

LYNX™

Multilink Surveillance System

NGT-2000/2500



Part Number 9022500-10000

Installation Manual

This manual contains installation instructions and recommended flightline maintenance information for the NGT-2000/2500 Multilink Surveillance System and Configuration Module. Guidelines for external equipment necessary for installation are included. This information is supplemented and kept current by revisions, service letters and service bulletins.



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Aviation Products

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Foreword

This manual provides information intended for use by persons who, in accordance with current regulatory requirements, are qualified to install this equipment. Installation requirements may vary, depending on the particularities of each aircraft, and this manual is intended as a guideline for that purpose. This manual assumes familiarity with the setup and operation of the aircraft systems that interface with the NGT-2000/2500.

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ABOUT THIS MANUAL

SECTION 1 – GENERAL INFORMATION

This section provides the following information: unit configurations, unit functionality, items required but not supplied with the unit, equipment specifications, installation approval/limitations and TSO approvals.

SECTION 2 - INSTALLATION

This section contains instructions to locate, assemble and install the NGT-2000/2500 as well as information for unpacking equipment, and inspection procedure for in-shipment damage.

SECTION 3 – INSTALLATION CHECKOUT

This section contains instructions for post installation setup, post installation and return to service checkout.

SECTION 4 – MAINTENANCE

This section contains general flightline maintenance procedures. It includes periodic maintenance, troubleshooting and instructions for the return of defective components.

APPENDIX A – SIGNAL AND CABLE CHARACTERISTICS

This appendix defines the electrical characteristics of all input and output signals.

APPENDIX B – ENVIRONMENTAL QUALIFICATION FORM

This appendix provides the environmental qualification test data.

Descriptions for Warnings, Cautions and Notes described below.

WARNING

Used to give notice to or call one's attention to beforehand especially of danger (such as a warning to a Flight Crew person or a warning to a mechanic before performing a dangerous task).

CAUTION

Statement that expresses the need for heightened awareness to conditions that can cause damage to equipment.

NOTE

Used to point out a procedure, event or practice that it is desirable to highlight.

References

Publication	Description
0040-17010-01	Pilot's Guide for the NGT-2000/2500
0040-17020-01	Pilots guide for the CP-2500 Control Panel
0040-17021-01	Installation Manual for the CP-2500 Control Panel

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List of Abbreviations, Acronym and Symbols

ITEM	DEFINITION
°	Degrees
°C	Degrees Celsius
°F	Degrees Fahrenheit
1090ES	1090 megahertz extended squitter
AC	Advisory Circular
ACAS	Airborne Collision Avoidance System
ACSS	Aviation Communication and Surveillance Systems
ADC	Air Data Computer
ADS-B	Automatic Dependant Surveillance-Broadcast
ADS-R	Automatic Dependent Surveillance Rebroadcast
AHRS	Attitude & Heading Reference System
AIRB	Basic Airborne Situation Awareness
EVac	Enhanced Visual Acquisition
AMLCD	Active Matrix Liquid Crystal Display
AMM	Aircraft Maintenance Manual
ARINC	Aeronautical Radio, Incorporated
ASA	Aircraft Surveillance Applications
ASSAP	Airborne Surveillance and Separation Assurance Processing
ATC	Air Traffic Control
ATCRBS	Air Traffic Control Radar Beacon System
ATM	Air Traffic Management
AWG	American Wire Gauge
BIT	Built In Test
Cal	Calibration
CCW	Counter Clock Wise
CDTI	Cockpit Display of Traffic Information
CFR	Code of Federal Regulations
CW	Clock Wise
dBm	Decibels referenced to one Milli-watt
dc	Direct Current
DCM	Data Configuration Module
DL	Data Loading
DME	Distance Measuring Equipment
DO-	RTCA Document Number Prefix (i.e., DO-160)
DTIF	Display Traffic Information File
EVAcq	Enhanced Visual Acquisition Application
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FIS-B	Flight Information Services - Broadcast
FPGA	Field Programmable Gate-Array
FSS	Flight Service Station
Ft	feet
g	Gravitational Acceleration
GPS	Global Positioning System
hPa	Hectopascal
HW	Hardware
Hz	Hertz
i.e.	In other words
IAW	In Accordance With
ID	Identification
in Hg	Inches of Mercury
Kg	Kilogram
Kts	Knots
L-3 AS	L-3 Communications Avionics Systems
LRU	Line Replaceable Unit
M	Menu

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List of Abbreviations, Acronym and Symbols

ITEM	DEFINITION
m	Meter
MAG	Magnetometer
Max	Maximum
MHz	Megahertz
MPC	Maintenance Personal Computer
Msg	Message
MSS	MultiLink Surveillance System
MTL	Minimum Threshold Level
N/A	Not Applicable
NAS	National Airspace System
NAV or Nav	Navigation
NC	Not Connected
NGT	Not an abbreviation
NGT MAT	NGT Maintenance Application Tool
NOTAM	Notice to Airmen
NVM	Non-Volatile Memory
Orig	Original
P/N	Part Number
PBIT	Periodic Built-In Test
PED	Personal Electronic Device
PFD	Primary Flight Display
RAIM	Receiver Autonomous Integrity Monitoring
RF	Radio Frequency
RTCA	RTCA, Inc.
S/N	Serial Number
SBAS	Satellite Based Augmentation systems
STC	Supplemental Type Certification
STIF	Standard TCAS Intruder File
SURF	Basic Surface application
SW	Software
TAS	Traffic Advisory System
TCAS	Traffic Alert and Collision Avoidance System
TFR	Temporary Flight Restrictions
TIS-B	Traffic Information Service – Broadcast
TSO	Technical Standard Order
UAT	Universal Access Transceiver
UNR	Unrestricted Vertical Display Mode
USB	Universal Serial Bus
UTC	Coordinated Universal Time
Vdc	Volts Direct Current
VHF	Very High Frequency
VOR	VHF Omni-directional Range
VSA	Visual Separation on Approach
W	Watts
WAAS	Wide Area Augmentation System
WiFi	Wireless Fidelity
Wx	Weather

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Section 1

General Information

1.1 INTRODUCTION

This section includes functional descriptions, equipment specifications, and installation approval and limitations for the NGT-2000/2500 Multilink Surveillance System (MSS). Included at the end of this section is a list of approved equipment and equipment required but not supplied with the system. Table 1-1 provides a general description of the MSS.

Table 1-1: NGT-2000/2500 General Description

MODEL/ P/N	DESCRIPTION	INTERFACES/FUNCTIONS
NGT-2000 9022500-10000	Support GPS, ADS-B IN/OUT, and Wi-Fi.	<ul style="list-style-type: none"> • Maintenance Port • Altitude data input • Squawk code interception/comparator (If optional control panel is used) • Status indicator outputs (Required only if CP-2500 is not used) • Coverage indicator output (Required only if CP-2500 is not used) • Data Configuration Module • RS-232 output to which an external Wi-Fi adapter can be connected • GPS Antenna • UAT – L-Band Antenna
NGT-2500 * 9022500-10000	Supports GPS, ADS-B IN/OUT, Wi-Fi, and interfaces with traffic and weather displays.	<ul style="list-style-type: none"> • Maintenance Port • Altitude data input • Squawk code interception/comparator (If optional control panel is used) • Status indicator outputs (Required only if CP-2500 is not used) • Coverage indicator output (Required only if CP-2500 is not used) • Data Configuration Module • RS-232 output to which an external Wi-Fi adapter can be connected • GPS Antenna • UAT – L-Band Antenna • ARINC 429 output to drive a Traffic Display terminal. (STIF or DTIF) • RS-422 output to drive standard RS-422 displays

* Note: The NGT-2500 configuration requires a product key that is set up during installation. See paragraph 1.3.1.

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1.2 FUNCTIONAL DESCRIPTION

The Multilink Surveillance System (MSS) is a family of products that provide varying levels of functionality over a range of General Aviation (GA) aircraft (based on aircraft performance and owner preference). The levels of functionality that can be provided across the products are as follows:

- Automatic Dependant Surveillance – Broadcast (ADS-B) Out transmitted over 978 MHz Universal Access Transceiver (UAT) link.
- **Enhanced Visual Acquisition (EVAcq)** using traffic information from ADS-B In received via a UAT link.
- Flight Information Service – Broadcast (FIS-B) using received data via UAT link.
- Interfaces with RS-232 compatible transponders for the input of the Mode A squawk Code and mode of operation from the aircraft's existing Air Traffic Control Radar Beacon System (ATCRBS) transponder or through a dedicated MODE A control panel interface.

The **NGT-2000/25000** has an internal GPS receiver that provides own aircraft information (position, velocity, track (or ground track), etc.) **for ADS-B** Out messages and traffic display.

This GPS is not intended as a position source to a navigation management unit that outputs deviation commands keyed to a desired flight path.

When permitted the transmission of own ship identification can be inhibited using the Anonymous Mode function provided by the CP-2500 control panel. This may only be accomplished when VFR Mode is active.

See Figure 1-1 for an overview of the unit's system interface. The following paragraphs provide an overview of each of these functions.

1.2.1 **Enhanced Visual Acquisition** Functional Overview

The **Enhanced Visual Acquisition (EVAcq)** function provides flight crews with a display of nearby traffic relative to own aircraft (Cockpit Display of Traffic Information – Traffic Display) to assist with visually acquiring traffic out the window and provide traffic situational awareness beyond visual range. Each displayed traffic symbol conveys aircraft position, vertical trend and altitude information. Traffic on the display (i.e. CDTI displays or some PED applications) can be selected by the flight crew to obtain additional traffic information such as flight identification and ground speed.

The **EVAcq** function can display traffic on either an integrated traffic display (STIF **or DTIF**) or an external traffic display (i.e. PED).

Data received via a UAT link (Ground stations- when in a coverage area) is the ADS-B, ADS-R Rebroadcast, and TIS-B Traffic Information Service – Broadcast (traffic information used by **EVAcq**). ADS-B (UAT) traffic can be received directly from another UAT equipped aircraft. TIS-B traffic and ADS-R traffic can only be received when in the coverage area of an ADS-B ground station.

1.2.2 **GPS** Functional Overview

The GPS function utilizes signals from Global Positioning System (GPS) satellite constellation and Satellite-Based Augmentation Systems (SBAS) such as the USA Wide Area Augmentation System (WAAS), European EGNOS, Indian GAGAN and the Japanese MSAS. Currently it supports WAAS and WAAS compatible SBAS systems.

The GPS signals are down converted to a low Intermediate Frequency, which is then processed by a micro controller. This internal GPS function provides position, velocity, time and integrity (NIC, NAC etc) information to the ADS-B functions and is ADS-B rule compliant with the **position resource** requirements of AC20-165A.

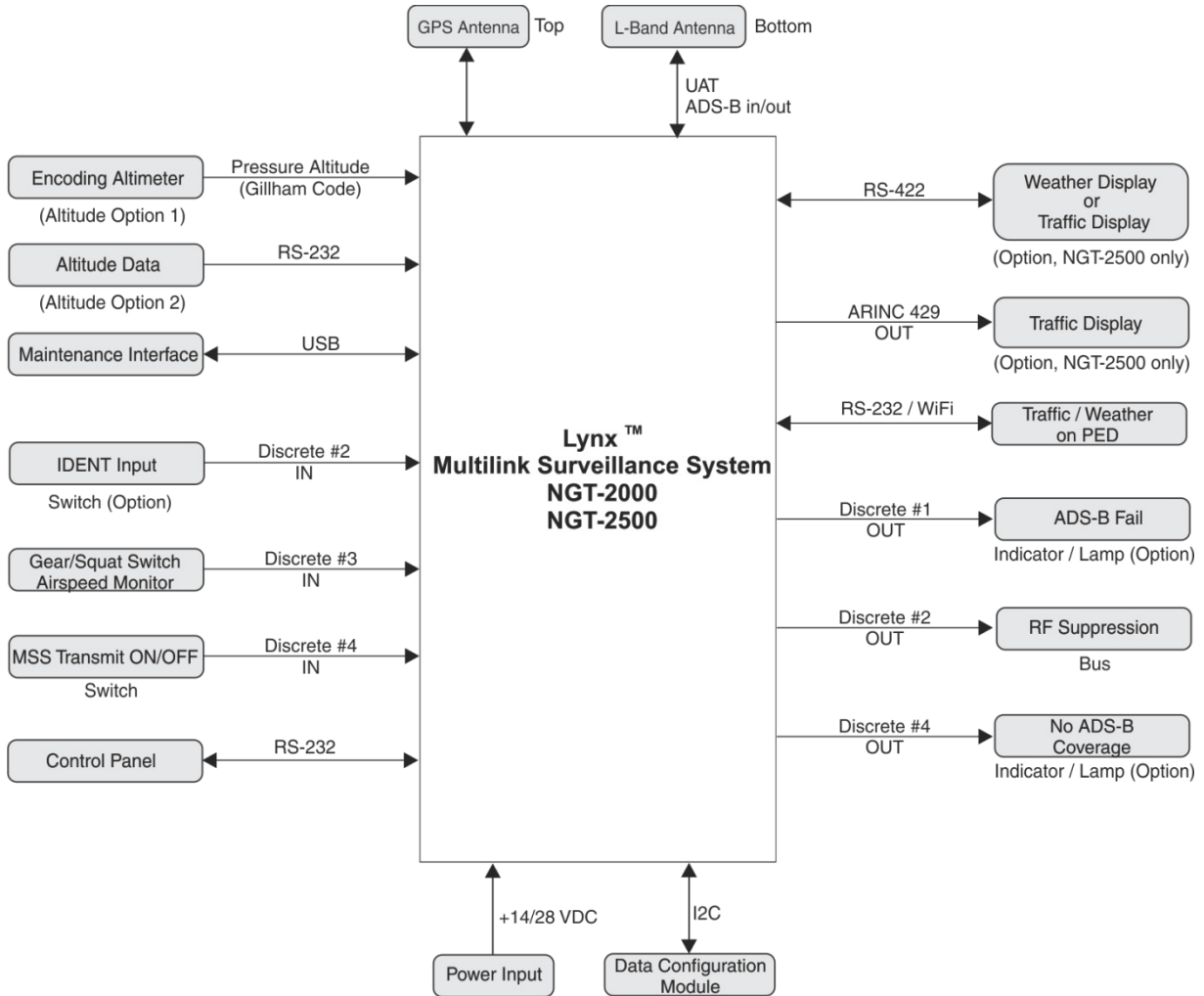


Figure 1-1: System Interface Overview

1.2.3 FIS-B Functional Overview

The Flight Information Services - Broadcast (FIS-B) function provides pilots with a cockpit display of certain aviation weather and aeronautical information for awareness of own aircraft location with respect to reported weather, including hazardous meteorological conditions (RADAR/AIRMETS/SIGMETS/NOTAMS/ METARS, etc) and NAS status (TFRs) indicators.

FIS-B is advisory information only and is intended to enhance pilot decision-making during strategic flight planning. FIS-B augments traditional sources of this information such as ATC and Flight Service Station (FSS). FIS-B information is provided over the ADS-B Services network on the 978 MHz UAT link when in ground station coverage.

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1.2.4 ADS-B Out Functional Overview

The ADS-B Out function supports the transmission of Automatic Dependant Surveillance – Broadcast (ADS-B) Out on a 978 MHz UAT link. The ADS-B Out data contains information about own aircraft such as aircraft position, velocity, direction, etc. The ADS-B function receives aircraft data to output from an internal GPS receiver.

Pressure altitude is received from existing altitude source, and control functions such as squawk codes, Ident, and operational mode (e.g. Mode "A", Mode "C", etc.) is obtained from an approved control panel.

1.2.5 Multiple Source Inputs Operation

The NGT-2000/2500 has multiple Altitude source connections available. There is an option, through the configuration module, of connecting RS-232 serial altitude source or Grey code altitude source, however only one source can be connected at a time. The altitude source must be the same source used for the mode "C" transponder if so equipped.

1.2.6 Discrete Inputs and Outputs

The MSS has discrete inputs and outputs that can be used in place of some functions that are not available to equipment that is compatible with the MSS. See Figure 1-1.

- The Squat/Airspeed Monitor switch signals the On Ground status to the MSS via a squat switch, gear switch, or external airspeed sensor input.
- The IDENT command activates SPI and transmits an ident pulse. An ident pulse highlights the aircraft's symbol on the ATC's radar screen and is identified on the control panel when active.
- The MSS Transmit ON/OFF function is used to stop ADS-B out transmission. Setting this discrete OFF turns the ADS-B Failure lamp ON.
- ADS-B Failure Lamp indicates that the MSS is unable to transmit due to the following:
 1. If the indicator lamp is flashing at a slow rate, then the aircraft position information is invalid or has failed. GPS may be acquiring signal in which case when it does the lamp will stop flashing. Flashing will last only 2 minutes before the lamp stays ON.
 2. If the indicator lamp is flashing at a fast rate then a Code mismatch (squawk code) has been detected. The squawk code must be re-entered correctly (matching the transponder) using the control panel.
 3. If the lamp is ON, then the ADS-B has failed or the MSS Transmit ON/OFF switch is set OFF.
- **No ADS-B Coverage** lamp is used to indicate that the unit is not receiving an ADS-B ground station signal.

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1.2.7 Transponder Interface

- If the aircraft is equipped with a compatible transponder that has an RS-232 control panel output (e.g. GTX-327), then the NGT-2000/2500 can receive mode control and the squawk code directly from that transponder.
- If the aircraft is equipped with a non-compatible transponder, then the aircraft needs a CP-2500 Control Panel installed. With the CP-2500 the NGT-2000/2500 can wirelessly intercept the Mode A squawk Code from the aircraft's existing ATCRBS transponder and conduct a cross check between the transponder broadcast value and the setting of the NGT-2000/2500 Mode A control panel setting to ensure the consistency in selected Mode A squawk code selections.

If the code entered from the control panel does not match the Mode A response from the transponder, then a Mode A mismatch failure message is set in the control panel and the aircraft call sign is used in the UAT Message transmissions. Pilot action is required to assure that the codes set into the transponder and the CP-2500 always match.

If a CP-2500 is not installed, then the ADS-B Failure indicator lamp will flash ON/OFF at a fast rate indicating a Mode A mismatch failure. Pilot action is required to correct the condition.

- If the aircraft is not equipped with transponder, then the control panel may be configured to provide squawk code data and mode control (i.e. standby, on, ALT modes).

1.3 EQUIPMENT DESCRIPTIONS

The NGT-2000 and NGT-2500 are equipped with a main sub-D connector (J2) and RF connectors (UAT and GPS). A USB port (J1) is available to establish communication between the NGT-2000 and a maintenance computer for installation and maintenance activities. Both units provide ADS-B In, ADS-B Out, ADS-R, TIS-B Traffic, FIS-B weather, NOTAMS, and TFRs functionality. Figure 1-2 shows the NGT-2000 system interface. Figure 1-3 shows the NGT-2500 system interface.

- The NGT-2000 and NGT-2500 both provide an RS-232 output that can be used to display UAT ADS-B traffic as well as FIS-B weather information when an external WiFi accessory is connected to transmit the received weather data to a commercial PED (i.e. Personal Electronic Device).
- The NGT-2500 outputs ARINC 429 to interface with an onboard cockpit display of traffic information display (STIF or DTIF) for the display of own ship (DTIF only) and traffic information.
- The NGT-2500 can interface with a RS-422 data bus output that may be interfaced to a display to provide weather or traffic information.

The UAT ADS-B In function supports the reception of ADS-B on a 978 MHz UAT link. The ADS-B In data contains information about proximate aircraft such as aircraft position, velocity, direction, etc. and also receives FIS-B data and ADS-R and TIS-B data from ground stations.

The ADS-B Out function is used to broadcast (without interrogation) periodic information about the aircraft that includes aircraft identification, position, altitude, velocity and other aircraft status information.

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The FIS-B function provides pilots and flight crews with a cockpit display of certain aviation weather and aeronautical information for awareness of own aircraft location with respect to reported weather, including hazardous meteorological conditions and NAS status indicators. FIS-B is advisory information only and is intended to enhance pilot decision-making during strategic flight planning. FIS-B augments traditional sources of this information such as ATC, Flight Service Station (FSS), and Aircraft Operational Communications Center. FIS-B information is provided over the ADS-B Services network on the 978 MHz UAT link.

Table 1-2 describes the available built-in interfaces. Refer to Appendix A for detailed information on the interface options. The traffic and weather display interfaces are only available to the NGT-2500 system and requires a system product key to activate. See paragraph 1.3.1.

Table 1-2: MSS Built-in Interfaces

Interface (no.)	Functionality
ARINC 429 Output (1)	(NGT-2500 only) Transmit to a display(STIF or DTIF)
RS-232 Input / Output (2)	Control Panel port and Wi-Fi accessory port
RS-232 Input (1)	Altitude Encoder port
RS-422 Input / Output (1)	(NGT-2500 only) Communicate with an external display port
Discrete Inputs (14)	Receive Gillham Altitude Encoder, IDENT Command, In Air / On Ground status, MSS Transmit ON/OFF
Discrete Output (4)	Transmit ADS-B Failure and No ADS-B Coverage
RF Suppression Input / Output (1)	Provides on aircraft suppression of the L-band equipment
I2C Port (1)	Configuration Module
GPS Antenna Port	Connect to a top mount antenna providing GPS data to support ADS-B functionality
L-Band Antenna Port	Connects to the bottom mount antenna. Provides UAT 978 MHz input and output to support ADS-B functionality.

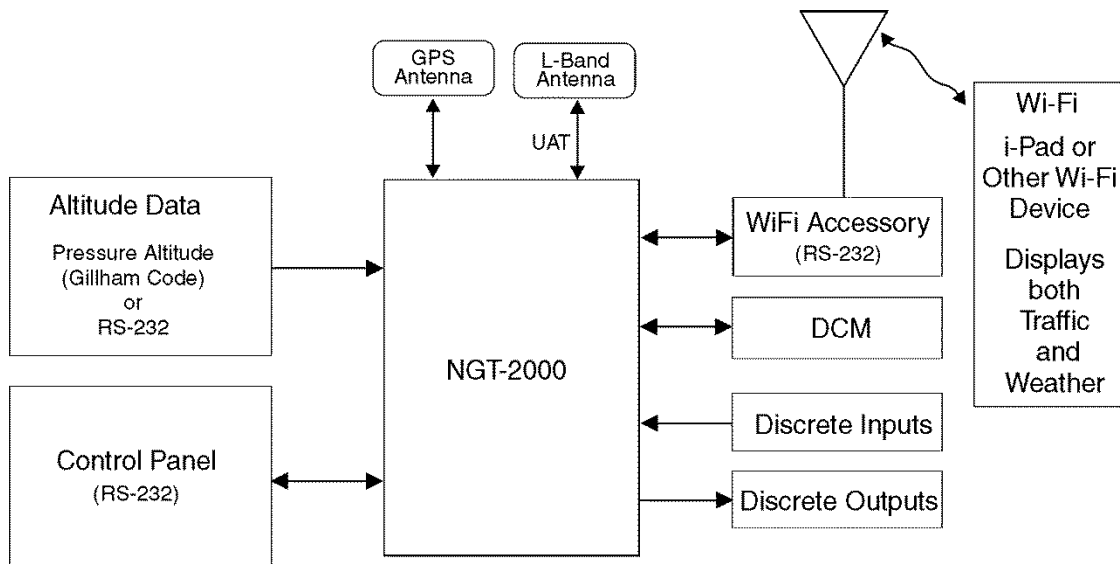


Figure 1-2: NGT-2000 Block Diagram

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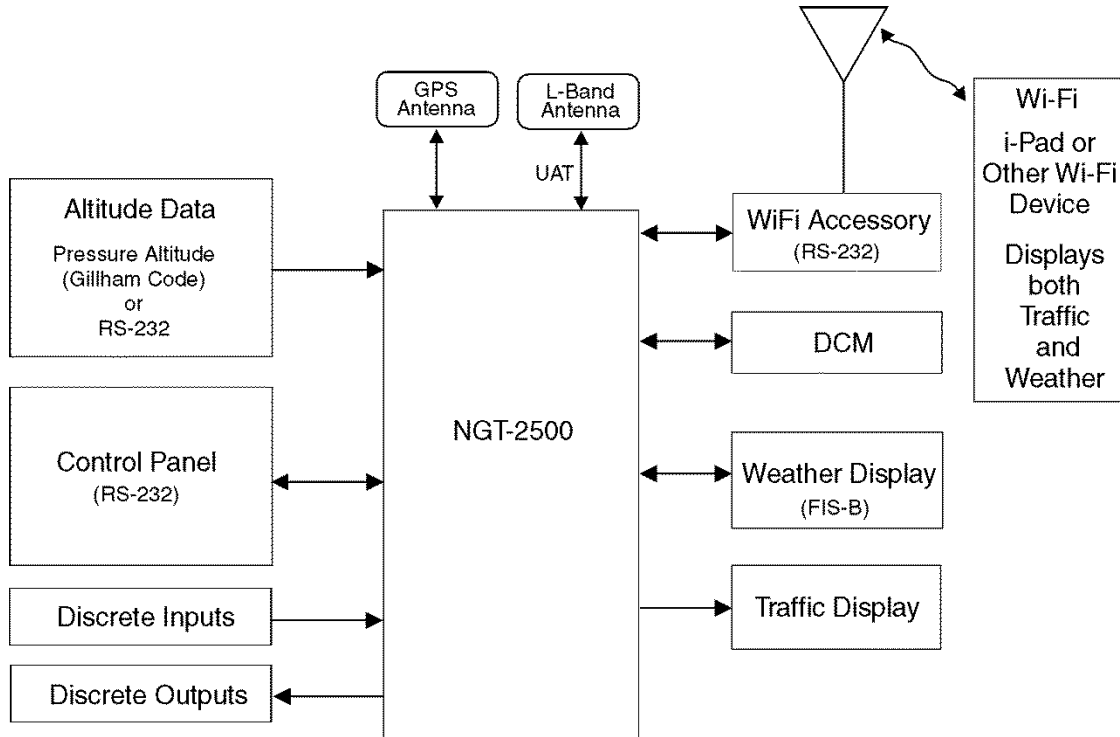


Figure 1-3: NGT-2500 Block Diagram

1.3.1 System Product Key

A product key is required if installing the NGT-2500 option. The product Key is a 10 digit code that is used during installation and requires the **NGT MAT** to configure the unit. The product key is typically shipped with the unit. If the product key is not included, contact L-3 Avionics Systems Customer Service to obtain the code. Be sure to have the Mode-S ID (e.g. **ICAO**) available for the service representative.

1.3.2 Data Configuration Module

The NGT-2000/2500 interfaces to a Data Configuration Module (DCM), part number 9230-17003-01 for the storage of configuration data. The DCM is permanently installed in the wire harness and interfaces to NGT-2000/2500 via a 4 wire interface from the DCM.

The configuration settings are stored in the unit's non-volatile memory and are entered via commands sent over the maintenance interface to configure such items as:

- I/O port allocation (e.g. which external equipment is tied to RS-232 and ARINC 429 Tx lines, etc.).
- Aircraft Configuration Data (specific aircraft ID information, 24 bit unique ICAO address, make, model, registration, etc).
- Mode A Control Panel type (RS-422).
- Optional equipment installation settings.

If the configuration data in the unit is not self-consistent (contains contradictory settings), the DCM is faulty or the DCM has corrupted data, the unit will annunciate a failed state and not transmit ADS-B position reports. A change in configuration data or replacement DCM will be needed to restore the unit to operation.

1.4 SPECIFICATIONS

Table 1-3: Specifications for the NGT-2000 and NGT-2500

PART NUMBER:	9022500-10000
CERTIFICATION:	TSO-C145c, C154c, C157a, C195a. For more information on TSO information, refer to paragraph 1.5. Listed are current certifications at time of publication, contact Field Service Engineering for latest certification information.
ADVISORY CIRCULARS:	AC 20-165A (ADS-B Out), AC-20-172A (ADS-B In), AC20-138D (GPS), AC20-149A (FIS-B)
RTCA COMPLIANCE:	Environmental Category: DO-160G (See Environmental Qualification Form in Appendix B.) Software Category: DO-178B, Level C Hardware Category: DO-254 Level C Other: DO-229D, DO-282B, DO-317A, DO-267A, FAR 91.227
SIZE:	Height 2.8 inch [71.6 mm] Width 4.5 inch [114 mm] Length 5.7 inch [145 mm]
WEIGHT:	1.0 lb nominal
CHASSIS GROUND:	Bonding impedance between aircraft ground and the MSS Chassis must be less than 2.5 milliohms.
POWER REQUIREMENTS:	Main Power 14 Vdc/28 Vdc, 8.9 watts nominal, 10.1 watts MAX
ELECTRICAL CONNECTORS:	<ul style="list-style-type: none"> • J2 [62 pin] Mates with P/N M24308/2-14 (TE connectivity) or L-3AS P/N 9001640-002 with backshell P/N 3050-17000-01 (See installation kit P/N 9060-17250-01) • J1 is a Mini-b USB connection (5 pin) Maintenance Port • RF Connector (2): 5W5 Coax D-Sub
OPERATING TEMPERATURE:	-45° to +70°C (-49° to 158°F)
STORAGE TEMPERATURE:	-55° to +85°C (-67° to +185°F)
MAXIMUM ALTITUDE:	Operating: 18,000ft (5486 meters) Tested: 25,000 ft (7620 meters) NOTE: the unit is tested at 25,000 ft, however the UAT device is restricted to 18,000 ft for transmit.
SCHEDULED MAINTENANCE:	None
SERVICE LIFE:	The unit has unlimited service life.
REPAIRABILITY:	Repairs performed at the FAA certificated Repair Station co-located at the OEM (equipment) facility.

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Table 1-4: Specifications for Configuration Module

PART NUMBER:	9230-17003-01
CERTIFICATION:	USA (FAA): TSO-C145c, C154c, C157a, C195a. Configuration module installed with NGT-2000/2500 For more information on TSO information, refer to paragraph 1.5. Listed are current authorizations at time of publication, contact Field Service Engineering for latest certification information
RTCA COMPLIANCE:	Environmental Category: DO-160F See Environmental Qualification Form in Appendix B.
WEIGHT:	Negligible
SIZE:	Length: 6 inches (includes wires)
POWER REQUIREMENTS:	3.3 Vdc (regulated via J1 connector)
INTERFACE (S):	I2C serial interface
OPERATING TEMPERATURE:	-40° to +70°C (-40° to +158°F)
STORAGE TEMPERATURE:	-55° to +85°C (-67° to +185°F)
MAXIMUM ALTITUDE:	55,000 ft (installation environment)
SCHEDULED MAINTENANCE:	None.
SERVICE LIFE:	Unlimited.
REPAIRABILITY:	Replacement only.

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1.5 TSO INFORMATION

TSO NO.	FUNCTION	TSO TITLE	CONFIGURATION
TSO-C157a	FIS-B Display (RS-422)	Aircraft Flight Information Services-Broadcast (FIS-B) Data Link Systems and Equipment	NGT-2500
TSO-C145c	GPS SBAS Output	Airborne Navigation Sensors Using The Global Positioning System Augmented By The Satellite Based Augmentation System	NGT-2000/2500
TSO-C195a	ASSAP and ARINC 735 based traffic display Support	Avionics Supporting Automatic Dependent Surveillance – Broadcast (ADS-B) Aircraft Surveillance Applications (ASA)	NGT-2500
TSO-C154c	UAT-IN	Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on Frequency of 978 MHz	NGT-2000/2500
TSO-C154c	UAT-OUT	Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on Frequency of 978 MHz	NGT-2000/2500

1.5.1 TSO Markings

The following information summarizes the TSO application for the NGT-2000, NGT-2500, and the installed configuration module.

TSO NO.	TSO MARKING	TSO TITLE
TSO-C145c	TSO-C145c Class Beta 1	Airborne Navigation Sensors Using The Global Positioning System Augmented By The Satellite Based Augmentation System
TSO-C154c	TSO-C154c Class A1S	Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment Operating on Frequency of 978 MHz
TSO-C157a	TSO-C157a Class 2 Incomplete	Aircraft Flight Information Services-Broadcast (FIS-B) Data Link Systems and Equipment
TSO-C195a	TSO-C195a Class C1	Avionics Supporting Automatic Dependent Surveillance – Broadcast (ADS-B) Aircraft Surveillance Applications (ASA)

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1.5.2 TSO Deviations from Minimum Performance Standards

The following information lists the TSOs for the unit that requires a deviation to Minimum Performance Standards (MPS) that are called out in the TSO and provides the justification for the deviation.

TSO NO.	DEVIATION
TSOC-145c	TSO requires use of DO-160E for environmental qualification testing; DO-160G was used instead.
TSOC-145c TSO-C154c TSO-C157a	Per the guidance in FAA Order 8150.1c, the appliances are marked with the primary TSO along with a reference to the Installation Manual for the other TSO information (other applicable TSOAs, deviations, etc.).
TSOC-145c TSO-C154c TSO-C157a	The NGT-2500 utilizes a Maintenance Computer (i.e., a "special tool") as its primary support tool required for installation and debug effort. All installations will require that the Maintenance Computer be used to verify the software part number that is stored electronically in the unit thereby ensuring the part has been installed in compliance to the type design data. All software updates will also require that the Maintenance Computer be used to verify the software part number that is stored electronically in the unit thereby ensuring the part is in compliance to the type design data.
TSO-C154c	<p>The RF radiated emissions to exceed the Category L requirement for the RF radiated emission limit in the following frequency bands:</p> <ul style="list-style-type: none"> • 1956 MHz ± 2.25MHz (2nd Transmitter harmonic) Exceeds Cat L by as much as 30dB • 2934MHz ± 1MHz (3rd Transmitter harmonic) Exceeds Cat L by as much as 14dB • 3912MHz ± 1MHz (4th Transmitter harmonic) Exceeds Cat L by as much as 15dB • 4890Mhz ± 1MHz (5th Transmitter harmonic) Exceeds Cat L by as much as 8dB • 5868Mhz ± 1MHz (6th Transmitter harmonic) Exceeds Cat L by as much as 3dB <p>Meets DO-282B spectrum reply bounds. There is limited average radiated power in the deviation magnitudes due to the very low duty cycle. There are no defined aeronautical safety related operations utilizing these frequencies. For this deviation, the NGT-2500 Installation Manual will direct the installer to specifically verify non-interference with other avionic systems for these frequencies (See Installation Checkout section).</p>

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1.5.3 Non-TSO Functions

The NGT-2000 and NGT-2500 do not have any Non-TSO functions.

1.6 MODIFICATIONS

Modifications (MODS) to the NGT-2000/2500 are identified below and are identified by an entry on the I.D tag on individual units.

Table 1-5: Hardware Modifications

MOD #	EFFECTIVITY / COMPLIANCE	DESCRIPTION
None		

1.7 SOFTWARE REVISIONS

Software revisions and database versions are viewed using the MPC via the Maintenance Application Tool. A list of current software revisions is identified below.

Table 1-6: Software Revisions

DESCRIPTION	REVISION	PART NUMBER	COMPATIBLE NGT MAT
Composite Software	1.0	9021105-001	8010-17002-0001, Rev 1.0
Boot Loader	1.0	9021110-001	8010-17002-0001, Rev 1.0

1.8 INTERFACES

The electrical characteristics of all input and output signals are detailed in Appendix A.

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1.9 EQUIPMENT REQUIRED NOT SUPPLIED

Use Table 1-7 to identify equipment required for installation, calibration, and testing.

NOTE

Equivalent tools, equipment and hardware may be used.

Table 1-7: Equipment List

ITEM	DESCRIPTION
Cables and Wiring:	<p>The installer supplies all system wires and cables.</p> <p><u>Mating Connector (P1)</u></p> <ul style="list-style-type: none"> Wires are #22 AWG as noted on interconnect wiring diagram in section 2. Use M22759 or equivalent wire and use M27500 or equivalent for twisted shielded Tefzel wire for installation. <p><u>WiFi Accessory Connector</u></p> <ul style="list-style-type: none"> 9-Pin Sub-D Connector, P/N M24308/2-1 or equivalent. Use M27500 or equivalent for twisted shielded wire for installation as noted on interconnect wiring diagram. <p><u>Antenna Cables</u></p> <ul style="list-style-type: none"> L-Band and GPS Antenna Require M17/128-RG400 or equivalent Coaxial Cable. Attenuation must not exceed 1.5db per cable (including the connectors). Refer to Table 1-9. <p style="text-align: center;">NOTE</p> <p>RG type coaxial cable insertion loss can vary significantly between manufacturers. Refer to the cable manufacturer's specification sheet for actual attenuation (insertion loss) for the cable being used.</p>
Circuit Breaker:	<p>Installer is responsible for determining appropriate circuit breakers needed to protect aircraft wiring. Manufacturer recommends the following:</p> <ul style="list-style-type: none"> 1.0 Amp circuit breaker for the installations with 28Vdc input 1.5 Amp circuit breaker for the installations with 14Vdc input <p>If installing the NGT-2000/2500 with a CP-2500 Control Panel:</p> <ul style="list-style-type: none"> 2.5 amp breaker (connected to same breaker as NGT-2000/2500 with 14Vdc input) 2.0 amp breaker (connected to same breaker as NGT-2000/2500 with 28Vdc input)
Consumables:	<p><u>Antenna Sealant</u></p> <ul style="list-style-type: none"> For pressurized aircraft, use a sealant that meets the requirements of SAE AMS-S-8802 such as Flamemaster® CS3204 class B. For non-pressurized aircraft, use a non-corrosive sealant that meets the physical requirements of MIL-A-46146 such as General Electric RTV162. <p><u>Surface Preparation</u></p> <ul style="list-style-type: none"> Alodine® No. 1001 required for installation of the antenna.

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Table 1-7: Equipment List

ITEM	DESCRIPTION
Hardware:	<p>The following items are commercially available and is the responsibility of the installer:</p> <ul style="list-style-type: none"> • Ring Terminals (For Grounding). • Solder Sleeves. • Cable tie/Tie wrap. • Ground Braid (RAY-101-20.0/AA59569R36TXXXX or equivalent). • Coaxial connectors. • Status indicator lamps, placards (“fail lamp”). • Fusion tape. • No. 6 Mounting Screws, washers and nuts (mounting hardware).
Installation Tools:	<ul style="list-style-type: none"> • Insertion/Extraction tool CIET-20HD. • Crimp Tool: P/N: M22520/2-01. • Positioner: P/N: M22520/2-08. • Heating tool and reflector: PR-25 or PR-25D and HL1802E-ADAPT. (Tyco Electronics) for solder sleeves.
Installation Kits:	<p>Installation Kits for the NGT-2000/2500 are a customer option and are ordered separately. Refer to paragraph 1.9.1 for ordering information and a parts list.</p>
Software:	<p>NGT Maintenance Application Tool (NGT MAT)</p> <p>Tool used for diagnostics, set up configuration options, and software downloading. The tool is only available to an Avionics Systems Authorized Installer. Refer to paragraph 1.11 for details on how to obtain a copy or Contact Avionics Systems Field Service for more information.</p> <ul style="list-style-type: none"> • P/N 8010-17002-0001 <p>LynxMMS USB Driver</p> <p>This driver is required for communication between the MPC and the WiFi Accessory.</p>

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Table 1-7: Equipment List

ITEM	DESCRIPTION
Test Equipment:	<p><u>Air Data Test Set</u></p> <ul style="list-style-type: none"> Required to test altitude inputs. <p><u>Maintenance Computer (MPC)</u></p> <ul style="list-style-type: none"> The MPC is a laptop computer used to operate the NGT Maintenance Application Tool for system setup, post installation checkout and troubleshooting. <p>The computer should be using Windows 7 as the operating system, 1.3 GHz processor or greater and 512 MB or more of RAM. Other configurations may operate normally, but they have not been tested.</p> <p>The computer must also have an USB connection and the installation of the LynxMSS USB driver.</p> <p><u>Mini-b USB Cable</u></p> <ul style="list-style-type: none"> Required if using the USB port to interface the MPC to the MSS. <p><u>DB9 F/F Standard Null Modem Cable</u></p> <ul style="list-style-type: none"> Required to configure WiFi Accessory. <p><u>Flightline Tester</u></p> <ul style="list-style-type: none"> IFR-6000 Ramp Test Set (with upgrade package Option #3 (1090) & #5 (UAT), Manufacturer: AEROFLEX. <p><u>GPS Generator</u></p> <ul style="list-style-type: none"> GPSG-1000, Manufacturer: AEROFLEX. <p><u>Oscilloscope</u></p> <ul style="list-style-type: none"> Required to verify NGT-2000/2500 suppression pulse (100 μs \pm5μs, +28 V dc) <p><u>Milliohm Meter</u></p> <p>Required to check installation bonding to aircraft structure.</p>

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1.9.1 Installation Kits

Ordering Installation Kits is a customer option. Refer to the following for ordering information:

Table 1-8: Installation Kit P/N 9060-17250-01

DESCRIPTION	PART NUMBER	QTY
Hood-Sub Shell Size 4 Alum. With rotating JA	3050-17000-01	1
Connector D Sub Receptacle Hi Density 62 Positions Crimps	9001640-002	1

1.9.2 Antenna Cables

Table 1-9 lists examples of the recommended antenna cable vendors and the type of cable to be used for specific lengths of cable. Any cable meeting specifications is acceptable for the installation.

Table 1-9: Coaxial Cable Specifications

INSERTION LOSS (DB/100FT) [1]	CARLISLE IT TYPE [2]	MIL-C-17 TYPE [3]	RG TYPE
18.5	N/A	M17/128-RG400	RG-400
11.1	N/A	M17/112-RG304	RG-304
9.2	N/A	M17/127-RG393	RG-393
15.2	3C142B	N/A	N/A
9.2	311601	N/A	N/A
7.5	311501	N/A	N/A
5.8	311201	N/A	N/A
3.8	310801	N/A	N/A
<p>[1] RG type coaxial cable insertion loss can vary significantly between manufacturers. The insertion loss for RG type cables shown in this column is considered 'worst case'. Refer to the cable manufacturer's specification sheet for actual attenuation (insertion loss) for the cable being used.</p> <p>[2] Supplier information (for reference only): Carlisle IT 5300 W. Franklin Drive Franklin, WI 53132 Tel: 800-327-9473 414-421-5300 Fax: 414-421-5301 www.carlisle.com</p> <p>[3] Supplier information: See current issue of Qualified Products List QPL-17.</p>			

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1.10 EQUIPMENT INTERFACES

The equipment listed here is compatible with the NGT-2000/2500. Equipment interfaces not listed in this section can still be approved for installation, but must meet the requirements for the NGT-2000/2500.

1.10.1 GPS Antenna

All listed GPS antennas have TNC connector.

Table 1-10: Approved GPS Antennas

MANUFACTURER	PART NUMBER
Aero Antenna	AT575-326
Aero Antenna	AT575-493
Aero Antenna	AT575-343
Aero Antenna	AT575-516
Aero Antenna	AT135-3
Comant	CI-2580-200
Comant	CI-2728-410
Comant	CI 428-200
Comant	CI 429-200
Comant	CI 429-410
Sensor Systems	S67-1575-135
Sensor Systems	S67-1575-137
Sensor Systems	S67-1575-145
Sensor Systems	S67-1575-160

1.10.2 UAT Antenna

Table 1-11: Approved UAT Antennas

MANUFACTURER	PART NUMBER	CONNECTOR TYPE
RAMI	AV-74	BNC
Comant	CI-105	BNC
Comant	CI-105-11	TNC

1.10.3 Traffic Displays

Traffic information is output to a compatible traffic display from the NGT-2000/2500 using an ARINC 735B interface format. Possible traffic output format selections include Standard TCAS Intruder File (STIF or TIF) and Display Traffic Information File (DTIF). The NGT-2000/2500 allows installed configuration selection of STIF, DTIF, or both formats of output data via the ARINC 429 bus to the traffic display. Displays not listed below can still be approved for installation, but must meet the specifications required by the NGT-2000/2500.

Table 1-12: Approved Traffic Displays

MANUFACTURER	MODEL, DESCRIPTION	SW LEVEL
Garmin	MX-20 (Standard traffic only)	5.7
Garmin	GNS430 (Standard traffic only)	TBD
Garmin	G-500 (Standard traffic only)	GDU-620 Version 6.11 FPGA and I/O Vers – 2.1
Garmin	GTN-650 (Standard traffic only)	4.0 GPS SW Vers – 5.0
Garmin	GMX-200 (Standard traffic only)	TBD

1.10.4 Weather Display

Table 1-13: Approved FIS-B WX Displays

MANUFACTURER	MODEL, DESCRIPTION	SW LEVEL
Garmin	MX-20	5.7
Garmin	GMX-200	2.13

1.10.5 Control Panel

Table 1-14: Approved Control Panels

MANUFACTURER	MODEL, DESCRIPTION	SW LEVEL
L-3 Aviation Products	CP-2500	FW Rev 07 and HW Rev 00
Garmin	GTX-327	2.10
Garmin	GTX-330	4.40

1.10.6 WIFI Accessory

Table 1-15: Approved RS-232 to WiFi Accessories

MANUFACTURER	MODEL, DESCRIPTION
Roving Network	RN370M
L-3 Avionics Systems	TBD

1.10.7 PERSONAL ELECTRONIC DEVICE (PED) APPS

Table 1-16: Compatible APPS for PED

MANUFACTURER	DESCRIPTION
	Sky Radar
	Wing X

1.11 SOFTWARE UPDATES

Software for the MSS can be obtained by either downloading from the L-3 Technical Publications website or by receiving a compact disc.

1.11.1 Website Download

Use the following procedure to gain access to the L-3 Technical Publications website.

NOTE

For users of the L-3 RSA tokens a Risk-Based Authentication (RBA) security system is currently being implemented that will eventually eliminate the need for physical RSA tokens. Token accounts will not be immediately converted. Continue to log in using the token until the month in which it expires. Upon the expiration of the token, the account will be converted to a RBA account. The expiration date is located on the back of the RSA token.

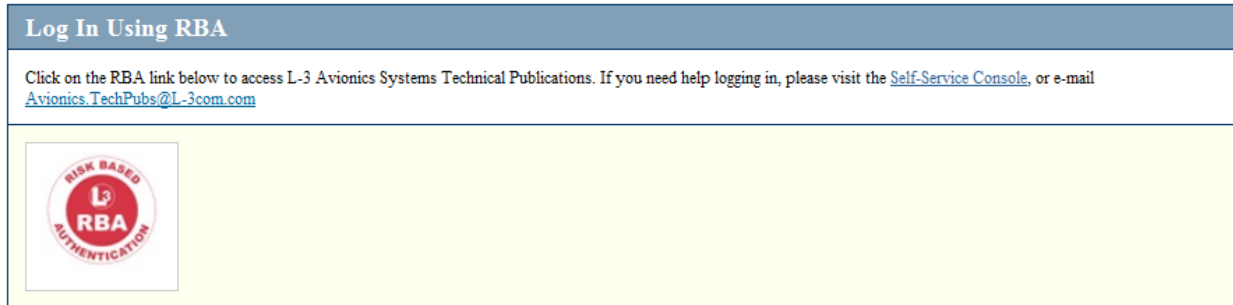
First time users:

1. Go to <https://www.l-3avionics.com/customer-support/technical-publications/>.
2. On the Technical Publications page first time users must fill out the Secure Site Access Request and return the form and supporting documentation to L-3 Avionics Systems by fax or email.
3. A User ID and temporary password will be sent by L-3 Avionics Systems after the documentation is reviewed and accepted.
4. Go to <https://www.avionictechpubs.com>.
5. Click on the Self-Service Console Link.
6. Enter the User ID and click the OK button.
7. Enter the temporary password and click the Log On button.
8. Create a new password and press the OK button.
9. Select and answer five security questions. Click the Submit button.
10. The Self-Service Console page is shown. Click the Log Off link in the upper right corner of the page to complete the process. Go to the User s with site access.

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Users with site access:

1. Go to <https://www.avionics.techpubs.com>.



2. Click on the red L-3 RBA link.
3. Enter User ID and click the OK button.
4. Answer security questions if requested. Click the Continue button.
5. Select the public or shared computer question. Click the Continue button.
6. After successful authentication the license agreement screen is shown. Click the I Agree button to be taken to the home page.

Using the technical publications web site:

1. On the left side of the home page and select Search Documents. Enter “NGT-2000” or NGT-2500 in the basic search field.
2. The search results provide a list of available publications and software for the NGT-2000 or NGT2500.
3. Click on the “details” for the document you want to subscribe too.
4. Click on the “Subscribe to this document”. A zip file will download to your computer. (Note – This download is only required one time. Afterwards any publication file may be downloaded on its own from My Subscriptions.)

If you do not see the “Subscribe to this document” option, then access to this document is restricted. Contact the Manuals Administrator at avionics.techpubs@l-3com.com for subscription access.

Software Revisions and Tools can also be obtained. A software notice document is used to identify the specific software and has restricted access beyond what is required for the publication. Contact the Manuals Administrator at avionics.techpubs@l-3com.com for access. The software notices for the **MSS** are listed in Table 1-17:

Table 1-17: List of Service Notices

SERVICE NOTICE ID	DESCRIPTION
8010-17002-0001_Rel-1.0	NGT Maintenance Application Tool (NGT MAT) Tool used for diagnostics, set up configuration options, and software downloading.

1.11.2 Compact Disc

The System Software Compact Disk (CD) contains executable files and instructions to update the MSS software. The contents of the CD are listed in Table 1-17.

The system software is transferred to the MSS using a maintenance computer. Refer to the maintenance section for loading and validation instructions.

Table 1-18: Software CD Part Number and Contents

PART NUMBER	RELEASE	CONTENTS
9230-TBD-0001	1.0	<ol style="list-style-type: none">1. Software Label Readme2. Composite Software, 9021105-001, Rev 1.03. Boot Loader, 9021110-001, Rev 1.04. NGT Maintenance Application Tool, 8010-17002-0001 Rev 1.0

1.12 INSTALLATION APPROVAL AND LIMITATIONS

1. The conditions and tests required for TSO approvals of this article are minimum performance standards. It is the responsibility of those desiring to install this article either on or within a specific type or class of aircraft to determine the suitability of the installation. The article may be installed only if further evaluation by the applicant documents an acceptable installation and is approved by the Administrator.
2. It is the installer's responsibility to ensure the ADS-B Out system is compliant with AC 20-165A.
3. The MSS is not approved for installations with SATCOM-equipped airplanes.
4. The MSS is not approved for use with a diplexer.
5. Per DO-260B 2.2.8.5.1, the MSS installation is considered non-precision. Meaning that the transmission requirement of the MSS does not include the use of GPS Time Mark for the potential extrapolating of position for transmission.

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Section 2

Installation

2.1 INTRODUCTION

This section provides installation information for the NGT-2000/2500 Multilink Surveillance System. Installation must be made by qualified personnel, in conformance with applicable government regulations. The information furnished is for convenience only.

Tolerances (unless otherwise indicated):

ANGLES ARE	$\pm 0.5^\circ$
0.00 TWO PLACE DECIMALS ARE	± 0.02
0.000 THREE PLACE DECIMALS ARE	± 0.010

2.2 UNPACKING AND INSPECTING

Carefully unpack the unit and note any damage to shipping containers or equipment. Visually inspect each component for evidence of damage. Compare the equipment received with that noted on the packing list. Report immediately any missing items or evidence of damage to the carrier making the delivery. To justify a claim, retain the original shipping container and all packing materials.

Every effort should be made to retain the original shipping containers for storage. If the original containers are not available, a separate cardboard container should be prepared that is large enough to accommodate sufficient packing material to prevent movement.

2.2.1 Transport and Storage Considerations

Transport of the NGT-2000/2500 should be done in accordance with standard procedures, i.e. hand carried or transported in the original container. The container limits the shock to the unit at a maximum of 20g's when dropped from a distance of 36 inches (0.91 meters).

Storage of avionics equipment must be consistent with industry standards for avionics equipment and performs satisfactorily after periods of storage up to 24 months. The ambient temperature of the storage area should not fall below -55°C (-65°F) or rise above $+85^\circ\text{C}$ ($+185^\circ\text{F}$).

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2.3 INSTALLATION PROCEDURES

1. The installer must take the following into consideration prior to installation.
 - The installer must obtain installation approval (i.e. Supplemental Type Certification).
 - Follow the acceptable avionics installation practices in FAA Advisory Circulars AC 43.13-1B and AC 43.13-2B or later revision of these documents.
 - Installers are responsible for obtaining installation hardware (i.e. screws, supporting plates, etc). Installation kits are available for purchase. Refer to the Equipment Required Not Supplied Paragraph in the general information section.
 - It is recommended that the aircraft battery be disconnected before performing installation procedure.
 - GPS and L-band antenna cables should be clearly labeled to prevent inadvertently installing on the wrong connector.
 - Tighten all screws to snug (i.e. only such torque that can be applied by hand) unless specific torque instructions are given.
 - After installation, refer to the Installation Checkout section for calibration, power-up and ground testing procedures.
2. Electrical equipment chassis, shield/ground terminations, antennas, supporting brackets, and racks must be electrically bonded to the aircraft's main structure (metallic aircraft) or instrument panel (composite aircraft). Compliance of the electrical bonding should be verified by inspection using a calibrated milliohm meter. An equivalent OEM procedure may also be substituted.
 - The electrical bond should achieve direct current (DC) resistance less than or equal to 2.5 m Ω to structure local to where the equipment is mounted for metallic aircraft or tube and fabric aircraft.
 - The electrical bond should achieve direct current (DC) resistance less than or equal to 5.0 m Ω to the instrument panel for composite aircraft.

The antenna ground plane must be electrically bonded to the antenna baseplate. Do not remove paint on outer skin of aircraft under the footprint of the antenna baseplate unless necessary to meet bonding requirements. Refer to antenna manufacturer's installation instructions.

2.3.1 Location

The NGT-2000/2500 provides flight information. When locating the unit in the aircraft take the following into consideration.

1. The unit should be accessible for inspection, maintenance, removal, free from excessive vibration or heat and located in a clean and dry area.
2. The wiring cable should not run adjacent to heaters, engine exhaust, or heat sources.
3. Ensure the space requirements for the unit is acceptable at the location area being considered. Refer to Figure 2-1 for dimensional requirements.
 - The installer is advised to consider the space requirements (2-3 inches) needed for the connector backshell and the cable bend radius.
4. Unit to be mounted firmly to the airframe using number 4 pan head machine screws.
5. The chassis of the unit must be properly bonded to the Ground. The chassis of the unit itself is conductive and acts as a ground.

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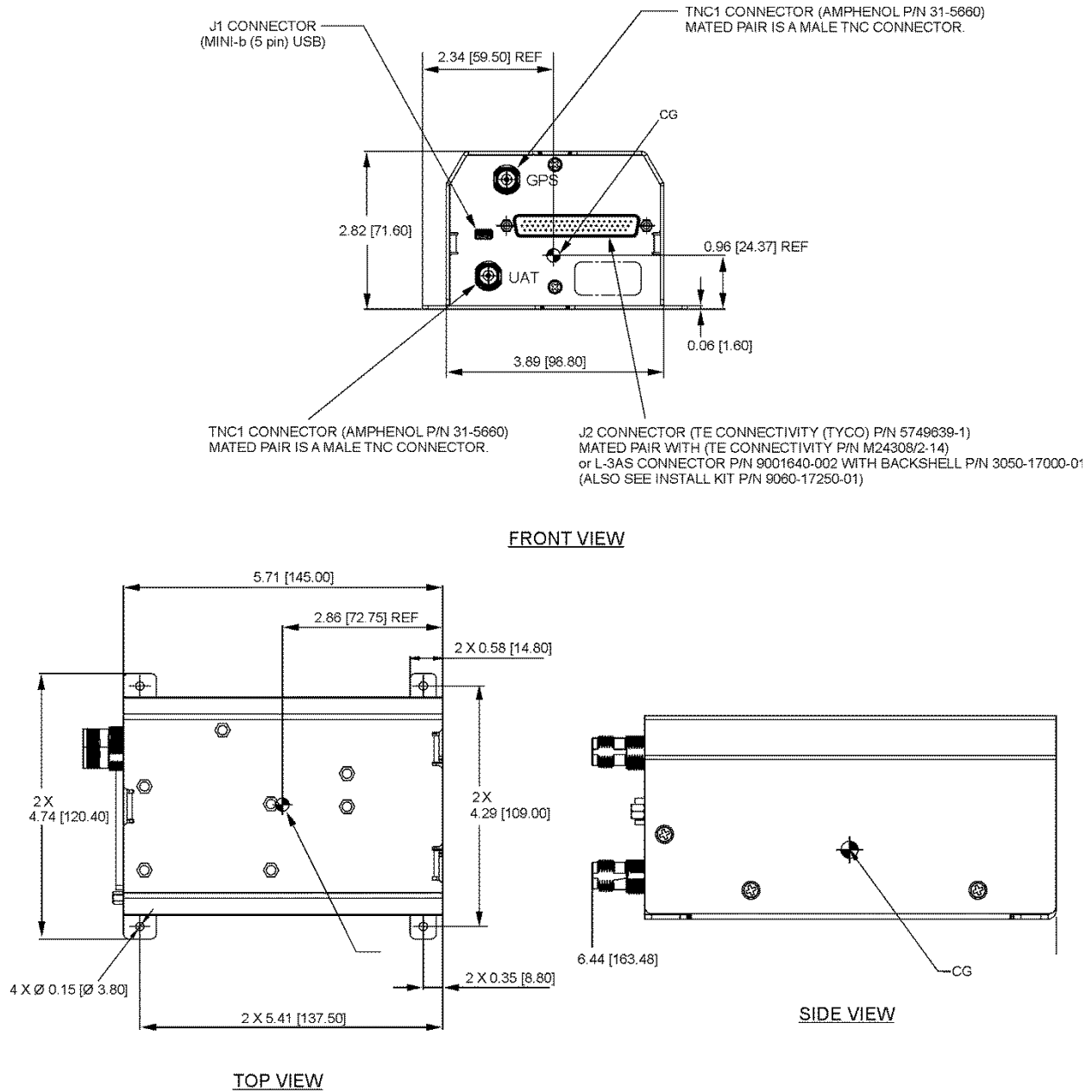


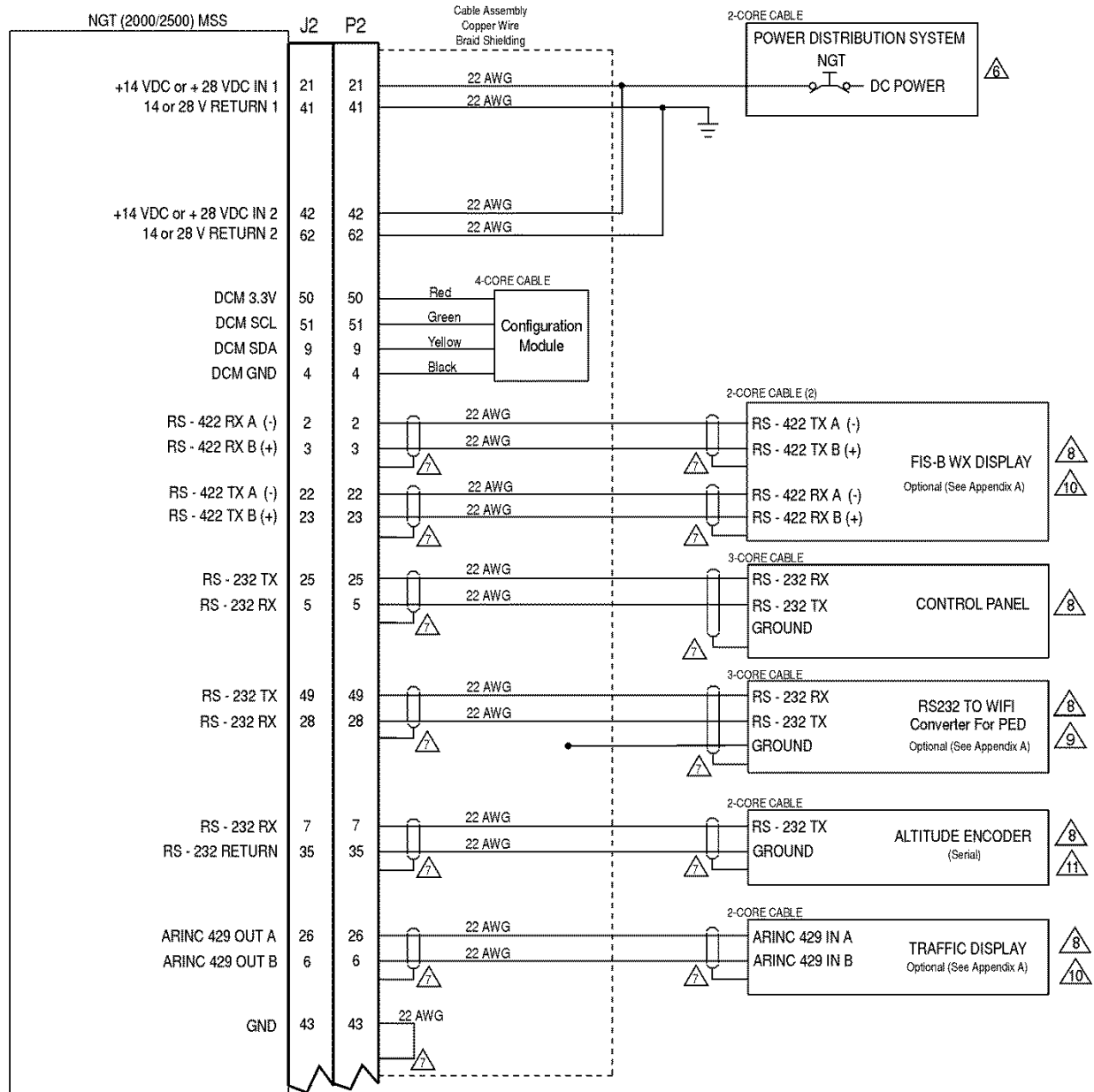
Figure 2-1: Outline Dimensions for NGT-2000/2500

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2.3.1.1 Electrical Connections

1. The installer must take the following into consideration before installation.
 - Use of any wire or cable not meeting specification voids all warranties.
 - The installer is responsible for supplying wires, cables and connectors.
 - Wire-marking identification is at the discretion of the installer.
 - All wiring must be in accordance with industry-accepted methods, techniques, and practices.
 - Refer to paragraph 1 for details on shielded cable preparation.
 - Refer to Appendix A for signal name and cable characteristics prior to wiring installation.
 - The length and routing of the external cables must be carefully studied and planned before attempting installation of the equipment.
 - The wiring harness should not run adjacent to heaters, engine exhaust, and heat sources or be located near fuel lines, high electrical capacity lines, flight control cables, and protected areas of the aircraft or be exposed to wire chafing.
 - Avoid sharp bends while routing the cables.
 - Cable runs should be as short as practical. Grounded pigtailed must not exceed 3 inches in length. Terminate shields in the backshell of the mating connector (at P1).
 - All wires shall be 22 AWG. Use M22759 or equivalent wire and Tefzel Wire M27500 or equivalent for twisted shielded wired for installation.
 - Installer is responsible for determining appropriate circuit breakers needed to protect aircraft wiring. Manufacturer recommends the following:
 - **1.0** Amp circuit breaker for the installations with 14Vdc input
 - **0.5** Amp circuit breaker for the installations with 28Vdc inputIf installing the NGT-2000/2500 with a CP-2500 Control Panel:
 - **2.0** amp breaker (connected to same breaker as NGT-2000/2500 with 14Vdc input)
 - **1.5** amp breaker (connected to same breaker as NGT-2000/2500 with 28Vdc input)
 - The configuration module is permanently attached to the **mating connector during wire installation and must be covered by the tinned copper braided shield as shown in xxxx**. Refer to paragraph 1 for details.
2. Refer to Figure 2-2 for an Interconnect Wiring Diagram. Refer to Figure 2-2 for interconnect wiring diagrams for optional LRU installations. **Refer to Appendix A for option equipment wiring diagrams.**
3. The P2 mating connector is a TE Connectivity P/N M24308/2-14 or an L-3 P/N 9001640-002 with Backshell P/N 3050-17000-01 (Also See Install Kit P/N 9060-17250-01) or equivalent. Refer to Figure 2-3 for pin locations and assignments. Refer to General Information Section- Equipment and Materials required for Installation for connector installation tools.
4. The GPS and UAT connections (TNC1 Amphenol P/N 31-5660) require a male TNC mating connector.
5. The WiFi interface should configure the WiFi Accessory prior to installation. Refer to the Installation Checkout section **(para. 3.3)** for details.
6. **It is recommended** that the installer perform the following wiring checks during installation:
 - Check all wiring point-to-point for continuity before connecting components.
 - Ensure voltages are not applied to signal wires.
 - Inspect cables for correct connection.

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NOTES:

1. ALL WIRES ARE 22 AWG. REFER TO P2 MATING CONNECTOR ASSEMBLY FOR WIRING DETAILS AND OVERBRAID DETAILS.
2. INDICATES TWISTED SHIELDED WIRE.
3. DENOTES POWER RETURN GROUND.
4. DENOTES CHASSIS OR AIRFRAME GROUND. CHASSIS GROUND WIRES MUST BE AS SHORT AS PRACTICAL.
5. DISC IN RETURN ARE CONNECTED INTERNALLY TO POWER GROUND.
6. THE RECOMMENDED CIRCUIT BREAKER RATING IS 1.0 A FOR 14VDC INSTALLATIONS AND 0.5 A FOR 28 VDC INSTALLATIONS. REFER TO AC43.13-1B FOR MORE INFORMATION. REFER TO THE ELECTRICAL CONNECTIONS PARAGRAPH FOR OTHER CONNECTION OPTIONS.
7. GROUNDED PIGTAILS MUST NOT EXCEED 3 INCHES IN LENGTH. TERMINATE INSIDE BACKSHELL.
8. PIN-OUT & INTERCONNECT INFORMATION IS DEPENDENT ON THE EQUIPMENT APPROVED FOR INSTALLATION. REFER TO THE APPROVED EQUIPMENT INSTALLATION INFORMATION FOR DETAILS. A LIST OF APPROVED EQUIPMENT IS PROVIDED IN THE GENERAL INFORMATION SECTION.
9. PIN-OUT & INTERCONNECT INFORMATION FOR MODEL RN131G (RS-232 TO WIFI CONVERTER) IS PROVIDED IN APPENDIX A.
10. NGT-2500 FUNCTIONALITY ONLY.
11. PRESSURE ALTITUDE REQUIRED - MAY BE EITHER SERIAL OR GILLHAM GRAYCODE.

Figure 2-2: NGT-2000/2500 Interconnect Wiring Diagram

(Sheet 1 of 2)

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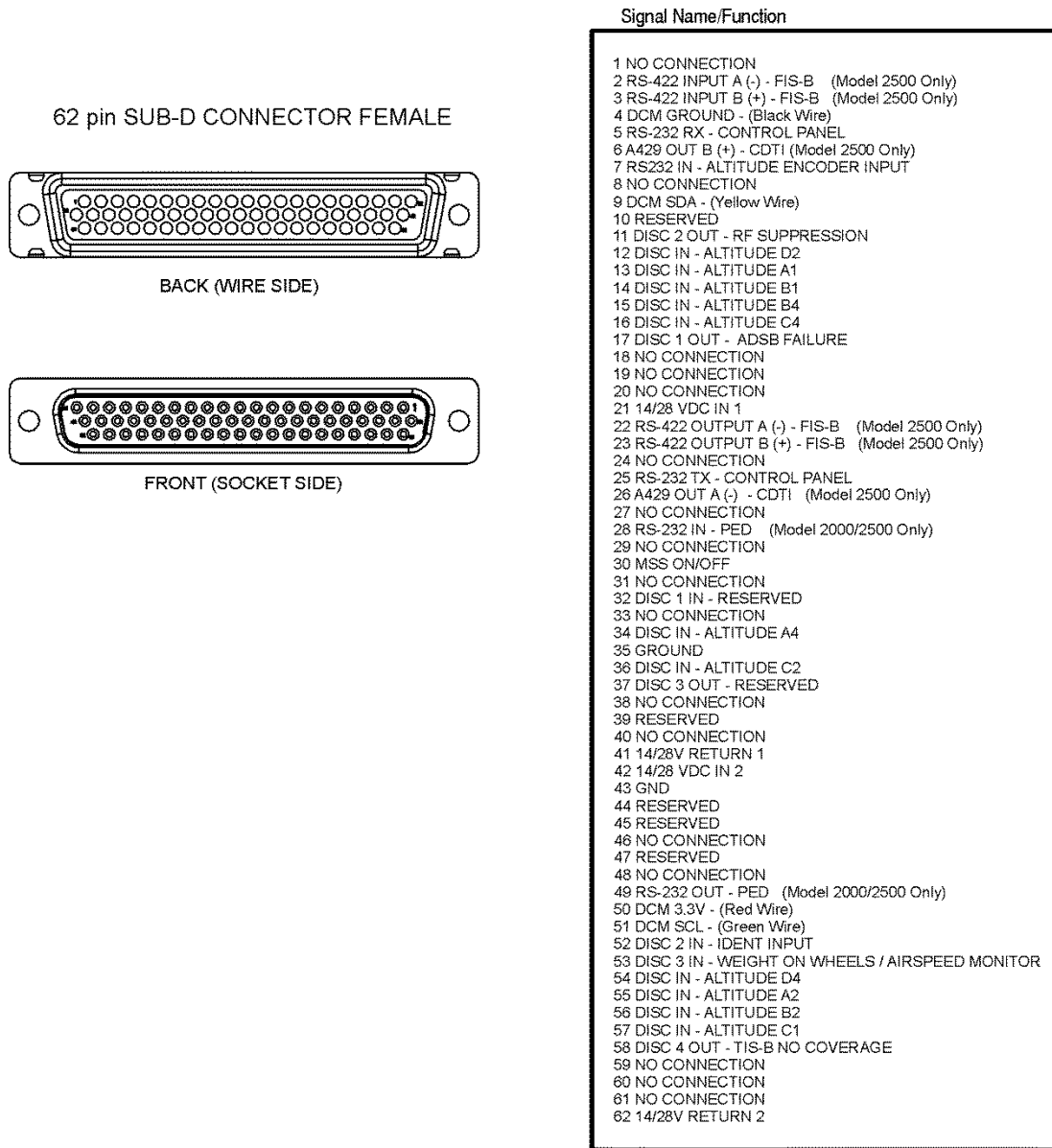
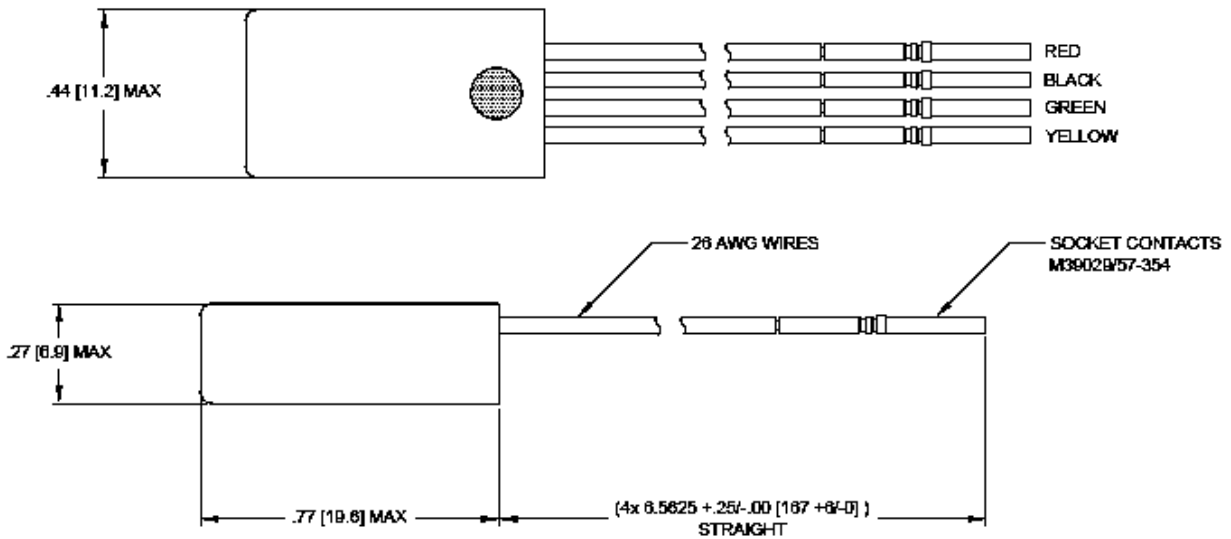


Figure 2-3: Mating Connector (P2) and Pin Assignments

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2.3.1.2 P2 Mating Connector Assembly

1. Installation Guidelines for the DCM.
 - a. Use the following information when locating and installing the DCM in the aircraft. Refer to Figure 2-5 for DCM mounting location.
 - b. The DCM is connected to the P2 mating connector during wire installation. Refer to electrical connections paragraph 2.3.1.1 for wiring details. Refer to Figure 2-4 for the outline dimensions of the DCM. Refer to Figure 2-2 for interface connections to the P2 mating connector.

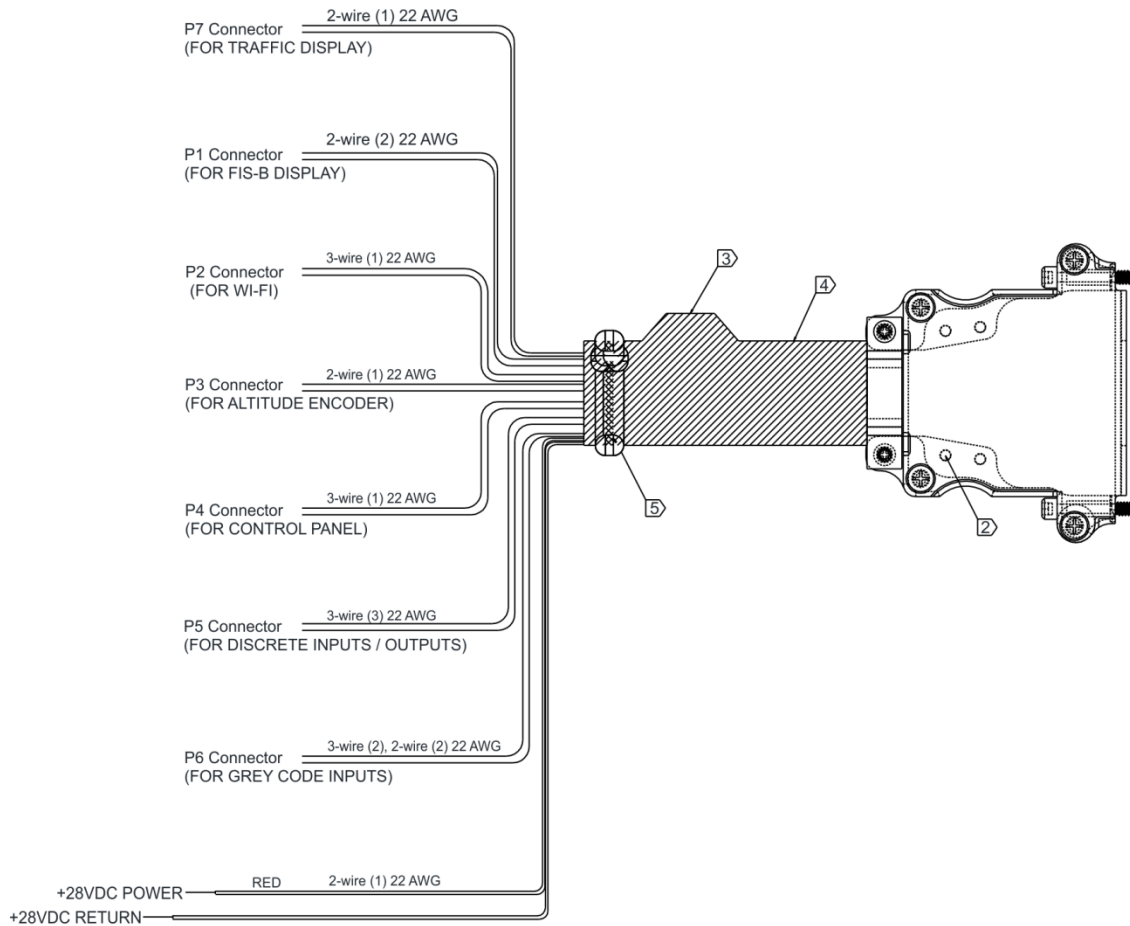


Note: Dimensions are in Inches [mm]

Figure 2-4: Outline Dimensions for the DCM

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NOTES

1. REFER TO INTERCONNECT DRAWING FOR DETAILS ON WIRE SIZE.
2. INTERNAL GROUNDING SCREWS USED TO GROUND THE SHIELDS OF 22 AWG WIRES.
3. CONFIGURATION MODULE.
4. USE A TINED COPPER BRAID SHIELD APPROXIMATELY 5" IN LENGTH, COVERING THE EXPOSED SHIELD CORE WIRES AND CONFIGURATION MODULE.
5. USE A TIE WRAP AS NECESSARY TO SECURE THE EXPOSED END OF THE OVERBRAID.

Figure 2-5: Mating Connector (P2) Cable Assembly

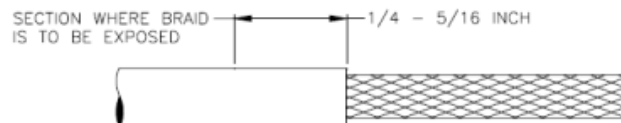
DRAFT 3-2

2.3.1.2.1 Shielded Cable Preparation

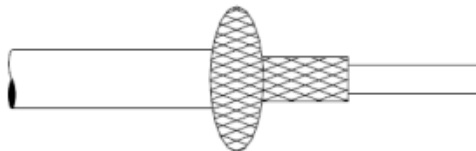
- Use these instructions to prepare the Shielded Tefzel Wire (MIL27500) or equivalent for connection to the 62 pin sub D connector.
- The crimp pins of the 62 pin connector are to be crimped to the wires.
- The Outer Jacket of the cable is to be removed for all cables on which the solder sleeve to be placed for ground contact. The installer is to ensure that the outer jacket is removed on the cable for the length of the cable inside the 62 pin connector backshell and can be around 1 to 1.5 inches from the crimped pin side. Refer to Table 2-1 for the procedure on how to remove the jacket and insertion of solder sleeve.

1. The cable can be stripped according to the following procedure designed to leave the shield braid smooth and flat. The use of finger cots is recommended to prevent transfer of oils to the shield.

a. Score and remove the jacket as shown below:



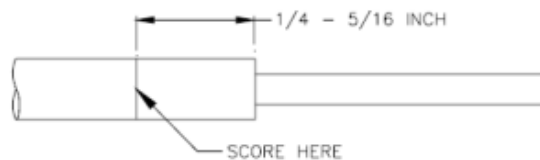
b. Bunch the braid:



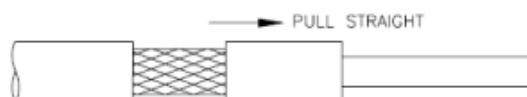
c. Trim the braid as close as possible to the jacket:



d. Score the jacket 1/4 to 5/16 inch from the end of the braid:



e. Remove the section of jacket carefully by pulling straight. This will flatten the braid strand ends:



f. Inspect the cable to make sure that the braid strands are lying against the primary insulation.

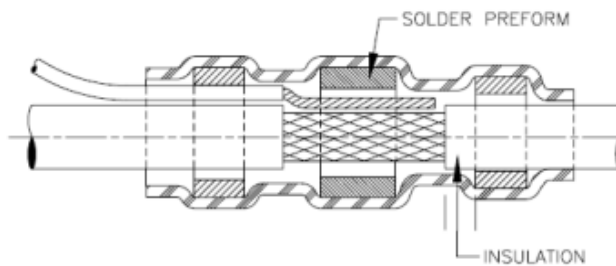
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2. Solder Sleeve placement

NOTE

Ensure the strands of the shield braid and ground lead lay flat and smooth.

- a. Position the stripped portion of ground lead (s) against the stripped portion of the shield braid.
- b. Slip the selected shield terminator over the cable and ground lead assembly. Rotate the shield terminator as it slides over the ground lead to prevent it from catching on the strands.
- c. Position the terminator so that the exposed shield is centered between the solder sleeve (solder preform) inserts and some of the cable jacket is visible between the solder sleeve inserts and the exposed shield.



3. Apply Heating on the Solder Sleeve

- a. Use Tyco Electronics approved heat source and reflector as shown below:

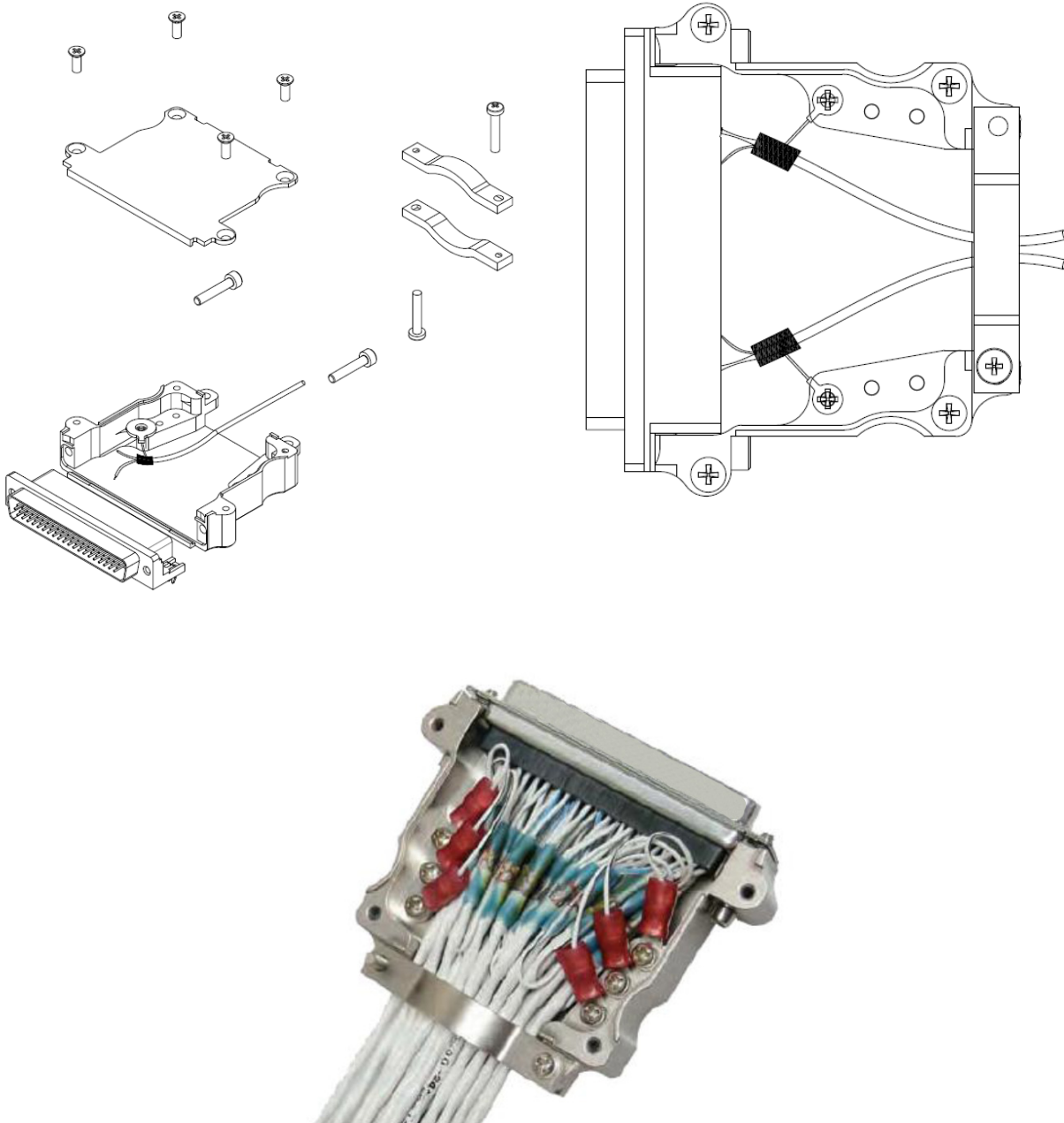
Heat Gun / Setting	Reflector
HL1910E = 6 on dial HL2010E = 700°F on LCD	PR-25 or PR-25D and HL1802E-ADAPT

- b. Allow hot air heaters to warm up before using.
- c. Position the assembly (cable, ground lead and terminator) in the reflector so that the solder preform is in the center of the hot air or at the focal point on the infrared heaters.
- d. If the cable jacket or ground lead insulation is susceptible to heat damage for example, if the insulation is PVC, or if the infrared heating is used with black insulation, move the assembly toward the heat source to minimize unwanted exposure of the jacket to the heat.
- e. Heat until the solder preform melts flows and wets the shield and ground lead.
- f. Some terminators contain a thermal indicator to signal when the correct amount of heat has been applied to the solder. There are two types of indicators. One is a thermo-chromic material which signals correct heating by loss of color. Terminators with this type of indicator should be heated until all the colored material in the joint area has turned colorless. (Slight traces of the material may remain in the standing of the shield). The other type of thermal indicator is a ring of fusible material around solder preform. Terminators with this Bi-Alloy indicator should be heated until the solder preform melts and the indicator ring completely disappears in the joint area.

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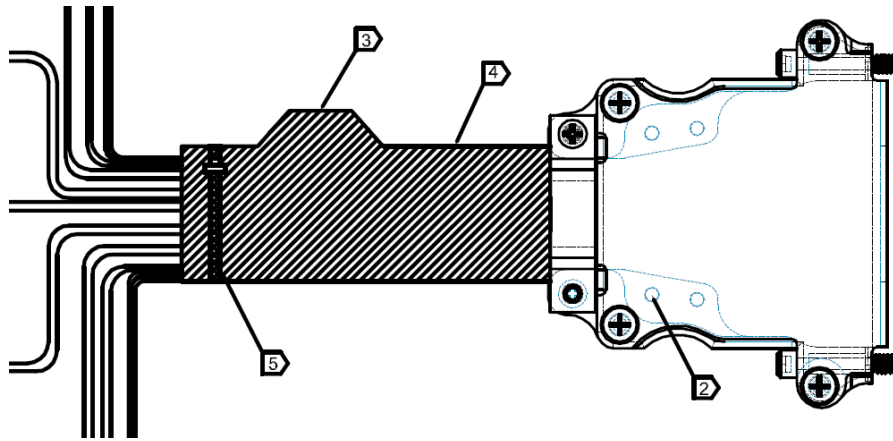
4. Assembly

- a. Cut the pre-installed lead on the solder sleeve as required (keep the length as low as 1 to 1.5 inch from the solder sleeve) and crimp the ring terminal to the wire for the ground terminations. Note that multiple (can be 2 or 3) leads can be clubbed together for crimp to a single ring terminal.
- b. Insert the ground braid (about 5 inches) to the cable harness (ensure that the DCM is also part of this cable harness) before inserting the crimped pins of the cables to 62 pin connector and then connect the cables as shown in the figures below:



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- c. On completion of the assembly of the cables, cable tie to be used to secure the cable harness and the cable harness with ground braid will be as shown in the figure below:



1. Refer to Interconnect drawing for details on wire size.
2. Internal grounding screws used to ground the shields of 22 AWG wires.
3. Configuration Module.
4. Use a tinned copper braid shield approximately 5" in length, covering the exposed shield core wires and configuration module.
5. Use a tie wrap as necessary to secure the exposed end of the overbraid.

- d. The installer shall ensure that the other side of the cable ground braid is also grounded for better EMI performance of the unit.

2.3.2 Antenna Installation Guidelines

This information provides general installation guidance to ensure the installed antennas meet the requirements for the NGT-2000/2500.

- Installation approval for the GPS and L-band antennas is not provided by the instructions provided in this manual.
- Cable requirements are located in paragraph 2.3.1.1. Cable vendors and approved antenna manufactures are located in the General Information section.
- An example of antenna placement is shown in Figure 2-6. Refer to the aircraft manufacturer's data and the antenna manufacturer's installation instructions to mount the antenna. The installer may use other FAA approved data to gain a separate antenna installation approval.

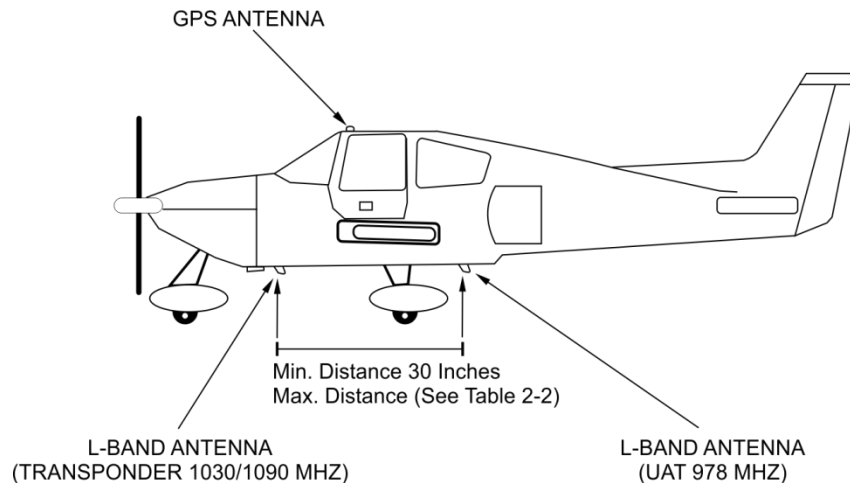


Figure 2-6: Example of Antenna Mounting Locations

2.3.2.1 GPS Antenna

The GPS antenna performance is critical to the performance of the NGT-2000/2500. The antenna must meet the minimum performance requirements for the NGT-2000/2500. Only the antennas listed in the General Information section meet these requirements.

- The antenna performance is critical to operation of GPS in the Unit. The recommended antenna is a DO-301 compliant antenna meeting the requirements of TSO-C190. For installations where the aircraft has an existing antenna complying with DO-228 (TSO-C144a), the unit may be installed utilizing this antenna, as per DO-229D Note 1, Section 2.1.1.10.
- The performance of the unit is affected by the gain, noise figure, impedance, and frequency selectivity characteristics of the antenna. The unit should be used only with the recommended antenna and cable. Use of other antennas or cables may not meet all the performance characteristics specified in DO-229D.
- The cable including connectors, loss should not exceed 10dB.

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2.3.2.1.1 GPS Antenna Location

The following guidance provides information to aid the installer in determining the best location is selected for the installation of the GPS Antenna.

The installation guidelines presented here meet the intent of AC 20-138C Chapter 12, Section 12-1.

NOTE

Not all the listed installation guidelines may be possible on all aircraft.
The guidelines are listed in order of importance. The chances of optimal
signal strength are decreased if the guidelines are not followed.

1. The antenna must be located on the top of the aircraft and should be mounted in a location to minimize the effects of airframe shadowing during typical maneuvers. Typically mounting farther away from the tail section reduces signal blockage seen by the antenna.
2. Mount the antenna as close to level as possible with respect to the normal cruise flight attitude of the aircraft. If the normal flight attitude is not known, substitute with the waterline, which is typically referenced as level while performing a weight and balance check. A shim may be used to level the antenna.
3. The antenna should be mounted no closer than 3 feet from any VHF COM antenna or any other antenna, which may emit harmonic interference at the L1 frequency of 1575.42 MHz. An aircraft EMI check can verify the degradation of GPS in the presence of interference signals.
 - If an EMI check reveals unacceptable interference, either insert a GPS notch filter in line with the offending VHF COM or select a different GPS Antenna location.
4. To maintain a constant gain pattern and limit degradation by the windscreen, avoid mounting the antenna closer than 3 inches from the windscreen.
5. It is permissible to temporarily locate the GPS Antenna with a coaxial cable connected to the MSS and check the GPS performance as described in the installation checkout section. Permanently mount the antenna once a suitable location has been verified.
6. Once the antenna mounting position has been established, route the coaxial cable from the antenna to the MSS. Proper selection of coaxial cable and assembly of connectors is critical to GPS signal performance.
7. For installations on rotorcraft, ensure that the rotor blades do not interfere with the GPS received signal. This problem has been experienced in some rotorcraft and varies with rotation rate.

2.3.2.1.2 GPS Antenna Installation

Refer to the aircraft manufacturer's data and the antenna manufacturer's installation instructions to mount the antenna. The installer may use other FAA approved data to gain a separate antenna installation approval.

1. **Electrical Bonding Requirements:**

The GPS/WAAS antenna requires a minimum ground plane radius of 7.5 inches around the perimeter of the antenna. For metal aircraft, the surrounding metal skin on which the antenna is mounted supplies the ground plane. For non-metal aircraft, the ground plane can be composed of heavy duty aluminum foil tape, such as 3M PIN 438 or other adhesive backed dead soft aluminum foil minimum 0.012 inches thick. It should be noted that if the antenna is struck by lightning, the foil by itself may not be sufficient to dissipate lightning currents. Additional protection may be needed depending on the construction of the structure to which the antenna is mounted.

 - The electrical bonding requirements stated in paragraph 2.3.1.1 must be met.
 - To prepare an aluminum surface for proper bonding, refer to SAE ARP1870 Sections 5.1 and 5.5.
2. Connection to the antenna should be made in accordance with the system interconnect diagram Figure 2-2.

2.3.2.2 L-Band (UAT/978) Antenna

The UAT/978 antenna must meet the minimum performance requirements for the NGT-2000/2500. Only the antennas listed in the General Information section meet these requirements.

Antennas meeting the minimum performance specifications needed by the NGT-2000/2500 may already be installed in the aircraft and may be available for use. Use the antenna location information below to verify an existing antenna location is acceptable for use.

Installation approval for the UAT Antenna is not provided through this Manual.

2.3.2.2.1 L-Band (UAT/978) Antenna Location

The UAT/978 antenna installation should be installed in accordance with AC 43.12-2A Chapter 3. The following guidance provides information to aid the installer in determining that the best location is selected for the installation of the L-band Antenna.

- The UAT/978 antenna must be mounted vertically on the bottom of the aircraft fuselage. The antenna shall be located to minimize obstruction to fields in the horizontal plane.
- The total attenuation including connectors shall not exceed 1.5dB. Based on this, the length of the cable can be decided assuming RG-400 cable. RG type coaxial cable insertion loss can vary significantly between manufacturers. Refer to the cable manufacturer's specification sheet for actual attenuation (insertion loss) for the cable being used.
- The UAT/978 antenna should be located away from major protrusions, such as engine(s), propeller(s), and antenna masts. It should be as far as practical from landing gear doors, access doors, or other openings that could affect its radiation pattern.
- The UAT/978 antenna must be mounted no closer than 20 inches from any FADEC (Full Authority Digital Engine Control).
- The UAT/978 antenna must be mounted no closer than 24 inches to any TAS/TCAS antenna.
- The UAT/978 antenna must be mounted no closer than 30 inches to any transponder antenna. Refer to Table 2-1 for maximum distances.
- Path loss between UAT and Transponder L-Band antenna is must be 20dB to 43.7dB.

Table 2-1: Maximum UAT Antenna to Transponder Antenna Separation

UAT ANTENNA CABLE ASSEMBLY CABLE LOSS (1)	MAXIMUM ANTENNA SPACING (2)
0.75 dB ≤ Cable Loss < 1.0 dB	137 inches
1.0 dB ≤ Cable Loss < 2.0 dB	122 inches
2.0 dB ≤ Cable Loss ≤ 3.0 dB	109 inches
Note (1) Cable assembly cable loss includes loss of the coaxial cable with connectors.	
Note (2) Measured from center of UAT/978 Antenna to the center of transponder antenna.	

- When the NGT-2000/2500 is configured to communicate with the aircraft transponder using the self-interrogation feature (CP-2500 installed), the following antenna guidelines must also be followed:
 - a. The installed transponder must be utilizing a bottom mounted antenna.
 - b. The bottom UAT/978 Antenna must be mounted no further from the transponder antenna than specified in Table 2-1.

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2.3.2.3 L-Band (UAT/978) Antenna Installation

Refer to the aircraft manufacturer's data and the antenna manufacturer's installation instructions to mount the antenna(s). The installer may use other FAA approved data to gain a separate antenna installation approval.

- **Electrical Bonding Requirements:**
Each L-Band antenna requires a minimum ground plane radius of 12 inches around the perimeter of the antenna. For metal aircraft, the surrounding metal skin on which the antenna is mounted supplies the ground plane. For non-metal aircraft, the ground plane can be composed of heavy duty aluminum foil tape, such as 3M PIN 438 or other adhesive backed dead soft aluminum foil minimum 0.012 inches thick. It should be noted that if the antenna is struck by lightning, the foil by itself may not be sufficient to dissipate lightning currents. Additional protection may be needed depending on the construction of the structure to which the antenna is mounted.
The electrical bonding requirements stated in paragraph 2.3.1.1 must be met.
- Connection to the antenna should be made in accordance with the system interconnect diagram Figure 2-2.
- Acceptable coaxial cable attenuation at 978 MHz is between 0.75 dB and 1.5 dB, including connectors.
- Reference General Information Section – Antenna Cables for UAT Antenna cable loss and minimum antenna spacing requirements.
- Refer to General Information section - lists some suitable cable types. Any 50Ω, double-shielded coaxial cable assembly that meets airworthiness requirements and the acceptable attenuation requirements (including connectors) may be used. When computing cable loss, a typical loss of 0.2 dB can be used for each connection. Refer to paragraph 2.3.7 Antenna electrical bonding requirements.

2.3.3 NGT-2000/2500 Installation

Perform the following to the extent necessary to install the NGT-2000/2500:

1. Place the unit in the location selected in paragraph 2.3.1.
2. Use four customer supplied fasteners to mount the unit to the aircraft.
3. Connect P2 mating connector to connector J2 of the unit.
4. Connect GPS and L-Band antenna to unit at appropriately marked TNC connections.

2.3.4 Remove and Replacement Procedures

If the NGT-2000/2500 or one of its system components requires removal after initial installation, replace it using the instructions given in the maintenance section of this manual.

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Section 3

Installation Checkout

3.1 INTRODUCTION

This section contains instructions to check out the installation of the NGT-2000/2500 (MSS) and configuration module. Refer to the fault isolation information provided in the maintenance manual for help in correcting installation issues found during checkout. Refer to the General Information section - Equipment Required Not Supplied for details on equipment used in this section.

The installation of the NGT-2000/2500 requires an approved control panel/display. Note that approved control panel/display may not operate exactly as stated in this checkout. Refer to the operating instructions for the controller/display for details.

NOTE

These procedures assume that the mounting, wiring, power, and antenna requirements have been checked out according to the instructions given in the installation section.

CAUTION

Operating the unit with the GPS antenna connected and the UAT antenna NOT connected may damage the unit.

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3.2 MAINTENANCE PC

The procedures for installation checkout require the use of a Maintenance PC (MPC), NGT Maintenance Appliance Tool (NGT MAT) and a USB cable. The MPC may only be connected and used while the aircraft is on ground. An example of the main page of the NGT MAT is shown in Figure 3-1.

The revision of the NGT MAT must be compatible with the unit's software release. Refer to software revisions in the General information section for details. The revision of the MPC MAT can be found in the Help menu.

Persons performing the checkout should monitor the NGT MAT status bar (located at the bottom of the screen) for messages and modes of operation.

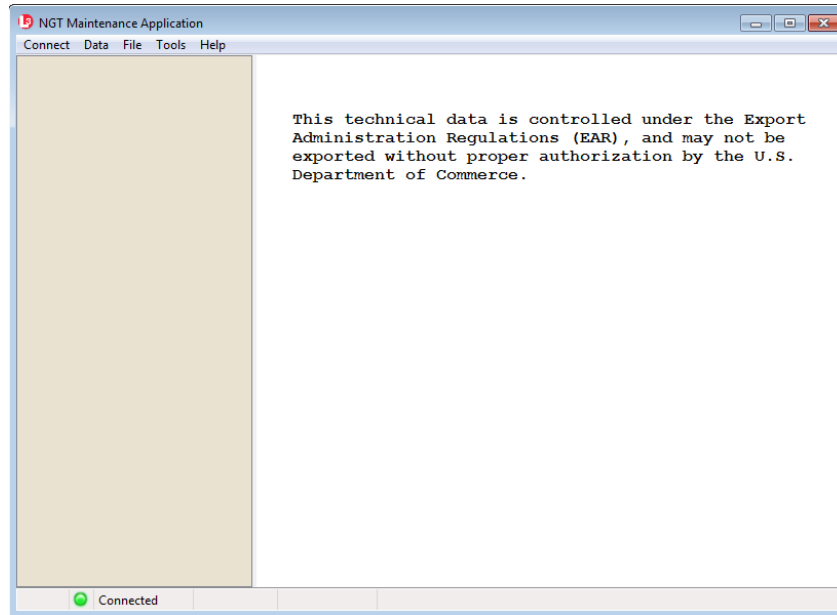


Figure 3-1: NGT Maintenance Appliance Tool – Main Page

- Do the following to connect and establish communication between the MPC and the MSS via the USB connection.
 - a. Apply power to the MSS and MPC.
 - b. The NGT MAT is active on the MPC.
 - c. Connect USB cable between MPC and the MSS.
 - d. From the NGT MAT menu select Connect→Appliance → USB.
 - e. Communication is established when the NGT MAT left view panel changes from grey to tan and the message 'Connected' is shown in the lower status bar.
 - If “Not Connected” is shown, then check the USB cable for proper connection.
 - If a “Response timeout for write request” message is seen on the status bar, then the unit is not responding to requests. Cycle power to the MSS.
 - The NGT MAT transitions into different modes depending on what is currently selected. The current mode can be determined by viewing the lower left corner of the status bar.
 - Within the first 2 minutes of cycling power to the MSS the Maint Mode can always be entered. If after 2 minutes of cycling power and the GPS signal has not yet been acquired then the Maint Mode cannot be entered. The unit will need to be cycled again before Maint Mode can be entered by the NGT MAT.

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- Do the following to connect and establish communication between the MPC and the MSS via the WiFi connection. **Note –This feature will be added in a future revision of the NGT MAT.**
 - a. After communication has been established using the instructions in step 1, WiFi communication can be established with the MSS for installation using the WiFi option. Refer to paragraph 3.3.
 - b. From the NGT MAT menu select Service → Maintenance through WiFi.
 - c. Press the Request button.
 - d. Cycle power to the unit.
 - e. Remove USB cable.
 - f. From the NGT MAT menu select Connect → Appliance → WiFi.
 - g. Connection should be established. If not, than restart the process begun in step 2.a.

3.3 CONFIGURE WIFI ACCESSORY

This procedure requires a Maintenance PC (MPC), NGT Maintenance Appliance Tool (NGT MAT), and a standard Null Modem cable (DB9 F/F).

These procedures assume the following:

- The NGT MAT is active on the MPC.
1. Connect WiFi Accessory to the MPC Com Port 1 using a standard Null Modem cable.
 2. From the NGT MAT menu select Tools → Configure WiFi Dongle. See Figure 3-2.

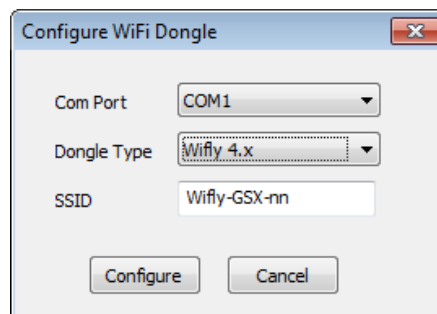


Figure 3-2: NGT MAT – WiFi Accessory

3. Select the accessory Type.
4. Enter the SSID (4.x only) if the entry field is not grayed out and accessible. Otherwise the SSID is already loaded.
5. Click “Configure” to begin. A message is shown to indicate configuration complete or if configuration could not be completed.

6. If the configuration could not be completed, then check the following:
 - Cable connection
 - Com port connection
 - Accessory type
 - Correct SSID
 - Check batteries for the WiFi Accessory
7. After the configuration is complete remove the serial cable and connect the accessory to the aircraft wiring harness connecting to the NGT-2000/2500.

3.4 VERIFY SOFTWARE VERSION

The Maintenance PC (MPC) and NGT Maintenance Appliance Tool (NGT MAT) are used to interface with the NGT-2000/2500 to load software / firmware, view factory / version data, and retrieve fault logs.

These procedures assume the following:

- Power is being supplied to the aircraft and NGT-2000/2500.
- The MPC is interfaced to the unit using the USB interface.
- The NGT MAT is active on the MPC. (Note – If Maint Mode is not accessible, then it is likely that 2 minutes have passed since power was cycled with no GPS lock. Cycle power again.)

1. From the NGT MAT select Info→ Versions. See Figure 3-3.
2. Verify that the composite software, boot loader software, and NGT MAT software are correct for this installation. Details on software versions are available in the General Information section under paragraph heading ‘Software Versions’.
 - If a software version is found to be incorrect, update using the procedures located in the maintenance section of this manual.

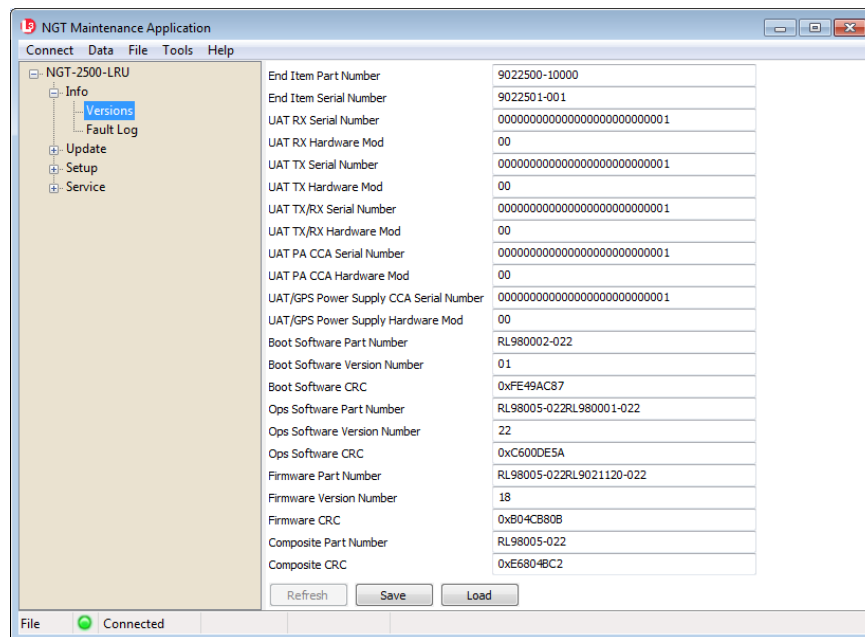


Figure 3-3: NGT MAT – Check Versions

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3.5 SELECT CONFIGURATION OPTIONS

This procedure is used to configure the NGT-2000/2500 and must be completed prior to performing the Installation Checkout for first time installations. The Log Sheet provided in Appendix C should be filled out prior to this procedure and maintained with the aircrafts permanent records.

- If a configuration file has already been created using the NGT MAT Backup function, then it may be used to load the data options. The configuration restore procedure is located in the maintenance section.
- A product key is required to enable the NGT-2500 system. The product key is typically shipped with the unit. If the product key is not included, contact L-3 Avionics Systems Customer Service to obtain the code.
- If the NGT MAT is not connected or is disconnected the left side panel color changes to a light grey and the “Not Connected” message is displayed at the bottom of the tool screen. Re-connect by doing the following - from the NGT MAT panel select Connect→Appliance→USB. This is required each time the unit power is cycled.
- Place the cursor over option titles to view tool tips (not always available).
- The top of the each configuration page has a DCM read monitor that checks the interface of the unit and DCM.
- A “Warning” message is shown when the user first attempts an operation that requires confirmation from the user stating “Changes should be done by trained service personnel”. The user will need to press the confirm button to acknowledge this warning.

These procedures assume the following:

- Power is being supplied to the MSS and system components (i.e. antenna, display, and controllers).
- The NGT MAT is active on the MPC.
- The MPC is connected to the unit via the USB interface
- The MPC and unit are communicating.

3.5.1 Aircraft Options

1. From the NGT MAT select Setup→ Configuration → Modify → Aircraft. See Figure 3-4.

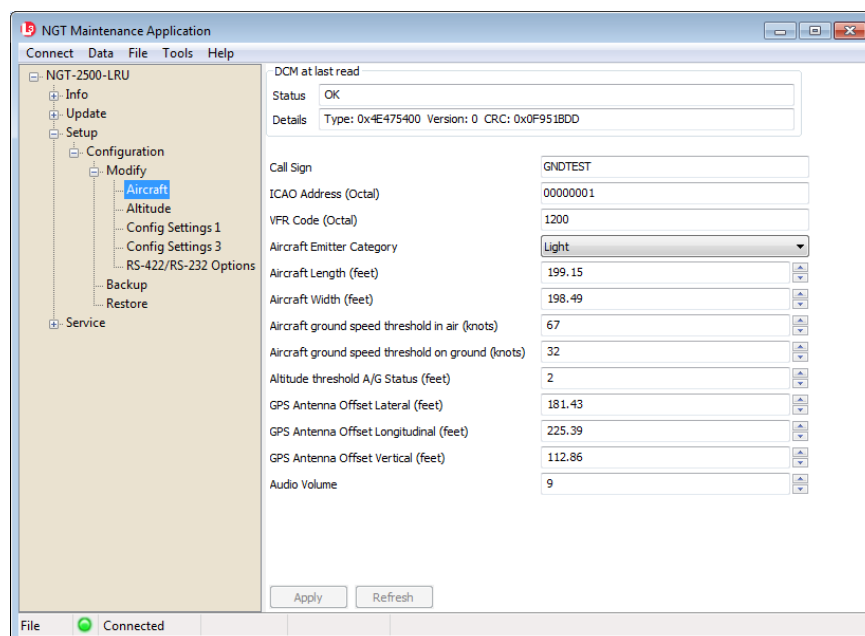


Figure 3-4: NGT MAT – Aircraft Options

2. Enter the information specific to the installation for the intended certification. Review the information below before entering the data.
 - **Call Sign. Or Flight ID** (Aircraft Registration Number i.e. N12345) is assigned to an aircraft for voice communications purposes.
 - **ICAO Address (Octal)**. (Mode S Identifier). This 24-Bit unique address is assigned to an aircraft during the registration process. The code can be obtained from either the aircraft registration certificate or the N number inquiry page→ <http://registry.faa.gov/aircraftinquiry/>.

The ICAO address must be entered before upgrading the unit to a NGT-2500. If the ICAO address is changed after the model upgrade code is entered, than the unit will be downgraded to a NGT-2000 and the upgrade code will need to be entered again.
 - **VFR Code** (Octal). Permits the use of different VFR codes for different regions / altitudes in the world. (i.e. 1200 for USA).
 - **Aircraft Emitter Category**. This information provides an indication of the aircrafts size and performance capabilities. Emitter categories are defined in TSO-C166b and TSO-C154c or Table 1 in AC20-165A.
 - **Aircraft Length (feet)**. This parameter provides ATC and other aircraft with quick reference to the aircraft's dimensions while on the surface.
 - **Aircraft Width (feet)**. This parameter provides ATC and other aircraft with quick reference to the aircraft's dimensions while on the surface.
 - **Aircraft ground speed threshold in air (knots)**. This will set the minimum ground speed of the aircraft, used in determination of air-ground status while the aircraft is in-air.
 - **Aircraft ground speed threshold on ground (knots)**. This will set the max ground speed of the aircraft, used in determination of air-ground status while the aircraft is on-Ground.
 - **Altitude threshold A/G Status (feet)**. This provides the minimum elevation above the ground reference for the A/G status to be considered as In-Air.
 - **GPS Antenna Offset Lateral (feet)**. These parameters are derived from the position source and provide a geometric based position. Reference all geometric position elements broadcast from the ADS-B unit to the World Geodetic System 1984 (WGS-84) ellipsoid.
 - **GPS Antenna Offset Longitudinal (feet)**. These parameters are derived from the position source and provide a geometric based position. Reference all geometric position elements broadcast from the ADS-B unit to the World Geodetic System 1984 (WGS-84) ellipsoid.
 - **GPS Antenna Vertical Offsets (feet)**. This is to provide the position offset of the GPS antenna from the ground.
 - **Audio Volume**. Use for Installation adjustment of audio output volume (Future).
3. Click on “Apply” after all information is entered. This information is saved to the DCM.

3.5.2 Altitude Options

1. From the NGT MAT select Setup→ Configuration→ Modify→ Altitude. See Figure 3-5.

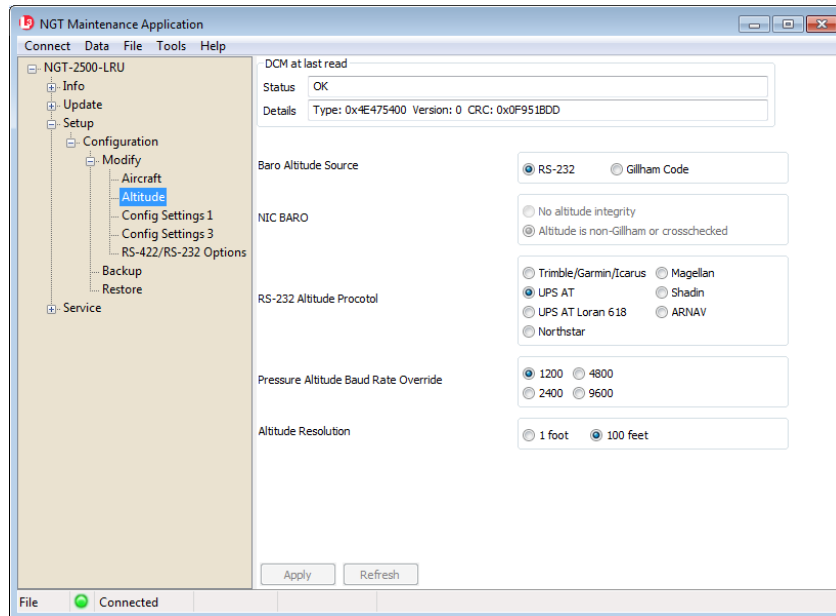


Figure 3-5: NGT MAT – Altitude Options

2. Enter the information specific to the installation for the intended certification. Review the information below before entering the data.
 - **Baro Altitude Source.** Indicates if the Baro Altitude source is RS-232 or 11-bit discrete Gillham code.
 - **NIC BARO.** Sets the NIC (navigation integrity category) baro to be used in ADS-B Messages. Selecting non-Gillham altitude source sets the NIC Baro to 1. Selecting no altitude integrity sets the NIC Baro to 0.
 - **RS-232 Altitude Protocol.** Sets the protocol that the transmitted serial altitude is read from the configuration module at start-up.
 - **Pressure Altitude Baud Rate Override.** Used to override the automatic selection of baud rate when one of the 7 protocols is selected.
 - **Altitude Resolution.** Setting based on the installed altitude source. 1 foot for RS-232. 100 feet for Gillham Code.
3. Click on “Apply” after all information is entered. This information is saved to the DCM.

3.5.3 Config Settings 1

1. From the NGT MAT select Setup→ Configuration→ Modify→ Config Settings 1. See Figure 3-6.

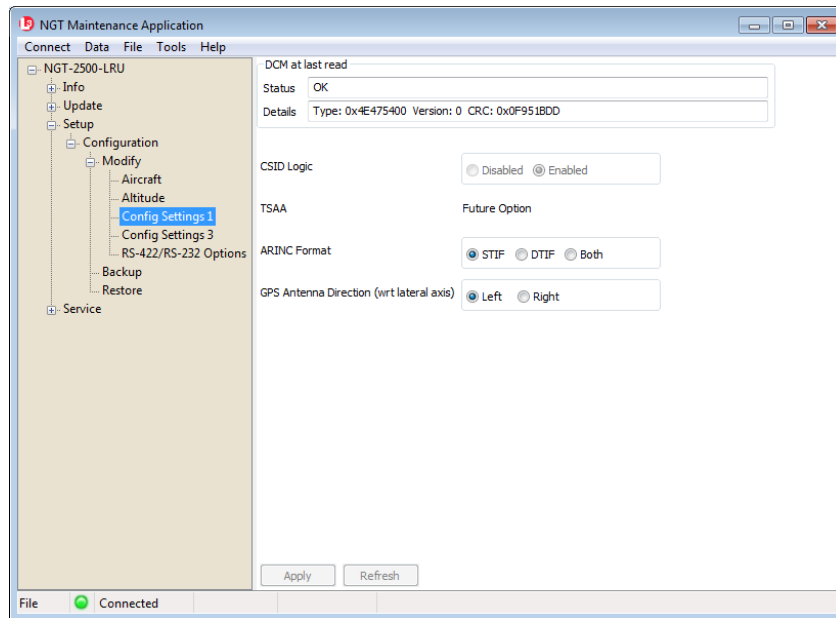


Figure 3-6: NGT MAT-Config Settings 1

2. Enter the information specific to the installation for the intended certification. Review the information below before entering the data.
 - **CSID Logic.** Call-Sign Identification (CSID) logic configuration setting shall be enabled or disabled in the DCM. When the CSID logic is enabled, the UAT transmits call sign and Flight Plan ID alternately in the ADS-B messages. When CSID is set to disabled, only call sign is transmitted.
 - **TSAA.** (Future Option).
 - **ARINC Format.** Used in creation of ARINC messages to be transmitted to Traffic Display. (NGT-2500 only)
 - **GPS Antenna Direction (with respect to lateral axis).** Sets the direction of the GPS axis along the lateral axis – left or right.
3. Click on “Apply” after all information is entered. This information is saved to the DCM.

3.5.4 Config Settings 3

1. From the NGT MAT select Setup→ Configuration→ Modify→ Config Settings 3. See Figure 3-7.

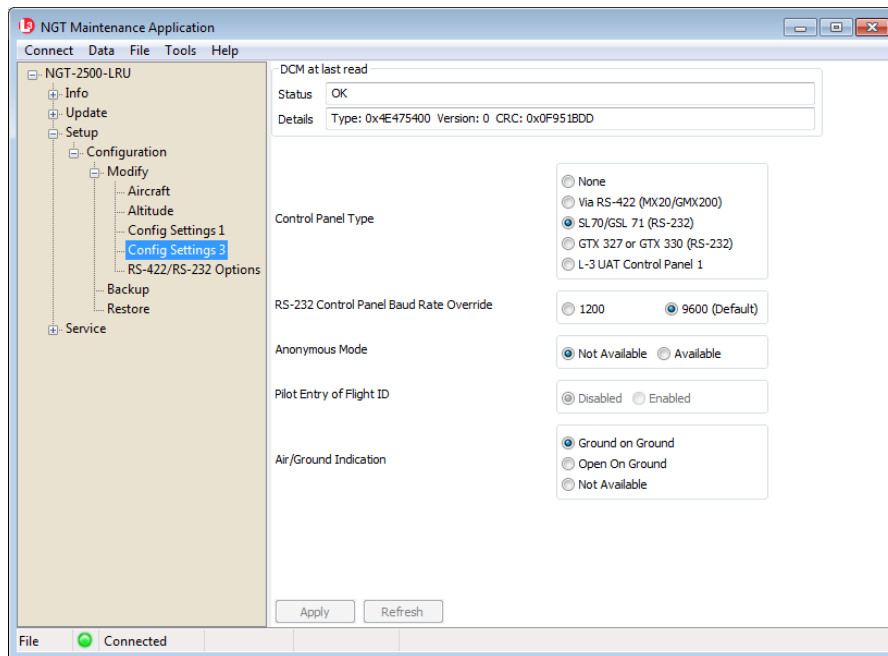


Figure 3-7: NGT MAT - Config Settings 3

2. Enter the information specific to the installation for the intended certification. Review the information below before entering the data.
 - **Control Panel Type.** Used to indicate if the control panel used is: Via Serial RS-422 (MX20/GMX200), SL70/GSL 71 (RS-232), GTX 327 or GTX 330 (RS-232), L-3 UAT Control Panel 1 (i.e. CP-2500), Other Type.
 - **RS-232 Control Panel Baud Rate Override.** (1200, 9600)
 - **Anonymous Mode.** Indicates if the aircraft has the ability to use Anonymous Mode or not. This function is used by the CP-2500 Control Panel.
 - **Pilot Entry of Flight ID.** (Disable , Enable)
 - **Air/Ground Indication.** Use to indicate the interpretation of the A/G (WOW/Squat Switch) discrete.
3. Click on “Apply” after all information is entered. This information is saved to the DCM.

3.5.5 RS-422/RS-232 Options

1. These configuration settings are for the NGT-2500 only. Installations for the NGT-2000 can ignore this procedure.
2. From the NGT MAT select Setup→ Configuration→ Modify→ RS-422/RS-232 Options. See Figure 3-8.

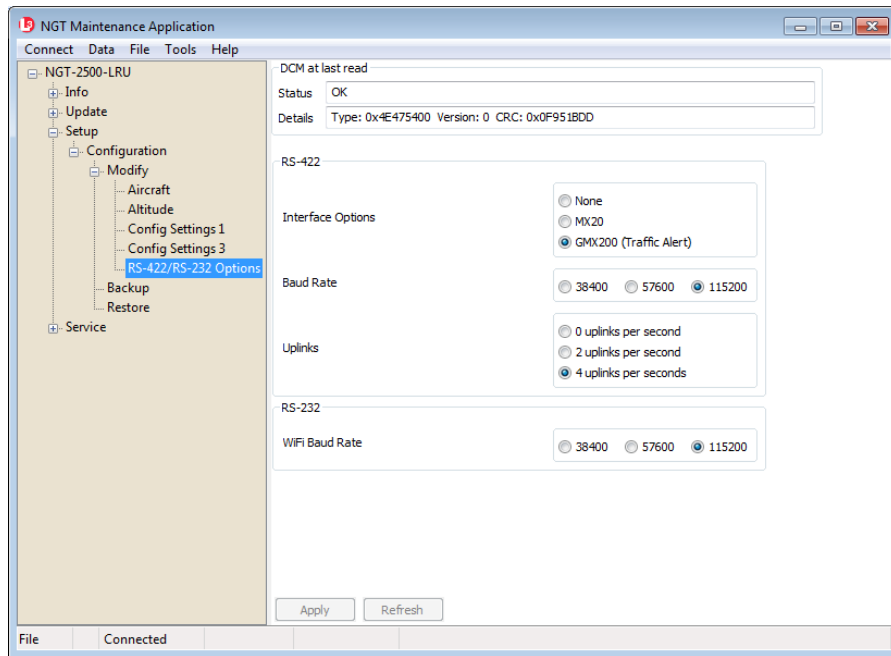


Figure 3-8: NGT MAT - RS-422/RS-232 Options

3. Enter the information specific to the installation for the intended certification. Review the information below before entering the data.
 - **Interface Options.** Use to select the RS-422 output format.
 - **Baud Rate.** Sets the baud rate of the RS-422 output.
 - **Uplinks.** Sets the max number of ground uplink messages that can be transmitted per second over RS-422.
 - **WiFi Baud Rate.** Sets the baud rate to be used for the Wi-Fi RS-232 communication.
4. Click on “Apply” after all information is entered. This information is saved to the DCM.

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3.5.6 Backup

1. From the NGT MAT select Setup→ Configuration→ Backup.
2. Click “Save” to copy the configuration information to a file on the MPC. See Figure 3-9.

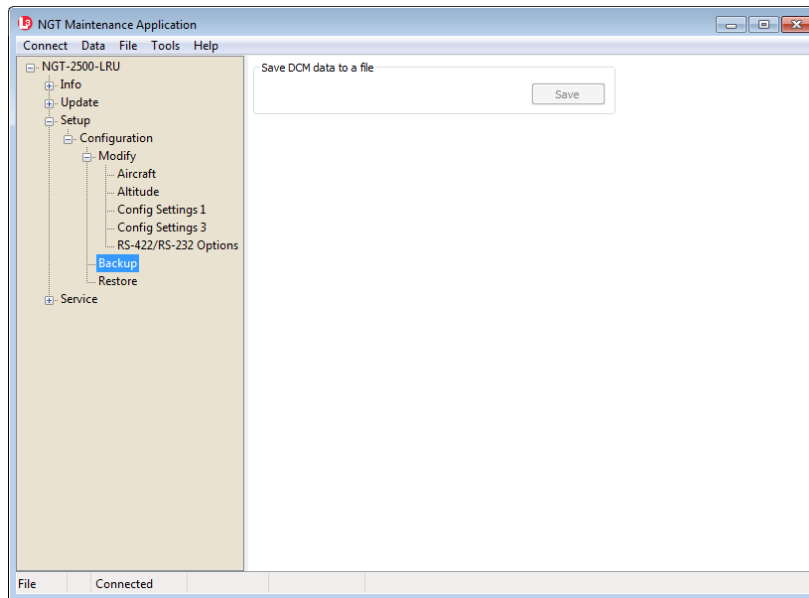


Figure 3-9: NGT MAT - Configuration Backup

3.5.7 Clear Fault Log

1. Clear the fault log from the NGT MAT by selecting Info → Fault Log See Figure 3-10.
2. Select Clear button.
3. Answer “Yes” to confirmation dialogs.
4. Cycle power to the unit.
5. The calibration and configuration setup is complete.

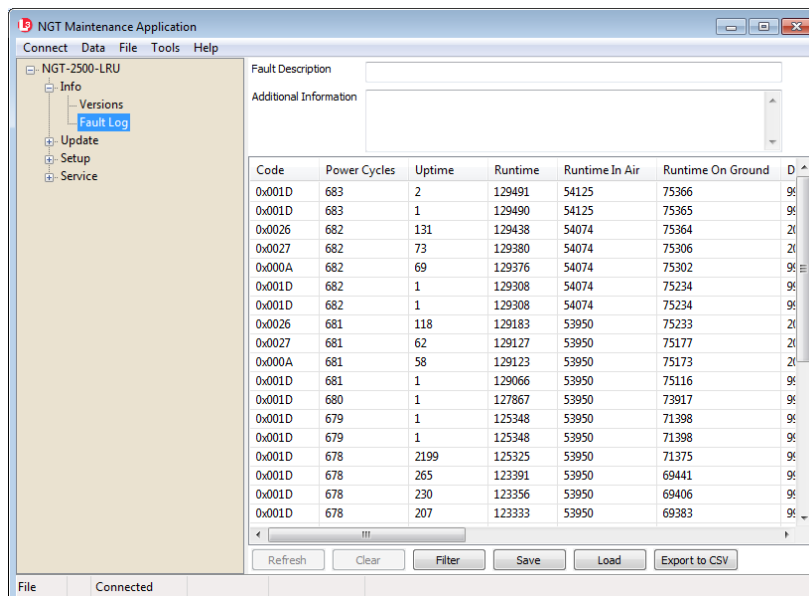


Figure 3-10: NGT MAT –Fault Log

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3.6 UPGRADE MODEL

Use this procedure to upgrade the MSS to a NGT-2500. **The selection is only available when “NGT-2000-LRU” is at the top of the item list.** It is recommended that the ICAO Address be set up in the configuration options before the upgrade procedure is performed. The upgrade code is set to only one ICAO Address and **no** other address will work. (Note - If needed, remove the NGT-2500 upgrade by entering a new ICAO Address and press apply.)

1. From the NGT MAT select Update→ Upgrade Model.
2. Press the Upgrade button. See Figure 3-9.
3. Enter the unlock code and press OK.
4. The message “Model number change succeeded. Unit will reset.” is shown.
5. Confirm the change after reconnecting and observe that the model listed on the NGT MAT is identified as NGT-2500.
6. The Configuration option “RS-422/RS-232 Options” will now work in the unit.

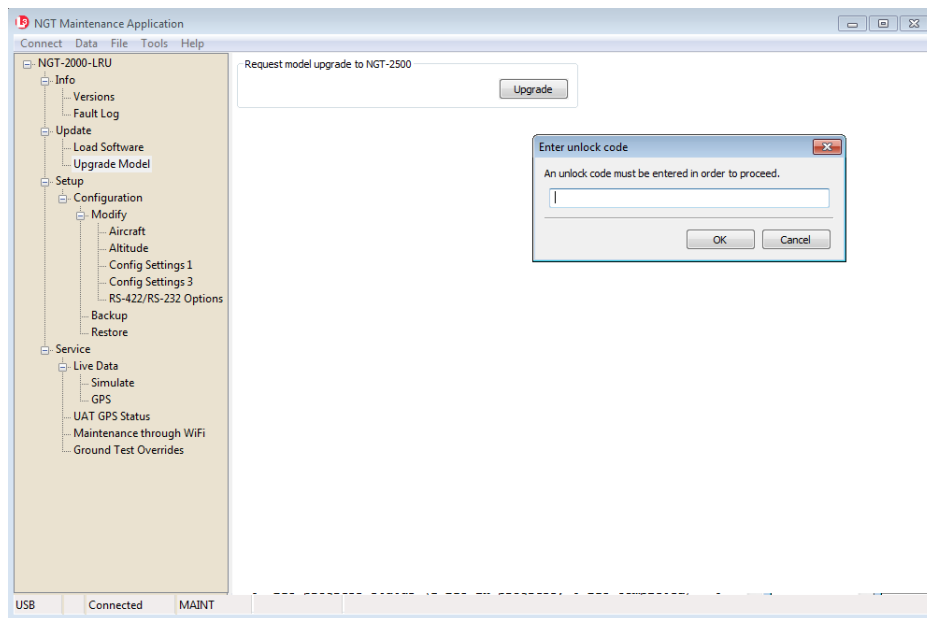


Figure 3-11: NGT MAT – Upgrade Model

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3.7 INSTALLATION CHECKOUT

This procedure validates the installation and configuration setup of the NGT-2000/2500 MSS and secondary equipment. Installers are advised to read through the entire procedure before performing the checkout. Take the following into consideration prior to installation.

- Perform the installation checkout procedure with aircraft on ground.
- Perform only those checks that are applicable to the installation.
- To conserve aircraft battery power, it is recommended that the aircraft be connected to an external aircraft power source during installation and checkout.
- An IFR-6000 (or equivalent) Ramp Test Set is required. These checks assume familiarity with the set up and operation of the ramp test set.
- All test equipment shall be calibrated in accordance with the manufacturer's recommendations.
- The approved display/control panel/PED may not operate exactly as stated in this checkout. Refer to the operating instructions for the controller/display/PED for details.
- The CP-2500 Control Panel is specifically designed to interface with the MSS and may be used during the checkout to verify the operation of the MSS.
- Depending on the installation - when power is applied to the unit the following indication is observed while the GPS initializing (acquiring a signal).
 - The CP-2500 shows a GPS INIT message.
 - The ADS-B Fail indicator lamp flashes ON/OFF.
 - Approved equipment may have its own kind of message or indication.
- It is normal for the ADS-B Out Of Coverage indicator/lamp to be ON during checkout if there is not a ADS-B ground station or signal within range.
- Some tests require the unit be set to Ground Test Mode. This is accomplished from the NGT MAT by selecting Service→ Live Data→ Ground Test Overrides and setting the ground speed to greater than 7kts (which sets the unit to Operate mode) and setting the track to a desired heading (which points the traffic on the traffic screen in the correct orientation). Press the Enable button to enter ground test mode and disable to return to normal operation mode. See Figure 3-12.

The ground test mode also sets the unit to “In-Air” status allowing Mode C (altitude) output and additional ADS-B output messages (sent at a higher rate). This allows the IFR-6000 to test the encoding altimeter input (mode C).
- These procedures assume the following:
 - Power is being supplied to the MSS and system components (i.e. antenna, display, and controllers).
 - The NGT MAT is active on the MPC.
 - The MPC is connected to the unit via the USB interface
 - The MPC and unit are communicating.

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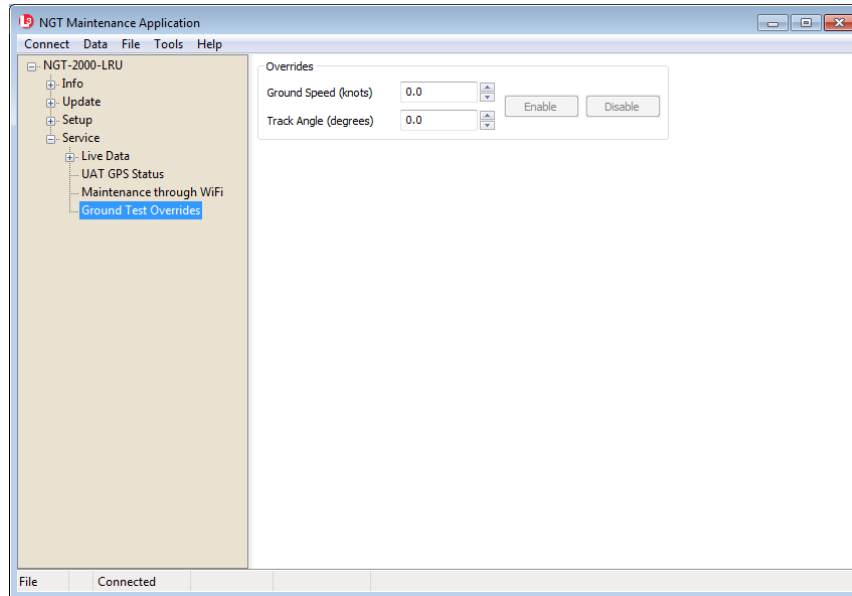


Figure 3-12: NGT MAT – Ground Test

3.7.1 Functional Check

The power ON self-test (PBIT) and continuous self-test (CBIT) checks the operation and the major hardware components in the unit. Verify this by viewing the Status information provided by the NGT MAT as follows:

1. From the NGT MAT select Service→ Live Data→ UAT GPS Status. See Figure 3-13.
2. Review the BITE Status and verify that no failures, indicated by a ‘1’ in the right column, are present.
3. If a failure is observed the problem must be resolved before continuing with the checkout. Use the MPC fault log as well as the troubleshooting help in the maintenance section.

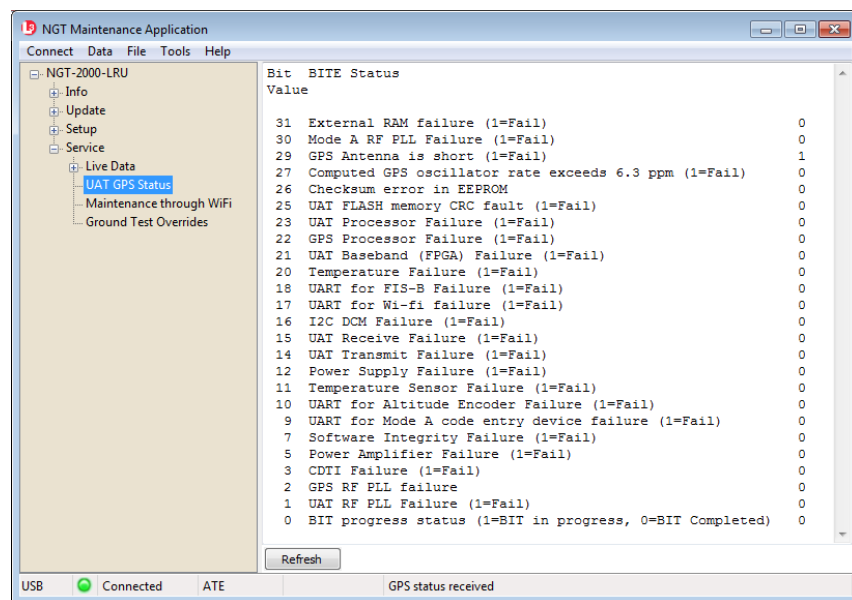


Figure 3-13: NGT MAT – UAT GPS Status

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3.7.1.1 Indicator Lamp Check

Verify the following indicator lamps functioning properly (if installed) during the checkout. These lamps are required if the control panel installed on the aircraft does not provide the indications stated below.

Note – the CP-2500 is capable of displaying messages of both these indications.

1. ADS-B Failure – This lamp does the following depending on the situation:
 - Flashes at a slow rate while the GPS is initializing. Check by cycling power to the unit. Flashing will last only 2 minutes before the lamp stays ON.
 - Flashes at a fast rate if a code mismatch is detected. Check by entering the different Mode A code from the one being transmitted by the transponder.
 - The lamp is ON when the ADS-B has failed or if the MSS Transmit ON/OFF switch is set OFF.
2. **No ADS-B Coverage** – This lamp is ON if no ground station signal is detected. The lamp is OFF when a signal is detected either by a ground station or when the IFR-6000 is used for ADS-B checks.

3.7.1.2 Discrete Switch Checks

Verify the following external switches are functioning properly (if installed) during the checkout. The Ident and MSS Transmit On/Off switches are required if the control panel installed on the aircraft does not provide the functions stated below. Note – the CP-2500 is capable of performing these functions.

1. Verify that the IDENT Input switch causes an annunciation on the display/PED.
2. Set the MSS Transmit ON/OFF switch ON and causes the ADS-B Fail indicator/Lamp ON. Set the switch to OFF to set the ADS-B Fail indicator/Lamp OFF.
3. The On-Ground switch function is verified by....

3.7.1.3 Control Panel Check

The NGT-2000 and NGT-2500 require an approved control panel (RS-232) to operate. The instructions provided in this manual for the control panel are generic. Refer to the manufacturers control panel manual for operation and checkout procedures.

3.7.1.4 Suppression Pulse Check

Use an oscilloscope to verify that the RF Suppression pulse (Discrete #2 out) is $100 \mu\text{s} \pm 5\mu\text{s}$, +28 V dc when the unit is transmitting.

3.7.1.5 Display Check

The NGT-2500 may be interfaced to an approved traffic display (ARINC 429) and weather display (RS-422). The instructions provided in this manual are generic. Refer to the manufacturers display manual for operation and checkout procedures.

- A functional check with the MSS is accomplished during the check of the ADS-B In, TIS-B, FIS-B and any other checks requiring the use of a Display.

3.7.1.6 PED Check

The PED (Personal Electronic Device) requires that a WiFi accessory be connected to the wiring harness and the WiFi configuration option be set up. This option may be used by both the NGT-2000 and NGT-2500.

- The PED requires a compatible APP.
- The PED and MSS WiFi interface must be configured. Refer to paragraph 3.3.
- A functional check with the MSS is accomplished during the check of the ADS-B In, TIS-B, FIS-B and any other checks requiring the use of a PED.

3.7.2 GPS Operation Check

This check requires that the GPS antenna to be open to a clear sky or a GPS Simulator to generate the necessary signal.

1. From the NGT MAT select Service→ Live Data→ GPS.
2. Cycle power to the MSS and allow the GPS to acquire the position
 - Acquisition of signal may take from 60 to 90 seconds. For initial installations the time to acquire a GPS signal may require additional time.
3. Observe that the GPS data is being received. See Figure 3-14. If the GPS reception is a problem, check the following:
 - The GPS signal may be blocked; move the aircraft to an open environment or input a GPS signal using test equipment.
 - Check the GPS antenna or wiring for installation issues.
 - Check that the L-band and GPS antenna cables are not swapped.
 - Check wiring or GPS antenna for installation.
 - Check the fault log (Info→ Fault Log) for issues.

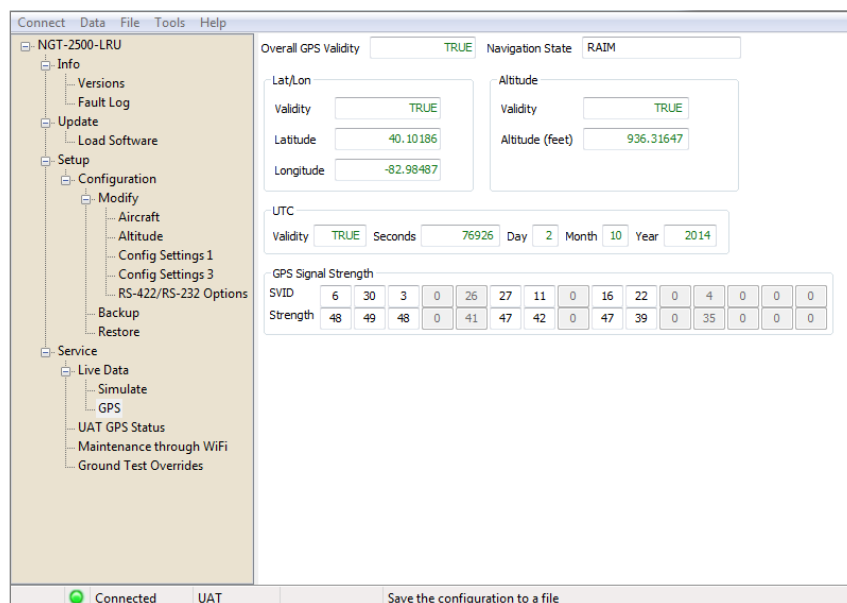


Figure 3-14: NGT MAT – Live Data-GPS

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4. Verify that the ADS-B Fail Lamp (if connected) is flashing until the position is available and then remains OFF indicating that the GPS position is computed by the Unit.
 - If a CP-2500 Control Panel is installed the GPS INIT message is removed from its display.
5. Verify that the GPS position agrees with a known reference point.
6. Verify that the Day, Month, and Year data is correct.
7. Verify that the signal Strength (C/No) of 30-50dB is displayed in the GPS Receiver Information Packet for all the GPS/SBAS satellites in view.
8. Turn ON other avionics and verify that the signal Strength (C/No) of 30-50dB is displayed in the GPS Receiver Information Packet for the satellites do not degrade significantly and position remains steady.
9. Turn ON VHF Com radios and verify that the signal Strength (C/No) of 30-50dB is displayed in the GPS Receiver Information Packet for the satellites do not degrade significantly and position remains steady.
10. If the aircraft is TAS/TCAS equipped, turn on the TAS/TCAS system and verify that the signal Strength (C/No) of 30-50dB is displayed in the GPS Receiver Information Packet for the satellites do not degrade significantly and position remains steady.
11. Any GPS interference (significant degrade in signal strength) must be resolved prior to completing the installation. Use the troubleshooting procedures in the maintenance section for help.

3.7.3 ADS-B Out Check

Before performing this check ensure that the GPS position is acquired, that the ADS-B Fail indicator/lamp is OFF, and the display/PED is in ON operational mode.

1. Set the Ground Test Override using the NGT MAT. See paragraph 3.7 for details.
2. Perform the ADS-B Out check per AC 20-165 and AC 20-172 using an IFR-6000 (or equivalent) Ramp Test Set.
 - These tests should confirm the configuration settings made in Section 3.5.1 are correctly transmitted in the ADS-B Out messages.
3. Verify that the ADS-B Out test performed by the test set is successful.

3.7.4 ADS-B In Check

Before performing this check ensure that the GPS position is acquired, that the ADS-B Fail indicator/lamp is OFF, and the display/PED is in ON operational mode.

1. Set the Ground Test Override using the NGT MAT. See paragraph 3.7 for details.
2. Perform the ADS-B In check, per AC 20-165 and AC 20-172, using an IFR-6000 (or equivalent) Ramp Test Set using the latest ADS-B update. The test set simulates ADS-B intruders by manually defining a scenario and can then verify that the correct traffic information has occurred on the MSS. Intruding flight patterns are programmed from the IFR-6000 screen.
3. Verify that Traffic information displayed on the display/PED with that being transmitted by the test set.
 - Test setup for 978 MHz ADS-B In.
4. Compare and verify the heading data transmitted by the test set is being displayed correctly on the display/PED.
 - If the WiFi option is installed a WiFi accessory connected to the wiring harness. The PED requires a compatible APP be installed.
 - The PED and MSS WiFi interface must be configured. Refer to paragraph 3.3.

3.7.5 TIS-B Traffic Check

Before performing this check ensure that the GPS position is acquired, that the ADS-B Fail indicator/lamp is OFF, and the display/PED is in ON operational mode.

1. Set the Ground Test Override using the NGT MAT. See paragraph 3.7 for details.
2. Perform the TIS-B check, per AC 20-165 and AC 20-172, using the IFR-6000 (or equivalent) Ramp Test Set. The test set simulates TIS-B intruders by manually defining a scenario and can then verify the correct Traffic Advisories have occurred on the MSS. Intruding flight patterns are programmed from the IFR-6000 screen.
3. Verify Traffic information displayed on the display/PED with that being transmitted by the test set.
4. Compare and verify the heading data transmitted by the test set is being displayed correctly on the display/PED.

3.7.5.1 FIS-B Uplink Check

Before performing this check ensure that the GPS position is acquired, that the ADS-B Fail indicator/lamp is OFF, and the display/PED is in ON operational mode.

1. Set the Ground Test Override using the NGT MAT. See paragraph 3.7 for details.
2. Perform the FIS-B check, per AC 20-165 and AC 20-172, using the IFR-6000 (or equivalent) Ramp Test Set. The test set simulates FIS-B ground base uplink. Test compliance (pass or fail) is shown on the IFR-6000.
3. Verify that weather information is being displayed on the display/PED.

3.7.5.2 Altitude Check

1. Perform the altitude check per 14 CFR Part 91.411 and 14 CFR Part 43 Appendix E.
2. Verify that the displayed altitudes of the display/PED and the primary display (PFD) or equivalent instrument are within the required range shown below (per the installation):
 - Gilham Code altitude source the range is +/- 100 ft.
 - Other altitude source the range is +/- 25 ft.

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3.7.6 Electromagnetic Interference (E.M.I.) Check

Check the following applicable aircraft systems, as well as any other system or device that is not listed, for interference. Initial tests are to be conducted with the aircraft operating on external ground power. Disregard any system or device that does not apply.

NOTE

The Electromagnetic Interference Check is required only for initial system installations and not required if the MSS is removed or replaced.

1. Communications

a. Cockpit Intercom

Using the cockpit intercom, verify interference free communications between the crew while monitoring the effects of the MSS.

b. VHF Communications

Set VHF communications radios to multiple frequencies and monitor effects of MSS while transmitting and receiving. At a minimum, the frequencies listed below should be tested, in addition to locally available frequencies:

Check the GPS signal status of the each satellite being received transmitting each frequency for a period of 35 seconds. Degradation of individual received satellite signals below a point where navigation is no longer possible is not acceptable and will require that additional isolation measures be taken.

For installations on rotorcraft, ensure that the rotor blades do not interfere with the received GPS signals. This problem has been experienced in some rotorcraft and varies with the rotation rate.

Test the following frequencies for 25 kHz COM channel spacing:

121.150 MHz	121.200 MHz	121.250 MHz	131.225 MHz	131.275 MHz	131.325 MHz
121.175 MHz	121.225 MHz	131.200 MHz	131.250 MHz	131.300 MHz	131.350 MHz

In addition test the following frequencies for VHF radios with 8.33 kHz channel spacing:

121.185 MHz	121.190 MHz	130.285 MHz	131.290 MHz
-------------	-------------	-------------	-------------

2. Navigation

a. VOR / ILS

Verify the operation of each VHF Nav receiver in both VOR and ILS modes (including glideslope) while monitoring the effects of the MSS.

b. DME

Verify the operation of each DME while monitoring the effects of the MSS. The same frequencies used for VOR and ILS testing may be used for this test.

c. Marker Beacon

Verify the operation of the Marker Beacon Receiver while monitoring the effects of the MSS.

d. ADF

Verify the operation of the ADF receiver while monitoring the effects of the MSS. Frequencies from each band should be tested when possible. Public broadcast stations are acceptable for conducting test.

3. Flight Director / Autopilot

Operate the flight director/autopilot system and verify it responds to commands from the flight guidance panel while monitoring the effects of the MSS.

4. Compass System

Verify each compass system is presenting correct information while monitoring the effects of the MSS.

5. Attitude System

Verify each attitude system is presenting correct information while monitoring the effects of the MSS.

6. Safety Equipment

a. TAWS (If Installed)

Verify the function of the TAWS and Terrain Display while monitoring the effects of the MSS.

b. Weather Monitoring System (If Installed)

Verify the function of the weather monitoring system while monitoring the effects of the MSS.

3.7.7 Flight Test

It is recommended that a flight test be conducted after installation to verify proper operation of the NGT-2000/2500 system per the AML STC.

3.7.8 Installation Checkout Complete

This completes the Installation Checkout procedure.

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Section 4

Maintenance

4.1 INTRODUCTION

This section contains general flightline maintenance and fault isolation procedures. Fault isolation is intended to aid in identifying and correcting invalidities or isolating failures to a defective assembly.

4.2 CONTINUED AIRWORTHINESS

Regular maintenance of the NGT-2000/2500 is not required except as included in this section and is to be maintained on a “Condition Monitored” basis. Condition monitoring is based upon the following:

- Visual observation by the user.
- All units have unlimited service life, where service life is defined as that point in time when repair is no longer economical.

4.2.1 Periodic Maintenance

Perform the following at regular aircraft inspection intervals:

- Visually inspect for signs of corrosion.
- Visually inspect for condition of wiring, shield terminations for proper grounding, routing, and attachment/clamping.
- Visually inspect the unit mounting to the aircraft, verify visually that the screw heads are in full contact with the mounting holes etc. Re-torque the screws if required.
- It is recommended that an electrical bond check be performed between the unit and nearby exposed portion of the aircraft metallic structure and verify that the measured value is less than or equal to 2.5 milliohms.

In the event of bonding check failure, remove the unit and clean it and its mounting holes at both the unit and the aircraft structure and reattach the unit. Re-verify the resistance between the unit and nearby exposed portion of aircraft metallic structure, and ensure it is less than or equal to 2.5 milliohms.

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4.3 FAULT ISOLATION

Use the following information for initial installations and debugging issues that may appear during operation.

If a fault is annunciated through indicator lamp or through messages displayed on the control panel or display screens, then refer to Troubleshooting Table 4-1. A MPC connected to the USB port of the MSS is essential in troubleshooting. Refer to paragraph 4.4.4 for instructions on viewing fault logs and using the service functions of the NGT MAT. In addition, devices connected to the MSS, such as a control panel or display can be useful for determining whether the MSS is functioning properly or if there are problems with the installation.

The information listed in the Symptoms column encompass all the possible issues that a technician may observe, but only some of the items may actually be seen depending on the model of the MSS and the installation of optional equipment. Typical installations of the MSS models have the following:

- The NGT-2000 has two indicator lamps (optional), PED (optional), or control panel (optional).
- The NGT-2500 has two indicator lamps (optional), PED (optional), display (optional), and control panel (optional).

If the only corrective action left is to contact L-3 Customer Service, then L-3 customer service personnel may request that a file be created using the MPC that would provide them with information on the unit (i.e. version, faults, configuration). Create this file by going to the File menu of the NGT MAT, selecting Save, and placing the file in a location that can be easily located for transfer to L-3 Customer Service.

Table 4-1: Troubleshooting

SYMPTOMS	CAUSE / CORRECTIVE ACTIONS
<p>No ADS-B Coverage Lamp ON.</p>	<p>A ground station signal is not being detected by the MSS.</p> <ol style="list-style-type: none"> 1. The signal may be block. Move the aircraft to an open environment. 2. If a ground station is not available the signal may need to be input using test equipment (i.e. IFR-6000). 3. If the lamp continues to be ON and ADS-B data is being seen on the display, check the wiring for connection problems or replacement of the MSS may be required. Contact L-3 Customer Service before removal of the unit.
<p>“NO DATA” is showing on the connected displays (traffic, weather, or PED). ADS-B fail indicator lamp is OFF. No ADS-B Coverage lamp is ON. No message is displayed on the CP-2500 (if installed).</p>	<p>No Power to the MSS.</p> <ol style="list-style-type: none"> 1. Check the Circuit Breaker. Reset breaker. 2. Verify continuity on the cable harness and verify that power and ground leads are correct. 3. Replacement of the MSS may be required. Contact L-3 Customer Service before removal of the unit.

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Table 4-1: Troubleshooting

SYMPTOMS	CAUSE / CORRECTIVE ACTIONS
<p>“NO DATA” on the connected displays (traffic, weather, or PED).</p> <p>ADS-B fail indicator lamp is Flashing at a slow rate. Flashing continues 2 min before the lamp stays ON.</p> <p>No ADS-B Coverage lamp is ON. Or CP-2500 (if installed) showing “No ADS-B Coverage”.</p> <p>A GPS Init message is displayed on the CP-2500.</p> <p>(Note: after 2 min the CP-2500 message changes to ADS-B Fail)</p> <p>An approved weather display may have the following functionality: A solid lamp and Amber box "ADS-B" is shown on the display.</p>	<p>GPS-Acquiring (On Ground – no previous position fix)</p> <ol style="list-style-type: none"> 1. Check the GPS antenna location and ensure the aircraft is not inside the hangar or the GPS repeater is operational and operational, GPS antenna is exposed to clear sky. 2. Check if 12V power is available at GPS antenna port, when the unit is powered on. 3. Verify that the GPS and UAT antennas cables are not reversed on the MSS. 4. Observe the GPS Data Message for Antenna cable related issues using the MPC Fault Log. Fix indicated issues. 5. Observe the GPS Receiver Information MPC (Service – GPS) for correct signal strength (C/No) of the GPS satellites. This has a range from 30dB to 50dB. If this is not the case, then check if the antenna cable loss is more than 10dB. 6. If problem continues contact L-3 Customer Service before removal of the unit or other equipment. <p align="center">NOTE</p> <p align="center">GPS requires approximately 60 to 90 seconds to provide a position after power is applied to MSS.</p>
<p>Information was showing, but is now missing on the weather or PED display.</p> <p>ADS-B fail indicator lamp is Flashing (1 sec ON and 1 sec OFF).</p> <p>A GPS Init message is displayed on the CP-2500 (if installed).</p> <p>An approved traffic display may have the following functionality: An Amber box "ADS-B" is shown on the display.</p>	<p>GPS-Acquiring (Ground or Air– previous position fix). This means only GPS data is not available however, the GPS position was available once during this power ON.</p> <ol style="list-style-type: none"> 1. Observe the GPS Data Message for Antenna cable related issues using the MPC Fault Log. Fix indicated issues. 2. Observe the GPS Receiver Information using the MPC (Service – GPS) for correct signal strength (C/No) of the GPS satellites. This shall be ranging from 30dB to 50dB. If this is not the case, then check if the antenna cable loss is more than 10dB. 3. Check if 12V power is available at GPS antenna port, when the unit is powered ON. 4. Check the GPS antenna location and ensure that the aircraft is not inside the hangar or repeater is on if inside the hangar, GPS antenna is exposed to clear sky. 5. If problem continues contact L-3 Customer Service before removal of the unit or other equipment. <p align="center">NOTE</p> <p align="center">GPS requires approximately 60 to 90 seconds to provide a position after power is applied to MSS.</p>
<p>Information is showing on the connected displays (traffic, weather, or PED).</p> <p>ADS-B fail indicator lamp is ON.</p> <p>Altitude information is missing from the control panel (if available).</p>	<p>Equipment problem.</p> <ol style="list-style-type: none"> 1. Check the equipment providing the altitude data (data is being received via Gilham Code or RS-232 depending on the installation). 2. Check that cable connections are secure. Check that connector pins have not been bent. 3. Check the MPC Fault Log. 4. Replacement of the MSS or the other equipment may be required. Contact L-3 Customer Service before removal.

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Table 4-1: Troubleshooting

SYMPTOMS	CAUSE / CORRECTIVE ACTIONS
<p>“NO DATA” showing on the connected displays (traffic, weather, or PED). ADS-B fail indicator lamp is ON. An approved traffic display may have the following functionality: Amber box "ADS-B" is shown on the display. An ADS-B Fail message is displayed on the CP-2500 (if installed).</p>	<p>Any one of the following:</p> <ul style="list-style-type: none"> • Check On/Off ADS-B Data discrete switch for proper position. • Check On/Off ADS-B Data, if available via the control panel. • Check that control panel has power applied. • GPS failure. • Configuration Module failure. • Major hardware component failure. <ol style="list-style-type: none"> 1. Observe the GPS Data Message for hardware related faults using the MPC Fault Log. 2. Observe UAT-GPS Status (using USB maintenance data port) for Hardware related faults. 3. If any hardware related faults are observed, contact L-3 Customer Service.
<p>Ownship is not displayed on other aircraft MFD, however, ownship data is displayed on the connected displays (traffic, weather, or PED). No Failures indicated on the displays and the ADS-B fail indicator lamp is OFF. No message is displayed on the CP-2500 (if installed).</p>	<p>STIF displays do not display ownship. For CDTI displays that do display ownship check the transmit path failure</p> <ol style="list-style-type: none"> 1. Verify the UAT antenna and RF cables are properly secured. 2. If problem continues contact L-3 Customer Service before removal of the unit or other equipment.
<p>Ownship is not displayed on other aircraft MFD; however, ownship data is displayed on the weather or PED display. ADS-B fail indicator lamp is ON. An approved traffic display may have the following functionality: Amber box "ADS-B" is shown on the display. An ADS-B Fail message is displayed on the CP-2500 (if installed).</p>	<p>STIF displays do not display ownship. For CDTI displays that do display ownship check transmit malfunction - Power Amplifier is providing less gain or has Failed.</p> <ol style="list-style-type: none"> 1. Observe UAT-GPS Status for hardware related faults using the MPC Fault Log. If Power Amplifier is not faulty in the status BIT, then verify the UAT antenna installation and UAT RF cable for damage/fault. 2. If Power Amplifier status is FAIL as shown in the MPC Fault Log, then contact L-3 Customer Service before removal of the unit or other equipment.

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Table 4-1: Troubleshooting

SYMPTOMS	CAUSE / CORRECTIVE ACTIONS
<p>Ownship is not displayed on other aircraft MFD, also no Ownship data on the weather display or PED display.</p> <p>ADS-B fail indicator lamp is ON.</p> <p>An approved traffic display may have the following functionality: Amber box "ADS-B" or "NO DATA" or "TRAF (MX20/GMX-200) is shown on the display</p> <p>An ADS-B Fail message is displayed on the CP-2500 (if installed).</p>	<p>STIF displays do not display ownship.</p> <p>For CDTI displays that do display ownship check transmit malfunction –UAT RF failure</p> <ol style="list-style-type: none"> 1. Observe UAT-GPS Status using the MPC Fault Log for Hardware related faults. 2. Check MPC Fault Log and look for Power Amplifier status is FAIL. Contact L-3 Customer Service before removal of the unit or other equipment. 3. If UAT Transmit failure is observed, then contact L-3 Customer Service before removal of the unit or other equipment.
<p>No targets are shown on the traffic or PED display.</p> <p>Ownship data is displayed on the connected displays (traffic, weather, or PED).</p> <p>ADS-B fail indicator lamp is OFF.</p> <p>No ADS-B Coverage lamp is ON. Or CP-2500 (if installed) showing "No ADS-B Coverage".</p>	<p>UAT non coverage area.</p> <ol style="list-style-type: none"> 1. Verify if the area is non UAT coverage area. <ul style="list-style-type: none"> • No targets are transmitting ADS-B. 2. Verify that other targets are transmitting ADS-B data. <ul style="list-style-type: none"> • No targets are within line-of-sight range of the tower. 3. Verify that other targets are within line-of-sight range. 4. Verify that antennas and cables are connected properly. If Antenna and cable are not connected. The ADS-B fail indicator lamp is ON.
<p>No targets are shown on the traffic or PED display</p> <p>Ownship data may or may not be displayed on the weather or PED display.</p> <p>ADS-B fail indicator lamp is ON.</p> <p>An approved traffic display may have the following functionality: Amber box "ADS-B" is shown on the display.</p> <p>An ADS-B Fail message is displayed on the CP-2500 (if installed).</p>	<p>Receive malfunction –UAT RF failure</p> <ol style="list-style-type: none"> 1. Observe UAT-GPS Status using the MPC Fault Log for Hardware related faults. 2. If UAT Receive failure is observed, then contact L-3 Customer Service before removal of the unit or other equipment.
<p>"NO DATA" on the weather or PED display.</p> <p>ADS-B fail indicator lamp is OFF.</p> <p>No message is displayed on the CP-2500 (if installed).</p>	<p>The FIS-B data is not being transmitted to the weather display.</p> <ol style="list-style-type: none"> 1. Weather data is broadcast every 5 minutes. After power cycle may need to wait for broadcast cycle. 2. No ground station is in range. No ADS-B Coverage lamp is ON. Or CP-2500 (if installed) showing "No ADS-B Coverage". 3. The ground station may not provide FIS-B service. 4. Check again within a known FIS-B service area. If the weather display continues to show no data, then contact L-3 Customer Service before removal of the unit or other equipment.

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Table 4-1: Troubleshooting

SYMPTOMS	CAUSE / CORRECTIVE ACTIONS
<p>ADS-B fail indicator lamp is flashing at a fast rate. A Code Mismatch message is displayed on the CP-2500 (if installed).</p>	<p>The squawk code entered into the CP-2500 control panel does not match the squawk code being transmitted by the installed transponder.</p> <ol style="list-style-type: none"> Enter the correct squawk code (the same as the transponder) into the control panel.
<p>The traffic symbols on the traffic or PED display are non-directional (diamond shape).</p>	<p>Non-directional traffic symbols on the traffic display is due to one of the following reasons:</p> <ul style="list-style-type: none"> The traffic display does not support the DTIF data format necessary to show directional data provided by ADS-B. The directional information that is being received by the MSS does not have directional data. The MSS continues to transmit non-directional data to the traffic display.
<p>Traffic or PED display is working correctly, but aircraft are not showing up on the display.</p>	<p>Lack of data as described below:</p> <ul style="list-style-type: none"> The ADS-B In requires other aircraft to be equipped with ADS-B Out. The TIS-B and ADS-R services are supported when in range of ground stations and are providing the service. If receiving the TIS-B service, but the Mode C and Mode S transponder equipped aircraft are not transmitting altitude information will not be seen on the traffic display. If receiving the TIS-B service, but aircraft not equipped with a transponder, or equipped with a Mode A transponder are not part of the TIS-B data and will not be seen on the traffic display. Check the cable connections between the UAT L-band antenna and the unit. UAT L-band antenna may not be operational. Contact L-3 Customer Service before removal.

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4.4 USING THE MAINTENANCE PC

The Maintenance PC (MPC) and NGT Maintenance Application Tool (NGT MAT) are used to interface with the NGT-2000/2500 to load software/firmware/, view factory / version data, retrieve fault logs, data recording, and simulating live data.

These procedures assume the following:

- Power is being supplied to the MSS and system components (i.e. antenna, display, and controllers).
- The correct NGT MAT software is being used to load software. See the General Information section (Software Versions) for software details.
- The NGT MAT is active on the MPC.
- The MPC is connected to the unit via the USB interface
- The MPC and unit are communicating.

Additional instructions on using the MPC are given in the Installation Checkout section.

4.4.1 Load Software

This procedure is used to update the system software used by the NGT-2000/2500.

1. Ensure that the MPC and MSS are in Maint Mode by viewing the NGT MAT status bar. Press the Request Maint Mode button on the bottom of the page to change the mode. **Confirm that Maint Mode is active on the NGT MAT (see lower status bar).**
2. From the NGT MAT select Update→Load Software. See Figure 4-1.
3. Press the Browse button to open a file window and select the composite binary file.
 - **If the NGT MAT fails to validate the composite binary file, then the "Status" field will contain the error (highlighted in red).**
4. Press the Upload button to begin loading the software. **A progress bar is shown for each SW load.**
5. An upload completed message is shown when the procedure has finished.
 - A failure message is shown if a problem loading the software is detected. Check that the file being loaded is correct and try the procedure again. If the problem persists cycle power to the unit.
6. When the procedures are complete cycle power to the NGT-2000/2500 system and perform a functional check (paragraph 4.5.1.4) to verify unit is functioning correctly. Verify the software Load by going to the configuration page of the Mat tool, see Figure 4-1. Refer to the Fault Isolation section if errors are detected.

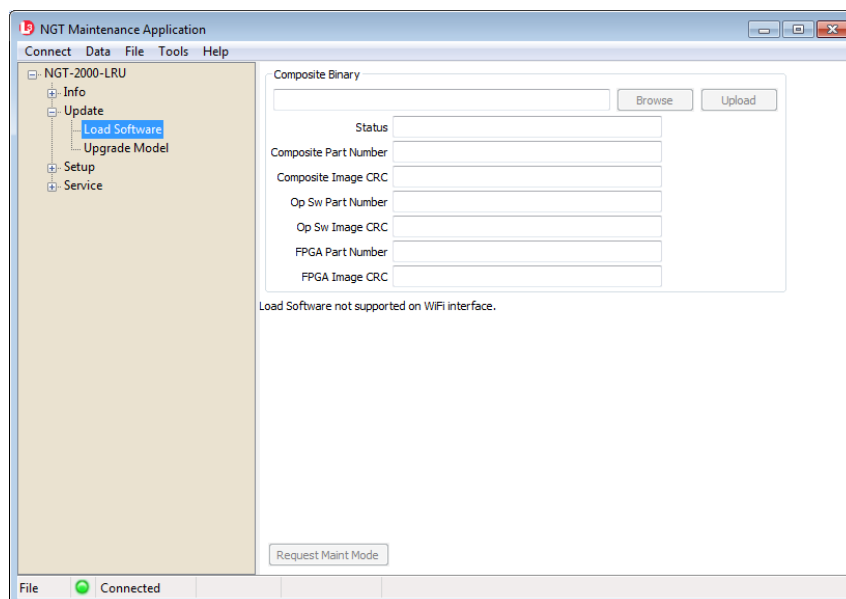


Figure 4-1 Software Loading

4.4.2 View or Retrieve Data

Use the NGT MAT to view versions and factory information and retrieve fault logs. See Figure 4-2. The versions data and fault log can be saved to a file for later viewing or loading.

The Versions page shows the current software versions on the unit. Buttons on the bottom of the page provide the user the options of 'Refresh', 'Save', and 'Load'.

The Fault Log can be used for troubleshooting. Each fault is entered on its own indexed row, with details for date, time, etc. Clicking on a row provides the user with additional information at the top of the page. This information includes a fault description. Buttons on the bottom of the page provide the user the options of 'Refresh', 'Clear', 'Filter', 'Save', 'Load', and 'Export to CSV'. The fault data can be cleared at the option of the user.

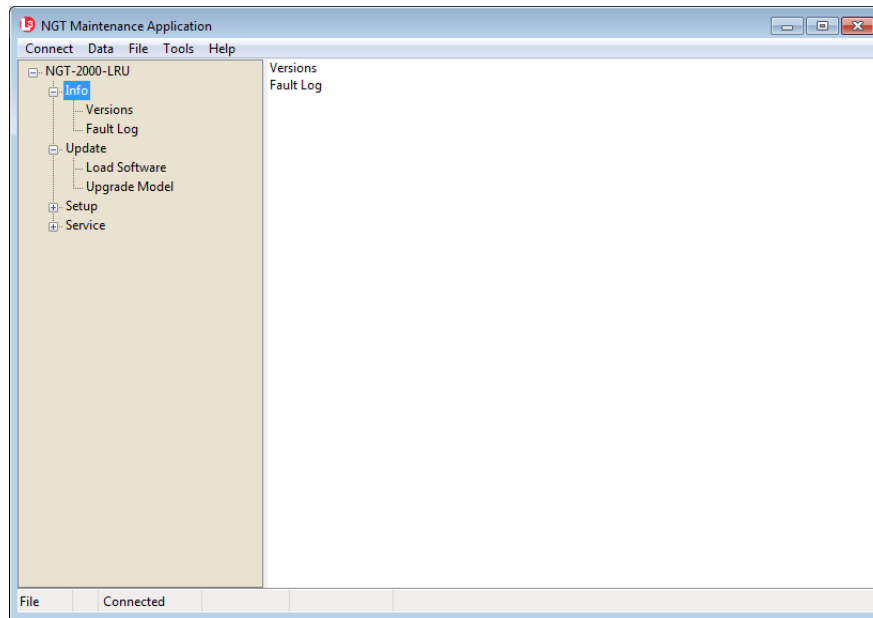


Figure 4-2 NGT MAT- Information

4.4.3 Configuration Restore

This procedure is used to automatically fill in the configuration options from a backup file. See Figure 4-3. Perform the following procedure using a MPC and NGT MAT. This procedure assumes that the unit is in Maintenance Mode and the MPC is interfaced to the unit using either the USB.

1. From the NGT MAT select Setup → Configuration → Restore.
2. Click on the Load button to 'Load a Pre-Existing Configuration File' to load the configuration options windows. After the file is loaded into the NGT MAT, open a configuration window and click on the Apply button to finish the update to the unit (see Note below). See instructions given in the Installation Checkout section.

NOTE

The Tail Number and Mode S Identifier are unique for every aircraft. From the NGT MAT select Setup → Configuration → Modify → Aircraft and enter the new data before pressing the Apply button.

3. Validate the restoration of the configuration options by comparing the configuration data in the setup pages with the log sheet for configuration and checkout created during initial installation.

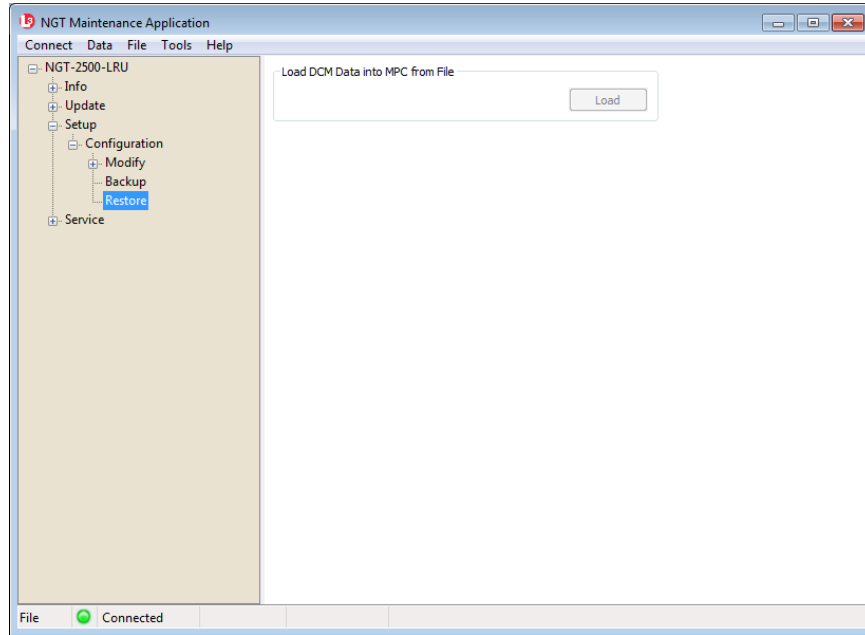


Figure 4-3: NGT MAT – Restore Configuration

4.4.4 Service

This procedure is used to service and troubleshoot the NGT-2000/2500. See Figure 4-4. The Live Data function is used for troubleshooting. Instructions on how to use live data are located in the Installation Checkout section.

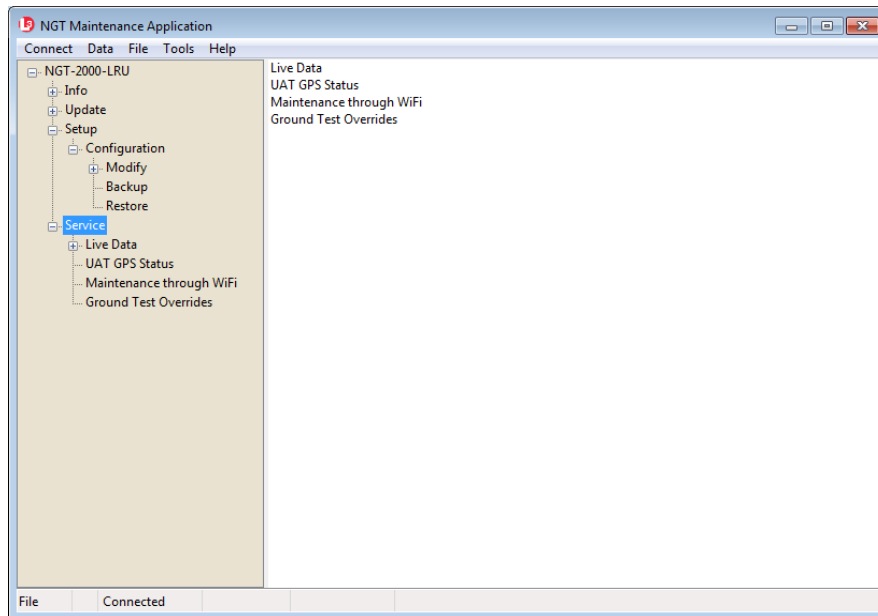


Figure 4-4: NGT MAT – Service

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4.5 RETURN TO SERVICE

Use this section to validate the return to service of the NGT-2000/2500 and system components.

4.5.1 NGT-2000/2500

Use this procedure to remove and replace the NGT-2000/2500. The instructions herein are generic in scope. The best established methods, techniques and practices should be used where no specific procedure is given.

1. Removal Procedure

- a. Ensure power to the unit is off.
- b. Remove mating connector P2
- c. Disconnect GPS and UAT L-band antenna connectors.
- d. Loosen (4) screws.
- e. Remove the unit from aircraft.

2. Installation Procedure

- a. Ensure aircraft power is off.
- b. Carefully place the unit in aircraft.
- c. Connect mating connector P2.
- d. Connect GPS and UAT L-band antenna. Be careful not to reverse those two antennas, as both are TNC type connectors.
- e. Secure the unit using (4) screws.

3. Functional Check Procedure

- a. Apply power to the aircraft and the unit.
- b. Configuration data is automatically loaded from the DCM.
- c. Ensure no failure messages are annunciated on the controller/display/PED and fail lamp is OFF after GPS has acquired a signal.
- d. Perform the checkout procedure provided in the installation checkout to verify unit is functioning correctly.
 - Refer to the fault isolation section if errors are detected.

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4.5.2 Configuration Module

Use this procedure to remove and replace the configuration module. The instructions herein are generic in scope. The best established methods, techniques and practices should be used where no specific procedure is given.

1. Removal Procedure
 - a. Disconnect P2 mating connector.
 - b. From the wire bundle remove tie wrap securing overbraid. Refer to installation section for details on the P2 cable assembly.
 - c. Slide overbraid to expose module.
 - d. Remove module contacts from the P2 mating connector.

2. Installation Procedure
 - a. Insert contacts of new module into P2 mating connector.
Refer to installation guidelines for the module in the installation section for details on the module.
 - b. Slide overbraid back into position, and use a new tie wrap to secure overbraid.
 - c. Connect mating connector P2.

3. Functional Check Procedure
 - a. Cycle power to the NGT-2000/2500 system.
 - b. Use the installation checkout section to perform the select configuration options procedure or use the maintenance sections configuration restore if the original configuration (.bin) file can be retrieved from the original installer of the configuration module. If the original files cannot be obtained use the log sheets in appendix C to help generate the information needed.
 - c. Perform the checkout procedure provided in the installation checkout to verify unit is functioning correctly.
 - Refer to the fault isolation section if errors are detected.

4.5.3 L-Band (UAT) Antenna

1. Refer to the aircraft manufacturer's data and the antenna manufacturer's installation instructions to remove and replace the antenna(s).
 - a. Perform the checkout procedure provided in the installation checkout to verify unit is functioning correctly.
 - Refer to the fault isolation section if errors are detected.

4.5.4 GPS Antenna

1. Refer to the aircraft manufacturer's data and the antenna manufacturer's installation instructions to remove and replace the antenna(s).
 - a. Perform the checkout procedure provided in the installation checkout to verify unit is functioning correctly.
 - Refer to the fault isolation section if errors are detected.

4.6 DISPOSITION OF FAILED ITEMS

1. The NGT-2000/2500 can only be repaired by a FAA Certified Repair Station Facility.
2. The configuration module cannot be repaired and must be replaced.
3. Return defective components to:

L-3 Avionics Systems
Attn: Customer Service
5353 52nd Street, S.E.
Grand Rapids, MI USA 49512-9704
4. Refer to the **manufacturer's** data for external displays, **controllers,** and antennas interfaced to the NGT-2000/2500.
5. If available, pack components in their original shipping container. If the original container is not available, pack them as follows:

CAUTION

Do not use desiccant crystals when packaging electronic assemblies. Since the assembly must be packed tightly, crystals in bag form cannot be used. The use of loose crystals may cause unnecessary damage resulting in a cleaning problem.

- a. Ensure that conductive covers/caps are installed on the exposed terminals of connector, if applicable.
- b. LRU's that are marked as electrostatic discharge sensitive (ESDS) must be wrapped in static protective materials.
- c. Wrap with bubble pack. Secure bubble pack with reinforced tape.
- d. Place assembly in a cardboard box.
- e. Wrap any accessories in tissue and place in the box. Fill spaces with bubble pack.
- f. Place an explanation letter in the box with the following information.**
 - Your name, address, and telephone number.
 - Purchase order number.
 - Description of component including, when applicable, model and serial number.
 - A brief description of the difficulty.
- g. Shut box, and seal with reinforced tape.
- h. Attach packing list to outside of box.

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Appendix A

NGT-2000/2500 Interface

Signal Name & Cable Characteristics

A.1 INTRODUCTION

This appendix defines the electrical characteristics of all input and output signal names to the NGT-2000/2500 Multilink Surveillance System. Sufficient data is included to use a bus reader for the purpose of identifying signal input and output characteristics and perform an electrical load analysis for the aircraft. The input and output interfaces are sometimes configurable as noted in the following paragraphs. The interface characteristics contained in this appendix are fully compatible with ARINC specifications where noted. Connection information identifies the connector-pin and signal names as shown on the external interconnect wiring diagram in the installation section.

A.2 INPUT AND OUTPUT INTERFACES

A.2.1 Input Power

The unit has two power inputs available for either +14 VDC or +28VDC operation (+9 to 36 VDC). Both inputs are diode isolated within the unit and can transition between power inputs without interruption to operation.

A.2.2 I²C Serial Bus (Configuration Module)

The I²C serial bus is used to communicate with the configuration module to store configuration options. See Appendix C for a listing of options.

A.2.3 RF Suppression Bus

The transmission asserts a positive voltage on the output to provide the suppression to other L-band equipment on the airplane. The suppression pulse output is DC coupled, and drives positive pulses not less than 18 Vdc or greater than 70 Vdc into system loads from 300 to 2000 Ohms with a shunt capacitance of up to 1850 pF. The signal meets the hardware characteristics as defined in ARINC 735B Attachment 8.

A.2.4 Gillham Input (Altitude Input)

The Gillham interface is optional. Only one altimeter input source (gray code or RS-232) should be connected. The Gillham interface consists of 11 discrete lines that are compliant with ARINC 718 requirements. These 11 discrete lines represent 11 binary digits representing the Gillham encoded pressure altitude. The Gillham code uses a modified Gray code algorithm to ensure that no more than one bit changes between adjacent altitudes. The three lowest significant bits represent 100 foot increments. The eight highest significant bits represent 500 foot increments.

The digits are labeled as follows beginning with the most significant bit to the least significant bit (D2, D4, A1, A2, A4, B1, B2, B4, C1, C2, & C4).

A.2.5 ARINC 429 Output

The unit has one ARINC 429 Output that transmits data at high (100 kbps). ARINC 429 output is only available via the NGT-2500 system. The NGT-2500 interfaces to a traffic display over the ARINC 429 bus using the standard traffic display (STIF) format as defined in ARINC 735 and the Display Traffic Information File (DTIF) as described in ARINC 735B. The specific display format is configurable through the configuration module.

A.2.5.1 ARINC 429 Output Labels

The following ARINC 429 labels are output to a Traffic Display on Bus #1:

- Label 13 - Control Panel Set
- Label 15 - Altitude Select Limits
- Label 16 - TCAS Mode/Sens
- Label 110 - Own Aircraft Latitude – Coarse
- Label 111 - Own Aircraft Longitude – Coarse
- Label 120 - Own Aircraft Latitude – Fine
- Label 121 - Own Aircraft Longitude – Fine
- Label 130 - Intruder Range
- Label 131 - Intruder Altitude
- Label 132 - Intruder Bearing
- Label 270 - Vert. Res. Adv.
- Label 274 - Selected Sensitivity Level (same as TXWORD 2)
- Label 203 - Own Aircraft Altitude (Uncorrected)
- Label 357 - RTS
- Label 350 - Maintenance
- Label 357 - ETX
- Label 377 - Equipment ID

A.2.6 Discrete Input

The NGT-2000/2500 has 4 discrete inputs that are set to GND/Open.

The discrete inputs provide 1.0 ± 0.25 mA of current when the input is grounded. The input is in the ground state when input voltage is less than or equal to 3.5Vdc, or there is less than 10 Ohms impedance to ground. The input is in the open state when the input voltage is greater than or equal to 18.0Vdc, or there is greater than 100K Ohms impedance to ground. The discrettes are dedicated or reserved as stated below:

- Discrete 2 is used for IDENT command which is used to signal the NGT-2000/2500 to identify itself with a unique 4-digit octal code. The discrete is set to GND/Open. Active position indicates IDENT transmitted.
- Discrete 3 is used for On Ground status which used to determine whether ownership is in air or on ground. The discrete is set to GND/Open. The active position indicates aircraft On Ground.
- Discrete 4 is used to turn ON/OFF the MSS Transmit function.

A.2.7 Discrete Output

The NGT-2000/2500 has 4 discrete outputs that are set to GND/Open.

The ground logic state has an output voltage of < 3.0Vdc when sinking 250mA of current. The open logic state has an output impedance of > 100K ohms to ground for voltages applied to the output of 0.0 to 36.0Vdc.

- Discrete 1 is used for ADS-B Failure. The discrete is set to GND/Open.
- Discrete 2 is used for RF suppression. The discrete is set to GND/Open.
- Discrete 4 is used for **No ADS-B Coverage**. The discrete is set to GND/Open.

A.2.8 RS-422 Interface

The RS-422 is a serial interface transmitting data from the NGT-2500 to an external weather display or traffic display. This interface is optional depending on the installation. The data parameters are dependent on the options set in the configuration module.

A.2.9 RS-232 Interface

The RS-232 is a serial interface used to receive and transmit altitude data, interface with Control Panel, and interface with Wi-Fi Device. This interface is optional depending on the installation.

A.2.9.1 RS-232 WiFi Output

The RS-232 WiFi interface is optional. When configured the NGT-2000/2500 outputs the following information to a WiFi connection:

- FIS-B Weather Data
- ADS-B Traffic Data
- Ownship Data

A.2.9.1.1 Compatible PED Interconnect Layout

Figure A-1 provides interconnect information for the RN370M PED Accessory.

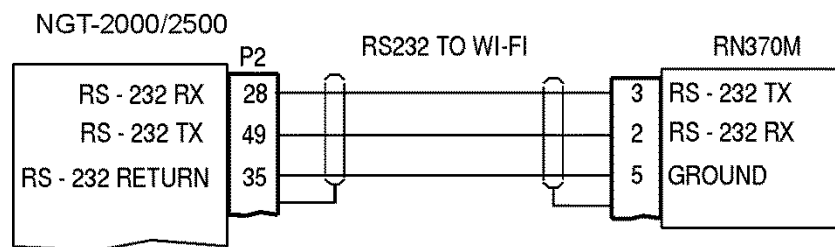


Figure A-1: RN370M Interconnect Option for RS-232 to WiFi Converter

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A.3 PIN DEFINITION SUMMARY

Table A-1: Connector (P1) Pin Assignments

Pin	Function Name	Type*	Pin	Function Name	Type*
1	NO CONNECTION	G	32	DISC 1 IN RESERVED	R
2	RS-422 INPUT A (-) FIS-B (NGT-2500 ONLY)	I	33	NO CONNECTION	
3	RS-422 INPUT B (+) FIS-B (NGT-2500 ONLY)	I	34	GILLHAM ALTITUDE ENCODER (A4)	I
4	3.3V RETURN FOR DCM (BLACK)	C	35	GROUND	S
5	RS-232 RX – CONTROL PANEL	I	36	GILLHAM ALTITUDE ENCODER (C2)	I
6	A429 OUT B (+) TRAFFIC DISPLAY (NGT-2500 ONLY)	O	37	DISC 3 OUT RESERVED	R
7	RS-232 IN - ALTITUDE ENCODER	I	38	NO CONNECTION	S
8	NO CONNECTION	S	39	RESERVED	R
9	I2C DATA LINE FOR DCM (YELLOW)	B	40	NO CONNECTION	S
10	RESERVED	R	41	14/28 V POWER RETURN 1	C
11	RF SUPPRESSION I/O	B	42	+14/28VDC POWER IN 2	P
12	GILLHAM ALTITUDE ENCODER (D2)	I	43	RESERVED	R
13	GILLHAM ALTITUDE ENCODER (A1)	I	44	RESERVED	R
14	GILLHAM ALTITUDE ENCODER (B1)	I	45	RESERVED	R
15	GILLHAM ALTITUDE ENCODER (B4)	I	46	NO CONNECTION	S
16	GILLHAM ALTITUDE ENCODER (C4)	I	47	RESERVED	R
17	DISC 1 OUT – ADS-B FAIL INDICATOR	O	48	NO CONNECTION	S
18	NO CONNECTION	S	49	RS-232 OUT – WIFI	O
19	NO CONNECTION	S	50	3.3V OUTPUT FOR DCM (RED)	O
20	NO CONNECTION	S	51	I2C CLOCK LINE FOR DCM (GREEN)	I
21	+14/28VDC POWER IN 1	P	52	DISC 2 IN - IDENT	I
22	RS-422 OUTPUT A (-) FIS-B (NGT-2500 ONLY)	O	53	DISC 3 IN – WEIGHT ON WHEELS / AIR SPEED MONITOR	I
23	RS-422 OUTPUT B (+) FIS-B (NGT-2500 ONLY)	O	54	GILLHAM ALTITUDE ENCODER (D4)	I
24	NO CONNECTION	S	55	GILLHAM ALTITUDE ENCODER (A2)	I
25	RS-232 TX – CONTROL PANEL	B	56	GILLHAM ALTITUDE ENCODER (B2)	I
26	A429 OUT A (-) TRAFFIC DISPLAY (NGT-2500 ONLY)	O	57	GILLHAM ALTITUDE ENCODER (C1)	I
27	NO CONNECTION	S	58	NO CONNECTION	S
28	RS-232 IN – WIFI	I	59	DISC 4 OUT – NO ADS-B COVERAGE	O
29	NO CONNECTION	S	60	NO CONNECTION	S
30	DISC #4 - MSS TRANSMIT ON/OFF	I	61	NO CONNECTION	S
31	NO CONNECTION	S	62	14/28 V POWER RETURN 2	C

* Signal Types: I = Signal Input O = Signal Output B = Bidirectional Signal P = Power Input
 C = Common or Ground S = Spare Pin R = Reserved (Do Not Connect)

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A.4 CONNECTOR [J2]

PIN 1

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

PIN 2

Signal Name:	RS422_RX2A
Signal Function:	RS-422 FIS-B Input
Electrical Characteristics:	Data bits 8, Parity none, Stop bit 1, Start bit 1, Data format is ASCII, Flow control is none.
Connection:	Optional. 22 AWG twisted shielded pair wire
Comments:	See paragraph A.2.6.

PIN 3

Signal Name:	RS422_RX2B
Signal Function:	RS-422 FIS-B Input
Electrical Characteristics:	Data bits 8, Parity none, Stop bit 1, Start bit 1, Data format is ASCII, Flow control is none.
Connection:	Optional. 22 AWG twisted shielded pair wire.
Comments:	See paragraph A.2.6.

PIN 4

Signal Name:	DCM GND
Signal Function:	SGND Serial Ground
Electrical Characteristics:	See paragraph A.2.9
Connection:	Configuration Module – Black wire
Comments:	

PIN 5

Signal Name:	RS232_RX
Signal Function:	RS-232 Control Panel Interface
Electrical Characteristics:	Data bits 8, Parity none, Stop bit 1, Start bit 1, Data format is ASCII, Flow control is none. Baud Rate: (configuration option) 1200, 2400, or 9600 bps. Depending on the equipment manufacturer
Connection:	22 AWG twisted shielded pair wire.
Comments:	See paragraph A.2.5.

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PIN 6

Signal Name:	TX_429B (ARINC 429_OUT B)
Signal Function:	ARINC 429 Output for traffic display
Electrical Characteristics:	High Speed ARINC 429 (100 kbps)
Connection:	22 AWG twisted shielded pair wire
Comments:	See paragraph A.2.1

PIN 7

Signal Name:	RS232_RX
Signal Function:	Altitude Encoder RS-232 RX
Electrical Characteristics:	Data bits (configuration option) 7 or 8, Parity none, Stop bit 1, Start bit 1, Data format is ASCII, Flow control is none. Baud Rate: (configuration option) 1200, 2400, 4800, 9600, 12000, 19200, 28800, 38400, 57600, or 115200 bps. Depending on the equipment manufacturer.
Connection:	22 AWG twisted shielded pair wire
Comments:	See paragraph A.2.5

PIN 8

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

PIN 9

Signal Name:	DCM SDA
Signal Function:	SDA Serial Data
Electrical Characteristics:	See paragraph A.2.9.
Connection:	Configuration Module – Yellow wire
Comments:	

PIN 10

Signal Name:	RESERVED
Signal Function:	DISC_OUT 3
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

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PIN 11

Signal Name:	SUPPR_BUS
Signal Function:	RF suppression input (DISC_OUT 2)
Electrical Characteristics:	
Connection:	Aircraft Suppression Bus. 22 AWG twisted shielded wire
Comments:	See paragraph A.2.3

PIN 12

Signal Name:	EXT_ALT_ENCODER[11]
Signal Function:	Gillham Altitude Encoder (D2)
Electrical Characteristics:	+30 V input max, < 1 mA sourced per line Frequency: 20 Hz, Source Z: > 10 k ohm per line Max Capacitance: < 20 pF per line
Connection:	22 AWG wire
Comments:	See paragraph A.2.4

PIN 13

Signal Name:	ALT_IN_A1
Signal Function:	Gillham Altitude Encoder (A1)
Electrical Characteristics:	+30 V input max, < 1 mA sourced per line Frequency: 20 Hz, Source Z: > 10 k ohm per line Max Capacitance: < 20 pF per line
Connection:	22 AWG wire
Comments:	See paragraph A.2.4

PIN 14

Signal Name:	ALT_IN_B1
Signal Function:	Gillham Altitude Encoder (B1)
Electrical Characteristics:	+30 V input max, < 1 mA sourced per line Frequency: 20 Hz, Source Z: > 10 k ohm per line Max Capacitance: < 20 pF per line.
Connection:	22 AWG wire
Comments:	See paragraph A.2.4

PIN 15

Signal Name:	ALT_IN_B4
Signal Function:	Gillham Altitude Encoder (B4)
Electrical Characteristics:	+30 V input max, < 1 mA sourced per line Frequency: 20 Hz, Source Z: > 10 k ohm per line Max Capacitance: < 20 pF per line.
Connection:	22 AWG wire
Comments:	See paragraph A.2.4

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PIN 16

Signal Name:	ALT_IN_C4
Signal Function:	Gillham Altitude Encoder (C4)
Electrical Characteristics:	+30 V input max, < 1 mA sourced per line Frequency: 20 Hz, Source Z: > 10 k ohm per line Max Capacitance: < 20 pF per line
Connection:	22 AWG wire
Comments:	See paragraph A.2.4

PIN 17

Signal Name:	DISC_OUT1 (Discrete Output No. 1)
Signal Function:	ADS-B Fail Indicator
Electrical Characteristics:	GND/Open (GND active) Ground State < 3.0Vdc when sinking 250mA. Open State has an impedance of >100K ohms to ground for voltages applied to the output of 0.0 to 36.0Vdc.
Connection:	Indicator Lamp. 22 AWG wire
Comments:	See paragraph A.2.8

PIN 18

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

PIN 19

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

PIN 20

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

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PIN 21

Signal Name:	PWR_14_28VDC_IN
Signal Function:	+ 14/28 VDC Power IN 1
Electrical Characteristics:	8.9 watts nominal, 10.1 watts MAX
Connection:	Aircraft 28V BUS. 22 AWG wire
Comments:	

PIN 22

Signal Name:	RS-422 Low
Signal Function:	RS-422 FIS-B Output
Electrical Characteristics:	Data bits 8, Parity none, Stop bit 1, Start bit 1, Data format is ASCII, Flow control is none. Baud Rate: (configuration option) 38400, 57600, or 115200. Depending on the equipment manufacturer
Connection:	Optional. 22 AWG twisted shielded pair wire
Comments:	See paragraph A.2.6.

PIN 23

Signal Name:	RS-422 High
Signal Function:	RS-422 FIS-B Output
Electrical Characteristics:	Baud Rate: (configuration option) 38400, 57600, or 115200. Depending on the equipment manufacturer
Connection:	Optional. 22 AWG twisted shielded pair wire.
Comments:	See paragraph A.2.6.

PIN 24

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

PIN 25

Signal Name:	RS232_TX
Signal Function:	RS-232 Control Panel Interface
Electrical Characteristics:	Data bits 8, Parity none, Stop bit 1, Start bit 1, Data format is ASCII, Flow control is none. Baud Rate: (configuration option) 1200, 2400, or 9600 bps. Depending on the equipment manufacturer
Connection:	22 AWG twisted shielded pair wire
Comments:	See paragraph A.2.5.

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PIN 26

Signal Name:	TX_429A (ARINC 429_OUT A)
Signal Function:	ARINC 429 Output for traffic display
Electrical Characteristics:	High Speed ARINC 429 (100 kbps)
Connection:	22 AWG twisted shielded pair wire
Comments:	See paragraph A.2.1

PIN 27

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

PIN 28

Signal Name:	RS232_RX
Signal Function:	RS-232 PED/Wi-Fi Device
Electrical Characteristics:	Data bits 8, Parity none, Stop bit 1, Start bit 1, Data format is ASCII, Flow control is none. Baud Rate: 115200 bps.
Connection:	Optional. 22 AWG twisted shielded pair wire
Comments:	See paragraph A.2.5.

PIN 29

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

PIN 30

Signal Name:	EXT_ADSB_ON_OFF
Signal Function:	Discrete Input. MSS Transmit ON/OFF
Electrical Characteristics:	Open = Invalid, = +27.5 Vdc at the input OR a resistance of greater than 100k Ohms to ground. Ground = Valid, < 3.5 Vdc at the input OR a resistance of less than 10 Ohms to ground.
Connection:	22 AWG twisted shielded pair wire
Comments:	See paragraph A.2.5.

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PIN 31

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

PIN 32

Signal Name:	DISC_IN1 (Discrete Input No. 1)
Signal Function:	Audio Mute (Future Option)
Electrical Characteristics:	GND/Open (GND active) Ground State < 3.5Vdc, Open State ≥ 18Vdc
Connection:	Momentary Switch. 22 AWG wire
Comments:	See paragraph A.2.7

PIN 33

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

PIN 34

Signal Name:	ALT_IN_A4
Signal Function:	Gillham Altitude Encoder (A4)
Electrical Characteristics:	+30 V input max, < 1 mA sourced per line Frequency: 20 Hz, Source Z: > 10 k ohm per line Max Capacitance: < 20 pF per line
Connection:	See paragraph A.2.4 22 AWG wire
Comments:	

PIN 35

Signal Name:	RS-232 RETURN
Signal Function:	Signal Ground
Electrical Characteristics:	Electrical Ground
Connection:	Black wire
Comments:	See paragraph A.2.5.

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PIN 36

Signal Name:	ALT_IN_C2
Signal Function:	Gillham Altitude Encoder (C2)
Electrical Characteristics:	+30 V input max, < 1 mA sourced per line Frequency: 20 Hz, Source Z: > 10 k ohm per line Max Capacitance: < 20 pF per line.
Connection:	22 AWG wire
Comments:	See paragraph A.2.4.

PIN 37

Signal Name:	DISC_OUT3 (Discrete Output No. 3)
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

PIN 38

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

PIN 39

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

PIN 40

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

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PIN 41

Signal Name:	Ground
Signal Function:	14/28 V Power Return 1
Electrical Characteristics:	-----
Connection:	Aircraft 28V Return BUS. 22 AWG wire
Comments:	

PIN 42

Signal Name:	PWR_14_28Vdc_IN
Signal Function:	+ 14/28 Vdc Power IN 2
Electrical Characteristics:	8.9 watts nominal, 10.1 watts MAX
Connection:	Aircraft 14/28V BUS. 22 AWG wire
Comments:	

PIN 43

Signal Name:	Audio Ground
Signal Function:	Audio Out 600 Ohm L
Electrical Characteristics:	Ground
Connection:	Audio Panel. 22 AWG twisted shielded pair wire
Comments:	Future Option

PIN 44

Signal Name:	AUDIO OUT #1
Signal Function:	Audio Out 4-600 Ohm H
Electrical Characteristics:	40 milli Watts (RMS) at 1000 Hz into a 600 Ohm audio distribution system.
Connection:	Audio Panel. 22 AWG twisted shielded pair wire
Comments:	Future Option

PIN 45

Signal Name:	AUDIO Out #2
Signal Function:	Audio Out 4-600 Ohm
Electrical Characteristics:	40 milli Watts (RMS) at 1000 Hz into a 600 Ohm audio distribution system.
Connection:	SPARE
Comments:	Future Option

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PIN 46

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

PIN 47

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

PIN 48

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

PIN 49

Signal Name:	RS232_TX
Signal Function:	RS-232 PED/Wi-Fi Device
Electrical Characteristics:	Data bits 8, Parity none, Stop bit 1, Start bit 1, Data format is ASCII, Flow control is none. Baud Rate: 115200 bps.
Connection:	Optional. 22 AWG twisted shielded pair wire
Comments:	See paragraph A.2.5

PIN 50

Signal Name:	DCM 3.3V
Signal Function:	SPWR Serial Power (3.3 Vdc Power), 50ma max
Electrical Characteristics:	See paragraph A.2.9
Connection:	Configuration Module – red wire
Comments:	

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PIN 51

Signal Name:	DCM SCL
Signal Function:	SCL Serial Clock
Electrical Characteristics:	See paragraph A.2.9
Connection:	Configuration Module – green wire
Comments:	

PIN 52

Signal Name:	DISC_IN2 (Discrete Input No. 2)
Signal Function:	IDENT
Electrical Characteristics:	GND/Open (GND active) Ground State < 3.5Vdc, Open State ≥ 18Vdc
Connection:	Momentary Switch. 22 AWG wire
Comments:	See paragraph A.2.7

PIN 53

Signal Name:	DISC_IN3 (Discrete Input No. 3)
Signal Function:	Gear/Squat Air Speed Monitor
Electrical Characteristics:	GND/Open (GND active) Ground State < 3.5Vdc, Open State ≥ 18Vdc
Connection:	22 AWG wire. On/Off Switch
Comments:	See paragraph A.2.7.

PIN 54

Signal Name:	ALT_IN_D4
Signal Function:	Gillham Altitude Encoder
Electrical Characteristics:	+30 V input max, < 1 mA sourced per line Frequency: 20 Hz, Source Z: > 10 k ohm per line Max Capacitance: < 20 pF per line
Connection:	22 AWG wire
Comments:	See paragraph A.2.4.

PIN 55

Signal Name:	ALT_IN_A2
Signal Function:	Gillham Altitude Encoder (A2)
Electrical Characteristics:	+30 V input max, < 1 mA sourced per line Frequency: 20 Hz, Source Z: > 10 k ohm per line Max Capacitance: < 20 pF per line
Connection:	22 AWG wire
Comments:	See paragraph A.2.4.

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PIN 56

Signal Name:	ALT_IN_B2
Signal Function:	Gillham Altitude Encoder (B2)
Electrical Characteristics:	+30 V input max, < 1 mA sourced per line Frequency: 20 Hz, Source Z: > 10 k ohm per line Max Capacitance: < 20 pF per line.
Connection:	22 AWG wire
Comments:	See paragraph A.2.4.

PIN 57

Signal Name:	ALT_IN_C1
Signal Function:	Gillham Altitude Encoder (C1)
Electrical Characteristics:	+30 V input max, < 1 mA sourced per line Frequency: 20 Hz, Source Z: > 10 k ohm per line Max Capacitance: < 20 pF per line.
Connection:	22 AWG wire
Comments:	See paragraph A.2.4.

PIN 58

Signal Name:	DISC_OUT4 (Discrete Output No. 4)
Signal Function:	No ADS-B Coverage
Electrical Characteristics:	GND/Open (GND active) Ground State < 3.0Vdc when sinking 250mA. Open State has an impedance of >100K ohms to ground for voltages applied to the output of 0.0 to 36.0Vdc.
Connection:	Indicator Lamp. 22 AWG wire
Comments:	See paragraph A.2.8.

PIN 59

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

PIN 60

Spare	Signal Name:
Spare pin	Signal Function:
---	Electrical Characteristics:
No Connection	Connection:
	Comments:

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PIN 61

Signal Name:	Spare
Signal Function:	Spare pin
Electrical Characteristics:	---
Connection:	No Connection
Comments:	

PIN 62

Signal Name:	Ground
Signal Function:	14/28 V Power Return 1
Electrical Characteristics:	----
Connection:	Aircraft 14/28V Return BUS
Comments:	

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Appendix B

Environmental Qualification Form

B.1 INTRODUCTION

This appendix includes the environmental qualifications form required for the NGT-2000/2500 Multilink Surveillance System and Configuration Module.

B.2 ENVIRONMENTAL QUALIFICATION FORM

(Reference Document 8008647 Rev.G-5)

PRODUCT DESCRIPTION: Multilink Surveillance System
MODEL: NGT-2000/2500
PART NO.: 9022500-10000
MANUFACTURER: Aviation Communication and Surveillance Systems
ADDRESS: ACSS 19810 N. 7th Avenue Phoenix, AZ 85027-4741

PRODUCT DESCRIPTION:: Configuration Module
PART NUMBERS: 9230-17003-01
MANUFACTURER: Aviation Communication and Surveillance Systems
ADDRESS: ACSS 19810 N. 7th Avenue Phoenix, AZ 85027-4741

REVISION & CHANGE NUMBER OF DO-160: G

CONDITION	SECTION/PARAGRAPH	TEST DESCRIPTION
Temperature and Altitude	4.0	Equipment tested to Category B2.
Low Temperature	4.5.1&4.5.2	Equipment tested to Category B2.
High Temperature	4.5.3&4.5.4	Equipment tested to Category B2.
In-Flight Loss of Cooling	4.5.4	Equipment Not Tested, External Cooling Not Required
Altitude	4.6.1	Tested Operating Altitude of 25,000' B2
Decompression	4.6.2	N/A
Overpressure	4.6.3	N/A
Temperature Variation	5.0	Equipment tested to Category B.
Humidity	6.0	Equipment tested to Category B.
Operational Shocks, and Crash Safety	7.0	Except Operation Shock tested to 20G's Category B2.
Vibration	8.0	For fixed wing, Cat S Curve L and

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CONDITION	SECTION/PARAGRAPH	TEST DESCRIPTION
		Cat R Curve C/C1. For Helicopter, Cat U2 Curve F/F1
Explosion Proofness	9.0	Equipment tested to Category X. No test performed.
Waterproofness	10.0	Equipment tested to Category X. No test performed.
Fluids Susceptibility	11.0	Equipment identified as Category X, No test performed.
Sand and Dust	12.0	Equipment identified as Category X, No test performed.
Fungus Resistance	13.0	Equipment identified as Category X, No test performed.
Salt Spray	14.0	Equipment identified as Category X, No test performed.
Magnetic Effect	15.0	Equipment tested to Category Z.
Power Input	16.0	Equipment tested to Category BXX.
Voltage Spike	17.0	Equipment tested to Category A.
Audio Frequency Conducted Susceptibility	18.0	Equipment tested to Category B.
Induced Signal Susceptibility	19.0	Equipment tested to Category ZC.
Radio Frequency Susceptibility	20.0	Equipment tested to Category TT.
Emission of Radio Frequency Energy	21.0	Equipment tested to Category L.
Lightning Induced Transient Susceptibility	22.0	Equipment tested to Category A3J3L3.
Lightning Direct Effects	23.0	Equipment identified as Category X, No test performed.
Icing	24.0	Equipment identified as Category X, No test performed.
Electrostatic Discharge	25.0	Equipment tested to Category A.
Other Tests		None.

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Appendix C

Configuration and Checkout Log

Date: _____ By: _____

Installation Information

(use the information found in the general information section to help fill out the following data)

Model NGT-2000 P/N 9022000-10000 Model NGT-2500 P/N 9022000-10000

Unit S/N: _____ Mod Level: _____

Aircraft Model: _____ Aircraft S/N: _____

Operation S/W: _____ Firmware S/W: _____

Configuration

Aircraft Options

Call Sign: _____

ICAO Address (Octal): _____

VFR Code (Octal): _____

Aircraft Emitter Category: _____

Aircraft Length (meters): _____

Aircraft Width (meters): _____

Aircraft ground speed threshold in air (knots): _____

Aircraft ground speed threshold on ground (knots): _____

Altitude threshold A/G Status (feet): _____

GPS Antenna Offset Lateral (feet): _____

GPS Antenna Offset Longitudinal (feet): _____

GPS Antenna Offsets Vertical (feet): _____

Audio Volume: _____

Table C-1: Log Sheet for Configuration and Checkout
(Sheet 1 of 2)

Altitude

Baro Altitude Source: (RS-232 Gilham Code)

NIC BARO (No altitude integrity Altitude is non-Gilham or crosschecked)

Altitude Source Protocol (Trimble/Garmin/Icarus Magellan UPS AT
 UPS AT Loran 618 Northstar Shadin ARNAV

Pressure Altitude Baud Rate (1200 2400 4800 9600)

Altitude Resolution (ft): 1 foot 100 feet

Config Settings 1

CSID Logic (Disabled Enabled)

TSAA (Disabled Enabled)

ARINC Format (STIF DTIF Both)

GPS Antenna Direction (Left Right)

Config Settings 3

Control Panel Type (None Via RS-422 (MX20/GMX200) SL70/GSL71 (RS-232)
 GTX 327 or GTX 330 (RS-232 L-3 UAT Control Panel 1

RS-232 Control Panel Baud Rate Override 1200 9600 (default)

Anonymous Mode (Not Available Available)

Pilot Entry of Flight ID (Disabled Enabled)

Air/Ground Indication (Ground on Ground On Ground Open Not Used)

RS-422 Options

Interface Options (None MX20 GMX200 Traffic Alert)

Baud Rate (38400 57600 115200)

Uplinks (0 uplinks per second 2 uplinks per second 4 uplinks per seconds)

RS-232 Options

WiFi Baud Rate (38400 57600 115200)

WiFi Accessory Configuration

WiFi Module SSID: Wifly-GSX-_____

**Table C-1: Log Sheet for Configuration and Checkout
(Sheet 2 of 2)**