Application		Revisions			
Next Assy	Used On	Rev.	Description	Date Approved	Approved
9K-88126-1	9K-88126-1	1	Initial Release per EC 14012	7/16/18	DB
9K-88126-3	9K-88126-3	2	Revised per EC 14069	7/26/18	DB
		3	Revised per EC 14099	8/28/18	DB
		4	Revised per EC 14119	9/12/18	DB
		5	Revised per EC 14128	9/28/18	DB
		6	Revised per EC 14167	11/20/18	DB

CONFIGURATION MANAGEMENT CONTROLLED REFERENCE

OPERATION AND INSTALLATION MANUAL FOR INTEGRATED STANDBY UNIT with AUTOTHROTTLE SYSTEM ON PILATUS PC-12 SERIES AIRCRAFT P/N 9K-88126-1 (PC-12/41, /45, /47) P/N 9K-88126-3 (PC-12/47E)

Contract Number:		Innovative Solutions & Support	
Contractor:			
Written By: B. Swearingen	Date: 7/14/18	OPERATION AND INSTALLATION MANUAL ISU A/T SYSTEM ON PC-12 SERIES AIRCRAFT	
Checker:	Date:		
Engineer: B. Swearingen	Date: 7/14/18		
Document Approval: D. Babe	Date: 7/16/18	CAGE CODE 0EUW0	1D-88126
QA Approval: B. Urbanski	Date: 7/16/18		
Design Approval: M. Knopf	Date: 7/16/18	Form# 07315-372 Rev -	SHEET 1 of 134

REVISION HISTORY

Rev 6 Updated Figure 2-1, 2-2, 2-3, 2-4 to depict the current model of Autothrottle
Updated Table 2-2 for Autothrottle leading characteristics
Updated Figure 4-4 with current menu picture
Updated section 4.8.3 to reflect alternate startup page
Updated section 4.8.5 for current configuration options
Updated Appendix J (Table 8-13, 8-17, 8-16) for release 5

Rev 5 Modified table 1-1 and 1-2 with actual configuration part numbers. Added note below to state need for customized configurations.
Paragraph 1.5.2: Provided reference to appendix F and deleted table 1-6 as it is duplicated in the document.
Generated paragraph 1.11 for acronyms
Par 2.1: Added the AHRS to the interface list of the ISU
Par 2.1.3: 2nd paragraph, fixed first sentence.
Par 2.3: Fixed 2nd sentence in last paragraph to describe the use of the internal air data source better
Table 2-1: Removed unused configurations, added rows for current draw
Table 2-2: Added rows for current draw, corrected short term temperature to -30 to +55 deg C
Par 2.6.3: referenced Electrical Load Analysis
Par 3.3.1.1: Described the lighting bus usage in the power section
Par 3.3.1.5: Removed reference to ATA ICD
Par 3.4.1: Referenced table as system failure description instead of system annunciation
Table 3-3: Changed to text in "Flag" column to make the table consistent
Par: 4.2.2: Referenced installation instructions, wiring diagram and installation drawing documents
Par 4.6: Added STC priority wording on the use of the installation instructions in this paragraph
Par 4.6.3: Removed last sentence before the NOTE about the environmental requirements
Par 4.6.7: Corrected the Ps/Pt system number
Par 4.6.12: Bonding impedance only refers to ISU and not ATA
Par 4.7.3: Added reference to the Installation Instructions
Par 4.8.4: Changed subparagraphs to be specific to Legacy PC-12 and PC-12 NG
Par 6.3.2.2.3: Updated with higher override force
Fig 7-1: Changed picture to newer NG install
Table 8-1: Updated environmental qualifications for ATA
Appendix H: Updated abbreviated spelling of MOPS
Appendix I.2: Changed FPDS to ISU
Appendix J: Added table 8-12 for latest black label SW release

Rev 4 Removed references to ATCP from the entire document
Removed 9K-88126-5 and -7 configurations throughout the document
Removed references to 9D-84176-15 and -17 configuration throughout the document
Par 1.1: Updated paragraph description without ATCP
Par 1.2: Changed STC number
Removed configuration tables 1-3 and 1-4

Par 1.7: Corrected first sentence
Removed paragraph 2.1.4 "ATCP Overview"
Par 2.4: Changed title to "Autothrottle Mode Description"
Removed paragraph 4.8.4 "Applying power to the ATCP system"
Par 7.1: Removed Note with reference to Maintenance Manuals

Rev 3 Updated Appendix J for release 3.
Updated required LRUs.

Rev 2 Updates to the ATA calibration and data loading.
Updated table 2-1 with additional performance limits of the ISU function
Updated table 8-8 with details on the zooming functionality and its verification.
Updated Table 8-9 for current software part numbers and current release of Software Accomplishment Summary.

Rev 1 Initial Release of document.

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1.0 GENERAL INFORMATION

1.1 PURPOSE

The purpose of this document is to provide installation guidance information as well as operating characteristics, maintenance procedures (level 1 maintenance work instructions only), reliability, operating limitations, checkout & troubleshooting procedures, and descriptive information for the IS&S Integrated Standby Unit (ISU) with Autothrottle (A/T) System P/N 9K-88126-1 and 9K-88126-3. System 9K-88126-1 applies to the legacy PC-12 (PC-12/41, /45, /47), and system 9K-88126-3 applies to the PC-12 NG (PC-12/47E).

1.2 SCOPE

This document only provides reference information for the IS&S equipment as delivered from IS&S and to be installed per STC SA02208BO following Title 14 CFR Part 43 guidance. It includes interface data for third party equipment that may be integrated with the IS&S equipment. See the third-party equipment manufacturer for information on their specific components.

This manual includes the guidelines, considerations, and recommendations for the installation and testing of the ISU A/T equipment to ensure that when installed in accordance with these procedures the equipment will meet the design requirements of the IS&S ISU A/T system. IS&S may provide an approved STC for the target aircraft. However, any deviations from the IS&S STC will need to be approved by the installer.

It is the responsibility of the installer to comply with appropriate certification agency installation guidance when installing the ISU A/T system. The information contained in this document along with guidance contained in FAA AC 43.13-1B (Acceptable Methods, Techniques and Practices - Aircraft Inspection and Repair) and other applicable advisory circulars should be followed by the installer.

The Instructions for Continued Airworthiness (ICA) provided with the Supplemental Type Certificate (STC) approvals for the ISU A/T equipment supersedes the instructions for continued air worthiness in this manual. The instructions provided in this manual are to support the ICA documents provided with the STC that authorizes installation of the ISU A/T equipment.

This document does not provide any instructions or procedures to repair the IS&S ISU A/T equipment since all repairs must be performed at the IS&S factory.

The data contained in this manual is intended for installation of the 9K-88126-1 and -3 ISU A/T system on aircraft that are type certified under Title 14 Code of Federal Regulations (CFR) Part 23 and aircraft identified via AC 23.1309-1C, Class III.

1.3 REFERENCE DOCUMENTS

The following are documents that are referenced in this document.

1.3.1 NON-IS&S DOCUMENTS

Document Number	Document Description
AC 23-17C	Systems and Equipment Guide for Certification of Part 23 Airplanes and Airships
AC 23.309-1E	Equipment, Systems, and Installations in Part 23 Airplanes
AC 43-4A	Corrosion Control for Aircraft
AC 43-6C	Altitude Reporting Equipment and Transponder System Maintenance and Inspection Practices
AC 43.13-1B	Acceptable Methods, Techniques, and Practices – Aircraft Inspection and Repair
AC 43.13-2B	Acceptable Methods, Techniques, and Practices – Aircraft Alterations
AC 91-85	Authorization of Aircraft and Operators for Flight in Reduced Vertical Separation Minimum Airspace
AC 23.1309-1C	Equipment, Systems, and Installations in Part 23 Airplanes
AC 23.1311-1A	Installation of Electronic Displays in Part 23 Airplanes
AC 25.1309-1A	System Design and Analysis (for reference only)
AMC 21A.303	Standard Parts
ANSI Y32.2	Graphic Symbols for Electrical and Electronics Diagrams
ANSI/IEE Std 260	Standard Letter Symbols for Unit of Measurement
ANSI/IEE Std 91	Graphic Symbols for Logic Functions
ASME Y1.1	Abbreviations for Use on Drawings and in Text
ASTM F 2490-05	Standard Guide for Aircraft Electrical Load and Power Source Capacity Analysis
ATA Specification 100	Specification for Manufacturers' Technical Data
ATA Specification 300	Packaging of Airline Supplies
CFR Title 14, FAR 23	
CFR Title 14, FAR 23, Subpart F	Airworthiness Standards: Normal, Utility, Aerobatic, and Commuter Category Airplanes, Subpart F Equipment
CFR Title 14, 91.411	Altimeter System and Altitude Reporting Equipment Tests and Inspections
MIL-DTL-5541F	Chemical Conversion Coatings on Aluminum & Aluminum Alloys
MIL-STD-721C	Definition of Terms for Reliability and Maintainability
MIL-HDBK-472	Maintainability Prediction
MIL-HDBK-5 / MMPDS-04	Metallic Materials and Elements for Aerospace Vehicle Structures
MIL-HDBK-470A	Designing and Developing Maintainable Products and Systems
MSG-3 Latest Revision	Operator/Manufacturer Maintenance Steering Group Document, MSG-3
SAE ARP 1870	Aerospace Systems Electrical Bonding and Grounding for Electromagnetic Compatibility and Safety
RTCA/DO-160G (EUROCAE ED-14G)	Environmental Conditions and Test Procedures for Airborne Equipment
RTCA/DO-178B (EUROCAE ED-12B)	Software Considerations in Airborne Systems and Equipment Certification

Document Number	Document Description
RTCA/DO-254 (EUROCAE ED-80)	Design Assurance Guidance for Airborne Electronic Hardware

1.3.2 IS&S DOCUMENTS

IS&S Document Number	Document Description
1D-13455	Master Drawing List (MDL), PC12 ISU A/T System
1D-13466	Airplane Flight Manual Supplement, ISU A/T System 9K-88126-1/-3
1D-13470	Pilot's Guide, ISU A/T System 9K-88126-1/-3
1D-13456	Installation Instructions, PC-12 ISU A/T System 9K-88126-1/-3
1D-13465	Electrical Load Analysis
1D-13462	Weight & Balance Report
1G-89003	Interface Control Document, Autothrottle Assembly
1G-84176	Interface Control Document, ISU
1V-84176-9	Envelope Drawing, ISU 9D-84176-9
1V-84176-11	Envelope Drawing, ISU 9D-84176-11
1V-89003-3	Envelope Drawing, A/T Assembly 9B-89003-3
1V-89003-5	Envelope Drawing, A/T Assembly 9B-89003-5
1Y-13460	Ground Test Plan, ISU A/T System
8E-13512	Installation Wiring Diagrams, ISU A/T System on PC-12
1D-13467	Instructions for Continued Airworthiness

1.4 IS&S ISU A/T EQUIPMENT

This section identifies the applicable ISU A/T equipment that will be installed on the target aircraft for the installation that is performed per the IS&S STC.

1.4.1 Required ISU A/T LRUs

The Integrated Standby Unit with Automatic Throttle (ISU A/T) System, 9K-88126-1/-3, equipment is manufactured by Innovative Solutions and Support (IS&S), CAGE code: 0EUW0, located in Exton, PA. Currently, only the configurations with an ISU are considered valid for the 9K-88126 system. The ISU A/T System consists of the Line Replaceable Units (LRU) in the following configuration tables:

Table 1-1 9K-88126-1 Legacy PC-12 LRUs

IS&S LRU	Nomenclature	IS&S Part Number	Quantity per Shipset
ATA	Automatic Throttle Assembly	9B-89003-3	1
ISU	Integrated Standby Unit	9D-84176-9	1
ICM	Installation Configuration Module (ICM)	9B-13428-1	1

Table 1-2 9K-88126-3 PC-12 NG LRUs

IS&S LRU	Nomenclature	IS&S Part Number	Quantity per Shipset
ATA	Automatic Throttle Assembly	9B-89003-5	1
ISU	Integrated Standby Unit	9D-84176-11	1
ICM	Installation Configuration Module (ICM)	9B-13428-3	1

*NOTE: There may be a need to obtain customized configuration modules with installation and aircraft specific settings depending on the aircraft modification state.

1.4.2 ISU A/T Software

The following Computer Software Configuration Items (CSCI) are developed by IS&S and are contained within the IS&S equipment when shipped from the IS&S factory. IS&S is responsible for developing and distributing any updates to these CSCI's. See Appendix J for the latest released software versions (identified by the "-xxx" dash numbers).

Table 1-3 IS&S Developed CSCI Summary

LRU (Top Level VDD)	CSCI P/N & VDD	CSCI DESCRIPTION	DO-178B DAL	DISPLAYED ON
ISU (7H-84176)	7H-13189- xxx	ISU OFP SW	B	ISU
	7H-09848- xxx	ISU Bootstrap SW	B	ISU
	7H-13331- xxx	ISU Service SW	E	ISU

1.4.3 Complex Hardware

The following Hardware Configuration Items (HCI) are contained within the ISU A/T LRUs when shipped from the IS&S factory. IS&S is responsible for any updates to these HCI's. See Appendix J for the latest released versions (identified by the "-xx" dash numbers).

Table 1-4 IS&S Provided HCI Summary

LRU	HCI P/N	DESCRIPTION	DO-254 DAL	DISPLAYED ON
ISU	10H-10041-xx	Standby Instrument Interface	B	ISU

1.4.4 Configuration Files

The following Configuration File (CF) are contained within the applicable ISU A/T LRUs when shipped from the IS&S factory. IS&S is responsible for any updates to these CF's. See Appendix J for the latest released versions (identified by the "-xxx" dash numbers).

Table 1-5 IS&S Provided Configuration File Summary

LRU	CF P/N	DESCRIPTION	DO-178B DAL	DISPLAYED ON
ISU	7H-13428-xxx	ISU ICM (PC-12)	B	ISU

1.4.5 Database or Data Files

There are no databases or data files contained within the LRUs of the IS&S ISU A/T system.

1.4.6 Software & Hardware Modification Identification

The software and hardware configuration of the IS&S equipment that is shipped from the factory is identified by the LRU Part Number. The LRU may identify the software version on the LRU ID Tag or may have a separate installed Software ID Label or may be displayed on the ISU.

Changes in the software on the IS&S equipment are controlled via the version number (dash number) of the software part number.

Hardware updates after initial release of fielded units can be identified through the use of a Modification (mod) Label on the LRU if the changes are considered minor.

1.5 THIRD-PARTY EQUIPMENT

This section identifies the required third-party equipment that are installed per the IS&S STC.

1.5.1 Required New Third-Party Equipment

Required new third-party Line Replaceable Units (LRUs) to be installed will be detailed within the IS&S installation kit.

1.5.2 Compatible Third-Party Equipment

The ISU A/T System interfaces with and is compatible with the third-party equipment identified in Appendix F.

The third-party equipment is based on Pilatus factory equipment for Legacy PC-12, PC-12 NG, and other compatible equipment that may be already installed in Legacy PC-12 aircraft.

The third-party equipment (or equivalent) that interfaces with the ISU should be installed and approved on the aircraft. Existing PC-12 ICA or third-party ICA is to be used for the third-party equipment.

1.6 TARGET AIRCRAFT

The ISU A/T equipment configuration described in this document is intended for installation per the IS&S STC on the target aircraft identified in the following table.

Table 1-6 Target Aircraft

Target Aircraft(s)	TCDS	TC Holder	Engine(s)	Existing Modifications
PC-12, PC-12/45, PC-12/47, and PC-12/47E	FAA A78EU or EASA.A.089	Pilatus Aircraft LTD	Quantity: 1 Manufacturer: Pratt & Whitney Canada Model Number: PT6A-67B or -67P Type: Twin shaft Turboprop	PC-12, PC-12/45, PC-12/47, and PC-12/47E

The following figure shows a legacy PC-12 aircraft instrument panel before the installation of the IS&S ISU A/T system, 9K-88126-1.

Figure 1-1 Before ISU A/T 9K-88126-1 Installation on a Legacy PC-12

The following figure shows a typical installation of the instrument panel on a legacy PC-12.

Figure 1-2 After ISU A/T 9K-88126-1 Installation on a Legacy PC-12

The following figure shows a PC-12 47/E aircraft instrument panel before the installation of the IS&S ISU A/T system, 9K-88126-3.

Figure 1-3 Before ISU A/T 9K-88126-3 Installation on a PC-12 47/E

The following figure shows the instrument panel after a typical installation of the ISU A/T system on a PC-12 47/E.

Figure 1-4 After ISU A/T 9K-88126-3 Installation on a PC-12 47/E

The retrofit configuration of the IS&S ISU A/T system is based on the target PC-12 aircraft and it interfaces with the following aircraft equipment:

- Attitude Heading Reference System (AHRS)
- ADC (Air Data Computer)
- Autopilot (AP)
- Flap Warning Control Unit (FWCU)
- Stick Pusher Warning Unit (SPWU)

1.7 CUSTOMER SUPPORT

Customer support is provided from IS&S by calling the following phone number or addressing questions to the following address or email:

Innovative Solutions & Support, LLC
Cage Code: 0EUW0
720 Pennsylvania Drive
Exton, PA 19341 USA
(610) 646-9800 (ask for customer service)
Email: ISSCustomerSvs@innovative-ss.com
Web: www.innovative-ss.com.

1.8 PRECAUTIONARY DATA

Warning, cautions, and notes in this manual are defined as follows:

- WARNING – is an operation or maintenance procedure or condition that, if not obeyed, can cause injury or death.
- CAUTION – is an operation or maintenance procedure or condition that, if not obeyed, can cause damage to the equipment.
- NOTE – provides information regarding a procedure or task.

All personnel that operate or maintain equipment specified in this manual must know and obey the safety precautions. The warning and cautions that follow apply to all parts of this manual.

WARNING: **Before you use a material, refer to the Material Safety Data Sheet provided by the manufacturer for that material for safety information. Some materials can be dangerous.**
CAUTION: **Do not use materials that are not equivalent to materials specified in this manual. Materials that are not equivalent can cause damage to the equipment and can void the warranty.**
CAUTION: **The ISU A/T system equipment contains items that are Electrostatic Discharge Sensitive (ESDS). This equipment is identified as ESDS on the identification labels of the equipment and also in this manual. If the necessary controls for ESDS equipment are not obeyed, the ESD can cause a failure or unsatisfactory operation of the unit. Use approved industry precautions to keep the risk of damage to a minimum when you touch, remove, or replace equipment.**

1.9 SYMBOLS

The following symbols may be used to identify Electrostatic Discharge Sensitive (ESDS) equipment.

Figure 1-5 Symbols

1.10 WEIGHTS AND MEASURES

The following weights and measures are used in this document:

- All weights and measurements are in U.S. values.
- The letter symbols for units of measurement are the same as shown in ANSI/IEEE standard 260.

1.11 ACRONYMS AND ABBREVIATIONS

The following acronyms and abbreviations are used in this document:

AC	Alternating Current Advisory Circular Aircraft Advisory Circular
AC	Advisory Circular
A/C	Aircraft
ADAHRS	Air Data and Attitude Heading Reference System
ADC	Air Data Computer
ADDU	Air Data Display Unit
ADF	Automatic Direction Finder
ADI	Attitude Directional Indicator
ADM	Air Data Module
AFCS	Automatic Flight Control System
AFMS	Airplane Flight Manual Supplement
AHRS	Attitude and Heading Reference Systems
AIC	Airborne Inhabited Cargo
ALS	Ambient Light Sensor
ALT	Altitude
AMM	Aircraft Maintenance Manual
ANSI	American National Standards Institute
AP	Autopilot
ARINC	Aeronautical Radio Incorporated
ARP	Aerospace Recommended Practices
ASPD	Airspeed
ATA	Air Transport Association
ATP	Acceptance Test Procedure
ATT	Attitude
BIT	Built-In Test
CAGE	Commercial And Government Entity
CBIT	Continuous Built In Test

CFR	Code of Federal Regulations
CM	Configuration Management
CMM	Component Maintenance Manual
COMM	Communications Receiver
CSCI	Computer Software Configuration Item
CW	Clockwise
DAL	Design Assurance Level
DB	Database
DC	Direct Current
DG	Directional Gyroscope
DME	Distance Measuring Equipment
EC	Engineering Change
EFIS	Electronic Flight Instrumentation System
EOT	End Of Transmission (word)
EPS	Emergency Power Supply
ESD	Electrostatic Discharge
ESDS	Electromagnetic Discharge Sensitive
ESIS	Electronic Standby Instrument System
FAA	Federal Aviation Administration
FADEC	Full Authority Digital Engine Control
FAR	Federal Aviation Regulations
FOD	Foreign Object Debris
FPGA	Field Programmable Gate Array
FPM	Feet Per Minute
FQIS	Fuel Quantity Indicating System
FWCU	Flap Warning Control Unit
HDG	Heading
HF	High Frequency
HIRF	High Intensity Radiated Field
HIRF	High Intensity Radio Frequency
HSI	Horizontal Situation Indicator
IAS	Indicated Airspeed
ICA	Instructions for Continued Airworthiness
ICD	Interface Control Document
ICM	Installation Configuration Module

IEEE	Institute of Electrical & Electronics Engineers
IFR	Instrument Flight Rules
IMU	Inertial Measurement Unit
IOP	Input/Output Processor
IRU	Inertial Reference Unit
ISU	Integrated Standby Unit
ITT	Inlet Turbine Temperature
KG	Kilograms
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LLC	Limited Liability Cooperation
LRU	Line Replaceable Unit
MAU	Modular Avionics Unit
MB	Marker Beacon
MB	Megabyte
MB	Millibars
MB	Mother Board
MDL	Master Drawing List
MOPS	Minimum Operational Performance Standard
MSDS	Material Safety Data Sheet
MTBF	Mean Time Between Failures
NOAA	National Oceanic and Atmospheric Administration
NVRAM	Non-Volatile Random Access Memory
OEM	Original Equipment Manufacturer
OFP	Operational Flight Program
PCL	Power Control Lever
PN	Part Number
PWR	Power
QTY	Quantity
RDMI	Radio Distance Magnetic Indicator
RF	Radio Frequency
RMI	Radio Magnetic Indicator
RTCA	Radio Technical Commission for Aeronautics
SAE	Society Of Automotive Engineers
SCI	Serial Communications Interface

SCI	Serial Control Interface
SPD	Speed
SPWU	Stick Pusher Warning Unit
SSEC	Static Source Error Correction
STC	Supplemental Type Certificate
SW	Software
TAWS	Terrain Awareness Warning System
TC	Type Certificate
TCAS	Traffic Collision Avoidance System
TCDS	Type Certificate Data Sheet
TRQ	Torque
TSO	Technical Standard Order
UUT	Unit Under Test
VAC	Volts of Alternating Current
VDC	Volts Direct Current
VDD	Version Description Document
VERT	Vertical
VFE	Max Flap Extended Speed
VHF	Very High Frequency
VMC	Minimum Control Speed with Critical Engine Out
VNE	Never Exceed Speed
VNO	Maximum Structural Cruising Speed
VOR	VHF Omni-Directional Radio Range
VS	Vertical Speed

2.0 DESCRIPTION

2.1 SYSTEM OVERVIEW

The Integrated Standby Unit with Autothrottle system (ISU A/T) consists of the following IS&S Line Replaceable Units (LRUs):

- Integrated Standby Unit (ISU) with Installation Configuration Module (ICM)
- Automatic Throttle Assembly (ATA)

The ISU A/T system receives input data from aircraft sensors, displays information based on these inputs, and provides outputs to other systems, as required, to achieve the system functionality. Cockpit control and indication for systems integrated with the ISU A/T system will be primarily displayed via the ISU, with user interface controls available on the bezel of the ISU.

The ISU A/T system provides the following functions:

- Backup Flight Instrument display
- Automatic Throttle Control

The main type of interfaces of the ISU A/T system consists of the following:

- Engine Systems
- Air Data Computer
- Attitude and Heading Reference System
- Autopilot System
- Pitot/Static Air Sensor
- Flaps System

A high-level architecture drawing of the ISU A/T system is shown in Figure 2-1 for the legacy PC-12:

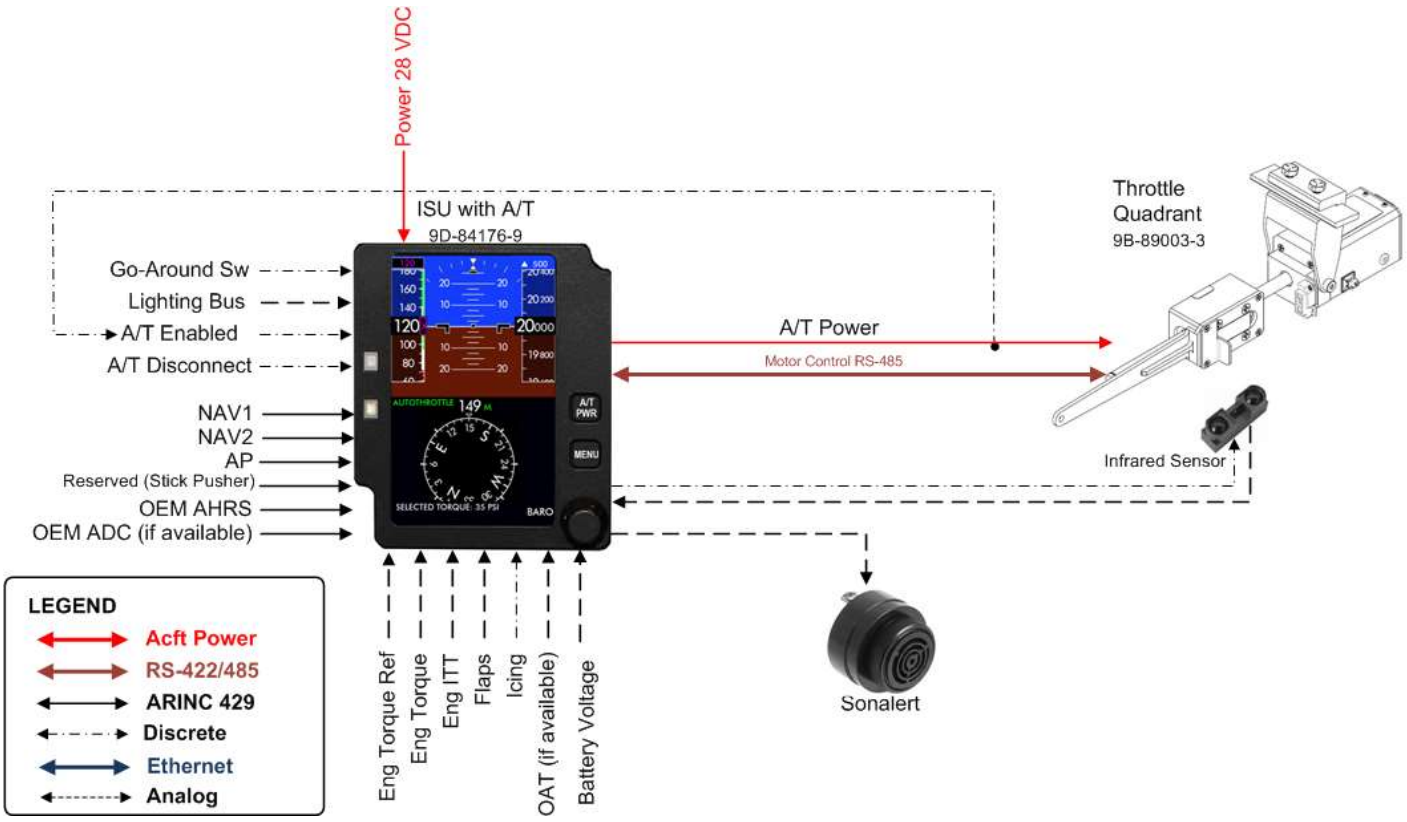


Figure 2-1 ISU with Autothrottle Architecture 9K-88126-1

A high-level architecture drawing of the ISU A/T system is shown in Figure 2-1 for the PC-12 NG:

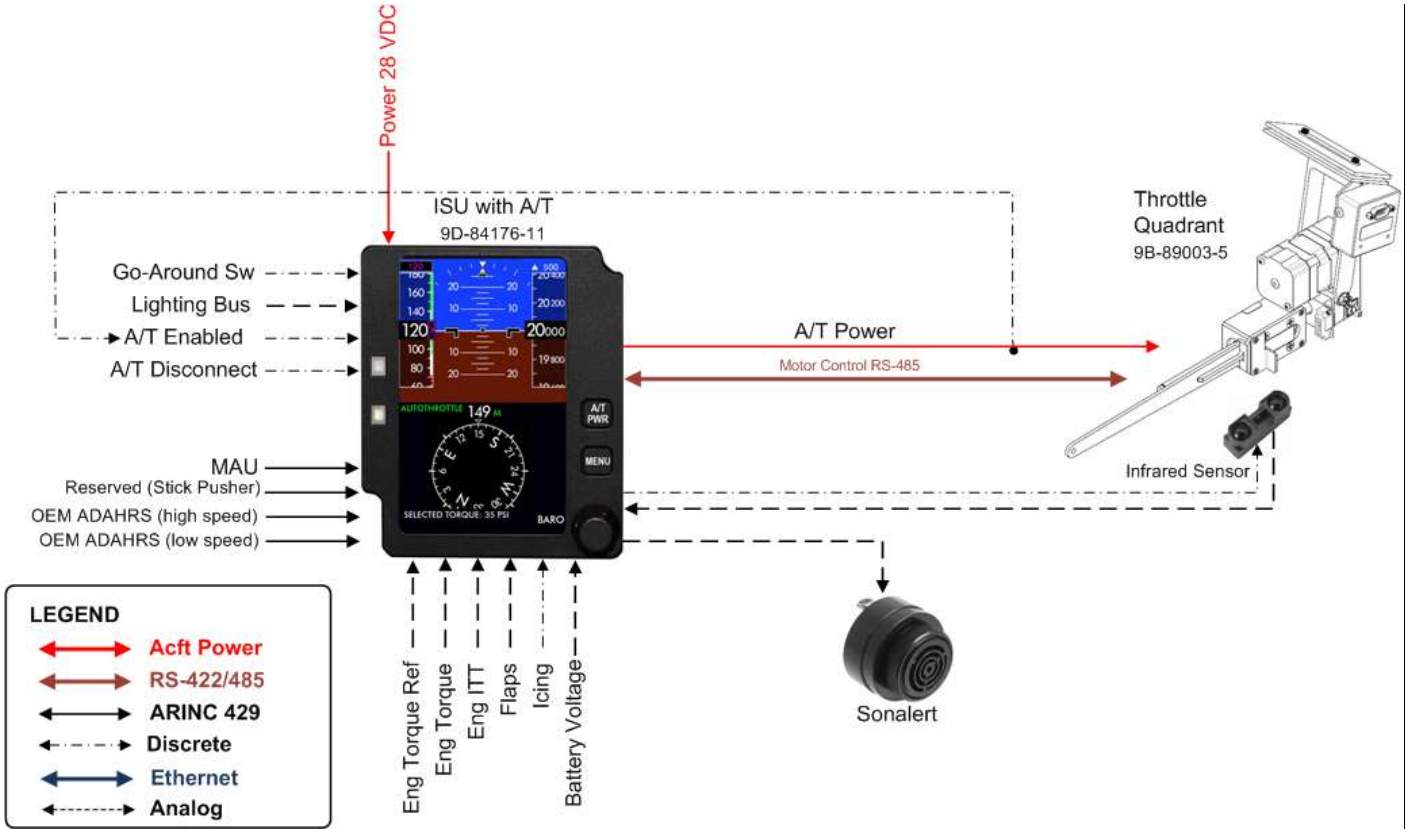


Figure 2-2 ISU with Autothrottle Architecture 9K-88126-3

An external air data computer provides air data information used by the ISU to control the autothrottle. The air data information is supposed to be the same data used by the pilot as its primary source. The ISU provides an interface to the engine sensors for autothrottle control. The ISU also provides standby primary flight, heading, and attitude sensor displays.

2.1.1 Third-Party Equipment

See the referenced third-party equipment for description information for any third-party equipment that was used to integrate with the ISU A/T system for the ISU A/T system upgrade.

2.1.2 ISU A/T System Internal Communication

The internal ISU A/T system communication scheme is designed to use RS-485 and ARINC 429 busses to pass messages between the components of the system. The ISU has RS-422 busses available for use in maintenance and software updates.

2.1.3 ISU Overview

The ISU A/T input parameters are received from peripheral aircraft equipment connected through digital, analog, and discrete signal sources and from the aircraft pitot-static system. It uses the Pitot Static Ports to make internal computations of airspeed, altitude and vertical speed. The ISU also has internal accelerometers and gyroscopes that enable it to internally compute attitude and heading.

The ISU principal function is as a backup flight instrument. It provides two (2) buttons and (1) rotary encoder for user input and menu selection. The ISU also provides an Ambient Light Sensor (ALS) that is used to dim or brighten the display depending on the lighting conditions in the cockpit. The back lighting for the bezel buttons is controlled by the aircraft lighting bus.

The ISU powers and controls the autothrottle assembly and provides the user interface for autothrottle control. Several of the A/T input parameters are received from peripheral aircraft equipment connected through digital, analog, and discrete signal sources.

2.1.4 ATA Overview

When the A/T Assembly (ATA) is engaged, the ISU provides automatic control of the Power Control Lever on the throttle quadrant of the PC-12 aircraft based on torque or airspeed control parameters. The ATA mode annunciation is displayed on the ISU.

2.1.5 Engine Instrument Interfaces

The ISU interfaces with the engine to receive the engine performance data needed for autothrottle control.

2.2 EXTERNAL ISU A/T LRU DESCRIPTION

This section provides external description of the IS&S LRUs only. See the referenced third-party document for a description of the third-party equipment used with the ISU A/T system.

2.2.1 ISU External Description

An illustration of an ISU isometric drawing is shown in the figure below. The Outline Drawing, 1V-84176-9 or -11, provides an external description with dimensions of the ISU. The following figure is for reference and illustration purposes only and the Outline Drawing should be obtained from IS&S for detailed information.

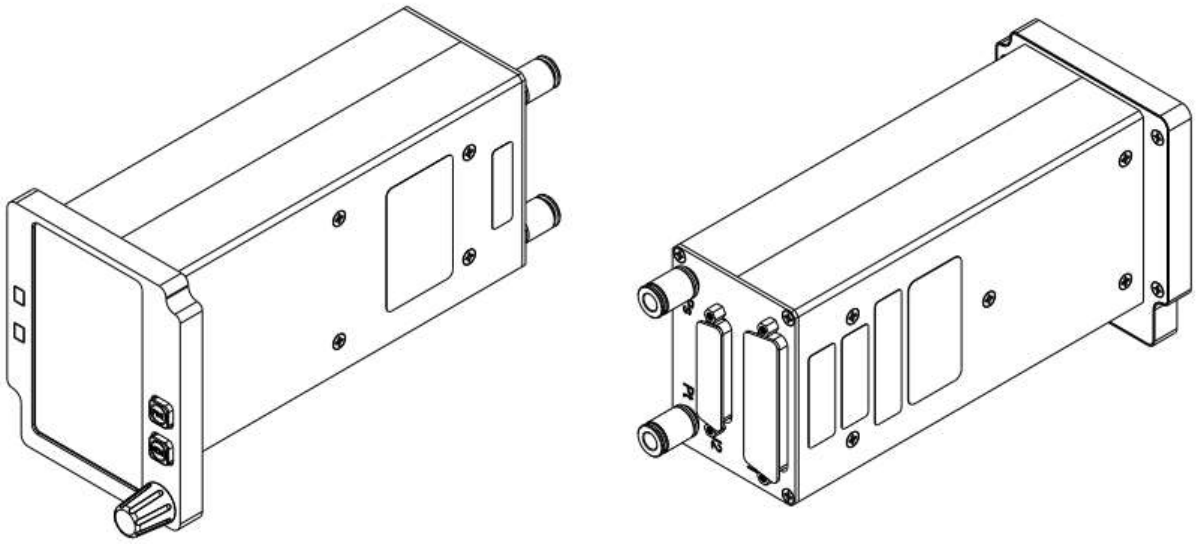


Figure 2-3 ISU Isometric Drawing

2.2.2 ATA External Description

An illustration of an Automatic Throttle Assembly (ATA) is shown in the figure below. The Outline Drawing, 1V-89003-3 or -5, provides an external description with dimensions of the ATA. The following figure is for illustration purposes only and the Outline Drawings from IS&S should be referenced for detailed information.

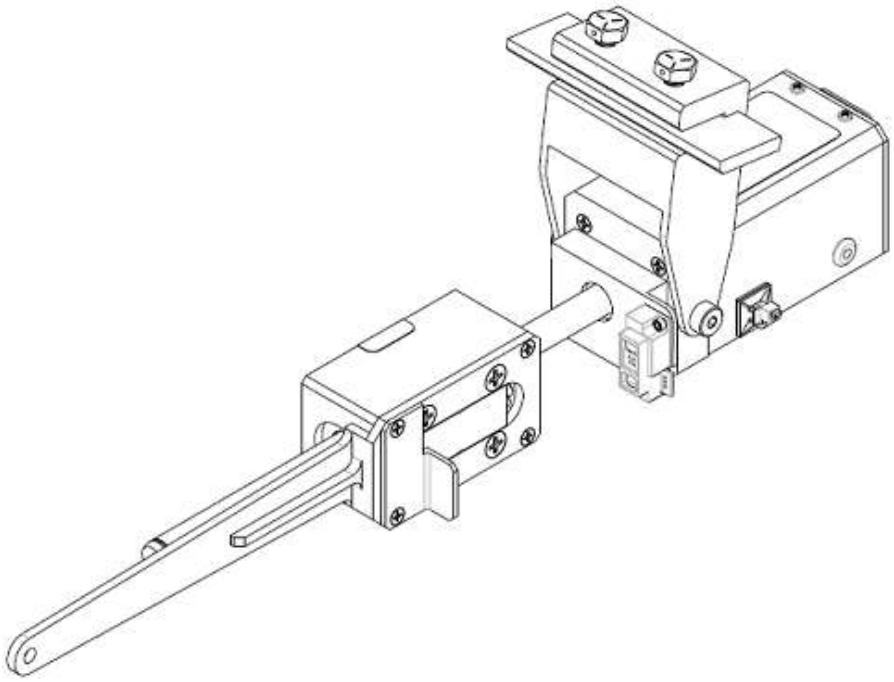


Figure 2-4 ATA Isometric Drawings 9B-89003-3

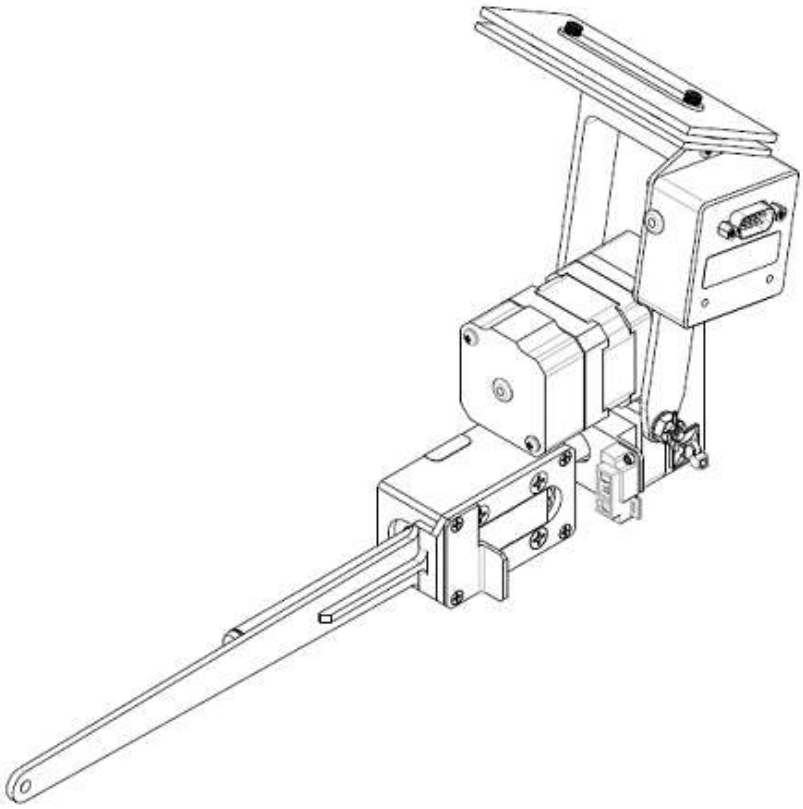


Figure 2-5 ATA Isometric Drawings 9B-89003-5

2.3 INTERNAL ISU WITH A/T DESCRIPTION

This section provides internal description of the IS&S LRUs only. See the referenced third-party document for a description of the third-party equipment used with the ISU A/T system.

The ISU computes aircraft attitude based on internal gyroscopic inertial sensors. The inertial sensors detect angular velocities that are used to estimate the aircrafts attitude. The ISU uses additional aiding sensors to mitigate the adverse effects induced by the aircraft motion and platform dynamics. The aiding information used in the IS&S compensation algorithm is taken from sensors that are internal to the ISU such as accelerometers and air data, as well as external information like magnetic heading via the ARINC 429 bus. The aiding information along with the normal gyroscopic data provides the input to numerous decisions within the algorithm that drives the computation of the final displayed attitude.

The FAA guidelines on usage and testing of AHRS equipment in regards to the incorporation of aiding data can be found in TSO-C201, RTCA/DO-334 and AC 20-181. In particular, these documents describe the necessary and sufficient metrics to have in place when aiding data is used and how it is to be tested. The IS&S ISU has been certified to meet DO-334 category A4H4T7/A4H9T7.

In line with these FAA guidelines, it is often desirable and at time necessary (see AC 20-181) to integrate multiple aiding systems with inertial sensors to achieve the specified AHRS performance. As an example, the ISU utilizes air data measurements from the internal ISU ADC function as an aiding input to the AHRS function. Per FAA guidelines, the utilization of this ADC function is acceptable if the function has obtained TSO-C106, which is the case for the ISU. Air data obtained from the ADC describes the aircraft longitudinal motion in terms of speed and acceleration. This information is used by the IS&S AHRS function to compensate linear accelerations measured by the internal accelerometers. Reducing the effect of aircraft accelerations in the inertial sensors leads to a more accurate AHRS solution when undergoing higher dynamic flight maneuvers.

However, with the inclusion of aiding sources into the algorithm, there also exists the potential of including unwanted corrections. In the case of air data, unwanted corrections may occur while experiencing high winds and can also be observed when the ISU has been installed into a leaking or blocked pitot static system. In the case of a poorly installed ISU, resulting in either a blocked or leaking pitot static system, the air data sensors will measure airspeed changes as a function of altitude alone. These measured changes are due to pressure changes in the blocked/leaking ports and not to actual aircraft accelerations. These artificial measurements are fed into the AHRS compensation and stimulate a (unwanted) correction for sensed acceleration that didn't actually occur. It should be noted that the ADC function will still continue to provide corrections to the AHRS function because the ADC within the ISU has no other information available that would discount these measurements.

The Autothrottle control functionality in the ISU is based on two basic modes. The Airspeed control mode is based on a selected airspeed setting that can be adjusted on the ISU. The internal controller compares the selected setting against the current airspeed received from the primary air data source unless the primary air data source is not available or specifically selected in the menu settings. The Autothrottle control algorithm will adjust the throttle to achieve the selected airspeed setting. The same logic applies to the torque control mode where the ISU provides a selected torque adjustment. The ISU internal control logic will adjust the throttle setting to achieve the selected torque value. Torque mode is also used for take-off and go-around setting which are automatically triggered using set values based on the Pilatus recommended settings for take-off and balked landing performance.

All of the above Autothrottle modes are protected by overspeed, underspeed, overtorque, undertorque and overtemperature control functions that provide FADEC like protection for the aircraft and engine.

2.4 AUTOTHROTTLE MODE DESCRIPTION

The Autothrottle has two basic modes: The Airspeed control mode is based on a selected airspeed setting that can be adjusted on the ISU. The internal controller compares the selected setting against the current airspeed received from the primary air data source. The Autothrottle control algorithm will adjust the throttle to achieve the selected airspeed setting. The same logic applies to the torque control mode where the Autothrottle controller provides a selected torque adjustment. The ISU's internal control logic will adjust the throttle setting to achieve the selected torque value. Torque mode is also used for take-off and go-around setting which are automatically triggered using set values based on the Pilatus recommended settings for take-off and balked landing performance.

All of the above Autothrottle modes are protected by overspeed, underspeed, overtorque, undertorque and overtemperature control functions that provide FADEC like protection for the aircraft and engine.

2.5 LRU LEADING CHARACTERISTICS

2.5.1 ISU Leading Characteristics

The leading characteristics of the ISU are listed and described in the following table.

Table 2-1 ISU Leading Characteristics

CHARACTERISTIC	DESCRIPTION
TSO	(see Appendix H)
Environment Certification	RTCA/DO-160G (See Appendix A)
Software Certification	RTCA/DO-178B, Level B
FPGA Certification	RTCA/DO-254, Level B
Form Factor	See 1V-84176-9, Outline Drawing (Legacy PC-12) See 1V-84176-11, Outline Drawing (PC-12 NG)
Overall Dimensions	
Maximum Weight	1.7 lbs.
Voltage	Nominal: +28 VDC
	Range: +22 to +30.3 VDC (Emergency +18 VDC)
Current (does not incl. A/T load)	Nominal: 0.35A
	Max: 0.536A
Altitude	RTCA/DO-160G, Category A2 (See Appendix A)
Altitude Range (ISU)	-1,000 to +55,000 feet (-300 to +16,760 meters)
Airspeed Range (ISU)	30 to 500 knots (IAS)
Mach Range (ISU)	0.380 to 0.999
Geographical Limits (ISU)	65° N to 40°S in Latitude Extended Geographical Limits can be achieved when Magnetic heading is provided by an IRU/AHRS rated to operate at Latitudes outside the 65N to 40S limitation.
Temperature Range	RTCA/DO-160G, Category A2
Operating	-20 ºC to +70 ºC
Storage	-55 ºC to +85 ºC
Storage Humidity	95% RH
Cooling	Convection type (no forced air cooling required)
Connectors	See 1V-84176-9, Outline Drawing (Legacy PC-12) See 1V-84176-11, Outline Drawing (PC-12 NG)
Interfaces	See 1G-84176, Interface Control Document, ISU with A/T

2.5.2 ATA Leading Characteristics

The leading characteristics of the A/T Assembly are listed and described in the following table.

Table 2-2 ATA Leading Characteristics

CHARACTERISTIC	DESCRIPTION
TSO	(see Appendix H)
Environment Certification	RTCA/DO-160G (See Appendix A)
Form Factor	
Overall Dimensions	See 1V-89003-3, Outline Drawing (Legacy PC-12)
Maximum Weight	See 1V-89003-5, Outline Drawing (PC-12 NG)
Power Type	RTCA/DO-160G, Category AXX & BXX
Voltage	Nominal: +28 VDC
	Range: +18 to +32.2 VDC
Current	Nominal: 0.2 @ 28 VDC
(does not incl. ISU load)	Max: 0.7 @ 28 VDC
Power	5.6 Watts
Distance Measurement Sensor	+5 VDC
Torque	Factory adjustable motor torque output
Altitude	RTCA/DO-160G, Category A2 (See Appendix A)
Temperature Range	RTCA/DO-160G, Category A2
Operating	-20 ºC to +55 ºC
Short Time Operating	-30 ºC to +55 ºC
Storage	-55 ºC to +85 ºC
Storage Humidity	95% RH
Cooling	Convection type (no forced air cooling required)
Connectors	See 1V-89003-3, Outline Drawing (Legacy PC-12) See 1V-89003-5, Outline Drawing (PC-12 NG)
Interfaces	See 1G-89003, Interface Control Document, A/T

2.6 LIMITATIONS – INSTALLATION & OPERATION

See the IS&S AFMS, 1D-13466, for the ISU A/T system operational limitations. See the IS&S ICA, 1D-13467, for Airworthiness Limitations. The limitations in this Installation & Operation Manual are installation related limitations only as required by the TSOs.

The installer and operator of the Innovative Solutions & Support, Integrated Standby Unit (ISU) with Autothrottle (A/T) system (P/N 9K-88126-1/-3) shall be cognizant that there may be limitations when using the ISU A/T system in certain aircraft. The installation guidance in this manual and the Installation Instructions in IS&S document 1D-13456 must be followed in order to ensure an airworthy installation of the ISU A/T system with the limitations listed in this manual.

2.6.1 Installation Approvals

The TSO articles (of the ISU A/T system) meet the minimum performance and quality control standards required by the Technical Standard Orders (TSO). Installation of these (ISU A/T system) articles (on an aircraft) requires separate approvals (by the installer).

The Integrated Standby Unit removes existing components on the legacy PC-12 or the PC-12 NG. The ISU removes the RMI on the legacy aircraft and will be installed in the same location. The ISU weight is lower than the removed component weight and therefore does not require a separate structural substantiation.

The ISU replaces the electronic standby unit in the PC-12 NG aircraft. The same justification applies for the structural substantiation where the ISU weight is lower than the weight of the removed component. This is further outlined in the Weight and Balance Report 1D-13462.

2.6.2 Interfaces of the ISU A/T System

The ISU A/T system is only intended to interface with the aircraft systems identified in this installation manual. Connections to any other aircraft systems are not covered by this installation manual and may require the installer to submit additional data for certification.

2.6.3 Aircraft Power

The impact on existing power busses within the aircraft for the installation of the ISU A/T system is covered in the IS&S Electrical Load Analysis (1D-13465) for the Legacy PC-12 aircraft. If installations of the ISU A/T system are attempted with power distribution that is different, the installer may need to provide an updated Electrical Load Analysis.

2.6.4 Automatic Throttle Engagement

The Autothrottle engagement/re-engagement REQUIRES MANUAL PILOT ACTION. Under no condition does the Autothrottle engage automatically except during initial power up when the engine is not running. The Autothrottle runs a Built-In Test and verifies its calibration settings by running the friction test. The Autothrottle must have been successfully calibrated and passed the friction test as outlined in the Section 6.3.3 before it can be used. If this initial test fails the "A/T Cal Required" message will be displayed along the bottom of the HSI.

The following tests must be performed by the pilot prior to takeoff before the Autothrottle may be used in flight:

- Throttle Lever Friction Test
- Autothrottle Override Test

See Section 6.3.2.2.2 for instructions on running the Friction test. The Autothrottle Override Test verifies powering and adjustment capability of the Autothrottle. See Section 6.3.2.2.3 for a guide on accessing and activating the Override test procedure.

Certain conditions will inhibit the activation of the Autothrottle. The A/T PWR line select key on the ISU is non-functional under the following conditions:

- Engine Torque is in exceedance of the configured maximum torque in psi
- Engine ITT is in exceedance of the configured maximum temperature in degrees Celsius
- Any of the following parameters are missing or in a failed state:
  - Airspeed
  - Torque
  - ITT
- A/T System fault
- Autothrottle communication failure,
- Power Lever position sensor fault
- Autopilot is engaged in IAS HOLD mode
- The A/T Disconnect switch is held down (stuck)
- The aircraft is on ground and the takeoff/go around is not engaged.
- The takeoff/go around switch is held down (stuck)

3.0 OPERATION

3.1 GENERAL

This section provides a description of the ISU A/T controls, functional operation, and system monitoring. However, it is limited in the description of operation of controls since this is covered in more detail in the IS&S ISU with A/T for PC-12 Pilot's Guide, 1D-13470.

3.2 ISU A/T CONTROLS

The ISU A/T controls are described in the IS&S ISU A/T for PC-12 Pilot's Guide, 1D-13470.

3.3 FUNCTIONAL OPERATION

This section describes the functional operation of the ISU A/T equipment.

3.3.1 ISU Functional Operation

The ISU operation can be grouped into the following functional blocks:

- Power Supply
- Input / Output Processing (IOP)

3.3.1.1 ISU Power Supply

The ISU accepts power from a 28 VDC power source for primary power and a 5 VAC/VDC power source for the bezel lighting. The ISU operates to all performance requirements of its requirements specification when powered by a 28 VDC power source. The ISU does not contain any internal batteries.

The 28 VDC power input handles all ISU functionality and generates a power output signal to the ATA at 24 VDC. The bezel lighting setting for the ISU is driven off the 5V lighting bus. The ISU reads the lighting bus value and drives the lighting to the interpolated setting if within the calibrated limits. Lighting bus settings outside of the standard lighting bus range will assume a lighting output equal to maximum calibrated setting.

3.3.1.2 ISU Microprocessor

The ISU contains a microprocessor, whose peripheral circuits accept data from inputs provided by the ISU's interfaces and provides output to the display and autothrottle assembly.

Input and output interfaces of the ISU are summarized in the ISU Interface Control Document, 1G-84176.

3.3.1.3 Autothrottle Assembly Functional Operation

The ATA operation can be grouped into the following functional blocks:

- Power Supply
- Stepper Motor Controller
- Stepper Motor
- Linear Actuator
- Infrared Position Sensor

3.3.1.4 ATA Power Supply

The ATA accepts power from a 24 VDC power source, which is provided by the ISU. This allows the ISU to remove power from the A/T motor assembly when a system failure is detected. The ATA operates to all performance requirements of its requirements specification when powered by a 24 VDC power source, which is provided by the ISU.

3.3.1.5 ATA Stepper Motor Controller/Driver

The ATA contains an internal controller to handle the motor control. The communication interface from the ISU to the stepper motor controller is RS-485. The stepper motor controller drives the two-phase stepper motor.

3.3.1.6 ATA Stepper Motor

The ATA stepper motor is controlled via the ISU commanding forward and backward movement to achieve a control target.

3.3.1.7 ATA Linear Actuator

The ATA Linear Actuator converts the angular motion of the turning shaft to linear motion. Clockwise rotation of the shaft causes aft motion of a Power Control Lever (relative to installation in the aircraft) that is attached to the linear actuator. Counter-clockwise rotation of the shaft causes forward motion of a Power Control Lever (relative to installation in the aircraft) that is attached to the linear actuator.

3.3.1.8 ATA Infrared Sensor

The ATA Infrared Sensor measures the position of the throttle control lever and outputs a voltage in DC to the ISU that indicates the position. The ISU does not allow for control of the Autothrottle outside of the calibrated throttle range. The infrared sensor requires a 5 VDC power source.

3.4 SYSTEM MONITORING

The ISU A/T system monitoring function consists of automatic Continuous Built-In-Test (CBIT) functions in the ISU that check for proper operation of the LRU. The ATA is controlled by the ISU, the ATA output is checked by the ISU, and the ISU annunciates any ATA fault states. The ISU annunciates any identifies faults to the flight crew as outlined in the IS&S ISU A/T for PC-12 Pilot's Guide, 1D-13470. The ISU performs continuous, automatic Built-In Tests which check for the proper operation of the major functional elements.

3.4.1 SYSTEM LEVEL ANNUNCIATIONS

The following table covers a system failure of the ISU A/T system:

Table 3-1 ISU System Failure

Annunciator or Condition	Source	Reason for Flag, Condition, or Annunciator
(Blank Display)	If display power is ON, this indicates a Display Failure	The ISU display is blank (dark) and the backlighting is NOT visible. The display has detected an internal failure and has shut down backlighting to blank the display or internal backlighting has failed.

3.4.2 FAILURE ANNUNCIATIONS

The following tables show annunciations that are present when a sensor failure occurs or data from the sensor goes missing.

3.4.2.1 ISU Data Failure Flags

The following table shows the annunciations due to data failure or missing data on the ISU.

Table 3-2 Airspeed Data Failure Flags

FLAG	MEANING
	The altitude parameter computed by the ISU using the internal air data sensor is invalid due to an internal sensor or communication failure.
	The attitude parameter computed by the ISU using the internal attitude sensor is invalid due to an internal IMU or communication failure.

FLAG	MEANING
	The ISU has detected a failure of the integrity of the Configuration File (CF) from the Installation Configuration Module (ICM), or the ICM is missing. This affects all functions that are configurable.
	The ISU has automatically switched to Directional Gyro (DG) mode of operation, an alternative method of computing the heading parameter. Occurs due to a failure of the Magnetic Heading input parameter.
	The airspeed parameter computed by the ISU using the internal air data sensor is invalid due to an internal sensor or communication failure.
	The vertical speed parameter computed by the ISU using the internal air data sensor is invalid due to an internal sensor or communication failure.

3.4.2.2 Automatic Throttle Data Input Failure Flags

The following table shows the annunciations due to A/T Assembly input data failure or due to missing data.

Table 3-3 ATA Data Failure Flags

Flag	Meaning of Flag
A/T CAL REQUIRED	The autothrottle is missing calibration data and must be calibrated. See autothrottle calibration in Section 6.3.3.
A/T FAIL	A failure has been detected in an engine parameter used by the autothrottle system, the momentary switch on the side of the control lever is stuck
EXT ADC FAIL	A failure has been detected with the external air data source (if used) and the autothrottle system reverts to A/T control using internally sensed airspeed.
INVALID FLAPS	A failure has been detected with the flaps input. Maximum flap deployment (40 degrees) is assumed for A/T control.
A/T COMM FAIL	Communication between the ISU and the Autothrottle mechanism could not be established
A/T INIT	Autothrottle initialization failed during startup.
POSITION INPUT INVALID	The position sensor reads a value outside of the calibrated range.

Flag	Meaning of Flag
MOTOR OVERTEMP	The Autothrottle motor has overheated and is unavailable until within operating limits
MOTOR FAULT	An internal failure of the Autothrottle motor has been detected

4.0 INSTALLATION

4.1 GENERAL

This section contains general instructions and information to consider before installation of the ISU with A/T equipment. Close adherence to these instructions will assure optimum performance of the equipment.

NOTE:
The information in this document does not supersede any STC or actual aircraft installation and wiring. This document cannot be used instead of an STC.

The conditions and tests required for TSO approval of the ISU with A/T equipment are based on minimum performance standard guidelines. It is the responsibility of those desiring to install this equipment either on or within a specific type or class of aircraft to determine that the aircraft installation conditions still meet applicable TSO standards. The installer must follow the STC installation documentation to ensure this compliance is met.

See the IS&S Installation Instructions (1D-13456) for detailed installation instructions for installation of the IS&S ISU with A/T in the Pilatus PC-12 aircraft. See Appendix I for information regarding STC data for installation of the ISU A/T system.

4.2 ITEMS SUPPLIED

4.2.1 EQUIPMENT SUPPLIED

Regarding the installation of the IS&S ISU with A/T LRUs identified in Section 1.4.1 of this manual, IS&S only supplies the IS&S ISU with A/T LRU equipment. Each LRU supplied by IS&S is accompanied by a data sheet that shows the results of the Acceptance Test Procedure that was performed at the IS&S factory for the LRU. Each LRU should also be accompanied by some type of a Certification of Conformance (CofC).

4.2.2 INSTALLATION ITEMS SUPPLIED

The IS&S Installation Instructions document points to the 8E-13512 wiring diagram and 8B-13513 Installation Drawing, which identifies the parts provided for the installation. The installer needs to confirm the installation parts during an aircraft survey to ensure the provided components work on the target aircraft. The installer and IS&S will address these in an installation specific work pack.

4.3 ITEMS NOT SUPPLIED

IS&S does not provide any special tools, fixtures, and consumables that may be needed to install the ISU with A/T equipment identified in Section 1.4.1 of this manual. Also, IS&S does not supply any third-party equipment that is needed (see Section 1.5) to interface with the ISU with A/T equipment.

4.4 UNPACKING AND INSPECTION EQUIPMENT

Exercise extreme care when unpacking the ISU with A/T equipment. Make a visual inspection of the equipment for evidence of possible damage incurred during shipment. Check the contents to ensure that all items identified on the packing list are included.

If a claim for damage is to be made, save the shipping container to substantiate the claim. The claims for damage should be promptly filled with the transportation company involved.

IS&S suggests retaining the container and packaging material after all equipment has been removed in case it is necessary to store or ship the equipment.

Check that the required certificates and acceptance test data sheets are included with each piece of equipment that is received.

4.5 PRE-INSTALLATION LRU TESTING

The ISU A/T LRU equipment has been calibrated and tested to meet factory Acceptance Test Procedures (ATP) before shipment from the factory. Therefore, pre-installation testing is not required. The following table identifies the ATP that is performed at factory for each LRU.

Table 4-1 IS&S LRU ATP

IS&S LRU	Nomenclature	IS&S Part Number	ATP
ATA	Automatic Throttle Assembly	9B-89003-3/-5	1A-89003-3
ISU	Integrated Standby Unit	9D-84176-9/-11	1A-84176
ICM	Installation Configuration Module (for ISU)	9B-13428-()	1A-13428

4.6 INSTALLATION PLANNING

This section describes planning guidance for the installation of the ISU A/T equipment. The information provided herein is generic and may differ from the STC installation instructions. Wherever that is the case, the STC instructions take precedence.

4.6.1 General

The following sections contain information regarding the initial installation of the ISU A/T System and provide instructions concerning the location and mounting of the various components of the system.

The ISU A/T equipment should be installed in the aircraft in a manner consistent with acceptable workmanship and engineering practices and according to the instructions set forth in this publication.

4.6.2 Minimum System Configuration

The minimum ISU A/T installation requires the following IS&S equipment:

- A/T Assembly
- ISU

4.6.3 Location of Equipment

Location of the ISU A/T equipment is on or behind the instrument panel and in the center console.

The ISU is on the instrument panel. The ISU replaces the RMI indicator on the legacy PC-12 configurations. The ISU will mount into the same opening using the 3ATI counting clamp. The weight of the ISU is lower compared to the removed component and therefore no further structural substantiation is required. Figure 1-1 and Figure 1-2 provide a before and after representation of the ISU location in a legacy PC-12 aircraft (/41, /45 and /47). The ISU replaces the Thales or L-3 standby on the PC-12 NG (/47E) aircraft. Figure 1-3 and Figure 1-4 are provided to provide a before and after illustration of the ISU mounting location in the Pilatus PC-12 NG aircraft. The A/T Assembly is installed in the upper portion of the center console.

Figure 4-1 Installation Location of A/T Assembly

Care should be taken to avoid installing the ISU A/T system equipment near other equipment that operate with high pulse current or high-power outputs, such as radar and satellite equipment.

The ISU A/T system equipment should be installed in a location convenient for operation, inspection and maintenance, and in an area free from excessive vibration, heat, and electrical noise generating sources.

Length of the wiring between the ISU A/T system LRUs and existing aircraft avionics equipment should be kept as short as possible.

NOTE: There may be cases in which the above-mentioned installation requirements are not practical or are impossible to meet. However, it is the responsibility of the installation agency to ensure that installation requirements are achieved.

4.6.4 Electrical Preparation

See IS&S Interface Control Documents 1G-84176 (ISU) and 1G-89003 (ATA) for power, signal characteristics, interfaces, and pin assignment details for the ISU A/T system. The ISU A/T system LRUs require circuit breakers to control the power to the LRU power input(s). The ISU A/T system LRUs also require reference voltage inputs that are used for analog inputs or outputs.

4.6.5 Fabrication of Wire Harness

Wiring harnesses must be firmly supported to prevent movement and should be carefully protected against chafing. Additional protection should also be provided in all locations where the cables may be subject to abuse, such as high traffic areas.

4.6.5.1 ISU A/T Harness

Wiring harness can be fabricated according to the Installation Wiring Diagrams 8E-13512.

The connectors on the ISU A/T LRUs mate with the following connectors or equivalent.

Table 4-2 ISU A/T LRU Mating Connectors

ISU A/T LRU	DESIGNATOR	Pin Count	Part Number
ATA	J1	9	(DB9) M24308/2-1Z
ISU	J1	50	M24308/2-5F or equivalent
	J2	25	M24308/2-3F or equivalent

See the appropriate IS&S Hardware Envelope Drawing 1V-xxxxx (where xxxxx represent the base part number of the LRU, for example, for the ISU, 1V-84176-11) to determine what polarizing position is used on the mating connectors of the LRUs.

To allow for inspection or repair of the mating connector and harness, sufficient harness length should be provided when fabricating the new harness for the ISU A/T equipment. Also, a bend should be made in the harness that sits lower than the mating connector to allow water droplets (that might form on the harness due to condensation) to drip off at the bend and not collect in the mating connector.

4.6.5.2 Cable/Wire Shielding

Some interfaces to or from the ISU A/T equipment require the interfacing wire groupings to be shielded. The type of shielded wire used shall be appropriate for installation on Part 23 aircraft. The wire groupings that require shielding are listed in the 1G-84176 ICD and are also shown in the Installation Wiring Diagram, 8E-13512. These reference documents also provide the information regarding the grounding of the wire shields.

4.6.5.3 Engine Data Wiring

Some interfaces to or from the ISU require the wires interfacing with the existing temperature sensors to have a known wire lead resistance. The EOT wires should have a total impedance of 1 ohm. If the total resistance of these wires is not correct, then the errors will be introduced due to the amount of difference in resistance.

4.6.6 Mechanical Preparation

The A/T Assembly conforms to the mechanical outline dimensions detailed in the IS&S Envelope Drawing 1V-89003-[3,5]. The ATA is normally installed by using two screws to attach the ATA to the existing aircraft structure of the center console (see **Error! Reference source not found.**). The installation screws are to be lock-wired in place to secure them. The ATA is oriented forward and aft such that the connection of the linear actuator component of the ATA is lined-up with the connection point of the Power Control Lever and the Power Control Cable. The ATA mechanical installation details should be derived from the IS&S envelope drawing 1V-89003-[3,5].

The ISU conforms to the mechanical outline dimensions detailed in IS&S Envelope Drawing 1V-84176-[9,11]. The ISU is normally installed by using the captive screws on the ISU to attach the ISU on the instrument panel with a screw pattern that is compatible with the ISU dimensions and matches the 3ATI clamp dimensions. The ISU mechanical installation details should be derived from the IS&S envelope drawing 1V-84176-[9,11].

4.6.7 Pneumatic Preparation

The IS&S Integrated Standby Unit (ISU) requires connection to Pitot and Static pressure system. The ISU has a Static Port that conforms to MS33649-6 specification. The Pitot port conforms to MS33649-4 specification. The ISU is to be installed on the instrument panel on the Pilot side. The Pitot and Static system must be modified to connect the ISU to the Copilot's Pitot and Static system. For the PC-12 NG, the Pitot and Static System are not changed by the installation of the ISU A/T System. However, equipment connections to the Pitot and Static system do change. The Electronic Standby Instrument System (ESIS) is replaced by the ISU and the ISU connects to the same No. 1 Pitot and Static lines that were connected to the ESIS.

The connections to the aircraft's Pitot and Static ports designated as Pilot's and Copilot's shall be the same as those defined in the Pilatus PC-12 AMM, Section 34-11-20 (module 12-A-34-11-20-00A-040-A), and described below for reference:

- Pilot's Pitot system is connected to the Pitot tube on the Right wing.
- Copilot's Pitot system is connected to the Pitot tube on the Left wing.
- Pilot's Static system is cross-connected between the left/forward static port and the right/aft static port.
- Copilot's Static system is cross-connected between the left/aft static port and the right/forward static port.

4.6.8 Placards and Labels

The following placards are removed from the Power Control Lever (if applicable):

- Frequency Transfer Switch Placard

The following new placards are to be installed on the power control lever, next to what used to be the Frequency Transfer switch:

- Automatic Throttle Disconnect (A/T DISCON) Placard

The following new placards are to be installed on the circuit breaker panels:

- New circuit breaker placards per the IS&S 8E-13512 Installation Wiring drawing and the Installation Instructions (1D-13456).

The new placards are to be maintained and inspected per the existing Pilatus AMM maintenance practices (Chapter 11-00-00, module 12-A-11-00-00-00A-040-A).

4.6.9 Wire Harness Routing

Wire harness routing installation should be done in accordance with AC 43.13-1B, Chapter 11, and the PC-12 Wiring Diagram, 06-00-81 (Harness Electrical & Avionics).

Wire harness or cables should be installed in protected areas of the target aircraft that are identified in the 06-00-81, Harness Electrical & Avionics.

Care should be taken when routing wires or harnesses near Fuel Quantity Indicating System (FQIS) wiring in order to ensure the following:

- Provide adequate wire separation between FQIS wiring and structures and other wiring
- Do not route FQIS wires them in wire bundles together with any high voltage wires
- FQIS wiring should adhere to aircraft manufacturer's standard wiring practices.

Care should be taken when routing wires harnesses or cables near other systems as noted below in order to ensure the following:

- Wire harnesses or cable should not be routed near flight control cables
- Wire harnesses or cable should not be routed high voltage lines or high energy sources.

4.6.10 Cooling Considerations

All of the IS&S ISU A/T equipment is designed to operate without forced air cooling. However, installation of the ISU A/T equipment shall ensure adequate movement of free air around all sides of the ISU A/T equipment in order to support the convection of heat from the equipment to the free air. Enclosed compartments housing any ISU A/T equipment shall be vented to allow for free air flow. The ambient temperature around the ISU A/T equipment should not be allowed to rise above the qualified temperature limits for the unit when the equipment is operating.

4.6.11 Interface Planning

See the ISU A/T Interface Control Document, 1G-84176, for interface planning of the ISU A/T equipment interfaces. The required interfaces for the installation of the ISU A/T have been accounted for in the Installation Wiring Diagram, 8E-13512. However, if other interfaces are desired, see the ISU A/T Interface Control Document for the supported interfaces.

4.6.12 HIRF Considerations

The installation of the ISU A/T 9K-88126-[1, 3] wiring must comply with installation guidance in this manual, including references to IS&S documents. Length, shielding, and bonding of wires to ground of installed wiring must be in accordance with the lengths per the installation guidance such as the Installation Wiring Diagrams.

Bonding impedance between aircraft ground and the chassis of ISU must be less than 2.5 milliohms.

4.6.13 Certification Considerations

The installation of the ISU A/T system 9K-88126-[1, 3] is considered a major alteration to the aircraft type design. Installers should submit the required installation approval data.

The ISU A/T equipment is shipped from IS&S with labeling that supports any TSO authorizations from the FAA. However, it is the responsibility of the installer to obtain installation approval such as Supplemental Type Certificate (STC) authority from the FAA to install the ISU A/T equipment. The installer should contact IS&S regarding the availability of STC authority granted by the FAA for the installation of the ISU A/T equipment as well as for permission to use it.

The conditions and tests required for TSO approval of the ISU A/T equipment are minimum performance standards. It is the responsibility of those installing this equipment either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the TSO standards. Equipment that holds TSO certification must still have separate approval for installation in an aircraft. The article may be installed only if performed under 14 CFR part 43 or the applicable airworthiness requirements.

4.7 ISU WITH A/T EQUIPMENT INSTALLATION

4.7.1 ISU WITH A/T WIRING DIAGRAMS

Reference the IS&S Installation Wiring Diagram, 8E-13512 for wiring and power needed to install the ISU A/T equipment.

4.7.2 ISU WITH A/T INSTALLATION PROCEDURES

See the IS&S Installation Instructions document, 1D-13456, for procedure/instructions to install the new structures and ISU A/T equipment as well as re-locating re-used equipment.

See the third-party installation manuals for installation information regarding the third-party equipment.

4.7.3 PITOT AND STATIC CONNECTIONS

The equipment shall be connected to the existing Pitot and Static systems as follows:

- Connect the ISU to the Pitot and Static system described in the IS&S Installation Instructions (1D-13456).

The existing equipment with connections to these systems that are retained shall be connected to the existing Pilot's and Copilot's Pitot and Static systems as follows:

- Leave the existing Standby Altimeter connected to the same Pitot and Static System that is was connected to before the upgrade
- Leave the existing Autopilot Computer connected to the Pilot's Pitot and Static System.
- Leave the existing Cabin Altimeter Differential Pressure Indicator connected to the Pilot's Pitot and Static System.
- Leave the existing Cabin Altimeter Differential Switch connected to the Pilot's Pitot and Static System.

4.7.4 INSTALLATION OF PLACARDS AND LABELS

After installation of wiring, structures, and equipment, the new placards should be installed on the instrument panels and the new circuit breaker panel labels should be installed on the circuit breaker panels.

4.8 POST INSTALLATION CHECKS

The post installation checks include the following checks in the following order:

1. An electrical check of the wiring and connectors between the ISU A/T system equipment and the existing aircraft equipment before power is applied and before equipment is installed.
2. Electrical checks of the power and ground pins on all of the ISU A/T system equipment with power applied but with equipment not installed.
3. A visual inspection of the installed equipment and wiring.
4. A post-installation test that applies power to the equipment and functionally checks the equipment (see the Troubleshooting and Testing section for this test).
5. Pitot and Static system checks.
6. System Configuration Checks (software, configuration files, etc.).
7. Final functional Checks (Ground Tests)

4.8.1 Electrical Checks

4.8.1.1 Check Equipment Wiring

A system inter-wiring and intra-wiring check is performed before installation of the ISU A/T system equipment. This check verifies that the inter-connections between the ISU A/T system equipment (inter-wiring) and the connections with other existing aircraft equipment (intra-wiring) are correct before power is applied.

Using the Installation Wiring Diagrams, 8E-13512, check the wiring for proper wire source and destination connections, opens, and shorts.

4.8.1.2 Check Equipment Power and Ground pins

Check the specified power pins for each of the equipment in the ISU A/T system (see the Installation Wiring Diagrams) to ensure that correct voltage is applied when the correct circuit breaker is closed and is removed when the circuit breaker is open. Power should not be present on any other pins of the ISU A/T system equipment.

Check the specified ground pins for each of the equipment in the ISU A/T system (see the Installation Wiring Diagrams) to ensure that connection to aircraft ground meets the required impedance value. Ground connections should not be present on any other pins of the ISU A/T system equipment.

4.8.2 Visual Inspections

4.8.2.1 Equipment Visual Inspections

The following table provides the visual inspection procedure that should be used by the installer to check equipment after installation of the ISU A/T equipment. The inspections can also be used for future periodic maintenance inspection checks on the ISU A/T equipment installation.

Equipment	Inspection/Check Procedure
All ISU A/T system LRUs	1. Inspect for any sign of damage. 2. Check that the unit is properly installed and the retaining mechanism are securely tightened. 3. Check that all ISU A/T LRU connector pins are straight and not pushed back. 4. Check that all harness mating connector sockets are not pushed back. 5. Ensure that the mating connectors are securely tightened.

4.8.2.2 System Inter-Wiring Visual Inspection

The wiring used to provide connections with the interfaces of the ISU A/T system equipment should be visually checked by the installer to ensure the following is met for new and re-used wiring:

1. Wire/cable routing is as planned and will prevent chafing of the wires.
2. Wire does not have any cuts or breaks in the insulation.
3. Wiring is free of accumulated debris that would prevent heat from escaping the wiring.
4. Wiring is installed according to the applicable standard inter-wiring and cable fabrication reference information in the planning section of this manual.

4.8.3 Applying Power to the ISU A/T System

After the ISU A/T system is installed, checked per the preceding sections, and assuming all other aircraft equipment is ready for application of power, then apply aircraft power. When the ISU display powers up, perform the following:

- Check that the ISU turns ON. Press the knob to close the engine startup screen if displayed to display the operational ISU screen.

- Check that the ISU aligns (may take 60 seconds to align, see figure below)

Figure 4-2 ISU Operational Screen

- Check that the ATA is ON (A/T FAIL is not displayed on ISU)
  If any of the equipment does not appear to be ON, re-check the power and grounds and try again. Check that the mating connectors are properly mated with the connector on the LRU. For the ATA, ensure that the torque and ITT inputs to the ISU are valid.

4.8.4 Pitot and Static System Checks

4.8.4.1 Legacy PC-12 Pitot Static Connection

Check that the ISUs Pitot and Static system is connected to the aircraft Ps/Pt #1 system as described in Section 4.6.7 and that the equipment described in Section 4.7.3 is connected to the Pilot's Pitot and Static system. Perform a leak check on the Pitot and Static System.

4.8.4.2 PC-12 NG Pitot Static Connection

Check that the ISUs Pitot and Static system is connected to the No.2 Ps/Pt system as described in Section 4.6.7. Perform a leak check of the No.2 Pitot and Static System.

4.8.5 System Configuration Check

4.8.5.1 Configuration Files

After the ISU A/T system is installed, the ISU Service page should be checked to verify the version of the IS&S Configuration File that is installed on the system. This page is available on the ISU for one minute after power up and accessible via pressing and holding line select key 1, releasing when zoomed, turning the encoder to select Service Mode, and depressing the encoder to access the page. These are settings that are not selectable by flight crew and are normally used to initially configure the ISU A/T system after an installation on a target aircraft. There are normally set and provided by IS&S after request by customer for specific configuration settings. The following table identifies the possible configuration options. Individual configuration file version settings are not listed in this document as they are installation dependent. Contact IS&S for specific configuration file versions. If a configuration file has not been loaded, the ISU uses default values that are hardcoded in the software until a configuration file is loaded.

Table 4-3 IS&S Configuration File

Configuration Item	Configurable Options
Engine Parameters	Torque Upper Caution Torque Upper Warning (Max Take-off Torque Limit) ITT Upper Caution ITT Upper Warning (Max Take-off ITT Limit)
Reference Speeds	Landing Max Weight Stall Speed (Vso) Clean Max Weight Stalling Speed (Vs1) Max Flap Extended Speed (VFE) Max Cruise Speed (Vno) Never Exceed Speed (Vne)
SSEC	Static Source Error Correction data
DisplayThreshold	How much vertical rate is required before vertical speed is displayed
AircraftType	0 = PC-12 Legacy 1 = PC-12 NG
ILSInputType	0 = ARINC 1 = Analog
DataloggingOff	0 = Datalogging disabled 1 = Datalogging enabled
PidPage	0 = Disabled 1 = Enabled
GrossWeight	Default gross weight used in autothrottle calculations

Configuration Item	Configurable Options
AutoThrottleOn	0 = Autothrottle disabled 1 = Autothrottle enabled
UseExternalIAS	0 = Use internal calculated IAS for autothrottle control 1 = Use IAS from external ADC for autothrottle control
UseInfraredSensor	0 = Position sensor disabled 1 = Position sensor enabled
Motor Direction	0 = Straight shaft motor 1 = Reverse motor
Inputs	Defines device ID numbers and speeds for inputs to the ISU
ScreenConfiguration	0 = Portrait 1 = Landscape
SlipSkid	0 = Disabled 1 = Enabled
ADIMode	0 = Disabled 1 = Enabled
HSIMode	0 = Disabled 1 = Enabled
DisplayVSI	0 = Disabled 1 = Enabled
DisplayTAT	0 = Disabled 1 = Enabled
DisplayOAT	0 = Disabled 1 = Enabled
DisplaySAT	0 = Disabled 1 = Enabled
MetricDefault	0 = Disabled 1 = Enabled
BaroUnits	0 = hPa 1 = InHg
BaroSync	0 = Disabled 1 = Enabled
DisplayCabinPressure	0 = Disabled 1 = Enabled
CabinPressureAlert	0 = Disabled 1 = Enabled
AtSelect	0 = Torque hold selected by default 1 = Speed hold selected by default
LocalizerScale	0 (Unused)
GlideslopeScale	0 (Unused)
TATProbResistance	0 (Unused)
HotStart	0 = Hot start protection disabled 1 = Hot start protection enabled

Configuration Item	Configurable Options
MachAscendingThreshold	Integer value that corresponding to a mach value (i.e. 400 for .400) for the ascending threshold
MachDescendingThreshold	Integer value that corresponding to a mach value (i.e. 400 for .400) for the descending threshold
MinimumAirspeed	Configured minimum airspeed
MaximumAirspeed	Configured maximum airspeed
OnGroundAirspeed	Configured on ground airspeed
MinimumAltitude	Configured minimum altitude
MaximumAltitude	Configured maximum altitude
HotStartIttTimeOne	Limit used in hot start protection monitoring
HotStartIttTimeTwo	Limit used in hot start protection monitoring
HotStartIttTempOne	Limit used in hot start protection monitoring
HotStartIttTempTwo	Limit used in hot start protection monitoring
IttRise	The rate of change in degrees Celsius over 1 second that will trigger a hot start warning
AtPowerReadBackIndex	Defines which discrete input is used for the A/T power discrete
AtMomentaryIndex	Discrete input index for A/T disconnect
AntiIceOnIndex	Discrete input index for ice mode
GoAroundIndex	Discrete input index for go around switch
DayNightIndex	Discrete input index for Day/Night Mode
AnalogGSValidIndex	Discrete input index for Analog Glideslope
AnalogLOCValidIndex	Discrete input index for Analog Localizer
BezelLightDimIndex	Discrete input index for the LED light dim
AtIASHold	Discrete input index for IAS Hold mode
VoltageLevel	Lighting Bus Voltage max
Autothrottle Parameters	IS&S Proprietary settings
Configuration File P/N	7H-13428-xxx (where “-xxx” = configuration file version)

4.8.5.2 Installed Software

After the ISU A/T system is installed, the ISU Service Page should be checked to verify the installed software. This can be done via the service page, which is available within 30 seconds after powering on. Apply power to the system and check the status page of the ISU by press the MENU key, using the encoder to scroll to “Config” and depressing the encoder, then using the encoder turning to select the Service Mode and depressing to activate. Check the STC documents to ensure that the software that is installed matches the software called out in the STC documents. The figure below illustrates the service page and is for reference only, the figure may not indicate correct versions of software.

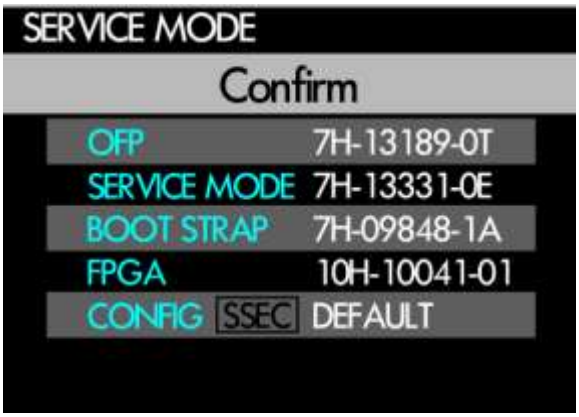


Figure 4-3 ISU Service Page

4.8.5.3 ISU Settings Page

After the ISU A/T system is installed, the ISU config page should be checked for the appropriate flight crew selectable settings (standard baro, metric display, and baro set units). Figure below is for reference only and may not indicate correct settings.

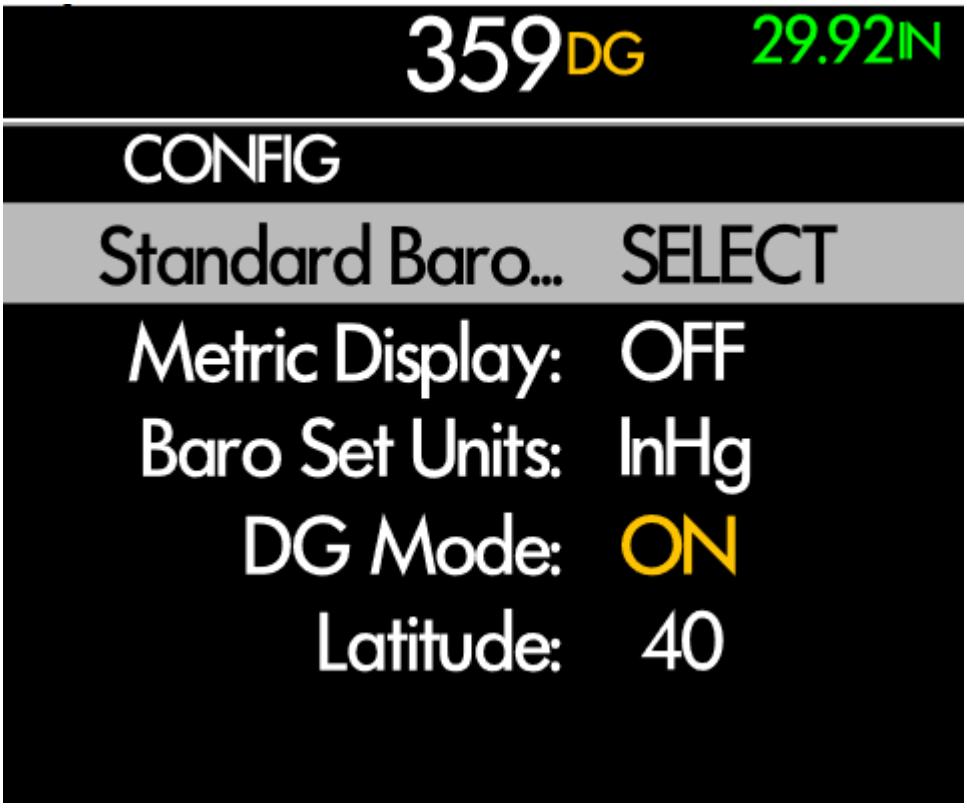


Figure 4-4 ISU CONFIG Page

SETTINGS ITEM	LRU	OPTIONS
BARO SET UNITS	ISU	ENGLISH / METRIC
METRIC DISPLAY	ISU	ON / OFF
STANDARD BARO	ISU	SELECT
DG MODE	ISU	OFF / ON

4.8.6 Functional Checks

4.8.6.1 Ground Tests

Perform the functional tests described in the IS&S Ground Test, 1Y-13460, to verify the functionality of the installed ISU A/T system. Complete each test and record the test results. These test results are to be saved and submitted to the installer's Quality Assurance group for validation of test results. Validation of test results should include, at a minimum, if the test results are complete, accurate, legible, and successful (all tests pass). After validation of test results, the results are to be included with the STC installation records.

4.8.7 Existing Magnetic Compass Accuracy

Check the existing magnetic compass on the aircraft to verify that the installation has not affected the accuracy of the magnetic compass. If necessary, perform the calibration of the magnetic compass per the aircraft maintenance manual and record any correction data in the aircraft logbook before running the ground tests.

5.0 FAULT ISOLATION

5.1 GENERAL

Built-in test features are performed automatically by the ISU A/T system during normal operation. Serial data inputs from the interfacing aircraft systems are monitored for validity and expected transmission rates. If the data is not found to be valid or is missing, the unit will set display the affected parameters as flags. Parameters which are replaced by a flag the display indicate a loss of input. Parameters which are not active will be replaced with dashes.

If the ISU detects an internal test failure, the problem may be caused by a failure of the data source or a failure of the ISU input circuits. Aircraft signals should be checked before returning a unit for repair. ISU fault summary is listed in Section 3.4.

The ISU A/T LRUs cannot be field-tested on a test bench setup when removed from the aircraft. System fault diagnosis should be performed on aircraft and the faulty unit confirmed by replacing the ISU or interface unit and rechecking the system performance. Faulty ISUs must be returned to the factory for repair.

The ISU is the primary interface for all of the data processed and displayed by the ISU A/T system. If data is not available or corrupted on a particular data bus, several flags may appear on the ISU.

5.2 ISU A/T NORMAL DATA PATHS

Knowledge of the data paths of the ISU A/T system can help in fault isolation of an issue. The following sections provide the data paths of the ISU A/T system when the Operational Flight software is running. Only the indirect paths are discussed, since the direct paths of data are obvious from the system block diagram.

5.2.1 ISU to/from ATA Data

The ISU communicates to the ATA via an RS-485 interface that exists between the two LRUs. Movement commands to the ATA are sent by the ISU when Autothrottle is active, and the ATA sends acknowledgements back to the ISU to ensure that communication is still present.

5.2.2 Configuration Data Usage

The IS&S Configuration File (7H-13428) is loaded into the ISU from an Installation Configuration Module (ICM) whenever powerup occurs. If the Configuration File (CF) data is not valid, the ISU will use default values for the configuration settings that are based on default settings in the OFP software, and this condition will display an amber “CONFIG” flag on the bottom left of the ISU.

The ISU service page should be checked for the correct part number of the CF every time power is applied to the ISU (on-ground or in-air) to ensure that the intended configuration files are being used.

When replacing an ISU, ensure that the correct ICM is attached to the ISU harness before applying power to the ISU. If the correct ICM is not attached to the ISU when power is applied to the ISU, the ISU will revert to the last valid configuration settings that is stored in NVRAM or provide default settings. If this occurs, the ISU should be reloaded with the correct CF version by powering off, removing the incorrect or faulty ICM, and attaching the correct or functioning ICM before powering on the unit.

5.3 ISU A/T SYSTEM SERVICE MODE DATA PATHS

Knowledge of the data paths of the ISU A/T system can help in fault isolation of an issue. The following sections provide the data paths of the ISU A/T when Service Mode software is running.

5.3.1 ISU A/T System Data Loading Paths

The ISU can be data loaded via an individual serial interface from a PC.

5.4 FAULT ISOLATION

This section provides guidance for fault isolation (troubleshooting) of failures that are identified by failure flags on the display of the ISU, missing display items, or other types of failures as listed. It assumes that the aircraft equipment has already been checked for correct software, firmware, and configuration versions; and that the installation has passed all tests/checks.

5.4.1 General Fault Isolation

The following table provides general fault isolation guidance for the ISU A/T System.

Table 5-1 General Fault Isolation Guide

Malfunction Symptom	Probable Cause(s)	Corrective Action(s)
ISU does not respond to user inputs via pushbuttons and knobs on ISU bezel and default settings are in use by the ISU	Internal ISU hardware failure.	If no response on the display, return to IS&S for repair.
Black screen on ISU	No power to display. Software has been incorrectly loaded or is corrupted. Internal display hardware failure.	Cycle display power. If no response on the display, return to IS&S for repair.
Amber “EXT ADC FAIL” appears on ISU	Power to the ADC is off The A429 wiring to the ISU is swapped or incorrect or broken Connector between ADC and ISU is loose	Ensure power to ADC is ON Check A429 wring and fix if necessary Check mating connector and tighten if needed
Amber “CONFIG” flag appears on the ISU	Corrupted configuration file, incorrect file loaded, or ICM is failed/missing.	Attach missing ICM or replace ICM with correct/new configuration module.
The ISU will monitor its sensors and display a flag for each parameter as follows: 1. Airspeed: **SPD** 2. Attitude: **ATT** 3. Altitude: **ALT** 4. Vertical Speed: **VERT** 5. Heading: **HDG**	1. Pitot Static Connection Leak/Failure 2. Magnetometer Interface Failure 3. Pitot Static Connection Leak/Failure 4. Pitot Static Connection Leak/Failure (No Altitude Data) 5. Magnet Heading Source Interface Failure	1, 3, 4: Check the Pitot Static Connection for leaks or breaks and ensure the ISU is correctly connected. 2, 5: Internal magnetometer failure. May need to be sent to IS&S for repair.

Malfunction Symptom	Probable Cause(s)	Corrective Action(s)
Amber “INVALID FLAPS” appears on the ISU	The flap position input to the ISU is either missing or has failed	Check the flap position signal input to the ISU. Check the FWCU if indications that it has failed are seen.

5.4.2 A/T Function Fault Isolation

The following table provides A/T Assembly fault isolation guidance.

Table 5-2 A/T Assembly Fault Isolation Guide

Malfunction Symptom	Probable Cause(s)	Corrective Action(s)
Amber color “A/T FAIL” is displayed on Automatic Throttle annunciator field of the ISU	A necessary condition for automatic throttle operation has become invalid or has become unavailable while the A/T function is ON. Control Lever Position Sensor data is missing or invalid. Torque data has become invalid. ITT data has become invalid. A/T DISCON switch is pressed for more than 2 seconds. Max torque is exceeded. Max ITT is exceeded. Airspeed data is invalid. Flaps data is invalid.	If on ground, use A/T MAINT page to check the following: Verify Position Sensor wiring between ATA and ISU. Valid TRQ data displayed on ISU. Valid ITT data displayed on ISU. A/T DISCON switch is not stuck. Torque and ITT are not over their maximum limit Ensure valid airspeed is received. Ensure valid flaps data is received. Try to re-engage A/T if all the above have checked OK.
Amber color “A/T CAL REQUIRED” is displayed on Automatic Throttle annunciator field of the ISU	A/T calibration data has become invalid.	Recalibrate the Autothrottle mechanism (See Section 6.3.4)
Amber color “A/T COMM FAIL” is displayed on Automatic Throttle annunciator field of the ISU	Communication between the ISU and the Autothrottle has failed.	Verify wiring between ATA and ISU
Amber color “A/T INIT” is displayed on Automatic Throttle annunciator field of the ISU	The Autothrottle failed to initialize when powering up	Communication or power supply error between the ISU and the ATA. Verify wiring between ATA and ISU

Malfunction Symptom	Probable Cause(s)	Corrective Action(s)
None of the A/T modes (TRQ, ASPD) can be engaged.	Note that while on ground, the Autothrottle may only be engaged in torque takeoff mode. Otherwise, a necessary condition for automatic throttle operation is invalid or not present and will not allow the A/T to be engaged: Control Lever Position Sensor data is missing or invalid. A/T calibration data has become invalid. Torque data has become invalid. ITT data has become invalid. A/T DISCON switch is pressed for more than 2 seconds and continuously held. IAS Hold mode from the Autopilot is engaged. Max torque is exceeded. Max ITT is exceeded. Airspeed data is invalid.	If on ground, use A/T MAINT page to check the following: Verify Position Sensor wiring between ATA and ISU. A/T calibration is valid and loaded. Valid TRQ data displayed on the ISU. Valid ITT data displayed on the ISU. That A/T DISCON switch is not stuck. Torque and ITT are not over their maximum limit Ensure valid airspeed is received. Ensure valid flaps data is received. Try to engage A/T if all the above have checked OK. If in air, check if all engine data is valid and press A/T PWR pushbutton twice to see if A/T FAIL flag is removed.

6.0 MAINTENANCE

This section provides or identifies the instructions covering periodic maintenance, calibration, and repair, for the continued airworthiness of the ISU A/T airborne equipment. If applicable, it includes recommended inspection intervals and service life, as appropriate.

6.1 GENERAL

The rest of this section, the service bulletins, and service information letters in this document (Appendix C and Appendix D) identify the maintenance requirements of the ISU A/T system equipment provided by IS&S. Federal and FAA regulations, airworthiness directives, advisory circulars also require certain maintenance requirements.

Most of the ISU A/T LRUs are designed and manufactured to allow for "On-Condition Maintenance". This means that there are no periodic maintenance requirements necessary to maintain continued airworthiness of the ISU A/T equipment. No maintenance is required until the equipment does not perform the intended function. When service is required, a complete performance test should be accomplished following any repair action.

Automatic performance monitoring and self-tests are continuously performed by the ISU A/T system LRUs Built-In-Test (BIT) software to detect malfunctions. After major aircraft maintenance cycles, the ISU A/T LRUs should be checked for proper system operation.

The only exception to the above is that the Automatic Throttle Assembly (ATA) of the ISU A/T does require planned inspections and maintenance, if inspection fails. Also, for the ISU, even though the ISU is calibrated at the factory and doesn't require any periodic alignment, calibration, or adjustment to ensure proper operation of the LRU, the FAA does require that altimeter and altitude reporting equipment to be periodically checked for accuracy per AC 43-6C.

6.2 INSTRUCTIONS FOR CONTINUED AIR WORTHINESS

The IS&S Instructions for Continued Airworthiness (ICA), 1D-13467, provided with the STC approvals per 14 CFR § 21.50, §§ 23.1529, FAA Order 8110.4C [paragraph 2-3 d (8)] and 8110.54A, for the ISU A/T equipment supersedes the instructions for continued air worthiness in this manual.

An annual inspection of the calibration of the Linear Actuator of the ATA is required to ensure the force required by crew to overcome the automatic movement of the Power Control Lever and Beta Cable in the PC-12 aircraft is within specified limits.

The operator is required by the FAA to test and inspect the ISU for altimetry functionality per guidance in FAA AC 43-6C and requirement in 14 CFR 91.411.

6.3 PLANNED OR SCHEDULED MAINTENANCE

6.3.1 FAA Required Inspection & Maintenance

6.3.1.1 Altimeters

Aircraft that are operated in controlled airspace under instrument flight rules (IFR) must have each altimeter and static system tested in accordance with procedures described in 14 CFR part 43, Appendix E, within the preceding 24 calendar months.

The IS&S ISU A/T system contains a single Integrated Standby Unit (ISU) that (among other interfaces) interfaces with the Copilot's side static system to provide display of altitude, airspeed, and vertical speed.

6.3.2 Automatic Throttle Assembly Inspection & Maintenance

An annual inspection of the calibration of the Linear Actuator of the ATA is required to ensure the force required by crew to overcome a "stuck" shaft of A/T Assembly is within specified limits. Another inspection requires that the A/T Assembly is able to automatic move the Power Control Lever and the attached Power Control Cable within the possible commanded range in the PC-12 aircraft.

6.3.2.1 ATA Inspection Schedule

An annual inspection schedule should be followed to check the Linear Actuator of the ATA to ensure the force required by crew to overcome the automatic movement of the Power Control Lever and Power Control Cable in the PC-12 aircraft is within specified limits.

6.3.2.2 ATA Inspection Procedure

The inspection consists of running two tests. One inspection test checks that the ATA can move the PCL back and forth without detecting any errors in position (Command/Friction test). The other inspection test is to ensure that the operator can overcome (override test) the friction between the motor shaft and the linear actuator components of the ATA if the motor shaft is frozen in place (not turning). A calibration of the ATA is performed before the inspection test is done to ensure that the ATA is calibrated to the PCL travel range in the aircraft.

6.3.2.2.1 ATA Inspection Test Setup

The following are the setup steps to prepare for manually initiating the Friction Test, Override Test, and calibration of the A/T Assembly. The same setup conditions must be present before the A/T Assembly can be used. The setup procedures assume that the ISU A/T installation and checkout have been successfully performed and the ISU A/T components are operating without any failure flags being displayed.

(1) For this setup procedure, the aircraft must be on the ground with the engine off.

(2) Ensure aircraft ground power is available and that the aircraft is being supplied with ground power (not battery power).

(3) Turn ON aircraft power.

(4) Ensure that all circuit breakers without collars that disable them are ON.

(5) Press the “MENU” key to activate the menu

(6) Turn the encoder to scroll to the “A/T SETUP” menu option, and press the encoder to select

(7) Use the encoder to highlight “A/T Status” and depress the encoder. Verify that all of the engine and flight data displayed on the status page is valid.

(8) Ensure that there are no failure flags displayed on the ISU. Press the upper line select key to return to the autothrottle setup menu. Observe Friction Test, Override Test, Back Pos and Forward Pos are selectable options in this menu.

(9) Ensure that the torque on the main HSI is displayed in magenta if not depress the takeoff/Go Around switch.

(10) The system is now ready for the on-aircraft calibration or testing of the A/T Assembly to be accessed and performed.

6.3.2.2.2 Friction Test Procedure

This test is meant to verify that the A/T Assembly can move the Power Control Lever (PCL) in the aircraft forward and aft automatically without any impediments. This is an automatic test and the test will start and end automatically when initiated. This procedure will also attempt to automatically run on powerup when on ground with the engine off. The Friction test procedure is the following:

(1) Ensure the setup conditions are in place before using this procedure (see Section 6.3.2.2.1).

(2) Perform the on-aircraft A/T Assembly range of motion calibration if needed (see Section 6.3.3.1). Ensure the calibration is successful before continuing with this procedure. If not successful, contact IS&S.

(3) Navigate to the Autothrottle menu as specified in Section 6.3.2.2.1.

(4) Ensure that the override and friction test fields do not indicate that either test is currently active (Displays “RUN” in green within the test’s field).

(5) Highlight the friction test field and depress the encoder.

(6) The text of the friction test field will indicate RUN in green. This indicates that the test is active.

(7) The PCL in the aircraft should now be moving forwards and then aft. It may move aft first before moving forward if PCL was not all the way aft to start movement of the PCL from the most aft position that has been calibrated in the aircraft.

(8) When the PCL has moved forward and aft and has stopped moving, check the FRICTION value on the AUTOTHROTTLE status screen. The display should display a numeric value.

(9) The numeric value displayed should be less than 20,000 for a passing test. If a value of 20,000 or greater is displayed, rerun the test a few times to see if the same result is consistently obtained. If the same approximate result is consistently obtained, the test has failed. Contact IS&S if the test has failed.

(10) If test has passed, the test is complete and will automatically de-activate (text will change color from green back to white).

6.3.2.2.3 Override Test Procedure

This test is meant to verify that the operator can move the Power Control Lever (PCL) in the aircraft forward and aft with a force of less than 15 lbs. (lbf) in order to override the calibrated friction between the motor shaft and linear actuator components of the A/T Assembly. When the test is activated, the ISU sets the motor torque to a normal operation value and keeps the shaft stationary. This allows the test operator to push or pull the PCL using a force gauge to attempt to overcome the current calibrated friction setting. If the operator is able to move the PCL forward and aft with a force of no more than 15 lbs. (pounds force - lbf), then the current calibration is still valid. If the operator is NOT able to move the PCL forward or aft with a force of no more than 15 lbs. (pounds force - lbf), then the current calibration is NOT valid and the A/T Assembly must be recalibrated.

The Override Test procedure is the following:

(1) Ensure the setup conditions are in place before using this procedure (see Section 6.3.2.2.1).

(2) Ensure the Friction Test has passed before continuing with this test procedure (see Section 6.3.2.2.2).

(3) Ensure that neither the friction nor the override test is currently active. Highlight the FRICTION TEST field and depress the encoder to activate the test.

(4) The text of the friction test field should change color from white to green and indicate ON. This indicates that the test is active.

(5) Use a Force Gauge to measure the force required to override the calibrated friction between the motor shaft and the linear actuator components of the A/T Assembly. Use the attachments that come with the force gauge to hold and pull the PCL using the force gauge. The override test will be performed in both the forward and aft direction of travel of the PCL. So, ensure that the force gauge attachment allows pulling of the PCL in both directions. It may be necessary to set the PCL all the way forward or aft depending on which direction is being tested.

(6) If the measured force in both directions is less than or equal to 15 lbf, the test passes. Test is complete, go to step 9.

(7) If the measured force in either direction is greater than 15 lbf, the test fails and the A/T Assembly calibration must be performed before this test is re-run.

(8) Reselect the override test and depress the encoder

(9) Ensure that the text of the OVERRIDE TEST changes color from green to white and indication has switched to off. This indicates that the test had been de-activated.

6.3.3 ISU Calibration

The ISU contains internal Accelerometers and Gyroscopes that are used to provide reliable situational awareness. To adjust for the positioning of the ISU a calibration routine must be run. To run the calibration routine, it is necessary to have a compass rose on a level surface that depicts at least magnetic North, South, East and West. This routine is only required if the ISU is connected to a magnetometer. If the ISU is receiving Heading information from an Inertial Reference Unit or AHRS input then you may proceed to Step 6.3.3.5.

The calibration routine also requires an aircraft pitch offset which is the difference between the aircrafts attitude on the ground versus in flight. To perform an aircraft pitch offset calibration, follow the procedures contained in Section 6.3.3.5.

Important! The calibration routine must be completed before the aircraft pitch offset procedures.

6.3.3.1 Required Equipment for Calibration

The following table contains the equipment that is required for the calibration procedures contained herein.

Equipment	Quantity	Comments
Aircraft Jacks (Optional)	1 Set	Used for leveling the aircraft.
Inclinometer	2	Provides a level reference.
Calibrated Handheld Magnetic Compass	1	Provides a precise magnetic heading source. (Not required if connected to an IRU)

6.3.3.2 Required Information for Calibration

The following information must be known before starting calibration:

The Latitude, Longitude and Elevation must be known in order to find the magnetic field data for the specific location of the calibration.

On a computer with internet access navigate to the following National Oceanic and Atmospheric Administration (NOAA) website to find the specific magnetic field data necessary for calibration.

NOAA website for magnetic field data - http://www.ngdc.noaa.gov/geomag-web/#igrfwmm

Field	Parameter	Value	Comments
Location	Latitude	Latitude of calibration	
	Longitude	Longitude of calibration	
	Elevation	Elevation of calibration	
Model	Model	IGRF 11	If a more current magnetic field model is available it should be used.
Date range	Start Date	Current Date	These are the default values.
	End Date	Current Date	
	Step Size	1	
Result	Result Format	HTML	

When all of the data is entered press the 'Calculate' button and a new window will appear with the magnetic field information at the calibration site.

Important! Print or record the magnetic field information.

6.3.3.3 System Configuration During Calibration

During calibration any aircraft equipment that produces a significant magnetic field should be turned off and if possible disconnected via the circuit breaker. Devices that produce significant magnetic fields include but are not limited to: Deice Manifold Heaters, Pitot Heaters, Static Heaters, Windshield Heaters, Air Conditioners, etc.

The calibration should be performed outside in an area of low magnetic influence away from buildings, fences, vehicles or any other large metal objects. The calibration should be performed using internal aircraft battery only. Do not use any external power, including power pack battery set, or ground power. If a tug is used to tow the aircraft into position during the calibration, use a hitch-type tug with a long aluminum tow bar. In each position, while the ISU is gathering data, the tug should be powered down.

6.3.3.4 Entering Service Mode

To begin calibration, enter the menu and select the Service Mode option within the first 30 seconds of power-up. This cannot be done in flight and the airspeed must be less than 50 knots. Once the service mode menu option has been selected the unit will display a prompt to cycle power to enter service mode. Cycle power. When the unit powers up it will display a Calibration option.

6.3.3.5 Setting the Aircraft Pitch Offset

The aircraft pitch offset procedures provide the ability to level the ISU's ADI to the aircrafts in flight attitude characteristics. The aircraft pitch offset procedure only needs to be performed at the initial installation of the LRU. All calibration information is maintained in non-volatile memory within the LRU.

1. Level the aircraft by adjusting the aircraft roll attitude to 0.0° ±2° and the pitch attitude to 0.0° ±2°. Measurement of level can be performed by placing a digital inclinometer on the aft cabin floor. Pitch should be measured by placing the digital inclinometer parallel to the centerline of the aircraft. Roll should be measured by placing the digital inclinometer perpendicular to the centerline of the aircraft.

2. Enter Service Mode as described in Section 6.3.3.4 and select the 'Pitch Offset' option.

3. A confirmation page will be displayed. Verify that the aircraft is level in both pitch and roll. If any of these requirements have not been met do not proceed.

4. If the preceding requirements have been met select the 'OK' option to continue.

5. The ISU will display an 'ACQUIRING DATA' indication. Ensure that the aircraft is stationary during the calibration period.

Caution! The aircraft should remain stationary while calibrating the pitch offset. Movement of the aircraft can lead to erroneous pitch offset calibration.

6. After the calibration period the ISU will display either a 'PITCH OFFSET CALIBRATION SUCCEEDED' or a 'PITCH OFFSET CALIBRATION FAILED' indication. If the calibration failed, repeat the Aircraft Pitch Offset calibration contained herein. If the calibration is successful select 'OK' and cycle power to the ISU.

6.3.3.6 Setting the Bezel Button Brightness

The bezel button brightness calibration allows the installer to adjust the maximum brightness intensity of the bezel button lighting circuitry. The intent of this feature is to allow installers the ability to optimize the high side intensity of the bezel button lighting to match any surrounding LRU by a simple visual comparison.

1. Enter Service Mode as described in Section 6.3.3.4 and select the 'Button Brightness' option.

2. The adjustment page will ask the installer to adjust the brightness of the buttons by pressing the up and down arrow keys or rotating the encoder knob.

3. While the up/down key is being pressed the brightness (intensity) of the buttons will be raised or lowered respectively. A numerical representation of the brightness will also increase or decrease with the button lighting brightness. (Note: that the brightness can be adjusted within the range of 10 to 100 percent.

4. Pressing the SEL key (depressing the encoder) will save the result. And ask the user to cycle power to the unit.

5. When the ISU powers on, adjust the aircraft lighting bus to its maximum and confirm that the bezel button lighting intensity is consistent with the brightness just set during the calibration activity.

6.3.4 ATA Calibration

6.3.4.1 In-Aircraft Range Calibration

When the A/T Assembly is installed or replaced on an aircraft, it requires an in-aircraft range calibration before it can be used. The calibration checks for the usable range of the A/T Assembly while moving the Power Control Lever (PCL) in the aircraft between maximum forward position and maximum aft position. The results of a successful calibration are stored in non-volatile memory of the ISU by the operator at the end of the calibration. The ISU can be checked to see if there is a valid calibration stored in memory or not. If this calibration is to be manually performed on the A/T Assembly that is currently installed on the aircraft, then use the following procedure for the In-Aircraft Range Calibration of the A/T Assembly.

(1) Navigate to the Autothrottle menu as described in section 6.3.2.2.1.

(2) Check that the Throttle Brake is not set so that it allows for normal throttle movement

(3) Use the encoder to highlight the “Back Pos” field within the Autothrottle menu

(4) After highlighting the field, set the PCL to the minimum aft position (gently move PCL back until it cannot be moved aft anymore).

CAUTION:

To prevent damage to the control linkage, do not move the Power Control Lever (PCL) aft of the Idle Detent (into the Reverse Range) with the engine not running (see the aircraft maintenance manual).

(5) Depress the encoder to store the rear throttle position.

(6) Use the encoder to highlight the “Forward Pos” field within the Autothrottle menu.

(7) After highlighting the field set the PCL to the minimum fore position (gently move PCL forward until it cannot be moved fore anymore)

(8) Depress the encoder to store the forward throttle position.

(9) After a calibration is performed, the inspection tests listed in Section 6.3.2.2 of this manual should be performed before using the A/T Assembly.

6.3.4.2 Linear Actuator Calibration

When needed, the A/T Assembly requires re-calibrating of the friction between the motor shaft and the linear actuator components. The calibration is performed at the IS&S factory before the unit is shipped. If an inspection of the calibration in the field determines that the calibration needs to be re-done, then use the following procedure for the calibration of the linear actuator component.

(1) Remove the A/T Assembly from the aircraft (see Section 7.1.1).

(2) Place the A/T Assembly in the A/T Calibration Test Fixture.

(3) Remove the two round covers from the Linear Actuator component of the A/T Assembly to gain access to the set screws that are used to adjust the friction setting between the Motor Shaft and the Linear Actuator.

(4) Loosen the screws and ensure that the linear actuator can be freely moved over the motor shaft when the motor shaft is kept from rotating by holding it in one hand. If this is not possible, return the A/T Assembly to IS&S for repair and end this calibration procedure. If it is possible, then proceed with the next step.

(5) Use the appropriate tool to tighten the two screws to an initial torque of in-lbs.

(6) Use a force gauge to move the Linear Actuator while the motor shaft is kept from turning (a test setup may be required). Ensure that the force required to slide the Linear Actuator over the stationary (not turning) shaft in both directions is 15 ± 2 lbs.

(7) If the force required is more than 15 ± 2 lbs., loosen both screws by a quarter of a turn and try the test again. Repeat the process until the calibration provides the correct result. If a setting cannot be found that allows the calibration to pass, then contact IS&S and return the A/T Assembly to IS&S.

(8) If the calibration is successful, replace the two screw covers on the Linear Actuator of the A/T Assembly.

(9) Replace the A/T Assembly in the aircraft (see Section 7.2.1).

6.3.4.3 Cleaning of ISU A/T Equipment

Although there are no periodic maintenance requirements necessary to maintain continued airworthiness of the ISU A/T equipment, there are some periodic maintenance tasks that will allow for optimum performance of the equipment. These maintenance tasks relate to cleaning of the equipment in the ISU A/T system and the portion of the aircraft wiring that is part of the system. When deemed necessary, depending on the environment to which the equipment is exposed to and the intensity of use, periodic cleaning should be performed.

When needed, the ATA only requires general cleaning of the assembly and re-calibrating of the linear actuator component. The cleaning should be performed per the cleaning procedures in the following sections. Be sure to remove any hydraulic fluid, grease, or oil from the motor shaft of the A/T Assembly if any is found to be present.

6.3.4.4 Cleaning General

(1) Use these procedures to remove dust, dirt, and unwanted oil and grease form the external portions of equipment. Be careful not to cause damage to the parts when these procedures are performed.

(2) Perform these cleaning procedures in a clean location.

(3) If pressurized air is use to clean or dry external portions of equipment (except display surfaces and bezels with user interfaces that may allow entry of moisture), use only the amount of air pressure that is necessary to clean the equipment. Avoid the use of excessive amount of air pressure that may force fluids into areas of the LRU that have.

(4) After the equipment is cleaned, protect the exposed part of the equipment from moisture, dust, and other contamination until you do a visual check and protect the exposed part (for example the mating connector pins).

(5) Follow existing cleaning instructions in the aircraft maintenance manual.

6.3.4.5 Cleaning Equipment and Agents

WARNING:

Some cleaning agents can be dangerous. For information, refer to the Material Safety Data Sheet (MSDS) provided by the manufacturer for the material before you use a material.

(1) See the following table for equipment to be used to clean the ISU A/T LRUs. Alternative equipment is permitted if they are equivalent.

Table 6-1 Equipment for Cleaning

Item	Description	Source	Applicable Equipment
Air Supply	Used compressed air with an ionizing nozzle or gun attachment. Set pressure for 20 psi.	Various	ISU, ATA
Soft Brush	Soft natural-bristle brush	Various	ISU, ATA
Stiff Brush	Stiff Bristle Brush	Various	ISU, ATA
Cotton Swab	Standard commercial Cotton Swab	Various	ISU, ATA
Cloth	Lint-free, cloth or micro-fiber cloth that is dry or dampened with cleaning material as appropriate per procedure	Various	ATA, ISU
Abrasive Corrosion Cleaner	4/0 Crocus cloth or equivalent	Various	ISU, ATA

(2) See the following table for cleaning agents to be used to clean the ISU A/T LRUs. Alternative equipment is permitted if they are equivalent.

Table 6-2 Cleaning Agents

Item	Description	Source	Applicable Equipment
Isopropyl alcohol	Isopropyl alcohol per Federal Specification TT-I-735A, Notice 3, Grade B (water content 0.4 percent maximum). IUPAC name is Isopropanol or 2-Propanol.	Various	ATA, ISU
Glass Cleaner	100% Ammonia-free glass cleaner or vinegar (DO NOT USE ammonia based glass cleaners, waxes, or abrasive cleaners as this may harm the display surface anti-reflective treatment)	Various	ISU
Water	Clean Water (H20)	Various	ATA, ISU
Detergent	Mild detergent	Various	ATA, ISU

6.3.4.6 Cleaning Procedure

CAUTION:

The ISU A/T system LRUs contains ESDS items. Use protective procedures.

CAUTION:

If you clean or dry ESDS parts with pressurized air, ensure that the hose has an ionizing nozzle or gun. An electrostatic charge can cause damage to the parts if the nozzle or gun attachment is not used.

CAUTION:

Before you use isopropanol as a solvent, make sure it does not cause damage to the painted surfaces. Apply a small amount of the solvent; too much solvent can cause damage to parts that are sensitive to moisture.

6.3.4.6.1 Display Surfaces

(1) Dampen a clean cloth with Isopropyl alcohol (display surface and bezel of ISU are resistant to Isopropyl alcohol, 100% Ammonia-free glass cleaners, and vinegar).

(2) Wipe the display glass surface with a circular motion, this way areas overlap and are able to remove smudges and dirt from the surface.

(3) Use a water diluted glass cleaner (50/50 mix) to wipe off excess alcohol if residue still exists on glass surface.

(4) The final clean step should be with a dry lint free cloth or micro-fiber cloth to wipe off excess water and remaining residue.

6.3.4.6.2 External Parts (Except Display Surfaces)

(1) Remove dirt and dust with pressurized air or a soft, natural-bristle, brush.

(2) Remove oil and grease that has collected on the equipment using a clean cloth or cotton swab that is moist with isopropanol.

(3) To clean an area in a recess, use a stiff-bristle brush that is moist with a mild detergent.

6.3.4.6.3 Connector Pins

(1) Remove dirt and dust around connector pins with pressurized air (only brief burst of low-pressure air should be used to dis-lodge any debris).

6.3.4.6.4 Metallic Mechanical Parts

(1) Remove any corrosion from the unpainted areas of metal parts with a 4/0 crocus cloth.

(2) Clean the metal parts by wiping the part fully with a cloth that is moist with Isopropyl alcohol.

(3) Dry the part with pressurized air (use low pressure air).

6.3.4.6.5 Wire Harness

(1) Use a clean natural fiber rag moistened with isopropyl alcohol to remove any accumulated dust and dirt from the portion of the wire harness that interconnects with the ISU A/T system equipment and the zones were the wire harness passes through.

(2) Wipe down the harnesses but never vigorously scrub the harnesses as this may damage the wire insulation.

(3) When cleaning an area, avoid movement of the harness and/or equipment during cleaning of non-aggressive contamination such as dust, dirt, or swarf. If it is necessary to move the harness for cleaning, release wiring from its installation (loosen clamp and ties) in a way that avoids placing stress on the connectors or support devices. Interior wire bundle contamination should be addressed by removing bundle ties before separating wires.

(4) Recognize corrosion in metals were wires are terminated (bonded) to the metal structure as this is an important part of the wire harness component cleaning process. Corrosion between wire and metal bonding surface can have a significant impact on system performance.

(5) If inspection identifies that repair of wire harness component is necessary, repair the wire harness component before cleaning of the wire harness area.

6.4 CONDITION BASED MAINTENANCE

None of the components installed during this type design change require scheduled overhaul. The LRUs of the system perform Continuous Built-In-Test (CBIT) and monitoring and any detected failures are annunciated to the flight crew via failure flags on the display. Therefore, the maintenance category of the LRUs of the ISU A/T system is On-Condition Maintenance (or Condition Monitoring – CM). If any failure cannot be cleared and has been verified to not be due to failure of interfacing equipment, then the equipment shall be returned to IS&S for repair.

6.4.1 Repair of IS&S Equipment

NOTE:

All repairs require depot-level service.

Unauthorized maintenance at the organizational-level may nullify the equipment warranty.

If any of the IS&S ISU A/T equipment fails and requires repair, it shall be returned to the IS&S factory for all repairs. No repairs shall be performed in the field. See Section 7.5 for shipping information.

NOTE: Refer to 1M-84176 Component Maintenance Manual (CMM) for the 9D-84176 ISU
Refer to 1M-89003 Component Maintenance Manual (CMM) for the 9B-84176 A/T

6.4.2 IS&S ISU A/T Software Modifications

Any modification of the IS&S provided software on fielded units will be released via a Service Bulletin that will include the reason, applicability, and instructions for the software update. There are no currently planned software modifications to fielded ISU A/T LRU software. See the software loading section to see what software can be loaded in the field and which require return of the LRU to the IS&S factory.

6.4.3 IS&S ISU A/T Hardware Modifications

All hardware modifications to the ISU A/T equipment that are required will be performed at the IS&S factory only. There are no currently planned hardware modifications to fielded ISU A/T LRU hardware.

6.4.4 IS&S ISU A/T Configuration File Modifications

Any modification of the IS&S provided Configuration file will be released via a Service Bulletin that will include the reason, applicability, and instructions for the configuration file update. There are no currently planned ISU A/T Configuration file modifications for fielded ISU A/T LRUs.

7.0 REMOVAL AND REPLACEMENT

7.1 REMOVAL OF IS&S ISU A/T LRU

This section provides the instructions for removal of the IS&S ISU A/T LRUs. Follow the following safety cautions and warnings during removal of the LRUs.

Return failed instruments to:

Innovative Solutions & Support, Inc.
Cage: 0EUW0
720 Pennsylvania Drive
Exton, PA 19341 USA

Table 7-1 LRU Removal Procedure Safety

WARNING: **Ensure that power remains OFF during all steps of LRU removal.**
CAUTION: **Equipment contains electrostatic sensitive devices (ESD). Electrostatic discharge protection requires that all ESD precautions be taken when performing the removal procedure.**
CAUTION: **These procedures detail the steps required for removal of the LRU and do not include, or recommend, any equipment repair or disassembly being performed on the instrument while on board the aircraft. Please note the following:** All instrument repairs must be done in an approved depot maintenance facility, or at the IS&S factory. Unauthorized maintenance actions at the organizational level may nullify equipment warranties**.**

7.1.1 Removal of A/T Assembly (ATA)

Follow the following instructions for removal of the ATA.

Table 7-2 A/T Assembly Removal Procedure

WARNING: **Ensure that all aircraft power remains OFF while performing all steps of the LRU removal procedure.**	
CAUTION: **Equipment contains electrostatic sensitive devices (ESD). Electrostatic discharge protection requires that all ESD precautions be taken when performing this procedure.**	
P/N:	9B-89003-[3,5]
Installation Location	Within top portion of the Center Console of a PC-12 aircraft (see illustration following this table).
Tools:	Hex screwdriver for loosening ATA mounting hardware Pliers for removing cotter pin
Materials:	ESD Cap (IS&S P/N: 2A-03324-110, CAPLUG P/N: DCC-11), QTY: 1
Removal Steps:	
1	Remove all units and blank plates from the upper region of the Center Console Pedestal (on PC-12 aircraft) to gain access to the ATA mounting hardware. Also, remove Pilot and Copilot side access panels of the Center Console Pedestal to gain more access to the ATA components. May need to remove Pilot side seat if more room is needed for access.
CAUTION: **Do not move the Power Control Lever (PCL) aft of the Idle Detent into the Reverse Range when the Beta Control Cable is connected (see the aircraft maintenance manual).**	
2	Gently move the Power Control Lever (PCL) in the PC-12 aircraft to the maximum forward position (see aircraft manual).
3	Disconnect cable connected to J1 electrical connectors of the ATA. Unscrew the two (2) thumb screws that secure the mating connector shell until connector & cable can be disengaged from the electrical connector. The connector is on the forward side of the ATA.
4	Disconnect the DB9 mating connector from the connector that terminates the ATA linear infrared sensor wiring.
5	See aircraft manual to remove the cotter pin from the hex bolt that holds the Linear Actuator, the Power Control Lever, and the Power (Beta) Control Cable (in the PC-12 aircraft) together. Discard the cotter pin. Remove and retain the hex bolt, nut, and two washers to disconnect the linear actuator arm of the ATA from the PCL and Control Cable. Temporarily connect the PCL and Control Cable using the hex bolt, nut, and two washers.
6	Loosen the two (2) hex head screws holding the ATA onto the metal structure of the forward part of the Center Console Pedestal (see figure following this table). Ensure that the two screws are not lost in the aircraft that could cause Foreign Object Damage (FOD) by leaving them attached to the A/T Assembly.

Table 7-2 A/T Assembly Removal Procedure	
7	Manually retract the linear actuator component towards the motor controller component of the ATA to make the ATA size smaller. Reach in through the open top of the Center Console and grasp the ATA by the body of unit (not the electrical connector) and remove from aircraft structure.
CAUTION: **Assemblies internal to the ATA could be damaged from electrostatic discharge conducted through the Electrical Connector J1.**	
8	Install ESD Caps on the Electrical Connector J1.
Note: Refer to Section 7.4 to prepare the LRU for shipment	

Figure 7-1 ATA Installation within PC-12 Aircraft Center Console - Top & Back View Note: PC-12 NGconfiguration

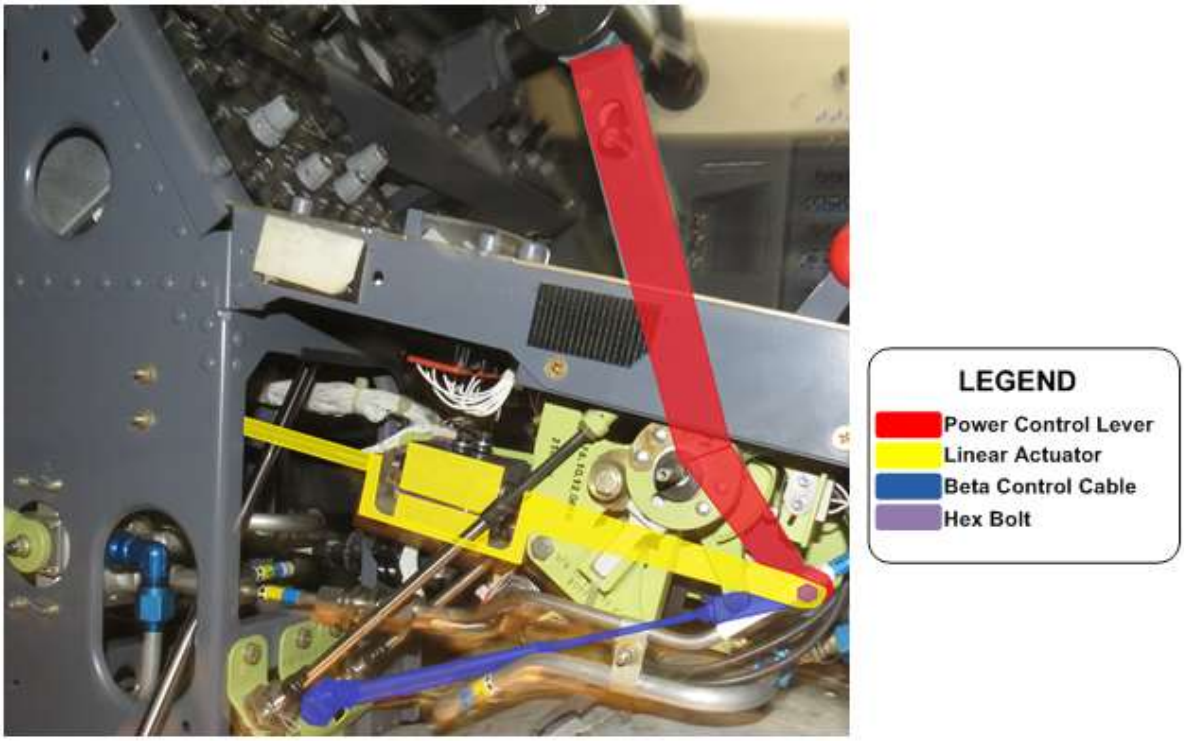


Figure 7-2 ATA Installation within PC-12 Aircraft Center Console - Side View Note: Similar Image

7.1.2 Removal of ISU

Table 7-3 ISU Removal Procedure	
WARNING: **Ensure that power remains OFF while performing all steps of the LRU removal procedure.**	
CAUTION: **Equipment contains electrostatic sensitive devices (ESD). Electrostatic discharge protection requires that all ESD precautions be taken when performing this procedure.**	
P/N:	9D-84176-[9,11] (ISU)
Installation Location	On the instrument panel (See figures below).
Tools:	Phillips screwdriver for removing mounting hardware
Materials:	ESD Cap (IS&S P/N: 2A-00853-22, CAPLUG P/N: CEC-22), QTY: 1
Removal Steps:	
1	Open and install a Safety clip (circuit breaker hold open) (Pt. No. 110.88.07.065) on this circuit breaker: - ISU (EPS BUS or BATTERY BUS)
2	Loosen the two screws [Item 2] that clamp the Integrated Standby Unit (ISU) [Item 1] in the left instrument panel.
3	Carefully pull the ISU [Item 1] out of the instrument panel to give access to the electrical connector [Item 3] and the pitot static pipe connectors [Item 4 & 5].
CAUTION: **Assemblies internal to the ISU could be damaged from electrostatic discharge conducted through the Rear Electrical Connector J1.**	
5	Disconnect the electrical connector [Item 3] from the ISU [Item 1].
6	[9D-84176-9 and -11 only] - Disconnect the pitot and static pipe connectors [Item 4 & 5] from the ISU [Item 1]. Some installation may have quick-disconnect pitot static connectors.
7	Install ESD cap on J1 and J2 of the ISU
8	Remove the ISU [Item 1] from the aircraft. The ICM [6] remains connected to the electrical connector [Item 3] in the aircraft.
Note: Refer to Section 7.4 to prepare the LRU for shipment	

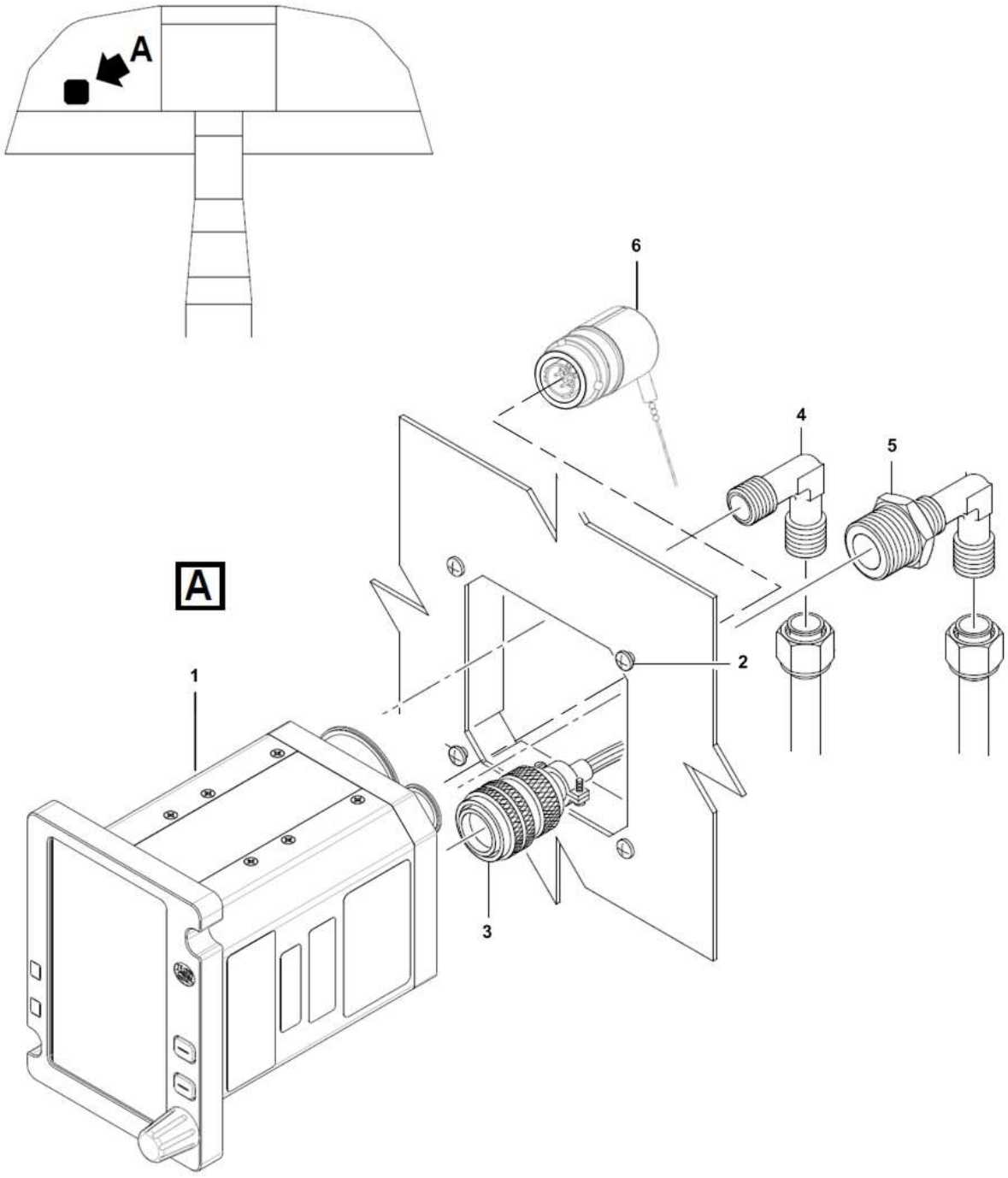


Figure 7-3 ISU Removal/Installation - Legacy PC-12 Note: Similar Image

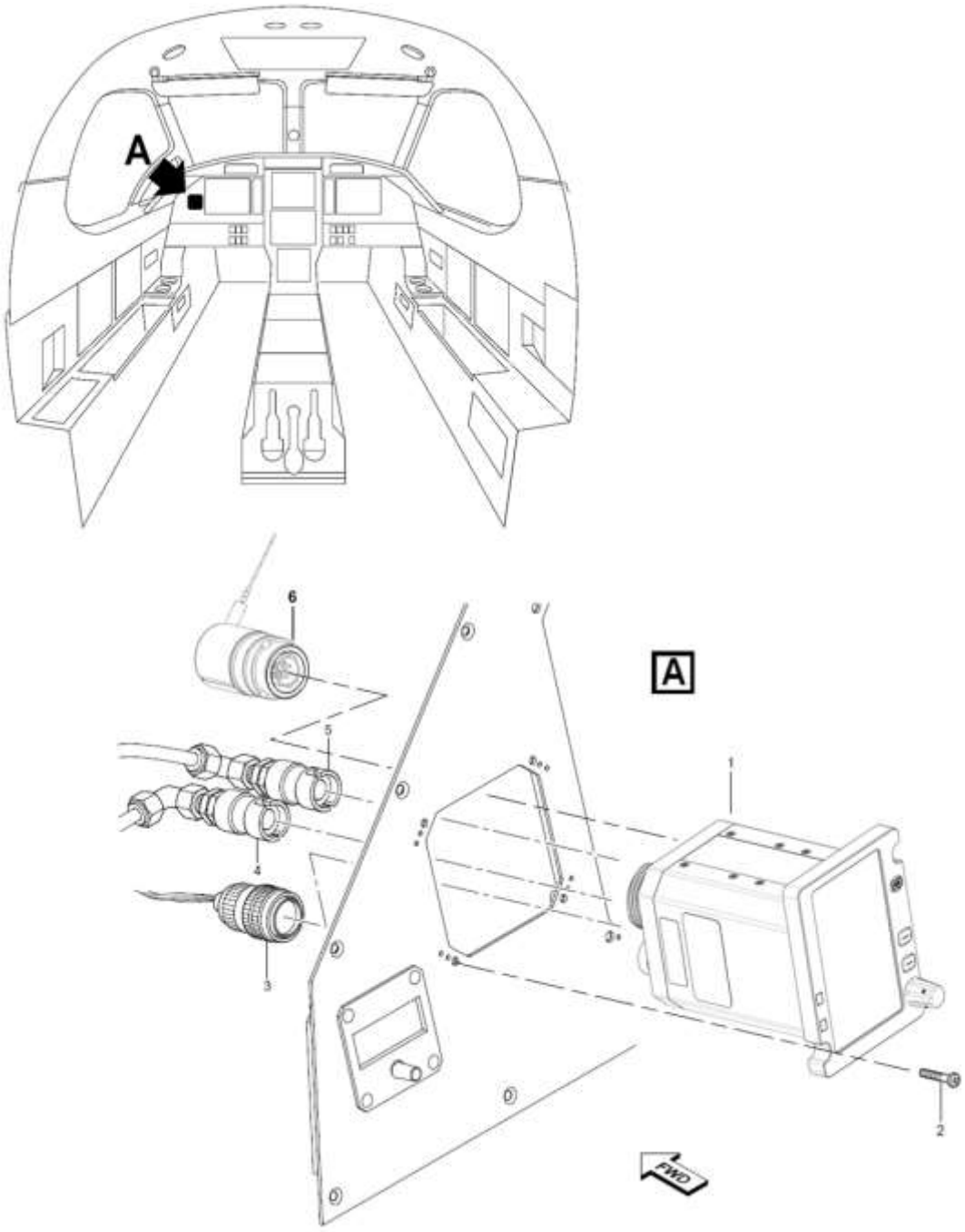


Figure 7-4 ISU Removal/Installation - PC-12 NG Note: Similar Image

7.2 REPLACEMENT OF IS&S ISU A/T LRU

This section provides the instructions for the replacement of the ISU A/T system LRUs after it has been removed (assumes installation work for the LRU has already been accomplished). Follow the following safety cautions and warnings during replacement of the ISU A/T LRUs.

Table 7-4 LRU Replacement Procedure Safety

WARNING: **Ensure that power remains OFF during all steps of LRU replacement.**
CAUTION: **Equipment contains electrostatic sensitive devices (ESD). Electrostatic discharge protection requires that all ESD precautions be taken when performing the replacement procedure.**
CAUTION: **These procedures detail the steps required for replacement of the LRU and do not include, or recommend, any equipment repair, or disassembly being performed on the instrument while on board the aircraft. Please note the following:** • All instrument repairs must be done in an approved depot maintenance facility, or at the IS&S factory. • Unauthorized maintenance actions at the organizational level may nullify equipment warranties.
NOTE: **All LRUs which have undergone organizational level maintenance or other disassembly, troubleshooting, or repair work, are required to undergo qualifying acceptance test procedures prior to use. The LRU must pass the Acceptance Test Procedure (see Section 4.5 for ATP document part number) at the IS&S factory prior to being installed on-board the aircraft.**

7.2.1 Replacement of A/T Assembly (ATA)

Follow the following instructions for replacement of the ATA.

Table 7-5 A/T Assembly Replacement Procedure

WARNING: Ensure that power remains OFF while performing all steps of the LRU replacement procedure.	
CAUTION: Equipment contains electrostatic sensitive devices (ESD). Electrostatic discharge protection requires that all ESD precautions be taken when performing this procedure.	
P/N:	9B-89003-[3,5]
Installation Location	Within top portion of the Center Console of a PC-12 aircraft (see illustration following this table).
Tools:	Hex screwdriver for tightening ATA mounting hardware Pliers for replacing cotter pin
Materials:	ESD Cap (IS&S P/N: 2A-03324-110, CAPLUG P/N: DCC-11), QTY: 1
Replacement Steps:	
1	Remove all units and blank plates from the upper region of the Center Console Pedestal (on PC-12 aircraft) to gain access to the ATA mounting hardware. Also, remove Pilot and Copilot side access panels of the Center Console Pedestal to gain more access to the ATA components. May need to remove Pilot side seat if more room is needed for access.
CAUTION: **Do not move the Power Control Lever (PCL) aft of the Idle Detent into the Reverse Range when the Beta Control Cable is connected (see the aircraft maintenance manual).**	
2	Gently move the Power Control Lever (PCL) in the PC-12 aircraft to the maximum forward position (see aircraft manual).
3	See aircraft manual to remove the cotter pin from the hex bolt that holds the Power Control Lever and the Power (Beta) Control Cable (in the PC-12 aircraft) together. Discard the cotter pin. Remove and retain the hex bolt, nut, and two washers to disconnect the PCL and Control Cable.
4	Remove the ESD Cap if installed on the Electrical Connector J1 of the LRU and inspect the electrical connector pins to ensure they are undamaged and there is no debris that could short the pins or keep the connector from mating correctly.
5	Loosen the two (2) mounting screws on the ATA mounting bracket, but do not remove them. Ensure that the screws are not lost in the aircraft that could cause Foreign Object Damage (FOD).
6	Manually retract the linear actuator components towards the motor controller component of the ATA to make the ATA size smaller. Grasp the ATA by the body of unit (not the electrical connector) and place within aircraft Center Console Pedestal structure via the open top of the Center Console.

Table 7-5 A/T Assembly Replacement Procedure	
7	Place the slot of the Pivot Bracket of the ATA over the edge of the Center Console structure (see picture in Removal section) with the Linear Actuator portion of the ATA facing AFT and lightly tighten the one mounting screw of the ATA until the ATA is secured to the Center Console structure but the Linear Actuator and Motor Shaft of the ATA can still be moved side to side. This allows play to connect the Linear Actuator Arm to the Power Control Lever.
8	Manually extend the Linear Actuator components towards the Motor Controller component of the ATA to make the ATA size larger and so the arm of the Linear Actuator can reach the point where it connects to the Power Control Lever (on PC-12 aircraft).
9	Connect the arm of the Linear Actuator to the Power Control Lever and the Power (Beta) Control Cable (see PC-12 aircraft manual) by installing the hex bolt to holds the Linear Actuator arm, the Power Control Lever, and the Power (Beta) Control Cable (in the PC-12 aircraft) together using the nut, and two washers. Install a new cotter pin to secure the hex bolt (see PC-12 aircraft manual).
10	Connect the mating electrical connector and harness by placing mate over the connector harness on the ATA and tightening the thumb screws until hand-tight.
11	Loosen the mounting screw that had been tightened. Adjust the ATA mounting bracket, if needed, to straighten the ATA and ensure that the slot in mounting bracket is fully seated onto the aircraft pedestal structure edge. Tighten the two (2) mounting screws to 25 in-lbs.
12	Use stainless steel lockwire to secure the two mounting screws on the ATA mounting bracket per Pilatus AMM procedures for lock-wiring bolts (see AMM 20-20-00, Section 2.E., and Figure 3).
13	Replace all aircraft access covers, parts, and Center Console parts or blank plates that were removed to gain access.

7.2.2 Replacement of ISU

Table 7-6 ISU Replacement Procedure

WARNING: **Ensure that power remains OFF while performing all steps of the LRU replacement procedure.**	
CAUTION: **Equipment contains electrostatic sensitive devices (ESD). Electrostatic discharge protection requires that all ESD precautions be taken when performing this procedure.**	
P/N:	9D-84176-[9,11] (ISU)
Installation Location	On the instrument panel (See figures below).
Tools:	Phillips screwdriver for removing mounting hardware
Materials:	ESD Cap (IS&S P/N: 2A-00853-22, CAPLUG P/N: CEC-22), QTY: 1
Replacement Steps:	
1	Remove the ESD caps from the ISU if present and hold the ISU near its [Item 1] mount in the left instrument panel.
2	ISU only - Connect the pitot static pipe connectors [Item 4] and [Item 5] to the ISU [Item 1]. Some installation may have quick-disconnect pitot static connectors.
3	Connect the electrical connectors [Item 3] to the ISU [Item 1].
CAUTION: **Assemblies internal to the ISU could be damaged from electrostatic discharge conducted through the Rear Electrical Connectors J1 and J2.**	
4	Put the ISU [Item 1] into its mount in the left instrument panel.
5	Tighten the ISU clamp screws [Item 2].
Note: Refer to **Error! Reference source not found.** and **Error! Reference source not found.** for a diagram of removal/installation	

7.3 RETURN TO SERVICE TEST

After removing and replacing an ISU A/T LRU per the instructions in this document a Return-to-Service test should be performed to ensure the LRU is still operational. The purpose of this test is just to check that the unit is still operational. However, the test will also verify the loaded software, FPGA, and configuration if the replaced unit is a different serial number or if the original serial number was repaired. The tests assume that all other equipment is installed and operating correctly when power is applied since nothing in the installation has been modified. Each test also assumes that only the specified equipment has been removed and has been replaced. If other equipment is removed and replaced, then other procedures to check the non-ISU A/T equipment will be needed.

7.3.1 Return to Service Test – A/T Assembly

The following procedure should be used for a Return-to-Service test of the A/T Assembly.

1. Apply power to the ISU and other aircraft equipment.
2. Perform the A/T Assembly maintenance procedure. (See Sect. 6.3.2)
3. Verify that the ATA passes the maintenance procedure.
4. If the ATA does not pass the maintenance procedure, see Section 5.0, Fault Isolation.

7.3.2 Return to Service Test - ISU

The following procedure should be used for a Return-to-Service test of the ISU.

1. Apply power to the ISU and other aircraft equipment.

2. Verify that the ISU display comes up and that the backlighting of the LCD is properly adjusted via the knob

3. Set the ISU Barometric Setting to 29.92 InHg.

4. Verify the Latitude setting of the ISU to ensure it is adjusted to the approximate latitude for the region of operation of the aircraft.

5. Wait for the ISU to initialize (initialization is complete when the amber ALIGNING flag is removed from the display).

6. Verify that there are no red X flags displayed or any red failure flags (SPD, ALT, VERT, ATT, or HDG) displayed.

7. If any failure flags are displayed, see Section 5.0, Fault Isolation,

8. If not performed during the replacement procedure, perform the Static and Pitot system checks for the system side that was disturbed when removing and replacing the ISU.

9. Verify that the Pitot and Static system checks pass.

10. If the unit has left the aircraft for repair and is being replaced after return via shipment, then check the ISU software, FPGA, and Configuration module versions via the Service Mode page to ensure that they are all per STC requirements

11. To enter service mode, power on the ISU. Within 30 second of powering up, press and hold the upper line select key to active the menu. Use the encoder to scroll to “Service Mode” and depress the encoder to activate the page.

12. If the ISU is a different serial number from the ISU that was removed and has never been installed on the aircraft, then perform the ISU calibration per the Section 6.3.3.

7.4 PREPARING IS&S ISU A/T EQUIPMENT FOR SHIPMENT

This section provides the instructions for preparing the IS&S ISU A/T LRUs for shipment.

Table 7-7 Preparing the IS&S LRU For Shipment

Step:	Action:
1	Inspect to ensure the LRU is clean and dry.
2	Inspect to ensure ESD Caps are installed on all of the Electrical Connectors.
3	Place the LRU in an ESD Bag.
4	Place the LRU in a plastic bag, equipped with desiccant (moisture absorbing material) and seal the bag.
5	Place the LRU in a W5C Type fiber carton, (or equivalent shipping container, see below) which has been lined on the bottom, sides and top with 4 in. thick foam rubber (or equivalent protective material). ATA: approximately 22 in. long, 12 in. wide and 16 in. deep ISU: approximately 7.5 in. long, 8.5 in. wide and 9.0 in. deep
6	Seal the shipping container with adhesive packaging tape.
7	Mark the shipping container "DELICATE INSTRUMENT - HANDLE WITH CARE".
8	Mark the shipping container with manufacturer's CAGE code (0EUW0).
9	Mark the shipping container with IS&S LRU nomenclature, part number, and serial number information: ATA, P/N: 9B-89003-[3,5], S/N: [4 to 5 digits] ISU, P/N: 9D-84176-[9,11], S/N: [4 to 5 digits]

7.5 SHIPPING IS&S EQUIPMENT

All IS&S ISU A/T equipment shipped to IS&S for repair or troubleshooting or update shall be placed in approved shipping containers and be accompanied by a form that identifies the work needed and shall be shipped to the following address:

Innovative Solutions & Support, LLC
Attention: Customer Service
Cage Code: 0EUW0
720 Pennsylvania Drive
Exton, PA 19341 USA
(610) 646-9800

7.5.1 Shipping Procedure

(1) Ensure that LRU has static shielding covers on all of the connector.

(2) Place LRU in static shielding bag. Fold mouth of bag over. Do not seal bag.

(3) Place bagged LRU into an ATA 300 compliant carton for the size of the LRU. The carton used to ship the LRU from IS&S may be re-used if it is complete and not damaged.

(4) Fold in carton flaps.

(5) Seal with carton tape.

(6) Apply FRAGILE and ELECTROSTATIC CAUTION labels, mark carton to identify unit, and to indicate date of packaging.

(7) Label with shipping address.

(8) Ship.

7.6 STORAGE

This product does not contain any components with a limited storage life. This product may be stored in a limited high humidity environment as long as it is non-condensing and the container in which the equipment is stored is not susceptible to fungal growth or compromised integrity. See Section 2.4 for the storage temperature limits of the equipment.

8.0 RELIABILITY

The Mean-Time-Between-Failures (MTBF) of the ISU A/T equipment has been predicted using the standard parts count methods identified in MIL-HDBK-217F. The MTBF for the ISU A/T LRUs is shown in the following table for Airborne Inhabited Cargo (AIC) environment at 25 ºC.

IS&S LRU Nomenclature	IS&S Part Number	MTBF (Hours)
ATA	9B-89003-[3,5]	389,995.6
ISU	9B-84176-[9,11]	23095.16
ICM	9B-13428-( )	1472405.48

A. APPENDIX A - ENVIRONMENTAL QUALIFICATION

A.1 ISU and ATA Environmental Qualifications

Error! Reference source not found. shows a condensed matrix of the environmental test requirements that are met by the ISU and A/T Assembly.

Table 8-1 RTCA/DO-160G Environmental Qualifications

DO-160G Section	Environmental Condition	Category	Minimum Limit or Test Description	Maximum Limit or Test Description
4.5	Temperature and Altitude	A2, A4 (See Subsections)		
4.5.2, 4.5.4	Operating (ISU)	A4	-20°C	+70 °C
4.5.2, 4.5.4	Operating (ATA)	A4	-20°C	+55 °C
4.5.1, 4.5.3	Short-Time Operating	A2	-30°C	+70 °C
4.5.1, 4.5.3	Short-Time Operating	A4	-30°C	+55 °C
4.5.1, 4.5.3	Ground Survival	A2	-55 °C	+85 °C
4.5.5	In-Flight Loss of Cooling	Not Applicable	N/A	N/A
4.6.1	Pressure Altitude	A2	+15,000 ft	+50,000 ft
4.6.2	Decompression	A2	+8,000 ft	+50,000 ft
4.6.3	Overpressure	A2	-15,000 ft	
5.0	Temperature Variation	B	5 °C /minute	
6.3.1	Humidity	A	48 Hr exposure	
7.0	Operational Shock and Crash Safety	Sec. 7.0, Cat. B, Aircraft type 4, test type F	Test Load applied for ≥ 3 seconds, Up 3g, Down 6g, Forward 18g, Aft 1.5g, Side (Left & Right) 4.5g	Tested for Random orientation (18g all directions)
8.0	Vibration	Sec. 8.0 S	Standard Vibration Aircraft Type 3 (Multi Engine >5,700 KG or 12,500 lbs),	Figure 8-3, Curve M, 1.5 g-Pk

DO-160G Section	Environmental Condition	Category	Minimum Limit or Test Description	Maximum Limit or Test Description
			Aircraft Zone 2	
9	Explosion Proofness	Not Applicable		
10	Waterproofness	Not Applicable		
11	Fluids Susceptibility	Not Applicable		
12	Sand and Dust	Not Applicable		
13	Fungus Resistance	Cat. F	Verify no fungus nutrient material used	
14	Salt Spray	Not Applicable		
15	Magnetic Effects	ISU Cat. Z ATA Cat. A	< 0.3 meters (ISU) Between 0.3m and 1m (ATA)	
16	Power Input	AXX, BXX	Unit operates during 50 ms power interruption	Upset or Power loss to UUT during test is allowed. The UUT must recover without operator intervention or data integrity issues after exposure. Manual reset of UUT is not allowed
17	Voltage spike	ATA: A ISU: B		
18	Audio frequency conducted susceptibility	Cat. Z		
19	Induced signal susceptibility	Cat. ZCE		
20	Radio Frequency Susceptibility	WQ	HIRF Compliance. Power Lines & Bundles 1 & 2 & 3	Tests with install tray

DO-160G Section	Environmental Condition	Category	Minimum Limit or Test Description	Maximum Limit or Test Description
20.4	RF Susceptibility - Conducted	W	CW/SW	0.01 to 400 MHz
20.5/.6	RF Susceptibility - Radiated	G Plus PM @ 100 V/m (Q)	CW/SW + PM @100 V/m	100 to 400 MHz
		G (minimum F)	CW/SW/PM	400 MHz to 1 GHz
		G (minimum D)	CW/SW/PM	1 GHz to 18 GHz
21	Emission of RF Energy	M	Equipment in E-Bay	Bundle 1, 2, 3, & Power
21.4	Conducted	M	Power lines 1, 2 & Cable Bundles 1, 2, & 3	Fig 21-1 & 21-2
21.5/.6	Radiated	M	Unit & cable or wiring	Fig 21-8
22	Lightning induced transient susceptibility	A3J3L3 A3G3L3	Level 3 for Bundles 1, 2, 3 & Power lines 1, 2	Level 3 only
22.5.1	Pin Injection	A3xxxx	WF 3/3, 4/1	WF Set A, Level 3 only
22.5.2.1	Cable Induction - Shielded	xxJ3L3	Bundle 1, 2, 3 WF 1 & 3, SS, MS, MB	WF Sets J&L, Level 3
22.5.2.1	Cable Induction- Unshielded	xxG3L3	Power lines 1, 2 WF 2 & 3, SS, MS, MB	WF Sets G&L, Level 3
23	Lightning Direct Effects	X	(Not Applicable)	(Not Applicable)
24	Icing	X	(Not Applicable)	(Not Applicable)
25	Electrostatic Discharge	A	Ten "-15k" volt pulses	Ten "+15k" volt pulses
26	Fire, Flammability	C	Flammability	

B. APPENDIX B - DATA LOADING

B.1 GENERAL

The IS&S Data Loading functionality is designed for loading of software, configuration files, checklists, or databases files into the applicable IS&S ISU A/T LRUs in the field. Field programmability allows software to be loaded without returning hardware to the IS&S facility for updates. This feature allows for faster software updates and reduces aircraft down time.

B.2 DATA LOADING INTERFACE

B.2.1 SERIAL INTERFACE

A Serial interface between a test computer (standard Windows compatible PC) and the IS&S ISU is used to load software files. The released files are loaded into the ISU using IS&S data loading software tool, 7P-10674. ISU data loading requires a special harness for serial communication. This harness may be procured by contacting your IS&S sales representative.

B.3 SERVICE SOFTWARE

The IS&S Data Loading functionality is only available in the Service Software that runs on the ISU A/T LRUs and is not available in the Operational Flight Software. However, the Service Software in the ISU can only run if aircraft in on-ground and if requested by aircraft maintenance personnel via a “SERVICE MODE” prompt within the menu of the ISU that is only present within one minute of application of power.

B.4 DATA LOADING LIMITATIONS

The ISU can be field loaded via a Serial interface with a PC but must be connected to a data loading harness. Not all items can be loaded into the ISU A/T LRUs. Some items, like FPGA firmware, must be loaded at the factory.

B.5 ISU SERIAL DATALOADING

ISU data loading requires a special harness for serial communication. All data loading requires the ISU data loading harness (IS&S P/N: 8E-10120-1). This harness may be procured by contacting your IS&S sales representative.

B.5.1 ISU SOFTWARE

The ISU software can be updated through the ISU test box (IS&S P/N: 9B-10154-2). The ISU Test Box may be procured by contacting your IS&S sales representative.

CAUTION! DO NOT remove power to the ISU once a software upload has been started. The system will display the progress and will indicate when the upload is complete and it is safe to remove system power. Wait until the ISU displays the prompt to cycle power. Removing the power during the upload process may render the unit unusable. If this happens, the unit needs to be returned to the factory to restore the software.

After the software has been successfully loaded, power must be cycled on the unit before normal operation resumes. Each of the displays performs a self-test during power up to confirm that the software has not been corrupted. Software versions can be checked in the Service Mode confirmation menu within 1 minute of power up via the menu.

B.5.2 DATA FILES

The following data files can be uploaded via the data loading harness.

- OFP – (IS&S P/N: 7H-13189-XX)
- Service – (IS&S P/N: 7H-13331-XX)
- Bootstrap – (IS&S P/N: 7H-09848-XX)
- Configuration – (IS&S P/N: 7H-13428-XXX) – an attached configuration file will override any data loaded configuration settings.

The ISU can be updated with new software without returning the unit to IS&S or opening the unit. Only IS&S authorized software should be loaded into a unit that is to be installed in an aircraft. Only IS&S or an authorized service center should dataload software. The following software part numbers are loadable using the data loading interface.

CAUTION!

Attempting to load mismatched or incomplete software versions may result in incorrect system operation. If loading procedures are not followed correctly, the unit may need to be returned to the factory for service.

Software upgrade files must be obtained using the IS&S or authorized service center release process.

Table 8-2 Software Upgrade Files

CSCI	Description	File Name
13189	OFP	7H-13189.uImage
13331	Service	7H-13331.uImage
09848	Bootstrap	7H-09848.uImage

B.5.3 DATALOADING

The following steps should be used for data loading the ISU.

1. Connect the ISU test box (IS&S P/N: 9B-10154-2). Connect the desired data loading port on the PC to J5 on the ISU test box. Connect ISU test box , port J2 to port J1 on the ISU via provided harness.
2. Power on the ISU and within 30 seconds of start-up enter the menu and select the 'Service Mode' option.
3. Cycle power when prompted on the ISU.
4. Select the "Dataloading" option by pressing the encoder

To proceed with a software load, make certain you have the following items available:

- IS&S software file to be loaded
- Windows 7/XP/2000 based Laptop Personal Computer (PC)
- Windows 7/XP/2000 administrator rights
- Port-Powered RS-232 to RS-422 Converter (Model 422LP9R or equivalent)
- IS&S 7P-10674-11 Stand-by Card Loader Tool

5. Run 7P-10674-11
6. Click on the load button and select the .uImage to load choices are listed in Table 8-2
7. Click on the transmit button.
8. Using the drop down box select the com port on the PC connected to J5 of the test box.
9. Click the Send button.
10. The ISU should now be displaying the part number being loaded and a progress bar.
11. Do not power cycle the unit until "Complete" is displayed on the screen.
12. Once complete the part numbers listed on the bottom of the ISU should be updated to the Part number that was just loaded.

B.5.4 Serial Software Load Procedures

Data loading procedures and prerequisites will be outlined in the applicable Service Bulletin.

C. APPENDIX C – SERVICE BULLETINS

No Service Bulletins have been released as of the release of this manual. The bulletins may include:

1. Purpose for issuing

2. Name of the applicable component

3. Detailed instructions for service, adjustment, modification or inspection, and source of parts (if required)

4. Estimated number of man-hours required to accomplish the job

D. APPENDIX D – SERVICE INFORMATION LETTERS

No Service Information Letters have been released as of the release of this manual.

E. APPENDIX E – FAULT / ERROR CODES

This appendix provides information on the possible faults and error codes that could be reported by the installed equipment. These are in addition to the displayed failure flags, annunciations, or messages that are covered in Section 3.4.

E.1 ISU A/T

Some of the ISU A/T LRUs log fault codes for failures found during CBIT but these are for IS&S factory use only and are not displayed on the ISU.

F. APPENDIX F – INTERFACING EQUIPMENT COMPATIBILITY AND CONFIGURATION

This appendix provides information on the equipment that is compatible with the ISU A/T interfaces when the interfacing equipment is configured as described in this appendix. For all of the interfaces, the ISU A/T must be configured per information in this manual and installed per the STC data.

Table 8-3 Compatible Pilatus OEM Equipment – Legacy PC-12

LRU	Nomenclature	Manufacturer	Part Number	Quantity
ADC	KDC-481T	Honeywell (Bendix King)	065-00082-0011 (985.90.03.031)	1 (option)
ADC	CIC-8800M (Computer Instrument Corporation is now Kollsman)	Kollsman (04471-AA-TT-BB) AA = ARINC I/F TT = Temp Probe BB = Baro Offset	04471-02-02-03 (985.90.03.041) 04471-02-03-03 (985.90.03.043)	1 (option)
ADC	AM-250	AMATEK	70256N02D02 (PPN 985.99.11.207)	1 (option)
AHRS	LCR-92 Attitude and Heading Reference System	Litef GmbH	124210-2011	1
SPWU	Stick Pusher Warning Unit (SPWU)	EMCA AG	SPWG92-3/REL.5.xx (PPN 975.44.23.104)	1 (Channel A)
FWCU	Flap Control & Warning Unit	EMCA AG	FCWU95-2 (PPN 978.73.20.013)	1
AP	KCP-220 Flight Computer	Honeywell (Bendix/King)	065-0064-0015	1

Table 8-4 After Market Compatible ADC Equipment – Legacy PC-12

LRU	Nomenclature	Manufacturer	Part Number	Quantity
ADC	ADDU	IS&S	9D-80130-7	1
ADC	ADM	IS&S	9D-81070-5	1

Table 8-5 Compatible Pilatus OEM Equipment – PC-12 NG

LRU	Nomenclature	Manufacturer	Part Number	Quantity
KSG-7200	Air Data, Attitude and Heading Reference System (ADAHRS)	Honeywell (Bendix/King)	065-00188-5104 / SW/MOD 04/01	1
SPWU	Stick Pusher Warning Unit (SPWU)	EMCA AG	SPWG92-3/REL.5.xx (PPN 975.44.23.104)	1 (Channel A)
FWCU	Flap Control & Warning Unit	EMCA AG	FCWU99-3 Mod L, Rel 3.13/1.14 (PPN 978.73.20.017)	1
AFCS	Modular Avionics Unit (MAU) - AFCS	Honeywell	Pilatus PN: 985.99.12.147, 190, 231, 281, 251, 252, 285	1 (Channel A)

G. APPENDIX G – INTERCONNECT WIRE DIAGRAMS

See the IS&S Wiring Diagrams, 8E-13512, for the ISU A/T interconnect wiring diagrams.

H. APPENDIX H – TSO DATA

H.1 TSO AUTHORIZATIONS

The IS&S ISU A/T system, part number 9K-88126-( ), carries the following TSOs:

TSO#	TITLE	DATE
TSO-C106	Air Data Computer (SAE AS 8002)	01/15/1988
TSO-C113a	Airborne Multipurpose ELECTRONIC Displays (SAE AS 8034B)	04/30/2012
TSO-C201	Attitude and Heading Reference Systems (AHRS)	03/03/2017
TSO-C209	Electronic Flight Instrument System (EFIS) Display	09/29/2016

H.1.1 TSO FUNCTIONS

The following table identifies the TSO functions that are provided by the ISU. The fields include the TSO number, Title/TSO Class, the ISU functionality related to that TSO, and an identifier for complete, incomplete, and primary.

Table 8-6 TSO Functions, ISU

TSO	Title / TSO Class	IS&S ISU design displays the following information	Incomplete TSOA: Provides a major part and independent function
C106	Air Data Computer TSO-C106 / AS 8002A	N/A	Primary TSO
C113a	Airborne Multipurpose Electronic Displays TSO-C113a / AS 8034B	Displays	Primary TSO
C201	Attitude and Heading Reference Systems TSO-C201 / DO-334 (MAG)A4H4T7 / (DG)A4H9T7*	AHRS	Primary TSO
C209	Electronic Flight Instrument System (EFIS) Display	SPD, ATT, ALT	Primary TSO

* The RTCA/DO-334 Categories, per TSO-C201 section 5K are included below:

Table 8-7 RTCA/DO-334 Categories, TSO-C201 ISU

	Attitude Category	Heading Category	Turn and Slip Category
Magnetically Slaved	A4	H4	T7
Directional Gyro	A4	H9	T7

H.1.2 NON-TSO FUNCTIONS

The following table identifies the LRU and the NON-TSO functions that are provided by the LRU. The performance specification and the software, hardware, and environmental qualifications levels are the same as the TSO functions. The installation and operating instructions and limitations are the same as for the TSO functions. The ICA are the same as for the TSO functions. The tests to verify performance are included in the test procedures used for testing the TSO functions.

The non-TSO functions do not interfere with the compliance of the TSO articles with the TSO requirements.

Table 8-8 Non-TSO Functions

TSO	IS&S ISU Supports the following Non-TSO Functions	IS&S Comments
Non-TSO	Zooming Feature (initiated during adjustment of HSI manual offset, Baro Set value/indication)	Functioning on all previous IS&S TSO'd/STC'd display systems since 2005. The ISU zooming requirements have been captured in the Software Requirements Document 7D-13189-3_2 SW requirements document. The following test cases within the Software Test Procedures 7L-13189-3_2 cover the zooming functions: ISU7L75, ISU7L 92, ISU7L152, ISU7L 306, ISU7L332, ISU7L345, ISU7L413. The results for those tests have been captured in the Software Verification Results 7M-13189-3_A V&V test report as part of the RTCA DO-178B level B verification effort.

H.1.3 APPLICABLE MOPS PARAGRAPHS

Some ISU A/T LRUs provide TSO functions that are considered "incomplete system" since the specific LRU provides the function as only one components of a system (see Section H.1.2) that requires other components for the function to operate. As required by AC 21-46, the following MOPS paragraphs are applicable to the identified ISU A/T system LRUs. In order to create a complete system for the incomplete system TSO functions, the ISU A/T LRUs that provide an incomplete TSO function (see table below) must interface with each other and with a compatible TSO source (internal or external). See Section 1.5 for compatible third-parity LRUs. For the applicable paragraphs, any applicable deviations described in Appendix H.3 will also be applicable.

Per TSO-C209 / AS6296, the following functions are provided (X = function not included; C = Function included and meets the requirements of AS6296; D = Function included with approved deviation(s); I = Incomplete function included and meets a subset of that function's requirements of AS6296):

Function Name	**AS 6296 Section**	**Legacy TSO/MOPS (Reference Only)**	**Declaration (X, C, D, or I)**
Airspeed	4.1.1	TSO-C2d/AS 8019	C
Vertical Velocity (Rate of Climb)	4.1.2	TSO-C8e/AS 8016A	C
Altimeter	4.1.3	TSO-C10b/AS 392C/AS 8009B	D
Attitude (Bank and Pitch)	4.1.4	TSO-C4c/AS 396B/AS 8001	D
Direction Indicator	4.1.5	TSO-C5f/AS 8021, TSO-C6e/AS8012A	D

Function Name	AS 6296 Section	Legacy TSO/MOPS (Reference Only)	Declaration (X, C, D, or I)
Max Allowable Airspeed	4.1.6	TSO-C46a/TSO-C46a	C
Mach	4.1.7	TSO-C95a/AS 8018	C
Turn and Slip	4.1.8	TSO-C3e/AS 8004	C
Airborne Low-Range Radio	4.1.9	TSO-C87a/ED-30	X
Automatic Flight Guidance and Control System	4.1.10	TSO-C198/DO-325	C
Very High Frequency Omnidirectional Range (VOR)	4.2.1	TSO-C40c/DO-196	I
Distance Measuring Equipment (DME)	4.2.2	TSO-C66c/DO-189	I
Localizer	4.2.3	TSO-C36e/DO-195	I
Glideslope	4.2.4	TSO-C34e/DO-192	I
Marker Beacon	4.2.5	TSO-C35d/DO-143	X
Automatic Direction Finding (ADF)	4.2.6	TSO-C41d/DO-179	X
Stand-Alone Airborne Navigation Equipment Using the Global Positioning System Augmented By The Satellite Based	4.2.7	TSO-C146c/DO-229D	X
Flight Management System using Multi- sensor Inputs	4.2.8	TSO-C115c/DO-283A	X
Microwave Landing System	4.2.9	TSO-C104/DO-177	X
VHF Radio	4.2.10	TSO-C169a/DO-186B	X
HF Radio	4.2.11	TSO-C170/DO-163	X
Temperature	4.3.1	TSO-C43c/AS 8005	I
Fuel Flow	4.3.2	TSO-C44d/AS 407C	X
Manifold Pressure	4.3.3	TSO-C45b/AS 8042	X
Fuel, Oil, and Hydraulic Pressure	4.3.4	TSO-C47a/AS 408C	I
Tachometer	4.3.5	TSO-C49b/AS 404B	X
Fuel and Oil Quantity	4.3.6	TSO-C55a/AS 405C	X
Windshear Warning and Escape	4.4.1	TSO-C117a/TSO-C117a	X
Weather and Ground Mapping	4.4.2	TSO-C63d/DO-173 DO-220	X
Airborne Passive Thunderstorm	4.4.3	TSO-C110a/DO-191	X
Optional Display Equipment for	4.4.4	TSO-C105/DO-174	X
Terrain Awareness and Ground Proximity*	4.5.1	TSO-C92c/DO-161A TSO-C151b/TSO-C151b	X Class A
Helicopter TAWS	4.5.2	TSO-C194/DO-309	X
Traffic Collision Avoidance System	4.6.1	TSO-C118a/DO-197A TSO-	X
Traffic Advisory System	4.6.2	TSO-C147a/DO-197A as modified	X

H.2 TSO CONDITIONS AND LIMITATIONS

The installation procedures and limitations provided in this 1D-88126 document are sufficient to ensure that the airborne TSO articles, when installed according to the installation or operational procedures and limitations, still meet the TSO requirements.

As required by the TSOs, the following is provided regarding each manufactured article of ISU A/T system:

"The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those installing this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the TSO standards. TSO articles must have separate approval for installation in an aircraft. The article may be installed only if installation is performed under 14 CFR part 43 or the applicable airworthiness requirements."

As required by TSO-C113a, the following is provided regarding each manufactured article of ISU A/T system:

"The TSO articles meet the minimum performance and quality control standards required by a technical standard order (TSO). Installation of the TSO articles require separate approvals."

H.3 TSO DEVIATIONS

The TSO deviation requests have been documented by IS&S in 1D-13471, Manufacturer's TSO Qualification Report, ISU with Autothrottle 9K-88126-( ). The deviations that are approved by the FAA, are incorporated into this section of the Installation and Operation Manual.

H.3.1 ISU DEVIATIONS

TSOA deviations have been granted by the FAA for the ISU with Single Engine Autothrottle, part number 9K-88126-( ). The below substantiates the deviation approval.

U.S. Department of Transportation
Federal Aviation Administration

Aircraft Certification Service
Compliance & Airworthiness Division
Boston Aircraft Certification Office (ACO)
Branch AIR-7B0

1200 District Avenue
Burlington, MA 01803
(781) 238-7151

MAY 24 2018

In reply, refer to: 18-DOC-08143

Innovative Solutions & Support, Inc.
Attention: Brian Urbanski, VP Quality Assurance
1500 District Avenue
Burlington, MA 01803

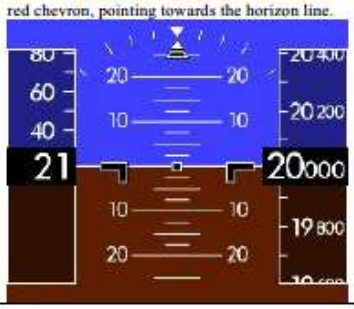
Subject: TSO-C209 Deviation Request in advance of applications for proposed IS&S articles:
(1) Integrated Standby Unit with Single Engine Autothrottle, P/N 9K-88126-( ).
(2) Integrated Standby Unit with Dual Engine Autothrottle, P/N 9K-88121-( ).

Dear Mr. Urbanski:

This is in reply to your TSO-C209 deviation request letters of April 24, 2018, reference IS&S-A&C-472b & -473b, regarding the subject proposed articles.

The TSO-C209 deviation request, in advance of applications for the subject proposed IS&S articles, has been reviewed and found to be compliant with 14 CFR § 21.618(a). Therefore, the FAA is pleased to grant the following TSO-C209 deviations without limitations or contingencies (FAA internal Memo AIR-6B-18-6BO-DM325):

Index #	TSO/ Standard	Requirement	Deviation Request/ELOS	Request Granted/ Denied	Comments to Request
1	TSO-C209 AS6296 Electronic Flight Instrument System (EFIS) Displays	**4.1.3.8 Altimeter Graduations** Markings shall be provided at intervals not exceeding 20 feet of altitude with major increment markings at 100-foot intervals. ARP4102-7 Appendix A, items 39 and 40 provide an acceptable alternative means (minors every 100 ft, majors every 500 ft).	**DEVIATION:** ISU has minor marks every 100 ft, major marks (i.e., with numerals) every 200 ft. **ELOS:** SAE ARP4102-7, Appendix A, Sheet 23, #56 yields the proper guidance material for an EADI/PFD. Deviation has been previously granted for existing IS&S TSO-C10b articles. **REQUIREMENT:** IS&S ISU Specification Control Document, 1R-84176, Section 5.1.5.1: "The altitude tape shall [1R0318] have major graduations every 200 feet. The altitude tape shall [1R0319] have minor graduations every 100 feet except where there would be a major graduation. The altitude tape shall [1R2101] display a range of 800 feet. The 200-foot intervals on the altitude tape shall [1R0320] be labeled with the corresponding altitude."	Granted	The FAA concurs with the Equivalent Level of Safety (ELOS) provided by the 200ft labeled intervals.

Index #	TSO/ Standard	Requirement	Deviation Request/ELOS	Request Granted/ Denied	Comments to Request
					
2	TSO-C209 AS6296 Electronic Flight Instrument System (EFIS) Displays	**4.1.4.2 Attitude Graduations** The pitch display shall provide minor graduation lines every 5 degrees and major graduation lines every 10 degrees between -30 and 50 degrees. This entire range need not be visible at one time. The major graduations shall be marked with their numerical value.	**DEVIATION:** The ISU will display minor graduation marks at 2.5-degrees, between -10 and +10-degrees as opposed to the 5-degree minor graduation specified in TSO-C209. **ELOS:** SAE ARP4102-7, Appendix A, Sheet 12, #6 yields the proper guidance material for an EADI/PFD. Deviation has been previously granted for existing IS&S TSO-C201 articles. **REQUIREMENT:** IS&S ISU Specification Control Document, 1R-84176, Section 5.1.3.1 and 5.1.3.2: The ISU shall[ISU1R0178] display an ADI across the full screen width with a sky(blue)/ground(brown) depiction and a white line drawn on the border between the sky and ground depictions. Presentation of pitch and roll angles shall[ISU1R0998] appear as viewed by the pilot when looking forward out of the aircraft. The design shall[ISU1R2027] provide suitable contrast between sky and ground segments such that pitch up/down are immediately recognizable. ADI Pitch ladder tick marks shall[ISU1R0180] be displayed in 2.5-degree increments, between 0 and ±20° of pitch. ADI Pitch ladder tick marks shall[ISU1R0181] be displayed in 5-degree increments, between ±20° and ±50° of pitch. ADI Pitch ladder tick marks shall[ISU1R0182] be displayed in 20-degree increments, between ±50° and ±90° of pitch. The ±10°, ±20°, ±30°, ±40°, ±50°, ±70°, and ±90° tick marks shall[ISU1R0183] be labeled with the corresponding numerical increment. Extreme pitch angles of -30°, ±50°, and ±70° shall[ISU1R0184] be indicated with a red chevron, pointing towards the horizon line. 	Granted	The FAA concurs with the ELOS provided by the IS&S graduation arrangement.

Index #	TSO/ Standard	Requirement	Deviation Request/ELOS	Request Granted/ Denied	Comments to Request
3	TSO-C209 AS6296 Electronic Flight Instrument System (EFIS) Displays	**4.1.5.3 Direction Graduations** The indicator shall provide minor graduation lines at 5 degrees or smaller intervals, with major graduation lines every 10 degrees.	**DEVIATION:** The ISU only displays major graduations (marks) every 10 degrees with numerals at intervals of 30 degrees. Minor graduation marks are not displayed. **ELOS:** The ISU provides a digital numerical display of the heading with three digits having a heading resolution of 1 degree. Deviation has been previously granted for existing IS&S TSO-C6e articles. **REQUIREMENT:** IS&S ISU Specification Control Document, 1R-84176, Section 5.2.1.1: "The compass shall [1R1868] provide graduation lines ever 10°. The heading shall [1R2046] not be limited; it shall [1R2046] transition smoothly from 001 to 360 and from 360 to 001." 	Granted	The FAA concurs with the ELOS provided by the IS&S graduation arrangement.

If we can be of further assistance, please do not hesitate to contact Mr. Tony Pigott, telephone number (781) 238-7158, e-mail: anthony.pigott@faa.gov.

Sincerely,

Anthony Pigott for

Kevin Dickert
Manager, Boston ACO Branch

I. APPENDIX I – STC DATA

I.1 STC INFORMATION

After STC approval by the FAA, the STC with the Master Drawing List (MDL) information can be made available from IS&S for those who are installing the IS&S ISU A/T system per the STC data.

I.2 PERMISSION TO USE THE IS&S STC

After STC approval by the FAA, candidate installers of the ISU A/T system can request a permission letter to use the IS&S STC data to install the ISU with A/T. This complies with guidance in FAA AC 21-40 and FAA Order 8110.4B.

I.3 CONTINUED AIRWORTHINESS INSTRUCTIONS

After STC approval by the FAA, the IS&S 1D-13467, Instructions for Continued Airworthiness (ICA) for Installation of IS&S ISU A/T system 9K-88126-[1,3], can be made available by IS&S to those who are installing the IS&S ISU A/T system per the IS&S STC data. Contact IS&S for availability of this data.

J. APPENDIX J – SOFTWARE HISTORY

This section provides a revision (release) history of the IS&S software that is used in the IS&S ISU A/T equipment.

J.1 Release 1 (Certification Baseline)

Release 1 of the software represents the software released with the IS&S ISU A/T equipment with the submittal for TSO approval and is the certification baseline.

The following Software Configuration Items (SCI), Hardware Configuration Items (HCI), and Configuration Files (CF) are developed by IS&S and are contained within the IS&S equipment. IS&S is responsible for developing and distributing any updates to these CSCI's.

J.1.1 ISU A/T Software Summaries

The table below lists the SCI Summary for the software of the ISU A/T System Release 1. Please refer to the Software Accomplishment Summary, 7K-84176-1 Rev. 1 dated 07/16/2018, for a list of open software problem reports.

Table 8-9 IS&S Developed ISU A/T SCI Summary (Certification Baseline)

LRU (Top Level VDD)	CSCI P/N & VDD	CSCI DESCRIPTION
ISU (7H-84176-01)	7H-13189-01	ISU OFP SW
	7H-09848-01	ISU Bootstrap SW
	7H-13331-01	ISU Service SW

The table below lists the SCI Summary for the software of the ISU A/T System Release 2. Please refer to the Software Accomplishment Summary, 7K-84176-2 Rev. 1 dated 07/25/2018, for a list of open software problem reports.

Table 8-10 IS&S Developed ISU A/T SCI Summary (Release 2 Baseline)

LRU (Top Level VDD)	CSCI P/N & VDD	CSCI DESCRIPTION
ISU (7H-84176-03)	7H-13189-03	ISU OFP SW
	7H-09848-03	ISU Bootstrap SW
	7H-13331-03	ISU Service SW

The table below lists the SCI Summary for the software of the ISU A/T System Release 3. Please refer to the Software Accomplishment Summary, 7K-84176-3 Rev. 1 dated 08/24/2018, for a list of open software problem reports.

Table 8-11 IS&S Developed ISU A/T SCI Summary (Release 3 Baseline)

LRU (Top Level VDD)	CSCI P/N & VDD	CSCI DESCRIPTION
ISU (7H-84176-05)	7H-13189-05	ISU OFP SW
	7H-09848-03	ISU Bootstrap SW
	7H-13331-03	ISU Service SW

The table below lists the SCI Summary for the software of the ISU A/T System Release 4. Please refer to the Software Accomplishment Summary, 7K-84176-4 Rev. 1 dated 9/28/2018, for a list of open software problem reports.

Table 8-12 IS&S Developed ISU A/T SCI Summary (Release 4 Baseline)

LRU (Top Level VDD)	CSCI P/N & VDD	CSCI DESCRIPTION
ISU (7H-84176-07)	7H-13189-07	ISU OFP SW
	7H-09848-03	ISU Bootstrap SW
	7H-13331-03	ISU Service SW

The table below lists the SCI Summary for the software of the ISU A/T System Release 5. Please refer to the Software Accomplishment Summary, 7K-84176-5 Rev. 1 dated 11/20/2018, for a list of open software problem reports.

Table 8-13 IS&S Developed ISU A/T SCI Summary (Release 5 Baseline)

LRU (Top Level VDD)	CSCI P/N & VDD	CSCI DESCRIPTION
ISU (7H-84176-09)	7H-13189-09	ISU OFP SW
	7H-09848-05	ISU Bootstrap SW
	7H-13331-05	ISU Service SW

J.1.2 Complex Hardware

The following Hardware Configuration Items (HCI) are contained within the ISU A/T LRUs. IS&S is responsible for any updates to these HCI's. Please refer to the Hardware Accomplishment Summaries 10K-10041-1 Rev. 2 dated 9/12/14 for a list of open hardware problem reports of the ISU.

Table 8-14 IS&S Provided HCI Summary

LRU	HCI P/N	DESCRIPTION
ISU	10H-10041-01	Standby Instrument Interface

J.1.3 Configuration Files

The following Configuration Files (CF) are contained within the applicable ISU. IS&S is responsible for any updates to these CF's.

Table 8-15 IS&S Provided Configuration File Summary

LRU	CF P/N	DESCRIPTION
ISU	7H-13428-01	ICM (Legacy PC-12/45)
ISU	7H-13428-03	ICM (PC-12 NG)

The functionality of the ISU that is based on the ISU A/T Configuration File is described in Section 4.8.5.1. Specific configuration file versions are installation dependent.

The following table shows the configuration settings selected on the 7H-13282-01 version of the ISU A/T Configuration File.

Table 8-16 IS&S Configuration File Settings (7H-13428-01 Version)

Configuration Item	Configurable Options	7H-13428-01 Setting (PC-12/45 ISU)
Engine Parameters	Torque Upper Caution Torque Upper Warning (Max Take-off Torque Limit) ITT Upper Caution ITT Upper Warning (Max Take-off ITT Limit)	36.9psi 44.4psi 720 degrees Celsius 760 degrees Celsius
Reference Speeds	Landing Max Weight Stall Speed (Vs0) Clean Max Weight Stalling Speed (Vs1) Max Cruise Speed (Vno) Never Exceed Speed (Vne)	VS0 = min 30 max 64kts VS1 = min 64 max 130kts VNO = min 130 max 236kts VNE = min 236 max 550(max airspeed)
SSEC	Static Source Error Correction data	K0 = 1 PsiCorrectionK = 8.0 CurveAltitude, MinQciOverPsi, MaxQciOverPsi, MinCalQciOverPsi, LowMachSlope, PsCorrAboveMaxMach, PsiCorrectionK, NumSSECCurves = 0
DisplayThreshold	How much vertical rate is required before vertical speed is displayed	550
AircraftType	0 = PC-12 Legacy 1 = PC-12 NG	0 = PC-12 Legacy
ILSInputType	0 = ARINC	1 = Analog (Unused)

Configuration Item	Configurable Options	7H-13428-01 Setting (PC-12/45 ISU)
	1 = Analog	
DataloggingOff	0 = Datalogging disabled 1 = Datalogging enabled	0
PidPage	0 = Disabled 1 = Enabled	0 = Disabled
GrossWeight	Default gross weight used in autothrottle calculations	9900
AutoThrottleOn	0 = Autothrottle disabled 1 = Autothrottle enabled	1
UseExternalIAS	0 = Use internal calculated IAS for autothrottle control 1 = Use IAS from external ADC for autothrottle control	1
UseInfraredSensor	0 = Position sensor disabled 1 = Position sensor enabled	1
Motor Direction	0 = Straight shaft motor 1 = Reverse motor	0
Inputs	Defines device ID numbers and speeds for inputs to the ISU	[0] = 1 (VOR, Speed = 1 (low speed)) [1] = 1 (VOR, Speed = 1 (low speed)) [2] = 16 (Autopilot, Speed = 1 (low speed)) [3] = 17 (PUSHER, Speed = 1 (low speed)) [4] = 9 (IRU, Speed = 0 (high speed)) [5] = 15 (ADM, Speed = 1 (low speed))
ScreenConfiguration	0 = Portrait 1 = Landscape	0
SlipSkid	0 = Disabled 1 = Enabled	1
ADIMode	0 = Disabled 1 = Enabled	0
HSIMode	0 = Disabled 1 = Enabled	0
DisplayVSI	0 = Disabled 1 = Enabled	1
DisplayTAT	0 = Disabled 1 = Enabled	0
DisplayOAT	0 = Disabled 1 = Enabled	0
DisplaySAT	0 = Disabled 1 = Enabled	0
MetricDefault	0 = Disabled 1 = Enabled	0

Configuration Item	Configurable Options	7H-13428-01 Setting (PC-12/45 ISU)
BaroUnits	0 = hPa 1 = InHg	1
BaroSync	0 = Disabled 1 = Enabled	0
DisplayCabinPressure	0 = Disabled 1 = Enabled	0
CabinPressureAlert	0 = Disabled 1 = Enabled	0
AtSelect	0 = Torque hold selected by default 1 = Speed hold selected by default	0
LocalizerScale	0 (Unused)	0
GlideslopeScale	0 (Unused)	0
TATProbResistance	0 (Unused)	0
HotStart	0 = Hot start protection disabled 1 = Hot start protection enabled	0
MachAscendingThreshold	Integer value that corresponding to a mach value (i.e. 400 for .400) for the ascending threshold	400
MachDescendingThreshold	Integer value that corresponding to a mach value (i.e. 400 for .400) for the descending threshold	380
MinimumAirspeed	Configured minimum airspeed	30
MaximumAirspeed	Configured maximum airspeed	550
OnGroundAirspeed	Configured on ground airspeed	97.1922
MinimumAltitude	Configured minimum altitude	-1000
MaximumAltitude	Configured maximum altitude	60000
HotStartIttTimeOne	Limit used in hot start protection monitoring	20000
HotStartIttTimeTwo	Limit used in hot start protection monitoring	5000
HotStartIttTempOne	Limit used in hot start protection monitoring	800
HotStartIttTempTwo	Limit used in hot start protection monitoring	870
IttRise	The rate of change in degrees Celsius over 1 second that will trigger a hot start warning	180
AtPowerReadBackIndex	Defines which discrete input is used for the A/T power discrete	0
AtMomentaryIndex	Discrete input index for A/T disconnect	1
AntiIceOnIndex	Discrete input index for ice mode	4
GoAroundIndex	Discrete input index for go around switch	3
DayNightIndex	Discrete input index for Day/Night Mode	6 (inactive)
AnalogGSValidIndex	Discrete input index for Analog Glideslope	6 (inactive)
AnalogLOCValidIndex	Discrete input index for Analog Localizer	6 (inactive)
BezelLightDimIndex	Discrete input index for the LED light dim	2
AtIASHold	Discrete input index for IAS Hold mode	6 (inactive)
VoltageLevel	Lighting Bus Voltage max	5 (VDC)

Configuration Item	Configurable Options	7H-13428-01 Setting (PC-12/45 ISU)
Autothrottle Parameters	IS&S Proprietary settings	
Configuration File P/N	7H-13428-xxx (where "-xxx" = configuration file version)	

The following table shows the configuration settings selected on the 7H-13282-03 version of the ISU A/T Configuration File.

Table 8-17 IS&S Configuration File Settings (7H-13428-03 Version)

Configuration Item	Configurable Options	7H-13428-03 Setting
Engine Parameters	Torque Upper Caution Torque Upper Warning (Max Take-off Torque Limit) ITT Upper Caution ITT Upper Warning (Max Take-off ITT Limit)	36.9psi 44.4psi 820 degrees Celsius 850 degrees Celsius
Reference Speeds	Landing Max Weight Stall Speed (Vso) Clean Max Weight Stalling Speed (Vs1) Max Flap Extended Speed (VFE) Max Cruise Speed (Vno) Never Exceed Speed (Vne)	VS0 = min 30 max 64kts VS1 = min 64 max 130kts VNO = min 130 max 236kts VNE = min 236 max 550(max airspeed)
SSEC	Static Source Error Correction data	K0 = 1 PsiCorrectionK = 8.0 CurveAltitude, MinQciOverPsi, MaxQciOverPsi, MinCalQciOverPsi, LowMachSlope, PsCorrAboveMaxMach, PsiCorrectionK, NumSSECCurves = 0
DisplayThreshold	How much vertical rate is required before vertical speed is displayed	550
AircraftType	0 = PC-12 Legacy 1 = PC-12 NG	1 = PC-12 NG
ILSInputType	0 = ARINC 1 = Analog	1 = Analog (Unused)
DataloggingOff	0 = Datalogging disabled 1 = Datalogging enabled	0
PidPage	0 = Disabled 1 = Enabled	0 = Disabled
GrossWeight	Default gross weight used in autothrottle calculations	9900
AutoThrottleOn	0 = Autothrottle disabled 1 = Autothrottle enabled	1
UseExternalIAS	0 = Use internal calculated IAS for autothrottle control 1 = Use IAS from external ADC for autothrottle control	1

Configuration Item	Configurable Options	7H-13428-03 Setting
UseInfraredSensor	0 = Position sensor disabled 1 = Position sensor enabled	1
Motor Direction	0 = Straight shaft motor 1 = Reverse motor	1
Inputs	Defines device ID numbers and speeds for inputs to the ISU	[0] = 0 (blank, no device) [1] = 0 (blank, no device) [2] = 16 (Autopilot, Speed = 1 (low speed)) [3] = 0 (blank, no device) [4] = 9 (IRU, Speed = 0 (high speed)) [5] = 10 (ADC, Speed = 1 (low speed))
ScreenConfiguration	0 = Portrait 1 = Landscape	0
SlipSkid	0 = Disabled 1 = Enabled	1
ADIMode	0 = Disabled 1 = Enabled	0
HSIMode	0 = Disabled 1 = Enabled	0
DisplayVSI	0 = Disabled 1 = Enabled	1
DisplayTAT	0 = Disabled 1 = Enabled	0
DisplayOAT	0 = Disabled 1 = Enabled	0
DisplaySAT	0 = Disabled 1 = Enabled	0
MetricDefault	0 = Disabled 1 = Enabled	0
BaroUnits	0 = hPa 1 = InHg	1
BaroSync	0 = Disabled 1 = Enabled	0
DisplayCabinPressure	0 = Disabled 1 = Enabled	0
CabinPressureAlert	0 = Disabled 1 = Enabled	0
AtSelect	0 = Torque hold selected by default 1 = Speed hold selected by default	0
LocalizerScale	0 (Unused)	0
GlideslopeScale	0 (Unused)	0
TATProbResistance	0 (Unused)	0

Configuration Item	Configurable Options	7H-13428-03 Setting
HotStart	0 = Hot start protection disabled 1 = Hot start protection enabled	0
MachAscendingThreshold	Integer value that corresponding to a mach value (i.e. 400 for .400) for the ascending threshold	400
MachDescendingThreshold	Integer value that corresponding to a mach value (i.e. 400 for .400) for the descending threshold	380
MinimumAirspeed	Configured minimum airspeed	30
MaximumAirspeed	Configured maximum airspeed	550
OnGroundAirspeed	Configured on ground airspeed	97.1922
MinimumAltitude	Configured minimum altitude	-1000
MaximumAltitude	Configured maximum altitude	60000
HotStartIttTimeOne	Limit used in hot start protection monitoring	20000
HotStartIttTimeTwo	Limit used in hot start protection monitoring	5000
HotStartIttTempOne	Limit used in hot start protection monitoring	800
HotStartIttTempTwo	Limit used in hot start protection monitoring	870
IttRise	The rate of change in degrees Celsius over 1 second that will trigger a hot start warning	180
AtPowerReadBackIndex	Defines which discrete input is used for the A/T power discrete	0
AtMomentaryIndex	Discrete input index for A/T disconnect	1
AntiIceOnIndex	Discrete input index for ice mode	4
GoAroundIndex	Discrete input index for go around switch	3
DayNightIndex	Discrete input index for Day/Night Mode	6 (inactive)
AnalogGSValidIndex	Discrete input index for Analog Glideslope	6 (inactive)
AnalogLOCValidIndex	Discrete input index for Analog Localizer	6 (inactive)
BezelLightDimIndex	Discrete input index for the LED light dim	2
AtIASHold	Discrete input index for IAS Hold mode	6 (inactive)
VoltageLevel	Lighting Bus Voltage max	5 (VDC)
Autothrottle Parameters	IS&S Proprietary settings	
Configuration File P/N	7H-13428-xxx (where “-xxx” = configuration file version)	03