD, Aero SDU-7300 Configuration Module, Outline Drawing
- [21] 780-A0649\_OD, SBB SDU External CM holder assembly, Outline Drawing
- [22] 677-A0169\_OD, Aero HPA-7400, High Power Amplifier, Outline Drawing
- [23] 677-A0198\_OD, Aero HPA-7450, High Power Amplifier, Outline Drawing
- [24] 677-A0187\_OD, HLD-7260 High Power/Low Noise Amplifier and Duplexer, Outline Drawing
- [25] 862-A0100\_WD, SwiftBroadband SDU-7320/SDU-7330, Wiring Diagram
- [26] 862-A0118\_UM, SwiftBroadband User Manual
- [27] 862-A0119\_AM, SwiftBroadband Administrator Manual
- [28] 870-A0416\_PS, SwiftBroadband SDU-7330/7320 Product Specification
- [29] 677-A0002\_IM, Aero-M/I Antenna Installation Manual
- [30] 870-A0506\_ICD, SwiftBroadband SDU Monitoring and Control ICD
- [31] 677-A0187\_PS, SwiftBroadband HLD-7260 Product Specification
- [32] 677-A0169\_PS, HPA-7400 High Power Amplifier Product Specification
- [33] 677-A0198\_PS, HPA-7450 Product Specification

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## **3. WARNINGS**

### **3.1 Radiation**

During transmission this system can radiate microwave power from the antenna unit in any direction. High levels of radio frequency radiation are considered harmful to health. Although all countries have not agreed upon a single allowable limit, the American National Standards Institute (ANSI/IEEE C95.1-1999) recommends that any person in a controlled environment should not be exposed to radiation stronger than 5 mW/cm<sup>2</sup> at the frequencies used in this system. Accordingly, the operator of the system should ensure that no person should approach within 6.6 feet (2 meters) of the antenna when the system is transmitting, unless adequate screening is provided.

### **3.2 Power Cable Installation**

Care should be taken when modifying the power supply system of the aircraft to support the installation. All power cables should be correctly insulated and installed in accordance with normal aircraft safety notices. Failure to correctly install power cables could lead to injury or death.

### **3.3 System Cable Installation**

Care should be taken when planning the routing of cables to and from the system. The installation of these cables must not interfere with existing aircraft systems or make future interference a possibility. All cables must be correctly secured and insulated.

### **3.4 Hardware Installation**

The installation of the system hardware must not compromise the safety or integrity of the aircraft structure. Care must be taken to prevent any changes to vital aircraft components or structures when installing this system.

## 4. SWIFTBROADBAND (SBB) SYSTEM DESCRIPTION

The SwiftBroadband (SBB) system is a satellite based packet radio network operated by Inmarsat. The SBB system provides near-global coverage from 3 satellites in geostationary orbits. The satellites are 4<sup>th</sup> generation Inmarsat satellites. The locations are on the equator at longitudes 25E, 143.5E and 98W.

The SBB system uses 3GPP communication protocols, with an adaptation for the satellite air-interface, and as such it offers the same range of services as a modern cell-phone network.

Each satellite illuminates a part of the earth surface; this area is called the satellite footprint. Within this footprint, a terminal may be able to receive the global-beam of a satellite to acquire system almanac data. Within the global beam exists a number of smaller beams called regional beams, covering only a part of the footprint. Network registration and call-announcements are done in the regional beam that covers the terminals geographical location. Terminal data traffic (calls) takes place in narrow spotbeams, typically covering only a few hundred kilometres across, these spotbeams are formed by digital beamforming on the satellite and only exist when needed for traffic.

The terrestrial connection point of the SBB system is called the Satellite Access Station (SAS). The SAS connects the satellite system with terrestrial networks like the global Internet and the international Public Switched Telephone Network (PSTN). Addressing for data traffic uses global IP addressing, whereas PSTN calls are routed by using international dialling prefixes. The SBB system has the international dialling code +870 and all calls must therefore include international dialling prefixes.

### 4.1 Aeronautical Earth Station (AES) Components

The airborne components of the SwiftBroadband (SBB) system are called the Aeronautical Earth Station (AES). The AES consists of:

- Satellite Data Unit (SDU).
- Configuration Module (CM).
- High Power Amplifier (HPA).
- Duplexer/Low Noise Amplifier (DLNA).
- Antenna, either a High Gain (HGA) or an Intermediate Gain (IGA).
- Aircraft navigational data sources interface.
- Discrete Inputs from aircraft.
- User terminal equipment, e.g. telephone and computer equipment.

For single-modem installations the HPA and DLNA may be replaced by a single unit called an HLD (High power/Low noise amplifier and Diplexer).

The SDU is the master unit of the AES, providing modem and control functionality. Two variants of SDU are available, with the same functionality but different enclosure sizes: the SDU-7320 and the SDU-7330. The SDU controls the AES and allows user equipment to communicate over the satellite network to the SAS.

One CM must be used. It may be inserted into the SDU front panel or it may be fastened to the airframe and wired to the SDU rear connector. The CM contains all identification, configuration and installation specific data needed for AES operation.

The HPA and DLNA form the radio frequency (RF) interface between the SDU and antenna. For multi-modem operation the HPA-7400 or HPA-7450 and DLNA must be used, whereas the HLD-7260 may only be used for single-modem operation. In the HLD-7260 the functionality of the HPA and DLNA are combined into one compact unit.

The HPA amplifies the transmit RF signal generated by the SDU and feeds the signal through the DLNA to the antenna. The DLNA splits the receive and transmit signals and also amplifies the received signal before feeding it to the SDU.

The antenna must have a line-of-sight view of the satellite for the AES to connect to the SBB network; it will normally be installed on top of the fuselage or in the tail of the aircraft. Both HGA and IGA antennas provide signal directivity or 'gain'; meaning that they have a 'beam' that focuses on a part of the sky. The antenna beam must point towards a selected satellite before the AES can connect to the SBB network.

To point the antenna beam towards a satellite, the AES needs to know the location and attitude (heading, roll, and pitch) of the aircraft and the antenna installation angles on the aircraft. The AES must do Doppler frequency compensation to the transmit and receive signals and therefore needs aircraft velocity data. These data shall be provided at a fixed rate by navigational data sources on the aircraft.

All user equipment connects to the SDU. User equipment includes phones, PCs, routers and ISDN terminal equipment.

#### **4.1.1 SDU-7320/SDU-7330 Satellite Data Unit (SDU)**

The SDU-7320 is a single or <sup>2</sup>multi-modem SDU packaged in a 2 MCU ARINC-600 enclosure. The SDU-7320 multi-modem can contain a maximum of two modems. The SDU-7330 is a single or multi-modem SDU packaged in a 3 MCU ARINC-600 enclosure. The SDU-7330 can contain a maximum of four modems. The part numbers indicate the amount of modems by means of a dash number at the end of the part number. The 004 in the part number 677-A0188-004 designates a four-modem SDU-7330.

The SDU-7320 and SDU-7330 offer identical interfaces. The differences between the two are only their physical dimensions. The maximum possible data throughput is proportional to the number of modems present in the SDU.

The SDU provides the modem and control functionality of the AES. The control function of the SDU includes:

- Management and steering of antenna based on navigational data input via ARINC-429 or SRU<sup>3</sup> interfaces and optional use of internal GPS receiver.
- Management of HPA/DLNA or HLD.
- Management of configuration data stored in a Configuration Module (CM).
- Logging and storage of AES status and events.
- Management and loading of software upgrades in all the units of AES.
- Transmitter Mute (TX-MUTE) input, with configured functionality (see 5.10).
- User traffic management.

All user interfaces terminate in the SDU; the following interfaces are available:

- 2 x ISDN S/T Bus (Euro or NT1 protocols) for up to a total of 5 powered or 8 self-powered ISDN Terminals
- 4 x 10BaseT Ethernet ports (10 Mbps twisted pair) with Class-0 Power over Ethernet (PoE), limited to a total power of 16W
- 4 x Two-wire phone interfaces (POTS), maximum 2 phones per port and up to a total of 6 phones connected to the SDU.
- 1 x Serial Data Port (RS232) that may be used for the Monitor and Control Interface.
- Outputs for remote status LED panel and reset switch.

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<sup>2</sup> A multi-modem system refers to a two-modem SDU-7320 or a two- or four-modem SDU-7330.

<sup>3</sup> See section 19.





Figure 4-1: SDU-7330 and SDU-7320 Satellite Data Units

The SDU may be installed in a temperature-controlled pressurised environment or a non-temperature controlled, non-pressurized environment. Please refer to the document referenced in [28] for the technical specifications of the SDU-7320 and SDU-7330.

#### 4.1.1.1 Satcom Console

The Satcom Console is web-page-based interface to configure, control and monitor the AES. It is accessed via an SDU Ethernet port using any JavaScript<sup>4</sup> enabled web browser. See section 11 for instructions to connect to the Satcom Console.

#### 4.1.1.2 SDU Status LEDs and Front Panel Functions

The front panel of the SDU-7320 is shown in Figure 4-2. The behaviour and meaning of the SDU-7320/SDU-7330 Status LEDs are summarised in Table 4-1.

<sup>4</sup> JavaScript is a trademark of Sun Microsystems. JavaScript is a scripting language interpreted by most web browsers.

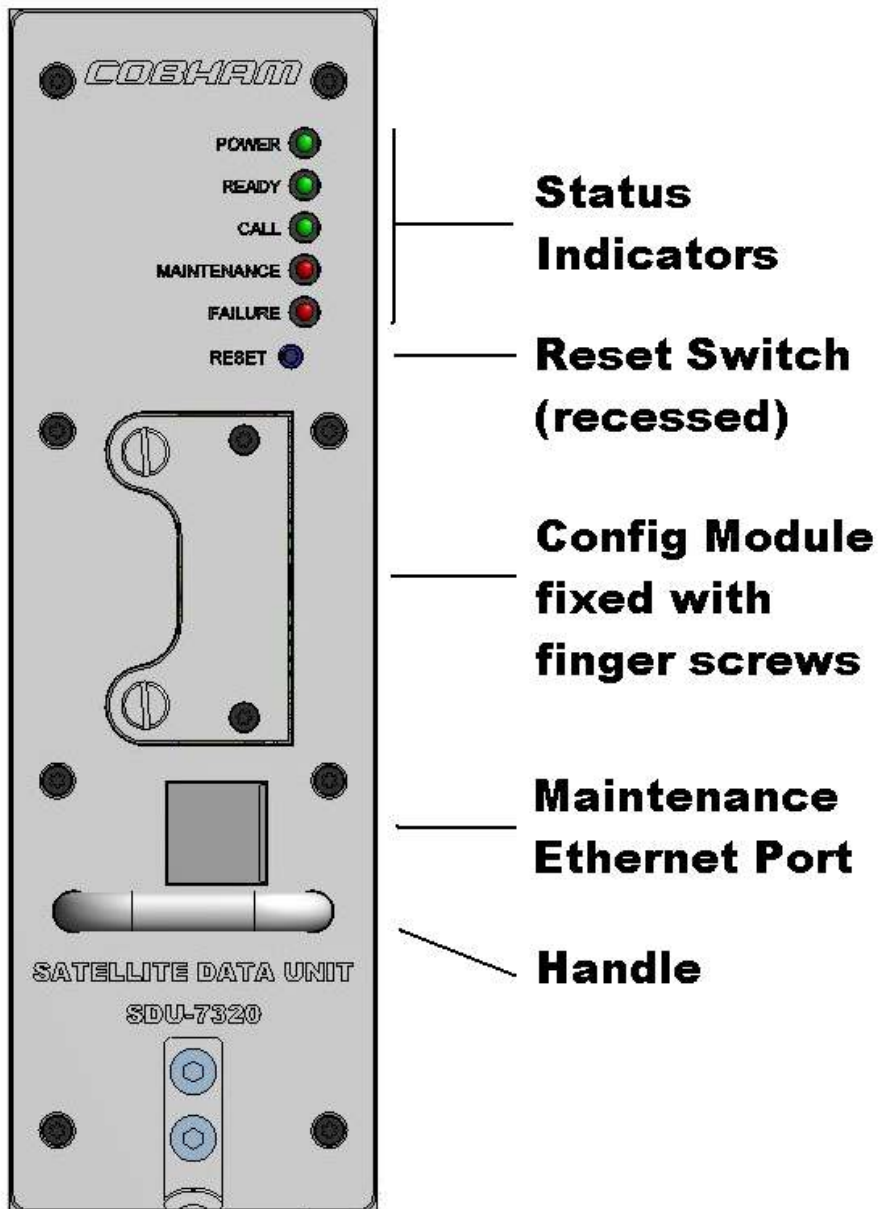


Figure 4-2: SDU-7320 front panel.

Table 4-1: SDU-7320/SDU-7330 LED Reference Table

| LED                | Colour | LED On                        | LED Slow Flash (0.5 Hz)                 | LED Fast Flash (5 Hz)  | LED Off                   |
|--------------------|--------|-------------------------------|---|------------------------|---------------------------|
| <b>POWER</b>       | Green  | SDU power is switched on      | Not Applicable                          | Not Applicable         | SDU power is switched off |
| <b>READY</b>       | Green  | Ready for call                | Software is initializing                | Not Applicable         | Not Applicable            |
| <b>CALL</b>        | Green  | Call in progress              | Call is being established or terminated | Not Applicable         | No call in progress       |
| <b>MAINTENANCE</b> | Yellow | Non-critical failure          | SDU service mode                        | Failure in another LRU | No non-critical failure   |
| <b>FAILURE</b>     | Red    | Critical SDU failure detected | Not Applicable                          | Not Applicable         | No failures present       |

If the MAINTENANCE or FAILURE LEDs are activated then maintenance action is required. If the MAINTENANCE LED is activated then the AES system logs must be inspected and appropriate action taken by qualified service personnel. If the FAILURE LED is activated the diagnostic file must be downloaded immediately and analysed to identify the failure. See section 11.7 for the details on how to perform the download. In the case where the nature of the failure does not make it possible to download the diagnostic file, the Satcom Terminal should be restarted and then the diagnostic file should be downloaded after the restart.

An SDU reset button is located on the front panel and may also be present on the SDU Remote Panel. The reset button is recessed into the front panel to avoid accidental activation. Use a pen or similar pointed object to press it. To reset the SDU press and hold the reset button for a minimum of 5 seconds, until the behaviour of the LEDs change. An SDU reset results in a reset of the complete AES. A system reset may also be performed by cycling the power using the circuit breaker.

The hatch-covered Ethernet connector may be used for maintenance and diagnostics of the SDU and the other AES components. The hatch must be slid to the left to insert a cable. The hatch is spring-loaded and will close when the cable is removed. The front panel Ethernet connection should be disconnected during flight; it may only be used while the aircraft is on the ground for maintenance and diagnostics purposes.

#### 4.1.1.3 Configuration Module (CM)

The Configuration Module (CM) contains installation-specific data and settings as well as identification and access codes for connecting to the satellite network. Identification, access codes and phone numbers of the AES are stored on the USIMs inside the CM. The CM is factory fitted with one USIM per SDU modem. For details regarding USIM replacement and provisioning see the document listed [27] - refer to the section titled "USIM ACTIVATION AND SERVICE PROVISIONING".



Figure 4-3: External Configuration Module holder.

See section 5.2.2 for the CM installation details.

**IMPORTANT:** If the SDU is replaced, the CM should remain on the aircraft. This ensures that the identification and installation parameters and telephone numbers of the AES remain unchanged and that the system will not require any re-commissioning or reconfiguration.

#### 4.1.1.4 Monitoring and Control Interface

The Satcom System may optionally be monitored and controlled via the serial RS232 or any Ethernet interface. The particular interface is selected on the *[System - SDU Monitor and Control]* page. The baud rate of the RS232 serial port setting of the Satcom System can be configured in the Satcom Console to match the baud rate of the controlling client. In order to alter the settings, the Satcom Console *[Installation - User Serial Port Settings]* page must be used. For a more detailed description of the Monitor and Control interface see document [30].

### 4.1.2 HPA-7400 and HPA-7450 High Power Amplifiers (HPA)

The HPA-7400<sup>5</sup> High Power Amplifier (HPA) is an RF power amplifier allowing multi-modem (to a maximum of two modems) operation together with a Type-F DLNA (e.g. DAU-7070) or single modem operation when used with a Modified Type-A DLNA (e.g. DAU-7060 or DAU-7050).

The HPA-7450 High Power Amplifier is an RF power amplifier allowing multi-modem operation together with Modified Type-A or Type-F DLNA. A Type-F DLNA must be used for the four-modem Satcom System variant.

Secondary functions of the HPA include providing regulated +28 VDC power to modem antennas via the SDU and monitoring the DLNA BITE output. The HPA is shown in Figure 4-4.

The HPA must be installed in a 2MCU ARINC 600 compatible tray, close to the DLNA (so that the cable loss from the HPA to the DLNA is not larger than 2dB) and to the antenna.

The HPA may be installed in temperature-controlled or non-temperature controlled environments that may be pressurized or non-pressurized. Please refer to the document referenced in [28] for the technical specifications of the HPA-7400 and the HPA-7450.



Figure 4-4: HPA-7400/7450 High Power Amplifier

The HPA-7400 and HPA-7450 are identical in appearance with the exception of markings.

<sup>5</sup> The HPA-7400 has been discontinued. Refer to section 18.

#### 4.1.2.1 HPA Status LEDs

The behaviour and meaning of the Status LEDs on the front panel of the HPA-7400/HPA-7450 are summarised in Table 4-2.

Table 4-2: HPA-7400/HPA-7450 LED Reference Table

| LED    | Colour | LED On                              | LED Slow Flash (0.5 Hz) | LED Fast Flash (5 Hz) | LED Off                              |
|--------|--------|-------------------------------------|-------------------------|-----------------------|--------------------------------------|
| POWER  | Green  | HPA DC power is switched on         | Not Applicable          | Not Applicable        | HPA DC power is switched off         |
| ACTIVE | Green  | Transmission of RF power is enabled | Not Applicable          | Not Applicable        | Transmission of RF power is disabled |
| ALARM  | Red    | HPA has detected a failure          | Not Applicable          | Not Applicable        | No HPA failures detected             |

### 4.1.3 Diplexer/Low Noise Amplifier (DLNA)

The Diplexer/Low Noise Amplifier (DLNA) is used together with the HPA-7400/HPA-7450. It separates and filters the received and transmitted RF signals and it amplifies the received signal.

The DLNA may be installed in a temperature-controlled pressurised environment or a non-temperature controlled, non-pressurized environment. Coaxial cable losses between DLNA and Antenna should be minimised to achieve best possible geographical coverage of the AES.

The BITE status of the DLNA may be monitored by the HPA-7400/HPA-7450 or by a suitable ARINC741/781 antenna.

There are two alternatives for the type of DLNA, e.g.:

- Type F DLNA (e.g. DAU-7070)
- Modified Type A DLNA (e.g. DAU-7060 or DAU-7050)

The type of DLNA must be selected as part of the AES configuration setup. A Type F DLNA will in some situations offer improved multi-modem AES performance over a Modified Type A DLNA because it allows the HPA-7450 to operate at a higher transmit power level.



Figure 4-5: DAU-7060 Diplexer/Low Noise Amplifier, as an example

#### 4.1.4 HLD-7260 High Power/Low Noise Amplifier and Diplexer (HLD)

The HLD-7260 High Power/Low Noise Amplifier and Diplexer (HLD) is a combined HPA and DLNA unit in compact physical outline for single modem operation.

The HLD must be installed as close as possible to the antenna with an associated cable loss not larger than 0.5dB. It may be installed in a non-temperature controlled, non-pressurized environment inside the fuselage. Please refer to Appendix A for the technical specifications of the HLD-7260.

##### 4.1.4.1 HLD-7260 Status LEDs

The behaviour and meaning of the Status LEDs on the HLD are summarised in Table 4-3.

Table 4-3: HLD-7260 LED Reference Table

| LED     | Colour | LED On                              | LED Slow Flash (0.5 Hz) | LED Fast Flash (5 Hz) | LED Off                              |
|---------|--------|-------------------------------------|-------------------------|-----------------------|--------------------------------------|
| POWER   | Green  | HLD DC power is switched on         | Not Applicable          | Not Applicable        | HLD DC power is switched off         |
| ACTIVE  | Green  | Transmission of RF power is enabled | Not Applicable          | Not Applicable        | Transmission of RF power is disabled |
| FAILURE | Red    | HLD failure detected                | Not Applicable          | Not Applicable        | No HLD failures detected             |



Figure 4-6: HLD-7260 High Power/Low Noise Amplifier and Diplexer



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#### 4.1.5 High Gain and Intermediate Gain Antenna (HGA and IGA) Options

The choice of either HGA or IGA type antenna determines the maximum user data traffic throughput of the AES. Using an HGA will enable a higher throughput than can be achieved when using an IGA.

The antenna options for the AES include:

- HGA-6000, mechanically steered tail mount ARINC 741 compatible HGA, with optional RF input from an external active GPS antenna.
- HGA-6500, mechanically steered ARINC-741/781 compatible HGA, optimized for helicopter installation.
- HGA-7000, a low profile phased array fuselage mount HGA with active GPS antenna.
- HGA-8000<sup>6</sup>, a low profile disc shaped phased array HGA with active GPS antenna designed for mounting on C130 hatches and helicopters.
- HGA-7001, a low-profile, phased-array, fuselage-mount, ARINC-741/781 compatible HGA.
- IGA-5001 Intermediate Gain Antenna, Low profile phased array IGA with active GPS antenna.
- Mini-M/Aero-I/IGA-5006 Intermediate Gain Antenna, mechanically steered with integrated navigation sensors as well as an active GPS antenna, capable of operating in self-steered or non-self-steered pointing mode.
- Any other ARINC 741/781 compatible HGA or IGA.

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<sup>6</sup> The HGA-8000 has been discontinued. Refer to section 19.

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## 5. INSTALLATION OVERVIEW AND PLANNING

### 5.1 Installation Overview

The installation of the AES involves the following steps:

- Planning the installation.
- Performing the installation.
- Service activation.
- Testing the installation.
- Interference Tests while stationary.
- Interference Tests in flight.

### 5.2 Installation Planning

The AES installation planning should include considerations of the following:

- Location of antenna relative to existing and planned future antenna locations.
- Location of DLNA and HPA (or HLD), air-flow and relative location to antenna.
- Location of SDU, air-flow and access.
- Location of user equipment.
- Cable routing through compartment dividers
- Configuration Module location options.
- Navigational Data Sources.

#### 5.2.1 AES Antenna Location

Please refer to the relevant antenna installation manual.

The AES and Iridium antennas should be separated as far as possible. It may, however, not be possible to avoid interaction and an SBB/Iridium service selection switch arrangement may be needed as part of the installation.

#### 5.2.2 SDU-7320/SDU-7330 and CM Installation

The SDU-7320 is installed in a 2-MCU ARINC-600 tray and the SDU-7330 in a 3-MCU ARINC-600 tray. Bonding resistance should be according to standard practice for the specific aircraft.

Even though the SDU will protect itself against overheating, installation of the SDU in a location with forced air flow is recommended if the ambient temperature of the installation environment is likely to be above +55 °C.

The 4-modem SDU-7330 requires forced air cooling. The installation must provide forced ventilation through the SDU to sustain airflow at a minimum rate of 18 CFM where the flow resistance is 40 Pa. The preferred flow rate is 26 CFM resulting in a pressure drop of 70 Pa

The SDU also makes provision to power and control an external fan for cooling air. The fan control voltage supplied by the SDU is 30 VDC with a maximum current of 1.2 A (including in-rush current).

The Configuration Module (CM) may be installed in one of two alternative locations; it can either be inserted into the front of the SDU, or it can be fixed to the airframe and wired to the SDU rear connector. It is recommended that the latter installation option is used, so that the CM can be fixed to the airframe. In both installation cases the CM is fixed in place with two finger screws.

A CM wired to the rear connector will take priority over a CM inserted in the front panel. A warning will be raised if two CMs are simultaneously connected to one SDU.

If the CM is wired from the SDU rear connector the following shall be adhered to:

1. A blind-plate<sup>7</sup> shall be installed over the SDU front-panel CM slot.
2. Maximum cable length between SDU and CM shall be 1.4 m.
3. CM shall be mounted in a cradle fixed to airframe.
4. CM orientation should have cable entry from bottom to ensure that water dripping onto or condensing on the cable does not enter the CM.

### 5.2.3 DLNA Installation

The DLNA must be located as close as possible to the antenna (with the DLNA to antenna cable loss not larger than 0.5dB) using the highest grade coaxial cable (Please refer to section 5.8 for details). The DLNA shall be installed in a location compatible with its DO-160 environmental string. The DLNA does not require cooling.

Provision should be made for a minimum of one DLNA mounting hole to be electrically bonded to the airframe. The four mounting holes, diameter 0.22" (5.7 mm), are masked off to a diameter of 12 mm to ensure adequate electrical contact for grounding purposes. Bonding resistance should be according to standard practice for the specific aircraft.

DLNA BITE may be monitored by the HPA or by an ARINC 741/781 compatible antenna. If the DLNA BITE will be monitored by the HPA, then the DLNA and HPA should preferably be connected to the same circuit breaker. This may prevent spurious DLNA BITE alarms when the HPA is powered while the DLNA is still switched off. The same considerations apply when using an ARINC 741/781 compatible antenna.

### 5.2.4 HLD-7260 Installation

The HLD-7260 must be located close to the antenna (with a cable loss-between the antenna and the DLNA not larger than 0.5 dB) using highest grade coaxial cable; please refer to section 5.8 for details. The HLD shall be installed in a location compatible with the DO-160E environmental string; it may be installed in a non-pressurized and non-temperature controlled location.

Provision should be made for a minimum of one HLD-7260 mounting hole to be electrically bonded to the airframe. The four mounting holes, diameter 0.22" (5.7 mm), are masked off to a diameter of 12 mm to ensure adequate electrical contact for grounding purposes. Bonding resistance should be according to standard practice for the specific aircraft.

A breather mechanism is located at the bottom of the unit; therefore the HLD should not be mounted upside down.

The HLD requires cooling. The self-heating power during standby is approximately 7 W and during a 100% duty-cycle transmission it is typically up to 40 W. The self-heating power must be dissipated for continuous operation; it can be dissipated through the mounting structure and/or through air circulation. If the HLD temperature becomes too high, transmissions will be terminated and inhibited until the temperature falls below a threshold of 90° C. A transmission shut-down due to over-temperature will be recorded in the SDU logs.

In cases where the HLD will be located where no airflow is available, or in a small compartment where the same air re-circulates, then structural cooling must be used to ensure continuous HLD operation. The thermal resistance of the HLD-7260 mounting base is 0.4 K/W, i.e. mounted on a flat metal plate with no airflow around the unit.

In the case where the HLD will be located where no structural cooling is available, then cooling from air-flow is required to ensure continuous HLD transmit operation. For convection cooling the HLD should always be oriented to maximise cooling by air-flow with the heat-sink ribs oriented vertically. The thermal resistance for the heat-sink is 0.9 K/W, with the HLD-7260 wall mounted with heat-sink ribs positioned vertically and without any structural cooling.

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<sup>7</sup> The blind-plate is delivered as part of the CM installation bracket (Omniplus part no: 478-A2412).

An optional fan-module (Omnipless part-number 780-A0631) is available from Cobham Satcom. If insufficient cooling is available, the fan-module may be used to create forced air-flow. The fan-module is controlled by the HLD and will only be operated when required. The fan module operation will form part of the HLD BITE reporting. The thermal resistance will be 0.6 K/W when the fan module is used.

To install the fan-module, remove the Fan Blanking plate by unscrewing 2X M2.5 countersunk screws and removing the part. Attach the fan-module in the fan module port (see [24]). Utilize the 2 countersunk screws provided with the fan-module together with a thread fastener to secure. Once installed, the Satcom System HLD fan presence must be configured using the Satcom Console [*Installation – Fan Settings*] page (the same as detailed in section 5.2.5). After having been configured, the fan module can be tested by using the Manual Fan Control button provided in the Fan Status and Control pane.

**NOTE:** Please contact Cobham Satcom for the installation suitability of using the fan-module as well as applicable HLD-7260 software version.

### 5.2.5 HPA-7400/HPA-7450 Installation

The HPA is installed in a 2-MCU ARINC 600 tray and requires airflow for cooling. The tray should be located away from any obstructions that may restrict the airflow.

Provision is made for the HPA-7400/HPA-7450 to be electrically bonded to the airframe through the tray. Bonding resistance should be according to standard practice for the specific aircraft. Refer to Section 20 for further product specifications.

The installation must provide forced ventilation through the HPA to sustain airflow at minimum rate of 23 CFM where the flow resistance is 65 Pa.

The HPA makes provision to control an external fan for cooling air. The voltage supplied by the HPA for fan control output is 26VDC with a maximum current of 3.5 A (including in-rush current).

In order to control an externally mounted fan it must be configured on the [*Installation - Fan Settings*] page. Incorrect fan configuration may result in HPA info and warning events being logged by the SDU.

After installation and configuration, the fan module may be tested by pressing the Manual Fan Control button on the Fan Status and Control pane.

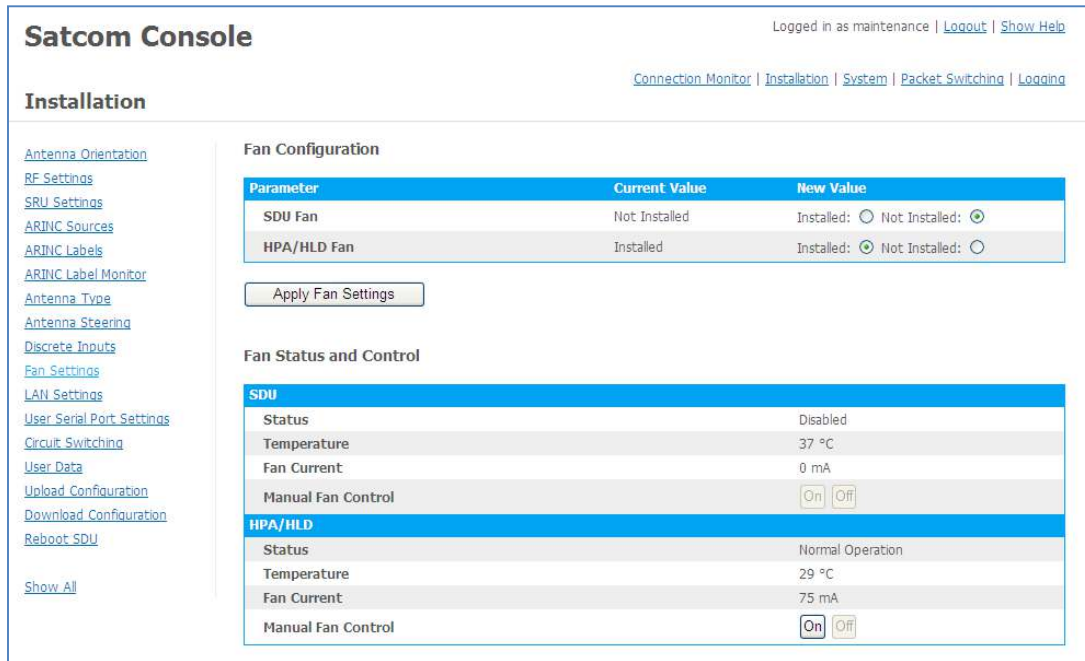


Figure 5-1: HPA/HLD Fan configuration

### 5.3 General Electrical Requirements

#24 AWG Wire may be used for all wires excluding power lines and RF cables, unless specified otherwise. For power lines connected to the SDU and HPA the wire gauges should be chosen according to the requirements in Table 6-3. However, the installer is responsible for determining the appropriate wire gauge to complement the length of the cable run to ensure that the specified maximum cable losses do not exceed those indicated in this manual.

Keep the interconnect cables away from circuits carrying heavy currents, pulse transmitting equipment and any other potential sources of interference.

Use shielded twisted-pair wiring for all balanced connections (RS-422, Ethernet, ISDN, POTS Phones, ARINC-429 and MIL-1553). The characteristic impedance of shielded twisted-pair cables must be nominal 100 Ohm. Connect shield grounds to the marked chassis pins provided in the connectors.

The characteristic impedance of coaxial cables must be 50 Ohm and care should be taken to ensure allowed signal loss limits are not exceeded. Refer to section 5.8 for the limitations on allowed signal losses.

### 5.4 Coaxial Cable Torqueing and VSWR Limits

It is recommended that the RF connectors be tightened using a torque wrench (listed in section 6) to torque the coaxial connectors to the values recommended in section 8. It is not recommended to only finger-tighten connectors. To prevent contamination prior to connecting the RF coaxial cables between LRUs, the LRU and tray RF connectors should have the dust caps left on. Prior to installation the dust caps should be removed and the connector should be cleaned with an appropriate applicator and cleaning agent, such as isopropyl alcohol.

The VSWR (Voltage Standing Wave Ratio) limits for cable assemblies shall be better than 1.22 maintaining a Return loss > 20 dB.

### 5.5 Power Supply Routing

The SDU, HPA, DLNA (or HLD) are powered by the +28 VDC power supply of the aircraft.

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It is recommended that the HPA and DLNA share the same circuit breaker if the HPA is wired to monitor the BITE status of the DLNA. This will prevent false DLNA BITE failures in the event that the HPA is powered while the DLNA is switched off. It is important that the circuit breaker rating is not higher than the connector pin rating or the wire gauge appropriate to the pin.

Power to the HGA-7000/8000, IGA-5001 and optionally the HGA-6000/6500 antenna is supplied from the HPA-7400/7450 or the HLD-7260. The power to these antennas is supplied via the same coaxial cable used for the antenna modem control signals (see section 5.12). For other antenna types please refer to the respective installation manuals.

### 5.5.1 Operating Voltages

For the SDU-7320, SDU-7330, HPA-7400, HPA-7450 and HLD-7260:

- Minimum Operating Voltage: 22 V DC
- Maximum Operating Voltage: 30.3 V DC

### 5.5.2 System Power Requirements

All power ratings provided in this section are specified for 28 VDC installations. For installations using different supply voltages the installer should recalculate the currents and make the relevant wire gauge choices based on the new current requirements.

#### 5.5.2.1 SDU Power Consumption

Table 5-1: Number of Modems vs. Power Requirements

|                         | <b>1 Modem</b>         | <b>2 Modems</b>        | <b>4 Modems</b>        |
|-------------------------|------------------------|------------------------|------------------------|
| SDU Power               | 23 W@28 Vdc=0.82 A     | 33 W@28 Vdc=1.18 A     | 53 W@28 Vdc=1.89 A     |
| 4x ISDN                 | 12 W                   | 12 W                   | 12 W                   |
| PoE (max)               | 16 W                   | 16 W                   | 16 W                   |
| Power consumption (max) | 51 W                   | 61 W                   | 81 W                   |
| In-rush current         | 12 A on 1/2.2 ms pulse | 12 A on 1/2.2 ms pulse | 12 A on 1/2.2 ms pulse |

#### 5.5.2.2 Amplifier Power Consumption

Table 5-2: Amplifier power consumption

| <b>HPA-7450 / HPA-7400</b> |                         |
|----------------------------|-------------------------|
| Maximum Power consumption  | 300 W @ 28 Vdc = 10.7 A |
| Power (standby mode)       | 8 W                     |
| In-rush current            | 8.9 A                   |

- The power consumption excludes any additional DC power consumption if the HPA is used to power an HGA or IGA.
- The power consumption of the HPA excludes power consumption of a fan assembly.
- The power consumption of the SDU excludes power consumption of any externally mounted cooling fans powered by the SDU in the case of a four modem installation.
- Power consumption is dependent on various system parameters e.g.: antenna gain, intermodulation requirements, etc.
- Maximum Power consumption is a worst case condition.

#### 5.5.2.3 HLD Power Consumption

Table 5-3: Amplifier power consumption

| <b>HLD-7260</b>           |   |
|---------------------------|---|
| Maximum Power consumption | 50 W @ 28 Vdc = 1.78 A                  |
| Power (standby mode)      | 7 W                                     |
| In-rush current           | 28 A on a 80/160 $\mu$ s pulse waveform |

- The power consumption excludes any additional DC power consumption if the HLD is used to power an HGA or IGA.
- Power consumption is dependent on various system parameters e.g.: antenna gain, intermodulation requirements, etc.
- Maximum Power consumption is a worst case condition.

## 5.6 Use of Navigation Data Sources

### 5.6.1 Navigation Data Sources

The AES requires aircraft attitude, position and velocity data to operate. Position and velocity data are required for transmitter timing and Doppler frequency offset compensation. Position and heading data are required for antenna pointing.

Possible sources of aircraft attitude data to the SDU:

- Aircraft Inertial Reference System (IRS).
- Aircraft Attitude and Heading Reference System (AHRS).
- Cobham Satcom SRU-7200<sup>8</sup> Satcom Reference Unit (SRU) and MSU-7250 Magnetic Sensor Unit (MSU).
- Mini-M/Aero-I/IGA-5006 antenna operated in self-steering mode.

Possible sources of aircraft position and velocity data to the SDU:

- Aircraft IRS.
- Aircraft GPS receiver with ARINC 743A compatible data output on an ARINC-429 interface.
- GPS receiver internal to the SDU, requiring a GPS RF signal from an active GPS antenna<sup>9</sup>.
- Aircraft pressure altitude.

These different options are summarised in Table 5-4.

Table 5-4: Source of aircraft position data for different combinations of attitude sensors and antennas

| Attitude Sensor                                    | Antenna and active GPS antenna configuration  |   |   |
|--|---|---|---|
|  | HGA/IGA with built in active GPS antenna  | ARINC 741/781 HGA/IGA only                  | ARINC 741/781 HGA/IGA and additional active GPS antenna |
| AHRS   | SDU's GPS receiver  | ARINC 743A-4 [6]<br>Compatible GPS Receiver | SDU's GPS receiver                                      |
| IRS  | IRS provides position data.<br>GPS based position data is recommended when available. | ARINC 743A-4 [6]<br>Compatible GPS Receiver | SDU's GPS receiver                                      |
| Aero Mini-M / Aero-I / IGA-5006 navigation sensors | SDU's GPS receiver  | Not applicable                              | Not applicable  |

Different system configurations using the alternative sources of aircraft attitude, position and velocity data are shown in the wiring diagrams. It is strongly recommended to use GPS based position data. The use of GPS altitude information is recommended, rather than pressure altitude information, where possible.

The relevant ARINC-429 source(s) must be configured using the *[Installation – ARINC Sources]* page. Each source may be configured to be one of the following: *Filtered, Disabled* or *Unfiltered*.

<sup>8</sup> The MSU-7250 and SRU-7200 are discontinued products. Refer to section 19.

<sup>9</sup> This can be from an HGA or IGA with built in active GPS antenna (e.g. HGA-7000, HGA-8000, or IGA-5001, Aero Mini-M/Aero-I/IGA-5006) or from an external active GPS antenna.



Use of the *Unfiltered* option should only be temporary in order to determine the labels or maximum label rates present on the ARINC-429 interface, if not already known. The intended mode of operation is *Filtered* mode.

The Filtered mode limits the number of labels per second used by the AES to steer the antenna. The Filter will limit the rate of each label individually to 8 Words per seconds (WPS), which is adequate for the SDU. Unused label types are deleted. The Filtered option prevents unused labels generating ARINC-429 errors in the logs, allowing more effective detection of ARINC-429 errors.

ARINC-429 labels to be used in the specific installation must be configured using the *[Installation- ARINC labels]* page.

### 5.6.2 Configuring ARINC-429 labels on the Satcom System

Each of the ARINC-429 data labels must be *Allowed* or *Blocked* by using the *[Installation- ARINC labels]* page. Labels that are blocked will not be used by the SDU.

Standard label sets supplied by the SRU-7200, and most IRS/AHRS equipment, can be allowed using the supplied quick configuration buttons at the bottom of the ARINC-429 label list. These may be different to those available on the aircraft and should be verified.

Labels that are allowed must comply with ARINC Specification 429P1-15, ARINC Characteristic 704-7 and ARINC Characteristic 705-5 (see the following documents [4][5][3]). Please consult Cobham Satcom if the devices available do not meet the specification. The AES may still perform adequately even if the accuracy and number of output words per second is less than required by the specification.

### 5.6.3 Using SRU-7200/MSU-7250 Data

The SRU-7200 Satcom Reference Unit (SRU)<sup>10</sup> and MSU-7250 Magnetic Sensor Unit (MSU) together with a GPS data source can provide all the navigation data required by the SDU. It is critical that the MSU is installed in a suitable location on board the aircraft; please refer to the HGA-7000 Installation Manual [13] for details.



Figure 5-2: SRU-7200 Satcom Reference Unit and MSU-7250 Magnetic Sensor Unit

<sup>10</sup> The MSU-7250 and SRU-7200 are discontinued products. Refer to section 19.

### 5.6.4 ARINC-429 label sets

Table 5-5 contains ARINC-429 input label sets that can be configured in the Satcom System. Input sets designated by "(Dx)" with x taking the values 1 to 5 represent Satcom System Internal GPS data. The Input set "(P)" denotes Inmarsat Network time and is received by the Satcom terminal in SwiftBB signalling messages from the RNC.

Table 5-5: Position - Hybrid, GNSS and IRS inputs

| Input sets  | Label #  | Description                     | <sup>11</sup> Update rate | Mandatory(M)/Optional(O) |
|-------------|--|---------------------------------|---------------------------|--------------------------|
| A           | 254  | Hybrid Latitude                 | 1                         | M                        |
|             | 255  | Hybrid Longitude                | 1                         | M                        |
|             | 256  | Hybrid Latitude Fine            | 1                         | O                        |
|             | 257  | Hybrid Longitude Fine           | 1                         | O                        |
| B           | 110  | GNSS Latitude, Autonomous       | 1                         | M                        |
|             | 111  | GNSS Longitude, Autonomous      | 1                         | M                        |
|             | 120  | GNSS Latitude Fine, Autonomous  | 1                         | O                        |
|             | 121  | GNSS Longitude Fine, Autonomous | 1                         | O                        |
|             | 101  | GNSS HDOP                       | 1                         | M                        |
|             | 102  | GNSS VDOP                       | 1                         | M                        |
|             | 273  | GNSS Sensor Status              | 1                         | O                        |
| C           | 310  | Present Position - Latitude     | 1                         | M                        |
|             | 311  | Present Position - Longitude    | 1                         | M                        |
| (D1 and D2) | Latitude from internal GPS receiver;<br>Longitude from internal GPS receiver |                                 |                           | M                        |

Table 5-6: Altitude - Hybrid, GNSS/IRS altitude inputs

| Input sets | ARINC-429 label                     | Description   | Update rate | Mandatory(M)/Optional(O) |
|------------|-------------------------------------|---|-------------|--------------------------|
| E          | 261 or 076                          | Hybrid Altitude; GNSS Altitude, Autonomous                                      | 1           | M                        |
| F          | 370 <sup>12</sup> or 076 or 361     | GNSS Height Above WGS84 Ellipsoid; GNSS Altitude, Autonomous; Inertial Altitude | 1           | M                        |
| (D3)       | Altitude from internal GPS receiver |   |             |                          |

Table 5-7: Attitude and Heading inputs

| Input sets | ARINC-429 label | Description | Update rate | Mandatory(M)/Optional(O) |
|------------|-----------------|-------------|-------------|--------------------------|
| G          | 324             | Pitch Angle | 10          | M                        |
|            | 325             | Roll Angle  | 10          | M                        |

<sup>11</sup> All rates are indicated per second.

<sup>12</sup> For aircraft receiving hybrid inertial/GNSS inputs (label-set A) ARINC label 370 (see label-set F) should not be used as it may also be defined as acceleration.

|  |                   |   |    |   |
|--|-------------------|---|----|---|
|  | 314 or 132 or 320 | <sup>13</sup> True Heading, Hybrid True Heading, Magnetic Heading | 10 | M |
|--|-------------------|---|----|---|

The antenna steering performance will be improved if the following data labels are also present:

Table 5-8: Steering performance improvement inputs

| Input sets | ARINC-429 label | Description         | Update rate | Mandatory(M)/Optional(O) |
|------------|-----------------|---------------------|-------------|--------------------------|
| H          | 336             | Pitch Attitude Rate | 10          | O                        |
|            | 337             | Roll Attitude Rate  | 10          | O                        |

The IRS must output at least one of the following sets of velocity labels to determine Doppler Shift (in order of preference) in conjunction with position data:

Table 5-9: Velocity inputs

| Input sets | ARINC-429 label            | Description                       | Update rate | Mandatory(M)/Optional(O) |
|------------|----------------------------|-----------------------------------|-------------|--------------------------|
| I          | 266                        | Hybrid North-South Velocity       | 1           | M                        |
|            | 267                        | Hybrid East-West Velocity         | 1           | M                        |
|            | 345                        | Hybrid Vertical Velocity          | 1           | O                        |
| J          | 137                        | Hybrid Track Angle True           | 1           | M                        |
|            | 175                        | Hybrid Ground Speed               | 1           | M                        |
|            | 345                        | Hybrid Vertical Velocity          | 1           | O                        |
| K          | 366                        | North-South Velocity              | 1           | M                        |
|            | 367                        | East-West Velocity                | 1           | M                        |
|            | 365                        | Inertial Vertical Velocity        | 1           | O                        |
| L          | 312                        | Ground Speed                      | 1           | M                        |
|            | 313                        | Track Angle True                  | 1           | M                        |
|            | 365                        | Inertial Vertical Velocity        | 1           | O                        |
| M          | 103                        | GNSS Track Angle True, Autonomous | 1           | M                        |
|            | 112                        | GNSS Ground Speed, Autonomous     | 1           | M                        |
|            | 165                        | GNSS Vertical Speed, Autonomous   | 1           | O                        |
|            | 273                        | GNSS Sensor Status                | 1           | O                        |
| (D5)       | Internal GPS velocity data |                                   |             |                          |

In the absence of any of the above sets of ARINC-429 data, Doppler calculations will be based on internal Satcom System internal GPS data (D5 in Table 5-11).

<sup>13</sup> If both True Heading and Magnetic Heading are available, then True Heading will be used. If Magnetic Heading is used, verify Date and Time inputs as per Table 5-10.

Date and Time must be obtained from one of the following input sets:

Table 5-10: Date and time inputs

| Input sets | ARINC-429 label                                   | Description | Update rate | Mandatory(M)/Optional(O) |
|------------|---|-------------|-------------|--------------------------|
| N          | 074 or 140  | UTC         | 1           | M                        |
|            | 260   | Date        | 1           | M                        |
| O          | 150 or 125  | UTC         | 1           | M                        |
|            | 260   | Date        | 1           | M                        |
| (D4)       | Internal GPS date and time data                   |             |             |                          |
| (P)        | Inmarsat Network date and time data <sup>14</sup> |             |             |                          |

When using Magnetic Heading, Antenna Steering requires date and time to determine magnetic declination therefore Inmarsat Network date and time (Input set (P)) cannot be used. In such cases the Satcom System will remain in a “waiting for steering” state.

### 5.6.5 Internal GPS

See section 5.6.1 regarding the AES requirements for the availability of Satcom System internal GPS data. Even if the internal GPS data is available to the Satcom System (GPS patch antenna connected and lock received), the decision to use the values are made internally to the Satcom System and depends on the other sources of position and time wired and configured in the Satcom System.

The internal GPS receiver provides the following position and time data:

Table 5-11: Internal GPS data (non-exhaustive list)

| Satcom System Internal GPS | Description                              |
|----------------------------|--|
| D1                         | Latitude from internal GPS receiver      |
| D2                         | Longitude from internal GPS receiver     |
| D3                         | Altitude from internal GPS receiver      |
| D4                         | Date and Time from internal GPS receiver |
| D5                         | Velocity                                 |

If date and time is not provided via the ARINC 429 labels or via the internal GPS receiver, the Satcom System will retrieve date and time information from the Inmarsat Network, specifically the Global Beam.

### 5.6.6 Configuring for Navigational sources input

The subsections below demonstrate combinations of external ARINC-429 input word sets and alternative sources required to steer the Satcom System antenna with the required accuracy.

The SDU requires valid (SSM=Normal) ARINC-429 data labels for aircraft position, altitude, attitude, heading, velocity, date and time from an IRS to steer the antenna. This data can be valid external ARINC-429 data labels or originate from the SDU’s internal GPS.

<sup>14</sup> Inmarsat Network date and time data is only received when the satellite is acquired. In the absence of any time sources - Inmarsat Network time will be used.

Conventions used in the following subsections:

- Capitalized letters A, B, C, E, F, G, H, I, J, K, L, M, N and O refer to ARINC-429 word sets. The sets are exhaustively listed in section 5.6.4.
- Capitalized letter D followed by an index ranging between 1 and 5 - refer to data used from the SDU internal GPS receiver (see section 5.6.5).
- If more than one label is listed in a particular table cell (see Input Set "E" in Table 5-6), it should be interpreted as follows: "In absence of label 261 use label 076", thus decreasing priority from left to right.

**5.6.6.1 Configuring for IRS data**

At least one label set in each table listed in section 5.6.4 (with the exception of Table 5-8) must be configured as inputs to the Satcom System to successfully steer an antenna.

Table 5-12 shows an example of a complete selection of ARINC-429 label sets required to successfully steer the Satcom System antenna.

Table 5-12: IRS Label configuration example

| Data type             | Table reference | <sup>15</sup> label sets |
|-----------------------|-----------------|--------------------------|
| Position              | Table 5-5       | A                        |
| Altitude              | Table 5-6       | E                        |
| Attitude and Heading  | Table 5-7       | G                        |
| Velocity              | Table 5-9       | I                        |
| Steering improvements | Table 5-8       | H                        |
| Date and Time         | Table 5-10      | D4                       |

It is strongly recommended that the position data is GPS based rather than inertia based. If no internal GPS data is required, the SDU does not require a GPS RF signal from an active GPS antenna. In such cases label set "N" may then be used in place of "D4" in the example configuration shown in Table 5-12. Without label set "N" configured, time will be derived from the BGAN Global Beam - see section 5.6.4.

**5.6.6.2 Configuring for AHRS Data**

The following configuration examples shown in Table 5-12 demonstrates combinations of external ARINC-429 inputs (or alternative sources) required to be configured by the Installer in order for the Satcom System to steer the antenna with the required accuracy.

Table 5-13: AHRS Label configuration example

| Data type             | Table reference | <sup>16</sup> label sets |
|-----------------------|-----------------|--------------------------|
| Position              | Table 5-6       | D1 and D2                |
| Altitude              | Table 5-7       | D3                       |
| Attitude and Heading  | Table: 5-14     | G                        |
| Velocity              | Table 5-9       | D5                       |
| Steering improvements | Table 5-15      | HQ                       |
| Date and Time         | Table 5-10      | D4                       |

The SDU requires the following valid (SSM=Normal) ARINC-429 data labels from an AHRS to steer the antenna:

<sup>15</sup> May also be Internal GPS data, indicated as "D4" in "Date and Time" row.

<sup>16</sup> May also be Internal GPS data, indicated as "D[1-4]" in the example.

Table: 5-14 AHRS inputs

| Inputs | ARINC-429 label | Description      | Update rate | Mandatory(M)/Optional(O) |
|--------|-----------------|------------------|-------------|--------------------------|
| G      | 324             | Pitch Angle      | 10          | M                        |
|        | 325             | Roll Angle       | 10          | M                        |
|        | 320             | Magnetic Heading | 10          | M                        |

The antenna steering performance will be improved if the following optional attitude rates are present:

Table 5-15: ADHRS related steering performance improvement inputs

| Inputs | ARINC-429 label | Description         | Update rate/s | Mandatory(M)/Optional(O) |
|--------|-----------------|---------------------|---------------|--------------------------|
| H      | 336             | Pitch Attitude Rate | 10            | O                        |
|        | 337             | Roll Attitude Rate  | 10            | O                        |

An AHRS must either be used in combination with an ARINC-743A compatible GPS receiver system, or in combination with the GPS receiver internal to the SDU to obtain the position and speed data required by the SDU.

### 5.6.6.3 Configuring for Antenna Data

If an ARINC-741/781 antenna is used, the following labels should be used:

- "144 Antenna Status Word",
- "350 Antenna Maintenance Word"
- "356 Antenna Configuration Word" (ARINC-781 only)

### 5.6.7 Monitoring configured ARINC-429 Data

Received ARINC-429 labels can be monitored using the ARINC-429 Label Monitor. See the *[Installation- ARINC Label Monitor]* page. The ARINC-429 data is shown in its interpreted form and should be verified to ensure that the data is valid, is without parity errors, and is being received at an acceptable rate.

The labels displayed will be the labels used by the SDU. All labels that are blocked by the filter, or which arrive at a port which is disabled, will not be shown and will not be used by the SDU.

## 5.7 Antenna Alignment

The alignment of the antenna relative to the aircraft must be accurately determined and entered into the AES configuration via the Satcom Console *[Installation – Antenna Orientation]* page. It is recommended that these angles be measured and recorded before the antenna is mounted on its adaptor/mounting plate as it may be difficult to measure these angles once the antenna is in place. Please refer to the relevant antenna’s installation manual.

Antenna alignment can be measured with respect to the aircraft’s axis. If the angles are measured with respect to the aircraft’s longitudinal and lateral axis the Aircraft Orientation should be set to zero.

If the angles are measured with respect to the aircraft’s orientation the aircraft’s pitch and roll values should be entered. The SDU will automatically calculate the difference between the angles and save this as the antenna alignment information. For further configuration details see section 11.3.

## 5.8 Coaxial cable Loss Limits

Allowed coaxial-cable losses are shown in Figure 5-3 and listed in Table 5-16. Cable losses shall be known at 1.6 GHz, and must be entered as part of the AES configuration during system installation.

A maximum loss of 2.5 dB is allowed from the HPA output to the antenna input, as shown in Figure 5-3. The loss is the sum of cable loss and DLNA transmit path loss. The DLNA transmit path loss is specified to maximum 0.8 dB, but will typically be 0.6 dB; the actual loss of a unit is available from the test-sheet.

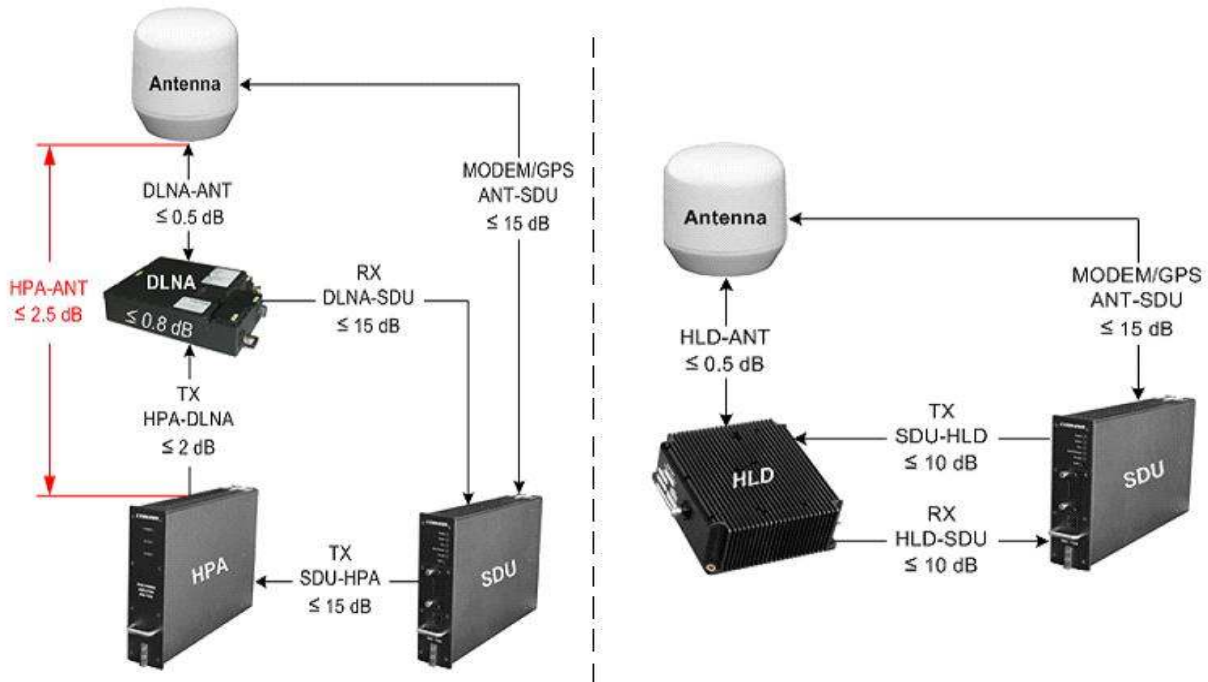


Figure 5-3: RF Coaxial Cable Loss Limits.

Table 5-16: Loss Limits for Coaxial Cables (at 1.6 GHz).

| <b>Cable/Device</b> | <b>Max dB</b> |
|---------------------|---------------|
| HPA-SDU             | 15.0          |
| HLD-SDU (RX)        | 10.0          |
| SDU-HLD (TX)        | 10.0          |
| HPA-DLNA            | 2.0           |
| DLNA-ANT            | 0.5           |
| HLD-ANT             | 0.5           |
| DLNA-SDU            | 15.0          |
| ANT-SDU (GPS)       | 15.0          |

The coaxial cable losses between the antenna and the DLNA (or HLD) should be kept to a minimum. The same applies for losses between the HPA and the DLNA. The coaxial cable losses are minimised by having a short physical separation between the units and by using low-loss cables.

The advantages of low Antenna to DLNA (or HLD) losses are:

- Better data throughput near edge of satellite coverage.
- Larger coverage area where multi modem operation is possible (with HPA-7400).
- Lower power consumption.

The coaxial cable losses between the SDU and the HPA (or HLD) and between the DLNA and SDU do not affect AES performance, provided the losses are within allowed limits.

When using an active GPS antenna, the total GPS antenna gain should be between 10 and 30 dB. Total GPS antenna gain is GPS antenna gain plus amplifier gain minus cable loss. When using the built-in GPS antennas of the IGA-5001, Mini-M/Aero-I/IGA-5006, HGA-7000 or HGA-8000 then the gain will be correct if the specified cable losses are adhered to.

### 5.8.1 Limits for Passive Inter-Modulation (PIM)

The Passive Inter-modulation<sup>17</sup> (PIM) installation requirements only apply to multi-modem AES installations.

The coaxial cable assembly, including any adaptors, between the antenna and the DLNA shall not generate 3<sup>rd</sup> or higher order PIM products above a level of -133 dBm when tested with two CW signals each at a level of 10 W. The coaxial cable assembly between HPA and DLNA should comply with the same requirement. The test frequencies used by cable assembly manufacturer may be between 500 and 2,000 MHz.

Cobham Satcom can supply custom cables meeting the PIM requirements. Please contact Cobham for further details.

**NOTE:** Do not use Kovar-glass hermetically sealed TNC-TNC bulkhead adaptors for antenna adaptor plates, since Kovar is a potential source of PIM.

## 5.9 User Equipment Installation

### 5.9.1 ISDN Terminal Equipment

Up to three ISDN terminal devices can be powered by one ISDN port of the SDU. A maximum of 5 devices can be powered by the SDU. A maximum of four self-powered ISDN devices may be connected to each ISDN port.

The maximum allowed ISDN bus length is 100 meters, (using AWG-22 wire size).

Each ISDN bus must be terminated with two 100 Ohm resistors: one resistor between Rx+ and Rx- (RJ-45 pins 3 and 6) and one resistor between Tx+ and Tx- (RJ-45 pins 4 and 5).

Wiring for multiple ISDN terminal equipment must be made in a daisy-chain cable routing configuration (rather than a star-configuration), with the termination resistors fitted at the last device in the chain (furthest from the SDU).

**NOTE:** Under specific external conditions, the performance of the Ethernet interface may be affected when combined with operation of the ISDN interface. Contact the manufacturer for further information.

### 5.9.2 POTS Phone Equipment

Two POTS devices may be connected to one POTS port and a total of six POTS phone devices may be connected to the SDU. Two phones connected to one port will share the line (party line), i.e. both will ring on incoming calls and it will not be possible to make local calls between them. The recommended maximum POTS bus length is 6 Ohm which equates to approximately 60 meters (using AWG-22 wire size).

The type of service must be selected for each POTS port as part of the installation setup. When using standard voice phones the most economical service selection will be AMBE-2 voice service, but a 64 kBit/s ISDN service

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<sup>17</sup> PIM is a frequency mixing process that typically occurs between loose metallic contacts in connectors and in cable braids. PIM causes radio interference which potentially disturbs the AES receiver or other on-board radio and navigation systems through antenna re-radiation.



is also available. Additional settings exist for the POTS port, such as volume, loop current and echo cancellation (see section 12.2).

Additional information is available on the help screens on the Satcom Console.

### 5.9.2.1 Audio Status Tones

Audio tones on the user phone or voice equipment signals AES status. The meanings of the audio tones are shown in Table 5-17.

Table 5-17: Audio Status Tones

| Tone                   | Meaning   | Audio Tone                      |         |       |         |
|------------------------|---|---------------------------------|---------|-------|---------|
|                        |   | Tone                            | Silence | Tone  | Silence |
| Ringing                | Alerting  | _____                           | _____   | _____ | _____   |
| Invitation to Dial     | Internal calls possible/External calls may be possible. | Continuous Tone (High)<br>_____ |         |       |         |
| Busy/Rejected/Released | Call not possible or disconnected.                      | Continuous Tone (Low)<br>_____  |         |       |         |

### 5.9.3 Ethernet with Power-over-Ethernet (PoE) Interface

The SDU has four 10Base-T Ethernet ports, each supporting Power-over-Ethernet (PoE) Class-0 power sourcing. Power sourcing on the Ethernet ports may be configured through the Satcom Console [*Install – LAN Settings*] page; however the total power available for external power sourcing on all four ports together is limited to 15 W.

The Ethernet ports must be wired using screened twisted pairs with characteristic impedance of 100 Ohm. The cable screen shall terminate as close as possible to the SDU connector and the cable screens grounding connection shall have a maximum length of 25mm.

The PoE line voltage (-48 V) will be fed to the Ethernet RX line pairs when enabled, whereas the TX line pairs DC path is permanently grounded.

### 5.10 Transmit-Mute (Radio Silence) Input

The TX-MUTE input will disable any transmissions when asserted and will typically be connected to a “Radio Silence” switch. Alternatively it may be used, where the SBB system has been found to interfere with other aircraft systems, to disable the Satcom transmissions when required. The use of the Tx-Mute input is optional.

Transmit-Mute (TX-MUTE) input may be wired to passive aircraft switches (see [25]). The polarity of these inputs may be configured using the Satcom Console and are automatically stored on the Configuration Module as part of the AES configuration.

The configuration is done in the Satcom Console [*Installation - Discreet Inputs*] page. To activate/deactivate the input select the appropriate checkbox for the Tx-Mute Discrete Input parameter. The Switch State for Tx-Mute Active parameter checkbox may be used to configure the polarity.

### 5.11 Remote Status Panel

The SDU front panel status LEDs and reset switch functionality are available on the rear-connector for connection to a remote status panel. Showing the SDU status remotely may enable the SDU to be installed in a less accessible location.

### 5.12 Modem Antenna Supply Voltage

The HPA DC Power Output (+28 VDC, current limited 1 Ampere) may be configured as an output available for supplying DC power to the HGA/IGA via the modem cable, a GPS pre-amplifier or other auxiliary equipment.

The output is a regulated +28 VDC supplied from the HPA-7400/7450 (or HLD-7260) via the transmit coaxial cable to the SDU as shown in Figure 5-4. A connected antenna would then receive the 28 VDC on the BP12 pin. Alternatively, with BP5 and BP9 not strapped, the SDU may be configured to supply regulated 5 VDC to the connected antenna via the antenna control coaxial cable. In that case the 28VDC setting in Figure 5-4 will result in only 5 VDC on BP12.

Power routing from the HLD-7260 is similar to the routing shown in Figure 5-4.

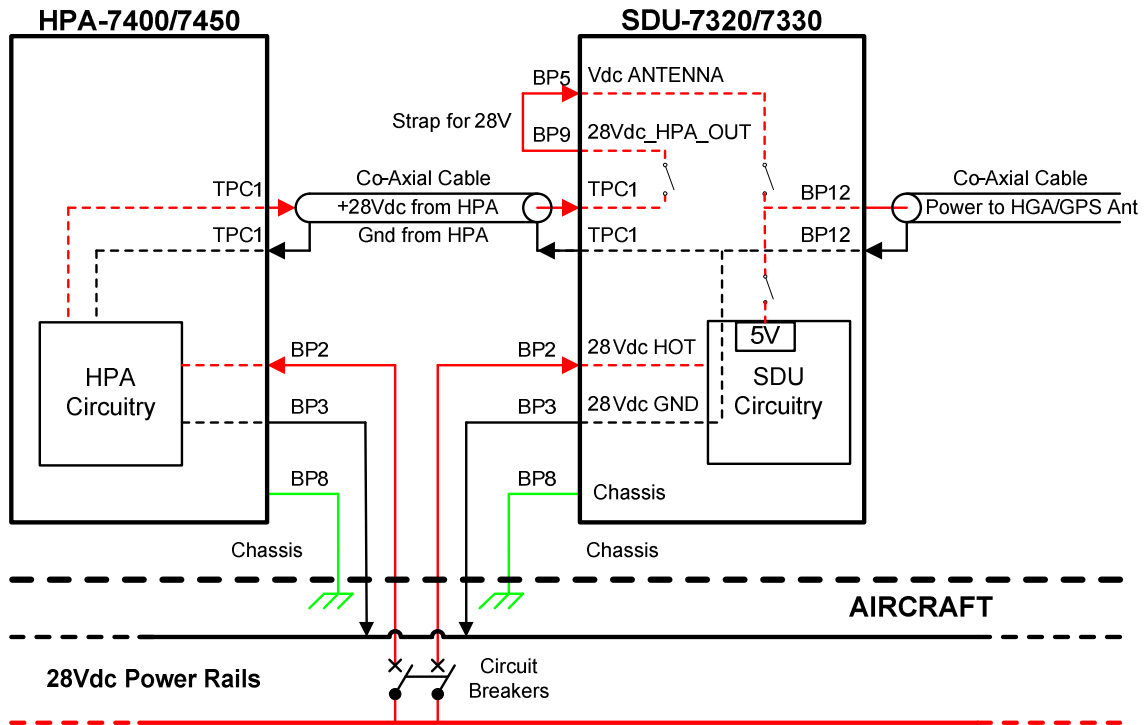


Figure 5-4: DC Power Routing from HPA-7400/7450

The antenna voltage is configured using the [Installation – Antenna Type] page (see Figure 5-5).

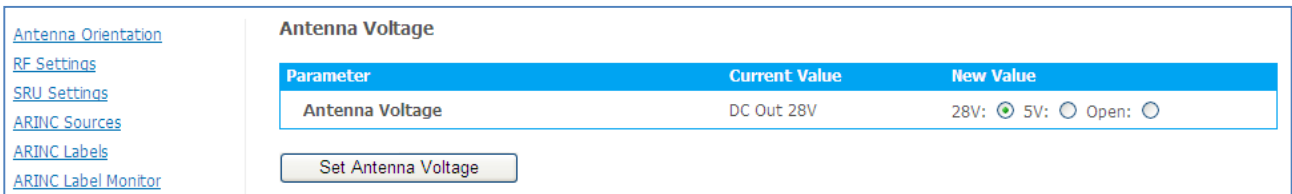


Figure 5-5: Antenna Voltage selection

### 5.13 Satcom Console

AES configuration, diagnostics and fault-finding can be performed through the Satcom Console (see 4.1.1.1). Any JavaScript enabled web browser on a personal computer is required to access to the Satcom Console. The

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Satcom Console is always available through the maintenance Ethernet port on the front panel of the SDU. The Satcom Console can be accessed at the following default IP address: **10.0.1.100**. The procedure for setting up an Ethernet connection to the Satcom Console from a PC is shown in section 12.3.

Access to the Satcom Console through the rear-panel Ethernet ports is also possible. The following factory default IP address may be used in this case: **172.18.0.250**.

**NOTE:** 172.18.0.250 may not provide access to the Satcom Console if non-factory defaults were previously configured for the User Network Configuration using the *[Installation - LAN Settings]* page.

In the event of difficulties, a diagnostics file containing system status as well as system failure and event logs may be downloaded to a PC through the Satcom Console. Section 11.7 contains details on how to perform the download. Once downloaded the diagnostics file may be sent to Cobham Satcom customer support.

## 6. TOOLS REQUIRED FOR INSTALLATION

The following tables list details of special tools, components and equipment that may be required for the installation; however these may be substituted by equivalent products from other manufacturers.

### 6.1 Tools Required for SDU and HPA Installation

Table 6-1: Tools required for SDU and HPA Installation

| <b>ARINC 600 Contact Insertion Tools</b>    | <b>MIL-SPEC P/N (RADIAL P/N)</b>             |
|---|--|
| <b>For Socket size 22 (620 200)</b>         |  |
| Extraction tool                             | M 81 969/1.01 (282 885)                      |
| Positioner                                  | M 22 520/2.23 (282 970)                      |
| Crimping Tool                               | M22 520/2.01 (282 281)                       |
| <b>For Socket size 20 (620 310)</b>         |  |
| Extraction tool                             | M 81 969/1.02 (282 886)                      |
| Positioner                                  | M 22 520/2.08 (282 971)                      |
| Crimping Tool                               | M22 520/2.01 (282 281)                       |
| <b>For Socket size 16 (620 330)</b>         |  |
| Extraction tool                             | M 81 969/1.03 (282 546)                      |
| Positioner                                  | M 22 520/1.02 (282 972)                      |
| Crimping Tool                               | M22 520/1.01 (282 291)                       |
| <b>For Socket size 12 (620 340)</b>         |  |
| Extraction tool                             | M 81 969/28.02 (282 547)                     |
| Positioner                                  | M 22 520/1.02 (282 972)                      |
| Crimping Tool                               | M22 520/1.01 (282 291)                       |
| <b>For Co-Axial Socket size 5 (620 020)</b> |  |
| Extraction tool                             | M 81 969/28.01 (282 946)                     |
| Center Contact Positioner                   | (282 550) (Daniels K345)                     |
| Center Contact Crimping Tool                | M 22 520/2.01 (282 281)                      |
| Center Contact Selector                     | 6: RG58, RG223<br>8: RG141, RG142, RG400     |
| Outer Contact Die                           | M 22 520/5.05 (282 246)<br>Hex A.21 on flats |
| Outer Contact Crimping Tool                 | M 22 520/5.01 (282 293)                      |

The RF coaxial cable connector tools are listed in Table 6-2. The corresponding coaxial cable connectors' torque values are provided in section 8.

Table 6-2 RF cable connector torque tools

| <b>Torque tools (Manufacturer)</b> | <b>Specification (P/N)</b>     |
|------------------------------------|--------------------------------|
| TNC Torque wrench (Huber Suhner)   | 1 Nm 14 mm /.551in. (23021864) |

## 6.2 Equipment Required for SDU Installation

Table 6-3: Equipment Required for SDU-7320/SDU-7330 Installation

| <b>Description</b>  | <b>Quantity</b> |
|---|-----------------|
| 2MCU ARINC 600 Mounting Rack for the SDU-7320               |                 |
| <b>OR</b>   |                 |
| 3MCU ARINC 600 Mounting Rack for the for SDU-7330           | 1               |
| Connector, ARINC 600, plug, size 2, rear removable contacts | 1               |
| Radiall, NSX N 2 P 221 X 00                                 |                 |
| ARINC 600, coaxial socket, contact, size 1                  | 2               |
| Radiall, 620 101 003  |                 |
| ARINC 600, pin contact, size 22, crimp, rear                | 119             |
| Radiall, 620 200  |                 |
| Cable Size: 22,24,26 AWG                                    |                 |
| ARINC 600, socket contact, size 20, crimp, rear             | 2               |
| Radiall, 620 310  |                 |
| Cable Size: 20,22,24 AWG                                    |                 |
| ARINC 600, socket contact, size 16, crimp, rear             | 1               |
| Radiall, 620 330  |                 |
| Cable Size: 12,14,16 AWG                                    |                 |
| ARINC 600, socket contact, size 12, crimp, rear             | 4               |
| Radiall, 620 340  |                 |
| Cable Size: 12,14,16 AWG                                    |                 |

|  |   |
|--|---|
| Connector, ARINC 600, coaxial socket contact, size 5, RG58 / RG141 | 1 |
| Radiall, 620 020   |   |

### 6.3 Equipment Required for HPA-7400/HPA-7450 Installation

Table 6-4: Equipment Required for HPA-7400/HPA-7450 Installation

| Description   | Quantity |
|---|----------|
| 2MCU ARINC 600 Mounting Rack                                | 1        |
| Connector, ARINC 600, plug, size 2, rear removable Contacts | 1        |
| Radiall, NSX N 2 P 221 X 00                                 |          |
| ARINC 600, coaxial socket contact, size 1                   | 2        |
| Radiall, 620 101 003  |          |
| ARINC 600, pin contact, size 22, crimp, rear                | 4        |
| Radiall, 620 200  |          |
| Cable Size: 22,24,26 AWG                                    |          |
| ARINC 600, socket contact, size 20, crimp, rear             | 3        |
| Radiall, 620 310  |          |
| Cable Size: 20,22,24 AWG                                    |          |
| ARINC 600, socket contact, size 12, crimp, rear             | 3        |
| Radiall, 620 340  |          |
| Cable Size: 12,14,16 AWG                                    |          |

## 6.4 Tools Required for DLNA and HLD-7260 Installation

Table 6-5: Tools Required for DLNA Installation

| <b>Description</b>                              | <b>Part Number (Souriau)</b> |
|---|------------------------------|
| Extraction tool for un-wired contacts (size 20) | 8522-56                      |
| Filler Plugs                                    | MS 27488-20                  |
| Back shell tightening pliers                    | 8498-03                      |
| square jaw (order 2)                            | 8500-1015                    |
| OR  |                              |
| Strap back shell tightening spanner             | 8498-04                      |
| square strap                                    | 8498-103                     |
| Crimping tool                                   | 8365 (M22520/1-01)           |
| locators  | 8365-02 (M22520/1-02)        |
| OR  |                              |
| Crimping tool                                   | 8476-01 (M22520/2-01)        |
| locators  | 8476-02 (M22520/2-01)        |

The RF coaxial cable connector tools are listed in Table 6-5. The corresponding coaxial cable connectors' torque values are provided in section 8.

Table 6-6 RF coaxial cable connector torque tools

| <b>Torque tools (Manufacturer)</b>           | <b>Specification (P/N)</b>     |
|--|--------------------------------|
| TNC Torque wrench (Huber Suhner)             | 1 Nm 14 mm /.551in. (23021864) |
| N-type Torque wrench (Agilent) <sup>18</sup> | 1.2Nm 19mm/.748in. (8710-1766) |

## 6.5 Equipment Required for DLNA Installation

Table 6-7: Equipment Required for DLNA Installation

| <b>Description</b> | <b>Quantity</b> |
|--------------------|-----------------|
|                    |                 |

<sup>18</sup> The tool torque rating depends on the type of N connector and must be supplied by the connector manufacturer. The actual torque rating may differ from the indicated value.

|   |   |
|---|---|
| MIL-C-26482 series II Female Connector                                    |   |
| Shell size 12, Contacts 10, female, normal polarisation, contact size 20. |   |
| Souriau Part Number: MS3475L12-10SN                                       | 1 |

## 6.6 Equipment Required for HLD-7260 Installation

Table 6-8: Equipment Required for HLD-7260 Installation

| Description   | Quantity |
|---|----------|
| MIL-C-26482 series II Female Connector                                    |          |
| Shell size 12, Contacts 10, female, normal polarization, contact size 20. |          |
| Souriau Part Number: MS3475L12-10SN                                       | 1        |
| Optional Fan Module   |          |
| Omnipless Part Number 780-A0631   | 1        |



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## **7. OUTLINE DRAWINGS**

### **7.1 SDU-7320**

Refer to document [17], 677-A0183\_OD, Aero SDU-7320, SwiftBroadband Satellite Data Unit, Outline Drawing

### **7.2 SDU-7330**

Refer to document [18], 677-A0188\_OD, Aero SDU-7330, SwiftBroadband Satellite Data Unit, Outline Drawing for the Single or Dual Channel SDU.

Refer to document [19], 677-A0188\_OD, Aero SDU-7330, SwiftBroadband Satellite Data Unit, Outline Drawing for the Four Channel SDU.

### **7.3 Configuration Module (CM)**

Refer to document [20], 780-A0550\_OD, Aero SDU-7300 Configuration Module, Outline Drawing.

### **7.4 CM Installation Bracket**

Refer to document [21], 780-A0649\_OD, SBB SDU External CM holder assembly, Outline Drawing.

### **7.5 HPA-7400**

Refer to document [22], 677-A0169\_OD, Aero HPA-7400, High Power Amplifier, Outline Drawing.

### **7.6 HPA-7450**

Refer to document [22], 677-A0198\_OD, Aero HPA-7450, High Power Amplifier, Outline Drawing.

### **7.7 HLD-7260**

Refer to document [24], 677-A0187\_OD, HLD-7260 High Power/Low Noise Amplifier and Duplexer, Outline Drawing.

### **7.8 DLNA**

Contact the Supplier for the appropriate Outline Drawing.

## 8. CONNECTOR DRAWINGS AND PIN-OUTS

### 8.1 ARINC 600 Connector

The SDU-7320, SDU-7330 and HPA-7400 use the same ARINC 600 Connector, with the exception that the shell polarisation insert code position is 4 on the SDU and 8 on the HPA (code number is reflected in suggested part-numbers).

#### 8.1.1 Connector Description and Part-numbers

Table 8-1 and Table 8-2 show the specifications for the ARINC 600 connector used on the SDU and its mating plug on the ARINC 600 Tray.

Table 8-1: SDU-7320/7330 and HPA-7400/7450 Connector Specification

|                              |  |
|------------------------------|--|
| Manufacturer                 | Radiall  |
| Specification Number         | SDU: NSX F2R 221 Y 00 04<br>HPA: NSX F2R 221 Y 00 08           |
| Shell Style                  | ARINC 600  |
| Shell Size                   | 2  |
| Insert Arrangement           | Code 221   |
| Contact Configuration        | Receptacle   |
| Contact Type                 | Metal Contact Retention System (Clips)                         |
| Shell Polarisation Post Code | SDU: ARINC 600 Code number 04<br>HPA: ARINC 600 Code number 08 |
| Materials / Finish           | Nickel plated Aluminium  |

Table 8-2: SDU-7320/7330 and HPA-7400/7450 Tray Connector specification

|                              |  |
|------------------------------|--|
| Manufacturer:                | Radiall  |
| Specification Number:        | SDU: NSX N2P 221 X 00 04<br>HPA: NSX N2P 221 X 00 08           |
| Shell Style:                 | ARINC 600  |
| Shell Size:                  | 2  |
| Insert Arrangement:          | Code 221   |
| Contact Configuration:       | Plug   |
| Contact Type:                | Metal Contact Retention System (Clips)                         |
| Shell Polarisation Post Code | SDU: ARINC 600 Code number 04<br>HPA: ARINC 600 Code number 08 |
| Materials / Finish:          | Nickel plated Aluminium  |

### 8.1.2 ARINC 600 Connector Pin-numbering

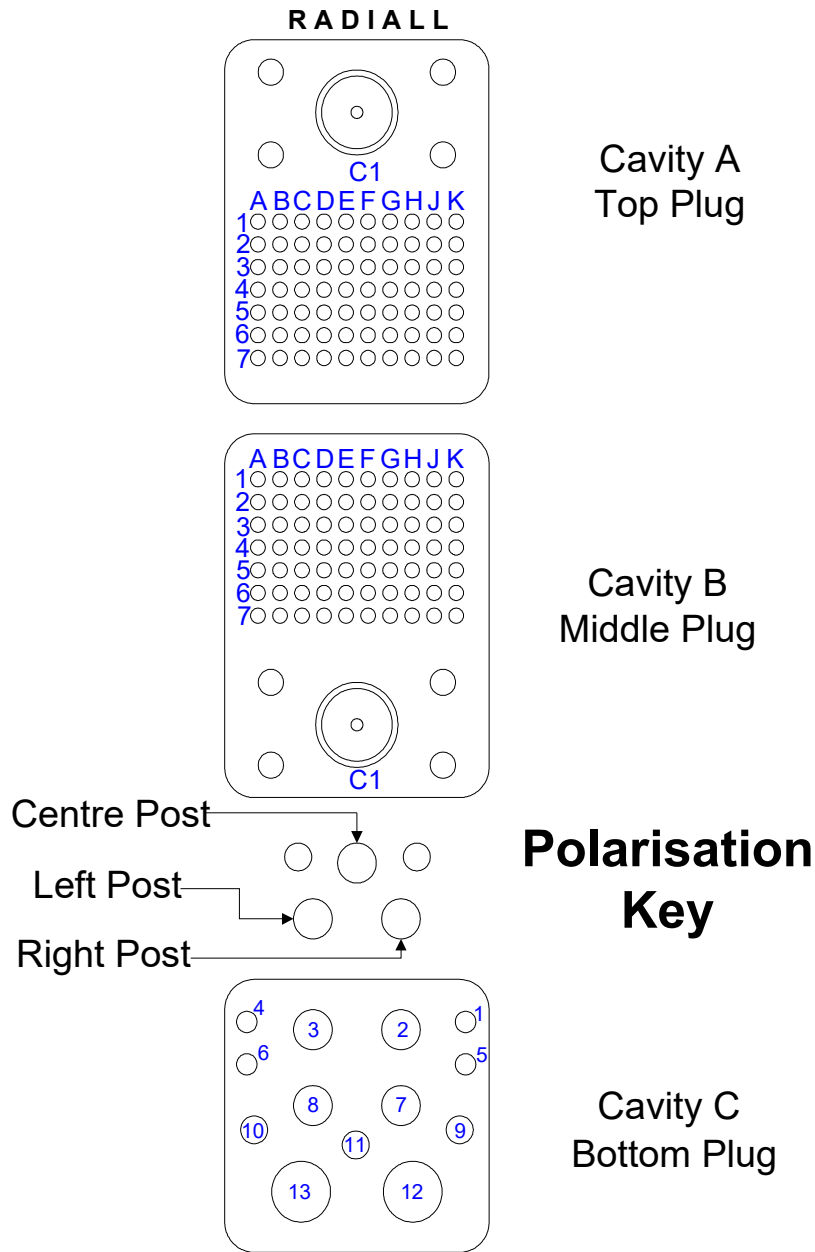


Figure 8-1: SDU & HPA ARINC-600 Connector Pin Numbering (viewed from the rear)

## 8.2 SDU-7320/SDU-7330 ARINC 600 Connector

### 8.2.1 SDU-7320/SDU-7330 ARINC 600 Connector Pin-out

Table 8-3: SDU-7320/7330 ARINC 600 Pin-outs

| Pin  | SIGNAL NAME        | SIGNAL DESCRIPTION                                 |
|--|--------------------|--|
| <b>ARINC 600 CONNECTOR CAVITY A / TOP PLUG</b> |                    |  |
| TPC1   | RF TX              | Connected to RF IN of HPA-7400 (Coaxial)           |
| TP1A   | Ethernet Rx1-      | Ethernet Port 1 Receive -                          |
| TP1B   | Ethernet Rx1+      | Ethernet Port 1 Receive +                          |
| TP1C   | Ethernet Tx1-      | Ethernet Port 1 Transmit -                         |
| TP1D   | ANT CTRL OUT A     | A429 Control Out A to ARINC 741/781 BSU or Antenna |
| TP1E   | GND                | Ground (Rear CM)                                   |
| TP1F   | Rear CM TXD        | Rear Configuration Module: Data from CM            |
| TP1G   | RS LED Power       | Remote Status Power LED                            |
| TP1H   | RS Reset Switch    | Remote Status Reset Switch (Close to Reset)        |
| TP1J   | RS LED Ready       | Remote Status Ready LED                            |
| TP1K   | Reserved           | (SDU-7300 LEDs)                                    |
| TP2A   | Ethernet Rx2+      | Ethernet Port 2 Receive +                          |
| TP2B   | Ethernet Rx2-      | Ethernet Port 2 Receive -                          |
| TP2C   | Ethernet Tx1+      | Ethernet Port 1 Transmit +                         |
| TP2D   | ANT CTRL OUT B     | A429 Control Out B to ARINC 741/781 BSU or Antenna |
| TP2E   | GND                | Ground (ANT CTRL OUT)                              |
| TP2F   | Rear CM Power      | Rear Configuration Module voltage supply           |
| TP2G   | Rear CM RXD        | Rear Configuration Module: Data to CM              |
| TP2H   | RS LED Maintenance | Remote Status Maintenance LED                      |
| TP2J   | Reserved           | (SDU-7300 LEDs)                                    |
| TP2K   | RS LED Failure     | Remote Status Failure LED                          |
| TP3A   | Ethernet Tx2+      | Ethernet Port 2 Transmit +                         |
| TP3B   | Ethernet Tx2-      | Ethernet Port 2 Transmit -                         |
| TP3C   | GND                | Ground (Ethernet TX1)                              |
| TP3D   | GND                | Ground (Ethernet RX3)                              |
| TP3E   | POTS-Phone 4 TIP   | POTS 4 (2-wire) Tip Signal                         |

| <b>Pin</b> | <b>SIGNAL NAME</b> | <b>SIGNAL DESCRIPTION</b>               |
|------------|--------------------|---|
| TP3F       | Rear CM Heater 28V | Rear Configuration Module heater supply |
| TP3G       | Reserved           |   |
| TP3H       | Reserved           |   |
| TP3J       | Reserved           | (SDU-7300 LEDs)                         |
| TP3K       | RS LED Call        | Remote Status Call LED                  |
| TP4A       | Ethernet Tx3-      | Ethernet Port 3 Transmit -              |
| TP4B       | Ethernet Tx3+      | Ethernet Port 3 Transmit +              |
| TP4C       | GND                | Ground (Ethernet RX1)                   |
| TP4D       | GND                | Ground (Ethernet TX4)                   |
| TP4E       | POTS-Phone 4 RING  | POTS 4 (2-wire) RING Signal             |
| TP4F       | M1553 Port1 A      | Mil-1553 port 1, Line A                 |
| TP4G       | M1553 Port1 B      | Mil-1553 port 1, Line B                 |
| TP4H       | GND                | Reserved                                |
| TP4J       | POTS-Phone 3 TIP   | POTS 3 (2-wire) Tip Signal              |
| TP4K       | ISDN1 Rx+          | ISDN1 S/T Bus Receive +                 |
| TP5A       | Ethernet Rx3-      | Ethernet Port 3 Receive -               |
| TP5B       | Ethernet Rx3+      | Ethernet Port 3 Receive +               |
| TP5C       | GND                | Ground (Ethernet TX2)                   |
| TP5D       | GND                | Ground (Ethernet RX4)                   |
| TP5E       | GND                | POTS 4 (2-wire) Ground                  |
| TP5F       | GND                | Reserved                                |
| TP5G       | Reserved           |   |
| TP5H       | GND                | POTS 3 (2-wire) Ground                  |
| TP5J       | POTS-Phone 3 RING  | POTS 3 (2-wire) RING Signal             |
| TP5K       | ISDN1 Rx-          | ISDN1 S/T Bus Receive -                 |
| TP6A       | Ethernet Rx4+      | Ethernet Port 4 Receive +               |
| TP6B       | Ethernet Rx4-      | Ethernet Port 4 Receive -               |
| TP6C       | GND                | Ground (Ethernet RX2)                   |
| TP6D       | GND                | Ground (TX-MUTE)                        |
| TP6E       | TX-MUTE            | Transmitter Mute/Inhibit Discrete Input |
| TP6F       | GND                |   |

| <b>Pin</b> | <b>SIGNAL NAME</b> | <b>SIGNAL DESCRIPTION</b>   |
|------------|--------------------|-----------------------------|
| TP6G       | Reserved           |                             |
| TP6H       | POTS-Phone 1 TIP   | POTS 1 (2-wire) Tip Signal  |
| TP6J       | GND                | Ground (ISDN1 RX)           |
| TP6K       | ISDN1 Tx-          | ISDN1 S/T Bus Transmit -    |
| TP7A       | Ethernet Tx4+      | Ethernet Port 4 Transmit +  |
| TP7B       | Ethernet Tx4-      | Ethernet Port 4 Transmit -  |
| TP7C       | GND                | Ground (Ethernet TX3)       |
| TP7D       | GND                | Ground (WOW)                |
| TP7E       | WOW                | Weight-on-Wheels            |
| TP7F       | GND                | Ground (Mil-1553 port 2)    |
| TP7G       | POTS-Phone GND     | POTS 1 (2-wire) Ground      |
| TP7H       | POTS-Phone 1 RING  | POTS 1 (2-wire) Ring Signal |
| TP7J       | GND                | Ground (ISDN1 TX)           |
| TP7K       | ISDN1 Tx+          | ISDN1 S/T Bus Transmit +    |

**ARINC 600 CONNECTOR CAVITY B / MIDDLE PLUG**

|      |               |                                       |
|------|---------------|---------------------------------------|
| MPC1 | RF RX         | Receive RF Signal from DLNA (Coaxial) |
| MP1A | Reserved      |                                       |
| MP1B | Reserved      |                                       |
| MP1C | GND           | Ground (M1553)                        |
| MP1D | M1553 A       | Mil-Std-1553 bus signal A             |
| MP1E | M1553 B       | Mil-Std-1553 bus signal B             |
| MP1F | GND           | Ground (Aux A429 IN)                  |
| MP1G | Aux A429 IN A | Spare ARINC-429 data input signal A   |
| MP1H | Aux A429 IN B | Spare ARINC-429 data input signal B   |
| MP1J | Reserved      |                                       |
| MP1K | ISDN2 Tx-     | ISDN2 S/T Bus Transmit -              |
| MP2A | Reserved      |                                       |
| MP2B | Reserved      |                                       |
| MP2C | Reserved      |                                       |
| MP2D | Reserved      |                                       |

| <b>Pin</b> | <b>SIGNAL NAME</b> | <b>SIGNAL DESCRIPTION</b>                           |
|------------|--------------------|---|
| MP2E       | Spare              | Reserved for future use                             |
| MP2F       | GND                | Ground (Spare A429 OUT)                             |
| MP2G       | Aux A429 OUT A     | Spare ARINC-429 data output signal A                |
| MP2H       | Aux A429 OUT B     | Spare ARINC-429 data output signal B                |
| MP2J       | GND                | Ground  |
| MP2K       | ISDN2 Tx+          | ISDN2 S/T Bus Transmit +                            |
| MP3A       | IRS Data In A      | ARINC-429 data input from SRU or IRS or AHRS        |
| MP3B       | IRS Data In B      | ARINC-429 data input from SRU or IRS or AHRS        |
| MP3C       | GND                | Ground (IRS Data IN)                                |
| MP3D       | Reserved           |   |
| MP3E       | GND                | Ground  |
| MP3F       | Reserved           |   |
| MP3G       | POTS-Phone 2 RING  | POTS 2 (2-wire) Ring Signal                         |
| MP3H       | POTS-Phone 2 TIP   | POTS 2 (2-wire) Tip Signal                          |
| MP3J       | GND                | ISDN2 TX  |
| MP3K       | ISDN2 Rx+          | ISDN2 S/T Bus Receive +                             |
| MP4A       | GPS Data In A      | ARINC-429 GPS data input A                          |
| MP4B       | GPS Data In B      | ARINC-429 GPS data input B                          |
| MP4C       | GND                | Ground (GPS Data In)                                |
| MP4D       | Reserved           |   |
| MP4E       | GND                | Ground  |
| MP4F       | Reserved           |   |
| MP4G       | POTS Phone 2 GND   |   |
| MP4H       | Reserved           |   |
| MP4J       | GND                | Ground (ISDN2 RX)                                   |
| MP4K       | ISDN2 Rx-          | ISDN2 S/T Bus Receive -                             |
| MP5A       | ANT CTRL BITE IN A | A429 BITE Input A from ARINC 741/781 BSU or Antenna |
| MP5B       | ANT CTRL BITE IN B | A429 BITE Input B from ARINC 741/781 BSU or Antenna |
| MP5C       | GND                | Ground (ANT CTRL BITE IN)                           |
| MP5D       | Reserved           | Reserved for future use                             |
| MP5E       | Reserved           | Reserved for future use                             |

| <b>Pin</b> | <b>SIGNAL NAME</b> | <b>SIGNAL DESCRIPTION</b>                                 |
|------------|--------------------|---|
| MP5F       | RS232 CTS          | Monitor and Control Interface RS232 CTS signal            |
| MP5G       | GND                | Ground (SRU In)   |
| MP5H       | GND                | Monitor and Control Interface RS232 Ground                |
| MP5J       | Reserved           | Reserved for future use                                   |
| MP5K       | Reserved           | Reserved for future use                                   |
| MP6A       | Reserved           | Reserved for future use                                   |
| MP6B       | Reserved           | Reserved for future use                                   |
| MP6C       | SRU Out B          | GPS Data & Status Request output to drive SRU-7200. RS422 |
| MP6D       | GND                | Ground  |
| MP6E       | GND                | Ground (SRU Out)  |
| MP6F       | Reserved           | Reserved for future use                                   |
| MP6G       | Reserved           | Reserved for future use                                   |
| MP6H       | RS232 Rx           | Monitor and Control Interface RS232 Rx Out data           |
| MP6J       | Reserved           | Reserved for future use                                   |
| MP6K       | Reserved           | Reserved for future use                                   |
| MP7A       | SRU In B           | SRU Status Reply input to SDU                             |
| MP7B       | SRU In A           | SRU Status Reply input to SDU                             |
| MP7C       | SRU Out A          | GPS Data & Status Request output to drive SRU-7200. RS422 |
| MP7D       | Reserved           | Reserved for future use                                   |
| MP7E       | RS232 RTS          | Monitor and Control Interface RS232 RTS signal            |
| MP7F       | Reserved           | Reserved for future use                                   |
| MP7G       | Reserved           | Reserved for future use                                   |
| MP7H       | RS232 Tx           | Monitor and Control Interface RS232 Tx In data            |
| MP7J       | Reserved           | Reserved for future use                                   |
| MP7K       | Reserved           | Reserved for future use                                   |



| Pin   | SIGNAL NAME  | SIGNAL DESCRIPTION                                       |
|---|--------------|--|
| <b>ARINC 600 CONNECTOR CAVITY C / BOTTOM PLUG</b> |              |  |
| BP1   | Reserved     | Reserved for future use                                  |
| BP2   | 28VDC HOT    | +28 Volt dc power input - connected to Aircraft power    |
| BP3   | 28VDC GND    | +28 Volt dc ground input - connected to Aircraft power   |
| BP4   | Fan OUT      | Fan Control DC output                                    |
| BP5   | VDC Antenna  | Strapping input to BP9 for 28 VDC antenna supply feeding |
| BP6   | Fan RET      | Ground return for Fan Control                            |
| BP7   | RS GND       | Ground return for Remote Status Panel                    |
| BP8   | CHASSIS      | Connected to Aircraft Chassis                            |
| BP9   | 28VDC HPA    | DC output  |
| BP10  | Reserved     | Reserved for future use                                  |
| BP11  | Reserved     | Reserved for future use                                  |
| BP12  | DC/GPS/MODEM | DC, GPS & Control to and from antenna                    |
| BP13  | Reserved     | Reserved for future use                                  |

## 8.2.2 SDU-7320/SDU-7330 ARINC 600 Coaxial Connectors

### 8.2.2.1 TPC1 Coaxial Connector

Purpose: RF Output to HPA

Type: Panel mount coaxial male socket size 1.

Suggested mating connector for tray usage Radiall, 620 101 003. Provides for straight, male, TNC Suhner 11 TNC-50-7-2/133 NE from HPA to SDU tray, 1 Nm (0.7 ft-lb) torque.

### 8.2.2.2 MPC1 Coaxial Connector

Purpose: RF Input to SDU from DLNA

Type: Panel mount coaxial male socket size 1.

Suggested mating connector for tray usage Radiall, 620 101 003. Provides for straight, male, TNC Suhner 11 TNC-50-7-2/133 NE from HPA to SDU tray, 1 Nm (0.7 ft-lb) torque.

### 8.2.2.3 BP12 Coaxial Connector

Purpose: Antenna Control or external GPS input

Type: Size 5 Coaxial Contact Socket

The SDU provides a regulated 28VDC supply on this connector to the HGA-6000/HGA-7000/HGA-8000/IGA-5001 or external active GPS antenna.

The SDU may be configured to supply the following output voltage to BP12 (see section 5.12):

- 28 V DC supply on this connector to the HGA-6000/HGA-6500/HGA-7000/HGA-8000/IGA- 5001/Mini-M/Aero-I/IGA-5006
- 5 V DC supply on this connector to an external active GPS antenna.

## 8.3 Configuration Module (CM) Connector

### 8.3.1 Connector and Mating Plug

The CM connector is a D-Sub 9-pin Male. The mating connector shall be a D-Sub 9-pin Female.

### 8.3.2 Connector Pin-outs

The Configuration Module D-Sub 9 pin Male connector pin-out is shown in Table 8-7.

Table 8-4: Configuration Module Connector Pin-Out

| <b>PIN</b> | <b>SIGNAL DESCRIPTION</b> | <b>COMMENT</b>                |
|------------|---------------------------|-------------------------------|
| 1          | Reserved                  |                               |
| 2          | CM TXD                    | Serial Data from CM to SDU.   |
| 3          | CM RXD                    | Serial Data from SDU to CM.   |
| 4          | Reserved                  |                               |
| 5          | CM Ground                 | Ground return.                |
| 6          | CM Power                  | Supply for CM logic circuit.  |
| 7          | Reserved                  |                               |
| 8          | CM Heater                 | Supply for CM heater circuit. |
| 9          | Reserved                  |                               |

## 8.4 HPA-7400/HPA-7450 ARINC 600 Connector

### 8.4.1 HPA-7400/HPA-7450 ARINC 600 Connector Pin-outs

**NOTE:** All pins not shown on the following table are not used and should be left unconnected.

Table 8-5: HPA-7400/HPA-7450 ARINC-600 Connector Pin-outs

| PIN                        | SIGNAL DESCRIPTION | COMMENT                                |
|----------------------------|--------------------|--|
| <b>CAVITY A / TOP PLUG</b> |                    |  |
| TPC1                       | RF IN              | Connected to RF OUT of SDU             |
| TP1A                       | BITE DLNA          | Connected to LNA BITE on DLNA          |
| TP1B                       | GND                | Connected to LNA BITE CONT GND on DLNA |
| TP1C                       | BITE HPA           | For external fault indication          |
| TP1D                       | GND                | Ground                                 |
| TP2A                       | Reserved           |  |
| TP2B                       | Reserved           |  |
| TP2C                       | Reserved           |  |
| TP2D                       | Reserved           |  |
| TP2E                       | Reserved           |  |
| TP2F                       | Reserved           |  |
| TP2G                       | Reserved           |  |
| TP2H                       | Reserved           |  |
| TP2J                       | Reserved           |  |
| TP2K                       | Reserved           |  |
| TP3A                       | GND                | Ground                                 |
| TP3B                       | GND                | Ground                                 |
| TP3C                       | GND                | Ground                                 |
| TP3D                       | GND                | Ground                                 |
| TP3E                       | GND                | Ground                                 |
| TP3F                       | GND                | Ground                                 |
| TP3G                       | GND                | Ground                                 |
| TP3H                       | GND                | Ground                                 |
| TP3J                       | GND                | Ground                                 |
| TP3K                       | GND                | Ground                                 |

| <b>PIN</b>                    | <b>SIGNAL DESCRIPTION</b> | <b>COMMENT</b> |
|-------------------------------|---------------------------|----------------|
| TP4A                          | Reserved                  |                |
| TP4B                          | Reserved                  |                |
| TP4C                          | Reserved                  |                |
| TP4D                          | Reserved                  |                |
| TP4E                          | Reserved                  |                |
| TP4F                          | Reserved                  |                |
| TP4G                          | Reserved                  |                |
| TP4H                          | Reserved                  |                |
| TP4J                          | Reserved                  |                |
| TP4K                          | Reserved                  |                |
| TP5A                          | GND                       | Ground         |
| TP5B                          | GND                       | Ground         |
| TP5C                          | GND                       | Ground         |
| TP5D                          | GND                       | Ground         |
| TP5E                          | GND                       | Ground         |
| TP5F                          | GND                       | Ground         |
| TP5G                          | GND                       | Ground         |
| TP5H                          | GND                       | Ground         |
| TP5J                          | GND                       | Ground         |
| TP5K                          | GND                       | Ground         |
| TP6A                          | Reserved                  |                |
| TP6B                          | Reserved                  |                |
| TP6C                          | Reserved                  |                |
| TP6D                          | Reserved                  |                |
| TP7A                          | GND                       | Ground         |
| TP7B                          | GND                       | Ground         |
| TP7C                          | GND                       | Ground         |
| TP7D                          | GND                       | Ground         |
| <b>CAVITY B / MIDDLE PLUG</b> |                           |                |

| <b>PIN</b>                    | <b>SIGNAL DESCRIPTION</b> | <b>COMMENT</b>   |
|-------------------------------|---------------------------|--|
| MPC1                          | RF OUT                    | Connected to TX port on DLNA                                     |
| <b>CAVITY C / BOTTOM PLUG</b> |                           |  |
| BP2                           | 28VDC HOT                 | +28 Volt dc power input - connected to Aircraft DC power         |
| BP3                           | 28VDC GND                 | +28 Volt dc ground input - connected to Aircraft DC power ground |
| BP4                           | 28VDC FANS OUT            | +28VDC fan supply  |
| BP6                           | 28VDC FANS RET            | +28VDC fan supply ground   |
| BP8                           | CHASSIS                   | Connected to Aircraft chassis                                    |

## 8.4.2 HPA-7400/HPA-7450 Coaxial Connectors

### 8.4.2.1 HPA-7400/HPA-7450 TPC1 Coaxial Connector

Purpose: RF Input to HPA from SDU

Type: Panel mount coaxial male socket size 1.

Suggested mating connector for tray usage Radiall, 620 101 003. Provides for straight, male, TNC Suhner 11 TNC-50-7-2/133 NE from HPA to SDU tray, 1 Nm (0.7 ft-lb) torque.

### 8.4.2.2 HPA-7400/HPA-7450 MPC1 Coaxial Connector

Purpose: RF Output to DLNA

Type: Panel mount coaxial male socket size 1.

Suggested mating connector for tray usage: Radiall, 620 101 003. Provides for straight, male, TNC Suhner 11 TNC-50-7-2/133 NE from HPA to SDU tray, 1 Nm (0.7 ft-lb) torque.

## 8.5 HLD-7260 Connectors

### 8.5.1 HLD-7260 Power/BITE J4

A MIL-C-26482 12-10 Series II Connector with male contacts is used on the HLD. The cable connector shall use female inserts. Requirements for mating connector are shown in Table 8-6 and pin configuration is shown in Figure 8-2 and finally connector signals in Table 8-7.

Table 8-6: MIL-C-26482 Series II Mating Connector Specification for HLD-7260

|                           |                             |
|---------------------------|-----------------------------|
| Manufacturer              | Souriau                     |
| Manufacturers Part Number | MS3475L12-10SN              |
| Specification Number      | MIL-C-26482 Series II 12-10 |
| Shell Style               | MIL-C-26482 12-10           |
| Shell Size                | 12                          |
| Insert Arrangement        | 12-10                       |
| Contact Type              | Female                      |
| Polarisation              | Normal                      |
| Materials / Finish        | Nickel plated               |

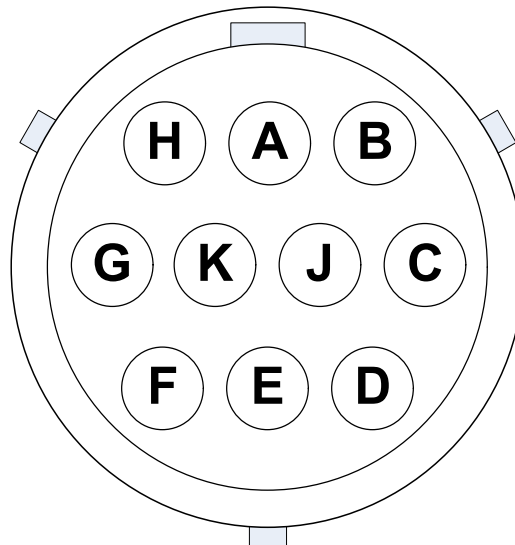


Figure 8-2: HLD MIL-C-26482 12-10 Pin Configuration (view towards the connector)

Table 8-7: HLD-7260 MIL-C-26482 Connector Pin-Out

| <b>PIN</b> | <b>SIGNAL DESCRIPTION</b> | <b>COMMENT</b>   |
|------------|---------------------------|--|
| A          | Chassis Ground            | Shall be connect to the airframe with low resistance strap, < 2.5 milliohm |
| B-F        | Reserved                  |  |
| G          | 28 VDC Hot                | +28 Volt dc power input - connected to Aircraft DC power                   |
| H          | HLD BITE                  | HLD BITE Output, not used in current configuration                         |
| J          | BITE Ground               |  |
| K          | 28 VDC Cold               | +28 Volt dc ground input - connected to Aircraft DC power ground           |

### 8.5.2 HLD-7260 TX IN Coaxial Connector J3

Purpose: RF Transmit Input to HLD from SDU

Type: Panel Mount, female, N

Suggested mating connector: Straight, male, N (depends on cable) , 1.2 Nm (0.9 ft-lb) torque<sup>19</sup>.

### 8.5.3 HLD-7260 RX OUT Coaxial Connector J2

Purpose: RF Receive Output from HLD to SDU

Type: Panel Mount, female, TNC

Suggested mating connector: Straight, male, TNC Suhner 11 TNC-50-7-2/133 NE, 1 Nm (0.7 ft-lb) torque.

### 8.5.4 HLD-7260 ANTENNA Coaxial Connector J1

Purpose: RF Input/Output to Antenna

Type: Panel Mount, female, TNC

Suggested mating connector: Straight, male, TNC Suhner 11 TNC-50-7-2/133 NE, 1 Nm (0.7 ft-lb) torque.

### 8.5.5 HLD-7260 Fan Module Connector J5

The HLD-7260 can be fitted with an optional build-on fan module. The HLD connector for the fan control is a flange receptacle Souriau Circular Miniature Connector size 02 (Souriau part number 8STA0 02 35 SN). The Souriau part number of the plug is 8STA6 02 35 PN. Pin 1 connects to fan positive and pin 2 to fan negative.

## 8.6 SDU Remote Panel

Components and wiring for a remote panel should comply with Figure 8-3 and Table 8-8 shown next. The remote reset switch should be a sprung push-to-make switch. See the wiring diagram referenced in [25] for the electrical specification of the remote panel interface.

<sup>19</sup> Torque depends on the chosen N-type connector and must be supplied by the connector manufacturer.

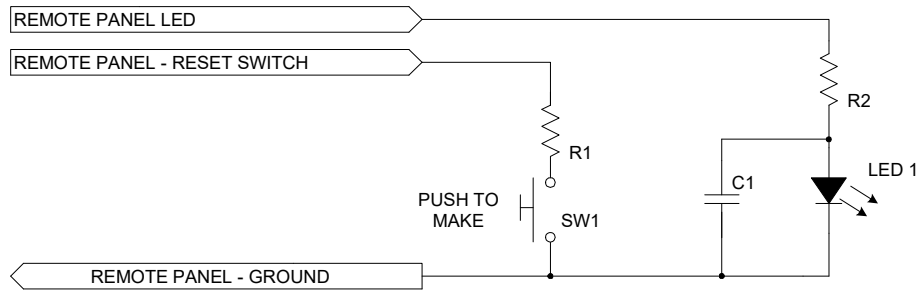


Figure 8-3: SDU Remote Panel LED and Reset Switch wiring example

Table 8-8: Remote Panel Component Specification

| Component            | Label   | Specification         | Colour                    |
|----------------------|---------|-----------------------|---------------------------|
| Reset Switch         | SW1     | Sprung Push to Make   |                           |
| Resistor             | R1 / R2 | 220 $\Omega$ , 250 mW |                           |
| Capacitor            | C1      | 1 $\mu$ F, 50 V       |                           |
| Light Emitting Diode | LED 1   | 2 mA                  | Duplicate SDU Front Panel |

### 8.7 Maintenance Port Ethernet 100Base-T

The maintenance port is an Ethernet RJ-45 socket located behind a hatch on the SDU front panel. The maintenance port does not supply Power over Ethernet (PoE). The method to access to the Satcom Console through the maintenance port is discussed in section 11.1.

### 8.8 RJ-45 Connector Drawing

RJ-45 connectors are used by ISDN terminal adaptors and for Ethernet adaptors. The RJ-45 connector socket and plug with pin numbering is shown in Figure 8-4. The installation of RJ-45 connectors for ISDN and Ethernet in appropriate places in the aircraft is recommended.

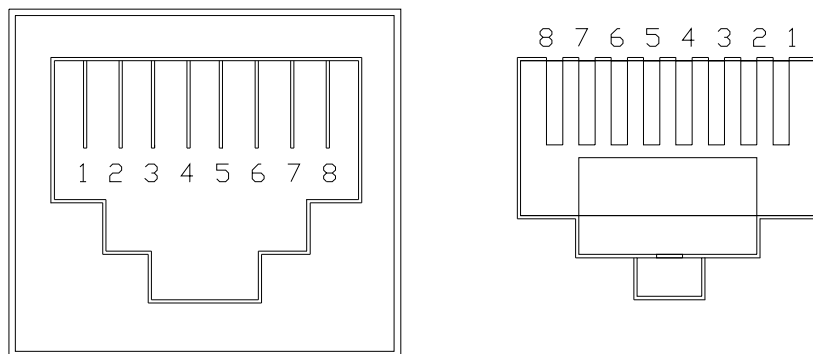


Figure 8-4: RJ-45 ISDN & Ethernet Socket and Plug

### 8.9 RJ-11 Connector Drawing

RJ-11 connectors are used by two-wire phone devices. The RJ-11 connector socket and plug with pin numbering is shown in Figure 8-5. The installation of RJ-11 connectors for two-wire phone devices in appropriate places in the aircraft is recommended.



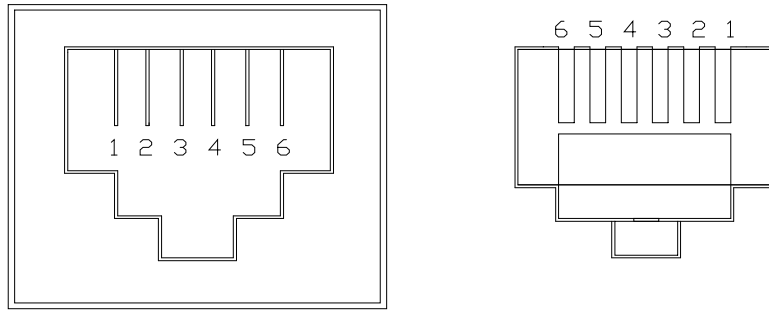


Figure 8-5: POTS RJ-11 Socket and Plug

## 9. WIRING DIAGRAM

Refer to document [25], 862-A0100\_WD, SwiftBroadband SDU-7320/SDU-7330, Wiring Diagram for the AES wiring diagram.

Alternative configurations shown in the wiring diagram are separated by dashed lines.

---

## 10. SERVICE ACTIVATION

Service activation is the process whereby the owner registers the AES with a service provider of his choice. The service provider in turn registers the AES with Inmarsat.

After service activation the service provider will supply the following data that will enable circuit switched calls and data connections to be made via the Satcom System:

- MSISDN's: one unique directory number for every service type (e.g. Voice, 3.1kHz Audio, UDI, RDI). These numbers are the telephone numbers tied to the installed handsets used for incoming and outgoing circuit switched calls. The numbers are allocated per USIM and therefore in a typical multi-modem system four different numbers per modem will be supplied.
- Username and password: Two text strings that need to be provided by the user when attempting to establish authenticated packet data connections.

Each modem of a multi-modem AES must be individually activated. For this reason, all International Mobile Subscriber Identification (IMSI) numbers located on the Configuration Module must be recorded and used on one application form each.

For more details please contact your service provider or Inmarsat Customer Care:

- [www.inmarsat.com](http://www.inmarsat.com) or
- +44 (0) 20 7728 1000

## 11. CONFIGURING THE AES

During installation, various settings must be configured on the SDU before the AES can be used for the first time. Further detail on all configuration aspects can be found in the document referenced in [27].

### 11.1 Login via the Satcom Console

Table 11-1 contains the factory default username and passwords needed for authentication when logging into the Satcom Console. The installer logs into the Satcom Console using the Maintenance account. The Maintenance account provides access to all configuration aspects of the Satcom Terminal. The Administrator account is not used by the installer; however the Maintenance account may be used to restore the Administrator account authentication data to factory defaults (see 11.2).

Table 11-1: Satcom Console Authentication

| Account       | Factory Username | Factory Password |
|---------------|------------------|------------------|
| Maintenance   | "maintenance"    | "SwiftBB"        |
| Administrator | "admin"          | "password"       |

To configure the AES, proceed as follows:

1. Connect a PC to the SDU via the maintenance Ethernet port or optionally one of the Ethernet user ports of the SDU using a standard Ethernet cable. If connected to a user port, jump to section 12.3.
2. If connected to the maintenance Ethernet port, start a JavaScript enabled web browser (Internet Explorer was used in the example below). Type '**http://10.0.1.100/**' in the web browser's address field. The *[Connection Monitor]* appears as shown in Figure 11-1.

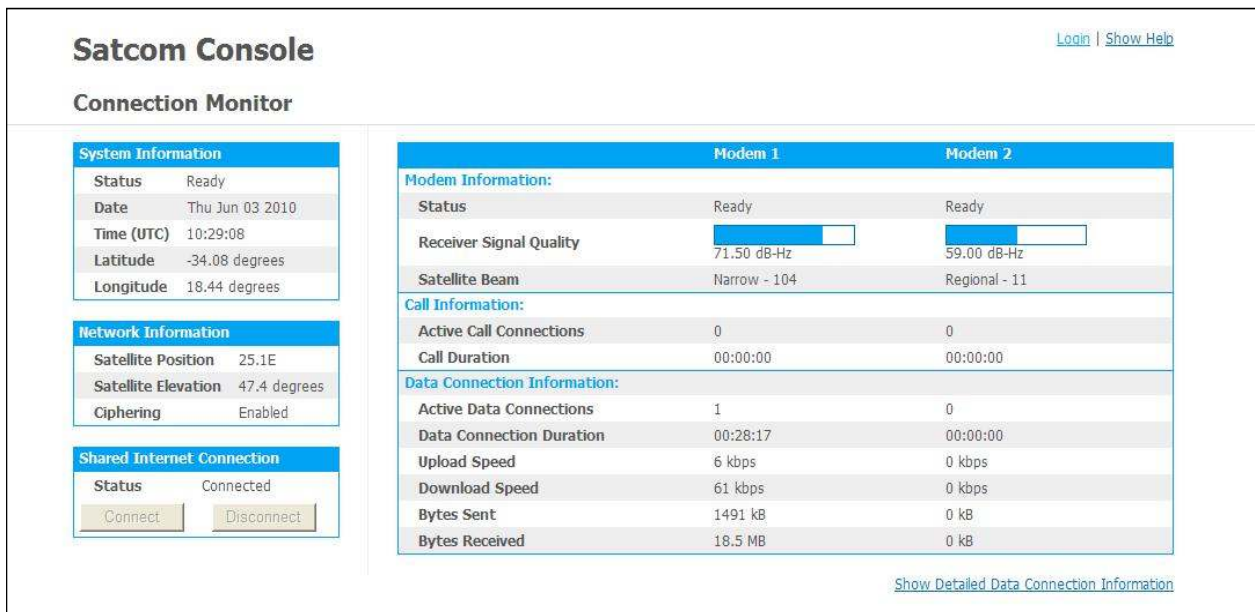


Figure 11-1: Satcom Console [Connection Monitor] page

3. Login with the user name 'Maintenance' to get rights to modify installation settings.

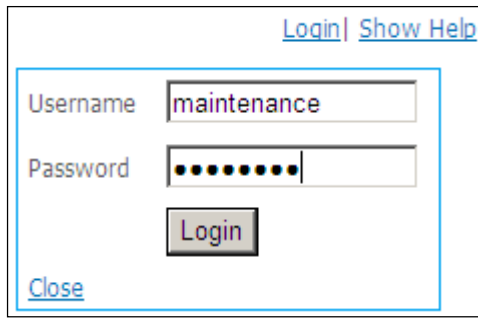


Figure 11-2: Satcom Console [Login] dialogue

4. After successful authentication, various hyperlinks appear in the top pane of the [Connection Monitor] page. Click on the *Installation* link.
  
5. The installation menu is opened with all the active screens listed as a vertical menu in the left pane.

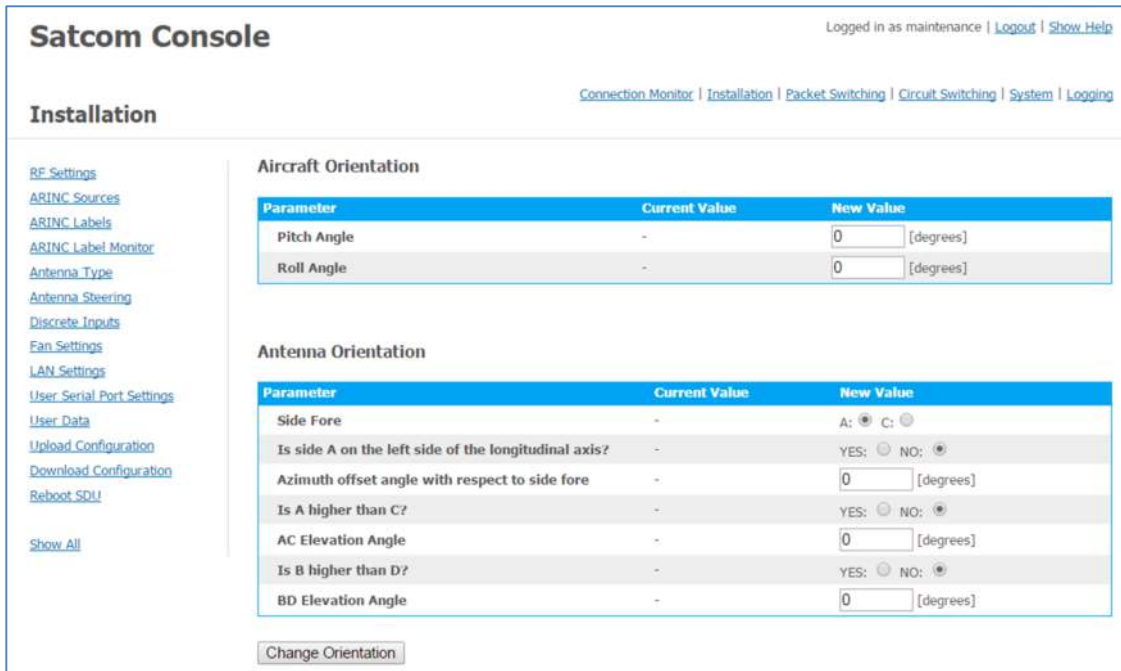


Figure 11-3: Satcom Console [Installation] page.

Help is available for all the installation sub-pages shown as hyperlinks in the left pane of the [Installation] page shown in Figure 11-3. This is achieved by clicking the *Show Help* link on the respective pages.

## 11.2 Restore Administrator Password to Default Password

A forgotten Administrator account login password may be reset to the factory issued default password from within the Maintenance account. The Satcom Console [System - Restore Defaults] page may be used to accomplish that.

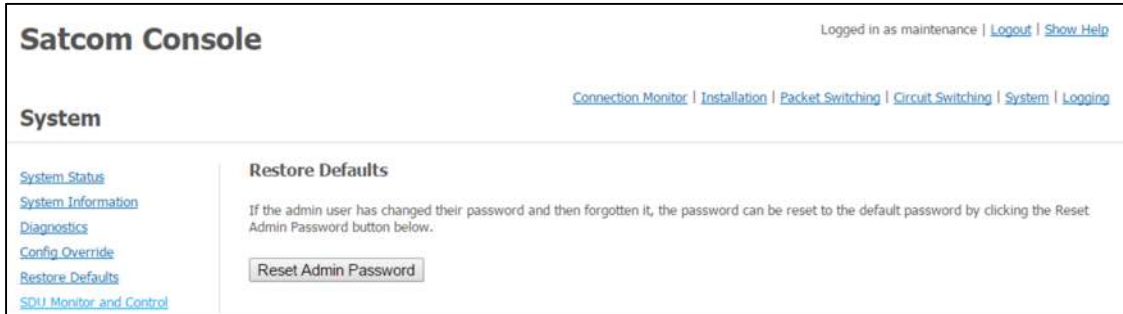


Figure 11-4: Satcom Console [System - Restore Defaults] page.

## 11.3 Configuring Antenna Alignment

The alignment of the antenna with respect to the aircraft must be determined and entered into the Satcom Console for storage in the Configuration Module. Refer to the relevant antenna installation manual for details on how to determine the angles.

**NOTE:** Antenna alignment must not be configured and stored in both the antenna and the SDU, as both devices will then compensate for alignment. In the case of the Cobham Satcom IGA-5001, Mini-M/Aero-I/IGA-5006, HGA-6000 (when connected via co-axial modem cable), HGA-6500, HGA-7000, HGA-7001 or HGA-8000 any installation angles stored in the antenna will be cleared automatically by the SDU. In the case of any other antenna it is important to ensure that installation angles are only configured in either the SDU or in the antenna. Also see the following documents [12][13][14][15][29].

As an example, the index marks used to describe the orientation of the HGA-7000 is shown in Figure 11-5, the front of the HGA corresponds to the A direction. Consult the respective antenna installation manual (referenced in [13]) to determine the front of the antenna. If the actual installed antenna does not have the A-B-C-D direction indication, then it is recommended that temporary index marks be made on the antenna.

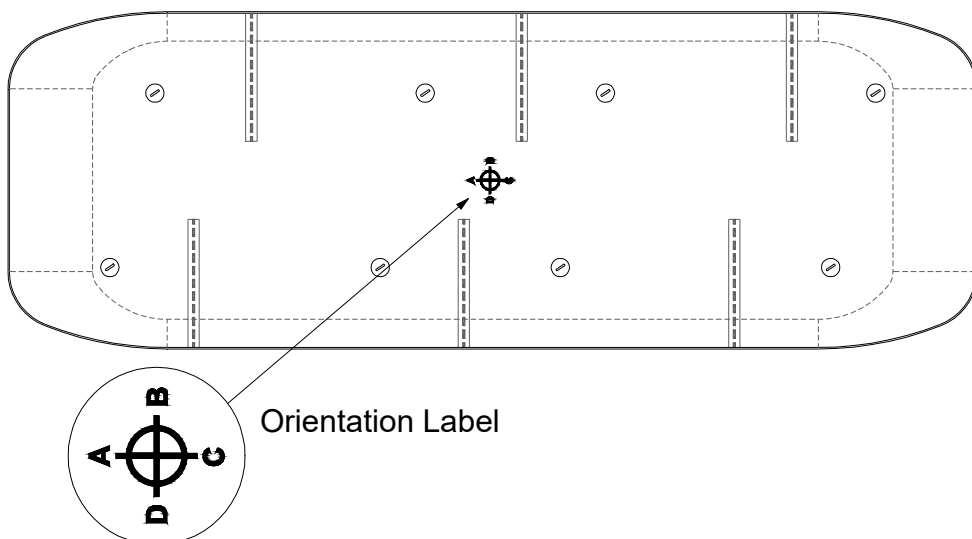


Figure 11-5: Index Marks for Antenna Alignment, HGA-7000 example.

The installer provides the antenna alignment details in the *[Install - Antenna Configuration]* page. The data provided by the installer are the following:

- What is the azimuth angle of a line drawn between index marks A and C, relative to the longitudinal axis of the aircraft? Range: 0 to 90 °
- Which of Sides A or C is closer to the aircraft nose? (Any side can be selected if they are equally close).
- Is Side A on the port or starboard side of C? (Any side may be selected if line AC is parallel to the longitudinal axis of the aircraft).
- What is the elevation angle, as measured with an electronic spirit level, of a line drawn between index marks A and C? Range: 0 to 45 °.
- Is Side A higher or lower than Side C? (If both A and C are at the same level, then either may be selected)
- What is the elevation angle, as measured with an electronic spirit level, of a line drawn between index marks B and D? Range: 0 to 45 °.
- Is Side B higher or lower than Side D?
- What is the roll attitude of the aircraft when parked on the runway, as measured by the aircraft attitude reference system (AHRS, IRS or the Cobham SRU)? The roll angle is positive when the port wing is higher than the starboard wing, and negative otherwise.
- What is the pitch attitude of the aircraft when parked on the runway, as measured by the aircraft attitude reference system (AHRS, IRS or the Cobham SRU)? The pitch angle is positive if the nose points up and negative otherwise.

## 11.4 Self-Steering Antennas

### 11.4.1 Mini-M/Aero-I/IGA-5006 Antenna

The Aero Mini-M/Aero-I/IGA-5006 antenna may be used like any other antenna with aircraft attitude data supplied by external sensors as described above.

The Antenna however also contains built in sensors that can be used by the SDU to determine the attitude of the aircraft. This mode is called 'Self-Steering Mode'.

#### 11.4.1.1 Configuration for Self-Steering Antenna in Non-Self-Steering Mode

The following procedure is applicable when the antenna is required to operate in non-self-steering mode

- Open the *[Installation – Antenna Type]* page in the Satcom Console.
- Disable the Self-Steering functionality by checking the appropriate checkbox.

#### 11.4.1.2 Sensor Calibration Procedure

The magnetometer of the Mini-M/Aero-I/IGA-5006 must be calibrated after installation before it can be used in self-steering mode, as described below. To calibrate the magnetometer, the aircraft must be positioned in an area free from external magnetic interference, and with all aircraft systems powered to represent the magnetic environment of the aircraft during flight. A detail description of the calibration procedure and the interpretation of the calibration results are provided in the online Help on the *[Self-Steering Calibration]* Page.

The following steps should be followed to calibrate the magnetometers:

- Configure the Satcom System to use the self-steering antenna by using the following functionality offered by the Satcom Console [*Installation – Antenna Type*] page.
- Check the *Self-Steering* parameter checkbox under the *Self-Steering Antenna* heading. Once enabled, the [*Self-Steering Calibration*] link will appear in the left pane.
- With the aircraft ready to start rotating, select *Start* on the [*Self-Steering Calibration*] page (under the Calibration Status and Control heading).
- Rotate the aircraft through 360 degrees at a maximum rate of 3 degrees per second.
- Once the full rotation was completed select *Stop* under the Calibration Status and Control heading on the [*Self-Steering Calibration*] page. The results of the calibration and whether the calibration was successful or not, will then be displayed.

If a successful calibration cannot be performed due to too much magnetic interference from the aircraft or the environment, a diagnostic log file should be downloaded (see section 11.7) to capture details of the magnetometer measurements recorded during the last calibration attempt. Note that this detail data is non-volatile, and will be lost when the Satcom System is reset.

### 11.5 RF Cable Loss Registration

The losses in the RF cables and DLNA at 1.6 GHz must be determined to an accuracy of 0.1 dB and entered into the configuration. The cable loss limits are defined in Section 5.8.

The AES uses the cable loss values to ensure the correct levels of transmit and receive signals. Incorrect loss values will degrade performance and may even prevent the AES from operating.

### 11.6 SRU-7200 Installation and Calibration

This step is required if an SRU-7200 is used to provide aircraft attitude data to the SDU. When the SRU is installed and calibrated with the Installation and Support tool PC Software (Part no 800-A0265). Re-calibration is therefore required when a SRU or MSU is replaced on the aircraft, provided the replacement units are installed in an identical position and orientation. The SRU installation and calibration procedure is described in document [13].

### 11.7 Diagnostics Tests on an Installed System

Diagnostic test results on an installed system are retrieved through the Satcom Console. The tests will retrieve the current status of all the sub-systems, as well as records of past failures and warnings, serial numbers and version data, various measurements and other information that may be useful for fault finding. They are accessed in the following manner:

From the Satcom Console select the [*System – Diagnostics*] page. Download the diagnostics file by selecting the *Download* option in the central pane.

The diagnostics file is a text based file containing the system diagnostics data. Alternatively the system logs may individually be viewed and downloaded from within the [Logging] page. Snapshots of the various system logs, that are located on the [Logging] page, are also present in the diagnostics file.

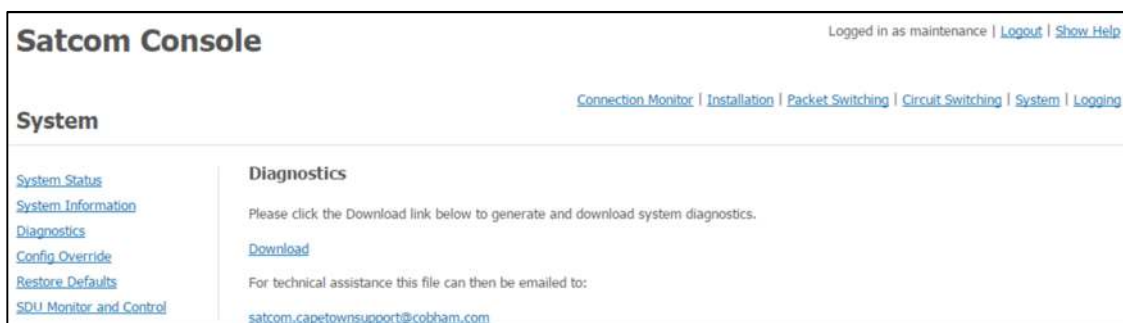


Figure 11-6: Satcom Console – System menu Diagnostics page

## 11.8 Network Settings

Ciphering is a process whereby user signalling and data are encrypted over the satellite link to prevent unauthorised interception of information. The functionality is enabled by default, **and should only be disabled for diagnostic purposes when investigating connection problems**. If enabled, the terminal's ciphering capability is signalled to the network during registration, and will be applied to every PDP context created. Ciphering is applied at the network's discretion.

Ciphering can be enabled/disabled in the Network Settings pane of the *[System-Config Override]* page as shown in Figure 11-7. Changes made to Ciphering in the Satcom Console only get affected at new context creation.

On completing the required changes, press the Apply Advanced Network Settings button.

The network may disable ciphering at its discretion for any session. Users are advised to apply their own end-to-end encryption wherever confidentiality is of paramount concern.

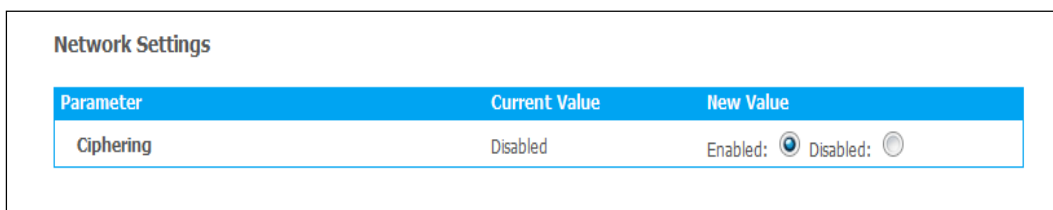


Figure 11-7: Network Settings

## 11.9 Preservation of Configuration Data

A maintenance facility exists that preserves the user configuration data in data file format uploaded/downloaded from/to a connected PC. The downloaded configuration data file can then be uploaded to another Satcom System where the same configuration is required.

The *[Installation – Download Configuration]* page can be used to download all user configuration data to the connected PC.

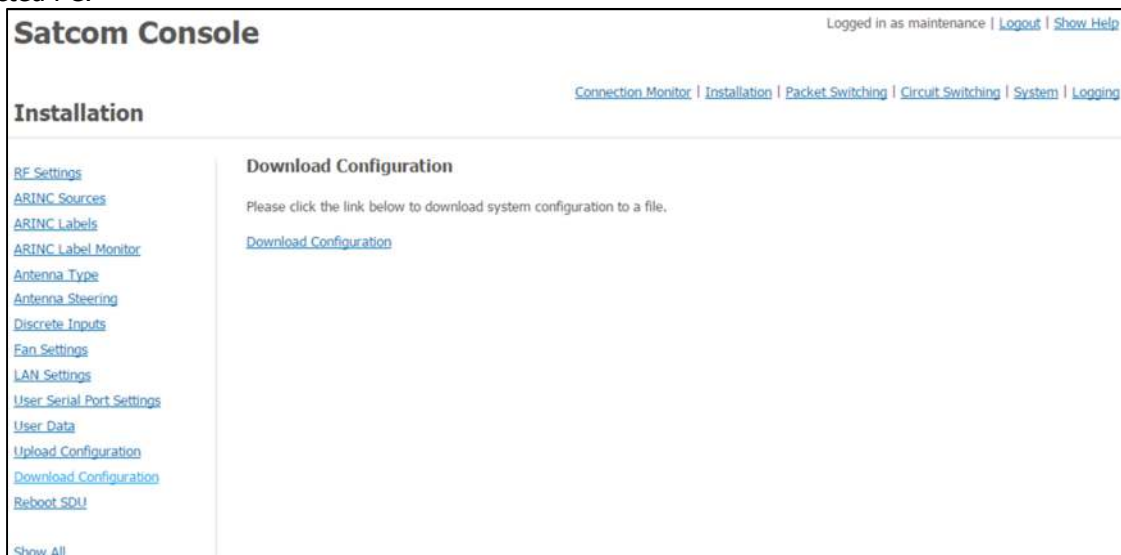


Figure 11-8: Download Configuration

The *[Installation – Upload Configuration]* page can be used to upload previously saved user configuration data to the same or a different Satcom System from a configuration file previously stored on a connected PC.

A restart is required for the uploaded configuration to become active.



**NOTE:** All existing configuration will be overwritten on the CM after affecting the configuration upload. Care must therefore be taken to first download the existing configuration.

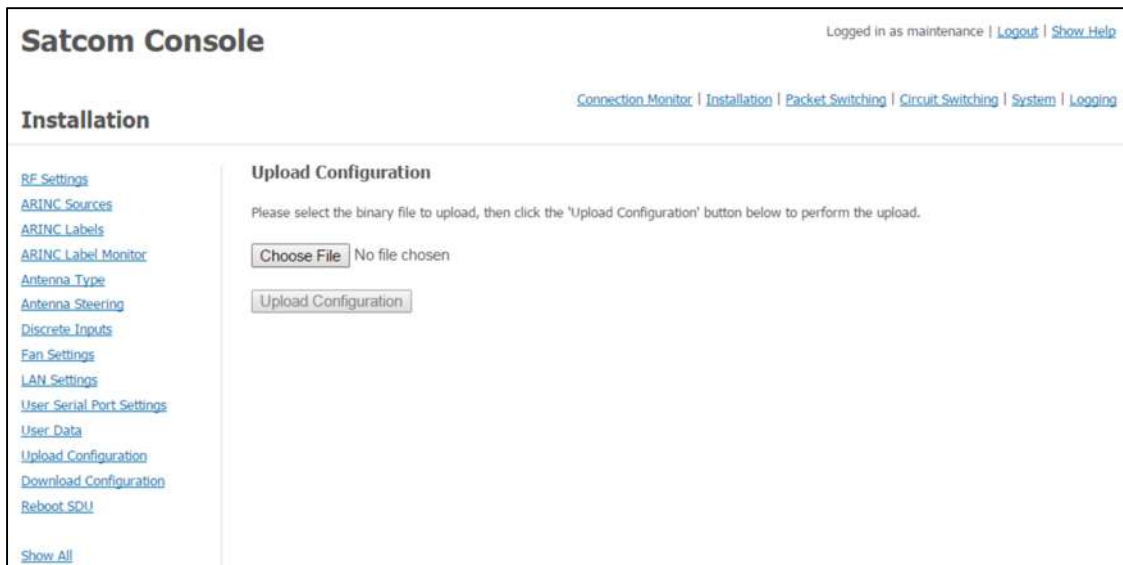


Figure 11-9 10: Upload Configuration

## 12. SETTING UP USER EQUIPMENT

### 12.1 Configuring for ISDN Terminals

ISDN terminal equipment must be set up by following the installation instructions for the equipment. The call routing for ISDN incoming and outgoing calls (performed by the SDU) is managed through the Satcom Console and needs to be configured in order to customize the ringing, bearer services and default USIM associated with the connected terminals. Refer to the document listed in [27] for the configuration details.

### 12.2 Configuring for Telephone (POTS) Handsets

Open the Satcom Console [*Circuit Switching-POTS & ISDN Configuration*] page. The General Configuration section is used to configure the handset impedance, loop current and respective volume levels.

The Echo Canceller section is used to switch echo cancellation functions on/off for the corresponding POTS user port. It is recommended to enable echo cancellation (using the checkbox corresponding to the used port) per default.

The call routing for POTS incoming and outgoing calls (performed by the SDU) is managed through the Satcom Console and needs to be configured in order to customize the ringing, bearer services and default USIM associated with the connected terminals. Refer to the document listed in [27] for the configuration details.

Some configuration settings will automatically be applied once the corresponding Save button is clicked, while others (loop current and impedance) will only be applied after an SDU restart. This will be indicated to the installer with a message after the Save button was clicked.

When connecting POTS devices to the SDU, ensure that they are on-hook during connection as an automatic port calibration process is performed after connection.

Suggested<sup>20</sup> configuration values for the following flight certified handsets:

<sup>20</sup> The configuration settings listed may differ from the values prescribed by the handset manufacturer, but must be used in order for the handset to function with the Satcom System.

Table 12-1: Suggested SDU-side POTS device configuration

| POTS Device                                    | Loop current (mA) | Ring Frequency (Hz) | Ring Waveform |
|--|-------------------|---------------------|---------------|
| ICG Jetphone                                   | 20                | 25                  | Trapezoidal   |
| ICG SIGMA-7 line powered retractable reel      | 29                | 25                  | Trapezoidal   |
| ICG SIGMA7 externally powered retractable reel | 26                | 25                  | Trapezoidal   |

### 12.3 Configuration to enable IP-capable devices on Satcom Terminal LAN

To establish Internet access for an IP-capable device, the device has to be connected to any SDU Ethernet user port.

The Satcom Terminal may be configured to run the DHCP (Dynamic Host Configuration Protocol) service that automatically assigns unique IP addresses to all devices connected to the Satcom Terminal LAN. The new IP address received consists of two parts, a network part (most significant three octets) and a host part (least significant octet). The IP address may change with every subsequent re-connection to the Satcom System.

Care must be taken that the IP address received from the Satcom system may cause the device to lose connectivity to other devices it had connections to prior. For example - in cases where the device is logically connected to other devices via an Ethernet switch.

The Satcom Terminal may also be configured to provide for devices that have fixed/static IP addresses. In that case DHCP is not used and the device uses the same address even between re-connections to the Satcom System. For the allocation of static IP addresses on the Satcom Terminal LAN see [27]. To configure a user PC with a static IP address see [26].

The following steps may be followed to connect a user PC (using Windows 7) to the Satcom Terminal using DHCP:

1. Via the Maintenance account (see section 11.1), enable the DHCP parameter in the Satcom Console *[Installation – LAN Settings]* page.
2. Connect the PC's Ethernet adaptor (Network Interface Card) to the Satcom Terminal rear-panel Ethernet socket using an Ethernet cable.
3. Log on to Windows. Click on the Start button, and then select Control Panel.

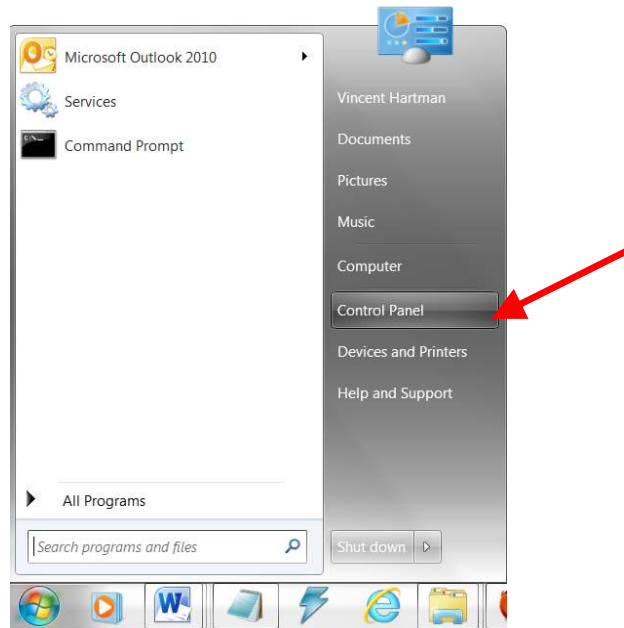


Figure 12-1: Windows Start Menu

The Control Panel window will open.

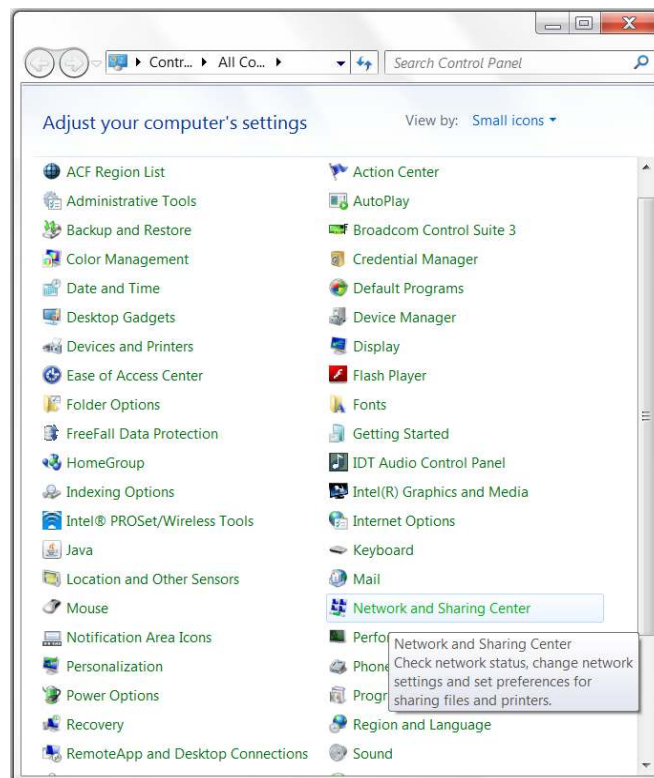


Figure 12-2: Windows Control Panel.

4. Double-click on the Network and Sharing Center icon.

A window displaying the list of available network connections will be shown. The Ethernet connections will be listed in the LAN or High Speed Internet section. If no connection associated with an Ethernet adaptor is displayed, an appropriate driver must be installed before proceeding.

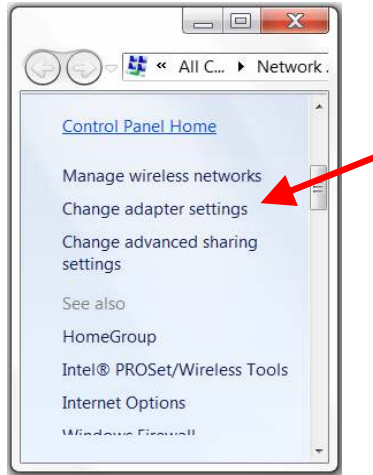


Figure 12-3: Windows Network Connections.

5. Right-Click on the connection associated with your Ethernet adaptor, and select Properties.

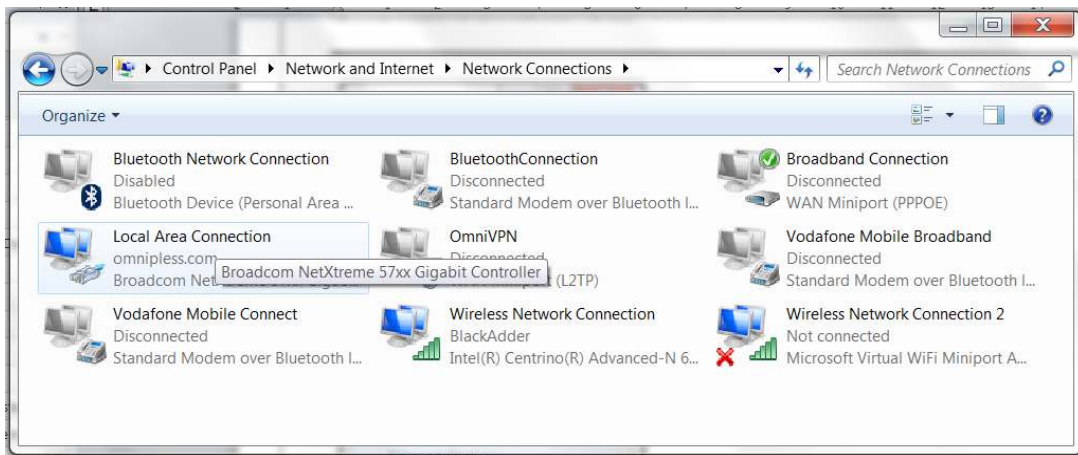


Figure 12-4: Windows LAN Properties

6. Right click on the "Local Area Connection" and select the "Properties" item in the list. The following dialogue appears

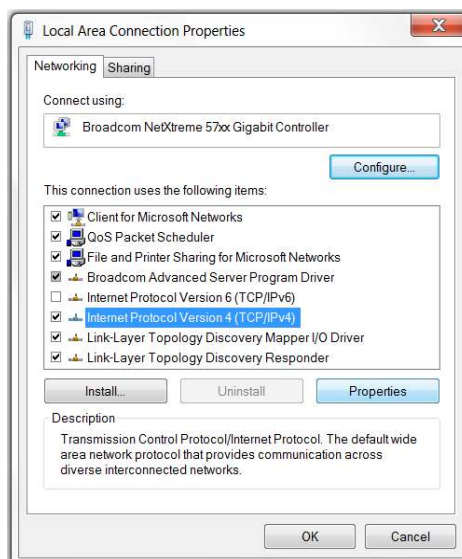


Figure 12-5: Internet Protocol Properties

7. Scroll down until Internet Protocol Version 4 (TCP/IPv4) is highlighted, and then click on the Properties button.

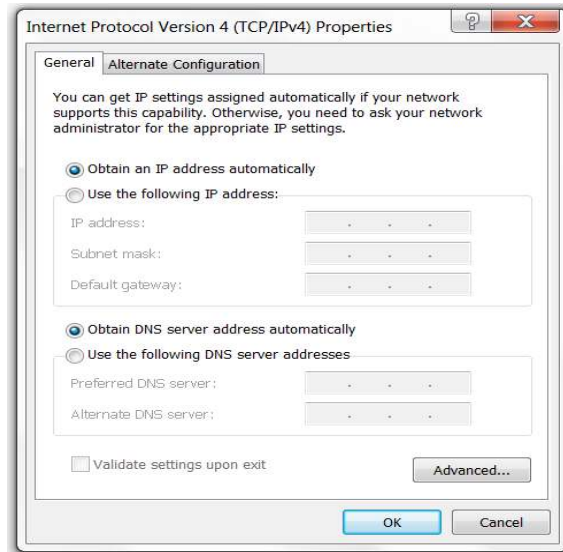


Figure 12-6: IP Properties General tab

8. Ensure that both "Obtain an IP Address automatically" and "Obtain DNS server address automatically" are selected.
9. Click on the OK button to return to the network connection properties, and click on the Close button again to return to the Network Connections window.
10. If the Network Connections window indicates that the Ethernet adaptor is currently disabled, right-click on the connection and select "Enable".

If the connection is working, the LAN Icon in the Windows 7 status bar will display the following status "Internet Access"

Once connected:

- Start the browser.
- In the Browser Tools menu, click Internet Options.
- Click on the Connections page tab.
- Click on LAN Settings.
- Ensure the check-box marked "Use a proxy server..." is cleared.
- Click OK, and again click OK to close the Internet Options check-boxes.
- Start surfing. This step will only succeed if the Satcom System's Shared Internet Connection (see the document reference in [27]) is active.

## 13. SYSTEM VERIFICATION

### 13.1 Wiring Verification

When the wiring is complete and before units are inserted into the mounting trays it is advisable to verify that the DC power routing is correct. Use a volt-meter and ensure that all power inputs are of the correct level and polarity.

### 13.2 Post-Installation Tests

Position the aircraft so that the antenna has a clear view of the sky. After power-up initialisation of the AES, the front panel status LEDs on the SDU and HPA (or HLD) should be as shown in Table 13-1 and Table 13-2 (or Table 13-3) below before any calls can be made. It may take a few minutes to reach this state, particularly if the GPS receiver also has to perform a cold start. More information on the interpretation of the SDU front panel LEDs is given in section 4.1.1.2.

Table 13-1: SDU-7320/SDU-7330 LED Initialised State

| LED         | Colour | State | Meaning   |
|-------------|--------|-------|---|
| POWER       | Green  | On    | SDU DC power is switched on                               |
| READY       | Green  | On    | SDU and peripherals ready for calls                       |
| CALL        | Green  | Off   | No calls in progress                                      |
| MAINTANENCE | Yellow | Off   | System is fully configured and no maintenance is required |
| FAILURE     | Red    | Off   | No critical failures detected                             |

Table 13-2: HPA-7400 LED Initialised State

| LED    | Colour | State | Meaning                              |
|--------|--------|-------|--------------------------------------|
| POWER  | Green  | On    | HPA DC power is switched on          |
| ACTIVE | Green  | Off   | Transmission of RF power is disabled |
| ALARM  | Red    | Off   | No HPA failures detected             |

Table 13-3: HLD-7260 LED Initialised State

| LED     | Colour | State | Meaning                              |
|---------|--------|-------|--------------------------------------|
| POWER   | Green  | On    | HLD DC power is switched on          |
| ACTIVE  | Green  | Off   | Transmission of RF power is disabled |
| FAILURE | Red    | Off   | No HLD failures detected             |

The start-up processes within the AES can be monitored by observing the LEDs and referring to Table 4-1. A few seconds after power is applied all of the SDU LEDs should briefly be on simultaneously. Then the READY LED will flash slowly until valid aircraft position data is available to point the antenna and the AES has registered itself on the satellite network.

### 13.2.1 Antenna Steering Check

The Satcom Console may be used to verify that the antenna steering is correct and an acceptable signal is received from the satellite. Various Status and Diagnostics messages will help isolate any problems that may arise.

To perform the steering check it is required that the aircraft is slowly turned through 360°, during which time the following shall be observed:

- Aircraft attitude (True Heading, Roll and Pitch Angles) should reflect the rotation; Use the Antenna Steering Details section on the *[System- System Status]* page.
- Antenna steering state should remain 'Pointing';
- Use the Satcom Console *[System-System Status]* page. Locate the GPS Details heading and verify the status. If the GPS receiver internal to the SDU is used, the GPS 'Locked' status as well as 'GPS Satellites Tracked' should be seen.
- The Receiver Signal Quality of the received signal from the BGAN Satellite should remain constant within +/-1 dB-Hz; modem status may also be viewed in the System Status window. Alternatively the Modem Information section in on the *[Connection Monitor]* page may be used to verify the steering status by monitoring the Received Signal Quality parameter.

### 13.2.2 Voice Call Quality Check

Before any calls can be made, ensure that the AES has been properly activated by an Inmarsat Service Provider as described in section 10.

Make a voice call and then turn the aircraft through 360° while monitoring speech quality.

### 13.2.3 Data Call Quality Check

Configure the SDU for maximum data throughput and then connect a computer to the Internet by accessing an appropriate web page. Download a large data file and monitor data throughput while the aircraft is turned through 360 °.

### 13.2.4 Interference Check

An interference check must be performed on-ground before the first flight-test. The purpose of the interference check is to verify that the AES does not interfere with the navigation and communication systems of the aircraft.

To perform the interference check the aircraft must be parked outside with clear view to the Inmarsat satellites.

The aircraft must be parked such that the antenna beam points in the general direction of most of the other aircraft antennas (for example if the antenna is tail-mounted then the nose of the aircraft must point towards the satellite). If the antenna is mounted in the centre of the aircraft, possibly interfering with antennas both in front and behind, the test should be repeated for each direction. Qualified personnel must verify that no interference occurs with other aircraft systems when the AES system is operating.

#### 13.2.4.1 Inter-Modulation (IM) Interference

System performance may be degraded as the result of Inter-Modulation Interference. Contact the manufacturer for further assistance.

### 13.3 In-flight Functional Tests

Repeat the antenna steering check, voice call quality check and the data call quality check described above while the aircraft is flying in a circle or figure-of-8 at cruise speed. Be aware of potential blocking of the satellite signal by the fuselage, wings or tail at high bank angles and low satellite elevations.

## 14. TROUBLESHOOTING

The AES performs power-on self-tests, as well as periodic tests. The SDU collects logs and displays status LED information for the complete AES.

Failures are classified according to severity and displayed on the front panel of the SDU through the MAINTENANCE and FAILURE LEDs (see Table 4-1). More detailed information about the failures is recorded in diagnostic logs which are stored in the SDU and can be retrieved through the Satcom Console. These logs may also be downloaded in one go, as shown in section 11.7.

Certain failures will cause the system to reset automatically, in an attempt to recover from the failure. The system will reset for a total of three times after which a final error state will indicate that the particular failure is persistent.

**NOTE:** In an event of a failure condition, the first step should always be to download the Diagnostics log file.

Failures seen during the installation process might be resolved by performing some of the actions listed in Table 14-1.

Conventions used in Table 14-1

All values in the 'Component/Location' and 'Status' columns of Table 14-1 are read from Satcom Console pages and mean the following:

- The 'Component' may refer to the Satcom System or subsystem thereof, of which the component status is given in Column 2 of Table 14-1.
- The 'Location' identifies the Satcom Console page where the corresponding status values, given in the second column of Table 14-1, are read from.

The information pointed to from within the 'Action' columns are either found in the Satcom System logs invoked from the *[Logging page]* page, or directly read from the various Satcom Console pages.

Table 14-1: Trouble shooting action list

| "Component / Location"  | Status                  | Action 1   | Action 2  | Action 3 |
|---|-------------------------|--|---|----------|
| <b>System/[System-System Status]</b><br>(System Component Status parameter 'System Status') | Waiting for Steering    | See ' <a href="#">Antenna Steering</a> Status'   |   |          |
|   | Waiting For Peripherals | Check for any heating events generated in the event logs. Monitor the logs to verify that the heating completes. | Inspect the system log files. Verify if any error events were received. Identify the components in error and re-visit the first column of this table. |          |
|   | Acquiring               | See ' <a href="#">Modem 1/2</a> component'.  |   |          |
|   | Ready                   | No corrective actions required.  |   |          |



| "Component / Location" | Status                     | Action 1  | Action 2   | Action 3   |
|------------------------|----------------------------|---|--|--|
|                        | System Error               | Inspect system logs for clues on which subsystems (components) might be at fault.   | Use this table to investigate further based on a component state or related events.                                | Verify that all installation parameters were correctly configured. Verify all content configured via the <i>[Installation]</i> page. |
|                        | Modem Error                | See ' <a href="#">Modem 1/2</a> component'.   |  |  |
|                        | RF Amplifier error         | Check the state on the <i>[System-System Status]</i> page.<br>Refer to <a href="#">HPA /HLD</a> and use the corresponding 'Alarm' state to investigate further. | Check that the HPA/HLD Power LED is lit. Also check the Error LED (See Table 13-2 and Table 13-3 for LED meaning). |  |
|                        | Antenna Error              | Refer to ' <a href="#">Antenna</a> ' states   | Verify from the system event logs if any antenna errors are present.<br>Verify the Antenna Voltage supply.         |  |
|                        | Configuration Module Error | See ' <a href="#">CM</a> ' states (start with the 'detected' state).  |  |  |
|                        | Calibration failed         | Check RF Cable connectivity between SDU and HPA.  | Confirm that correct RF Cable Losses are programmed by using the <i>[Installation – RF Settings]</i> page.         | Verify that the configured losses agree with the actual measured cable losses.   |

| "Component / Location"   | Status               | Action 1   | Action 2  | Action 3  |
|--|----------------------|--|---|---|
|  | Radio Silence        | <p>(Only an error If the state is entered unintentionally.)</p> <p>Use System Component Status field on the <i>[System –System Status]</i> page to determine the source of the TX Mute assertion.</p> <p>(This state may be caused by asserting the Tx Mute discrete or by sending a TX Mute message via the Connection Monitor and Control interface)</p> | <p>If the state was caused unintentionally:</p> <p>Ensure that the message was not sent via the Control and Monitor Interface.</p> <p>Check if the discrete switch polarity is correctly configured. <i>[Installation-Discrete Inputs]</i></p> <p>Verify why the discrete line was asserted (if it is for instance connected to a hard reset switch or breaker switch fitted to the airframe, verify what caused the assertion)</p> | <p>Check the SDU version of the state of the Tx Mute switch using the Real-time Discrete Input Monitor parameter of the <i>[Installation-Discrete Inputs]</i> page. Compare to actual switch state.</p> |
| <p><b>HPA/ [System-System Status]</b><br/>(System Component Status)</p>              | No HPA/HLD Detected  | Check the HPA Power LED. If not lit, verify 28 Vdc power to HPA.   | Check RF Cable (Tx) between SDU and HPA.  | Replace HPA   |
|  | HPA/HLD Detected     | No corrective action required.   |   |   |
|  | Invalid HPA Detected | Check HPA hardware and software revisions for SBB compatibility using the Upgrade documentation received with the installed software.  | If SW has been downloaded to the HPA prior to receiving the Invalid event, restart the AES.   |   |
| <p><b>HPA Status</b><br/><i>[System-System Status]</i> (System Component Status)</p> | Initializing         | If the HPA does not transition from this state within a minute, restart the AES.   | <p>After restart, draw the diagnostics log and inspect the log for the presence of HPA related events.</p> <p>Diagnose further by using this table.</p>   |   |
|  | Idle                 | Confirm correct RF Cable losses are programmed (SDU to HPA see section 5.8). Ensure that actual measured cable losses are used.  | Use the system logs to verify if calibration failure events were received.  |   |

| "Component / Location" | Status                                    | Action 1  | Action 2   | Action 3  |
|------------------------|---|---|--|---|
|                        | Active                                    | No corrective action required. The HPA is ready to transmit.  |  |   |
|                        | Alarm                                     | <p>Review system logs and search for HPA failure related events.</p> <p>Ensure that no short circuit conditions exist on the RF cable connection between the HPA and Antenna (the HPA may supply DC power to the antenna in the same cable)</p> <p>The HPA may be at a too high temperature, verify that the fan assembly is functional (fans should all come on briefly after a HPA power cycle) as well as other methods of cooling employed.</p> | <p>Check HPA power supply current capability and match with the required power (see section 5.5.2.2 and 5.5.2.3)</p> <p>Check the system event logs. If a DLNA BITE Error message is present, the DLNA may be in error.</p> <p>Verify that the DLNA BITE wiring between the HPA and DLNA is correct.</p> <p>If the DLNA BITE ERROR event appears to have originated from a connected antenna, Verify that the AES was correctly configured (HPA TP1A pin was connected to pin BP2).</p> <p>Verify that the DLNA is powered correctly.</p> <p>Verify the DLNA wiring.</p> | <p>In case of the DLNA BITE error:</p> <p>If the DLNA is powered and the problem still exists Replace the DLNA.</p> |
|                        | Software Download                         | Maintenance process underway. If status prevails after the download completed, restart the AES.   |  |   |
|                        | HPA/HLD Detected – Busy Heating : Temp xx | No corrective action required if this occurs at start-up, allow additional time for heating to complete. The time to wait may be in a range of 8 to 15 minutes.   |  |   |

| "Component / Location"   | Status   | Action 1  | Action 2  | Action 3  |
|--|--|---|---|---|
| <b>Antenna / [System-System Status]</b><br>(System Component Status) | No Antenna Detected  | Check Antenna cabling towards the SDU. Verify SDU wiring between BP5 and BP9 for 28 Vdc (see document [25]) | Verify the Antenna Voltage configuration; see the Antenna Voltage section in the <i>[Installation-Antenna Type]</i> page.   | Measure the Antenna supply voltage. (The HPA supplies the power to the antenna in the case of a modem controlled antenna) |
|  | For modem controlled antennas:<br>"IGA-5XXX Detected"<br>"HGA-XXXX Detected" | Correct if detected antenna agrees with actual installed antenna. No corrective action required.            |   |   |
|  | For ARINC controlled antennas:<br>"ARINC741 detected"<br>ARINC781 detected   | Correct if antenna agrees with actual installed antenna. No corrective action required.                     |   |   |
|  | Error  | If antenna software was downloaded. Redo the download.  | Measure the Antenna supply voltage. (The HPA supplies the power to the antenna in the case of a modem controlled antenna) and ensure that the antenna has the correct voltage levels. | Restart the AES. If the antenna errors are still present.<br><br>Replace the antenna.                                     |
|  | Unknown Antenna Detected   | Confirm that a non-Cobham antenna is installed. No corrective action required.                              |   |   |

| "Component / Location"  | Status                      | Action 1   | Action 2   | Action 3  |
|---|-----------------------------|--|--|---|
| <b>Modem1/2</b><br>/ <i>[System-System Status]</i><br>(System Component Status) | Not Present                 | For a multi-modem system:<br>Check system logs for number of detected modems.<br>If this occurs after a software upgrade, reload the software ensure that the instructions in the upgrade document are strictly followed.<br><br>For single modem system: No action required provided that one modem is detected. If no modem is detected proceed to Action 2. | Replace SDU if status persists.  |   |
|   | Initialising                | No corrective action required. Event only seen during start-up and restart. Allow additional time.   |  |   |
|   | USIM Not Available          | Check if CM is present and connected to the SDU. Also see <a href="#">CM</a>   | Check if CM is fitted with the required number of USIMs  | Replace CM.   |
|   | Heating                     | Correct for AES start-up below 40 degrees. No corrective action required.  | Wait at least 3 minutes. Check the system status as well as the event logs for further clues during the waiting period. Verify that the Ready state is received after the heating completed. |   |
|   | Waiting for Navigation Data | Note the Antenna Steering Status on the <i>[System – System Status]</i> page.<br>Investigate possible causes by looking at the actions listed under <a href="#">Antenna Steering</a> in this table.  | Check Antenna Steering Details section on the <i>[System – System Status]</i> page.  | Check GPS antenna connection. Check that selected ARINC429 labels are received.<br><i>[Installation-ARINC Label Monitor]</i><br>Check that the required labels were selected, see the <i>[Installation-ARINC Sources]</i> and <i>[Installation-ARINC Labels]</i> pages. |

| "Component / Location" | Status                       | Action 1   | Action 2  | Action 3  |
|------------------------|------------------------------|--|---|---|
|                        | Waiting to Start Acquisition | Download Diagnostic file.<br>Reset the system.   |   |   |
|                        | Acquiring                    | Allow additional time after ensuring that no navigation info is simulated, or that simulated navigation is correct; see the <i>[System-Config Override]</i> page.  | Is the aircraft outside of the hanger? Ensure the aircraft has clear view of the sky. Nearby buildings may be obscuring the path to the satellite | Verify antenna orientation and misalignment <i>[Installation-Antenna Orientation]</i> as well as navigation data. |
|                        | Ready                        | Correct. No corrective action required.  |   |   |
|                        | Modem Error                  | Download the Diagnostics file.<br>Restart the AES.   |   |   |
|                        | Software Download            | If status prevails after the download completed, restart the AES.  |   |   |
|                        | Blocked                      | <p>Check the <i>[System-System- Status]</i> and system logs for the following:</p> <ul style="list-style-type: none"> <li>• HPA/HLD Detected – Busy Heating. See <a href="#">HPA/HLD</a> states.</li> <li>• From events logs determine if the blocked condition is steering related. See '<a href="#">Antenna Steering</a> Status.'</li> <li>• For a multi-modem system Check reported antenna gain; use the <i>[System System Status]</i> page. Low reported antenna may result in insufficient available HPA output power. Is the Satcom System located within the Inmarsat I4 satellite coverage area?</li> </ul> |   |   |

| "Component / Location"  | Status                  | Action 1   | Action 2  | Action 3   |
|---|-------------------------|--|---|--|
| <p><b>Internal GPS / [System-System Status]</b><br/>(System Component Status section)</p>         | Locked                  | <p>Correct.<br/>No corrective action required.</p>   | <p>Long time delay perceived to get lock. (longer than 2 minutes) elapsed before the Locked status was achieved, verify the following in the GPS Details section of the [System-System Status] page.</p> <ul style="list-style-type: none"> <li>• check Satellites Tracked (Should be &gt;4) else Action 3</li> <li>• check Satellites Visible (Should be &gt;4) else Action 3</li> </ul> | <p>Verify the GPS RF antenna cable length and loss.<br/>Check if the GPS antenna has open sky.</p> |
|   | Not Locked              | <p>Correct if external ARINC429 GPS is available and configured correctly in the Satcom Console.<br/>Not correct if internal GPS is required. Ensure that the GPS antenna has a clear view of the sky.</p> | <p>Confirm GPS Patch connected and powered.<br/>If GPS signal is received by a GPS patch antenna located on a connected antenna, ensure that the antenna RF cable is installed correctly.<br/>If powered by the SDU 5V supply, verify that this was configured. [Installation – Antenna Type]. Also verify the required wiring (see [25])</p>   | <p>Check cable loss and connectivity between SDU and GPS Antenna.</p>                              |
| <p><b>Configuration Module / [System-System Status]</b><br/>(System Component Status section)</p> | Front Panel CM Detected | <p>Correct if using internal CM. No corrective action required.</p>  |   |  |
|   | External CM Detected    | <p>Correct if using external CM. No corrective action required.</p>  |   |  |

| "Component / Location"   | Status  | Action 1   | Action 2  | Action 3   |
|--|---|--|---|--|
|  | External and Front Panel CM Detected (Using External) | Correct if both internal and external CMs connected. No corrective action required. A system warning will be logged. (Care must be taken as only the external (rear) CM will be used in this case) | For flight purposes only retain one CM per SDU.   |  |
|  | None Detected   | Insert Configuration Module fitted with provisioned USIMs  | Check wiring between SDU and External CM  | Restart the AES.   |
| <b>Antenna Steering / [System-System Status]</b><br>(Antenna Steering Status section)    | Waiting for steering & Doppler data                   | Check antenna presence.  | Check the actions related to <a href="#">Steering Input Data</a> , <a href="#">Time input Data</a> and <a href="#">Doppler Input Data</a> in this document. |  |
|  | Waiting for satellite position                        | Check the system status and determine if calibration was successful.   | Check the <a href="#">Modem 1/2 states</a> . The expected states should be Acquiring or Ready.  | Check if Navigation information present.                                       |
|  | Pointing  | Correct. No corrective action required.  |   |  |
| <b>Time Input Data / [System-System Status]</b><br>(Antenna Steering Status section)     | Invalid   | Check GPS Source <i>[System-System Status]</i>   | Check ARINC Time Label source. <i>[Installation-ARINC Labels]</i>   | Check ARINC Label filter by using the <i>[Installation-ARINC Labels]</i> page. |
|  | Valid   | Correct. No corrective action required.  |   |  |
| <b>Steering Input Data / [System-System Status]</b><br>(Antenna Steering Status section) | Invalid   | Refer to Satcom Console <i>[System-System Status]</i> page to determine what navigation data is invalid/missing.   |   | Check ARINC Label selection table  |
|  | Valid   | Correct. No corrective action required.  |   |  |
|  | Invalid   | Check GPS Source used.   |   |  |



| "Component / Location"  | Status      | Action 1  | Action 2   | Action 3                            |
|---|-------------|---|--|-------------------------------------|
| <b>Doppler Input Data / [System-System Status]</b><br>(Antenna Steering Status section) | Valid       | Correct. No corrective action required.   |  |                                     |
| <b>Antenna / [System-System Status]</b><br>(Antenna Steering Status section)            | Not Present | Verify that the antenna supply was correctly configured in the Satcom Console. Use the Antenna Voltage section on the <i>[Installation – Antenna Type] page</i> | Check cable between SDU and Antenna, as well as SDU wiring between BP5 and BP9 for Modem powered antennas. | Check Power source to ARINC Antenna |
|   | Present     | Correct. No corrective action required.   |  |                                     |

If the actions do not contribute to the successful resolving of the failure, the Diagnostics file should be downloaded and supplied to product support for debugging purposes.

## 15. COMPONENT REMOVAL

The following removal procedures are guidelines that may have to be adapted to allow for the special circumstances of some installations.

### 15.1 SDU-7320/SDU-7330 Removal

**NOTE:** The configuration module should remain with the aircraft. If the CM is inserted into the SDU it shall be removed from the SDU and be inserted into the replacement SDU. If the configuration module is replaced, the IMSI numbers identifying the system will change, including telephone numbers, and the entire installation specific configuration data will have to be re-entered.

1. Shut down the system
2. Isolate the system from the power supply (e.g. pull the circuit breakers)
3. If the Configuration Module is located in the front panel, move it to replacement SDU, and cover the slot in the front plate with the dummy plate
5. Undo the knurled knobs securing the SDU unit
6. Remove the unit from the tray

### 15.2 HPA-7400/HPA-7450 Removal

1. Shut down the system
2. Isolate the system from the power supply
3. Undo the knurled knobs securing the unit
4. Remove the unit from the tray

### 15.3 CM Removal

1. Shut down the system
2. Isolate the system from the power supply
3. Undo the finger screws securing the CM
4. Remove the CM from the holder or SDU

**NOTE:** The configuration module should remain with the aircraft. If the configuration module is replaced, the IMSI numbers identifying the system will change, including telephone numbers, and the entire installation specific configuration data will have to be re-entered.

### 15.4 HLD-7260 Removal

1. Shut down the system
2. Isolate the system from the power supply
3. Unscrew the coaxial cables and the circular multi-pin connector
4. Put protective caps over connectors and coaxial cable ends
5. Unfasten and remove the unit

### 15.5 DLNA Removal

1. Shut down the system
2. Isolate the system from the power supply
3. Unscrew the coaxial cables and the circular multi-pin connector
4. Put protective caps over connectors and coaxial cable ends
5. Unfasten and remove the unit

## 16. MAINTENANCE AND INSPECTION

### 16.1 SDU-7320 / SDU-7330

#### 16.1.1 Scheduled Maintenance

The SDU-7320 and SDU-7330 do not require scheduled maintenance or adjustment.

#### 16.1.2 Inspection

The recommended inspection interval is equal to the Mandatory Periodic Inspection interval for the aircraft type on which it is fitted. This may be modified depending on the accessibility of the equipment.

Table 16-1: SDU-7320/SDU-7330 Inspections and Actions

| INSPECTION  | ACTION   |
|---|--|
| 1. Check that the SDU is securely fastened to the tray.   | Re-tighten the tray fastener screw that is used to secure SDU in place.      |
| 2. Check that the top of the SDU is free of any material that may restrict airflow.                           | Remove any material that blocks the ventilation holes on the top of the SDU. |
| 3. If a front panel Configuration Module (CM) is installed check that the CM is securely fastened to the SDU. | Re-tighten the CM screws to the SDU.   |

### 16.2 HLD-7260

#### 16.2.1 Scheduled Maintenance

The HLD-7260 does not require scheduled maintenance or adjustment.

#### 16.2.2 Inspection

The recommended inspection interval is equal to the Mandatory Periodic Inspection interval for the aircraft type on which it is fitted. This may be modified depending on the accessibility of the equipment.

Table 16-2: HLD-7260 Inspections and Actions

| Inspection  | Action   |
|---|--|
| 1. Check that the HLD mounting bolts are securely fastened.   | Re-tighten the mounting bolts to the correct torque setting. |
| 2. Check that the HLD is not covered or free of any material. | Remove any material that covers the HLD.                     |
| 3. Check that all the cables to the HLD are secured.          | Re-tighten to the required torque setting if applicable.     |

## 16.3 HPA-7450 / HPA-7400

### 16.3.1 Scheduled Maintenance

The HPA-7450 and HPA-7400 do not require scheduled maintenance or adjustment.

### 16.3.2 Inspection

The recommended inspection interval is equal to the Mandatory Periodic Inspection interval for the aircraft type on which it is fitted. This may be modified depending on the accessibility of the equipment.

Table 16-3: HPA-7450/HPA-7400 Inspections and Actions

| INSPECTION  | ACTION   |
|---|--|
| 1. Check that the HPA is securely fastened to the tray.                             | Re-tighten the tray fastener screw that is used to secure HPA in place.      |
| 2. Check that the top of the HPA is free of any material that may restrict airflow. | Remove any material that blocks the ventilation holes on the top of the HPA. |

## 17. PRODUCT DISPOSAL

Products intended to be scrapped may be shipped back to the manufacturer for disposal. In such cases the process can be initiated by contacting Cobham at the following address:

[satcom.capetownsupport@cobham.com](mailto:satcom.capetownsupport@cobham.com) If disposed of by the product owners, products shall be mutilated to prevent re-use in similar intended or non-intended ways by any third parties and discard in an environmentally safe manner.

## 18. SERVICE BULLETINS

Service bulletins, which may be published by Cobham Satcom and distributed to users of the Cobham SwiftBroadband System, should be inserted into this section of this manual.

## 19. DISCONTINUED PRODUCTS

Cobham has ceased production of the products listed in Table 19-1. The following part numbers are affected:

Table 19-1: Discontinued Products

| Product  | Part number                                 |
|----------|---|
| MSU-7250 | 677-A0144                                   |
| SRU-7200 | 677-A0132                                   |
| HPA-7400 | 677-A0169                                   |
| HGA-8000 | 677-A0163<br>677-A0163-002<br>677-A0163-003 |

The references to these products in this document are retained as these components are present in a number of operational systems.

## 20. SPECIFICATIONS

### 20.1 SDU-7320 one and two-modem variants

|                    |   |
|--------------------|---|
| Dimensions:        | 13.5" L x 2.4" W x 7.6" H (343.7mm x 61mm x 194mm)  |
| Weight:            | 6.6 lbs (3.0 kg): One modem<br>6.8 lbs (3.1 kg): Two modem  |
| Temperature Range: | -67°F to +158°F (-55°C to +70°C )(operating)<br>-67°F to +185°F (-55°C to +85°C )(survival)                                   |
| Altitude:          | Up to 55,000 feet   |
| Frequency:         | 1525 MHz to 1660.5 MHz  |
| Qualifications:    | DO-160E [9] Environmental Category:<br>[F2X]BAB[S(M,L,B)]EYXXFXZ[AB]AR[ZW][RR]M[A3E3X]XXAC<br>Software: RTCA/DO-178B: Level E |

The SDU-7320 (1 and 2 modem) product specification document is referenced in [28].

### 20.2 SDU-7330 one and two-modem variants

|                    |   |
|--------------------|---|
| Dimensions:        | 13.5" L x 3.6" W x 7.6" H (343.7mm x 90.4mm x 194mm)  |
| Weight:            | 7.0 lbs (3.2 kg): One modem<br>7.3 lbs (3.3 kg): Two modem  |
| Temperature Range: | -67°F to +158°F (-55°C to +70°C) (One/Two modem operating)<br>-67°F to +185°F (-55°C to +85°C) (survival)                     |
| Altitude:          | Up to 55,000 feet   |
| Frequency:         | 1525 MHz to 1660.5 MHz  |
| Qualifications:    | DO-160E [9] Environmental Category:<br>[F2X]BAB[S(M,L,B)]EYXXFXZ[AB]AR[ZW][RR]M[A3E3X]XXAC<br>Software: RTCA/DO-178B: Level E |

The SDU-7330 (1, 2 and 4-modem) product specification document is referenced in [28].

### 20.3 SDU-7330 four-modem variant

|                    |   |
|--------------------|---|
| Dimensions:        | 13.5" L x 3.6" W x 7.6" H (343.7mm x 90.4mm x 194mm)  |
| Weight:            | 8.8 lbs (4.0 kg)  |
| Temperature Range: | -67°F to +131°F (-55°C to +55°C) (operating)<br>-67°F to +185°F (-55°C to +85°C) (survival)   |
| Altitude:          | Up to 55,000 feet   |
| Frequency:         | 1525 MHz to 1660.5 MHz  |
| Qualifications:    | RTCA/DO-160E [9] Environmental Category:<br>[F3X]BAB[S(M,L,B)]EYXXFXZ[AB]AR[ZW][RR]M[A3E3X]XXAC<br>RTCA/DO-160G [10] Environmental Category: Refer to Section 21.1<br>Software: RTCA/DO-178B: Level E |

The SDU-7330 (1, 2 and 4-modem) product specification document is referenced in [28].

### 20.4 HPA-7400

|                    |  |
|--------------------|--|
| Dimensions:        | 13.5" L x 2.4" W x 7.6" H (343.7mm x 61mm x 194mm)   |
| Weight:            | 8.8 lbs (4.0 kg)   |
| Temperature Range: | -67°F to +158°F (-55°C to +70° C) (operating),<br>-67°F to +185°F (-55°C to +85° C) (survival)                           |
| Altitude:          | Up to 55,000 feet  |
| Qualifications:    | DO-160D [8] Environmental Category:<br>[A2F2]XBBB[SCLM]EXXXFXZ[AB]A[AB]C[WW]M[A3E3]XXA<br>Software RTCA/DO-178B: Level E |

The HPA-7400 product specification document is referenced in [32].

### 20.5 HPA-7450

|                    |  |
|--------------------|--|
| Dimensions:        | 13.5" L x 2.4" W x 7.6" H (343.7mm x 61mm x 194mm)   |
| Weight:            | 8.8 lbs (4.0 kg)   |
| Temperature Range: | -67°F to +158°F (-55°C to +70° C) (operating),<br>-67°F to +185°F (-55°C to +85° C) (survival)   |
| Altitude:          | Up to 55,000 feet  |
| Qualifications:    | DO-160E [9] Environmental Category:<br>[F2X]BBB[U2(F,F1)S(LMB)]EYXXFXZ[A/B]AR[CW][RR]M[A3E3X]XXAC<br>RTCA/DO-160G [10] Environmental Category: Refer to Section 21.2<br>Software RTCA/DO-178B: Level E |

The HPA-7450 product specification document is referenced in [33].

## 20.6 HLD-7260

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|                    |  |
|--------------------|--|
| Dimensions:        | 7.8" L x 7.0" W x 2.4" H (196.7mm x 190.0mm x 60mm)  |
| Weight:            | 5.06 lbs (2.3 kg)  |
| Temperature Range: | -67°F to +158°F (-55°C to +70° C) (operating),<br>-67°F to +185°F (-55°C to +85° C) (survival)                               |
| Altitude:          | Up to 55,000 feet  |
| Qualifications:    | DO-160E [9] Environmental Category:<br>[F2X]BAB[S(M,L,B)]EYXXFXZ[AB]AR[ZW][RR]M[A3E3X]XXAC<br>Software RTCA/DO-178B: Level E |

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The HLD-7260 product specification document is referenced in [31].



## 21. APPENDICES

### 21.1 Appendix A – SDU-7330 (4ch) DO-160G Environmental Qualification Form

| Conditions                                 | Section | Description of Tests Conducted   |
|--|---------|--|
| Temperature and Altitude                   | 4       | Equipment tested to Category F3  |
| Operating Low Temperature                  | 4.5.2   | -55 deg. C   |
| Operating High Temperature                 | 4.5.4   | +55 deg. C with auxiliary air cooling  |
| Short Time Operating Low                   | 4.5.1   | -55 deg. C   |
| Short Time Operating High                  | 4.5.3   | +55 deg. C with auxiliary air cooling  |
| Ground survival low:                       | 4.5.1   | -55 deg. C   |
| Ground survival high:                      | 4.5.3   | +85 deg. C   |
| In-Flight Loss of Cooling                  | 4.5.5   | Equipment tested to Category X (No test performed)   |
| Altitude:                                  | 4.5.1   | 55,000 ft  |
| Decompression:                             | 4.5.1   | Equipment tested to Category X (No test performed)   |
| Overpressure:                              | 4.5.1   | Equipment tested to Category X (No test performed)   |
| Temperature Variation                      | 5       | Equipment tested to Category B   |
| Humidity                                   | 6       | Equipment tested to Category A   |
| Operational Shock & Crash Safety           | 7       | Equipment tested to Category B   |
| Vibration                                  | 8       | Equipment tested to Category S(L,M,B):<br>Aircraft zone 1 and 2 for fixed wing reciprocating and turboprop engines, multi-engine over 5,700 kg (12,500 lbs), multi-engine less than 5,700 kg (12,500 lbs), and single-engine less than 5,700 kg (12,500 lbs) using vibration test curves L and M.<br>Aircraft zone 2 for fixed wing turbojet or turbofan engines, fixed wing unducted and turbofan engines using vibration test curve B. |
| Explosive Atmosphere                       | 9       | Equipment tested to Category E   |
| Waterproofness                             | 10      | Equipment tested to Category Y   |
| Fluids Susceptibility                      | 11      | Equipment tested to Category X (No test performed)   |
| Sand & Dust                                | 12      | Equipment tested to Category X (No test performed)   |
| Fungus Resistance                          | 13      | Equipment tested to Category X (No test performed)   |
| Salt Fog                                   | 14      | Equipment tested to Category X (No test performed)   |
| Magnetic Effect                            | 15      | Equipment tested to Category Z   |
| Power Input                                | 16      | Equipment tested to Category ABXX. Current ripple and inrush current tests not performed.  |
| Voltage Spike                              | 17      | Equipment tested to Category A   |
| Audio Frequency Susceptibility             | 18      | Equipment tested to Category R   |
| Induced Signal Susceptibility              | 19      | Equipment tested to Category ZW  |
| Radio Frequency Susceptibility             | 20      | Equipment tested for Conducted Susceptibility to Category R (ISDN and Ethernet operation tested individually between 30 & 200 MHz).<br>Equipment tested for Radiated Susceptibility to Category R.   |
| Radio Frequency Emission                   | 21      | Equipment tested to Category M   |
| Lightning Induced Transient Susceptibility | 22      | Equipment tested to Category A3E3XX:<br>Pin test waveform set A, level 3, Cable Bundle test waveform set E, Single Stroke Level 3, and Multiple Burst no test performed.   |
| Lightning Direct Effects                   | 23      | Equipment tested to Category X (No test performed)   |
| Icing                                      | 24      | Equipment tested to Category X (No test performed)   |
| Electrostatic Discharge                    | 25      | Equipment tested to Category A   |
| Fire, Flammability                         | 26      | Equipment tested to Category C   |

## 21.2 Appendix B – HPA-7450 DO-160G Environmental Qualification Form

| Conditions                                 | Section | Description of Tests Conducted   |
|--|---------|--|
| Temperature and Altitude                   | 4       | Equipment tested to Category F2  |
| Operating Low Temperature                  | 4.5.2   | -55 deg. C   |
| Operating High Temperature                 | 4.5.4   | +70 deg. C with auxiliary air cooling  |
| Short Time Operating Low                   | 4.5.1   | -55 deg. C   |
| Short Time Operating High                  | 4.5.3   | +70 deg. C with auxiliary air cooling  |
| Ground survival low:                       | 4.5.1   | -55 deg. C   |
| Ground survival high:                      | 4.5.3   | +85 deg. C   |
| In-Flight Loss of Cooling                  | 4.5.5   | Equipment tested to Category X (No test performed)   |
| Altitude:                                  | 4.5.1   | 55,000 ft  |
| Decompression:                             | 4.5.1   | Equipment tested to Category X (No test performed)   |
| Overpressure:                              | 4.5.1   | Equipment tested to Category X (No test performed)   |
| Temperature Variation                      | 5       | Equipment tested to Category B   |
| Humidity                                   | 6       | Equipment tested to Category B   |
| Operational Shock & Crash Safety           | 7       | Equipment tested to Category B   |
| Vibration                                  | 8       | Equipment tested to Category S(L,M,B):<br>Aircraft zone 1 and 2 for fixed wing reciprocating and turboprop engines, multi-engine over 5,700 kg (12,500 lbs), multi-engine less than 5,700 kg (12,500 lbs), and single-engine less than 5,700 kg (12,500 lbs) using vibration test curves L and M.<br>Aircraft zone 2 for fixed wing turbojet or turbofan engines, fixed wing unducted and turbofan engines using vibration test curve B. |
| Explosive Atmosphere                       | 9       | Equipment tested to Category E   |
| Waterproofness                             | 10      | Equipment tested to Category Y   |
| Fluids Susceptibility                      | 11      | Equipment tested to Category X (No test performed)   |
| Sand & Dust                                | 12      | Equipment tested to Category X (No test performed)   |
| Fungus Resistance                          | 13      | Equipment tested to Category X (No test performed)   |
| Salt Fog                                   | 14      | Equipment tested to Category X (No test performed)   |
| Magnetic Effect                            | 15      | Equipment tested to Category Z   |
| Power Input                                | 16      | Equipment tested to Category ABXX. Current ripple and inrush current tests not performed.  |
| Voltage Spike                              | 17      | Equipment tested to Category A   |
| Audio Frequency Susceptibility             | 18      | Equipment tested to Category R   |
| Induced Signal Susceptibility              | 19      | Equipment tested to Category CW  |
| Radio Frequency Susceptibility             | 20      | Equipment tested for Conducted Susceptibility to Category R, and for Radiated Susceptibility to Category R.  |
| Radio Frequency Emission                   | 21      | Equipment tested to Category M   |
| Lightning Induced Transient Susceptibility | 22      | Equipment tested to Category A3E3XX:<br>Pin test waveform set A, level 3, Cable Bundle test waveform set E, Single Stroke Level 3, and Multiple Burst no test performed.   |
| Lightning Direct Effects                   | 23      | Equipment tested to Category X (No test performed)   |
| Icing                                      | 24      | Equipment tested to Category X (No test performed)   |
| Electrostatic Discharge                    | 25      | Equipment tested to Category A   |
| Fire, Flammability                         | 26      | Equipment tested to Category C   |