ADS-B Integrity Application

Operation Manual

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OPERATION MANUAL

ADS-B INTEGRITY APPLICATION

PUBLISHED BY
VIAVI Solutions, Inc.

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Subject to Export Control, see Cover Page for details.

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Cable Statement:
For continued EMC compliance, all external cables must be double shielded.
For continued EMC compliance, all external cables must be 3 meters or less in length.

Nomenclature Statement:
In this manual Unit refers to the ADS-B Integrity Application.

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INTRODUCTION

This manual contains operating instructions for the ADS-B Integrity Application. It is strongly recommended that personnel be thoroughly familiar with the contents of this manual before attempting to operate this equipment.

Refer all servicing of unit to qualified technical personnel.

ORGANIZATION

This manual is divided into the following Chapters:

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Chapter 2
Software Installation 2-1

Chapter 3
Hardware Installation 3-1

Chapter 4
Drawings 4-1

Chapter 5
Frequently Asked Questions 5-1

Chapter 6
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SECTION 1 - ADS-B INTEGRITY APPLICATION DESCRIPTION

1. GENERAL DESCRIPTION AND OPTION KITS

1.1 DESCRIPTION

On January 1, 2020, per Advisory Circular (AC) 20-165B when operating in the airspace designated in 14 CFR §91.225 all aircraft must be equipped with ADS-B Out avionics that meet the performance requirements of 14 CFR §91.227.

The ADS-B integrity application is a Windows based Personal Computer application for verifying the performance of an ADS-B or UAT system installed on an aircraft meant to aid the user to meet the requirements mentioned above. The application is divided into two operational modes, Static and Dynamic.

STATIC MODE

The static test compares the ADS-B, UAT data being generated by the ADS-B transmitter or UAT transmitter, with user input for applicable parameters. Additionally, the static test checks for AC 20-165 compliance in ADS-B and/or UAT data. Typically, the static test can be used to validate the unit under test prior to performing the dynamic test. Or it can be used for troubleshooting in case the dynamic test fails. The static test can also be useful in new installations where the user can enter the expected parameters in the 'User Defined' column so that it can be compared to the actual ADS-B and/or UAT data. The ADS-B, UAT, and/or user-defined data can be loaded from the File menu. The data are compared, and the results are color coded as green for pass and red for fail. A pass indicates the data matches the user input and fail signifies incorrect data match.

DYNAMIC MODE

The dynamic test simulates GPS position data to the GPS receiver and receives ADS-B transmissions and generates a performance report of the ADS-B data modeled after the FAA ADS-B performance report generator. The dynamic simulation logs the simulated GPS position real time and monitoring squitter data provides time stamps on the data being provided by the ADS-B transmitter. Additionally, the generated NMEA and ADS-B logged data with time stamps can be processed to generate a latency measurement. The dynamic test currently supports testing of Airborne 1090 only.

1.2 OPTION KITS

Three Option Kits are available for testing with the ADS-B integrity application. The IFR-6000/6015 option if purchased alone allows for static mode testing with the integrity application, if purchased with the GPSG-1000 kit dynamic mode testing is available to the user. If The GPSG-1000 option and the IFF-45TS/A options are purchased the combination of the two is capable of static and dynamic mode testing albeit without UAT capability in Static mode.

Press POWER Key. Start-Up Screen appears on the DISPLAY. XPDR-Auto Test Screen with blank data fields always displays on Power-up.

IFR-6000 OPTION KIT CONTENTS

	140609	6000OPT6 ADS-B Integrity Test Option
	140619	License Key, 6000OPT6, ADS-B Integrity
	140606	Cable, Serial STR thru DB9 F/F, 6 ft
	140610	CD, 6000OPT6 ADS-B Integrity Test Option Installation and Approval Application
	108892	Cable, USB to Serial Converter
	140671	CD, ADS-B 3rd Party Adapter Drivers
	11959	Cable Pouch

GPSG-1000 OPTION KIT CONTENTS

	140607	GPSGOPT3 ADS-B Integrity Test Option
	140618	License Key, GPSGOPT3, ADS-B Integrity
	140604	Cable, ADS-B Integrity IFR-6000/6015
	140610	CD, ADS-B Installation and Approval Application
	108892	Cable, USB to Serial Converter
	140671	CD, ADS-B 3rd Party Adapter Drivers
	11959	Cable Pouch
	140599	USB to Ethernet Adapter w/3 port USB hub
	121888	Cable Ethernet 7 ft

IFF-45TS OPTION KIT CONTENTS

	140608	45TS/AOPT10 ADS-B Integrity Test Option
	140620	License Key, 45TSOPT10, ADS-B Integrity
	30050	CBL Molded Shield DB9 Data thru M/F
	140605	Cable, ADS-B, Integrity IFF-45TS
	140610	CD, ADS-B Installation and Approval Application
	108892	Cable, USB to Serial Converter
	140671	CD, ADS-B 3rd Party Adapter Drivers
	11959	Cable Pouch

1.3 INSTRUMENT OPTION SOFTWARE REQUIREMENTS

The following table details the instrument software version required for each device used by the ADS-B integrity test application.

Instrument	Software Version and Option Requirements
IFR-6000	03.15.00 or later with 6000OPT6
IFR-6015	02.13.00 or later with 6000OPT6
IFF-45TSA	Release 10 or later with 45TSOPT10
IFF-45TS	Release 9.6 or later with 45TSOPT10
GPSG-1000	3.3.1 or later with GPSGOPT3

1.4 PERSONAL COMPUTER SYSTEM REQUIREMENTS

The following table details the personal computer system requirements needed to run the application.

Item	Requirement
CPU	Core 2 Duo or greater
CPU Speed	2.0 GHz or greater
RAM	2 GB or greater
Video	800 x 600 or greater
Available Ports	1 USB using supplied adapters
Free Disk Space	700 MB

SECTION 2 – SOFTWARE INSTALLATION

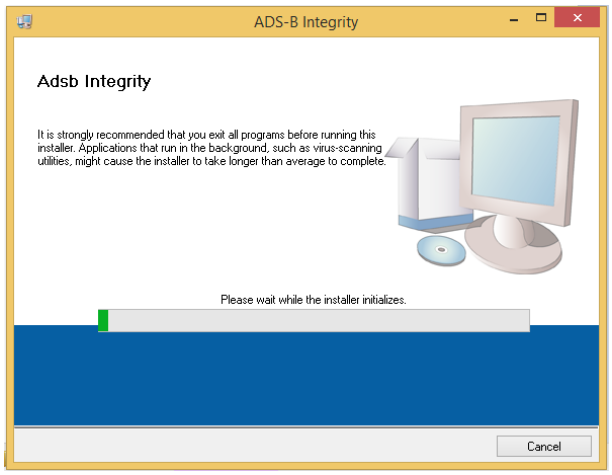
2. APPLICATION AND DRIVER SOFTWARE INSTALLATION

2.1 APPLICATION SOFTWARE INSTALLATION

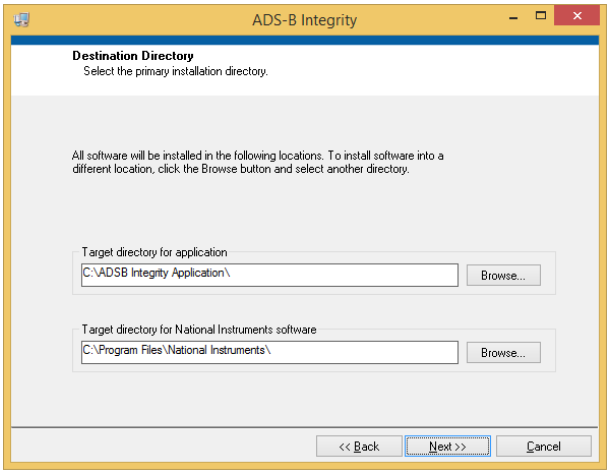
The ADS-B integrity application will operate on desktop and laptop computers running Microsoft Windows XP and higher 32 bit operating systems, and Windows 7 and higher 64 bit operating systems.

The ADS-B integrity application installation image is located on a CD, and may be installed directly from the CD, or the contents of the CD can be copied to a USB drive and installed.

To begin the installation of the ADS-B integrity application, first close all programs which might be open on the PC. Next, browse to the CD or USB drive directory containing the installation image and open the Setup.exe application. When the setup application has been opened, the Installation Initializing popup will be displayed.

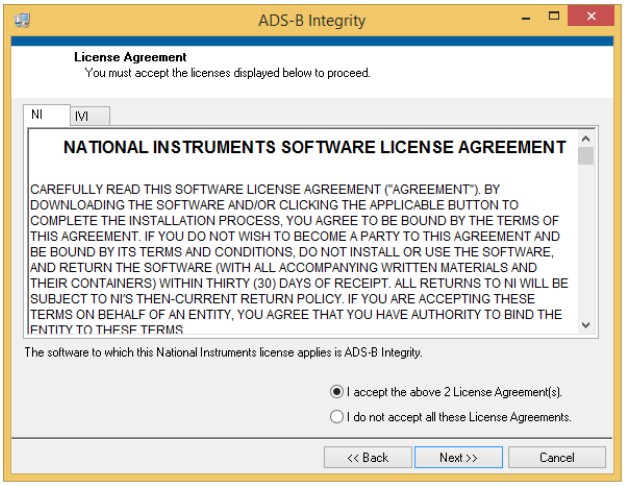


After the Setup Initialization popup has disappeared, the Destination Directory popup will be displayed. At this point, you may choose the directories that you want the ADS-B integrity application and the supporting National Instruments software to be installed to by choosing the 'Target directory for application' or 'Target directory for National Instruments software' boxes in the popup and browsing to, or directly typing in the desired directory information.

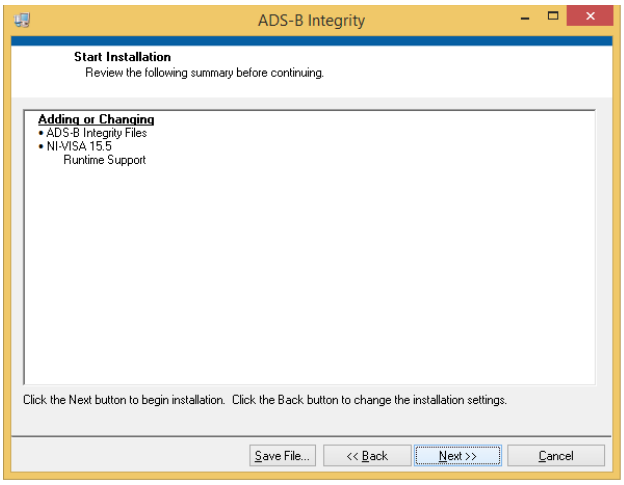


It is highly recommended that you use the default paths that are preselected for the installation by selecting the 'Next>>" button to continue with the installation. If you wish to stop the installation, select the 'Cancel' button to exit the installation application.

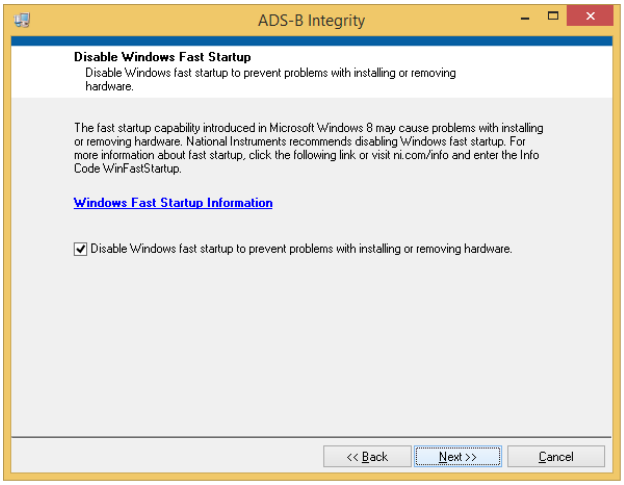
The License Agreement popup prompts you to accept licenses from National Instruments.



If you choose not to accept the licensing agreements the installation application will be cancelled, and no data will be written to the PC. If you select the “Cancel” button on the Accept License Agreement popup the installation will be cancelled and no data will be written to the PC. If you select the “<<Back” button the Confirm Configuration popup will reappear. If you select the “I accept the above 2 License Agreements” checkbox and press the “Next>>” button, the installation will continue.

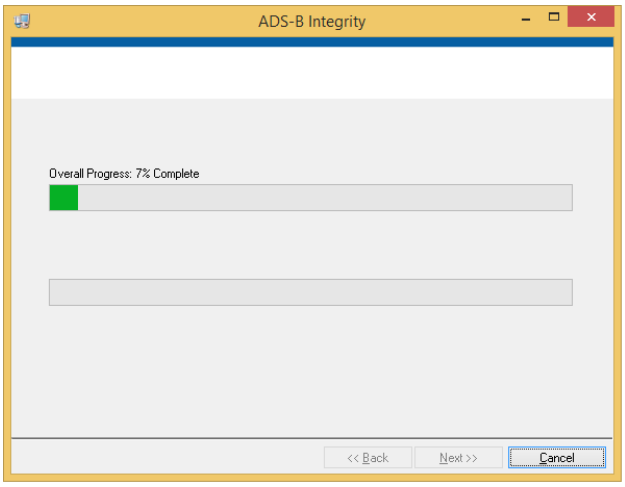


For some Windows systems, the Disable Windows Fast Startup popup will appear next.



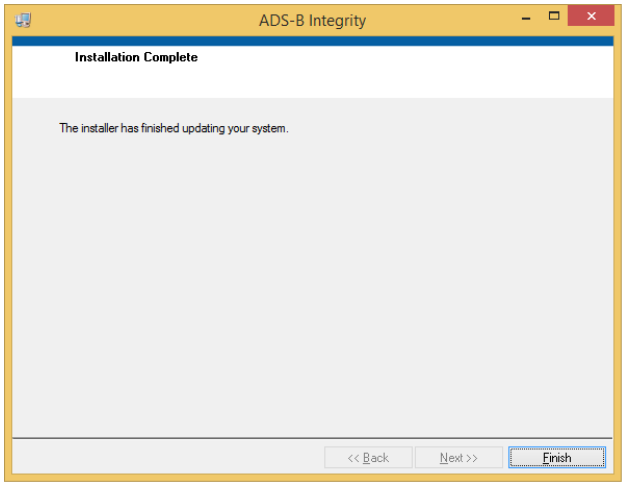
This popup prompts you to accept the disabling of the Windows Fast Startup feature and will not appear during all installations. If the popup appears and you choose not to accept the disabling of the Windows Fast Startup feature, the feature will not be disabled, however issues may arise later during operation. If you select the “Cancel” button on the Accept License Agreement popup, the installation will be cancelled, and no data will be written to the PC. If you select the “<<Back” button the Accept License Agreement popup will reappear. If you press the “Next>>” button to continue the installation, the Start Installation popup will appear.

The horizontal bars shown in the Installation Progress popup provide an indication of the overall progress of the installation and the progress of individual pieces.

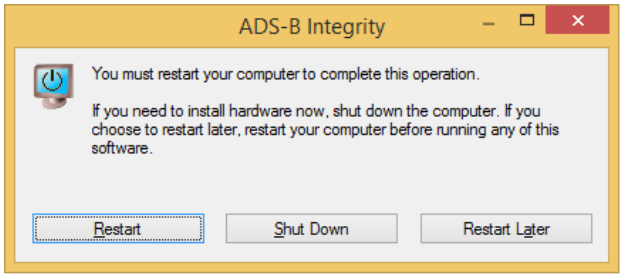


It is not recommended to use the “Cancel” button of the Installation Progress popup; if activated the installation will be cancelled and only partially completed leaving the system in an unknown state.

After the installation has been completed, the Installation Complete popup will appear informing you that the installation has been completed.



Select the "Finish" button of the Installation Complete popup and note that the Restart popup appears.



The Restart popup gives you the option of restarting the computer immediately, shutting down the computer immediately, or restarting the computer at a later time; choose the option that best fits your needs, but be aware that the computer must be restarted before the ADS-B integrity application can be opened.

2.2 THIRD PARTY ADAPTER DRIVER SOFTWARE INSTALLATION

If the test system is using the supplied USB to Serial Converter and/or USB to Ethernet Adapter, please install the drivers that have been included with the option kit for the GPSG-1000 on the third-party driver CD. Install the drivers according to the manufacturer's instructions. If you have issues with the system operations, please download the latest adapter drivers from the adapter manufacturer's website and install them according to the manufacturer's instructions.

2.3 ETHERNET ADDRESS CONFIGURATION WINDOWS 7 OR LATER

If using the GPSG-1000 as the position source for static testing, or if you are doing dynamic testing, the GPSG-1000 requires communication through its Ethernet port to the controlling PC. The following procedure assumes you are using a static address on the GPSG-1000.

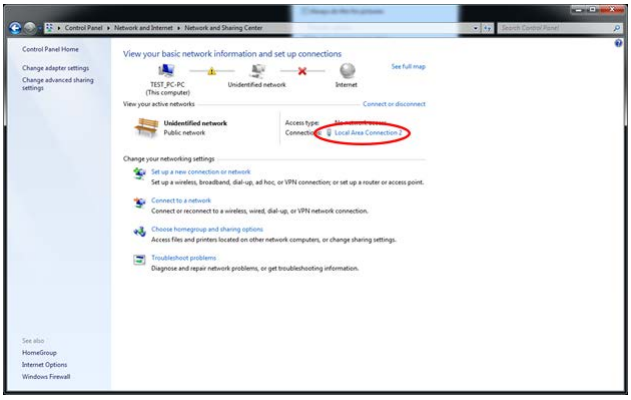
Note: In order to prevent communication errors to the GPSG-1000 and the network adapter provided with the ADS-B application, the static addresses assigned to these devices should not be within the range of the addresses available from the user's local network.

Right click on the Network icon in the taskbar which is generally located in the lower right of the operating system screen.



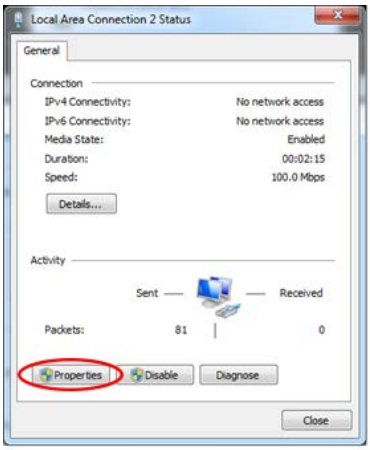
Within the 'Network and Internet popup, choose the 'Network and Sharing Center'.

Within the ‘Network and Sharing Center popup, choose the ‘Local Area Connection’ that is to be attached to the GPSG-1000, in the example the network connection is named ‘Local Area Connection 2’

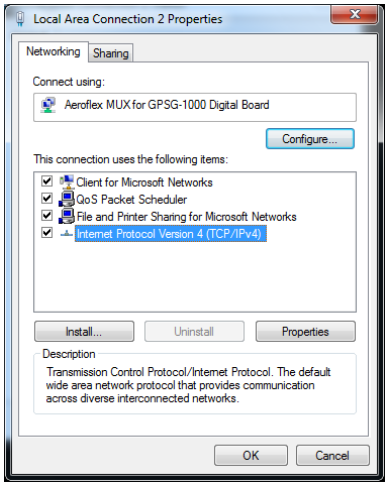


After the ‘Local Area Connection’ device has been selected, a Local Area Connection 2 Status popup will appear on the screen.

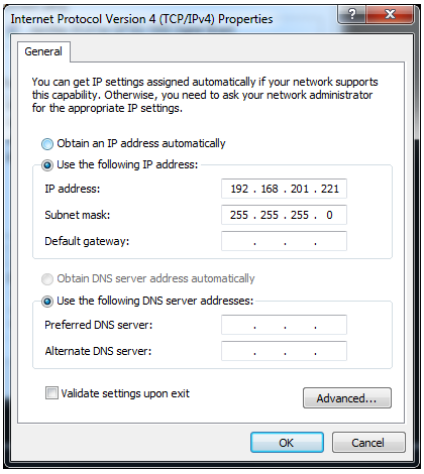
Choose the ‘Properties’ button.



From within the ‘Local Area Connection Properties’ popup, highlight the ‘Internet Protocol Version 4 (TCP/IPv4)’ item (Windows XP may have the item named ‘Internet Protocol TCP/IP), and then choose the ‘Properties’ button.



From within the ‘Internet Protocol Version 4 (TCP/IPv4) Properties’ popup, select the ‘Use the following IP address’ checkbox, and enter the appropriate ‘IP address’ and ‘Subnet Mask’ information. Note that the address should be within the range of the Ethernet address selected on the GPSG-1000.



In this case, the GPSG-1000 had a selected address of 192.168.201.200 and a subnet address of 255.255.0.0, so the computer address was chosen to be 192.168.201.221, with a subnet address of 255.255.255.0. Save the entered information by choosing the ‘OK’ button of the ‘Internet Protocol Version 4 (TCP/IPv4) Properties’ popup, and then close all of the previously opened popups. The Ethernet Address selection is now complete.

2.4 ETHERNET ADDRESS CONFIGURATION WINDOWS XP

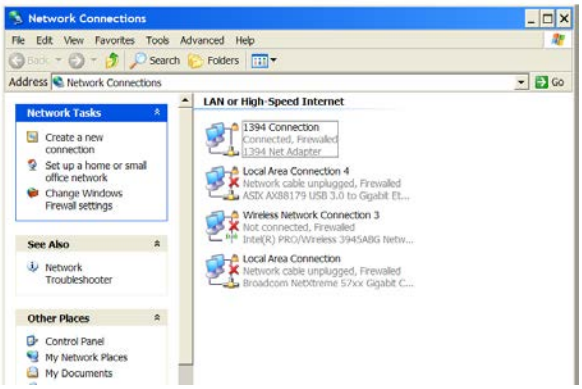
If using the GPSG-1000 as the position source for static testing, or if you are doing dynamic testing, the GPSG-1000 requires communication through its Ethernet port to the controlling PC. The following procedure assumes you are using a static address on the GPSG-1000.

Note: In order to prevent communication errors to the GPSG-1000 and the network adapter provided with the ADS-B application, the static addresses assigned to these devices should not be within the range of the addresses available from the user's local network.

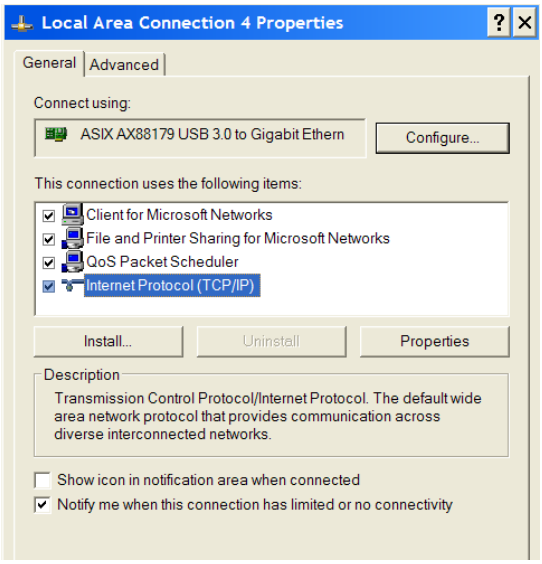
Right click on the Network icon in the taskbar located in the lower right of the operating system screen.



Within the 'Network and Internet' popup, choose 'Open Network Connections' to open the LAN or High-Speed Internet selections.

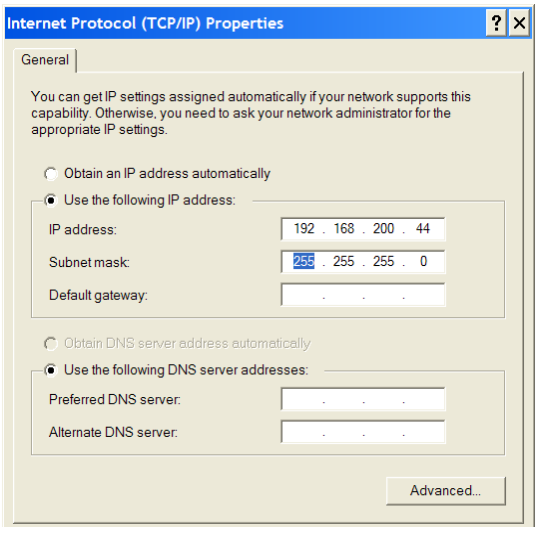


Choose the 'LAN or High Speed Internet' connection that is to be attached to the GPSG-1000 by double clicking on the item in the list. In the example, the network connection is named 'Local Area Connection 4'. After the 'Local Area Connection' device has been selected, a Local Area Connection 4 Properties popup will appear.



From within the Local Area Connection Properties popup of the selected device, highlight the 'Internet Protocol (TCP/IP)' item in the list of connections. Then choose the 'Properties' button.

The Internet Protocol (TCP/IP) Properties screen appears.



From within the ‘Internet Protocol (TCP/IP) Properties’ popup, select the ‘Use the following IP address’ checkbox, and enter the appropriate ‘IP address’ and ‘Subnet Mask’ information. Note that the address should be within the range of the Ethernet address selected on the GPSG-1000. In this case, the GPSG-1000 had a selected address of 192.168.200.55 and a subnet address of 255.255.0.0; so the computer address was chosen to be 192.168.200.44, with a subnet address of 255.255.255.0. Save the entered information by choosing the ‘OK’ button of the ‘Internet Protocol (TCP/IP) Properties’ popup, and then close all of the previously opened popups. The Ethernet Address selection is now complete.

2.5 POWER SAVING SETTINGS

The power saving settings of the PC must be set such that none of the power saving features become active while the ADS-B Integrity Application is actively collecting data. Since the period of active data collection is controlled by the user, they are responsible for the selection of an appropriate time delay preventing power savings features from becoming active during the period of active data collection. Failure to set the time delay of the PC power saving features correctly could result in failed or shortened test runs.

2.6 VIRTUAL PRIVATE NETWORK (VPN)

Any VPNs installed on the PC should be disabled during the periods that the ADS-B Integrity Application is active. VPNs can affect the ability of the ADS-B Integrity Application to provide instrument control and logging functions.

SECTION 3 – HARDWARE

3. SETUP AND TESTING

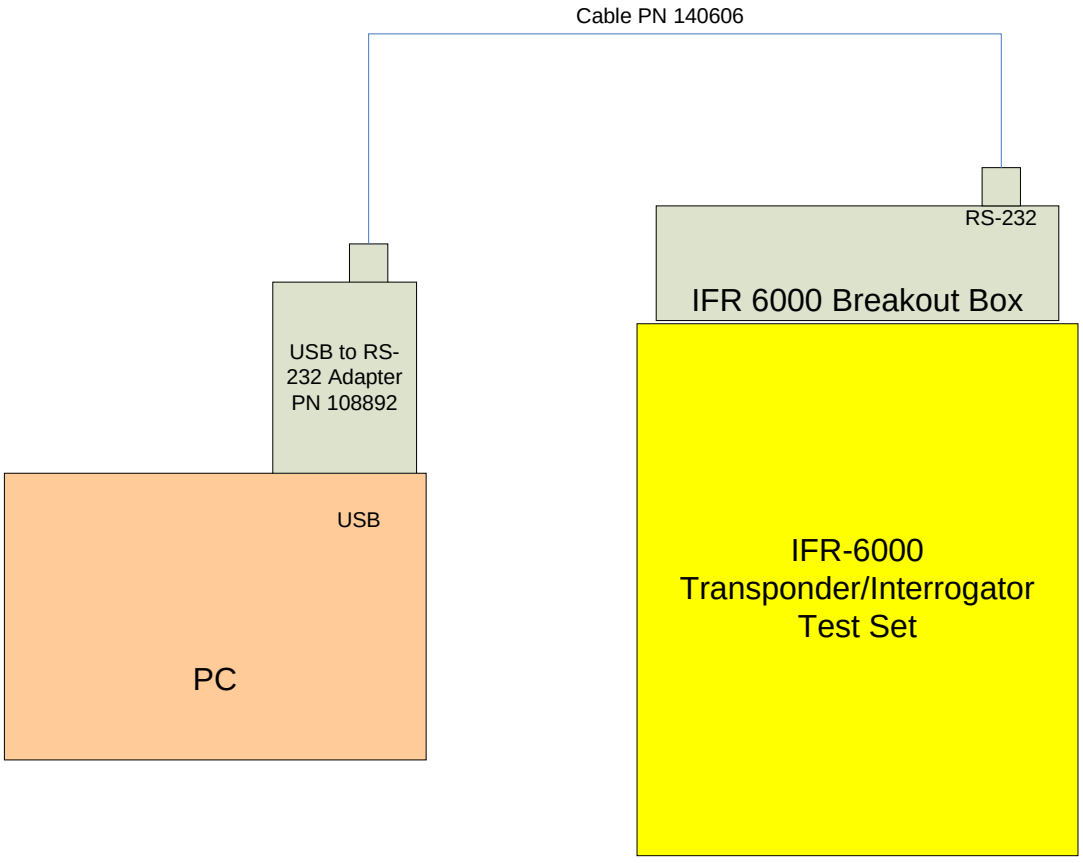
3.1 HARDWARE SETUP

The connection between the test instruments and the PC are accomplished using the supplied cables and adapters. The block diagrams provide detail regarding the interconnection between instruments and the controlling PC for the supported testing types (static and dynamic). The instrument diagrams provide additional detail regarding the locations of the connections utilized on each instrument for the testing.

3.2 STATIC TESTING / IFR 6000

When performing static testing using only the IFR 6000 instrument, connect the instrument to the PC as shown.

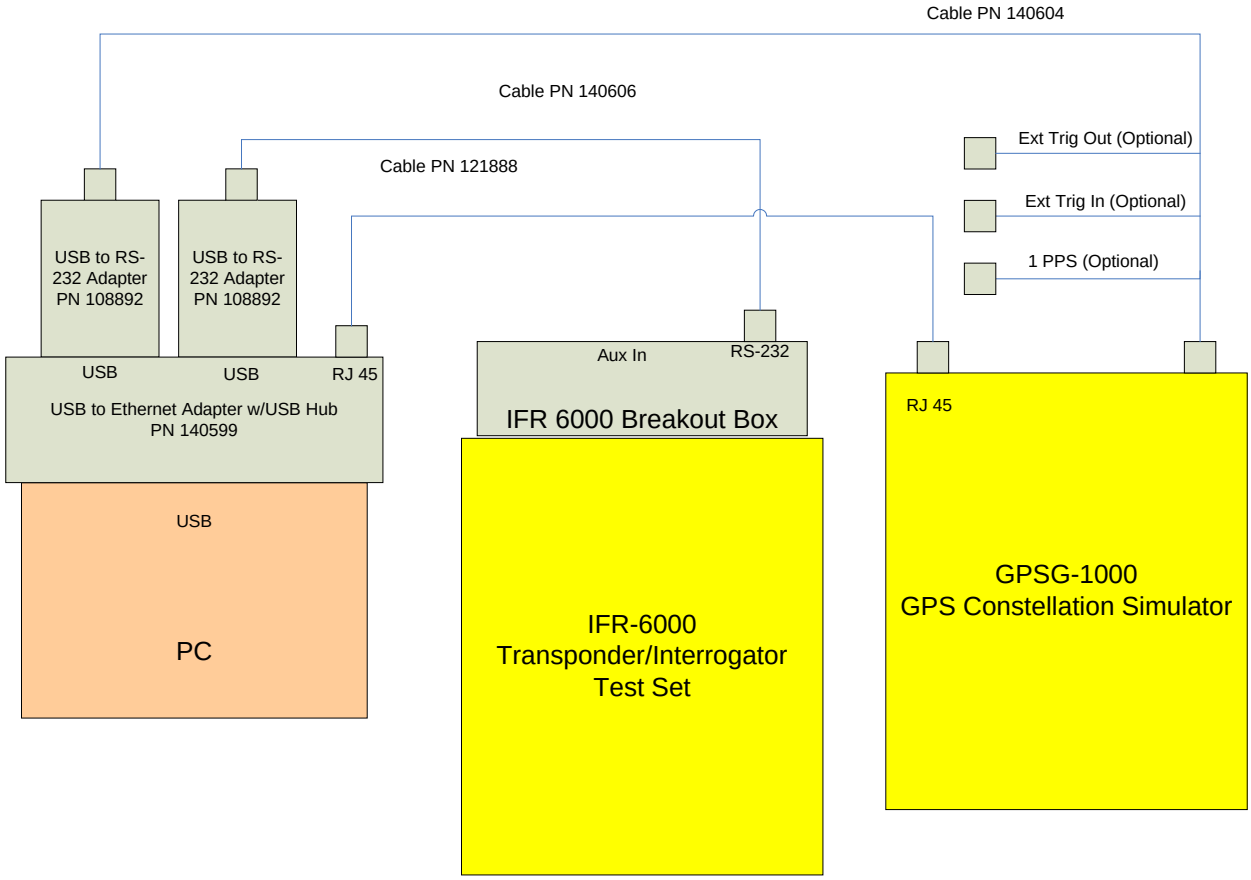
Note that the RF connections from the IFR 6000 to the aircraft are detailed in the User's Manual for the instrument.



3.3 STATIC TESTING / IFR 6000 AND GPSG-1000

When performing static testing using the IFR 6000 and the GPSG-1000 instruments, connect the instruments to the PC as shown.

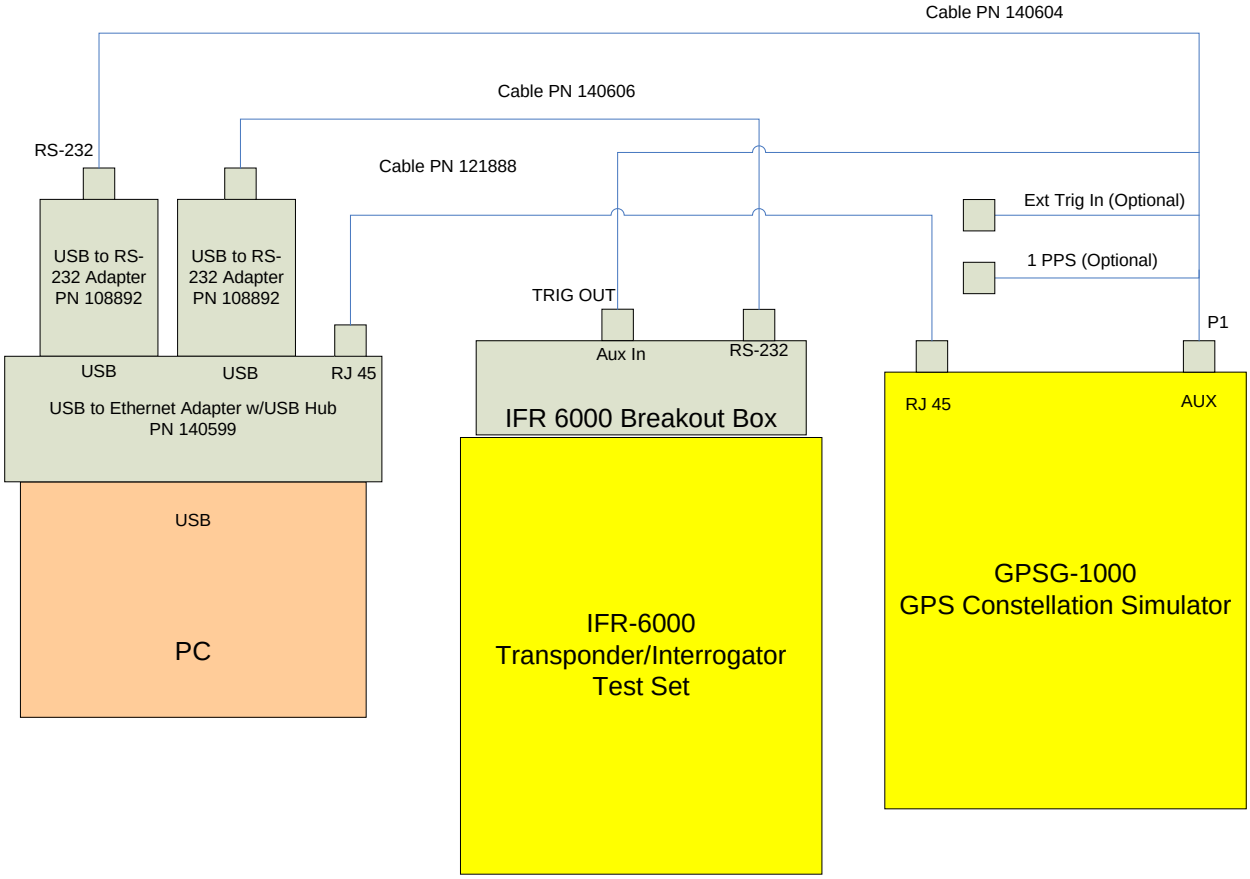
Note that the RF connections from the IFR 6000 and the GPSG-1000 to the aircraft are detailed in the User's Manuals for the instruments.



3.4 DYNAMIC TESTING / IFR 6000 AND GPSG-1000

If performing dynamic testing using the IFR 6000 and GPSG-1000, connect the instrument to the PC as shown.

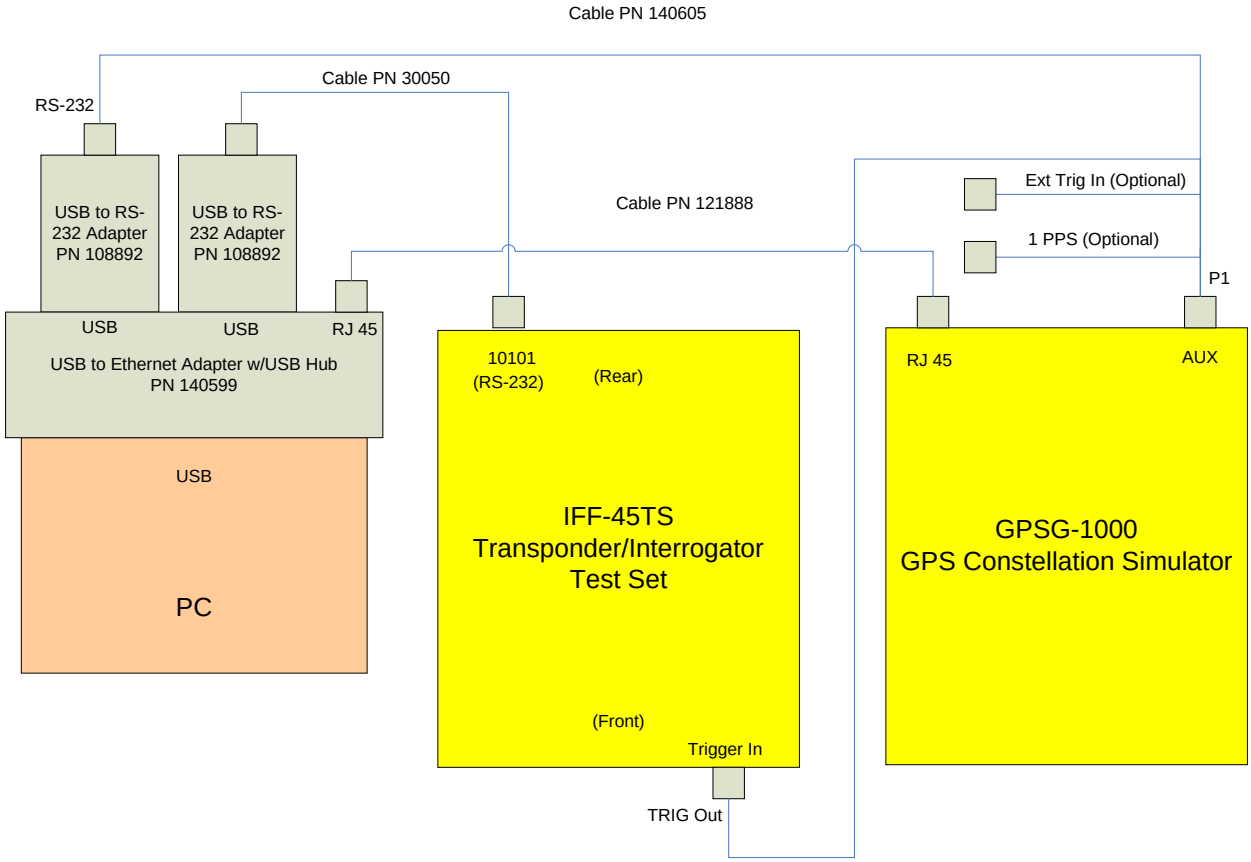
Note that the RF connections from the IFR 6000 to the aircraft and GPSG-1000 to the aircraft are detailed in the User's Manuals for the respective instruments.



3.5 DYNAMIC TESTING / IFF-45TS AND GPSG-1000

If performing dynamic testing using the IFF-45TS and GPSG-1000, connect the instrument to the PC as shown.

Note that the RF connections from the IFF-45TS to the aircraft and GPSG-1000 to the aircraft are detailed in the User's Manuals for the respective instruments.



SECTION 4 – DRAWINGS

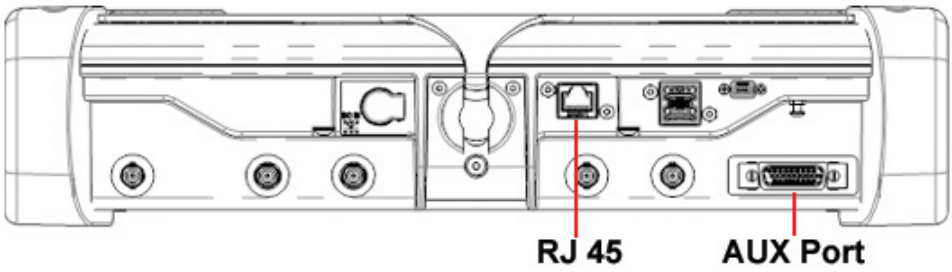
1. INSTRUMENT CONNECTIONS

4.1 INSTRUMENT INPUT/OUTPUT DETAIL DRAWINGS

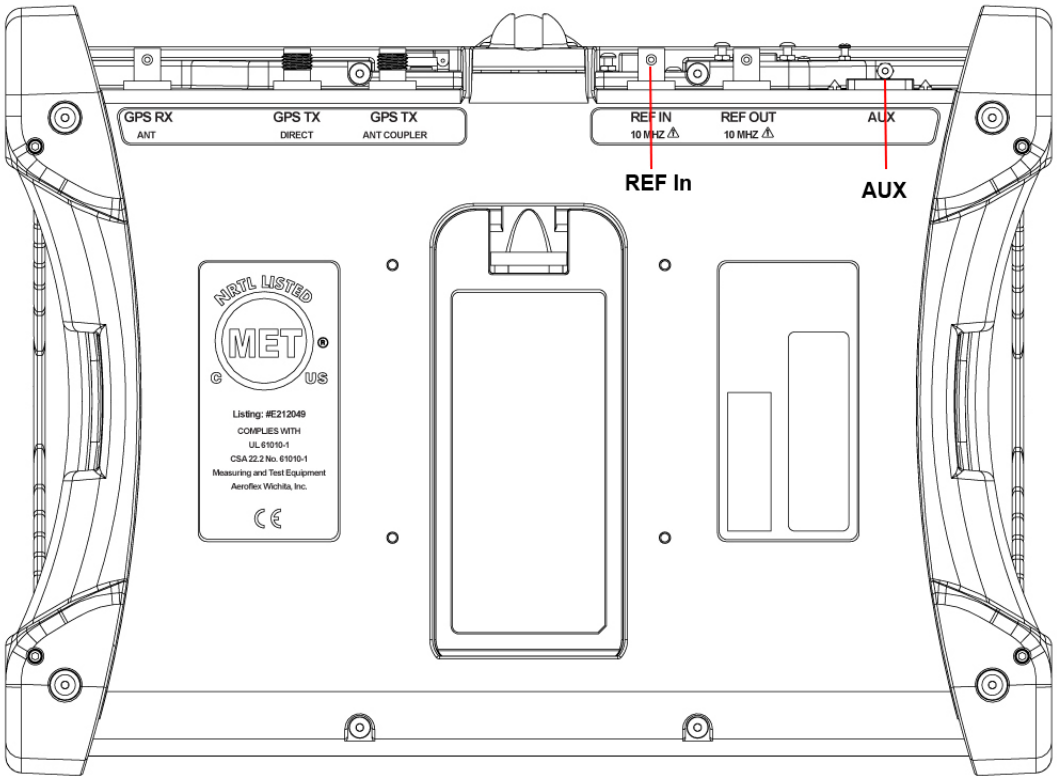
This section contains drawings that detail the input and output connections to each of the instruments using the ADS-B integrity application.

The following drawings detail connections for:

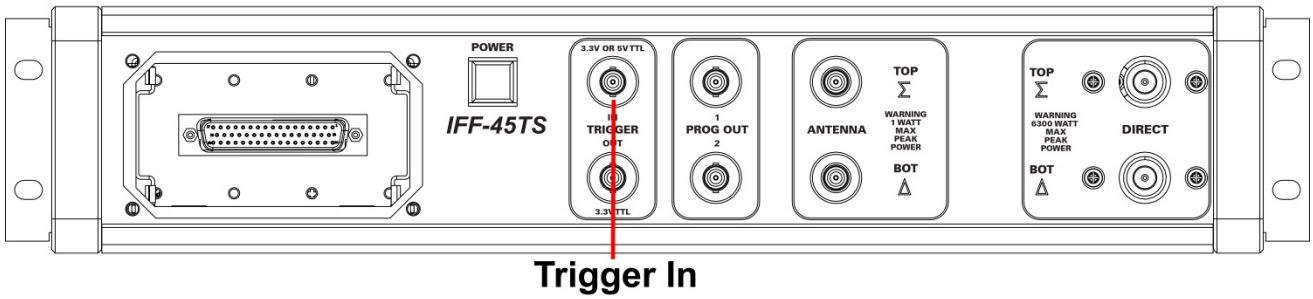
- GPSG-1000
- IFF-45TS
- IFR 6000



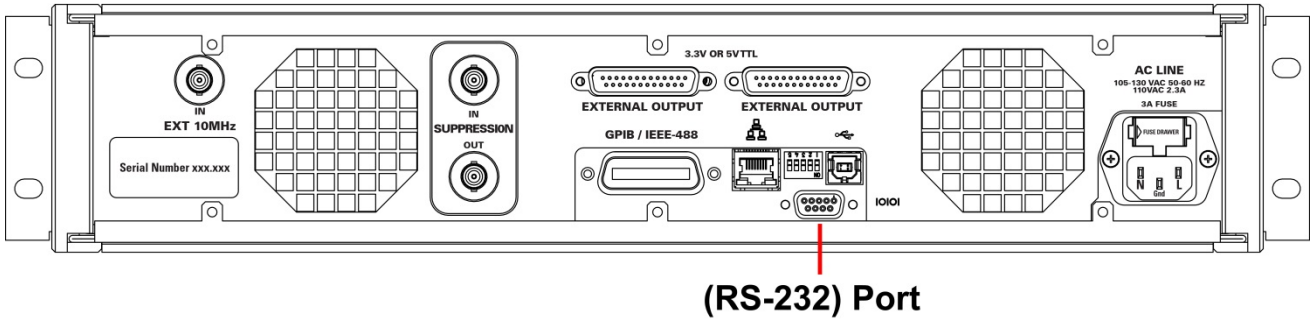
GPSG-1000 Top View



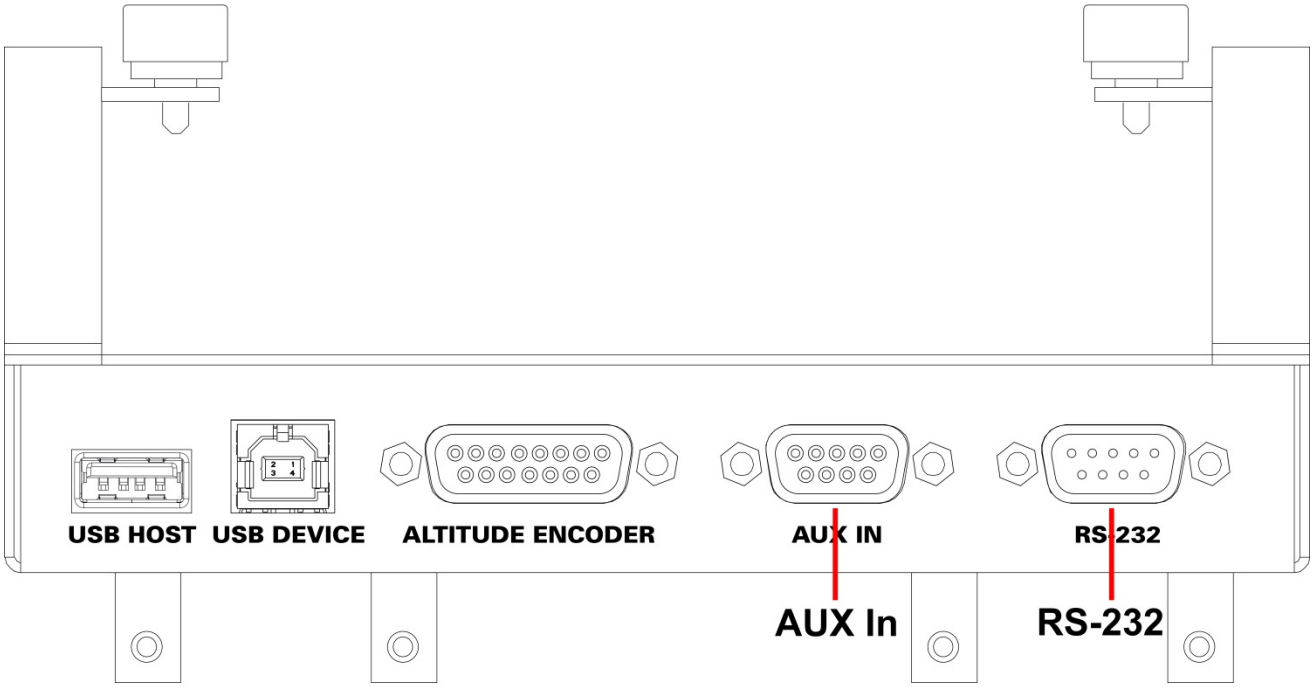
GPSG-1000 Back View



IFF-45TS Front View



IFF-45TS Back View



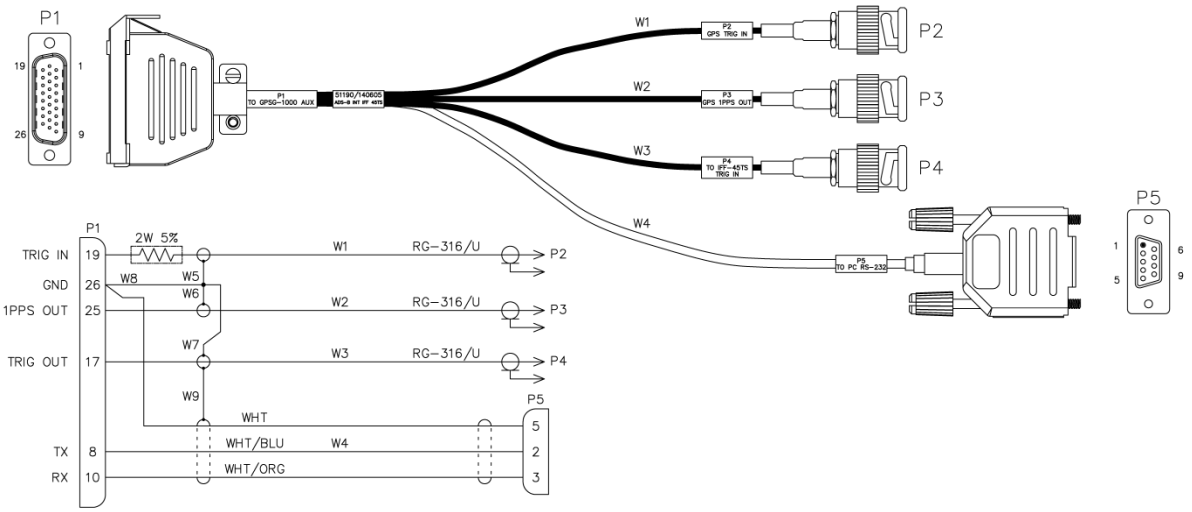
IFR-6000 Breakout Box

4.2 CUSTOM CABLE ASSEMBLIES WIRING DIAGRAMS

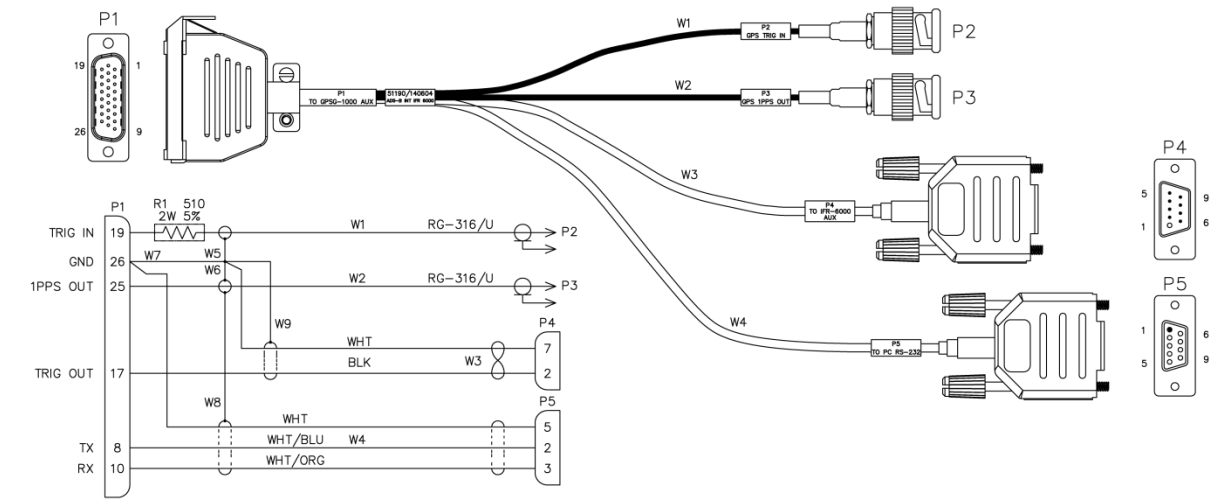
This section details the custom cable assemblies used while operating the ADS-B Integrity application in dynamic test mode.

The following custom cable assemblies are detailed in this section:

Cable, ADS-B Integrity IFF-45TS (PN 140605)
Cable, ADS-B Integrity IFR-6000 (PN 140604)



ADS-B Integrity IFF-45TS Cable
(PN 140605)



ADS-B Integrity IFR-6000 Cable
(PN 140604)

Pin Number	Signal Name	Description
1,2,3,4,5,6,7,9,11,12,13,14,15, 16,18,20,21,22,23,24	NC	No Connection
8	RS232 TX	Serial Communication Output from GPSG-1000
10	RS232 RX	Serial Communication Input to GPSG-1000
17	Ext Trigger Out	External Trigger Output from GPSG-1000, Synced to Start of RF Output Generation
19	Ext Trigger Input	External Trigger Input to GPSG-1000 (optional connection)
25	1 PPS	One Pulse Per Second Output from GPSG-1000, Synced to Time Reference within RF Output (optional connection)
26	GND	Ground

GPSG-1000 Auxiliary Connector (P1)

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SECTION 5 – FREQUENTLY ASKED QUESTIONS

5. FREQUENTLY ASKED QUESTIONS

Q: All of the com ports on my PC are showing 'In Use' although I am only using a few of the ports, how do I make the ports available for use?

A: This has been seen on certain PCs and a change in the system's registry is required. See your IT department to fix the issue.

Q: The ADS-B integrity application fails to communicate to my instrument(s) when my laptop PC is operating on battery power, why?

A: Many laptop PCs have power saving features that turn off communication to USB hubs, Ethernet adapters, etc. to conserve battery power. These power saving features must be disabled within the device manager to ensure that communication continues to the instrument(s) while the PC is operating on battery power.

Q: I cannot establish Ethernet communication to my GPSG-1000 using the application, why?

A: The Ethernet addresses on the GPSG-1000 and the Ethernet adapter provided with the ADS-B application must set to values that do not fall within the range of addresses that are usable for any other local networks that are available to the controlling PC. See your IT department to obtain a list of static addresses that are compatible with your local network.

Q: One of my USB to RS-232 adapters is not able to obtain a com port number, what should I do?

A: Be sure you have installed the latest driver for the USB to RS-232 adapter. If you have installed the latest driver and the system will still not obtain a com port number, see your IT department to troubleshoot the issue.

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SECTION 6 – APPLICATION INTERFACE OPERATION

6. DESCRIPTION AND SCREEN HEIRARCHY

6.1 APPLICATION INTERFACE OPERATION DESCRIPTION

The ADS-B performance application includes two modes of operation, Static and Dynamic. Selection of the Static or Dynamic application modes is performed through a dropdown menu.

The Static test mode collects data from the unit under test and then compares the ADS-B, UAT data, and/or user-defined data. Additionally, the static test checks for AC 20-165 compliance in ADS-B and/or UAT data. Static test mode is useful as a troubleshooting aid in cases where the Dynamic mode testing generated failures.

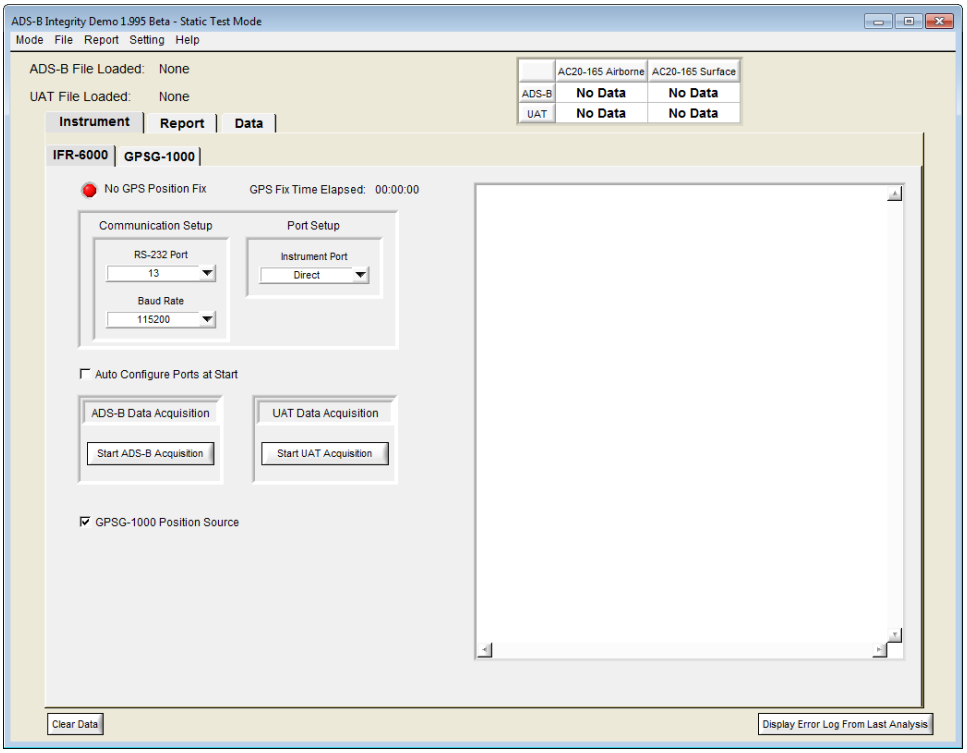
Trouble shooting in Static mode involves the user entering expected parameters in the 'User Defined' column so that it can be compared to the actual ADS-B and/or UAT data collected by the test instrument. Static mode tests are performed in two phases, the data collection phase, and the data analysis phase. During the data collection phase, the test instrument reads data from the system under test, and then transfers the data to the personal computer. During the data analysis phase, the data is then compared to user entered or compliance data. In general, passing data is shown in green, and failing data is shown in red.

The Dynamic test generates a performance report of the ADS-B data modeled after the FAA ADS-B performance report generator. Dynamic testing is performed in three phases, simulation setup, data collection and data analysis. During the simulation setup phase, the GPS simulator is programmed to fly a designated route, and the transponder test instrument is setup to acquire data beginning at the time the GPS simulation is started. In the data collection phase, the simulation is started, and positional data is collected from the GPS simulator, while simultaneously ADS-B data is collected from the transponder.

During the data analysis phase, the data collected from the instruments is compared to each other, and to FAA performance data limits, and a performance report is generated. In general, failing data within the performance report is shown highlighted in red. Additionally, Dynamic mode provides a graphical analysis feature for the user that details certain key comparisons between position velocity and time data recorded from the GPS simulation source and the system under test.

6.2 STATIC TEST MODE

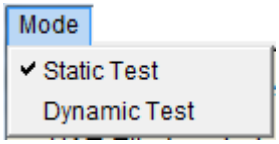
Static Test Mode screen provides interface to setup, performs static mode testing and displays test results.



Static Test Mode Screen

Mode dropdown menu

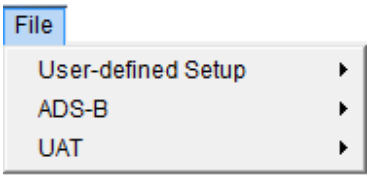
The 'Mode' menu determines the test setting of the application: Static or Dynamic.



Static Test: Sets the application to compare User-defined parameters, ADS-B, and/or UAT data.
Dynamic Test: Sets the application to perform an ADS-B Performance Monitor test.

File dropdown menu

The 'File' menu provides the operator a way of loading or saving the 'user defined' parameters used in the static test and the ability of selecting ADS-B/UAT files for analysis.

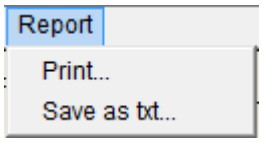


User-defined Setup: 'Load' or 'Save' user-defined parameters and Aircraft Summary. File extension is ".usr".

ADS-B: Selects the ADS-B file to 'Load' for analysis or to 'Save' the loaded file. In addition to the raw data, the 'Save' option also stores the Aircraft Summary, Position Reference, and UAT Altitude Reference. File extension is ".ads".

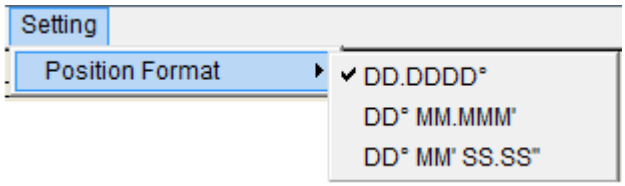
UAT: Selects the UAT file to 'Load' for analysis or to 'Save' the loaded file. In addition to the raw data, the 'Save' option also stores the Aircraft Summary, Position Reference, and UAT Altitude Reference. File extension is ".uat".

Report dropdown menu



Print: Sends the test result to the selected printer
Save as txt: Saves the result to a text file. When opening the save text file with a text viewer or editor, be advised that the text is configured for a maximum of 80 columns

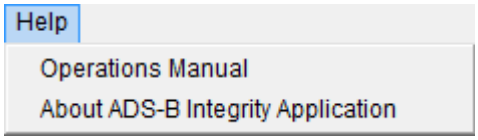
Setting dropdown menu
Allows the operator to select the Position format:



DD.DDDD° - displays the position in degrees
DD° MM.MMM' – displays the position in degrees and minutes
DD° MM' SS.SS" – displays the position in degrees, minutes, and seconds

Help dropdown menu

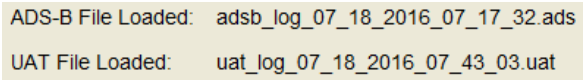
Contains selections to open the Operations Manual or a popup panel about the application.



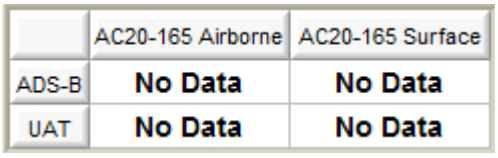
Operations Manual: Opens the Operations Manual. Note that a pdf document reader is required.
About ADS-B Integrity Application: Displays a popup panel with the application version and website link.

Selected file indicator

Displays the selected ADS-B and UAT files. Files generated by the application in static test mode will be stored in the 'static_log' subdirectory by default.



AC 20-165 Pass/Fail Indicator



Displays AC 20-165 Airborne and Surface results for the selected ADS-B and/or UAT data file.

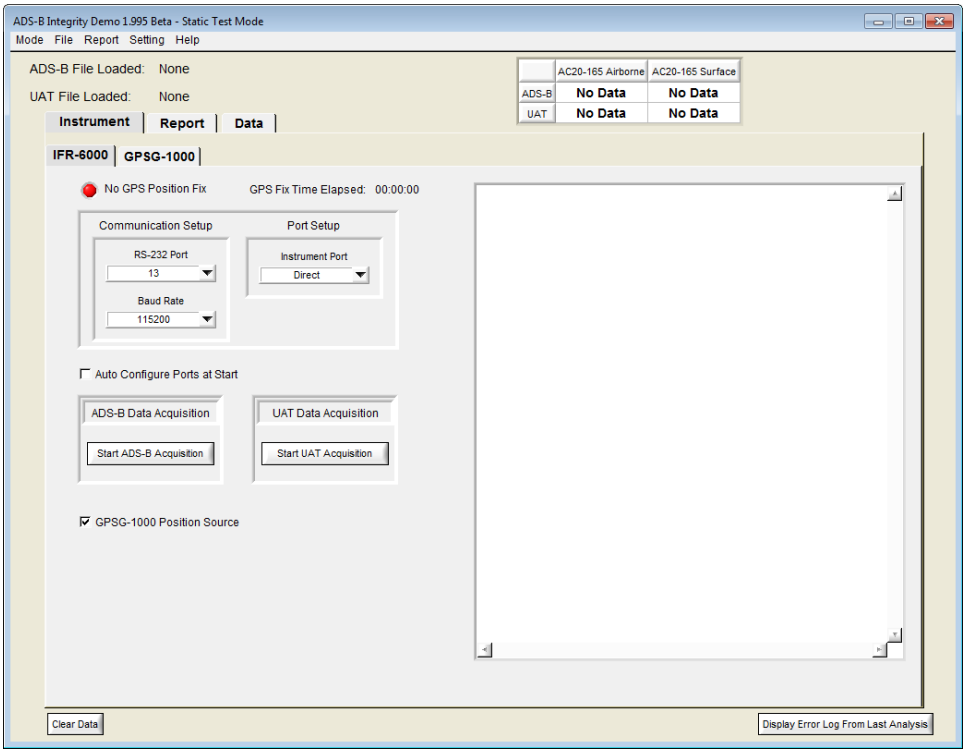
Error Log Display Button
Displays the error log of the last data analysis.



6.3 INSTRUMENT TAB

The Instrument tab configures the instrument setting, initiates data acquisition and monitors data retrieved from the instrument.

Note: If using a GPS simulator such as the GPSG-1000 to provide a GPS position stimulus to a terrain aware avionics system be sure to provide a simulated altitude to the avionics system that is at, or slightly below the altitude of the latitude and longitude position being simulated to prevent issues with forcing the engagement of ground mode on the avionics during static testing.



Instrument Tab Screen

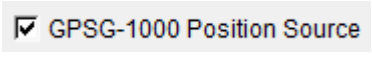
Auto Configure Ports at Start

Initiates an automatic search for the appropriate RS-232 port the instrument is connected to at the time a data capture is initiated.



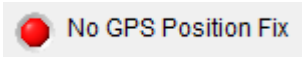
GPSG-1000 Position Source

When enabled, this option allows the user to configure the GPSG-1000 as the position source. If the GPSG-1000 will not be used, this selection must be unchecked.



GPS Position Fix Indicator

GPS Position Fix indicator will display the color red when there is no GPS position fix, yellow when GPS position fix is attained but the NIC is not AC 20-165 compliant, and green when there is GPS position fix and NIC is AC 20-165 compliant.



GPS Fix Time Elapsed

GPS Fix Time Elapsed displays the dwell time the application has spent waiting for a GPS position fix. The application will only continue testing when the NIC is AC 20-165 compliant.

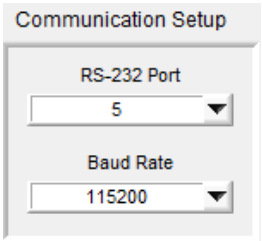


6.3.1 IFR-6000 CONFIGURATION

The IFR-6000 RF Port selection allows the operator to select the appropriate RF interface port being used to connect to the aircraft being tested. To setup other parameters such as the cable loss and coupler loss, refer to the IFR-6000 Operations Manual (part number 6093).

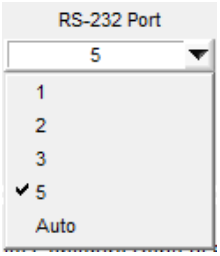
Communication Setup

The Communication Setup control group sets the RS-232 Port and Baud Rate.



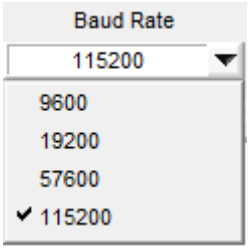
RS-232 Port

The RS-232 Port sets the RS-232 serial port where the valid values are from 1 to 32. Only the ports available on the system for use by the instruments will be displayed. Selecting 'Auto' will initiate the application to detect the RS-232 port that the instrument is connected to.



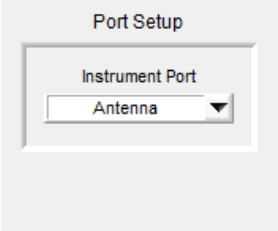
Baud Rate

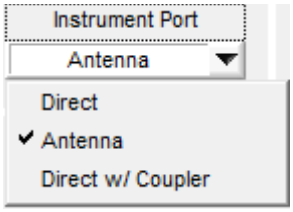
The Baud rate is a dropdown menu used to select the Baud Rate of the PC port used to make data transfers to the IFR-6000.
This setting needs to match the RS-232 setup of the IFR-6000. Refer to the IFR-6000 Operations Manual for more details.



IFR-6000 Port Setup

The Port Setup selects the RF port that will be used for testing.

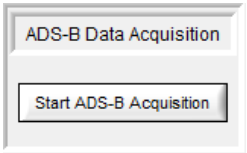




Direct: Select if the RF cable is connected directly to the UUT RF port.
Antenna: Select for over-the-air testing.
Direct w/ Coupler: Select this when using the RF cable with antenna coupler.

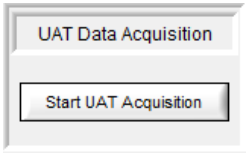
ADS-B Data Acquisition

The Start ADS-B Acquisition button initiates the ADS-B data test and retrieves the data.



UAT Data Acquisition

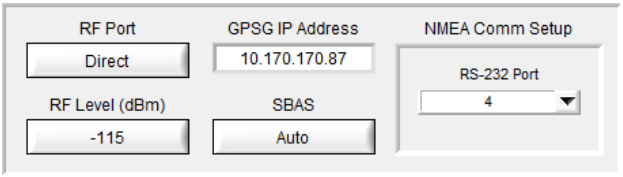
The Start UAT Acquisition button initiates the UAT data test and retrieves the data.



GPSG-1000 Setting

GPSG-1000 RF Port and RF Level settings are provided on the application. To setup other parameters such as the cable loss and coupler loss, refer to the GPSG-1000 Operations Manual. Also consider using the latest almanac; having the latest almanac may expedite the GPS receiver acquisition.

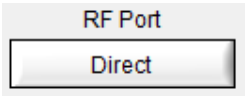
This sets the GPSG-1000 configuration.



RF Port

RF Port sets the RF Port that will be used to transmit GPS information to the UUT.

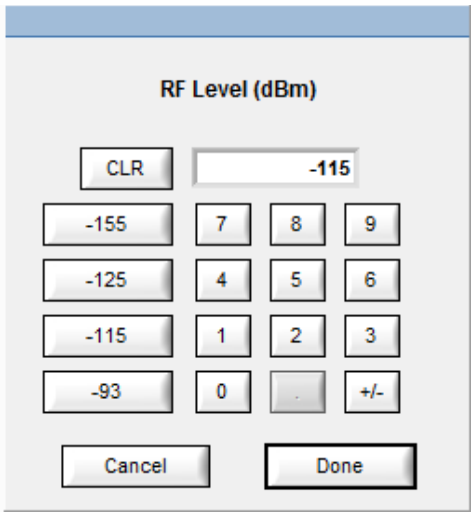
Direct: Used when the GPS TX Direct Port is connected directly to the UUT GNSS port.
Antenna Coupler: Used when the GPS TX Antenna Coupler is connected to the UUT GNSS antenna via an antenna coupler.



RF Level

RF Level sets the RF Level output of the selected port in dBm. Valid range is -155 to -93 dBm for Direct Port and -130 to -68 dBm for Antenna Coupler port.

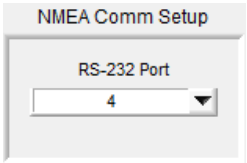




CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The four values on the left are preselected key values.

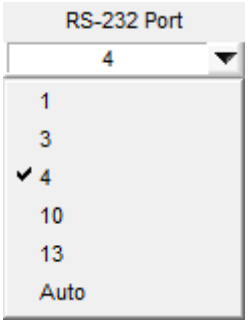
NMEA Comm Setup

NMEA Comm Setup sets the RS-232 port used in acquiring NMEA data from the GPSG-1000.



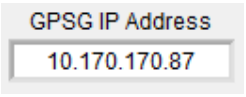
RS-232 Port

RS-232 Port sets the RS-232 serial port where the valid values are from 1 to 32; however, only the ports available will be displayed. Selecting 'Auto' will initiate the application to detect the RS-232 port that the GPSG-1000 is connected to.



GPSG IP Address

GPSG IP Address entry allows the user to enter the GPSG-1000 network IP Address. Note that when 'Auto' of the NMEA Comm RS-232 port is selected, the application will attempt to set up the proper GPSG-1000 network IP Address.



SBAS

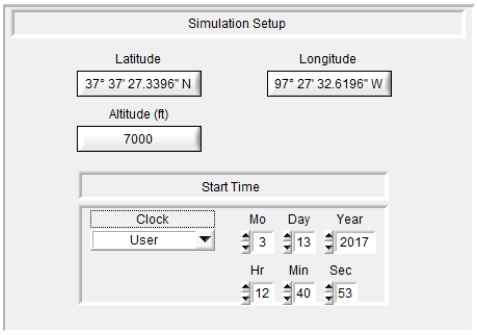
The SBAS control determines the status of the Satellite Based Augmentation Systems satellites.



Off: SBAS signal will not be present.
Auto: SBAS signal will be generated dependent on the location of the simulation.

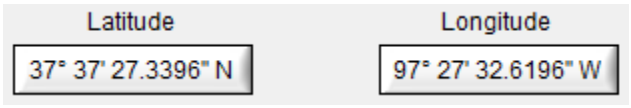
Simulation Setup

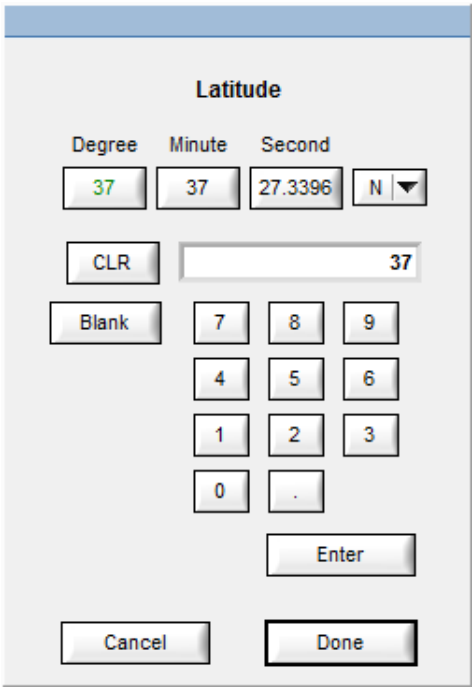
Simulation Setup sets the static location of the test site.



Latitude and Longitude Simulation Setup

Latitude and Longitude setting represents the static location of the test site.

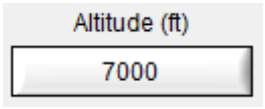


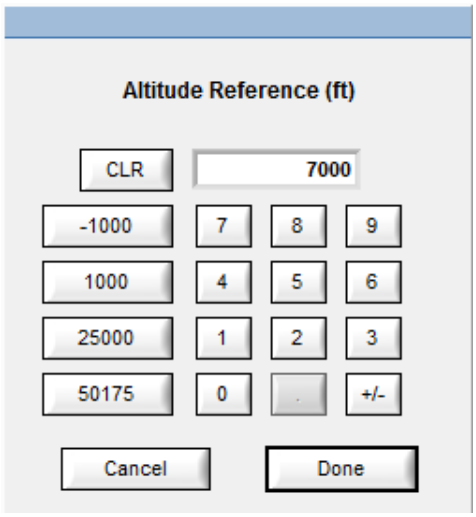


CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The 'Blank' button can be selected to return no value.

Altitude Simulation Setup

Altitude sets the GPS altitude of the aircraft.

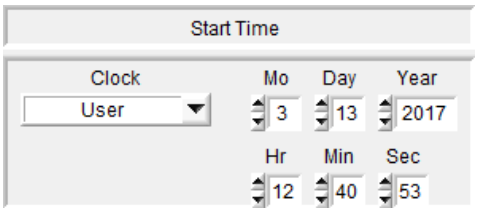




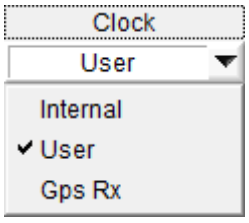
CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The four values on the left are preselected key values.

Start Time

The Start Time group sets the simulation clock source, date, and time.



Clock



Internal: The date and time are obtained from the GPSG-1000 internal clock.
User: The date and time are obtained from the user-defined entry.
Gps Rx: The date and time are obtained from the GPS receiver module if a GPS signal is available.

Date and Time

The date and time are set by typing the desired value. Or the parameters can be set by incrementing or decrementing the value through the up and down arrows.



6.3.2 DATA MONITOR PANEL

The Data Monitor screen displays the retrieved ADS-B or UAT data.



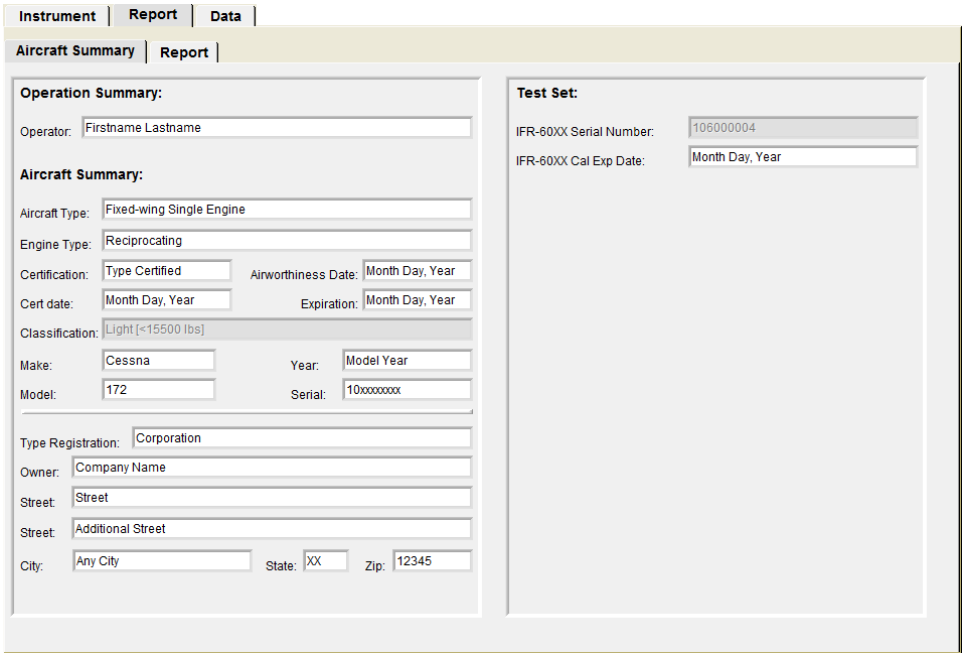
Clear Data Button

This clears the data from the Data Monitor panel and the results in the ADS-B and/or UAT Data Tab panel.



6.4 REPORT TAB

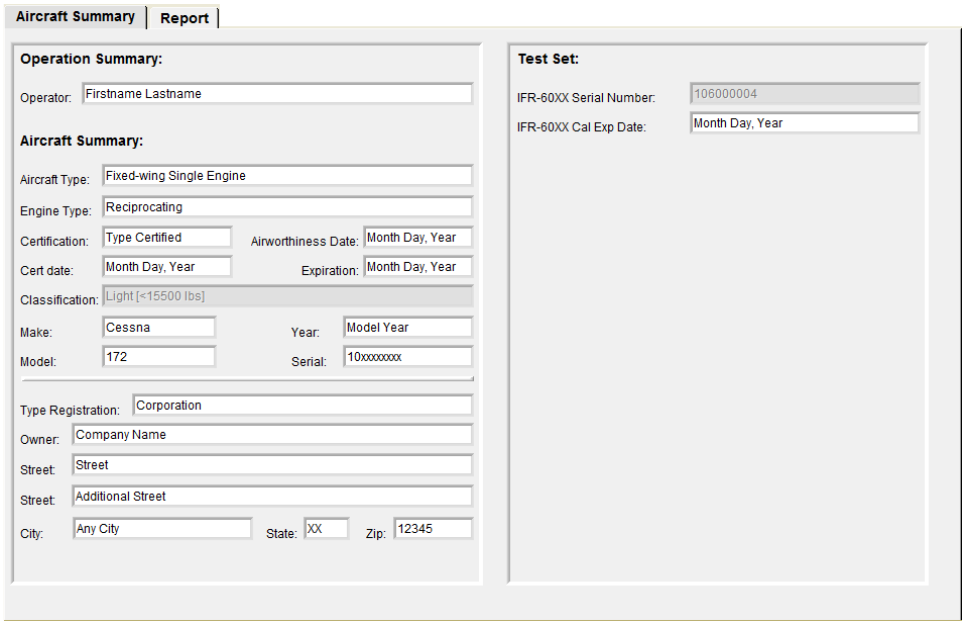
The Report Tab contains the Aircraft Summary and Report panels.



Report Tab Screen

6.4.1 AIRCRAFT SUMMARY

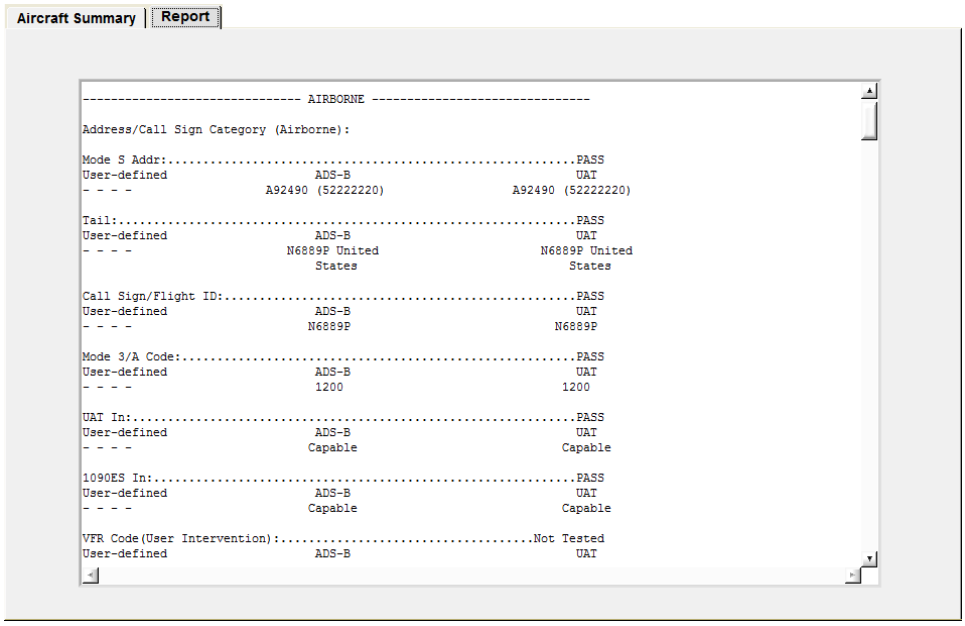
The Aircraft Summary screen allows the operator to enter Operator, Aircraft, and Test Set information. The IFR-6000 Serial Number is read remotely from the test set.



Aircraft Summary Screen

6.4.2 REPORT TAB

The Report Tab displays the result of the data analysis.



Report Tab Screen

Report Analysis

In general, the User Defined, ADS-B, and/or UAT data are compared to evaluate pass or fail.
In addition to the comparison test, the following parameters are tested as follows:
The Aircraft Address is validated against values: 0x000000, 0xA00000, 0x123456, and 0xFFFFFF.
The Air/Ground Position Error is calculated relative to the entered Position Reference. Therefore if a GPS simulator is not used, the aircraft's GPS antenna location must be as close to the Position Reference as possible.
The AC 20-165 limit of the Position Error is the Navigation Accuracy Category for Position (NACP) value received from the aircraft.
To test the Barometric Altitude accuracy for AC 20-165 compliance in ADS-B testing, a UF4 interrogation is transmitted to the unit under test to acquire the reference barometric altitude.

For UAT testing, a UAT Altitude Reference must be entered by the user. The Barometric Altitude accuracy AC 20-165 limit is within 125 feet of the reference altitude.
Navigation Accuracy Category for Velocity (NACV) AC 20-165 limit is greater than or equal to 1 (Radius of Containment < 370.4 m (0.2 nmi)).
Navigation Integrity Category (NIC) AC 20-165 limit is greater than or equal to 7 (< 10 m/s).
NACP AC 20-165 limit is greater than or equal to 8 (Estimated Positional Uncertainty < 92.6 m (0.05 nmi)).
System Design Assurance (SDA) AC 20-165 limit is greater than or equal to 2 (≤ 1×10^{-5} per hour).
Source Integrity Level (SIL) AC 20-165 limit is greater than or equal to 3 (≤ 1×10^{-7} per hour or per sample).
Aircraft Length/Width of value 0 (No Data or Unknown) is considered a 'Fail'.

6.5 DATA TAB

The Static Test Airborne and Ground data are grouped into the following: 'Address/Call Sign', 'Physical', 'Position', and 'Quality'. These groups are displayed as columns, namely: 'Field', 'User Defined', 'ADS-B', and 'UAT'. The 'Field' column shows the ADS-B and/or UAT parameters that are being analyzed.

The 'User Defined' column allows the user to enter the desired value of the field; note that this does not necessarily have to be filled and may be left blank by the user. The 'ADS-B' column displays the ADS-B data (1090 ES) extracted from the loaded ADS-B file while the 'UAT' column displays the UAT data from the loaded UAT file. The column labeled as 'Compare Alert' generally displays the comparison result of the User-defined, ADS-B, and/or UAT data. The 'ADS-B AC Alert' and 'UAT AC Alert' columns display the result of the AC 20-165 analysis. In general, a green indication signifies a passing result while red indicates a failure.

The following are also flagged as failures on the 'Compare Alert' Column:

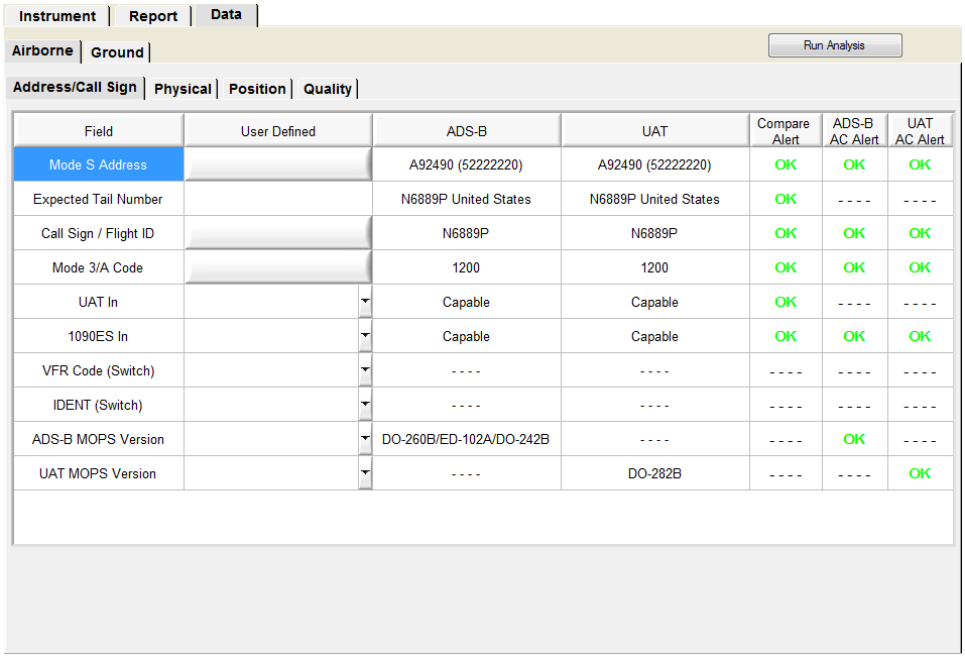
- Mode S Address values of 0x000000, 0xA00000, 0x123456, or 0xFFFFFF.

- Aircraft Length/Width raw value of zero.

- Pressure Altitude (Baro) User-defined, ADS-B, and/or UAT data difference greater than 125 feet.

- GPS Altitude (Geo) User-defined, ADS-B, and/or UAT data difference greater than 125 feet.

Also, note that the Aircraft Latitude and Longitude positional errors are calculated with reference to the 'Position Reference'. The position error fails if the calculated accuracy is greater than the NACP. Or if NACP is "EPU<3m", a pass/fail limit of plus or minus one Least Significant Bit may be utilized.

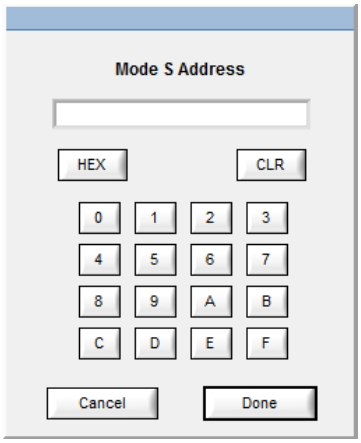


Data Tab Screen

Mode S Address (User Defined)

The Mode S Address can be entered in Octal or Hexadecimal format. The Expected Tail Number is derived from a valid Mode S address.



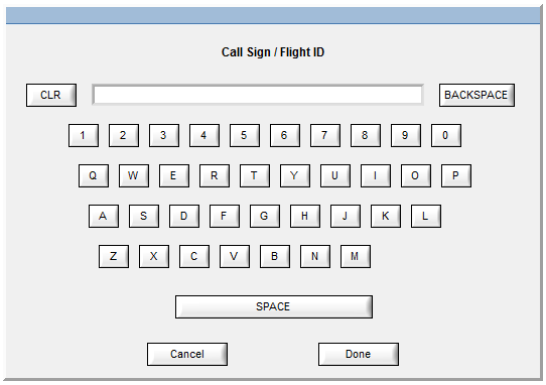


CLR: Clears the display.
Cancel: Retains previous value.
Done: Completes the value entry.

Call Sign/Flight ID (User Defined)

The eight character Call Sign/Flight ID can be entered via the QWERTY style keyboard.



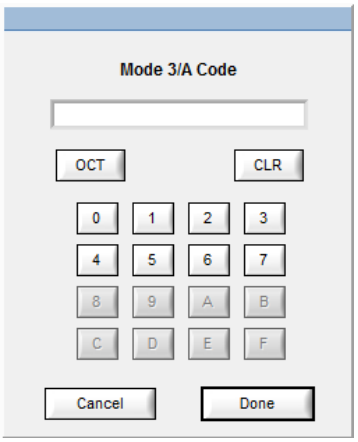


CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry

Mode 3/A Code (User Defined)

The Mode 3/A Code can be entered in Octal format.

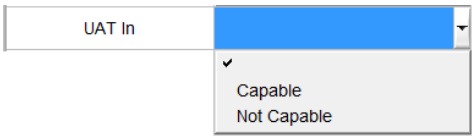




CLR: Clears the display.
Cancel: Retains previous value.
Done: Completes the value entry.

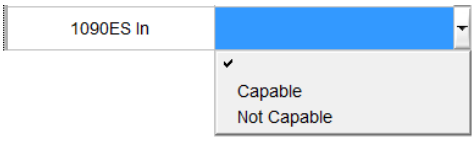
UAT In (User Defined)

The UAT In dropdown menu contains a selection of Blank, Capable, or Not Capable.



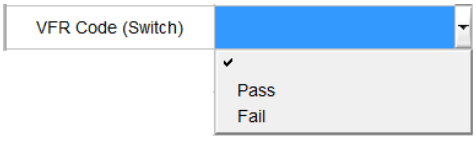
1090ES In (User Defined)

The 1090ES In dropdown menu contains a selection of Blank, Capable, or Not Capable.



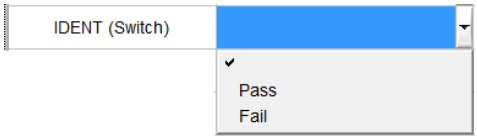
VFR Code (Switch) (User Defined)

The VFR Code dropdown menu contains a selection of Blank, Pass, or Fail. This test is manually performed by the operator by pressing the VFR Code switch.



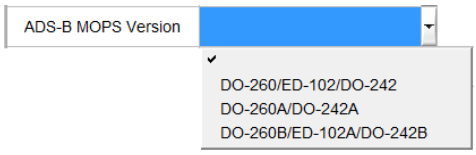
Ident (Switch) (User Defined)

The Ident dropdown menu contains a selection of Blank, Pass, or Fail. This test is manually performed by the operator by pressing the Ident switch.



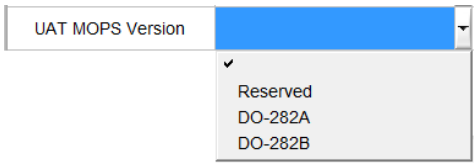
ADS-B MOPS Version (User Defined)

The operator can select the User Defined ADS-B MOPS Version from a dropdown menu.



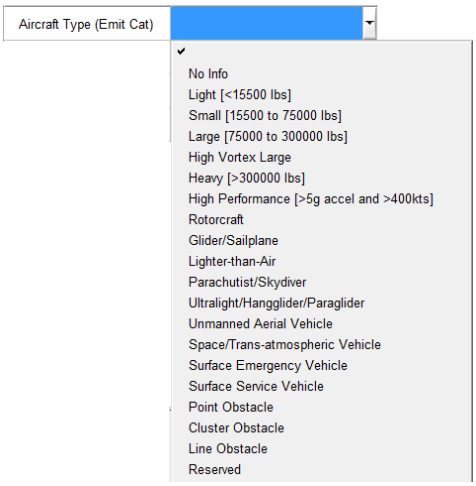
UAT MOPS Version (User Defined)

The operator can select the User Defined UAT MOPS Version from a dropdown menu.



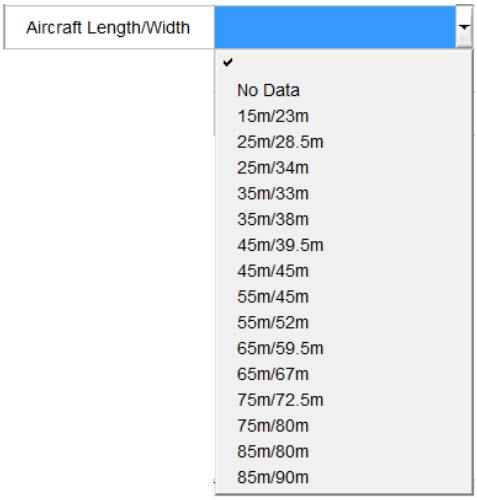
Aircraft Type (Emit Cat) (User Defined)

The operator can select the User Defined Aircraft Type from a dropdown menu.



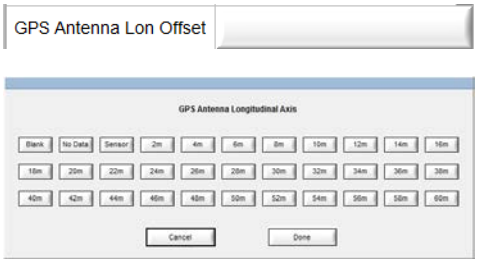
Aircraft Length/Width (User Defined)

The operator can select the User Defined Aircraft Length/Width from a dropdown menu.



GPS Antenna Lon Offset (User Defined)

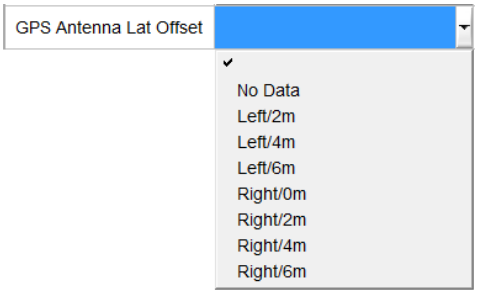
The operator can select the GPS Antenna Lon Offset from a popup panel.



Cancel: Retains previous value
Done: Completes the value entry

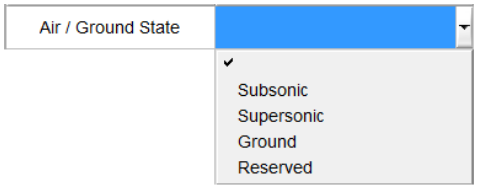
GPS Antenna Lat Offset (User Defined)

The operator can select the User Defined GPS Antenna Lat Offset from a dropdown menu.



Air / Ground State (User Defined)

The operator can select the User Defined Air / Ground State from a dropdown menu.

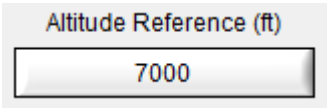


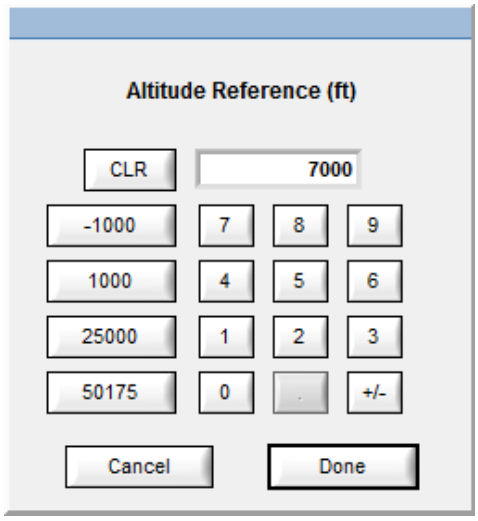
Pressure Altitude (Baro)(User Defined)

The ADS-B and UAT Pressure Altitude is validated against the Altitude Reference to within 125 feet when analyzing for AC 20-165 compliance. If the the ADS-B and UAT pressure altitudes are present, the difference limit is also validated to within 125 feet.

Pressure Altitude (Baro)	See Altitude Reference below.

The Altitude Reference entry is available in the Data->Position panel.





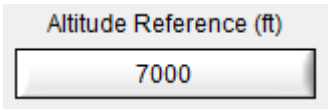
CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The four values on the left are preselected key values.

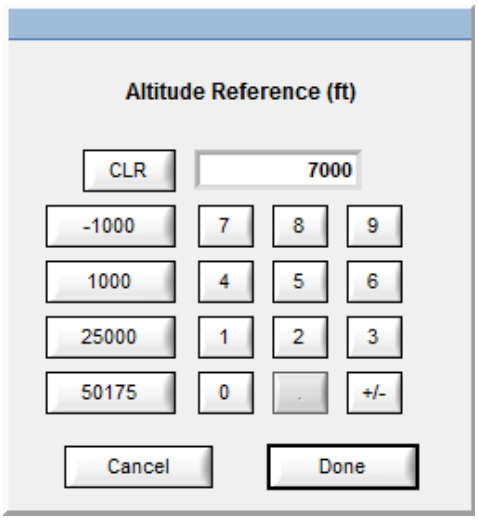
GPS Altitude (Geo) (User Defined)

The ADS-B and UAT GPS Altitude is validated against the Altitude Reference where the limit is within 125 feet. If the ADS-B and UAT GPS altitudes are present, the difference limit is also validated to within 125 feet.

GPS Altitude (Geo)	See Altitude Reference below.

The Altitude Reference entry is available in the Data->Position panel.

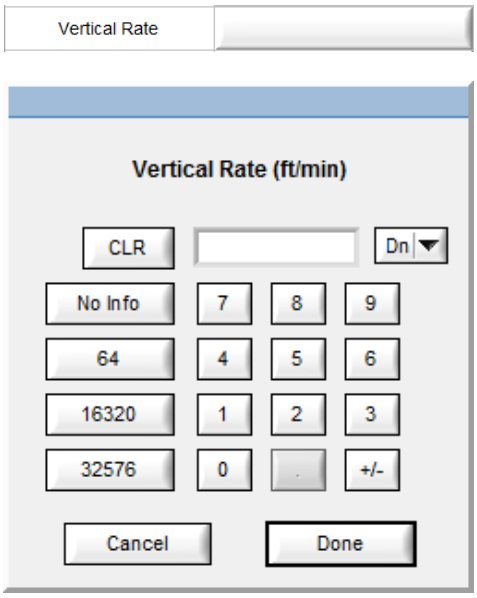




CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The four values on the left are preselected key values.

Vertical Rate (User Defined)

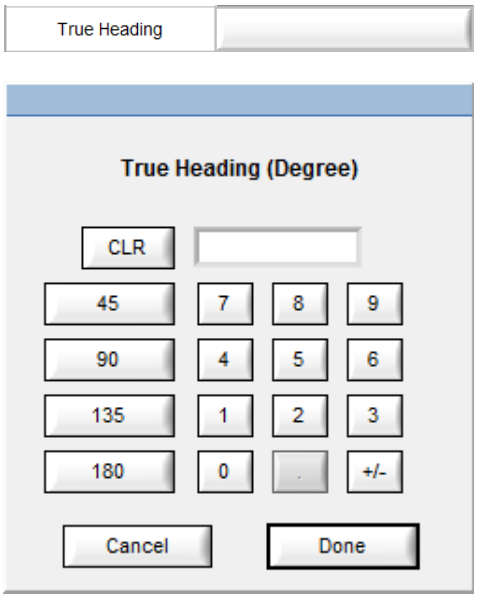
The User Defined Vertical Rate can be entered via a keypad entry. Valid entry is No Info or 0 to 32576 feet/minute.



CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The four values on the left are preselected key values.

True Heading (User Defined)

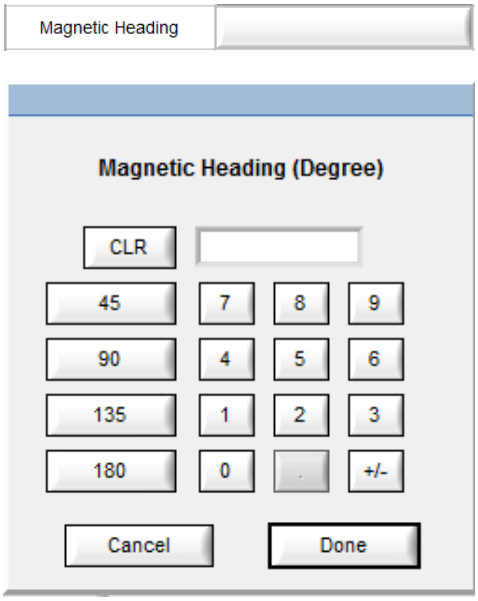
The User Defined True Heading can be entered via a keypad entry. Valid entry is from -180° to +180°.



CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The four values on the left are preselected key values.

Magnetic Heading (User Defined)

The User Defined Magnetic Heading can be entered via a keypad entry. Valid entry is from -180° to +180°.



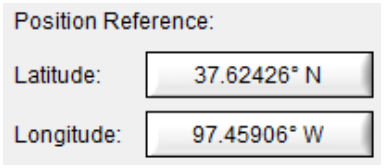
CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The four values on the left are preselected key values.

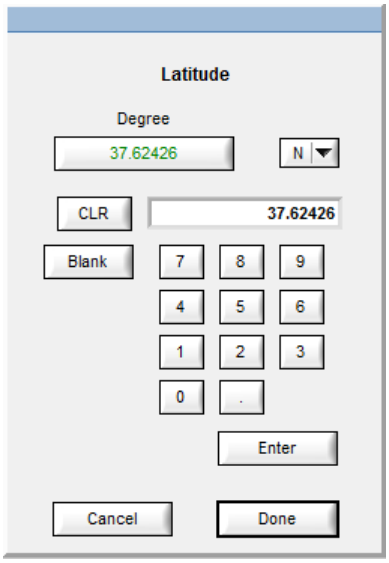
Aircraft Latitude and Aircraft Longitude (User Defined)

The Position Reference is typically the surveyed test site position. A GPS simulator such as the GPSG-1000 can also be used as a position reference. This user entry is available in the Data->Position panel.

Aircraft Latitude	See Position Reference below.
Aircraft Longitude	See Position Reference below.

The User Defined Latitude and Longitude are entered as Position Reference:





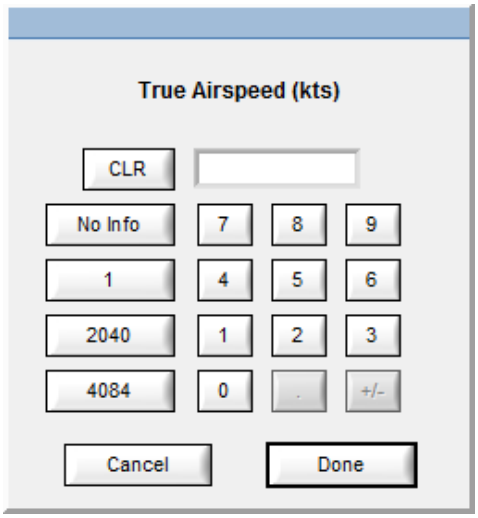
CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The 'Blank' button can be selected to return no value.

The Position Reference can be entered via a keypad entry. The position format can be changed from the dropdown menu under 'Setting'.

True Airspeed (User Defined)

The User Defined True Airspeed can be entered via a keypad entry. Valid entries are 'No Info' or 1 to 4084 knots.



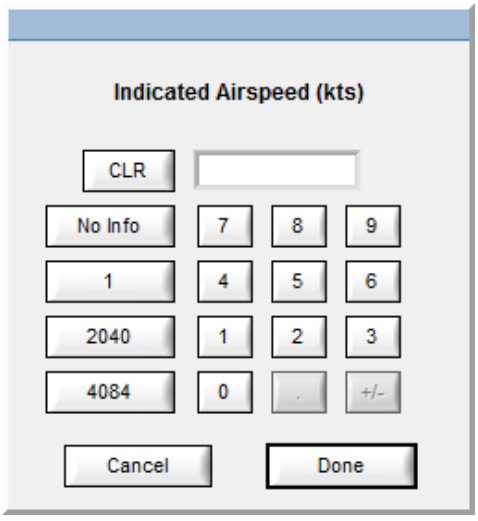


CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The four values on the left are preselected key values.

Indicated Airspeed (User Defined)

The User Defined Indicated Airspeed can be entered via a keypad entry. Valid entries are 'No Info' or 1 to 4084 knots.

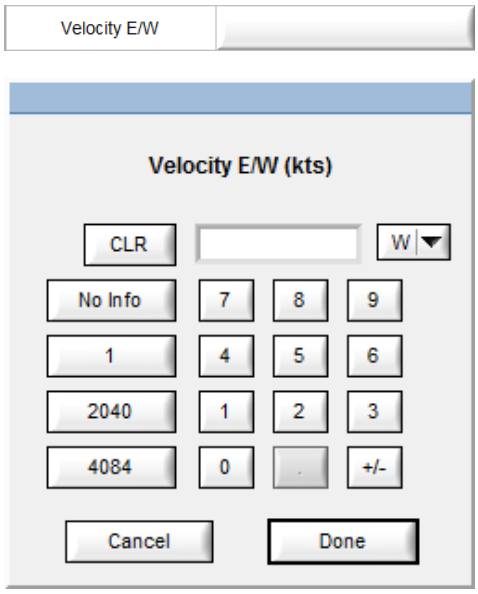




CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The four values on the left are preselected key values.

Velocity E/W (User Defined)

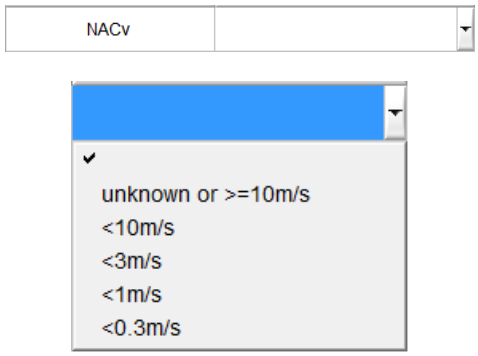
The User Defined Velocity E/W can be entered via a keypad entry. Valid entries are 'No Info' or 1 to 4084 knots.



CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The four values on the left are preselected key values.

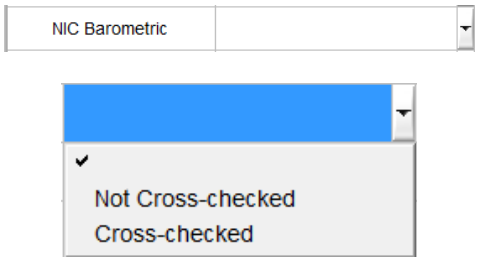
NACv (User Defined)

The User Defined NACv (Navigation Accuracy Category for Velocity) can be modified from a dropdown menu.



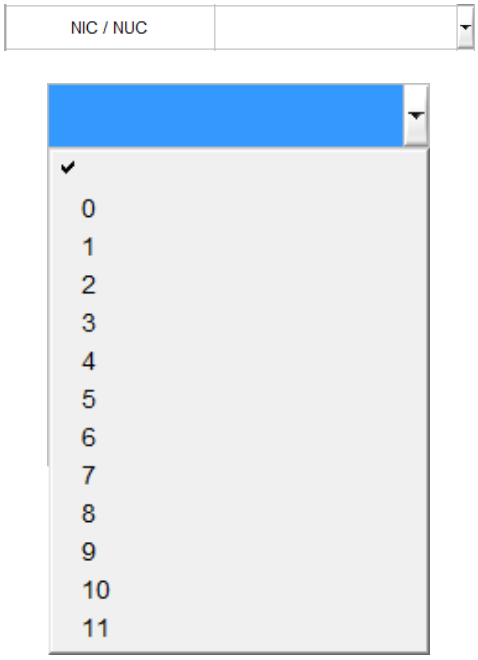
NIC Barometric (User Defined)

The User Defined NIC Barometric (Navigation Integrity Category for Barometric Altitude) can be modified from a dropdown menu.



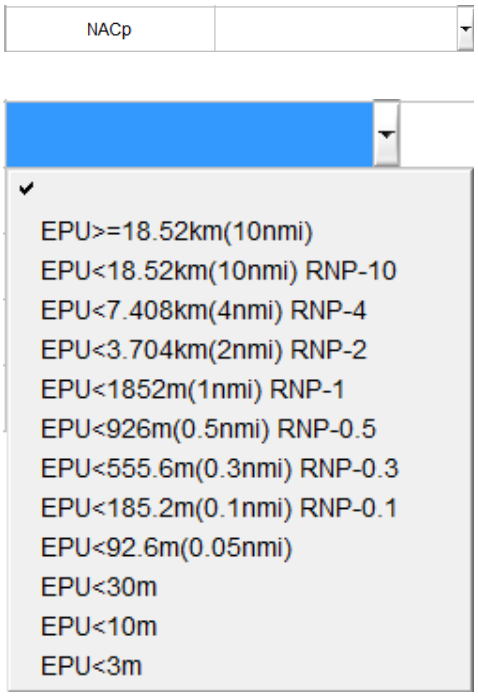
NIC/NUC (User Defined)

The User Defined NIC/NUC (Navigation Integrity Category / Navigation Uncertainty Category) can be modified from a dropdown menu.



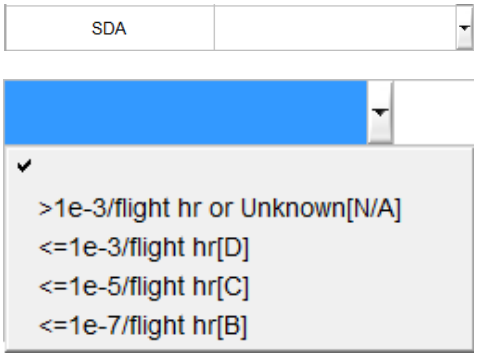
NACp (User Defined)

The User Defined NACp (Navigation Accuracy Category for Position) can be modified from a dropdown menu.



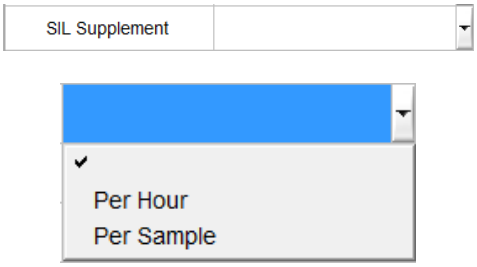
SDA (User Defined)

The User Defined SDA (System Design Assurance) can be modified from a dropdown menu.



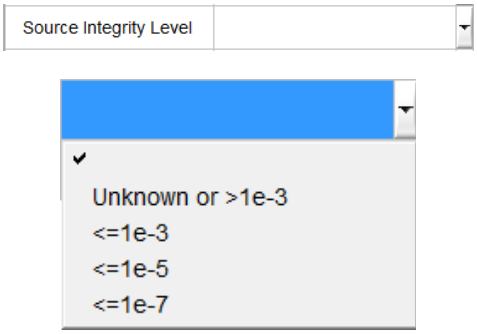
SIL Supplement (User Defined)

The User Defined SIL Supplement (Source Integrity Level Supplement) can be modified from a dropdown menu.



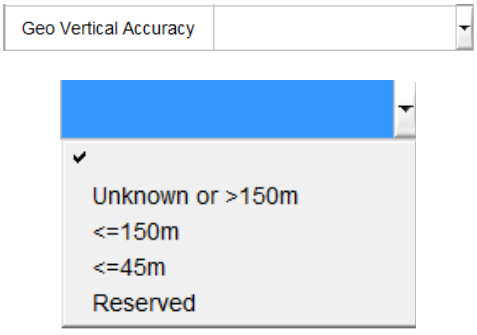
Source Integrity Level (User Defined)

The User Defined Source Integrity Level can be modified from a dropdown menu.



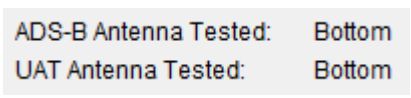
Geo Vertical Accuracy (User Defined)

The User Defined Geometric Vertical Accuracy can be modified from a dropdown menu



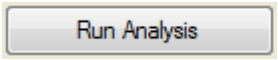
Antenna Tested Indicator

Antenna Tested Indicator indicates which antenna of the UUT was tested. The indicators are found in Data->Physical panel. Valid indications are Top or Bottom.



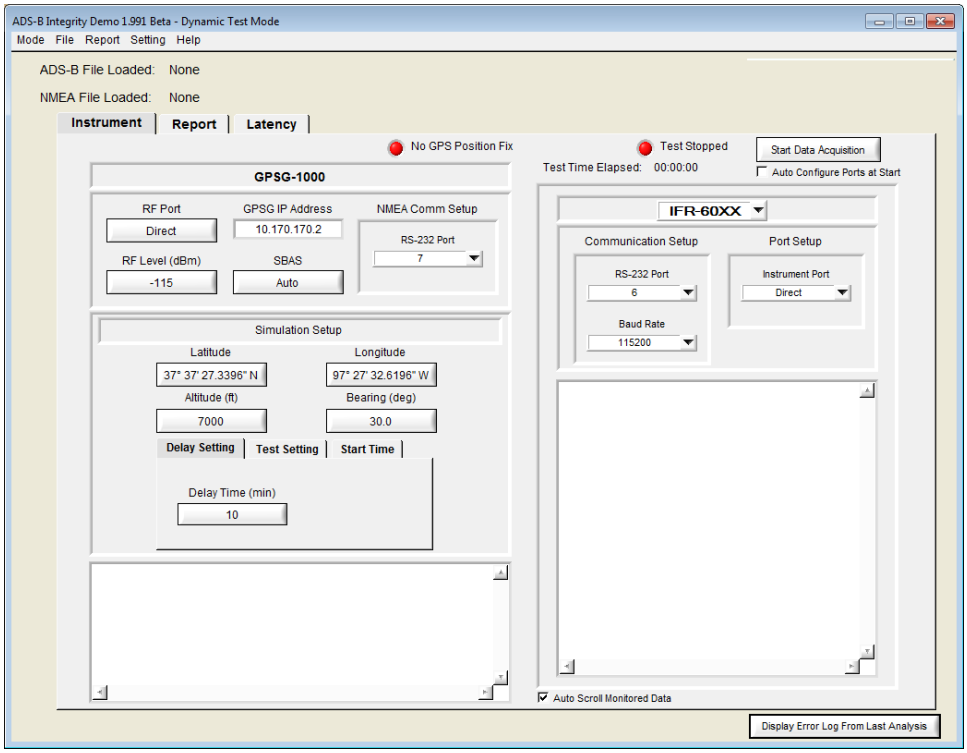
Run Analysis Button

The Run Analysis button can be used to initiate the data analysis. This may be used when a User Defined parameter is changed or entered.



6.6 DYNAMIC TEST MODE (ADS-B PERFORMANCE MONITOR TEST)

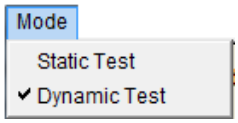
Dynamic Test Mode screen provides interface to setup, performs dynamic mode testing and displays test results.



Dynamic Test Mode Screen

Mode dropdown menu

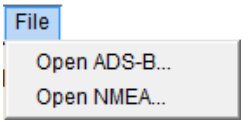
Mode menu determines the test setting of the application: Static or Dynamic.



Static Test: Sets the application to compare User-defined parameters, ADS-B, and/or UAT data.
Dynamic Test: Sets the application to perform an ADS-B Performance Monitor test.

File dropdown menu

File menu allows the operator to open an ADS-B data file or NMEA data file.

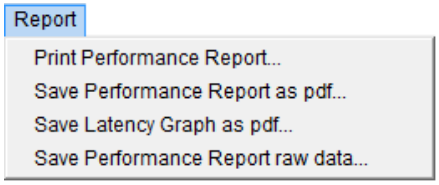


Open ADS-B: Opens an ADS-B file generated by the application with extension ".ads". This also opens performance report files saved by the user with extension ".rep".
Open NMEA: Opens an NMEA file generated by the application with extension ".nme".

Note: The NMEA file is not needed to generate the ADS-B Performance Monitor report. The NMEA file is only used when calculating latency. The ADS-B and NMEA data files must be the pair of files generated when a particular test is performed. The filename of the files are day and time stamped.

Report dropdown menu

Performance Report menu allow the operator to print or save the data or report.

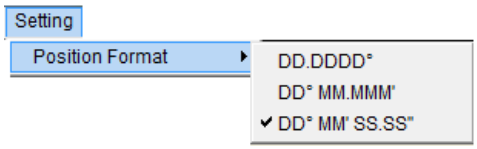


Print Performance Report: Sends the performance report to the selected printer.
Save Performance Report as pdf: Saves the performance report in pdf format.
Save Latency Graph as pdf: Saves the latency graphs in pdf format.

Save raw data as: Saves the ADS-B data file with the Operation and Aircraft Summary. This allows the operator to later retrieve this file with the Operation and Aircraft Summary information. File extension is ".rep".

Setting dropdown menu

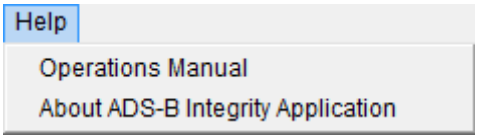
Setting menu allows the user to select the position format.



Position Format: Allows the user to change the position format.
DD.DDDD° - displays the position in degrees
DD° MM.MMM' – displays the position in degrees and minutes
DD° MM' SS.SS" – displays the position in degrees, minutes, and seconds

Help dropdown menu

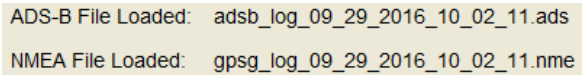
Contains selections to open the Operations Manual or a popup panel about the application.



Operations Manual: Opens the Operations Manual. Note that a pdf document reader is required.
About ADS-B Integrity Application: Displays a popup panel with the application version and website link.

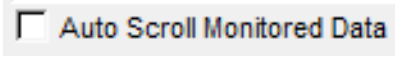
Selected Data File Indicator

Selected Data File Indicator displays the selected ADS-B and NMEA data files. Note that when the test stops, the ADS-B and NMEA data files created from the last test are automatically displayed. By default, the files will be located in subdirectory: dynamic_log.



Auto Scroll Monitored Data

Selecting the Auto Scroll Monitored Data option automatically scrolls the monitored NMEA and ADS-B data.



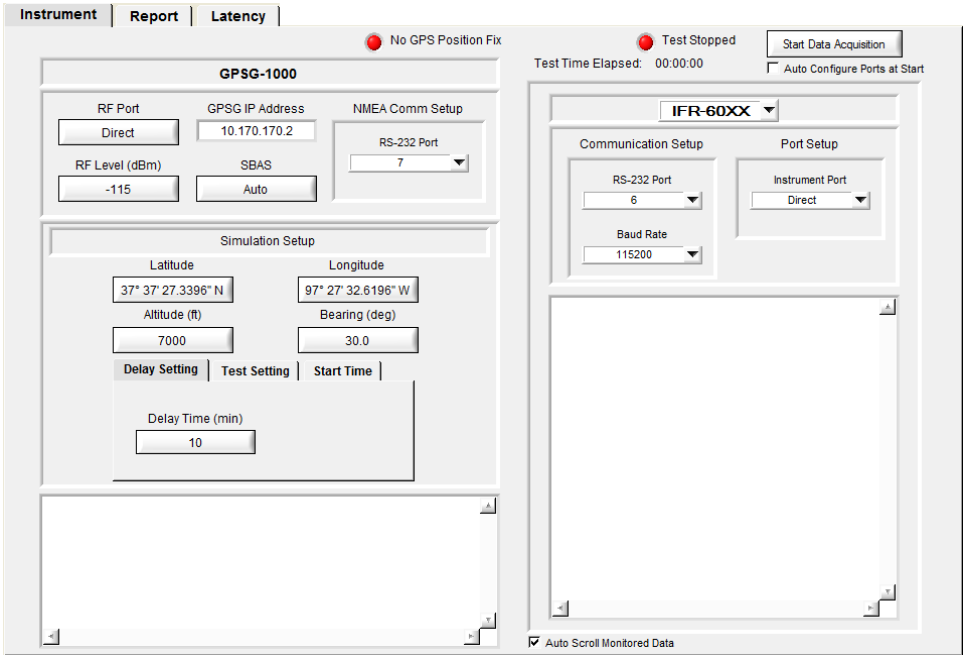
Error Log Display button

Selecting the Error Log Display button displays the error log of the last data analysis.



6.6.1 Instrument Tab

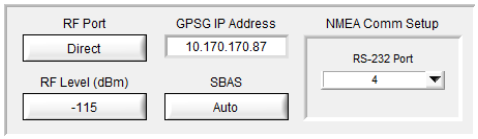
The Intrument Tab interface allows the operator to configure the instruments, start the data acquisition, and monitor the data being acquired.



GPSG-1000 Setting

GPSG-1000 RF Port and RF Level settings are provided on the application. To setup other parameters such as the cable loss and coupler loss, refer to the GPSG-1000 Operations Manual. Also consider using the latest almanac; having the latest almanac may expedite the GPS receiver acquisition.

This sets the GPSG-1000 configuration.



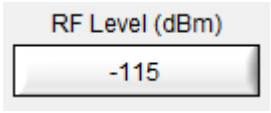
RF Port

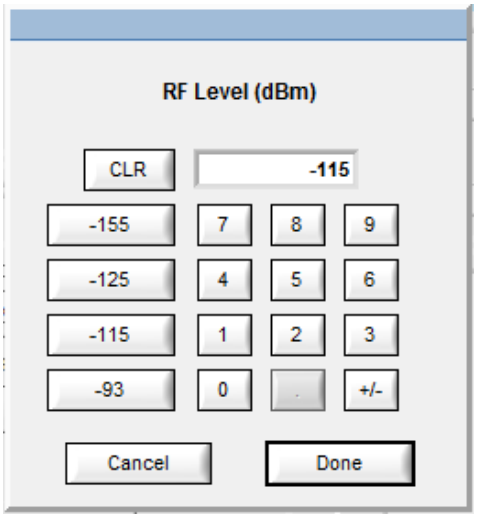
RF Port sets the RF Port that will be used to transmit GPS information to the UUT.
Direct: Used when the GPS TX Direct Port is connected directly to the UUT GNSS port.
Antenna Coupler: Used when the GPS TX Antenna Coupler is connected to the UUT GNSS antenna via an antenna coupler.



RF Level

RF Level sets the RF Level output of the selected port in dBm. Valid range is -155 to -93 dBm for Direct Port and -130 to -68 dBm for Antenna Coupler port.

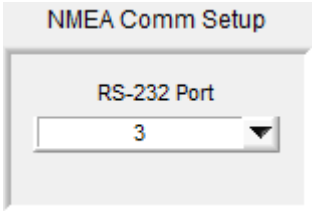




CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The four values on the left are preselected key values.

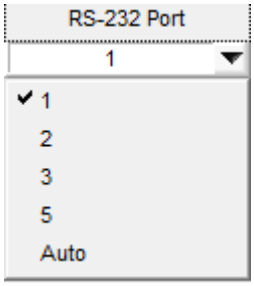
NMEA Comm Setup

NMEA Comm Setup sets the RS-232 port used in acquiring NMEA data from the GPSG-1000.



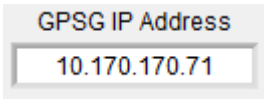
RS-232 Port

RS-232 Port sets the RS-232 serial port where the valid values are from 1 to 32; however, only the ports available will be displayed. Selecting 'Auto' will initiate the application to detect the RS-232 port that the GPSG-1000 is connected to.



GPSG IP Address

GPSG IP Address entry allows the user to enter the GPSG-1000 network IP Address. Note that when 'Auto' of the NMEA Comm RS-232 port is selected, the application will attempt to set up the proper GPSG-1000 network IP Address.



SBAS

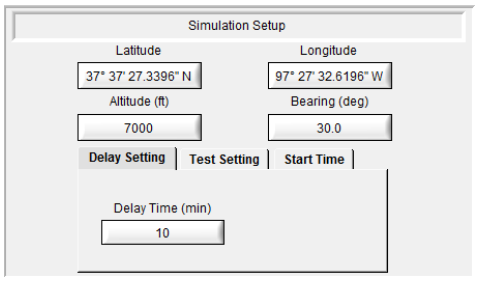
The SBAS control determines the status of the Satellite Based Augmentation Systems satellites.



Off: SBAS signal will not be present.
Auto: SBAS signal will be generated dependent on the location of the simulation.

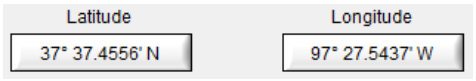
Simulation Setup

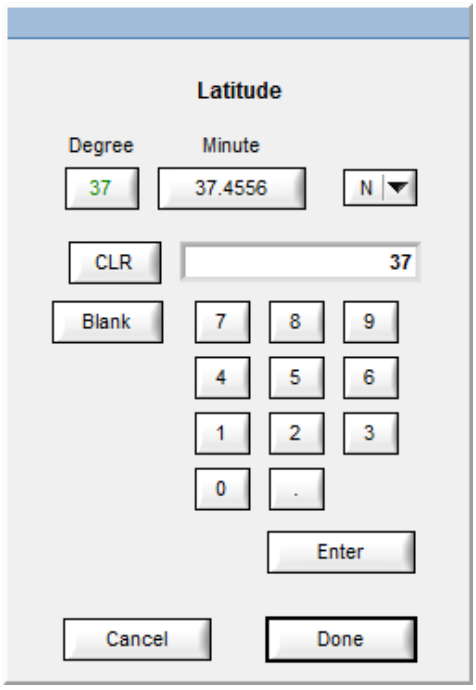
Simulation Setup sets the test path characteristics of the simulated flight.



Latitude and Longitude Simulation Setup

Latitude and Longitude setting represents the starting point of the flight.

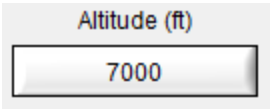


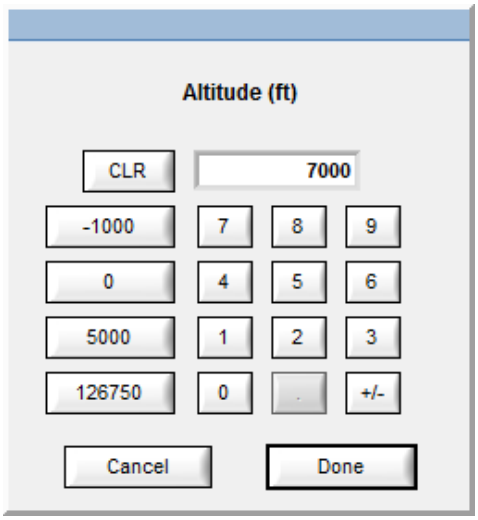


CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The 'Blank' button can be selected to return no value.

Altitude Simulation Setup

Altitude sets the GPS altitude of the aircraft.



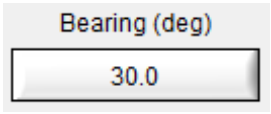


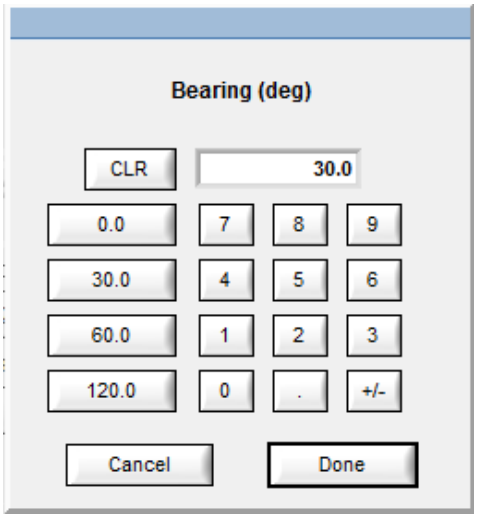
CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The four values on the left are preselected key values.

Note: If testing an avionics system with terrain awareness, the altitude selected for the simulated flight should be above that of any terrain or obstacles that might be encountered in the simulated flight path.

Bearing Simulation Setup

Bearing sets the direction of the flight
.



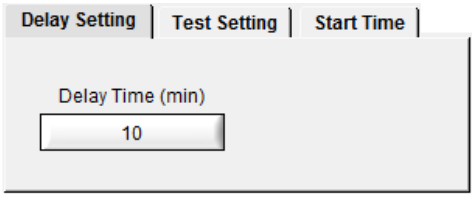


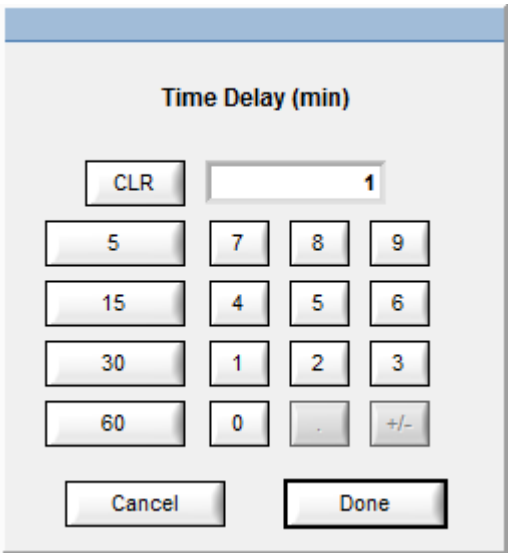
CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The four values on the left are preselected key values.

Delay Setting

Delay Setting sets the delay time to allow the UUT to acquire GPS satellites from the GPSG-1000. The distance and speed are not user-selectable, but the speed is typically less than 5 kts, and the distance is calculated to produce the desired Delay Time in minutes.

To minimize the number of failures in the Performance Report, it is advisable to set a long enough Delay Time to ensure that the Estimated Positional Uncertainty (EPU) of the Unit Under Test is as close to zero as possible.

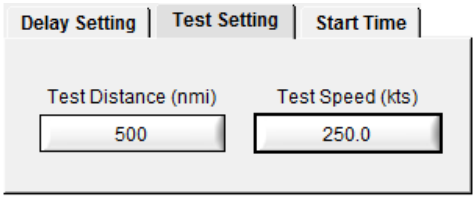




CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The four values on the left are preselected key values.

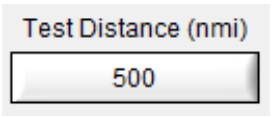
Test Setting

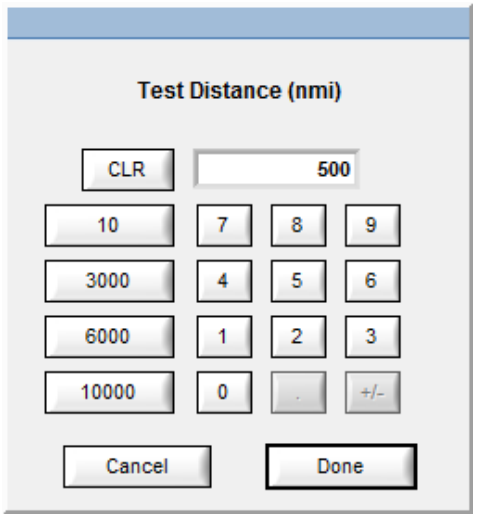
Test Setting sets the test distance and test speed of the aircraft for the test segment of the flight.



Test Distance

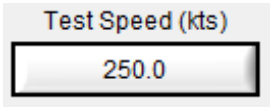
Test Distance sets the test distance of the flight in nautical miles.

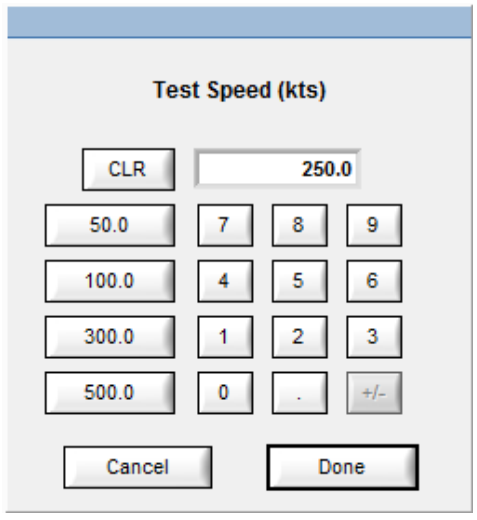




CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The four values on the left are preselected key values.

Test Speed
Test Speed sets the test speed of the flight in knots.

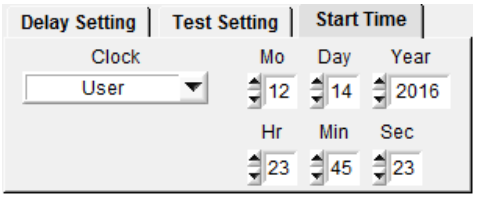




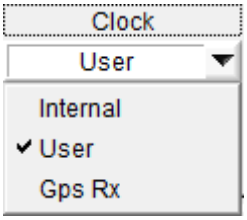
CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry
The four values on the left are preselected key values.

Start Time

The Start Time group sets the simulation clock source, date, and time.



Clock



Internal: The date and time are obtained from the GPSG-1000 internal clock.
User: The date and time are obtained from the user-defined entry.
Gps Rx: The date and time are obtained from the GPS receiver module if a GPS signal is available.

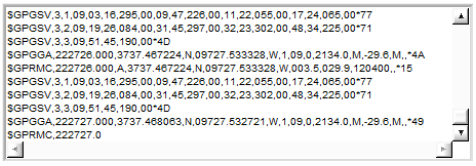
Date and Time

The date and time are set by typing the desired value. Or the parameters can be set by incrementing or decrementing the value through the up and down arrows.

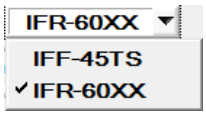


NMEA Data Monitor

The NMEA Data Monitor panel displays the acquired NMEA data from the GPSG-1000. The NMEA data is saved into a file and is used for latency calculation. The NMEA data is not needed to generate the ADS-B Performance Monitor report.

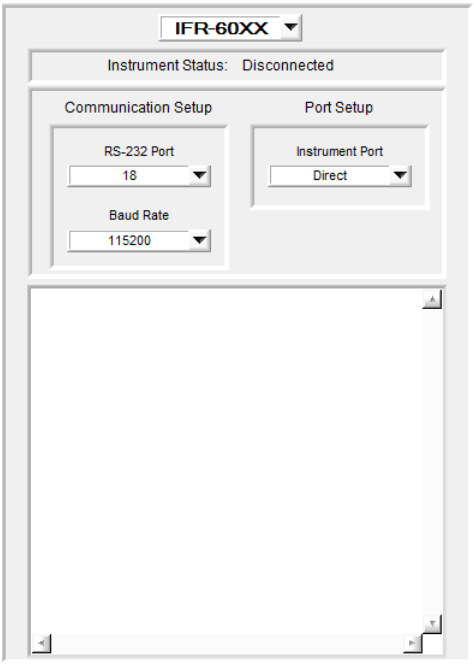


Test Set Selection Menu

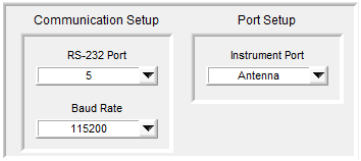


IFF-45TS: The IFF-45TS will be used to acquire ADS-B Out data
IFR-6000: The IFR-6000 will be used to acquire ADS-B Out data

Test Set Setup

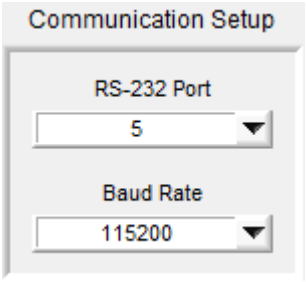


Test Set Configuration



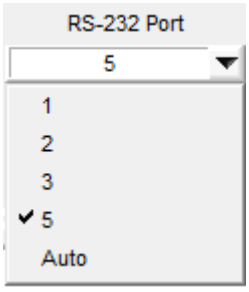
Communication Setup

This control group selects the test set RS-232 port and baud rate.



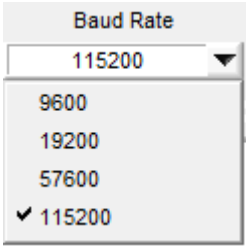
RS-232 Port

RS-232 Port dropdown menu sets the RS-232 serial port where the valid values are from 1 to 32; however, only the ports available will be displayed. Selecting 'Auto' will initiate the application to detect the RS-232 port that the test set is connected to.



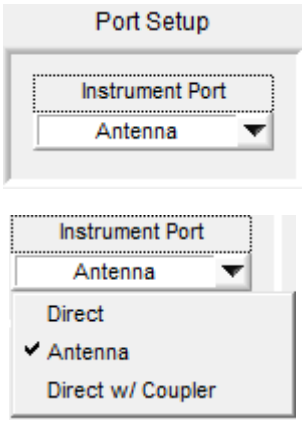
Baud Rate

Baud Rate dropdown menu selects the Baud Rate of the test set. This setting needs to match the RS-232 setup of the test set; see the test set Operations Manual for more details.



Port Setup

Port Setup selects the RF port that will be used for testing.



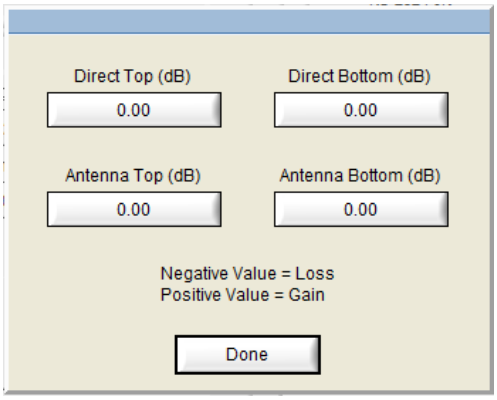
Direct: Select if the RF cable is connected directly to the UUT RF port.
Antenna: Select for over-the-air testing.
Direct w/ Coupler: Select this when using the antenna coupler.

Cable Loss (IFF-45TS Only)

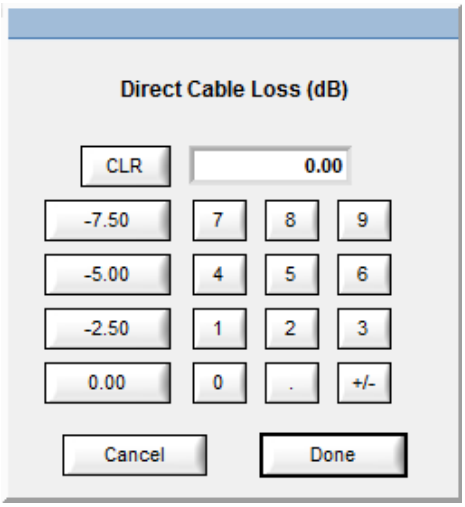
The Cable Loss control allows the entry of the Direct and Antenna port cable loss.



Select the Cable Loss button to display the popup entry.



Select the appropriate button to enter the cable loss. Note that a negative value represents a loss while a positive value represents gain. The value range is -50.00 to 50.00 dB.

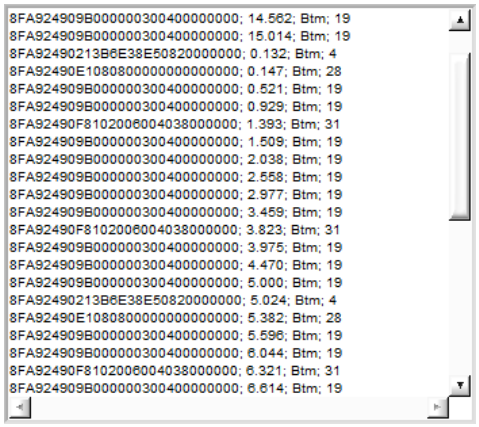


CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry

The four values on the left are preselected key values.

ADS-B Data Monitor

ADS-B Data Monitor panel displays the acquired ADS-B data from the UUT. The ADS-B data is saved into a file and used to generate the ADS-B Monitor Performance report and/or latency calculation.



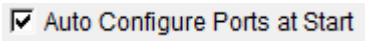
Start Data Acquisition

Start Data Acquisition button starts the simulated flight to acquire the ADS-B data and NMEA data. The test can be stopped manually by pressing the button again; otherwise, the test will stop once it reaches its destination per the GPSG-1000 Test Setting.



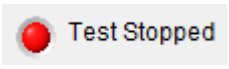
Auto Configure Ports at Start

When selected, the application automatically searches for the proper RS-232 port the instruments are connected to when the data acquisition is started by the user.

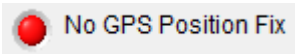


Test Status Indicator

The indicator will be red when the test is stopped or green when the test is active.



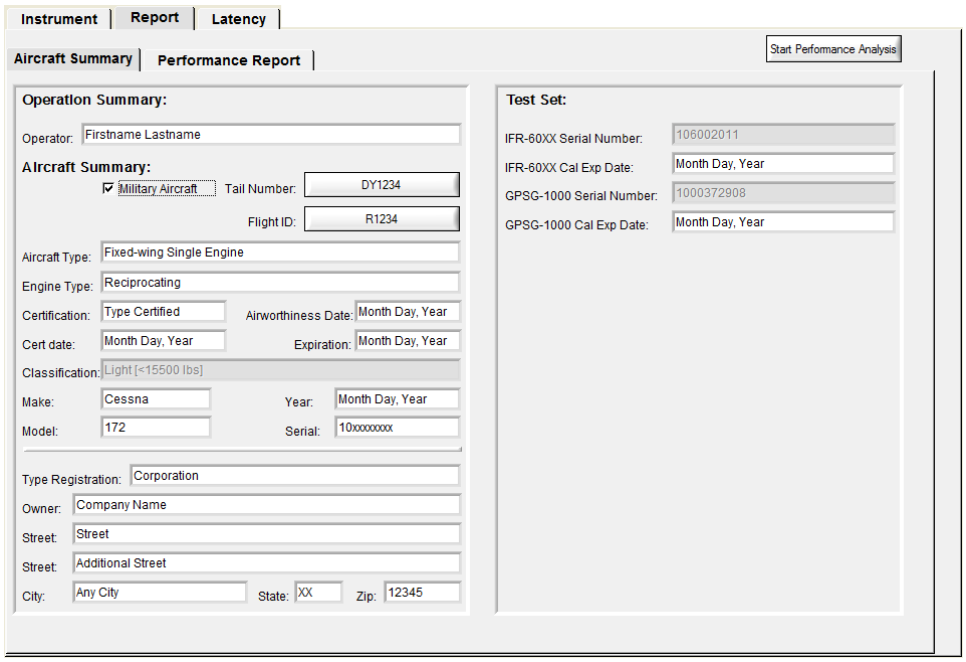
GPS Position Fix Indicator



GPS Position Fix indicator will display the color red when there is no GPS position fix, yellow when GPS position fix is attained but the NIC is not AC 20-165 compliant, and green when there is GPS position fix and NIC is AC 20-165 compliant.

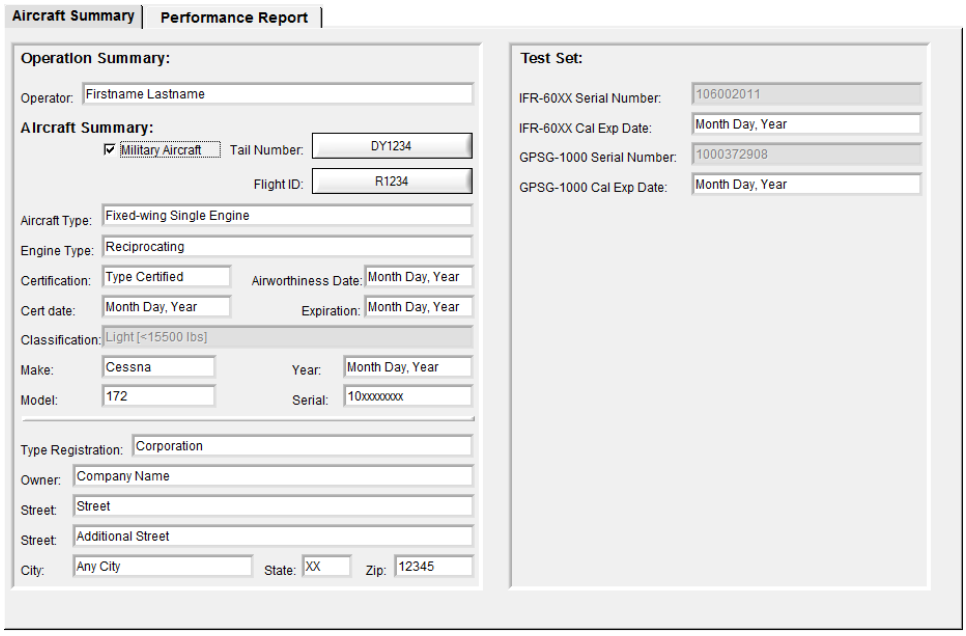
6.6.2 Report Tab

The Report Tab contains the Aircraft Summary and ADS-B Performance Report.



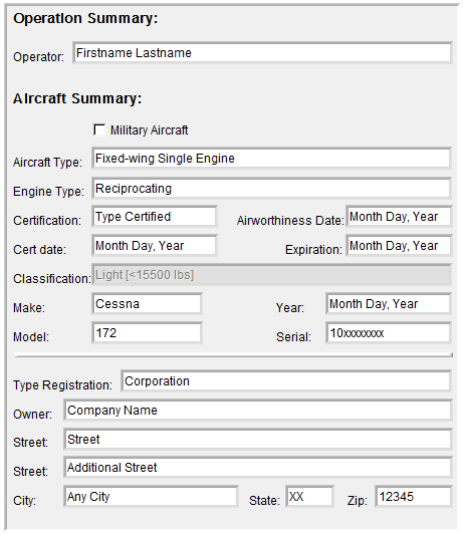
Aircraft Summary Tab

The Aircraft Summary Tab panel contains the operator, aircraft, and test set information. The IFF-45TS or IFR-6000 Serial Number and GPSG-1000 Serial Number are read remotely from the test sets.



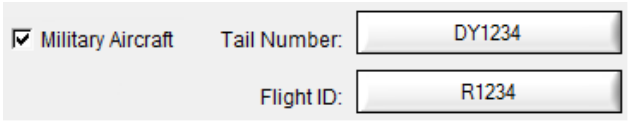
Operation and Aircraft Summary

The Operation and Aircraft Summary panel allows the operator to enter the operator and aircraft information. The last information is saved when the application is exited, and the last information from the last usage is retrieved during the application startup.



Military Aircraft

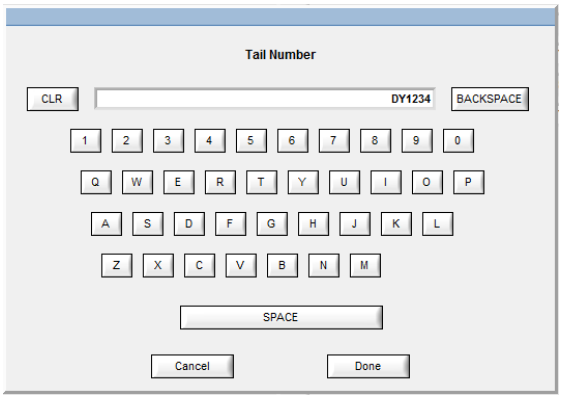
Military aircraft with Tail Numbers and Flight IDs that do not conform to civilian or commercial aircraft naming convention may be tested by selecting 'Military Aircraft' and entering the Tail Number and Flight ID. Note that the military Tail Number and Flight ID can only be entered if 'Military Aircraft' is selected. The 'Military Aircraft' selection box must be unchecked when testing civilian or commercial aircraft.



Tail Number

The military Aircraft Tail Number can be entered via the QWERTY style keyboard.



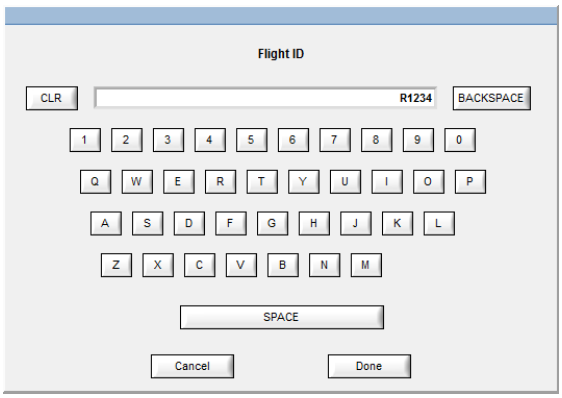


CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry

Flight ID

The military Aircraft Flight ID can entered via the QWERTY style keyboard.



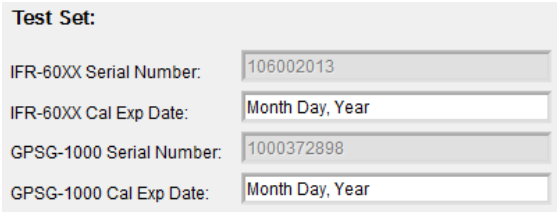


CLR: Clears the display
Cancel: Retains previous value
Done: Completes the value entry

Test Set

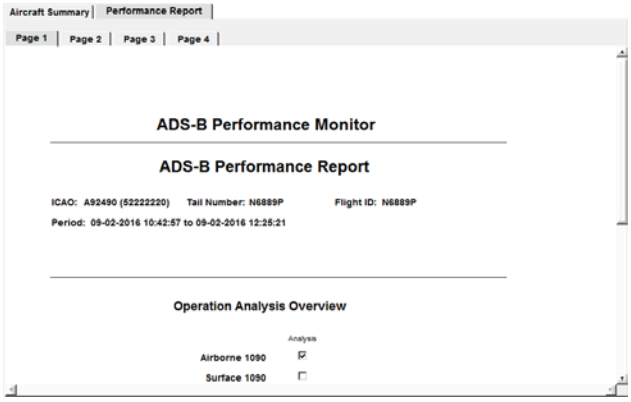
Test Set allows the operator to enter the Test Set information. This information is saved when the application is exited, and the information from the last usage is retrieved during the application startup.

The IFF-45TS or IFR-6000 Serial Number and GPSG-1000 Serial Number are read remotely from the test sets.



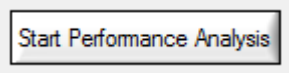
Performance Report Tab

The Performance Report Tab displays the result of the performance analysis of the selected ADS-B data file.



Start Performance Analysis Button

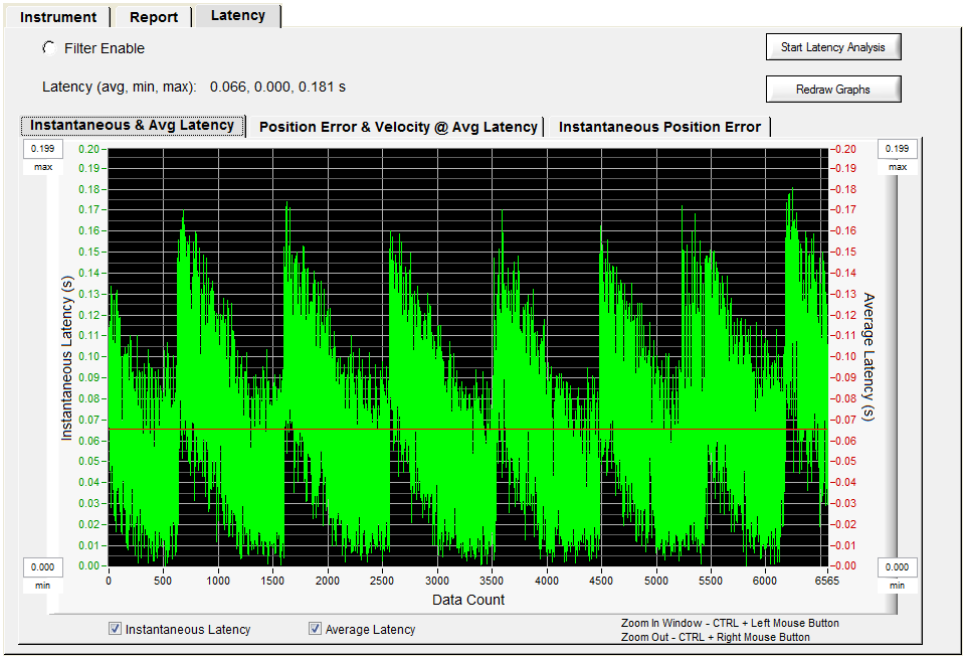
This control starts the performance analysis of the selected ADS-B data file.



After the Performance Analysis is completed, the ADS-B raw data will automatically be saved with the same filename but with an extension of '.rep' (report). The current Operation and Aircraft Summary is concurrently saved. The displayed 'ADS-B File Loaded' is updated to the new file created.

6.6.3 Latency Tab

The Latency Tab contains the result of the latency calculation from the selected ADS-B and NMEA files.



Filter Enable

Filter Enable enables or disables the filter for instantaneous latency. For 'Instantaneous & Avg Latency' and 'Instantaneous Position Error' calculations, latency greater than or equal to 2.0 seconds and instantaneous distance greater than or equal to 1000 feet are filtered out. For 'Position Error & Velocity @ Avg Latency' calculation, distance greater than 1000 feet and velocity greater than 1000 knots are filtered out.

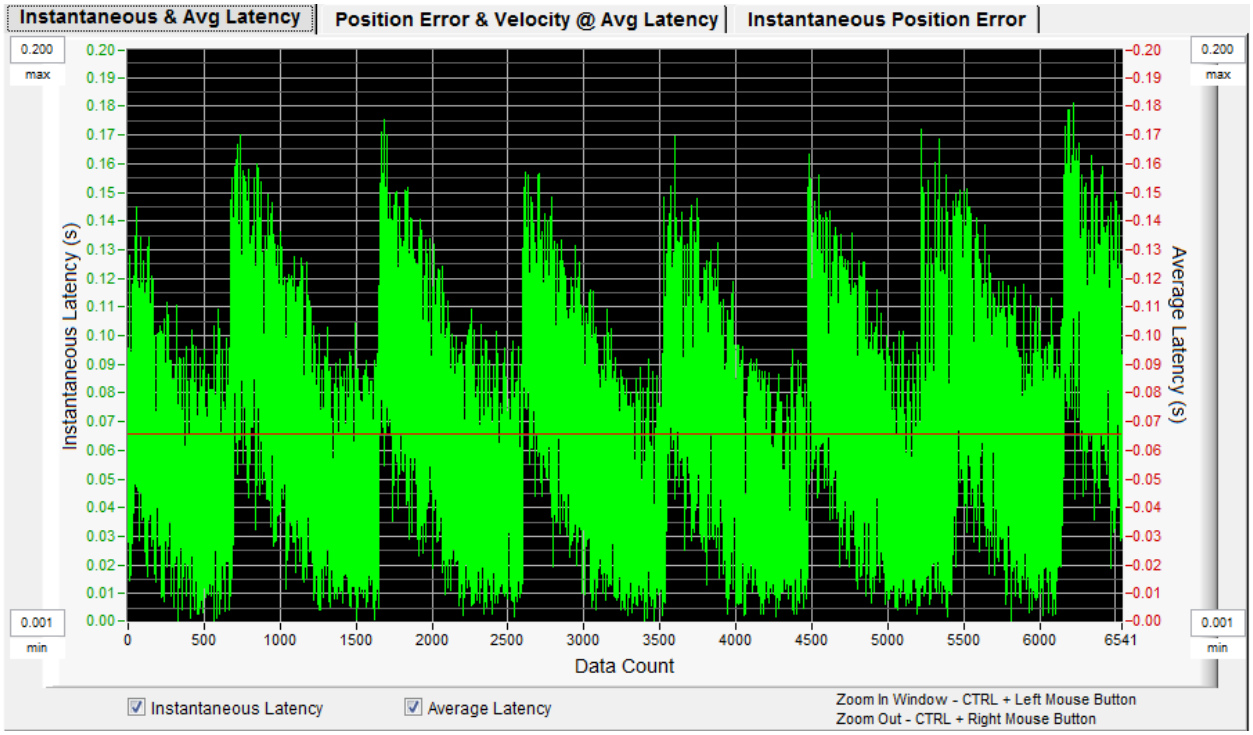


Latency (avg, min, max)

The calculated average, minimum, and maximum latency are displayed in seconds.

Instantaneous & Avg Latency

The Instantaneous & Avg Latency graph displays the instantaneous latency in seconds as green and Average Latency in seconds as red. Check or uncheck Instantaneous Latency or Average Latency to show or hide the corresponding graph. To zoom in, hold the CTRL key and left mouse button and drag the mouse to create a zoom window. To zoom out, hold the CTRL key and press the right mouse button. To revert to the original graph, select the 'Redraw Graphs' button.



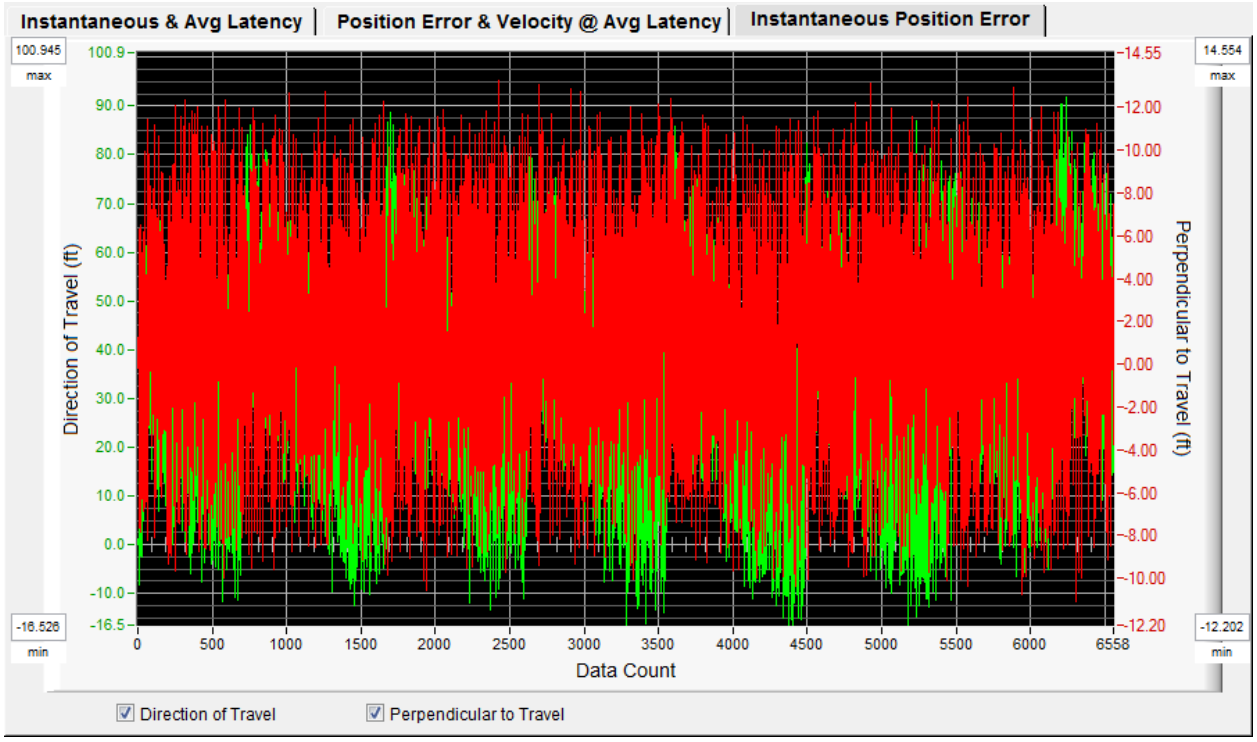
Position Error & Velocity @ Avg Latency

The Position Error & Velocity @ Avg Latency graph displays the position error in feet as green and velocity at average latency in knots as red. Check or uncheck Distance Error or Velocity to show or hide the corresponding graph. To zoom in, hold the CTRL key and left mouse button and drag the mouse to create a zoom window. To zoom out, hold the CTRL key and press the right mouse button. To revert to the original graph, select the 'Redraw Graphs' button.



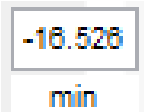
Instantaneous Position Error

The Instantaneous Position Error graph displays the instantaneous position error in the direction of travel in feet as green and instantaneous position error perpendicular to the direction of travel in feet as red. Check or uncheck Direction of Travel or Perpendicular to Travel to show or hide the corresponding graph. To zoom in, hold the CTRL key and left mouse button and drag the mouse to create a zoom window. To zoom out, hold the CTRL key and press the right mouse button. To revert to the original graph, select the 'Redraw Graphs' button.

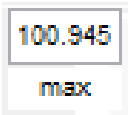


Graph Control

This control sets the minimum Y-axis of the corresponding graph.



This control sets the maximum Y-axis of the corresponding graph.



This control redraws the graph so that the min/max selected takes effect.

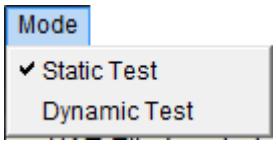


6.6.4 PERFORMING A STATIC TEST WITH THE IFR-6000

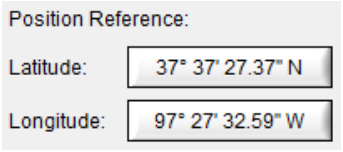
Note: If applicable, set the IFR-6000 cable and/or coupler losses on the test set 'SETUP-XPDR' page. Refer to the IFR-6000 Operation Manual.

STEP	PROCEDURE

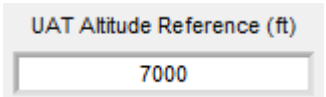
1. Select 'Static Test' from the 'Mode' menu.



2. Attach the Breakout Box to the IFR-6000.
3. Connect an RS-232 cable (serial thru DB9 F/F) from the host computer to the IFR-6000 RS-232 Breakout Box.
4. On the IFR-6000 test set, connect a coax cable to the proper RF Port. Connect the other end of the coax cable to the UUT or to the test set antenna if testing over-the-air.
5. Ensure that the UUT has proper GPS position source.
6. On the application, navigate to 'Data'->'Position' tab and enter the Position Reference. The Position Reference is typically the surveyed site position.



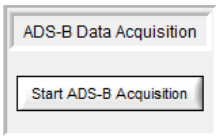
7. If a UAT test will be performed, also enter the 'UAT Altitude Reference'.



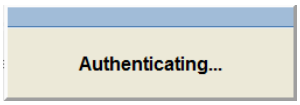
8. On the application, navigate to the 'Instrument' tab. Ensure that the 'Baud Rate' matches the configuration of the test set; refer to the test set operations manual.

STEP	PROCEDURE

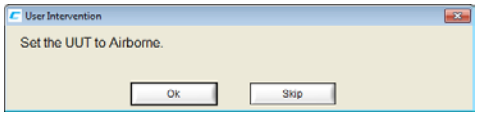
9. On the application 'RS-232 Port' menu, select 'Auto'. This will initiate the application to search for the serial port that the test set is connected to.
10. On the application 'Instrument Port' menu, select the proper RF Port the test set was connected to from Step 4.
11. To start the ADS-B Acquisition, press the 'Start ADS-B Acquisition' button.

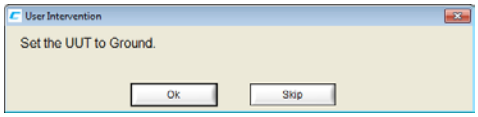


12. The application will authenticate the test set which may take up to two minutes. The authentication will not be performed again as long as the application is left open.



13. Follow the user prompts.



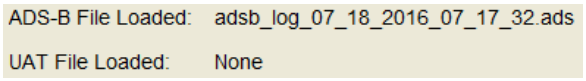


14. The acquired data will be displayed on the data monitor panel.

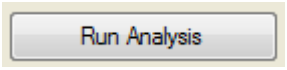


STEP PROCEDURE

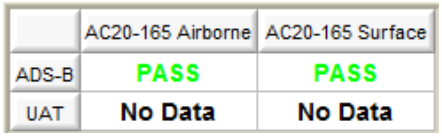
15. The saved file of the acquired data will be displayed. The file is saved in subdirectory: static_log.



16. To analyze the acquired data, navigate to 'Data' tab. Select the 'Run Analysis' button.



17. The result of the of the data analysis are displayed in the upper right hand side of the application window as shown below. Note that in this example, the ADS-B system has passed both its AC 20-165 Airborne and Surface data analysis tests.

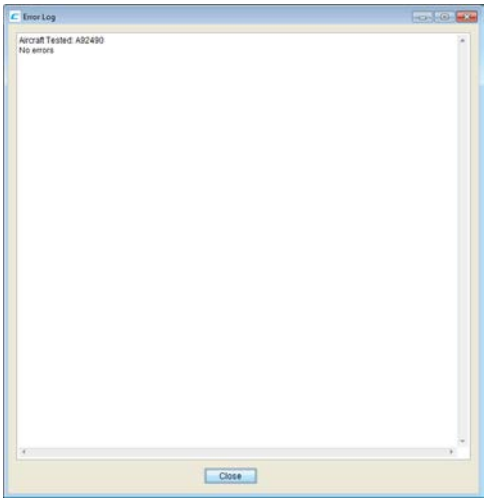


	AC20-165 Airborne	AC20-165 Surface
ADS-B	PASS	PASS
UAT	No Data	No Data

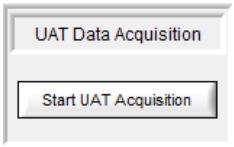
18. If any of the 'User Defined' or UAT parameters are present, comparison of the data will be displayed on the 'Address/Call Sign', 'Physical', 'Position', and 'Quality' tabs.
19. Details of specific errors can be displayed using the 'Display Error Log From Last Analysis Button'. When activated, the Error Log popup shown below will be displayed to the user which will provide more detailed information to the user regarding specific test failures.



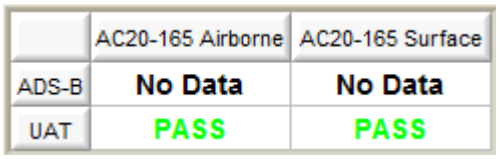
STEP PROCEDURE



20. To perform a UAT test, transfer the RF coax cable to the proper antenna as required.
21. Press the 'Start UAT Acquisition' button, and follow the user prompts.



22. The result of the of the data analysis are displayed in the upper right hand side of the application window as shown below. Note that in this example the UAT system has passed both its AC 20-165 Airborne and Surface data analysis tests.



	AC20-165 Airborne	AC20-165 Surface
ADS-B	No Data	No Data
UAT	PASS	PASS

23. If any of the 'User Defined' or ADS-B parameters are present, comparison of the data will be displayed on the 'Address/Call Sign', 'Physical', 'Position', and 'Quality' tabs.

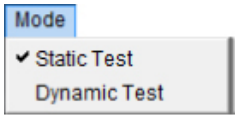
6.6.5 PERFORMING A STATIC TEST WITH THE IFR-6000 AND GPSG-1000

Note: If applicable, set the IFR-6000 cable and /or coupler losses on the test set 'SETUP-XPDR' page. Refer to the IFR-6000 Operation Manual.

Note: If applicable, set the GPSG-1000 cable and/or coupler losses on the test set 'SETUP' page. Refer to the GPSG-1000 Operation Manual.

STEP PROCEDURE

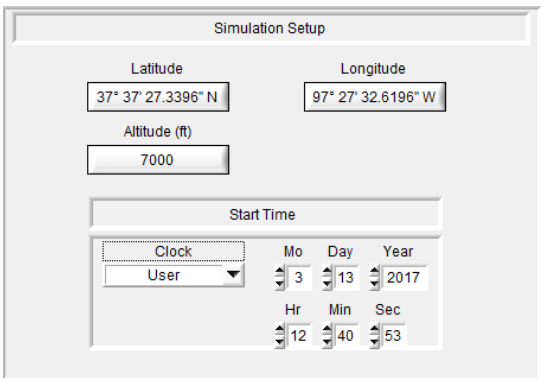
1. Select 'Static Test' from the 'Mode' menu.



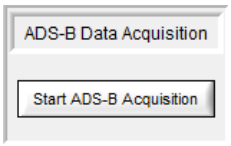
2. Attach the Breakout Box to the IFR-6000.
3. Connect an RS-232 cable (serial thru DB9 F/F) from the host computer to the IFR-6000 RS-232 Breakout Box.
4. Connect the ADS-B Integrity cable to the GPSG-1000 26-pin D-type Auxiliary connector.'
5. Connect the 9-pin D-type RS-232 connector of the ADS-B Integrity cable to the host computer RS-232 port.
6. Connect an Ethernet cable from the host computer to the GPSG-1000 Ethernet port.
7. On the IFR-6000 test set, connect a coax cable to the proper RF Port. Connect the other end of the coax cable to the UUT or to the test set antenna if testing over-the-air.
8. On the GPSG-1000 test set, connect a coax cable to the proper RF Port. Connect the other end of the coax cable to the UUT GPS antenna.

STEP PROCEDURE

9. On the application, navigate to the 'Instrument tab'. Ensure that the IFR-6000 'Baud Rate' matches the configuration of the test set; refer to the test set operations manual.
10. On the application IFR-6000 'Instrument Port' menu, select the proper RF Port the test set was connected to from Step 7.
11. On the application GPSG-1000 'RS-232 Port' menu, select 'Auto'. This will initiate the application to search for the serial port that the test set is connected to. If the serial port search is successful, the application will also attempt to acquire the GPSG-1000 Ethernet address.
12. On the application GPSG-1000 'Instrument Port' menu, select the proper RF Port the test set was connected to.
13. On the application GPSG-1000 'Simulation Setup' menu, enter the appropriate data for the latitude, longitude, altitude, time and date of the simulation.

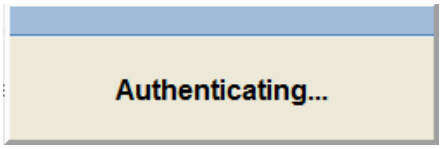


14. To start the ADS-B Acquisition, on the IFR-6000 ADS-B Data Acquisition menu press the 'Start ADS-B Acquisition' button.

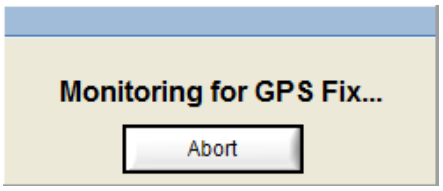


STEP	PROCEDURE

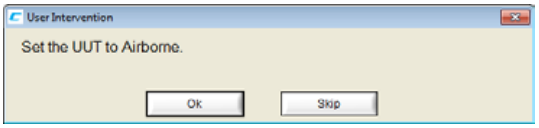
15. The application will authenticate the test sets which may take up to two minutes. The authentication will not be performed again as long as the application is left open.

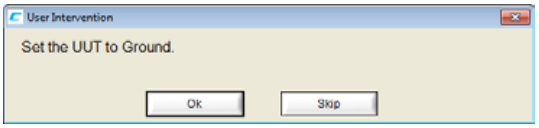


16. A “Monitoring for GPS Fix...” popup will appear and stay in this state until a NIC value which passes AC 20-165 is received from the UUT. Note that this may take several minutes.



17. Follow the user prompts.



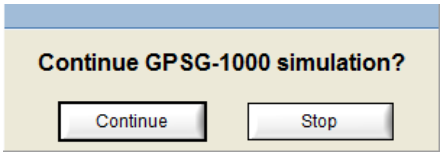


18. The acquired data will be displayed on the data monitor panel.

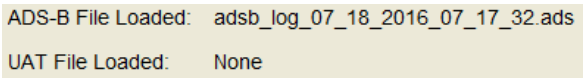


STEP	PROCEDURE

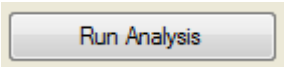
19. At the end of the acquisition process, the user will be given the option of stopping the simulation on the GPSG-1000 or continuing. If additional acquisitions are to be performed, it is suggested that the GPSG-1000 simulation be allowed to continue.



20. The saved file of the acquired data will be displayed. The file is saved in subdirectory: static_log.



21. To analyze the acquired data, navigate to ‘Data’ tab. Select the ‘Run Analysis’ button.



22. The result of the of the data analysis are displayed in the upper right hand side of the application window as shown below. Note that in this example, the ADS-B system has passed both its AC 20-165 Airborne and Surface data analysis tests.

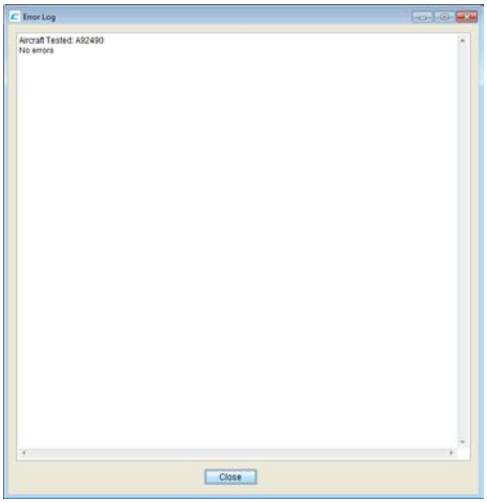
	AC20-165 Airborne	AC20-165 Surface
ADS-B	PASS	PASS
UAT	No Data	No Data

23. If any of the ‘User Defined’ or UAT parameters are present, comparison of the data will be displayed on the ‘Address/Call Sign’, ‘Physical’, ‘Position’, and ‘Quality’ tabs.

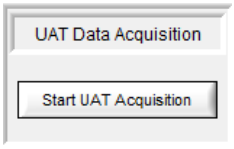
STEP PROCEDURE

24. Details of specific errors can be displayed using the ‘Display Error Log From Last Analysis Button’. When activated, the Error Log popup shown below will be displayed to the user which will provide more detailed information to the user regarding specific test failures.



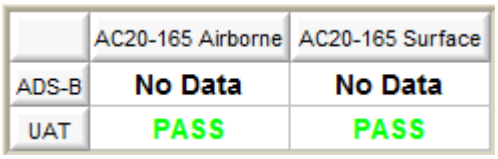


26. To perform a UAT test, transfer the RF coax cable to the proper antenna as required.
27. Press the ‘Start UAT Acquisition’ button, and follow the user prompts.



STEP PROCEDURE

28. The result of the of the data analysis are displayed in the upper right hand side of the application window as shown below. Note that in this example the UAT system has passed both its AC 20-165 Airborne and Surface data analysis tests.



	AC20-165 Airborne	AC20-165 Surface
ADS-B	No Data	No Data
UAT	PASS	PASS

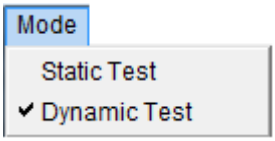
29. If any of the ‘User Defined’ or ADS-B parameters are present, comparison of the data will be displayed on the ‘Address/Call Sign’, ‘Physical’, ‘Position’, and ‘Quality’ tabs.

6.6.6 PERFORMING A DYNAMIC TEST WITH THE IFR-6000 AND GPSG-1000

Note: If applicable, set the IFR-6000 cable and/or coupler losses on the test set 'SETUP-XPDR' page. And on the GPSG-1000, set the cable and/or coupler losses on the test set 'Setup'->'I/O' page. Refer to the corresponding Operation Manual.

STEP PROCEDURE

1. Select 'Dynamic Test' from the 'Mode' menu.



2. Attach the Breakout Box to the IFR-6000.
3. Connect an RS-232 cable (serial thru DB9 F/F) from the host computer to the IFR-6000 RS-232 Breakout Box.
4. Connect the ADS-B Integrity cable to the GPSG-1000 26-pin D-type Auxiliary connector.
5. Connect the 9-pin D-type RS-232 connector of the ADS-B Integrity cable to the host computer RS-232 port.
6. Connect an Ethernet cable from the host computer to the GPSG-1000 Ethernet port.
7. Connect the Trigger Out 9-pin D-type connector of the ADS-B Integrity cable to the IFR-6000 Breakout Box AUX IN connector.
8. On the IFR-6000 test set, connect a coax cable to the proper RF Port. Connect the other end of the coax cable to the UUT or to the test set antenna if testing over-the-air.
9. On the GPSG-1000 test set, connect a coax cable to the proper RF Port. Connect the other end of the coax cable to the UUT GPS antenna.
10. On the application, navigate to the 'Instrument tab'. Ensure that the IFR-6000 'Baud Rate' matches the configuration of the test set; refer to the test set operations manual.

STEP PROCEDURE

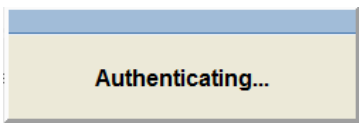
11. On the application IFR-6000 'RS-232 Port' menu, select 'Auto'. This will initiate the application to search for the serial port that the test set is connected to.
12. On the application IFR-6000 'Instrument Port' menu, select the proper RF Port the test set was connected to on Step 8.
13. On the application GPSG-1000 'RS-232 Port' menu, select 'Auto'. This will initiate the application to search for the serial and Ethernet ports that the test set is connected to.
14. On the application GPSG-1000 'Instrument Port' menu, select the proper RF Port the test set was connected to from Step 9.
15. On the application Simulation Setup, set the starting point of the test scenario by entering the Latitude and Longitude. Also enter the Altitude and Bearing of the test scenario.
16. On the application 'Delay Setting' tab, enter the 'Delay Time'. This delay will give the UUT GPS receiver time to acquire satellites.

Note: It is recommended to have the 'Delay Setting' long enough so that the navigational accuracy of the UUT is compliant with CPR 91.227 before the test route begins. This will reduce the number of potential errors on the report.

17. On the application 'Test Setting' tab, enter the 'Test Distance' and 'Test Speed' of the test scenario; this will create the test route.
18. Select the 'Start Data Acquisition' button to start the test.

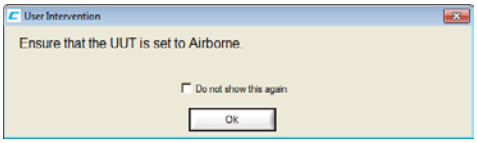


19. The application will authenticate the test sets which may take up to three minutes. The authentication will not be performed again as long as the application is left open.

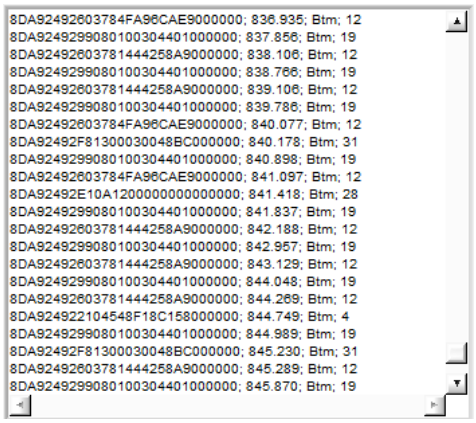


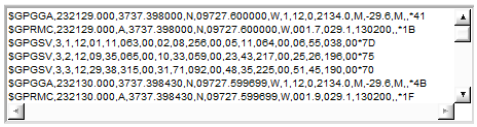
STEP	PROCEDURE

20. A user intervention control may appear to advise the user to ensure that the UUT is set to Airborne. The 'Do not show this again' check box can be selected to keep the user intervention popup from appearing again. Note that in order to change the setting to allow the user intervention popup to appear again, the application configuration ('.cfg' extension) file will need to be edited manually by a text editor.

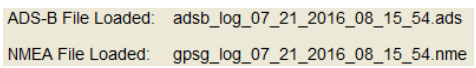


21. Once the data acquisition starts, the ADS-B data from the UUT and the NMEA data from the GPSG-1000 are monitored on the application.





22. The data acquisition can be stopped manually by selecting the 'Stop Data Acquisition' button, or the application will stop automatically once the test scenario is completed.
23. After the data acquisition stops, the ADS-B and NMEA data are automatically saved, and the associated files are displayed. The files are named with the same date and time and are saved in subdirectory: dynamic_log.



STEP	PROCEDURE

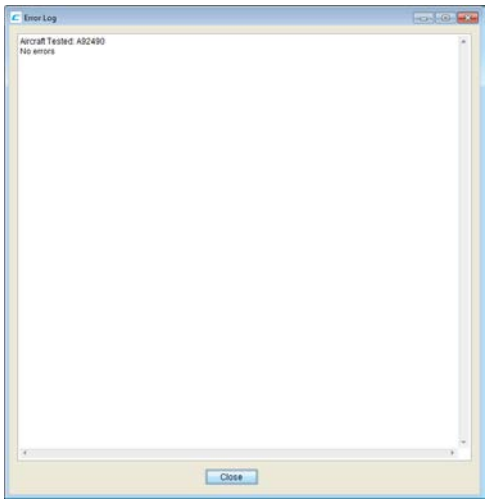
24. On the application, navigate to the 'Report'->'Aircraft Summary' tab and fill out the appropriate entries.
25. To generate a performance report, select the 'Start Performance Analysis' button.



Note: Only the ADS-B data is needed to generate a performance report; NMEA data is not used.

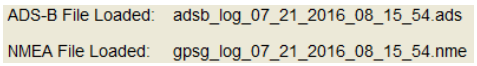
26. To view the performance report, select the 'Performance Report' tab and navigate through the page tabs. Items marked in red within the performance report indicate a failure has occurred.
27. Additional data on the causes of failures within the performance report can be obtained by selecting the 'Display Error Log From Last Analysis' button which is located in the lower right hand corner of the application window.





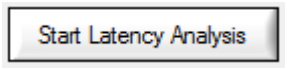
STEP	PROCEDURE

28. To evaluate latency, ADS-B and NMEA data files must be selected.



Note: A matching pair of ADS-B and NMEA data must be selected to calculate latency; typically, the data and time within the file names of the selected files must be the same.

29. On the application, navigate to the 'Latency' tab and select the 'Start Latency Analysis' button.



30. On the 'Instantaneous & Avg Latency' tab, the Instantaneous Latency represents the latency of each data point when the ADS-B and NMEA data are evaluated. The Average Latency is the average value of the Instantaneous Latency.

    Instantaneous Latency calculation: A time synchronized ADS-B and NMEA data is saved during data acquisition. For a given time there is an ADS-B position with a corresponding NMEA position where the ADS-B position will be lagging because of latency. This position error is calculated via the haversine formula. Velocity is calculated from current position versus the previous position; note that there is time associated with the aforementioned positions which is used to calculate velocity. Instantaneous latency is then calculated from the position error and the velocity.

31. On the 'Position Error & Velocity @ Avg Latency', the Position Error and Velocity are calculated at the Average Latency that was previously derived.

STEP	PROCEDURE

32. On the 'Instantaneous Position Error', Instantaneous errors in the 'Direction of Travel' and 'Perpendicular to Travel' are displayed.

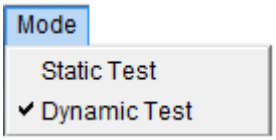
    Instantaneous Position Error calculation: Time synchronized ADS-B and NMEA data is saved during data acquisition. For a given time, there is an ADS-B position with a corresponding NMEA position where the ADS-B position will be lagging because of latency. This position error is calculated via the haversine formula. The position error has a 'Direction of Travel' and 'Perpendicular to Travel' component.

6.6.7 PERFORMING A DYNAMIC TEST WITH THE IFF-45TS AND GPSG-1000

Note: If applicable, set the GPSG-1000 cable and/or coupler losses on the test set 'Setup'->'I/O' page. Refer to the corresponding Operation Manual.

STEP PROCEDURE

1. Select 'Dynamic Test' from the 'Mode' menu.

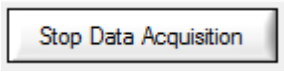


2. Connect an RS-232 cable (serial thru DB9 M/F) from the host computer to the IFF-45TS RS-232 Port.
3. Connect the ADS-B Integrity cable to the GPSG-1000 26-pin D-type Auxiliary connector.
4. Connect the 9-pin D-type RS-232 connector of the ADS-B Integrity cable to the host computer RS-232 port.
5. Connect an Ethernet cable from the host computer to the GPSG-1000 Ethernet port.
6. Connect the Trigger Out BNC connector of the ADS-B Integrity cable to the IFF-45TS TRIGGER IN connector.
7. On the IFF-45TS test set, connect a coax cable to the proper RF Port. Connect the other end of the coax cable to the UUT or to the test set antenna if testing over-the-air.
8. On the GPSG-1000 test set, connect a coax cable to the proper RF Port. Connect the other end of the coax cable to the UUT GPS antenna.
9. On the application, set the IFF-45TS 'Cable Loss' if applicable.
10. On the application IFF-45TS 'RS-232 Port' menu, select 'Auto'. This will initiate the application to search for the serial port that the test set is connected to and set the proper baud rate.
11. On the application IFF-45TS 'Instrument Port' menu, select the proper RF Port the test set was connected to on Step 7.

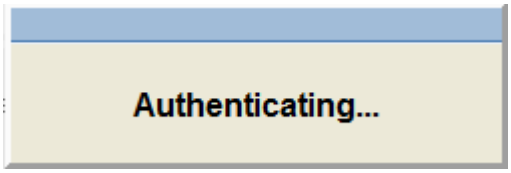
STEP PROCEDURE

12. On the application GPSG-1000 'RS-232 Port' menu, select 'Auto'. This will initiate the application to search for the serial and Ethernet ports that the test set is connected to.
13. On the application GPSG-1000 'Instrument Port' menu, select the proper RF Port the test set was connected to from Step 8.
14. On the application Simulation Setup, set the starting point of the test scenario by entering the Latitude and Longitude. Also enter the Altitude and Bearing of the test scenario.
15. On the application 'Delay Setting' tab, enter the 'Delay Time'. This delay will give the UUT GPS receiver time to acquire satellites.

    Note: It is recommended to have the 'Delay Setting' long enough so that the navigational accuracy of the UUT is compliant with CPR 91.227 before the test route begins. This will reduce the number of potential errors on the report.
16. On the application 'Test Setting' tab, enter the 'Test Distance' and 'Test Speed' of the test scenario; this will create the test route.
17. Select the 'Start Data Acquisition' button to start the test.

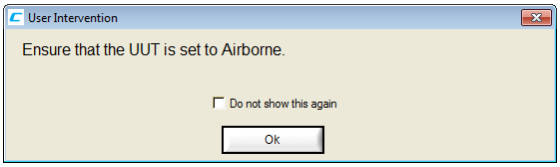


18. The application will authenticate the test sets which may take up to three minutes. The authentication will not be performed again as long as the application is left open.

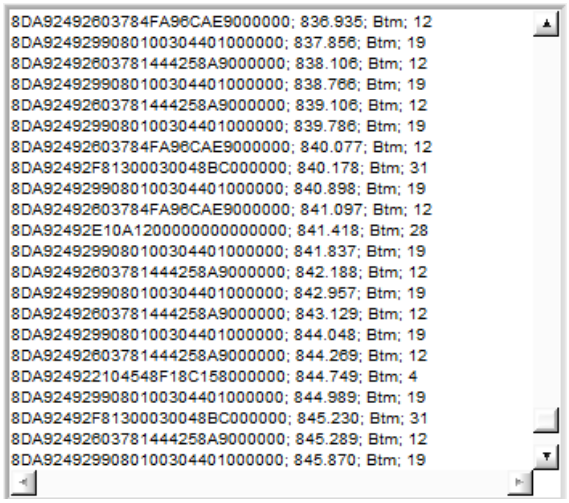


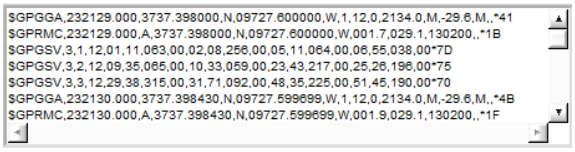
STEP PROCEDURE

19. A user intervention control may appear to advise the user to ensure that the UUT is set to Airborne. The 'Do not show this again' check box can be selected to keep the user intervention popup from appearing again. Note that in order to change the setting to allow the user intervention popup to appear again, the application configuration (' .cfg' extension) fi le will need to be edited manually by a text editor.



20. Once the data acquisition starts, the ADS-B data from the UUT and the NMEA data from the GPSG-1000 are monitored on the application.





21. The data acquisition can be stopped manually by selecting the 'Stop Data Acquisition' button, or the application will stop automatically once the test scenario is completed.

STEP PROCEDURE

22. After the data acquisition stops, the ADS-B and NMEA data are automatically saved, and the associated files are displayed. The files are named with the same date and time and are saved in subdirectory: dynamic_log.

ADS-B File Loaded:	adsb_log_06_02_2016_08_08_01.txt
NMEA File Loaded:	gpsg_log_06_02_2016_08_08_01.txt

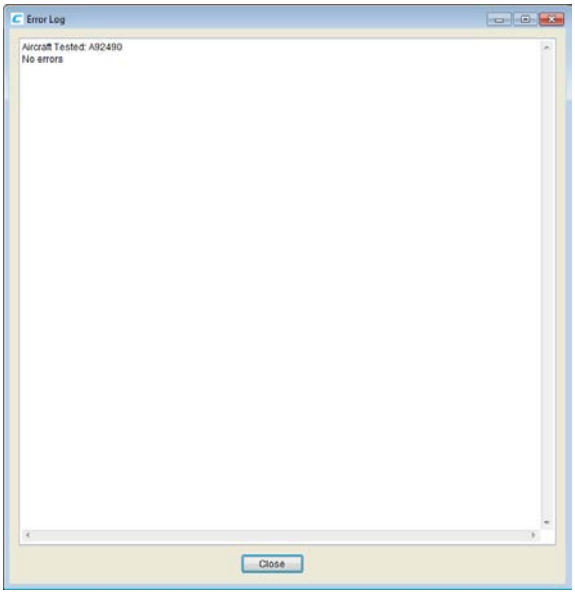
23. On the application, navigate to the 'Report'->'Aircraft Summary' tab and fill out the appropriate entries.
24. To generate a compliance report, select the 'Start Compliance Analysis' button.



Note: Only the ADS-B data is needed to generate a compliance report; NMEA data is not used.

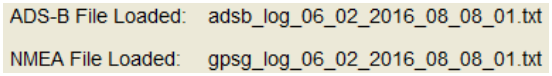
25. To view the compliance report, select the 'Compliance Report' tab and navigate through the page tabs. A red mark on any of the table indicates a failure.
26. To inspect for causes of failure, select the 'Display Error Log From Last Analysis' button.





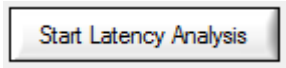
STEP	PROCEDURE

27. To evaluate latency, an ADS-B and NMEA data files must be selected.



Note: A matching pair of ADS-B and NMEA data must be selected to calculate latency; the date and time of the file name must be the same.

28. On the application, navigate to the 'Latency' tab and select the 'Start Latency Analysis' button.



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31. On the 'Position Error & Velocity @ Avg Latency', the Position Error and Velocity are calculated at the Average Latency that was previously derived.

STEP	PROCEDURE

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33. Instantaneous Position Error calculation: A time synchronized ADS-B and NMEA data is saved during data acquisition. For a given time, there is an ADS-B position with a corresponding NMEA position where the ADS-B position will be lagging because of latency. This position error is calculated via Haversine formula. The position error has a 'Direction of Travel' and 'Perpendicular to Travel' component.

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English

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