TITLE: **AD3X.() AIR DATA DISPLAY INSTALLATION AND OPERATION MANUAL**

DOCUMENT NO.: **AD-INSOP-400**

REVISION: **2.2**

PROJECT: **Solid State Flight Instrument Family**

MANUFACTURER: **THOMMEN AIRCRAFT EQUIPMENT AG**
CH-4132 Muttenz
Switzerland

ISSUING OFFICE: **Development Department**

	Name	Signature	Date
Author:	**J. Garrett**	JGarrett	11-Sept-2019
Checked:	**H. Richardt**		11-Sept-2019
Approved:	**A. Anehila**		11-Sept-2019

REVISION HISTORY

REVISION	DESCRIPTION	ISSUE DATE	INITIAL	CHECKED
1.0	INITIAL RELEASE	30th AUG, 2004	AG	RW
1.1	Title of the manual changed to AD3X.() Air Data Display Family. Note 1 & 2 added in Section I–1-A	1st DEC, 2004	AG	RW
1.2	Appendix VII – Identification Plates added. Appendix VIII – Barometric Potentiometer Output added. Sec III-1-C Lightning Induced Transient Susceptibility- RTCA/DO-160D Section 22.0 Cat. [A3E3] changed to RTCA/DO-160D Section 22.0 Cat. [A3J33].	18th July, 2005	AG	RW
1.3	Appendix IX- Software Version SW 2.10 features added.	22nd Nov, 2005	AG	RW
1.4	NOTE 2 added in Sec IV-1-E2.	9th Dec, 2005	AG	RW
1.5	Environmental Qualification updated. ARINC 429 labels descriptions added. Pt 100 TAT Probe added. Appendices added for SW versions 2.20 / 2.30 / 2.40 / 2.50 / 2.51 / 2.60. Diverse format changes.	18-Aug-2009	AF	RW

REVISION HISTORY (continued)

REVISION	DESCRIPTION	ISSUE DATE	INITIAL	CHECKED
1.6	Format changes throughout the document. TAT probe interface updated. Discrete I/O functions updated. Appendix I Failure Codes, Failure class and BIT Matrix added. Appendix III Airspeed calibration table extended. Appendix IV Mach no. calibration table extended. Appendix V TAT/OAT calibration table updated. Appendix XIV – SW Version 2.70 features added.	14-Oct-2009	AF	RW
1.7	Change of logical state of Bit 13. label 270 for selected SW versions.	27-May-2010	MB	RW
1.8	G.2: ARINC 429 transmit channel bus load specified.	04-Jan-2011	RW	AF
1.9	Updates for SW 2.71: label 102 added (section I, IV), section XV added.	15-Mar-2012	MB	RW
2.0	SB AD32/05 added. SW 2.72 added.	09-May-2012	MB	RW
2.1	BIT Test Sequence Changed (Ref. Page 41 and Appendix XVII)..	06-Dec-2012	CBr	AF
2.2	Environmental Qualification table deleted (Section III, C) (reference to DDP added). SB added in Service Bulletin Indices. Company logo and address updated.	11-Sept-2019	JG	HR

CAUTION: BEFORE ATTEMPTING ANY INSTALLATION AND OPERATION ACTIVITIES ON THE EQUIPMENT COVERED IN THIS MANUAL, VERIFY THAT YOU HAVE COMPLETE AND UP-TO-DATE PUBLICATIONS BY REFERRING TO THE APPLICABLE MANUAL REVISIONS AND SERVICE BULLETIN LIST.

SERVICE BULLETIN INDICES

SB No.	SERVICE BULLETIN SUBJECT	EDITION / REVISION NUMBER	Date
AD32/AC32/01	Hardware and Software Modification	Initial Release	30th August 2004
AD32/02	Hardware and Software Modification	Revision 1.1	11th March 2005
AD32/05	Software Modification only applicable for AD32.32.53F.28.1.DA / AD32.32.35F.28.1.DF	Initial Release	07th May 2012
AD32-SIL-004	Start-up BIT Sequence Changed	Initial Issue	07th Dec 2012
SB AD32/06	Hardware Modification for AD32 (HIRF compliance according to JAA INT/POL/27&29/1)	1.0	04-Sept-2019

Table of Contents Page

List of Figures

Page

List of Tables

Page

List of Abbreviations and Acronyms

Abbreviation	Description
A/C	Aircraft
Abs	Absolute
ADC	Air Data Computer
ARINC	Aeronautical Radio Inc.
ASCII	American Standard Code for Information Interchange
BIT	Built In Test
DC	Direct Current
Diff	Differential
EMI	Electro Magnetic Interference
FAA	Federal Aviation Administration (USA)
FAR	Federal Aviation Regulation
FI	Flight Instruments
FIG	Figure
HW	Hardware
ICAO	International Civil Aviation Organisation
IF	Interface
LCD	Liquid Cristal Display
N.A.	Not applicable
NC	Not Connected
REV	Revision
RTCA	Radio Technical Commission for Aeronautics
RVSM	Reduced Vertical Separation Minima
SSEC	Static Source Error Correction
SW	Software
TBD	To Be Defined
TSO	Technical Standard Order
HIRF	High Intensity Radiated Field

Section I

Introduction

A. Purpose of the manual

This manual provides the specifications, installation instructions, equipment operation and system maintenance in details for the REVUE THOMMEN AD3X.() Air Data Display Unit. This manual also defines interface design requirements including mechanical and electrical characteristics for Revue Thommen AD3X.(). The Interface Control Document (ICD) information is also covered in detail in this manual.

The description and procedures are covered in different topics as shown in the Table of Contents, and the troubleshooting procedures are given under sections to identify the fault and failure conditions of the unit with the interface systems.
The contents of this manual have been verified by actual performance of the equipment prior to distribution of printed copies.
The procedures in this manual are to be performed by qualified personnel familiar with REVUE THOMMEN AD3X.() Air Data Display Equipment.

Note 1 : This manual is applicable for all Air Data Display Family with part number as AD3X.()
Note 2 : This manual replaces the AD32 Interface Control Document (Doc no. AD-ICD-430) and
AD32 Operating Manual (Doc no. AD-OPM-400).

B. Equipment Specification

B.1 Applicable Documents

The following column shows the list of relevant applicable documents which forms the basis of approvals of the AD3X.() Air Data Display.

STANDARDS

TSO-C106	Air Data Computer
SAE AS8002	Air Data Computer Minimum Performance Standards
ARINC 706-4	Mark 5 Subsonic Air Data System
ARINC 607-3	Design Guidance for Avionic Equipment
ARINC 429	Mark 33 Digital Information Transfer System (DITS)
TSO-C88a	Automatic Pressure Altitude Reporting Code Generating Equipment
SAE AS8003	Minimum Performance Standard for Automatic Pressure Altitude Reporting Code Generating Equipment
TSO-C10b	Altimeter, Pressure Actuated Sensitive Type
SAE AS 392C	Altimeter, Pressure Actuated Sensitive Type

MILITARY

MIL-C-26482G	Connectors, Electrical
MIL-A-85505(AS)	Altimeter, Standby, Types I and II
MS33649	Bosses, Fluid Connection - Internal Straight Thread

SPECIFICATIONS

AD-SPE-400	AD32 Specification RVSM Air Data Display
ADAC-SWR-420	ADAC Software Requirements
Limitations	Limited to manufacturer specifications of the digital input bus and to the applicable configuration and Mod status.

COMMERCIAL

RTCA/DO-160D	Environmental Conditions and Test Procedures for Airborne Equipment with Change 1, Change 2 and Change 3
ED-12B RTCA/DO-178B	Software Considerations in Airborne Systems and Equipment Certification
ED-14D RTCA/DO-160D	Environmental Conditions and Test Procedures for Airborne Equipment
ED-80 RTCA/DO-254	ED-80 / RTCA/DO-254 Design Assurance Guidance for Airborne Electronic Hardware

OTHER PUBLICATIONS

- None

B.2 Identification

B.2.1 Type Identification

Type : AD32.32.53F.05.1.AM (For Sample)

AD32	Air Data Display
.3	ARINC Metal Case 408 3ATI, Black
.-2	Dial Markings are Lusterless white FED-STD-595a, No.37875
.53F	-1000 to 53000 Feet
.05	Lighting 5V DC
.1	Lighting White only
.AM	See special code below mentioned

AM special Code:

- Pneumatic ports
  “S” 1 / 2” -20UNJF-3B (MS 33649-5)
  “P” 7 / 16” - 20UNJF-3B (MS 33649-5)
- Electrical connector 55-Pin
  MS 3112E-22-55P (MIL-C-26482 Series 1)
- Integrated Altitude Alerter
- RVSM Compliant, 2 x 16 SSEC curves
- ICAO encoded output
- ARINC 429 Serial data bus
- Integrated Digital Air Data Computer
- TSO-C10b, TSO-C88a, TSO-C106
- Power supply 28VDC (< 8W)
- TAT probe input 500 Ohms per ARINC 706-4
- RS-232 Maintenance IF
- Numerals and letters acc. to Norme Francaise

Mod Number: MOD00A (For sample)
Configuration Number: ID 0100 (For sample)

B.2.2 Identification Plate

The Identification/Name plate is attached in the instrument case of AD32 RVSM Air Data Display Unit externally . The sample of Identification/Name plate of AD32 RVSM Air Data Display Unit is shown below:

REVUE THOMMEN AG **CH-4437 WALDENBURG**										
RVSM AIR DATA DISPLAY WITH ENCODER AND ALERTER CERTIFIED TSO-C10b / TSO-C106 / TSO-C88a										
PART/TYPE NO AD32.32.53F.05.1.xx				**CONFIGURATION ID xxxx**						
SER NO xxxxxxx	**MOD**	~~00~~	01	02	03	04	05	06	07	08	09
RANGES -1,000 ... 53,000 FEET		~~A~~	B	C	D	E	F	G	H	I	J
0 / 40 ... 450 KNOTS											
0.200 … 0.999 MACH		**MFR DATE** **month / year**									
SWISS MADE	**PHONE + 41 61 965 22 22**							**FAX + 41 61 961 81 71**		

NOTE: The configuration ID code allows identifying the individual configuration of the instrument. Instruments with the same config. ID codes are identical. Refer to the Technical Checklist for individual type of the instrument.

B.3 Installation Kit

Part Number	Quantity	Description
AD3X.XX.XXX.XX.X.XX	1	AD3X.() Air Data Display Unit
AD-INSOP-400	1	AD3X.() Installation and Operation Manual
AD-DDP-XXX	1	Declaration of Design and Performance Document

Table 1: Installation Kit

NOTE: As per ordered by the Installer.

C. Technical Specification

Characteristics	Specifications
Primary Power	28 VDC
During startup	max. 8 W
Normal operation	max. 6 W
max. current draw	0.7 A
Emergency Power	28 VDC

Lighting power	28 VDC (opt. 5 VDC)
Weight *	1.25 kg (2.8 lbs)
Physical Dimension	
Height	81.5 mm (3.2 in)
Width	81.5 mm (3.2 in)
Length	204.72mm (8.918 in)
Maintenance Requirements	On Condition

*Weight, excluding connectors, pneumatic adaptors and fixing screws

Table 2: Technical Specification

D. Equipment Dimensions

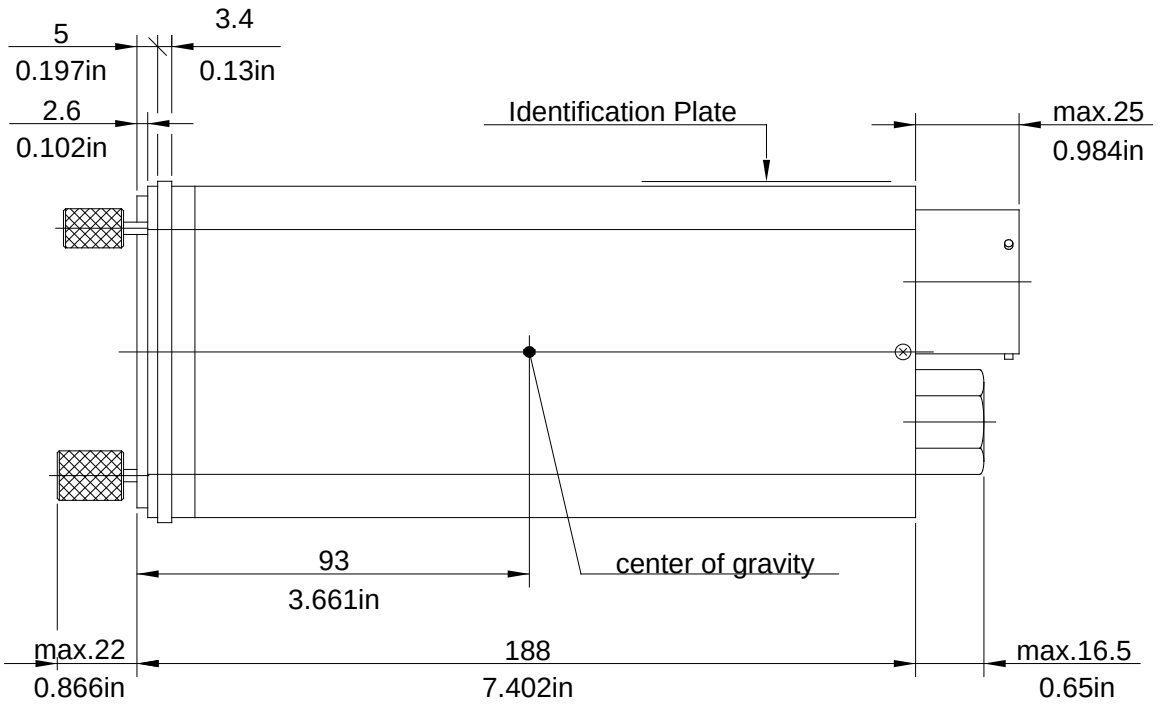


Figure 1: Equipment Side View

NOTE: The dimensions are in millimeters or inches
NOTE: Not to scale

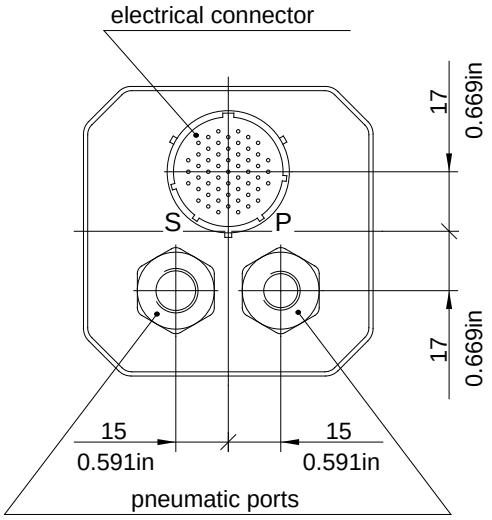


Figure 2: Equipment Back View

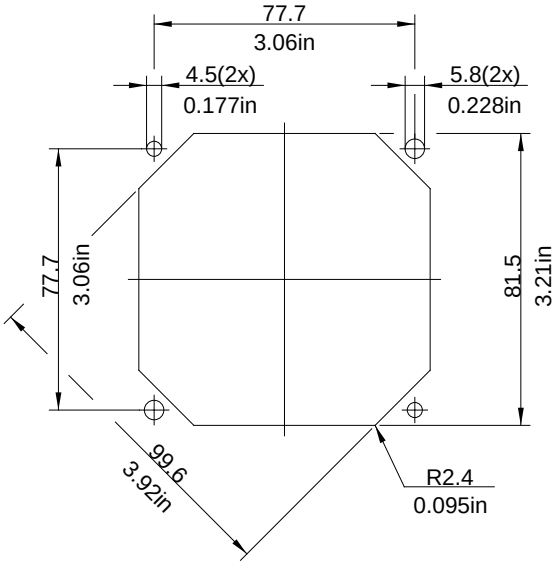


Figure 3: Equipment cut out

Pneumatic Pressure Ports

	mechanical	Pressure range	Over pressure capability
Static Port ”S” (standard)	1/2“-20UNJF-3B (MS33649-5)	25 … 1100 mbar abs	1500 mbar abs
Static Port ”S” (optional)	9/16“-18UNJF-3B (MS33649-6)	25 … 1100 mbar abs	1500 mbar abs
Pitot Port “P”	7/16“-20UNJF-3B (MS33649-4)	100 … 1500 mbar abs	3000 mbar abs

E. Interface Block diagram

AD32 RVSM Air Data Display with Alerter and Encoding Output

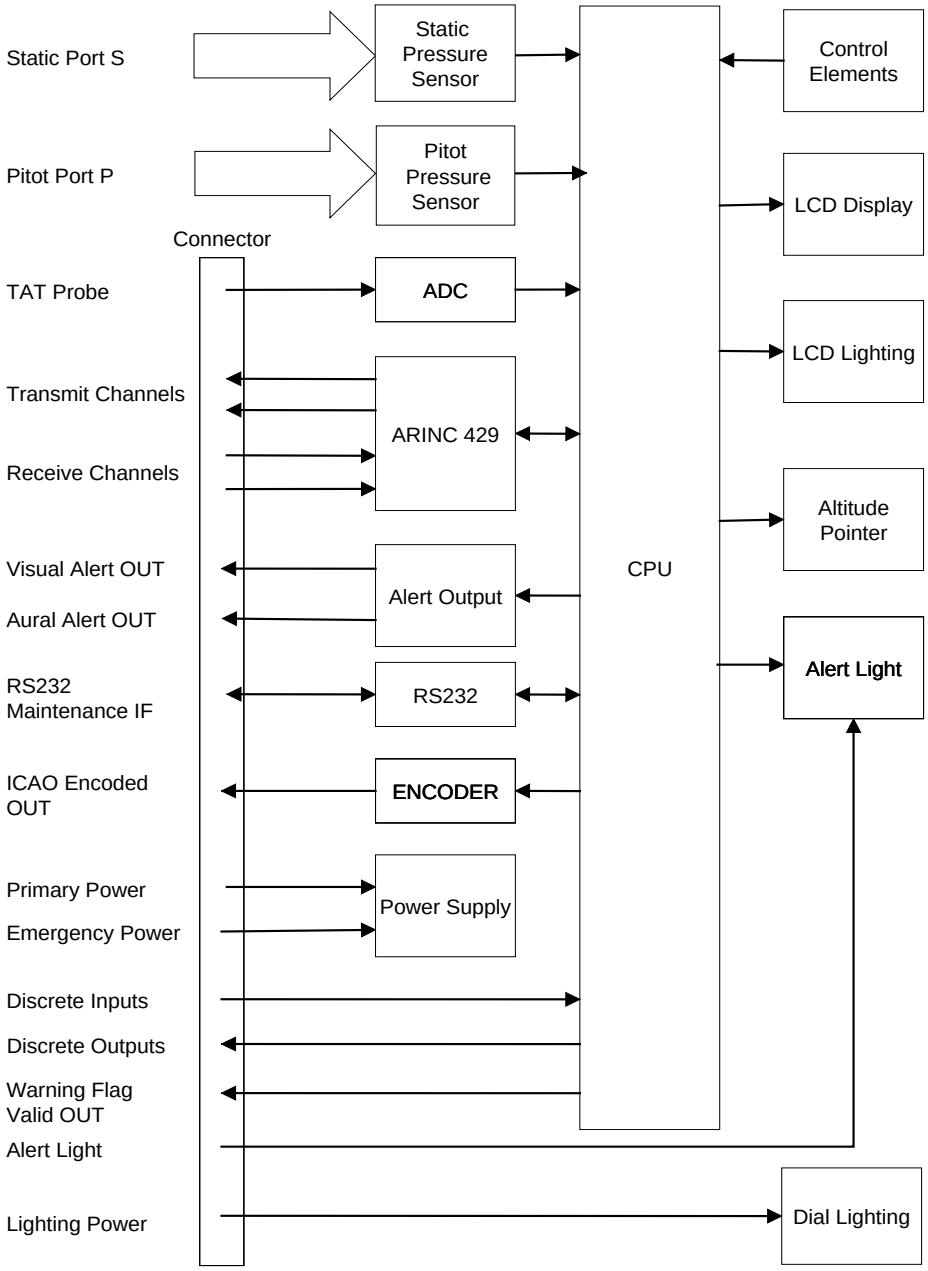


Figure 4: AD3X.() Block Diagram

Section II

General Information

This Section provides the description, the theory of operation and functional modes required to understand and operate of AD3X.() Air Data Display unit. Refer to the following paragraph for the brief description of the instrument.

Description

A. Instrument Description

The implementation of the AD3X.() Air Data Display Unit will provide measured barometric (corrected) altitude, airspeed and temperature. The pitot and static pressure are sensed and computed internally and the instrument provides both dedicated digital liquid crystal display (LCD) and analog pointer which features high intensity backlighting for daylight conditions. The altitude can be displayed in both metric units as well as English. (**see section II, part 2, B.2.4**)

The Display unit has the following features which can vary according to the individual MOD and configurations status:

- primary RVSM Altitude indication
- encoded altitude output (optional)
- integrated altitude alerter (optional)
- Airspeed and Mach computation
- ARINC 429 Interface (optional)
- TAT probe input (optional)

The AD3X.() belongs to the Solid State Flight Instruments Family of REVUE THOMMEN AG which is also RVSM compliant. It has the integrated solid state pneumatic pressure sensors for static and pitot pressure which provides up to 2 x 16 SSEC (Static Source Error Correction) curves and it can be configured for different installations as per parameter upload via the RS-232 serial maintenance interface. The corrected Altitude is displayed on a high contrast LCD (Liquid Crystal Display) by a stepper motor driven pointer and also digital format.

The computed air data parameters are transmitted by the ARINC 429 data bus. There are two transmit and receive channels, The AD3X.() has an integrated altitude alerter. The altimeter can be set to operate as a self-sensing standby instrument or to display altitude from an external Digital Air Data Computer source.
The unit also provides synchronization (baro setting and Altitude alerter synchronization) and altitude comparison in the case of dual altimeters installation.

The extensive Built-In-Test (BIT) guarantees safe operation using watch dog circuitry on each power on. The power supply is designed for less than 8 Watts; 28 VDC.The low power consumption and its low weight have been optimized for applications in state-of-the-art avionics.

The AD3X.() is a simple designed modular unit and hence having easy maintenance. By RS-232 maintenance interface serial data THOMMEN Air Data Display AD3X.() can be configured for different applications as per the interface requirements. Therefore its application range reaches from Business Aviation up to Regional Aircraft, Transporters and Helicopters.

The THOMMEN Air Data Display AD3X.() meets or exceeds the requirements of the FAA technical standard order (TSO) accuracy requirements. The flight instrument meets or exceeds the requirements of TSO-C10b, TSO-C106 and TSO-C88a.

B. Functional Description

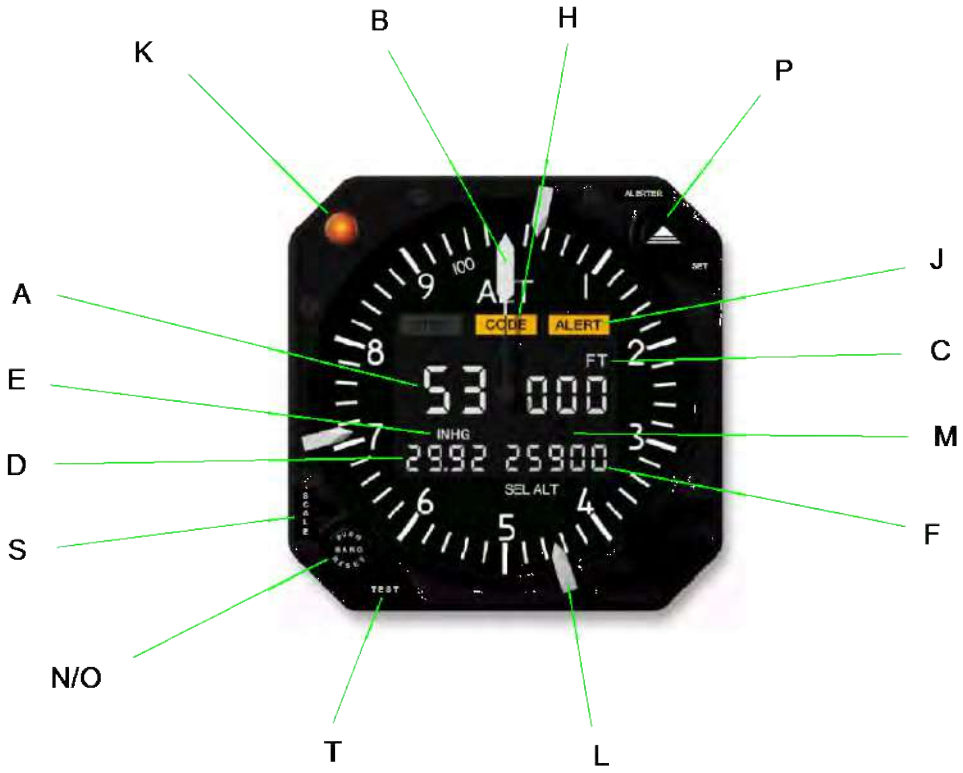


Figure 5: Front View

Display		Controls	
A	Digital Altitude Display	**N**	BARO Setting Knob
B	Altitude Pointer	**O**	BARO PUSH TO RESET Knob
C	Altitude Scale FT/M	**P**	Altitude Alerter Setting Knob
D	Baro Setting Display	**S**	SCALE Button
E	Baro Setting Scale INHG/MB	**T**	TEST Button
F	Altitude Select Display		
H	Code OFF Annunciator		
J	Altitude Alert Failure Annunciator		
K	Altitude Alert Lamp		
L	IMI ring pointers		
M	Indicators A, B and C		

B.1 Display

B.1.1 Digital Altitude Display

The aircraft's altitude is displayed on the digital display window with the range from –1’000 up to 53'000 feet, in 10, 20, 50 or 100 ft increments.

B.1.2 Altitude Pointer

The Altitude pointer moves with 1000 feet increments. The dial is marked with 100 (major) and 20 (minor) feet [meter] graduations.

B.1.3 Altitude Scale Setting FT/M

The Altitude scale setting FT/M indicates the scale unit in feet or meter. The scale unit has manufacturer preset value and can be set to different scale settings (MB/FT, INHG/FT, MB/M) by pushing the SCALE setting button.

B.1.4 Barometric Setting Display

The Barometric Setting Display shows the Barometric pressure which ranges between 20.67 to 31.00 inches Hg or 700 to 1050 millibars.

B.1.5 Barometric Scale Setting INHG/MB

The Barometric Scale setting indicates the barometric pressure unit which can be set in mbar or inHg

B.1.6 Altitude Select Display

Altitude Select displays the selected alert altitude in 100 feet or 10 m resolution, if when enabled.

B.1.7 Altitude Alert Failure Annunciator

The Altitude Alert Failure Annunciator indicates the failure of the altitude alerter circuit.

B.1.8 Altitude Alert Lamp

Altitude Alert Lamp is illuminated when Altitude Alerter circuitry is active.
The Altitude Alert Lamp is also controlled externally and the behaviour of the lamp depends on the external control.

Aural and Visual alert relays outputs

Aural and Visual warning alerts which acknowledges the altitude alert function and the relay outputs are disabled when it is switched off. The function can be enabled / disabled by pushing twice the alerter setting knob so that alerts function can be activated / deactivated again when there is alert condition.

B.1.9 Code OFF Annunciator

When the Code OFF annunciation is ON or illuminated, the ICAO Encoding signal is OFF or invalid.

B.1.10 Indicators A, B and C

- **A -** Indicates alerter setting in change (either rotating alerter setting knob or synchronization with remote alerter via Data Bus)
- **B** - Indicates Baro setting in change (either rotating baro setting knob or synchronization via Data Bus)
- **C** - Indicates that the maintenance mode (Calibration) is progress.

B.1.11 IMI ring pointers

The IMI ring pointers can be set to any desired position.

B.2 Controls

B.2.1 Baro Setting Knob

Barometric pressure is a cyan four digit readout in the lower left corner of the display and is used to adjust barometric setting. By rotating the Baro Setting knob the barometer setting value changes ranging between 700 mbars to 1050 mbars or 20.67 inHg to 31.00 inHg. An ICAO encoded altitude output is available as an option. But the reported altitude information which is sent to the transponder by the encoder is not affected by rotating the Baro Setting Knob in AD3X.() instrument.

B.2.2 Push to reset Knob

By pushing the Baro setting knob the baro pressure value will automatically change to the international standard of the barometric pressure of 29.9213 (29.92 displayed) inHg or 1013.25 mbar. The scale setting button on the panel of AD3X.() allows to select unit value of both in English and metric format.. The knob also allows the altimeter to indicate zero altitude with any existing ground level pressure ranging between 20.67 inHg to 31.00 inHg or 700 to 1050 mbars as selected. This extended adjust range allows QFE settings so altimeter reads zero at field elevation. The Baro setting can be reset by using push-to-reset function.

B.2.3 Altitude Alerter setting

By Rotating the altitude alerter setting knob the altitude display value will change ranging between -1000 to 53'000 ft or -300 to 16'000 m (as per scale selected).
Pushing the knob will enable or disable the alerter function and displays simultaneously. When the altitude alerter is disabled the selected altitude is not displayed which in turn does not activate the alerts function. And when enabled, the display shows the last value selected in the Altitude Alerter
.

B.2.4 Scale Setting INHG/MB and FT/M and synchronization

The “SCALE” setting button is flush mounted button on the bezel located in the front lower left corner of of the instrument By pushing the SCALE setting button will set the barometric pressure unit in "INHG" or "MB" or the altitude unit in “FT” or “M” as required. The altimeter continuously displays the scale selected at every aircraft altitudes until the selection is changed to different scale value..
The units of the barometric pressure and altitude (MB, INHG, M, FT) will automatically be synchronized between both AD3X.() (in case of dual AD3X.() installation) if the synchronization is been activated. If the synchronization is not possible or there is a fault , the corresponding scale setting display indication will flicker.
The following selection sequences in pairs are parametrically displayed in the display window of AD3X.() instrument:

MB/FT, MB/M (fixed mbar)
MB/FT, INHG/FT (fixed feet)
MB/FT, INHG/FT, MB/M (all combinations)

B.2.5 Test Button

The “TEST” button is flush mounted button located on the bezel of AD3X.() instrument by pressing and holding the TEST button for few seconds, the instrument performs the self test function (Built-In-Test) by testing the internal circuitry, the LCD, the alerter function and the of the accuracy of the pointer movement for its functionality. If the Built-In-Test (BIT) or self test function fails "Err" (Error) word appears on the altitude display window.

Operations

This part of the manual is to familiarize the reader with the AD3X.() Air Data Display instrument and to give a brief theory of operation.

Caution:

The AD3X.() Air Data Display flight instrument has been designed to exhibit a very high degree of functional integrity. However it is possible that erroneous operation could occur without fault indication. It is the responsibility of the operator to detect such an occurrence by means of cross check with redundant or correlated information available in the cockpit.

A. Theory of Operation

A.1 Power Supply

The AD3X.() is designed to supply a 28 VDC power supply in accordance with RTCA/DO-160D Section 16.0 Category Z. The instrument requires maximum of 8 W power consumption for normal operation (without bezel and display lighting power consumption). The power consumption 3.0 Watts maximum is for bezel lighting and 2.0 Watts maximum for LCD backlighting.

An optional secondary 28 VDC emergency power supply input, drawn from emergency bus should be provided in case of primary power supply failure.

NOTE: In case of power fail or switching off the equipment’s power supply the AD3X.() sets the warning flag valid output signal to LO (WFVOUTS).

A.2 Micro Controller

The Micro Controller is a flash type micro controller built around CPU (Central Processing Unit) board of the instrument. The CPU has an internal 32-bit architecture which is provided with sixteen 16-bit general registers and a concise, optimised instruction is designed for high-speed operation. The CPU can also address a 16-Mbyte linear address space.

The operating voltage and the port power voltage of the Micro controller is +3.3 VDC. A crystal oscillator of 4 MHz is connected to the micro controller and an internal clock generator produces the system clock of 16 MHz.

The data and address bus from the Micro controller is also used for the two functions used outside the CPU. This is for the communication with both the ARINC 429 and to the latches for the ICAO encoded output of the instrument.

A.3 ARINC 429 Interface

The ARINC 429 module in AD3X.() Instrument supports the ARINC-I/O interface and the bus interface to the CPU.

The ARINC 429 offers the following main features:

- Two transmitter and two receiver ports
- ARINC Low-Rate & High-Rate support with appropriate slew-rate control
- Multiple local loop-back facilities for improved BIT
- Lightning Induced Transients Suppression compliant with RTCA/DO-160D
- Hardening against aircraft wiring errors on ARINC inputs

Digital Data Standards are acc. to ARINC 429 Mark 33 DITS and ARINC 706-4 Mark 5 SADS / equipment ID 006

The following table shows the ARINC labels for various signals used for AD3X.() Air Data Display:

Label	Signal Name	Operational Range [1)]	Unit	Resolution	Update Rate per s
102	Selected Altitude	-1000 ..+53,000	feet	1	8
203	Pressure altitude (1013.25 mbar)	-1000 ..+53,000	feet	1	16
204	Baro corrected altitude #1	-1000 ..+53,000	feet	1	16
220	Baro corrected altitude #2	-1000 ..+53,000	feet	1	16
205	Mach number	0.200 .. 0.999	Mach	0.0000625 knot	8
206	Computed airspeed	0 / 40 .. 450	knots	0.0625	8
207	Maximum Allowable Airspeed	150 .. 450	knots	0.25	8
210	True airspeed	0 / 100 .. 599	knots	0.0625	8
211	Total air temperature	-60 .. +99	°C	0.25	2
212	Altitude Rate	0 .. 20,000	ft/min.	16	16
213	Static air temperature	-99 .. +60	°C	0.25	2
215	Impact Pressure	0 .. 372.5	mbar	0.03125	8
217	Static Pressure	0 .. 64	inHg	0.001	8
234	Baro Correction mb #1	700 .. 1050	mbar	0.1	8
235	Baro Correction inHg #1	20.67 .. 31.00	inHg	0.001	8
236	Baro Correction mb #2	700 .. 1050	mbar	0.1	8
237	Baro Correction inHg #2	20.67 .. 31.00	inHg	0.001	8
242	Total Pressure	25 .. 2048	mbar	0.03125	8
270	Discrete Word #1	--	--	--	2
271	Discrete Word #2	--	--	--	2
350	Maintenance Word #1	--	--	--	2
351	Maintenance Word #2	--	--	--	2
353	Indicated airspeed	0 / 40 .. 450	knots	0.0625	8
377	Equipment Identifier	006	--	--	16

Table 3: ARINC 429 Labels

A.4 RS-232 Serial Interface

The AD3X.() flight instrument has a RS-232 serial interface for maintenance and calibration purpose only. This interface is not accessible for normal operation in the aircraft.

The RS-232 Interface is provided for calibration and maintenance causes has the following transmission parameters:

Baud Rate..…….. 9600 kBit/s
Start Bits..…..... 1
Data Bits..…… 8
Stop Bits..…….. 1
Parity..……... None

A.5 Pointer Positioning

The pointer on the dial display of AD3X.() makes one revolution (360 deg) for each 1,000 feet (meters) of altitude per revolution in reference to the circular scale graduated with 20 ft. (meters) increments.
The pointer moves smoothly clock wise and counter clockwise around the dial as aircraft altitude is increasing or decreasing respectively. When the aircraft altitude sensed and measured internally exceeds the altitude indicated by the pointer by ± 2 feet (m). The pointer stops at indicated altitude level when the aircraft actual altitude overrides the altitude range design limit of the instrument [maximum tolerance level (> 53,280 or < - 1,020 feet OR >53000 feet or < -1000 feet) is included in the range limit].

A.6 Dial and Display

The analog dial pointer provides altitude information as required to supplement the digital display. The dial when viewed from a point directly in front of and below the dial centre line, the same graduations and markings are visible from an angle of 15 degrees. The value indicated on the pointer is clearly visible and readable from all positions around the dial. The display provides a direct reading of altitude in feet or meter (as per the scale selected) in a five digit LCD (Liquid Crystal Display) window with the provisioning of integral lighting. The 1 foot (m) digit on the extreme right is normally displayed as a fixed zero. A four digit display of barometric setting is also provided to display the setting in inches of Hg or millibars (HPa) (as per the scale selected). The display of barometric pressure setting is not be affected by altitude display failures.

The digital display also provides following flags with orange/amber colour:
CODE ; STBY; ALERT

Lighting characteristics

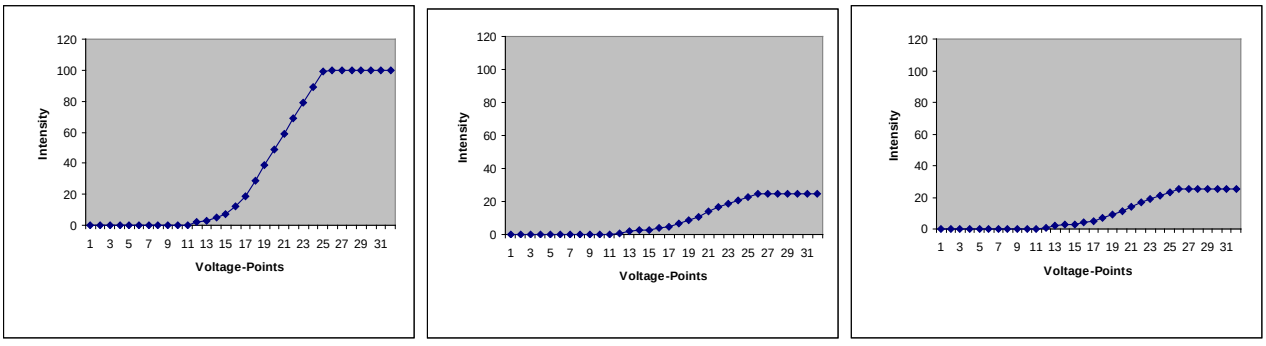
LCD lighting control intensity levels

DAY	NIGHT	NVG
> 30 fl	0-1 fL	0-1 fL
white lighting	NVIS green lighting	NVIS green lighting
controlled lighting intensity for LCD backlight only	controlled lighting intensity for LCD backlight and dial lighting	controlled lighting intensity for LCD backlight and dial lighting

In either DAY, NIGHT or NVG mode the lighting intensity shall be a function of the lighting voltage.

Separate lighting control curves shall be configurable individually for Dial and Display Lighting for each of the DAY/NIGHT/NVG lighting modes. They shall be defined by 32 points giving the brightness from 0 to 120 % of the nominal lighting voltage. Flickering shall be avoided by using a SW filter.

Example of lighting curves for DAY, NIGHT and NVG lighting modes:



NOTE: The lighting control is parametric. Refer to the individual execution of your instrument type.

A.7 Configuration Identification

The configuration identification defines a specific instrument configuration parameterized by the individual parameter lists for each AD3X.() instrument, which in turn explains the different parameter requested by the installer. So for every new AD3X.() instrument different Configuration ID number is designated.

CONFIGURATION ID 9001 (SAMPLE)

NOTE: Refer to Technical Checklist for Configuration ID (Identification) designation.

A.8 Operating Range, Limiting Values and Tolerances

Airdata	Operating ranges Note 1)	BIT Limits MIN/MAX Note 2)	Tolerance
ALTITUDE related Values			
ALT_P Pressure Altitude	-1,000 ft … + 53,000 ft -305 m … + 16,154 m	-1,060 ft … + 53,590 ft -323 m … + 16,332 m	refer to Appendix II
ALT_C Baro corrected Altitude	-1,000 ft … + 53,000 ft -305 m … + 16,154 m	-1,060 ft … + 53,590 ft -323 m … + 16,332 m	refer to Appendix II
ALT Rate Altitude rate	- 50,000 … + 50,000 ft/min	- 60,000 … + 60,000 ft/min	< 600 ft/min: ± 30 ft/min > 600 ft/min: ± 5% rdg
Static Pressure	25 … 1100 mbar abs	20 … 1150 mbar abs	
AIRSPEED related Values			
IAS Indicated Airspeed	0 / 20 … 750 knots	0 … 765 knots	refer to Appendix III
CAS Calibrated Airspeed (SSE corrected)	0 / 20 … 750 knots	0 … 765 knots	refer to Appendix III
TAS True Airspeed (SSE corrected)	0 / 100 … 1000 knots	0 … 1015 knots	± 4 knots
VMO Maximum Allowable Airspeed	150 … 750 knots	150 … 750 knots	--
$Mach_i$ indicated Mach number	0 / 0.200 … 1.200	0 … 1.250	refer to Appendix IV
Impact Pressure	0 … 512 mbar	0 … 512 mbar	
Total Pressure	25 … 2048 mbar abs	25 … 2048 mbar abs	
TEMPERATURE related Values			
Tti indicated Air Temperature	--	214 … 374 K	
TAT Total Air Temperature	- 60 … + 99 °C	- 61 … + 100 °C	± 0.5 °C
SAT (OAT) Static Air Temperature	- 99 … + 60 °C	- 100 … + 61 °C	± 1 °C

Table 4: Operating ranges, limiting values and tolerances

1) Operating range:

- Nominal operating range where the AD3X.() instrument is within the specification.

2) BIT limits

- Displayed and transmitted values is within the parametric BIT limits (tolerances for extreme environmental conditions have been considered)
- Values out of limits shall be handled according to the BIT-Matrix

B. Operating Modes

B.1 Normal Mode, Alerter function disabled

After start up LCD sequence, the selected “BARO” and “SCALE” settings and the measured altitude are displayed and the dial pointer moves exactly to the measured altitude position as shown in the altitude display.

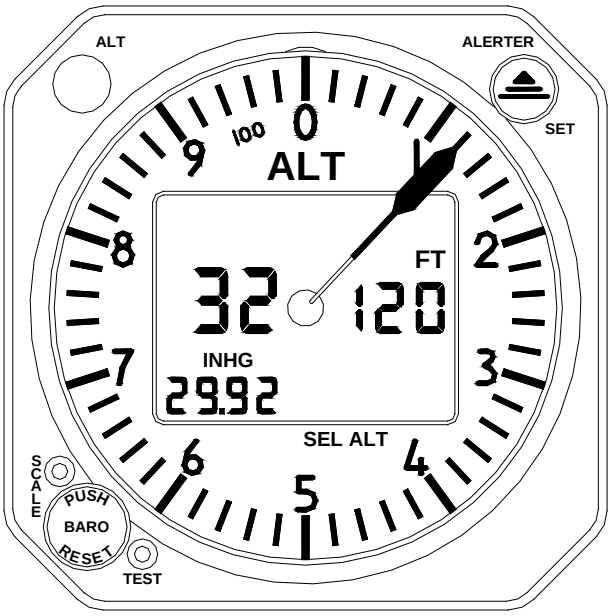


Figure 7: AD3X.() NORMAL Mode

B.2 Digital Display

The following tabular column shows the altitude indication and the baro setting on the display of AD3X.() instrument.

The altitude display in **feet** is shown below table

Measured Altitude [feet]	LCD Indication [feet]	
> 53,590	- - E r r	2)
10,000	10 000	
1,000	01 000	
100	0 100	
10	010	1)
5	05	1)
0	- - - 00	
-100	- 0 100	
-1,000	- 1 000	
< -1,060	- - E r r	2)

The altitude display meter is shown in the below table:

Measured Altitude [meter]	LCD Indication [meter]	
> 16,332	- - E r r	3)
10,000	10 000	
1,000	01 000	
100	0 100	
10	010	1)
5	05	1)
0	- - - 00	
-100	- 0 100	
< -323	- - E r r	3)

1) Resolution configurable
2) Nominal value including TSO-Tolerance at extreme temperature condition, parametric.
3) Nominal value including TSO-Tolerance (converted from feet to meter), parametric.

The altitude display resolution in feet depends on the altitude change rate as shown in the below table:

Altitude Change Rate [feet per min.]	Altitude [feet]	LCD Resolution [feet]	
< 750	<= 10,000	10	2)
	> 10,000	20	
>= 750 ... < 2,500	--	20	
>= 2,500 ... < 6,000	--	50	
>= 6,000	--	100	

The altitude display resolution in Meter depends on the altitude change rate as shown in the below table:

Altitude Change Rate [meter per min.]	Altitude [meter]	LCD Resolution [meter]	
< 250	<= 3,000	5	2)
	> 3,000	10	
>= 250 ... < 2,000	--	10	
>= 2,000	--	20	

Table 5: Altitude display resolution

2) Resolution configurable (see parameters for m or ft indication)

B.3 BARO Setting and Synchronization

The BARO Knob setting can be set within the range 700 to 1050 mbar or 20.67 to 31.00 inHg as required.

When synchronization is activated the BARO setting will automatically synchronize both the captain and First Officer AD3X.() instrument (in case of dual AD3X.() installation). But if the synchronization is not possible, the corresponding “Baro setting” indicator will flicker.

During barometric setting and synchronization the indicator ‘B’ is displayed.

Figure 8: AD3X.() BARO Setting Mode

B.4 Altitude Alerter

B.4.1 Altitude Alerter function

The AD3X.() Air Data Display instrument has an integrated altitude alerter function. It gets the input from the baro corrected altitude signal from the altimeter function.

Principle of Altitude Alerter Function

As the aircraft approaches the outer alert level (refer to operation sequence in fig. 9) of the selected or set altitude on the alerter, the switching logic circuit closures occurs for an external and/or an internal light and an external aural device. The aural and the visual warning occurs when the aircraft crosses the outer level or the inner level and the visual warning light remains "ON" till the aircraft remains between the range of outer and inner level.

As the aircraft departs form the selected altitude, the aural and the visual warning occurs when the aircraft crosses the inner level or the outer level and the visual warning light remains "ON" throughout to indicate the pilot that the A/C is departing from the selected altitude.

NOTE: The trigger for the outer level is at ±1000 ft (±300 m) and for the inner level at ±300 ft (±90 m). Trigger levels are parametric.

Operation Sequence

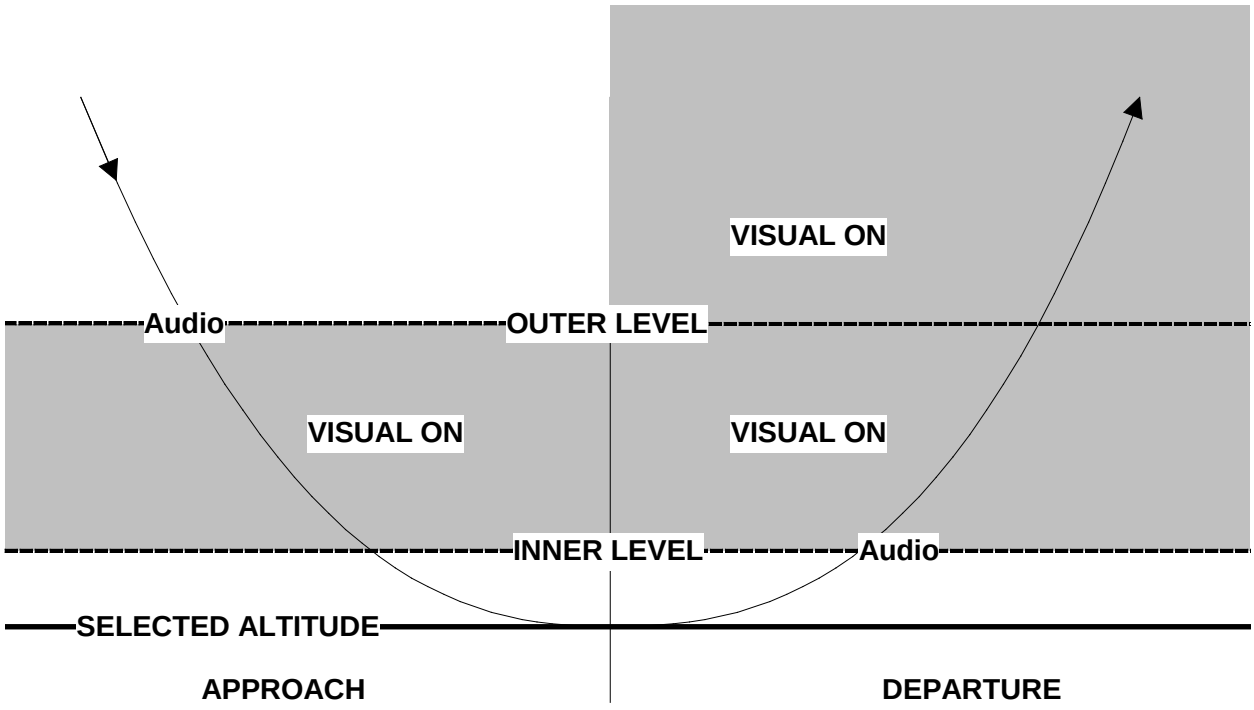


Figure 9: AD3X.() Altitude Alerter Operation Sequence

B.4.2 Altitude Alerter functions enabled

By pushing the alerter setting knob located in upper right hand corner of AD3X.() Instrument will enable or disable the integrated altitude alerter function and previously set barometric altitude is displayed on the LCD window and the altitude alerter is activated. The altitude alerter corresponds with the selected scale for the altimeter (ft or m).

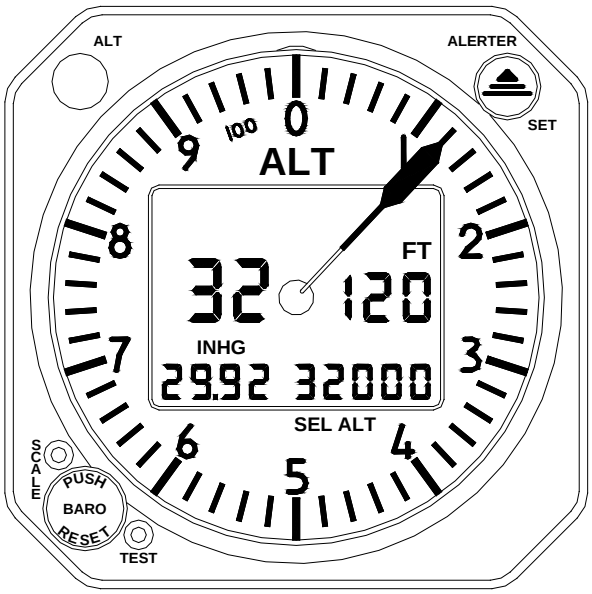


Figure 10 : AD3X.() Altitude Alerter, enabled

B.4.3 Altitude Alerter on/off function

There shall be made provisions to avoid unintended changes of the pre-selected flight level and to enable/disable the alerter function:

Pushing the Altitude Alerter setting knob shall switch off the Altitude Alerter. An ‘Alerter Activation Delay Time’ shall be parametric from 0 to 10s.

This function shall also be enabled/disabled by parametrization.

B.4.4 Alerter setting and synchronization

The alerter setting knob located in the front upper right hand corner of AD3X.() instrument allows to select altitudes ranging from –1'000 to 53'000 ft (parametric). When it is rotated clockwise or counterclockwise, the altitude setting is increased or decreased respectively. At the end positions of the range the values are limited. The resolution is adjustable by parameter setting between 1 to 100 (default values are 100 ft or 10 m).

During alerter setting function, the indicator 'A' is displayed. The resolution is given by parameterisation.

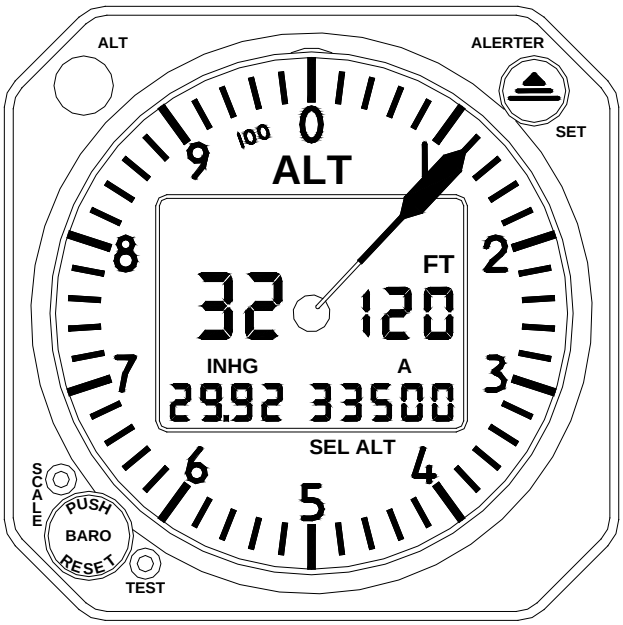


Figure 11: AD3X.() Alerter setting

The captain's and First officer's AD3X.() Air Data Display instruments installed in the cockpit can be synchronized for the altitude alerter setting via the data bus if it is parametrically calibrated for synchronization. Setting the altitude alerter on one Air Data Display unit will synchronize the altitude alerter display unit on the other instrument.

B.4.5 Altitude Alerter output

Automatic visual and audible signals (relays) alert the pilot while approaching or departing the pre selected flight level. The aural alert warning is activated for two seconds (parametric). After, alerter can be switched off by pushing the Alerter knob AD3X.().

Visual and Aural Alert Relays

For the external alert light and the external aural device there are separate relay contacts that are normally open (contact ratings: 1 A max., 28 VDC, resistive load).

The contact for the aural device can be activated for a parametric 2 s interval.

Alert Light Control

The on/off status is controlled

- internally by the integrated alerter
- externally by the voltage comparator input or a discrete input.

The external alert light control (from ext. alerter) and the internal control (from internal alerter) of the alert light can be used at the same time.

The brightness is controlled by the lighting input using a separate parametric lighting curve.

B.5 Altitude Comparison

In a dual installation the measured pressure altitude ALT_p shall be exchanged by both instruments (ARINC 429, RxD1, label 203, [ft]) and compared with the own calculated pressure altitude ALT_p [ft].

The following are conditions which apply in the principles of altitude comparison between the two AD3X.() instruments installed:

The Altitude Comparison between the two instruments is functional **up to the change rate of 10'000 ft/min only,** this is to avoid system related warnings.

When the altitude difference is more than 400 ft between the two instruments, the altitude (ALT) comparison warning (discrete output) is activated indicating it by warning lamp annunciation located on the upper left corner of the instrument.
This warning is been realized by both AD3X.() instruments and the ALT Comparison warning lamp annunciates on both AD3X.() instruments at the same time. The lamp annunciation goes OFF when the altitude difference between two AD3X.() instruments is less than 400 ft.
If the altitude difference between the two instruments becomes more than 500 ft, on TxD2 the SSM of ARINC bus label 203 is set to "no computed data". At this stage the transponder altitude information transferring function gets inactive and the message "FAIL" is indicated in ATC controller (transponder). When altitude difference becomes lesser than 500 ft, the SSM is set to normal operation.

When the altitude difference is more than 400 ft between the two instruments in the cockpit following remedial action can be taken for trouble shooting:

- Compare with standby altimeter
- Find out the failed instrument
- Press "TEST" button
- Select correct operating instrument on ARINC 429 switching device or alternatively switch the failed device to "Power off" (pull the circuit breaker)

The following table explains the default parameters and the actions.

If	Parameter	Action
ALT difference [ft] >=	Default: 400 ft	Discrete output = low (Warning)
ALT difference [ft] <	Default: 400 ft	Discrete output = high (normal)
ALT difference [ft] >=	Default: 500 ft	TxD2 / Label 203 / SSM = no computed data
ALT difference [ft] <	Default: 500 ft	TxD2 / Label 203 / SSM = normal operation

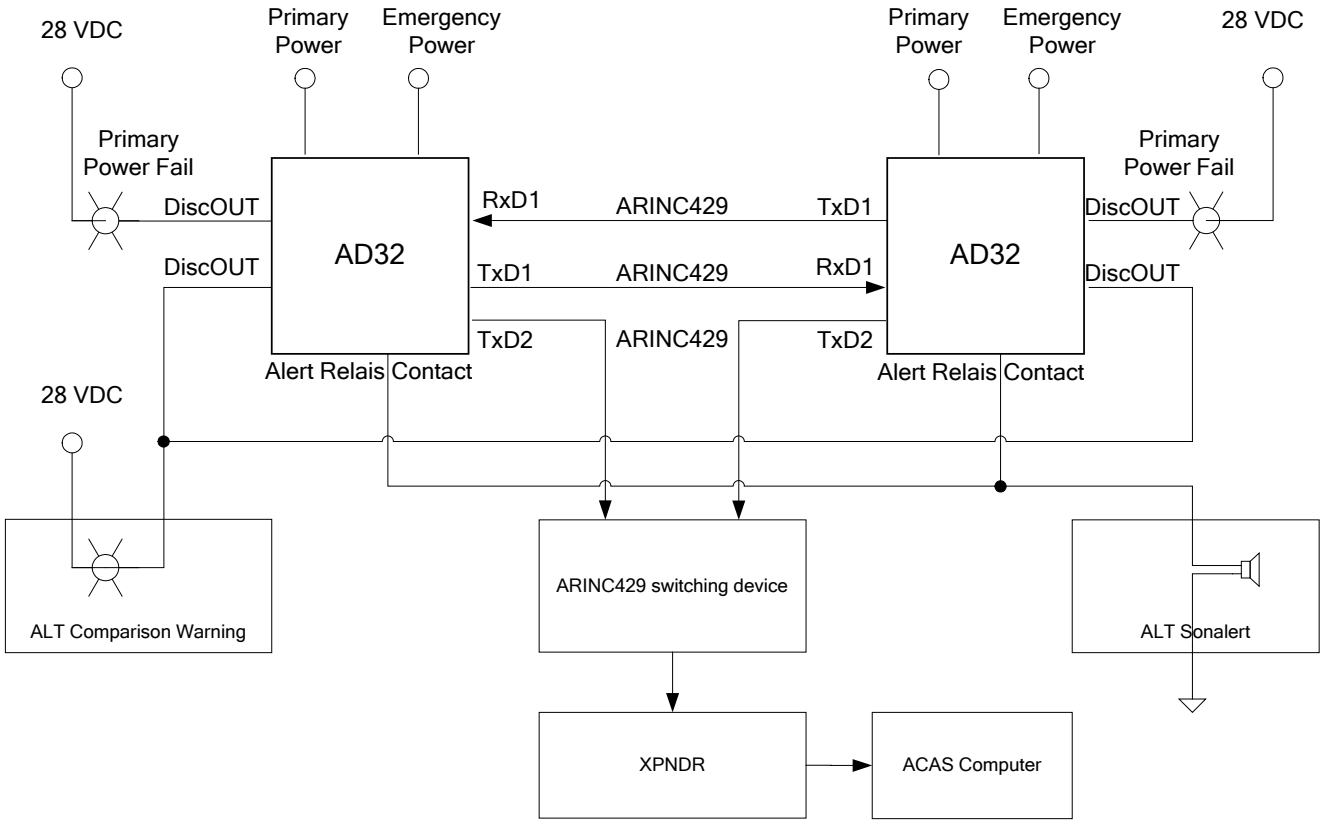


Figure 12: Altitude comparison diagram (example)

TESTING

A. Startup LCD Test Sequence

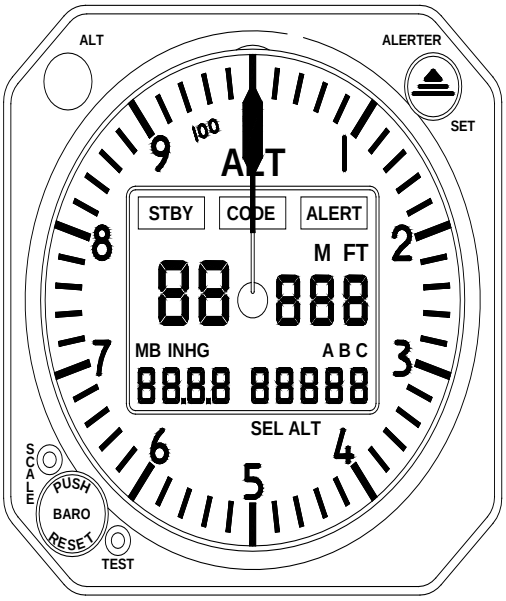


Figure 13: AD3X.() Startup Sequence Display

As soon as the instrument is powered all segments and annunciations and flags on the instrument are seen for 1 s during startup built-in-test time. At the same time the pointer moves clockwise to detect its reference position.

B. Startup BIT Sequence

After the Startup LCD Test Sequence the configuration ID (e.g. 9002) is displayed for 0.5 s allowing to check the correct installation of parameters in accordance to the flight manual.

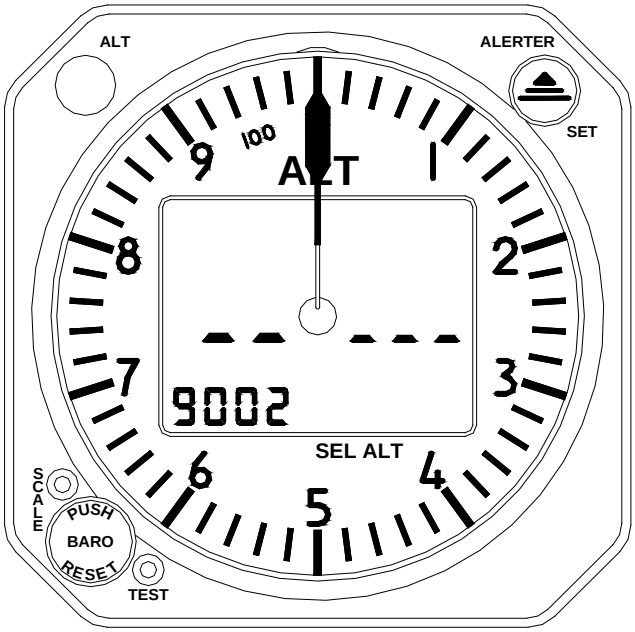


Figure 14: AD3X.() Startup BIT Sequence Display

C. Built-in-Test

C.1 BIT Overview

BIT	When?	Action	Duration
Startup BIT	Primary power switched on after power off condition (reset released)	- display all LCD segments - find pointer null	As long as pointer resets < 13 s totally
Initiated BIT	TEST button pushed	- same as Startup BIT	- same as Startup BIT
Continuous BIT	Background operation, once within 10 s	- test internal circuits and operating cond.	--

C.2 Start Up BIT

The flight instrument has a start-up built in Test (BIT) function, which is activated upon the application of primary or emergency power to the instrument.

C.3 Initiated BIT

The flight instrument can be initiated for built in Test (BIT) function, via “TEST” button located in the lower left corner of the instrument (SEE B.2.5). This BIT initiation sequence can be done by pressing the “Test” button then the Startup LCD including Startup BIT sequence is repeated.

C.4 Continuous BIT

The flight instrument has internally the continuous BIT sequence function, which is all the time active during normal operation of the instrument.

D. Failure Modes

D.1 Fault Code Handling

There are three types Failure Modes;

- **Critical Failures Mode;** It require an immediate shutdown of the instrument, in any case,
- **Non Critical Failures Mode;** It degrades the operation of the instrument but allows a safe operation of the instrument functionality. When failure is detected detection during startup BIT a shutdown of the instrument is required.
- **Tolerable Failures Mode**, It is not critical for the normal operation of the instrument so there is no requirement of shutting down of the instrument, in any case.

The detected failures modes are stored / saved in the instrument's BIT history for retrieval during maintenance and repair. Critical Failures require depot level maintenance in any case. The initiated BIT (TEST button pressed) function can be performed by flight crew or maintenance personnel if any failure occurs, to perform the self test function of the instrument.

If AD3X.() has a failure detected, the failure will be displayed by the indication of word "Err" on the display which can stop its operation. Even the warning flag valid output signal (WFVOUTS) can indicate an error.

The Failure codes displayed on the LCD and the reaction of the pointer and the operation mode due to failure code of the instrument in case of fault indication are as per the definition shown in the table below:

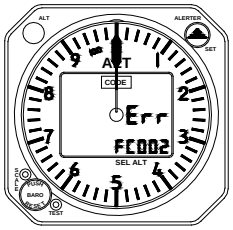
Failure Class	BIT	Action	Altitude Display Data Valid	Altitude Display Data not Valid
critical	Startup Initiated Continuous	- Warning Flag Valid Output Signal is set to LO - ARINC 429 communication marks all labels as "**failure warning**" - Pointer is stopped at its actual position - Failure Code is stored and displayed ('FCzzz') - instrument is set to idle mode		
non critical / tolerable	Startup Initiated Continuous	- Warning Flag Valid Output Signal is set to LO - ARINC 429 communication continues operation, invalid labels are marked as "**failure warning**" - Failure Code is stored	'XX E r r' First two digits indicate measured altitude	'- - E r r'

Table 6: Fault code handling

NOTE: - dashes will be indicated if no valid data can be displayed

The AD3X.() flight instrument has the possibility to find possible failures via extensive built in test (BIT) functions. To find BIT history, the AD3X.() flight instrument can be connected via the RS-232 serial data interface to PC, uploaded with ADAC32 maintenance Software.

NOTE: Refer to Appendix II for Failure codes and their descriptions

D.2 Power Failure

In case of primary and emergency power failure or switching off the instrument's power supply the AD3X.()

- sets the warning flag valid output signal (WFVOUTS) to LO
- sets the LCD blank
- leaves the pointer in actual position
- switches off lighting

Primary Power Fail Indication (optional)

Primary Power Fail indicates loss of primary power 28 VDC only if emergency power is available. Primary Power Fail is detected by the Voltage Comparator Input (refer to the external electrical connector section IV E.1.1) and must be connected to the primary power line in the external connector.

Switching Thresholds (± 5%)	Indication
< 25 % of specified Primary Power voltage	FAIL
> 60 % of specified Primary Power voltage	normal

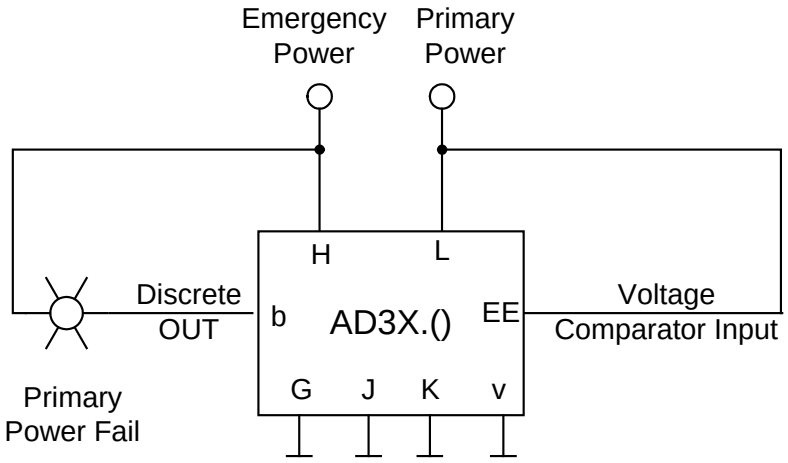


Figure 4: Primary Power Fail

NOTE: For the individual type execution of Air Data Computer, refer Appendix II Air Data Computer Execution.

D.3 Critical Failure Indication

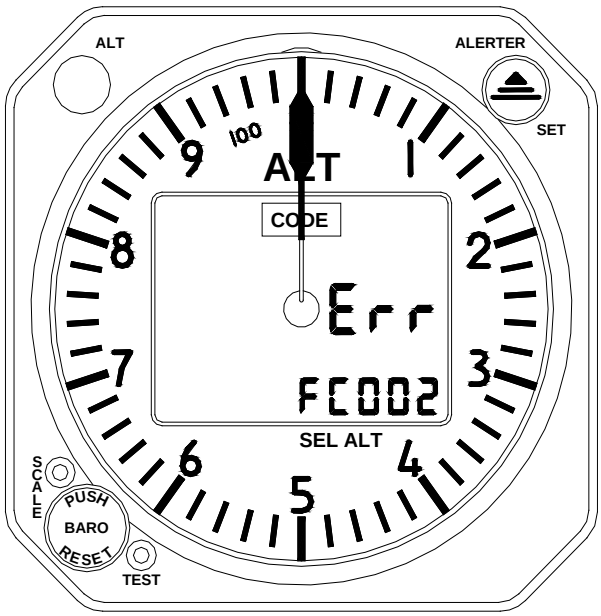


Figure 15: AD3X.() Indication of Critical Failures

In case of a Critical Failure (operation stopped) the Failure Code (FC) number is displayed in the lower part of LCD section. This condition requires depot level maintenance.

D.4 Critical Failure Codes

NOTE: Refer to Appendix II for Failure codes and their descriptions

D.5 Encoding Failure OR Indication of Code OFF Indication

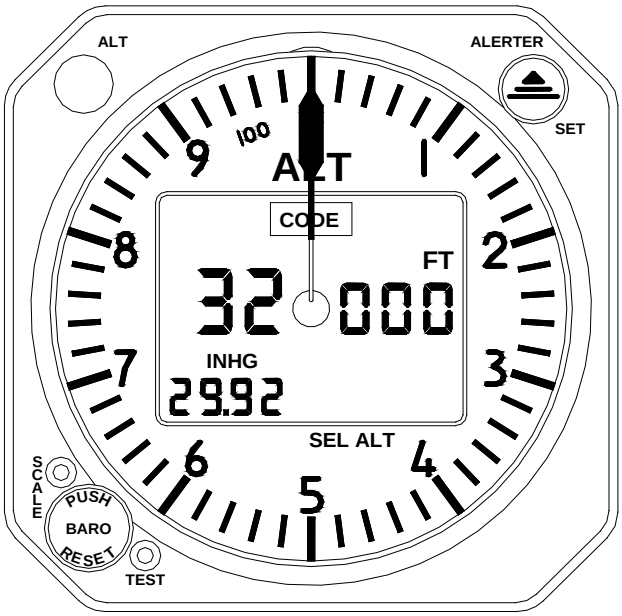


Figure 16: AD3X.() Indication of ‘CODE’ or Encoding Failure

When the Encoding function is inactive or the encoding circuit fails the orange indication/flag ‘CODE’ is in view. Refer to the AD3X.() for Encoding function description.

D.6 Altitude Alerter Failure Indication

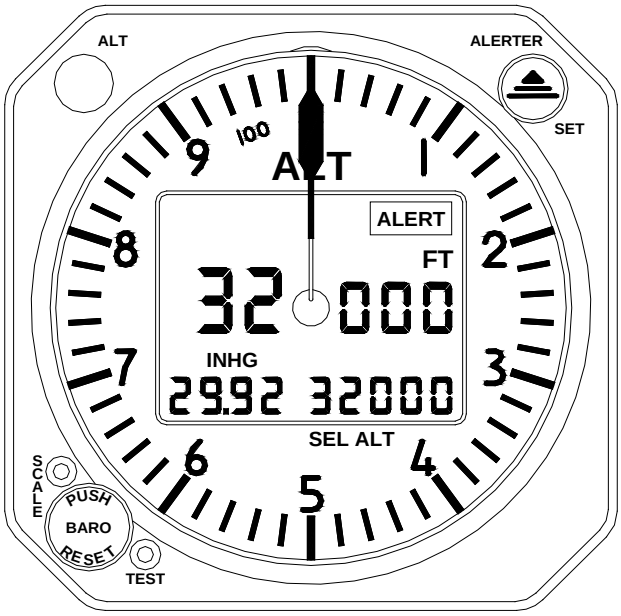


Figure 17: AD3X.() Altitude Alerter Failure indication

When the Alerter function has a failure the orange indication/flag ‘ALERT’ is in view See Section II Part 3 Para B.4.

Section III

Approvals

A. General

The approval of the AD3X.() Air Data Display Instrument is being accomplished under certified TSO-C10b / TSO-C106 / TSO-C88a.

NOTE: The TSO identifies the minimum performance standards, tests and other conditions applicable for issuance of design and production approval of the Instrument and does not specifically identify acceptable conditions for installation. It is the responsibility of those desiring to install this instrument either on or with in the specific type or class of aircraft / rotorcraft to determine that the aircraft / rotorcraft installation conditions are with in the TSO standards.

B. Instructions for Continued Airworthiness

Maintenance Requirements – Instructions for Continued Airworthiness under FAR 23.1529, 25.1529, 27.1529 and 29.1529

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

(1) Maintenance Manual information for the AD3X.() (description, Installation, testing, etc.) is contained in AD3X.() Air Data Display Installation and Operation manual No. AD-INSOP-400.

(2) The unit part number and other necessary part numbers contained in the installation manual should be placed into the aircraft operator’s appropriate airplane Illustrated Parts List (IPL).

(3) Wiring diagram information contained in this manual should be placed into the aircraft operator’s appropriate airplane Wiring Diagram Manuals.

(4) Scheduled Maintenance Program tasks to be added to the aircraft operator’s appropriate airplane maintenance program are as follows:

a. Recommended Periodic Scheduled Servicing Tasks:	On Condition
b. Recommended Periodic Scheduled Preventative Maintenance Tests/Checks to determine System Condition and/or Latent Failures:	On Condition
c. Recommended Periodic Inspections:	On Condition
d. Recommended Periodic Structural Inspections:	On Condition

(5) Recalibration Interval

The flight equipment has the following recalibration intervals :	On Condition

NOTE: Unit performs continuous self-testing (BIT) and monitoring; any detected failures are annunciated.

C. Environmental Qualification

The flight instrument shall be operated within the environmental limits specified in the Declaration of Design and Performance (AD-DDP-400).

Refer to document AD-DDP-400 for the environmental limits for the individual types of Air Data Display.

C.1 Electromagnetic Environment (EME)

The flight instrument is designed, analyzed, installed, and tested to perform and fulfill the aircraft electromagnetic environment (EME) requirements without any malfunction or degradation in performance.

C.2 Electromagnetic compatibility (EMC)

The flight instrument proves electromagnetic compatibility (EMC). Which means the flight instrument performs its individually designed functions in a common EME without causing or suffering unacceptable degradation due to electromagnetic interference (EMI) to or from other equipment/systems in the same environment in accordance with the overall requirements.

C.3 Electromagnetic interference (EMI)

The generation of EMI by the AD3X.() flight instrument and its susceptibility to EMI is controlled to the limitation in accordance to RTCA/DO-160D and as modified AD3X.() specification. The requirements are met in all operating modes.

C.4 Dielectric strength

The flight instrument can withstand application of 500VAC at a frequency of 50 Hz for 30 s. But in case EMI filters used ,it cannot withstand this voltage.

C.5 Pointer position error

The pointer position error does not exceed 5 feet maximum.

C.6 Scale error

Scale errors do not exceed the tolerances specified in the Section II Part 3 Para A.8.

C.7 Hysteresis

Apparent Hysteresis is limited to the amount required by design to obtain stability of the display.

Section IV

Installation

A. General

Installation data in this section consists of pre-installation checks, Electrical Interface, system interconnect diagrams and digital interface data to assure satisfactory performance of AD3X.() Air Data Display.

NOTE: Refer to Section I part D for Mechanical Installation details.

B. Unpacking and Inspecting

Unpack the equipment carefully and make a visual inspection of the instrument for possible shipping damage. If a claim for damage is to be made, save the original packing carton and materials to substantiate the claim.

C. Pre and Post Installation Check

Before installing the instrument in the aircraft, check for the applicable configuration ID and correct MOD status to ensure that the equipment meets performance specifications. The AD3X.() Air Data Display Instrument does not require any in- aircraft adjustment. All adjustments procedures are accomplished by the manufacture.

D. Electrical Interface

D.1 Overview of electrical interface

The following are the electrical interfaces for AD3X.() Air Data Display:

- Primary and Emergency Power Supply
- Lighting Power Supply
- Digital Communication Interfaces (ARINC 429 data bus, ICAO Encoder, RS-232 Maintenance IF)
- Discrete I/O’s
- TAT (Total Air Temperature) Probe input
- Altitude Alerter Relays

D.2 Power Control (DC Primary)

The AD3X.() Air Data Display flight instrument is designed for 28 VDC power supply in accordance with RTCA/DO-160D Section 16.0 under Category Z.

An optional Secondary 28 VDC emergency power supply input is drawn from the emergency bus is provided in case of primary power supply failure.

D.3 Power Consumption

The following table shows values of power consumed by AD3X.() instruments with the full operating functionality. The instruments e.g. without ARINC 429 module or without sensors have less power consumption.
The power consumption by the AD3X.() flight instrument at different stages of operation are shown below in the table:

	Power Consumption	
Operation	**Lighting on / maximum**	**Lighting off / minimum**
During startup	max. 8 W	max. 7 W
Normal operation	max. 6 W	max. 5 W
max. current draw	0.7 A	0.7 A

Note: Recommended CB (Circuit Breaker) of 1 Ampere.

NOTE: Power supply for the Lighting of LED (Liquid Crystal Display) are supplied internally in the instrument from primary or secondary power. Whereas this lighting supply input is only used to control its intensity (SEE A.5 for details) according to the lighting voltage (input current drawn form lighting power supply is less than <15 mA).

D.4 Power Fails indication

In case of power fail or switching off the equipment's power supply the warning flag valid output signal (WFVOUTS) sets signal to "LO".

D.5 Groundings and Shielding

➢ Groundings

All the ground strap chassis grounds aircraft , twisted shielded cables/wires and power cables/wires (See section B.2 wiring diagram for the grounding cables/wires) should be carefully grounded (aircraft ground & shield grounds) such a manner in order to :

- prevent ground loops and common ground returns for signals and power circuits
- provide effective shielding for signal circuits
- minimize EMI (Electromagnetic Interference) during the engine runup, and
- protect personnel from electrical shock hazards.

Note: All externally exposed metal parts, shields, connectors, etc. are grounded to the chassis ground.

➢ Harness shielding

To minimize the effects of HIRF (High Intensity Radiated Fields) and lightning hazards proper shielding and grounding techniques are required for the mating connector of the AD3X.(). The GROUND strap should be electrically connected to the mating connector with conductive overbraid shielding and the other end of the it should be connected to aircraft ground.

NOTE: For HIRF protection all the shielded wires should be grounded at both ends
NOTE: The maximum length of the GROUND strap : 30 cm (12 inches)

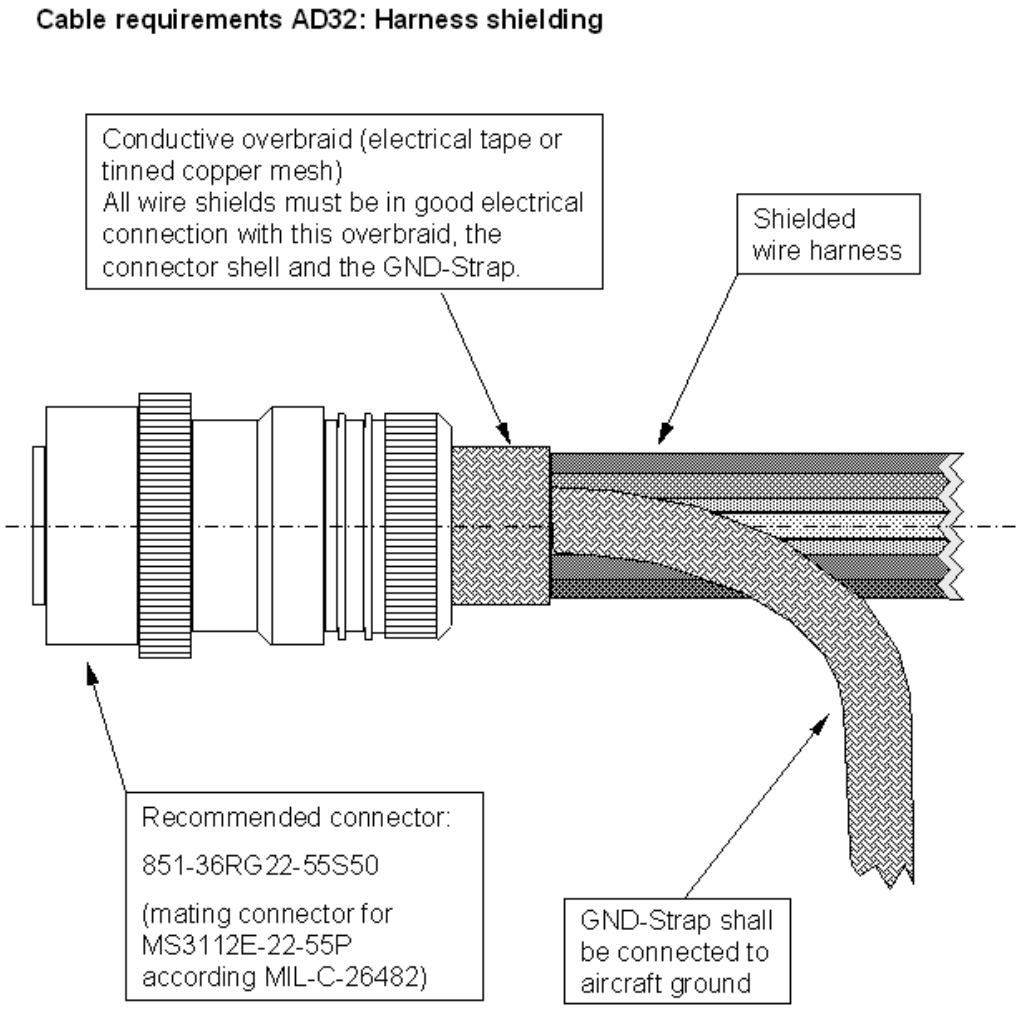


Figure 18: AD3X.() Harness Shielding

D.6 Power common leads

Instrument ground (common) may be connected to the power common leads (SEE Section IV 1- B ELECTRICAL CONNECTOR)

D.7 Primary Power Fail Indication (Optional)

Primary Power Failure indicates loss of 28 VDC primary power when only if emergency power is available. Primary Power Failure is detected by the Voltage Comparator Input (See section electrical connector) and which must be connected to the primary power line in the external connector.

Switching Thresholds (± 5%)	Indication
< 25 % of 28 VDC Primary Power voltage	FAIL

> 60 % of 28 VDC Primary Power voltage	normal

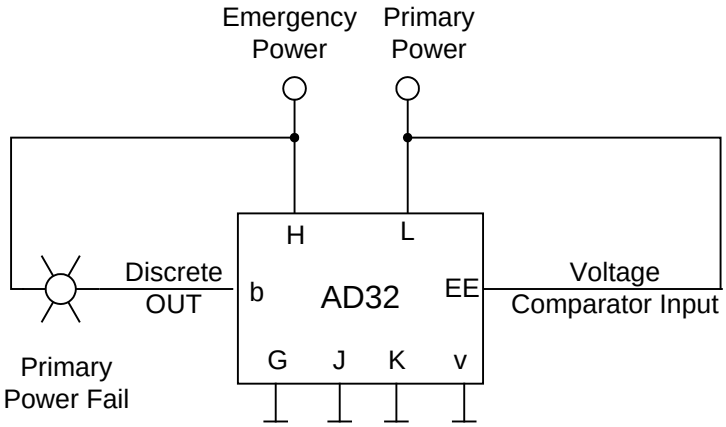


Figure 19: AD3X.() Primary Power Fail

NOTE: For use and assignment refer to the individual execution of instrument type in the AD3X.() Technical Checklist.

D.8 Alert Light external control (Optional)

The external alert light is detected by the **Voltage Comparator Input** or by discrete input (see electrical connector) and it must be connected to the external alert light signal.
The external alert light control (from ext. alerter) and the internal control (from internal alerter) of the alert light can be used at the same time.

The AD3X.() built-in alert light is not dimmed and will have full brightness when “ON”.

Alert light input voltage		AD3X.() built-in alert light
Nominal 5 VDC	**Nominal 28 VDC**	
< 1.2 VDC	< 7 VDC	OFF
> 3 VDC	> 16.8 VDC	ON

NOTE: For use and assignment refer to the individual execution of instrument type in the AD3X.() Technical Checklist.

E. Electrical connector

E.1 Pin Assignments

The **MS3112E-22-55P** (acc. to MIL-C-26482 Series 1) type of connector and **MS3126F-22-55S** type of mating connector and is used.

The below shown table shows the pin numbers and its definition/functionality for the Electrical Connector:

Pin #	Signal Name	Function	Signal Type	EMC cat.	Remarks
L	Primary Power supply	**Primary** Power supply	analogue	em./ susc.	28VDC
K	Power return	Power return	analogue	em./ susc.	5)
H	Emergency Power supply	**Secondary** Power supply	analogue	em./ susc.	optional 28VDC
J	Power return	Power return	analogue	em./ susc.	5), optional
U	Lighting supply	Dial Lighting Power supply	analogue	em./ susc.	9), 5 VAC, 5 VDC, 28 VDC
T	Lighting return	Dial Lighting Power return	analogue	em./ susc.	
R	TAT probe, supply hi	TAT probe, supply high	analogue	susc.	optional, supplied by AD32, ca. 1 mADC 2-/3-/4-wire connection
p	TAT probe, supply lo	TAT probe, supply low	analogue	susc.	
k	TAT probe, sense hi	TAT probe, sense high	analogue	susc.	
m	TAT probe, sense lo	TAT probe, sense low	analogue	susc.	
h	RS-232 TxD	Serial IF Transmit	data	--	1),3) only for maintenance
w	RS-232 RxD	Serial IF Receive	data	--	
W	ARINC 429 RxD 1A (RS422 RxD 1A)	Serial Interface Bus **Receive** Channel 1	data bus	em./ susc.	
X	ARINC 429 RxD 1B (RS422 RxD 1B)	Serial Interface Bus **Receive** Channel 1	data bus	em./ susc.	
Y	ARINC 429 RxD 2A (RS422 RxD 2A)	Serial Interface Bus **Receive** Channel 2	data bus	em./ susc.	
D	ARINC 429 RxD 2B (RS422 RxD 2B)	Serial Interface Bus **Receive** Channel 2	data bus	em./ susc.	
B	ARINC 429 TxD 1A (RS422 TxD 1A)	Serial Interface Bus **Transmit** Channel 1	data bus	em./susc.	
C	ARINC 429 TxD 1B (RS422 TxD 1B)	Serial Interface Bus **Transmit** Channel 1	data bus	em./susc.	

Pin #	Signal Name	Function	Signal Type	EMC cat.	Remarks
q	ARINC 429 TxD 2A (RS422 TxD 2A)	Serial Interface Bus **Transmit** Channel 2	data bus	em./susc.	
r	ARINC 429 TxD 2B (RS422 TxD 2B)	Serial Interface Bus **Transmit** Channel 2	data bus	em./susc.	
y	ICAO Code D4	Output	Logic	em./susc.	shielded
GG	ICAO Code A1	Output			
FF	ICAO Code A2	Output			
BB	ICAO Code A4	Output			
HH	ICAO Code B1	Output			
i	ICAO Code B2	Output			
AA	ICAO Code B4	Output			
z	ICAO Code C1	Output			
j	ICAO Code C2	Output			
P	ICAO Code C4	Output			
d	ICAO Code Strobe	Input	Discrete (5)		2)
Z	Alerter Visual OUT	Output Relay	Contact	--	10), normally open contact
E	Alerter Visual OUT	Output Relay	Contact	--	
x	Alerter Aural OUT	Output Relay	Contact	--	10), normally open contact
N	Alerter Aural OUT	Output Relay	Contact	--	
EE	Voltage Comparator Input High	Input	analogue	--	8) optional 5 / 28 VDC
v	Voltage Comparator Input Low	Input	analogue	--	8) optional
F	Discrete In 0 (TEST)	input	Discrete (0)	--	Standard
u	Discrete In 1	Input	Discrete (1)	--	7) optional
CC	Discrete In 2	Input	Discrete (2)	--	7) optional
s	Discrete In 3	Input	Discrete (3)	--	7) optional
DD	Discrete In 4	Input	Discrete (4)	--	7) optional
A	+ 28 V WFVOUTS Signal	Output	analogue	--	Warning Flag Valid Output Signal HI = valid
b	Discrete Out 1	Output	Discrete (1)	--	7) optional
c	Discrete Out 2	Output	Discrete (2)	--	7) optional
t	Discrete Out 3	Output	Discrete (3)	--	7) optional

Pin #	Signal Name	Function	Signal Type	EMC cat.	Remarks
V	Baro Pot High	Supply high	analogue	susc.	--
S	Baro Pot Out Signal	Output signal	analogue	susc.	--
n	Baro Pot Low	Supply low	analogue	susc.	--
a	Spare	--	--	--	4)
M	Spare	--	--	--	4)
g	Spare	--	--	--	4)
f	Spare	--	--	--	4)
G	System Ground	System Ground (Common)	--	--	For RS-232 , discretes, logic
e	Chassis GND	GND	--	--	

em. = emitting, susc. = susceptible

Table 7: Pin Assignments

Remarks

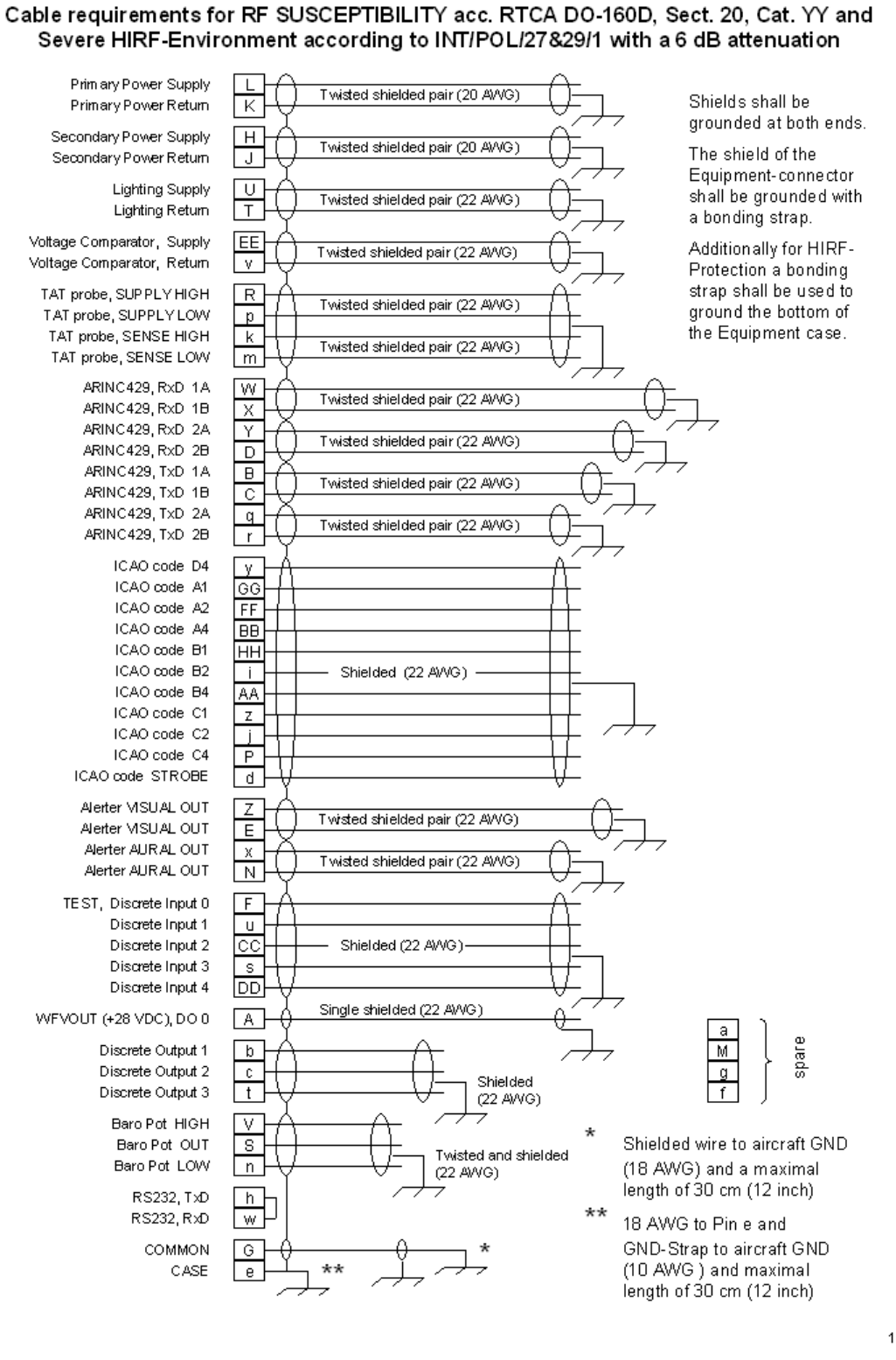
1) Short-circuit RS-232 TxD and RxD on aircraft installation (jumper aircraft connector pins)
2) To avoid "CODE" flag indication on the display discrete input no. 5 (connector pin no. "d") must be grounded
3) Transmit and Receive Signals are seen from the instruments view
4) Reserved for future development
5) Power Return for primary and secondary supply are connected internally
6) --
7) For use and assignment refer to the individual execution of your type in the technical checklist.
8) Voltage Comparator Input used for
   a) Primary Power Fail detection (refer to D.7 Primary Power Fail Indication (Optional))
   b) Alert light external control (refer to D.8 Alert Light external control (Optional))
9) Lighting is supplied from primary or secondary power. Lighting supply (Pin# U) is the lighting voltage input only to control the LED intensity.
10) Aural alert relay will close for a parametric interval time (0 …10 s, typically 2 s)

NOTE: For use and assignment refer to the individual execution of instrument type in the AD3X.() Technical Checklist.

E.2 Wiring Diagram

NOTE 1: For wiring diagram refer to the next page.

NOTE 2: Loop the Primary Power Return pin number "K" to COMMON pin number "G" with 20 AWG on the connector, to avoid the intermittent occurrence of Fault code FC010 on AD3X.() Air Data Display.



F. TAT Probe Interface

The TAT (Total Air Temperature) probe according to ARINC 706-4 Section 4.8 (500 Ohm) is connected to an input of the instrument with 2-/3- or 4-wire connection according to the

configuration required.
For 2- or 3-wire connections the wire resistance can be stored and is compensated by the instrument (Default correction value 0 Ohm).

Temperature range is **- 60 … + 99°C**

T_{Ti} Indicated Total Air Temperature °C	**Resistance Pt 500 acc. to ARINC 706-4 Table 5-1** Ohm
-60	381.64
-30	441.16
0	500.00
30	558.21
60	615.79
99	689.72

Table 8: Resistance Pt 500

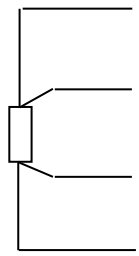
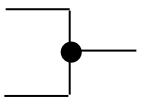
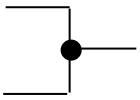
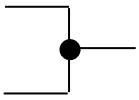
	Pin #	**Signal Name**	**2-wire connection**	**3-wire connection**	**4-wire connection**
	k	TAT probe, **sense** high	 1)		
	R	TAT probe, **supply** high			
	p	TAT probe, **supply** low	 1)	 1)	
	m	TAT probe, **sense** low			

Table 9: TAT Signals

1) connect both pins at the connector

NOTES: **- For use refer to the individual execution of your type in Technical Checklist.**
- Pt 100 configuration also available.
- AD3X.() is capable of TAT probe input.
- If the installation does not require a TAT probe a 500 Ohm resistor can replace the TAT probe at the input to avoid FC039.

NOTE:

Manufacturers of temperature probes shall be contacted for the evaluation of the correct TAT or OAT probe. The system installer shall be responsible for the selection of the probe. This needs to be evaluated on the aircraft level. The specification of the selected probe is required.

An OAT probe usually can be used up to airspeed 200 knots. Above 200 knots airspeed and at icing conditions it is required to use a heated TAT probe (to enable deicing).

F.1 TAT Synchronisation

If no TAT probe is connected directly to the equipment the parametric TAT synchronisation reads the air temperature from ARINC 429 label 211 (TAT) on channel RxD1 or RxD2 depending on availability.

The TAT handling is according to the following table:

TAT Source			TAT Use		
Self sensed TAT value	Received TAT value (Label 211 on RxD1)	Received TAT value (Label 211 on RxD2)	Used source for calculation of SAT and TAS	Handling of TAT BIT FC 039	SSM of transmitted Label 211
Yes	X	X	Self sensed TAT value	No	Normal Operation
No	Yes	X	Received TAT value (Label 211 on RxD1)	No	Failure Warning for 0.5 s if loss of TAT probe is detected, then normal operation
No	No	Yes	Received TAT value (Label 211 on RxD2)	No	Failure Warning for 0.5 s if loss of TAT probe is detected, then normal operation
No	No	No	None	Yes	Failure Warning

Note: X = don’t care

G. Digital Data Interface

G.1 ARINC 429 Data bus Interface

Digital Data Standards are acc. to ARINC 429 Mark 33 DITS and ARINC 706-4 Mark 5 SADS / equipment ID 006

Label	Signal Name	Operational Range [1)]	Unit	Resolution	Update Rate per s
102	Selected Altitude	-1000 ..+53,000	feet	1	8
203	Pressure altitude (1013.25 mbar)	-1000 ..+53,000	feet	1	16
204	Baro corrected altitude #1	-1000 ..+53,000	feet	1	16
220	Baro corrected altitude #2	-1000 ..+53,000	feet	1	16
205	Mach number	0.200 .. 0.999	Mach	0.0000625 knot	8
206	Computed airspeed	0 / 40 .. 450	knots	0.0625	8
207	Maximum Allowable Airspeed	150 .. 450	knots	0.25	8
210	True airspeed	0 / 100 .. 599	knots	0.0625	8
211	Total air temperature	-60 .. +99	°C	0.25	2
212	Altitude Rate	0 .. 50,000	ft/min.	16	16
213	Static air temperature	-99 .. +60	°C	0.25	2
215	Impact Pressure	0 .. 372.5	mbar	0.03125	8
217	Static Pressure	0 .. 64	inHg	0.001	8
234	Baro Correction mb #1	700 .. 1050	mbar	0.1	8
235	Baro Correction inHg #1	20.67 .. 31.00	inHg	0.001	8
236	Baro Correction mb #2	700 .. 1050	mbar	0.1	8
237	Baro Correction inHg #2	20.67 .. 31.00	inHg	0.001	8
242	Total Pressure	25 .. 2048	mbar	0.03125	8
270	Discrete Word #1	--	--	--	2
350	Maintenance Word #1	--	--	--	2
351	Maintenance Word #2	--	--	--	2
353	Indicated airspeed	0 / 40 .. 450	knots	0.0625	8
377	Equipment Identifier	006	--	--	16

Table 10: ARINC 429 Labels

1) Operational ranges are defined to meet customer requirements.

G.2 ARINC 429 Bit Rate & Bus Load

The ARINC 429 data bus is designed for:

- **High Speed: 100 kbits/s**, half load for both transmit channels
  (max. bus load per transmitter 1 kOhm / 9.5 nF)

Optionally it can be configured for:

- **Low Speed: 12.5 kbits/s**, full load for both transmit channels
  (max. bus load per transmitter 260 Ohm / 45 nF)

Note: In real installations the maximum bus load is determined by impedance of cabling and receivers. The installer shall make provisions to **allocate the bus load to both ARINC 429 transmit channels** of the AC32. This shall be taken into account especially at high speed bit rate and with more than 7 receivers per transmit channel. In individual installations the impedance of receivers connected to the AC32 could be much higher than expected.

The following table shows the ARINC 429 labels with I/O transfer channels:

Label	Signal Name	I/O Transfer channel Mode STBY or self sensing		I/O Transfer channel Mode NORM or Repeater ALT	
102	Selected altitude	TxD1/TxD2	--	TxD1/TxD2	--
203	Pressure altitude (1013.25 mbar)	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
204	Baro corrected altitude #1	TxD1/TxD2	--	--	RxD1/RxD2
220	Baro corrected altitude #2	TxD1/TxD2	--	--	RxD1/RxD2
205	Mach number	TxD1/TxD2	--	--	--
206	Computed airspeed	TxD1/TxD2	--	--	--
207	Maximum Allowable Airspeed	TxD1/TxD2	--	--	--
210	True airspeed	TxD1/TxD2	--	--	--
211	Total air temperature	TxD1/TxD2	--	--	--
212	Altitude Rate	TxD1/TxD2	--	--	--
213	Static air temperature	TxD1/TxD2	--	--	--
215	Impact Pressure	TxD1/TxD2	--	--	--
217	Static Pressure	TxD1/TxD2	--	--	--
234	Baro Correction mb #1	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
235	Baro Correction inHg #1	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
236	Baro Correction mb #2	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
237	Baro Correction inHg #2	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
242	Total Pressure	TxD1/TxD2	--	--	--
270	Discrete Word #1	TxD1/TxD2	--	--	--
271	Discrete Word #2 (provision)	--	--	--	--
320	Heading	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
350	Maintenance Word #1	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2

Label	Signal Name	I/O Transfer channel Mode STBY or self sensing		I/O Transfer channel Mode NORM or Repeater ALT	
351	Maintenance Word #2 (provision)	--	--	--	--
353	Indicated airspeed	TxD1/TxD2	--	--	--
377	Equipment Identifier	TxD1/TxD2	--	--	--

Table 11 : ARINC 429 I/O Transfer labels

The following table is for synchronization and comparison functions:

Label	Function	I/O Transfer channel Mode STBY or self sensing		I/O Transfer Mode NORM or Repeater ALT	
234 / 235	Baro Synch.	TxD1/TxD2	RxD1	TxD1/TxD2	RxD1
234	Baro Comp.	TxD1/TxD2	RxD1	TxD1/TxD2	RxD1
350	Scale Synch.	TxD1/TxD2	RxD1	TxD1/TxD2	RxD1
350	Scale Comp.	TxD1/TxD2	RxD1	TxD1/TxD2	RxD1
350	Alerter Synch.	TxD1/TxD2	RxD1	TxD1/TxD2	RxD1
203	ALT Comparison	--	RxD1	--	RxD1
203	ALT Comp. FAIL	TxD2	--	TxD2	--

Table 12: ARINC 429 I/O Transfer for functions

G.3 ARINC Label Formats

	Label	Signal Name	Format acc. to
ALT_P	203	Pressure altitude (1013.25 mbar)	ARINC 429 Mark 33 DITS equipment ID 006
ALT_C	204	Baro corrected altitude #1	
ALT_C	220	Baro corrected altitude #2	
Mach	205	Mach number	
CAS	206	Computed airspeed	
VMO	207	Maximum Allowable Airspeed	
TAS	210	True airspeed	
TAT	211	Total air temperature	
	212	Altitude Rate	
SAT	213	Static air temperature	
q_C	215	Corrected Impact Pressure	
P_S	217	Static Pressure	
	234	Baro Correction mb #1	
	235	Baro Correction inHg #1	
	236	Baro Correction mb #2	
	237	Baro Correction inHg #2	
P_T	242	Total Pressure	
	377	Equipment Identifier	
	270	Discrete Word #1	Section IV, G.3.19
	350	Maintenance Word #1	Section IV, G.3.22
	351	Maintenance Word #2	Section IV, G.3.23
IAS	353	Indicated airspeed	Section IV, G.3.24
SEL ALT	102	Selected Altitude	Section IV, G.3.1

Table 13: ARINC 429 Labels Format

G.3.1 Label 102 (Selected Altitude)

Label 102 (Selected Altitude)		
BIT No.		
1	SAL LSB	8 Bit SAL = 102 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	PAD	Range:
12	PAD	
13	Value BNR LSB	-65536 feet to
14		+65536 feet
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28	Value BNR MSB	
29	Sign BIT	0 = positive, 1 = negative
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

G.3.2 Label 203 (Pressure Altitude)

Label 203 (Pressure Altitude)		
Bit No.		
1	Label LSB	8 Bit SAL = 203 octal
2		
3		
4		
5		
6		
7		
8	Label MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	PAD	Spare
12	Value BNR LSB	Binary value in the range of –1000 feet to +53000 feet Resolution: 1 feet The MSB (**M**ost **S**ignificant **B**it) indicates the sign: 0 = positive number 1 = negative Number
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BNR MSB	
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

G.3.3 Label 204 (Baro corrected altitude #1)

Label 204 (Baro corrected altitude #1)		
Bit No.		
1	SAL LSB	8 Bit SAL = 204 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	PAD	Spare bit
12	Value BNR LSB	Binary value in the range of –1000 feet to +53000 feet Resolution: 1 foot The MSB (**M**ost **S**ignificant **B**it) indicates the sign: 0 = positive number 1 = negative Number
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BNR MSB	
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

G.3.4 Label 220 Baro corrected altitude #2

Label 220 (Baro corrected altitude #2)		
Bit No.		
1	SAL LSB	8 Bit SAL = 220 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	PAD	Spare Bit
12	Value BNR LSB	Binary value in the range of –1000 feet to +53000 feet Resolution: 1 foot The MSB (**M**ost **S**ignificant **B**it) indicates the sign: 0 = positive number 1 = negative Number
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BNR MSB	
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

G.3.5 Label 205 (Mach number)

Label 205 (Mach number)		
Bit No.		
1	SAL LSB	8 Bit SAL = 205 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	PAD	Spare Bits
12	PAD	
13	Value BNR LSB	Range: 0.200 to 0.999 Resolution: 0.0000625
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BNR MSB	
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

G.3.6 Label 206 (Computed air speed)

Label 206 (Computed air speed)		
Bit No.		
1	SAL LSB	8 Bit SAL = 206 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	PAD	Spare Bits
12	PAD	
13	PAD	
14	PAD	
15	Value BNR LSB	Range: 0 / 40 to 450 knots Resolution: 0.0625 knots
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BNR MSB	
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

G.3.7 Label 207 (Maximum allowable air speed)

Label 207 (Maximum allowable air speed)		
Bit No.		
1	SAL LSB	8 Bit SAL = 207 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	PAD	Spare Bits
12	PAD	
13	PAD	
14	PAD	
15	PAD	
16	PAD	
17	Value BNR LSB	Range: 150 to 450 knots Resolution: 0.25 knots
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BNR MSB	
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

G.3.8 Label 210 (True air speed)

Label 210 (True air speed)		
Bit No.		
1	SAL LSB	8 Bit SAL = 210 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	PAD	
12	PAD	
13	PAD	
14	Value BNR LSB	Range: 0/100 to 599 knots Resolution: 0.0625 knots
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BNR MSB	
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

G.3.9 Label 211 (Total air temperature)

Label 211 (Total air temperature)		
Bit No.		
1	SAL LSB	8 Bit SAL = 211 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	PAD	Spare Bits
12	PAD	
13	PAD	
14	PAD	
15	PAD	
16	PAD	
17	PAD	
18	Value BNR LSB	Range: -60 to +99 degree Celsius Resolution: 0.25 degree Celsius
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BNR MSB	
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

G.3.10 Label 212 (Altitude rate)

Label 212 (Altitude rate)		
Bit No.		
1	SAL LSB	8 Bit SAL = 212 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	PAD	Spare Bits
12	PAD	
13	PAD	
14	PAD	
15	PAD	
16	PAD	
17	PAD	
18	Value BNR LSB	Range: - 32600 to +32600 ft/min Resolution: 16 ft/min
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BNR MSB	
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

G.3.11 Label 213 (Static air temperature)

Label 213 (Static air temperature)		
Bit No.		
1	SAL LSB	8 Bit SAL = 213 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	PAD	Spare Bits
12	PAD	
13	PAD	
14	PAD	
15	PAD	
16	PAD	
17	PAD	
18	Value BNR LSB	Range: -99 to +60 degree Celsius Resolution: 0.25 degree Celsius
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BNR MSB	
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

G.3.12 Label 215 (Impact pressure)

Label 215 (Impact pressure)		
Bit No.		
1	SAL LSB	8 Bit SAL = 215 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	PAD	Spare Bits
12	PAD	
13	PAD	
14	PAD	
15	Value BNR LSB	Range: 0 to 372.5 mbar Resolution: 0.03125 mbar
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BNR MSB	
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

G.3.13 Label 217 (Indicated static pressure)

Label 217 (Indicated Static Pressure)		
Bit No.		
1	Label LSB	8 Bit SAL = 217 octal
2		
3		
4		
5		
6		
7		
8	Label MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	PAD	Spare
12	PAD	
13	Value BNR LSB	Binary value in the range of 0 inHg +64 inHg Resolution: 0. 0009765 inHg
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28	Value BNR MSB	
29	Sign Bit	0 = positive, 1 = negative Number
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

G.3.14 Label 234 (Baro correction mbar #1)

Label 234 (Baro correction mbar #1)		
Bit No.		
1	SAL LSB	8 Bit SAL = 234 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	Value BCD LSB	Range: 700 to 1050 mbar Resolution: 0.1 mbar
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BCD MSB	
30	SSM	Value is in BCD Format so SSM indicates if value is positive or negative: SSM_PLUS = 0 SSM_MINUS = 3
31	SSM	
32	PARITY	

G.3.15 Label 235 (Baro correction inHg #1)

Label 235 (Baro correction inHg #1)		
Bit No.		
1	SAL LSB	8 Bit SAL = 235 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	Value BCD LSB	Range: 20.67 to 31.00 inHg Resolution: 0.001 inHg
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BCD MSB	
30	SSM	Value is in BCD Format so SSM indicates if value is positive or negative: SSM_PLUS = 0 SSM_MINUS = 3
31	SSM	
32	PARITY	

G.3.16 Label 236 (Baro correction mbar #2)

Label 236 (Baro correction mbar #2)		
Bit No.		
1	SAL LSB	8 Bit SAL = 236 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	Value BCD LSB	Range: 700 to 1050 mbar Resolution: 0.1 mbar
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BCD MSB	
30	SSM	Value is in BCD Format so SSM indicates if value is positive or negative: SSM_PLUS = 0 SSM_MINUS = 3
31	SSM	
32	PARITY	

G.3.17 Label 237 (Baro correction inHg #2)

Label 237 (Baro correction inHg #2)		
Bit No.		
1	SAL LSB	8 Bit SAL = 237 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	Value BCD LSB	Range: 20.67 to 31.00 inHg Resolution: 0.001 inHg
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BCD MSB	
30	SSM	Value is in BCD Format so SSM indicates if value is positive or negative: SSM_PLUS = 0 SSM_MINUS = 3
31	SSM	
32	PARITY	

G.3.18 Label 242 (Total pressure)

Label 242 (Total pressure)		
Bit No.		
1	SAL LSB	8 Bit SAL = 242 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	PAD	
12	PAD	
13	Value BNR LSB	Range: 25 to 2048 mbar Resolution: 0.03125 mbar
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BNR MSB	
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

G.3.19 Label 270 (Discrete word #1)

	Label 270 (Discrete word #1)	Logic according to ARINC standard	Logical state for listed SW versions[1)]
Bit No.			
1	SAL LSB	8 Bit SAL = 270 octal	
2			
3			
4			
5			
6			
7			
8	SAL MSB		
9	SDI	Source / Destination Identifier	
10	SDI		
11	Icing Detector	1 = ON, 0 = OFF not available	
12	Pitot Probe Heat	1 = ON, 0 = OFF not available	
13	ADS Computer Status (WFVOUTS Status)	1 = FAIL 0 = GOOD	1=GOOD 0=FAIL
14	PITOT / STATIC Probe Heat	1 = ON, 0 = OFF not available	
15	Static Source Heat	1 = ON, 0 = OFF not available	
16	TAT Probe Heat	1 = ON, 0 = OFF	
17	Left Side Angle Of Attack Sensor Heat	1 = ON, 0 = OFF not available	
18	Right Side Angle Of Attack Sensor Heat	1 = ON, 0 = OFF not available	
19	VMO/MMO Overspeed Warning	1 = ON (WARN), 0 = OFF (NOT WARN)	
20	Primary Angle Of Attack Input	1 = FAIL, 0 = GOOD not available	
21	Angle Of Attack Average	1 = YES, 0 = NO not available	
22	VMO Alternate No. 1	1 = YES, 0 = NO not available	
23	VMO Alternate No. 2	1 = YES, 0 = NO not available	
24	VMO Alternate No. 3	1 = YES, 0 = NO not available	
25	VMO Alternate No. 4	1 = YES, 0 = NO not available	
26	SSEC Alternate	1 = YES, 0 = NO	
27	Angle Of Attack Alternate Correction	1 = YES, 0 = NO not available	
28	Baro Correction Port “A”	1 = YES, 0 = NO not available	
29	Zero Mach SSEC	1 = YES, 0 = NO (spare)	
30	SSM		
31	SSM		
32	PARITY		

Note 1: Only the following SW versions have the logic (1=GOOD, 0=FAIL) for ADS Computer Status: 1.53, 1.54, 2.00, 2.10, 2.11, 2.20, 2.30, 2.40, 3.00.

G.3.20 Label 271 (Discrete word #2)

Label 271 (Discrete word #2)		
Bit No.	**provision, not used in ADU32**	
1	SAL LSB	8 Bit SAL = 271 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	Zero Angle Of Attack	1 = YES, 0 = NO
12	Angle Of Attack Sensor Status	1 = FAIL, 0 = GOOD
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30	SSM	
31	SSM	
32	PARITY	

G.3.21 Label 320 (Magnetic Heading)

Label 320 (Magnetic Heading)		
Bit No.		
1	SAL LSB	8 Bit SAL = 320 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11		Range / Layout:
12		
13		n/a
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

G.3.22 Label 350 (Maintenance word #1)

Label 350 (Maintenance word #1)		
Bit No.		
1	SAL LSB	8 Bit SAL = 350 octal This Label transmits Information about alerter and display settings needed to provide synchronisation of two peers.
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	Value BNR LSB	Range: -1000 to +53000 feet Resolution: 1 foot
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26	Value BNR MSB	
27	Value Sign Bit	0= positive value, 1 = negative value
28	Alerter State	Indicates if Alerter is switched off(0) or on (1)
29	Altitude Display state	Indicates if the Altitude is displayed in Feet (0) or in Meter (1)
30	Baro Display state	Indicates if the Baro setting is displayed in mbar (0) or in inHg(1)
31	Push To Reset state	Indicates a “Push To Reset” Baro setting. Since the format of the Baro correction labels (234-237) has not the required precision to detect a reset to 1013.25 mbar.
32	PARITY	

G.3.23 Label 351 (Maintenance word #2)

Label 351 (Maintenance word #2)	
Bit No.	

1	SAL LSB	8 Bit SAL = 351 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
31		
32	PARITY	

G.3.24 Label 353 (Indicated air speed)

Label 353 (Indicated air speed)		
Bit No.		
1	SAL LSB	8 Bit SAL = 353 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	PAD	Spare Bits
12	PAD	
13	Value BNR LSB	Range: 0 / 40 to 450 knots Resolution: 0.0625 knots
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BNR MSB	
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

G.3.25 Label 377 (Equipment Identification)

Label 377 (Equipment Identification)		
Bit No.		
1	SAL LSB	8 Bit SAL = 377 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	Value BNR LSB	Range: 006 (Air Data Computer)
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BNR MSB	
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

H. Discrete I/O's

H.1 Discrete Inputs

Six (6) discrete inputs (0-5) are available. The use and logic of the discretes is parametric.

NOTE: For use and assignment refer to the individual execution of your type in the AD3X.() Technical Checklist (TCL).

Voltage level	28 VDC power supply	
'High'	>= 18.5 … <= 36 VDC	acc. to ARINC 706-4 section 4.11.4
'Low'	>= 0 … <= 3.5 VDC	

No.	Signal (default)	Description	Activation/Logic (default)
0	TEST	Performs a restart of the instrument	high = Normal low = activate BIT
1	Discrete input 1	Refer to TCL	--
2	Discrete input 2	Refer to TCL	--
3	Discrete input 3	Refer to TCL	--
4	Discrete input 4	Refer to TCL	--
5	ICAO Strobe	Detects Strobe signal	high = Code off low = Code on

Table 14: Discrete Inputs

NOTE: Discretes "SSEC Selection", "Zero Mach SSEC" and "TAT Heat" are also indicated by the ARINC 429 data label 270, Discrete Word #1.

H.2 Discrete Outputs

Four (4) discrete outputs (0-3) are available. The use and logic of the discretes is parametric.

For use and assignment refer to the individual execution of your type in the technical checklist.

Voltage level	28 VDC power supply	
'High'	>= 18.5 … <= 36 VDC	acc. to ARINC 706-4 section 4.11.4
'Low'	>= 0 … <= 3.5 VDC	

No.	Signal (default)	Description	Activation	electrical
0	Warning Flag Valid Signal WFVOUTS	indicates proper operation and no critical failure	high = Normal low = Failure condition	28 VDC / max. 14 mA
1	Discrete output 1	Refer to TCL	--	Open drain, max. 1 A
2	Discrete output 2	Refer to TCL	--	Open drain, max. 1 A
3	Discrete output 3	Refer to TCL	--	Open drain, max. 1 A

Table 15: Discrete Outputs

I. ICAO Encoded Altitude Output

The Air Data Display has an encoded altitude output (in feet) for automatic altitude reporting in accordance with TSO-C88a. Reported Altitude is always relative to standard pressure (29.9213 inHg or 1013.25 mbar).

NOTE: To activate, the ICAO strobe discrete input no. 5 must be grounded. This also switches off the "CODE" flag indication on the display.

J. RS-232 Serial Interface

The flight instrument has a RS-232 interface for maintenance and calibration purposes only (there is no real time data provided). This interface is not accessible for normal operation in the aircraft.

NOTE: The pins for RS-232 TxD and RxD shall be jumpered in the connector on the aircraft side to avoid inadvertent interferences!

Section V

1 Trouble shooting

The table below shows the general troubleshooting information to assist in locating and correcting any malfunctions with the AD3X.() Air Data Display.

Procedure:

Malfunction	Probable cause	Remedy
• pointer does not move	• power supply failure • input signal failure • electronic module failure	• make sure the power supply • make sure the input signal • repair electronic module
• pointer blocked	• deformation of pointer • electronic module failure	• replace pointer • repair electronic module
• indicated values out of tolerance (pointer or digital display)	• input signal failure • calibration error • electronic module failure	• make sure the input signal • calibrate instrument • repair electronic module
• pointer fails to return to power off position	• power back up failure	• repair electronic module
• digital display blank	• power supply failure • input signal failure • electronic module failure	• make sure the power supply • make sure the input signal • repair electronic module
• digital I/O fails	• I/O signal out of tolerance • electronic module failure	• make sure the I/O signal • repair electronic module
• lighting defect	• power supply failure • CPU module • Lighting module	• make sure the power supply • make sure/repair of CPU module • make sure/repair of LED on Lighting module
• brightness of digital display does not change	• CPU module • Lighting module	• make sure/repair CPU module • make sure/repair of LED on Lighting module
• TAT/OAT output out of range	• Temperature probe not connected correctly	• Make sure the probe or replacement resistor is connected
• CODE flag is indicated and Encoding output is not working	• Discrete input no. 5 (ICAO strobe) is not grounded / Encoder is off	• Ensure ground connection • Check Encoder function

Table 16: Trouble Shooting Procedures

NOTE: For any malfunction of the equipment not listed in the table above, Manufacturer can be contacted for assisting in the trouble shooting.
Check the equipment using the THOMMEN RS-232 monitoring SW. Read out the failure memory (BIT history) to analyse failures.

2 Maintenance

The Maintenance of the AD3X.() Air Data Display should be performed by the manufacturer representative or certified and can be performed on ramp. ADAC32 Maintenance manual describes software installation, the required maintenance files and the performance range of the instrument.
The requirements for software maintenance of the instruments are RS-232 Serial Data cable, computer with Microsoft Windows and the ADAC32 CDROM with maintenance Software.
The following is the summary of Maintenance modes which are provided for maintaining the instruments:

Maintenance Mode via RS-232	Allows to initialise, calibrate, configure and test the instrument via the RS-232 interface and a maintenance software.
Manual Maintenance Mode	allows to check and adjust the instrument when it's installed in the cockpit: To check all calculated air data values of the instrument at the display To check BIT failures The Manual Maintenance Mode is only accessible by service staff and may not be used for regular operation. SSEC is inactive in this mode!

NOTE: For clear understanding and use of the maintenance modes refer to the AD3X.() Maintenance Software Manual.

A. Recalibration Interval

The AD3X.() flight instrument has the following recalibration intervals:

Sensor Type	recalibration interval
High-end transducers	On Condition

APPENDICES

Appendix I

Failure Codes

FC	Description	Start Up / Initiated	Continuous	ARINC Failure Class
001	Program checksum Error	X	-	OFF
		-	X	FW 1
002	Parameter checksum Error	X	-	OFF
003	Calibration checksum Error	X	-	FW 1
005	RAM Test Error	X	-	OFF
		-	X	FW 1
006	CPU Test Error	X	-	OFF
007	Watchdog Test Error	X	-	OFF
010[1)]	ARINC 429 Error	X	-	OFF
		-	X	OFF
012	I2C bus Error	X	-	OFF
		-	X	FW 1
013	Configuration Error	X	-	OFF
014	I/O Expander Error	X	-	OFF
021	3.3V Voltage Failure	-	X	FW 1
022	+5.0V Voltage Failure	-	X	FW 1
023	-5.0V Voltage Failure	-	X	FW 1
024	+15.0V Voltage Failure	-	X	OFF
025	-15.0V Voltage Failure	-	X	OFF
026	28.0V Voltage Failure	-	X	FW 1
027	+2.5V reference Voltage Failure	-	X	FW 1
028	Power Backup System Failure	X	-	-
037	Static Frequency Measurement Device Error	X	-	FW 37
038	Pitot Frequency Measurement Device Error	X	-	FW 38
039	TAT A/D-C Error	X	-	FW 39
040	Static A/D-C Failure	-	X	FW 37
041	Pitot A/D-C Failure	-	X	FW 38
042	Static Pressure Range Failure	-	X	FW 37
043	Pitot Pressure Range Failure	-	X	FW 38
044	Baro Corrected Altitude Out of Range Failure	-	X	FW 44
045	IAS Out of Range Failure	-	X	FW 45
046	CAS Out of Range Failure	-	X	FW 46
047	TAS Out of Range Failure	-	X	FW 47
049	VMO Out of Range Failure	-	X	FW 49
050	Mach No Out of Range Failure	-	X	FW 50
051	Altitude Rate Out of Range Failure	-	X	FW 51
052	TAT Out of Range Failure	-	X	FW 39
053	SAT Out of Range Failure	-	X	FW 53
055	Static Sensor Temperature Out of Range Failure	-	X	FW 37
056	Pitot Sensor Temperature Out of Range Failure	-	X	FW 38
057	Static Sensor Temperature Diode Voltage Failure	X	X	FW 37
058	Pitot Sensor Temperature Diode Voltage Failure	X	X	FW 38
059	Null Drift Test and Failure	X	-	FW 59

FC	Description	Start Up / Initiated	Continuous	ARINC Failure Class
060	Pointer Failure	X	-	-
061	LCD Failure	-	X	-
065	Pressure Altitude Out of Range Failure		X	FW 65
070	WFVOUTS Failure	-	X	-
071	ICAO Failure	-	X	-
072	Aural Alert Relay Failure	X	X	-
073	Visual Alert Relay Failure	X	X	-
074	Instrument disabled by discrete input	-	-	FW 1
080	No Initialisation Failure	X	-	OFF
255	Unknown Error Code failure	N/A	N/A	FW 1

Note 1): The wrap around test functionality of the Failure Code FC010 is deactivated from SW version 2.71 (refer to Failure Codes and BIT-Matrix in section Appendix XV)

ARINC failure class definition

If a failure occures at following ARINC 429 labels the Failure Warning shall be indicated in the SSM.

SAL	102	203	204	205	206	207	210	211	212	213	215	217	242	270	353	377
	Selected Altitude	Pressure altitude	Baro corr. altitude #1	Mach number	Computed airspeed	Max. Allow. Airspeed	True airspeed	Total air temp	Altitude Rate	Static air temp	Impact Pressure	Static Pressure	Total Pressure	Discrete Word #1	Indicated airspeed	Equipment Identification
FW 1	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW
FW 37	-	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	-	-	FW	-
FW 38	-	-	-	FW	FW	-	FW	FW	-	FW	FW	-	FW	-	FW	-
FW 39	-	-	-	-	-	-	FW	FW	-	FW	-	-	-	-	-	-
FW 44	-	FW	FW	-	-	FW	-	-	FW	-	-	-	-	-	-	-
FW 45	-	-	-	FW	-	-	FW	FW	-	FW	-	-	-	-	FW	-
FW 46	-	-	-	-	FW	-	-	-	-	-	-	-	-	-	-	-
FW 47	-	-	-	-	-	-	FW	-	-	-	-	-	-	-	-	-
FW 49	-	-	FW	-	-	FW	-	-	-	-	-	-	-	-	-	-
FW 50	-	-	-	FW	-	-	FW	FW	-	FW	-	-	-	-	-	-
FW 51	-	-	-	-	-	-	-	-	FW	-	-	-	-	-	-	-
FW 53	-	-	-	-	-	-	FW	-	-	FW	-	-	-	-	-	-
FW 59	-	FW	FW	FW	FW	FW	FW	FW	FW	FW	FW	-	FW	-	FW	-
FW 65	-	FW	FW	-	-	***	-	-	FW	-	-	-	-	-	-	-

Legend:

FW set SSM flag to failure

- no SSM flag setting

*** depending on VMO calibration

BIT-Matrix

The failure reaction is defined in the BIT Matrix:

FC	Critical Error indication	Non Critical Error indication	Stop Operation	Park Pointer	ICAO Off	Warning Flag indication	Store Failure	Non Recoverable	Code Flag indication	Alert Flag indication	Set Display Dark	Disable ARINC 429 IF
001	CI		SO	PP	CO	WF	SF	NR				
002	CI		SO	PP	CO	WF	SF	NR				
003	CI		SO	PP	CO	WF	SF	NR				
005	CI		SO	PP	CO	WF	SF	NR				
006	CI		SO	PP	CO	WF	SF	NR				
007		EI				WF	SF	NR				
010[1)]		EI				WF	SF	NR				DA
012	CI		SO	PP	CO	WF		NR				
013	CI		SO	PP	CO	WF	SF	NR				
014	CI		SO	PP	CO	WF	SF	NR				
021	CI		SO	PP	CO	WF		NR				
022	CI		SO	PP	CO	WF	SF	NR				
023	CI		SO	PP	CO	WF	SF	NR				
024	CI		SO	PP	CO	WF	SF	NR				DA
025	CI		SO	PP	CO	WF	SF	NR				DA
026	CI		SO	PP	CO	WF	SF	NR				
027	CI		SO	PP	CO	WF	SF	NR				
028		EI				WF		NR				
037	CI		SO	PP	CO	WF	SF	NR				
038		EI				WF	SF					
039		EI				WF	SF					
040	CI		SO	PP	CO	WF	SF					
041		EI				WF	SF					
042		EI				WF	SF					
043		EI				WF	SF					
044		EI				WF	SF					
045		EI				WF	SF					
046		EI				WF	SF					
047		EI				WF	SF					
049		EI				WF	SF					
050		EI				WF	SF					
051		EI				WF	SF					
052		EI				WF	SF					
053		EI				WF	SF					
055	CI		SO	PP	CO	WF	SF	NR				
056		EI				WF	SF					
057	CI		SO	PP	CO	WF	SF	NR				
058		EI				WF	SF					
059	CI		SO	PP	CO	WF	SF	NR				
060		EI		PP		WF	SF	NR				
061						WF	SF	NR			SD	
065		EI			CO	WF	SF					

FC	Critical Error indication	Non Critical Error indication	Stop Operation	Park Pointer	ICAO Off	Warning Flag indication	Store Failure	Non Recoverable	Code Flag indication	Alert Flag indication	Set Display Dark	Disable ARINC 429 IF
070							SF					
071		EI			CO	WF	SF	NR	CF			
072		EI				WF	SF	NR		AF		
073		EI				WF	SF	NR		AF		
074	CI		SO	PP	CO	WF	SF					
080	CI		SO	PP	CO	WF		NR				
255	CI		SO	PP	CO	WF	SF					

Note:
The following abbreviations are used for the failure attributes.
CI : Critical Error indication
EI : Non Critical Error indication
SO : Stop Operation
PP : Park Pointer
CO : ICAO Off
WF : Warning Flag indication (WFVOUTS)
SF : Store Failure
NR : Non Recoverable
CF : Code Flag indication
AF : Alert Flag indication
SD : Set Display Dark
DA : Disable ARINC 429 Interface

Note 1): The wrap around test functionality of the Failure Code FC010 is deactivated from SW version 2.71 (refer to Failure Codes and BIT-Matrix in section Appendix XV)

Appendix II

Altimeter Calibration Table

Altitude [Feet] (Baro setting 1'013 mbar)	**Tolerance acc. to TSO-C10b ± [Feet]**		**Tolerance acc. to RVSM requirements ± [Feet]** 2)	
	@25 °C	@ -30/+71°C 1)	@25 °C	@ -30/+71°C 1)
-1'000	20	--	10	--
0	20	40	10	10
500	20	--	10	--
1'000	20	--	10	--
1'500	25	--	10	--
2'000	30	--	10	--
3'000	30	--	10	--
4'000	35	--	10	--
6'000	40	60	10	10
8'000	60	--	10	--
10'000	80	--	10	--
12'000	90	90	10	10
14'000	100	--	10	--
16'000	110	--	10	--
18'000	120	120	10	10
20'000	130	--	15	--
22'000	140	--	15	--
25'000	155	155	15	15
29'000	--	--	20	--
30'000	180	--	20	--
32'500	--	--	25	--
35'000	205	205	25	25
37'500	--	--	30	--
40'000	230	--	30	--
41'000	--	--	30	--
45'000	255	--	40	--
50'000	280	280	45	45
53'000	(295)	--	50	--

NOTE: 1) allowable change from room temperature scale error test indication
2) SSEC data are applied automatically.

Appendix III

Airspeed Calibration Table

			Scale Error acc. to ETSO/TSO-C46a	
Impact Pressure @ 25 °C (77 °F)		**Airspeed IAS**	**Temperature @ 25 °C** (77 °F)	**Temperature @ -30 / +50 °C** (-22 / +122 °F)
[in Hg]	**[mbar]**	**[Knots]**	**± [Knots]**	**± [Knots]**
				Note 3)
0.0192	0.649	20 Note 1)	5.0 Note 1)	--
0.0767	2.597	40 Note 1)	4.0 Note 1)	--
0.1198	4.057	50	4.0	--
0.1727	5.848	60	2.0	4.5
0.3075	10.413	80	2.0	--
0.4814	16.302	100	2.0	4.5
0.6950	23.535	120	2.0	--
1.091	36.945	150	2.5	4.5
1.580	53.505	180	3.0	--
1.959	66.339	200	3.0	4.5
2.610	88.385	230	3.0	--
3.100	104.978	250	3.0	4.5
3.924	132.882	280	3.5	--
4.534	153.538	300	3.5	4.5
5.195	175.922	320	3.5	--
6.286	212.868	350	4.0	4.5
7.082	239.823	370	4.5	--
8.385	283.948	400	5.0	4.5
9.826	332.746	430	5.5	--
10.870	368.100	450	6.0	4.5
12.558	425.329	480	7.0	
13.776	466.643	500	7.0	4.5
15.069	510.327	520	7.0	--
17.159	581.069	550	8.5	4.5
18.660	631.899	570	8.5	--
21.075	713.680	600 Note 2)	10.0 Note 2)	4.5
25.589	866.541	650 Note 2)	10.0 Note 2)	4.5
30.764	1041.786	700 Note 2)	10.0 Note 2)	4.5
36.566	1238.264	750 Note 2)	10.0 Note 2)	4.5

Notes:1) not included in ETSO/TSO-C46a , 2) acc. to MIL-I-27197C
3) The scale error must not exceed by more than 4.5 knots the tolerances specified.

Appendix IV

Mach Number Calibration Table

$Mach_i$ (indicated Mach number)	**Tolerances acc. to SAE AS8002 Revision A ± Mach**	
@ **Altitude 0 feet**	@ **25 °C** (77 °F)	@ **-20 / +71°C** (-4 / +160 °F)
0.200	0.012	0.016
0.300	0.012	0.016
0.400	0.012	0.016
0.500	0.010	0.014
0.600	0.0075	0.010
@ **Altitude 10‘000 feet**	@ **25 °C** (77 °F)	@ **-20 / +71°C** (-4 / +160 °F)
0.400	0.012	0.016
0.500	0.010	0.014
0.600	0.0075	0.010
0.700	0.005	0.007
@ **Altitude 20‘000 feet**	@ **25 °C** (77 °F)	@ **-20 / +71°C** (-4 / +160 °F)
0.400	0.012	0.016
0.500	0.010	0.014
0.600	0.0075	0.010
0.700	0.005	0.007
@ **Altitude 30‘000 feet**	@ **25 °C** (77 °F)	@ **-20 / +71°C** (-4 / +160 °F)
0.600	0.0075	0.010
0.700	0.005	0.007
0.800	0.005	0.007
0.900	0.005	0.007
0.950	0.0075	0.010

Mach	**Calculated Tolerances acc. to ETSO/TSO-C46a/SAE AS418A ± Mach**	
@ **Altitude 40‘000 feet**	@ **25 °C** (77 °F)	@ **-20 / +71°C** (-4 / +160 °F)
0.700	0.013	0.027
0.800	0.013	0.026
0.900	0.013	0.025
0.950	0.013	0.025
@ **Altitude 50‘000 feet**	@ **25 °C** (77 °F)	@ **-20 / +71°C** (-4 / +160 °F)
0.700	0.016	0.034
0.800	0.016	0.032
0.900	0.015	0.031
1.000	0.015	0.030

Mach	**Tolerances (equipment specification) ± Mach**	
@ **Altitude 60‘000 feet**	@ **25 °C** (77 °F)	@ **-20 / +71°C** (-4 / +160 °F)
0.900	0.020	0.030
1.000	0.020	0.030
1.200	0.200	0.030
@ **Altitude 70‘000 feet**	@ **25 °C** (77 °F)	@ **-20 / +71°C** (-4 / +160 °F)
0.900	0.025	0.035
1.000	0.025	0.035
1.200	0.025	0.035
@ **Altitude 80‘000 feet**	@ **25 °C** (77 °F)	@ **-20 / +71°C** (-4 / +160 °F)
0.900	0.030	0.040
1.000	0.030	0.040
1.200	0.030	0.040

Appendix V

Total Air Temperature (TAT) / Outside Air Temperature (OAT) Calibration Table

TTi Indicated Total Air Temperature °C	**Resistance Pt 500 acc. to ARINC 706-4 Table 5-1** Ohm
-60	381.64
-30	441.16
0	500.00
30	558.21
60	615.79
99	689.72

TAT/OAT Calibration Table: Resistance Pt 500

TTi Indicated Total Air Temperature °C	**Resistance Pt 100 acc. to EN 60751** Ohm
-60	76.328
-30	88.222
0	100.000
30	111.673
60	123.242
99	138.126

TAT/OAT Calibration Table: Resistance Pt 100

Appendix VI

Identification Plates

The Identification/Name plates is attached in the equipment case of AD3X.() Air Data Display externally. The sample of Identification/Name plates of AD3X.() Air Data Display Unit is shown below:

Identification Plate: AD32.32.53F.05.1.AM , MOD00A , SW 2.60, HW 2.31 , Config. ID 9022

REVUE THOMMEN AG
CH-4437 WALDENBURG

AIR DATA DISPLAY
CERTIFIED TSO-C10b, TSO-C88a, TSO-C106
WT 1250 GM (2.75 LBS)

RTCA/DO-160D ENV.CAT. [D1]CBB[(TB1)(TR)]XXFDFSZZAAZ[YY]M[A3J33]XXA
RTCA/DO-178B LEVEL A **CONFIG ID**
PART/TYPE NO AD32.32.53F.05.1.AM 9022

SER NO xxxxxxx PWR SUPPLY 28 VDC
RANGES -1'000 … 53'000 FEET LIGHTING SUPPLY 5 VDC
0/40 … 450 KNOTS
0.200 … 0.950 MACH **MFR DATE month / year**

SWISS MADE PHONE +41 61 965 22 22 info@thommen.aero

REVUE THOMMEN AG
CH-4437 WALDENBURG

HW version 2.31

SW version 2.60

MOD

HW	X	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
SW	X	B	C	D	E	F	G	H	I	J	K	L	M	N	P	R	S

SWISS MADE PHONE +41 61 965 22 22 info@thommen.aero

Appendix VII

Barometric Potentiometer Output :

AD3X.() Air Data Display has the option of Baro potentiometer analog output. The baro setting range is parametric to meet customer specific requirements. Mechanical start and end positions of the baro setting Knob is adjustable and calibrated according to the required minimum and maximum voltages ratios.

AD3X.() Air Data Display with Baro potentiometer Knob does not have the push to reset option. One revolution of the baro setting knob corresponds to a change of 20 mbar or 0.20 inHg. There is no push to reset function available with AD3X.() Air Data Display with Baro Potentiometer Output option.

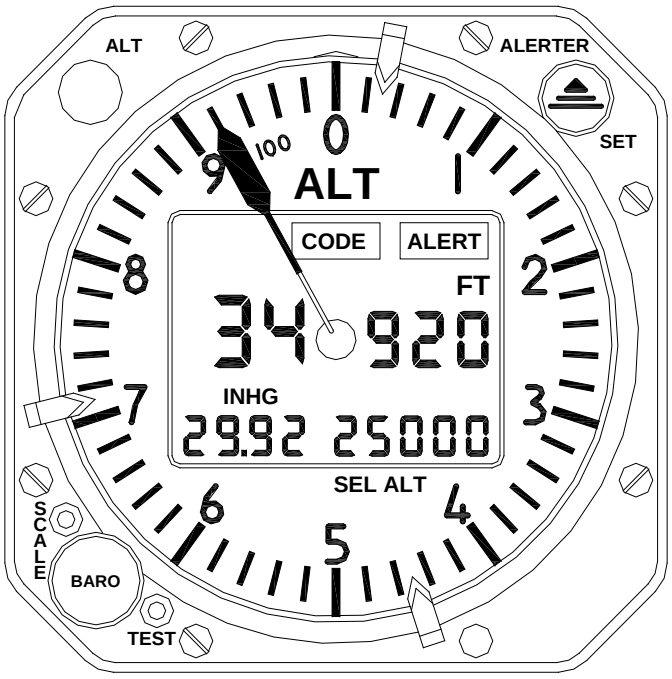


Figure 20: AD3X.() Baro Pot Output Version

Principle of Barometric Potentiometer Function

Below mentioned table shows the calibration Barometric Potentiometer output (example):

Barometric Potentiometer Output Calibration Table			
Pressure Setting [inHg]	**Feet Correction [feet]**	**Voltage Ratio V(W)/V(Ref)**	**Voltage Ratio Tolerance**
28.10	-1727.4	.3176	+/- .0005
28.86	-995.9	.2466	+/- .0005
29.38	-504.3	.1989	+/- .0005
29.92126	0	.1500	+/- .0005
30.47	+503.8	.1011	+/- .0005
30.91	+902.4	.0625	+/- .0005
31.00	+983.4	.0546	+/- .0005

Note: Operation of the barometric setting mechanism below 20.67 inHg or over 31.00 inHg does not result in an output resistance ratio below 0.035 or above 0.965, respectively.

Note: The barometric pressure setting range is parametric as per the customer specific requirements.

Appendix VIII

Software Version 2.10:

The Software Version 2.10 is applicable for all AD3X.() Air Data Display Versions. The features included in SW Version 2.10 are described as follows:

1) ARINC 429 FUNCTIONALITY

- All ARINC 429 labels are made available on all channels as independent and independency of Barometric correction ARINC 429 Label 234 and Label 235.

All ARINC 429 Labels available with AD3X.() Air Data Display (All Versions) are made independent with SW 2.10 Version (Excluding the ARINC 429 labels 203 for the purpose of ALT comparison Fail function).

ARINC 429 Label 234 and Label 235 are made independent , requiring only one ARINC 429 Label 234 or Label 235 for Barometric correction value.

The following priorities are available on the units to receive Barometric values for the barometric correction:

Priority 1 - ARINC 429 LABEL 235 on RxD1 Channel

Priority 2 - ARINC 429 LABEL 235 on RxD2 Channel

Priority 3 - ARINC 429 LABEL 234 on RxD1 Channel

Priority 4 - ARINC 429 LABEL 234 on RxD2 Channel

The following table shows the ARINC 429 Labels available on different ARINC Transmit and Receive Channels:

Label	Signal Name	I/O Transfer channel Mode STBY or self sensing		I/O Transfer Mode NORM or Repeater ALT	
102	Selected altitude	TxD1/TxD2	--	TxD1/TxD2	--
203	Pressure altitude (1013.25 mbar)	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
204	Baro corrected altitude #1	TxD1/TxD2	--	--	RxD1/RxD2
220	Baro corrected altitude #2	TxD1/TxD2	--	--	RxD1/RxD2
205	Mach number	TxD1/TxD2	--	--	--
206	Computed airspeed	TxD1/TxD2	--	--	--
207	Maximum Allowable Airspeed	TxD1/TxD2	--	--	--
210	True airspeed	TxD1/TxD2	--	--	--
211	Total air temperature	TxD1/TxD2	--	--	--
212	Altitude Rate	TxD1/TxD2	--	--	--
213	Static air temperature	TxD1/TxD2	--	--	--
215	Impact Pressure	TxD1/TxD2	--	--	--
217	Static Pressure	TxD1/TxD2	--	--	--
234	Baro Correction mb #1	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
235	Baro Correction inHg #1	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
236	Baro Correction mb #2	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
237	Baro Correction inHg #2	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
242	Total Pressure	TxD1/TxD2	--	--	--
270	Discrete Word #1	TxD1/TxD2	--	--	--
271	Discrete Word #2 (provision)	--	--	--	--
320	Heading	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
350	Maintenance Word #1	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
351	Maintenance Word #2 (provision)	--	--	--	--
353	Indicated airspeed	TxD1/TxD2	--	--	--
377	Equipment Identifier	TxD1/TxD2	--	--	--

- Synchronization & Comparison function for AD30 Air Data Display (Repeater Version)

Synchronization (Unit, Baro setting & Alerter Setting) & Comparison (Unit & Baro setting) functions made available for AD30 Air Data Display (Repeater Version).

Note: Either of Barometric synchronization or Barometric comparison can be configured.

The following table shows the ARINC 429 transfer channels:

Function	Label	I/O Transfer channel Mode STBY or self sensing		I/O Transfer Mode NORM or Repeater ALT	
Baro Synch.	235 / 234	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
Baro Comp.	235 / 234	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
Scale Synch.	350	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
Scale Comp.	350	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
Alerter Synch.	350	TxD1/TxD2	RxD1/RxD2	TxD1/TxD2	RxD1/RxD2
ALT Comparison	203	--	RxD1/RxD2	--	
ALT Comp. FAIL	203	TxD2	--		--

- No “ALT comparison warning” feature is available, if ARINC 429 label 203 (Pressure Altitude) is not received.

- Source/Destination Identifier function is made available as discrete inputs on AD3X.() Air Data Display. It identifies the ARINC 429 source.

Note: SDI Bit status is detected during startup only.

SDI pin A	SDI pin B	ARINC 429 Source
Bit 10	**Bit 9**	**Equipment No.**
0	0	0
0	1	1
1	0	2
1	1	3

- Flashing indication when SSM (Sign/Status Matrix) =TEST

The altitude display will flash if ARINC 429 label 204 is being received in TEST mode.

- ARINC 429 Label 320 (Magnetic Heading) and Label 350 (Maintenance Word #1) are made available on AD3X.() Air Data Display as forwarded only depending on when activated in the configuration.

Note: ARINC 429 Label 320 is forwarded, when enabled in the configuration.

Note: ARINC 429 Label 350 is forwarded only, when disabled in the configuration but if this Label is enabled in the configuration, will send only the local setting value. (Used for Altitude Alerter synchronization applicable for AD3X.()).

Note: For use and assignment refer to the individual execution of instrument type in the AD3X.()Technical Checklist.

Note: Sign Status Matrix

SSM	SSM	
Bit 31	**Bit 30**	**Equipment Status**
0	0	Failure warning
0	1	No computed data
1	0	Functional test
1	1	Normal operation

- ARINC 429 label 377 - Equipment Identifier made available on Receive Channel # 2 on AD30 Air Data Display (Repeater Version)

ARINC 429 Label 377 (Equipment Identification)

Label 377 (Equipment Identification)		
Bit No.		
1	SAL LSB	8 Bit SAL = 377 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	Value BNR LSB	Range: 006 (Air Data Computer)
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BNR MSB	
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

NOTE: For use and assignment refer to the individual execution of instrument type in the AD3X.() Technical Checklist.

- ARINC 429 Label 217 (Static Pressure) is added on AD3X.() Air Data Display units.

Label 217 (Static Pressure)

Label 217 (Static Pressure)		
Bit No.		
1	Label LSB	8 Bit SAL = 217 octal
2		
3		
4		
5		
6		
7		
8	Label MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	PAD	Spare
12	PAD	
13	Value BNR LSB	Binary value in the range of 0 inHg +64 inHg Resolution: 0. 0009765 inHg
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28	Value BNR MSB	
29	Sign Bit	0 = positive, 1 = negative Number
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

NOTE: For use and assignment refer to the individual execution of instrument type in the AD3X.() Technical Checklist.

2) ALTITUDE ALERTER FUNCTIONALITY

- Altitude Alerter function “AlerterAlwaysOn” is added with SW Version 2.10 on AD3X.() Air Data Display.

NOTE: This AlerterAlwaysOn function is parametric. If configured ‘YES’, alerter function cannot be switched off by pushing the Altitude Alerter setting knob and if configured ‘NO’ alerter function can be switched off by pushing the Altitude Alerter setting knob.

- Altitude Alerter on/off parametric delay 5 s

NOTE: An ‘Alerter Activation Delay Time’ is implemented for switching on/off the alerter functionality. This functionally can be parameterized from 0 to 5 s.

Appendix IX

Software Version 2.20:

The Software Version 2.20 is applicable for all AD3X.() Air Data Display Versions. The features included in SW Version 2.20 are described as follows:

- New interrupt routine implemented to adjust the brightness of the alert lamp according to the backlight-curve.
- A new parameter was implemented to allow the alerter display flashing when out-of-synchronisation condition.
- The IAS calculation is corrected with parametrized slope- and offset values.
- A new discrete input function was implemented to control the alert lamp. The internal alert lamp is illuminated when a discrete input is activated.

NOTE: For use and assignment refer to the individual execution of instrument type in the AD3X.() Technical Checklist.

Appendix X

Software Version 2.30:

The Software Version 2.30 is applicable for all AD3X.() Air Data Display Versions. The features included in SW Version 2.30 are described as follows:

DAY/NIGHT/NVG Discrete inputs

Input Function No.	Input Functions	Description	Activation
11	Day/Night/NVG - A	Selects Lighting mode	high / low = refer to Lighting Mode Logic
12	Day/Night/NVG - B	Selects Lighting mode	high / low = refer to Lighting Mode Logic

Lighting Mode Logic

	Lighting mode			
DISCRETE INPUT	**DAY**	**NIGHT**	**NVG**	
Day/Night/NVG - A	High (open)	Low (ground)	High (open)	Low (ground)
Day/Night/NVG - B	High (open)	High (open)	Low (ground)	Low (ground)

Warning Flag Valid Outputs

Two types of Warning Flag Valid Outputs use the following logic:

a) Warning Flag Valid Output Signal **WFVOUTS**

Warning Flag Valid Output Signal WFVOUTS	High =	Valid	Normal	No warning	28 VDC max. 14 mA (max. load 2 kOhm)
	Low =	Invalid	Failure condition	Warning	0 V

b) Warning Flag Valid Output Discrete **WFVOUTD**

Warning Flag Valid Output Discrete **WFVOUTD**						Voltage level acc. to ARINC 706-4 section 4.11.4
	High =	Invalid	Failure condition	Warning	Open (drain)	>= 18.5 … <= 36 VDC
	Low =	Valid	Normal	No warning	Ground max. 1 A	>= 0 … <= 3.5 VDC

Discrete Outputs

Three discrete outputs (1 to 3) are available.

No.	Signal	Description	Activation	electrical
1	Discrete output 1	According assigned function	high = inactive low = active	Open drain max. 1 A
2	Discrete output 2	According assigned function	high = inactive low = active	Open drain max. 1 A
3	Discrete output 3	According assigned function	high = inactive low = active	Open drain max. 1 A

Discrete output functions

Discrete output functions are assignable to the discrete outputs by parametrization.

Output function No.	Discrete output function	Description	Activation
0	--	not applicable	--
1	Primary Power FAIL	Indicates loss of 28 VDC primary power	high = normal low = FAIL
2	ALT comparison Warning	ALT Comparison Warning if difference >= xxx ft	high = normal low = Warning
3	IAS Low	Indicates low IAS	high = IAS ≥ MinIAS low = IAS < MinIAS
4	On altitude function	Indicates On Altitude	high = SEL ALT **not** reached low = SEL ALT reached
5	VNE (provision)	not applicable	--
6	Warning Flag Valid Output Discrete (WFVOUTD)	Indicates proper operation and no failure	high = failure condition low = valid operation

IAS damping
The fluctuation of the indicated airspeed IAS is damped by a parametric filter.

Calculation of impact pressure qci
If the result of the impact pressure (qci) calculation is less than zero, the impact pressure will be set to zero.

NOTE: For use and assignment refer to the individual execution of instrument type in the AD3X.() Technical Checklist.

Appendix XI

Software Version 2.40:

The Software Version 2.40 is applicable for all AD3X.() Air Data Display Versions. The features included in SW Version 2.40 are described as follows:

Disable CAS correction discrete input function

The disable-CAS-correction discrete input function determines whether the SSE corrected CAS- or the indicated CAS information shall be transmitted on ARINC label 206.

Input Function No.	Input Function	Description	Activation
13	Disable CAS correction	Selects IAS or CAS to be transmitted on ARINC label 206	high = CAS shall be transmitted low = IAS shall be transmitted

TAT FC039 change to tolerable definition

The TAT failure shall be always tolerable and shall not stop the instrument during startup.

NOTE: For use and assignment refer to the individual execution of instrument type in the AD3X.() Technical Checklist.

Appendix XI

Software Version 2.50:

The Software Version 2.50 is applicable for all AD3X.() Air Data Display Versions. The features included in SW Version 2.50 are described as follows:

The disable-Mach-correction discrete input function determines whether the SSE corrected Mach-number or the indicated Mach-number information shall be transmitted on ARINC label 205.

Input Function No.	Input Function	Description	Activation
14	Disable Mach correction	Selects corrected or indicated Mach-No. to be transmitted on ARINC label 205	high = corrected Mach-No. is transmitted low = indicated Mach-No. is transmitted

NOTE: For use and assignment refer to the individual execution of instrument type in the AD3X.() Technical Checklist.

Appendix XII

Software Version 2.51:

The SW Version 2.51 is applicable for installations upon request. The features included in SW Version 2.51 are described as follows:

ARINC 429 Label 242 (Total Pressure) was changed from ‘mbar’ to ‘inHg’

Label 242 (Total pressure)		
Bit No.		
1	SAL LSB	8 Bit SAL = 242 octal
2		
3		
4		
5		
6		
7		
8	SAL MSB	
9	SDI	Source / Destination Identifier
10	SDI	
11	PAD	
12	PAD	
13	Value BNR LSB	Range: 0.0 to 4095 inHg Resolution: 0.000976563 inHg
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29	Value BNR MSB	
30	SSM	Sign Status Matrix
31	SSM	
32	PARITY	

Appendix XIII

Software Version 2.60:

The Software Version 2.60 is applicable for all AD3X.() Air Data Display Versions. The features included in SW Version 2.60 are described as follows:

Discrete Outputs:

Discrete Outputs VNE, VFE and CAS warning are added as optional and are selectable.

Function No.	Discrete output function	Description	Activation
0	--	--	N/A (no function)
1	Primary Power FAIL	Indicates primary power fail	high = normal low = FAIL
2	ALT comparison Warning	ALT Comparison Warning if difference	high = normal low = Warning
3	IAS Low	Indicates that IAS is below IAS low threshold	high = normal low = Warning
4	On altitude	Indicates that preselected altitude is reached	high = altitude is not reached low = altitude is reached
5	VNE	Indicates if the IAS is greater than the VNE threshold	high = IAS less than Vne threshold low = IAS greater than Vne threshold
6	Warning Flag Valid Out Discrete (WFVOUTD)	Indicates proper operation and no failure	high = failure condition low = valid operation
7	CAS exceed	Indicates if the CAS is greater than the CAS exceed threshold	high = CAS is less than CAS exceed threshold low = CAS is greater than CAS exceed threshold
8	VFE	Indicates if the IAS is greater than the VFE threshold	high = IAS less than VFE threshold low = IAS greater than VFE threshold

Offset/Slope Correction & Damping

IAS Offset/Slope Correction and Damping function implemented to affect CAS/TAS computation

CAS/TAS Damping

CAS and TAS are also damped by the damping filter.

Configuration of forward Label 102

Configuration of forward Label 102 allows to disable its transmission.

Separate alert light control

The brightness of the alert light is controlled

independently from the brightness of the LCD backlight.

NOTE: For use and assignment refer to the individual execution of instrument type in the AD3X.() Technical Checklist.

Appendix XIV

Software Version SW 2.70:

The Software Version 2.70 is applicable for all AD3X.() Air Data Display versions with Hardware Version 4.10. SW Version 2.70 cannot be used on HW Versions 2.XX.

The features included in SW Version 2.70 are described as follows:

Discrete Output Functions

Function No.	Discrete Output Function	Description	Activation (default)
6	Warning Flag Valid Output Discrete WFVOUTD	indicates failure status	open = invalid condition ground = valid operation
1	Primary Power FAIL	Indicates **loss of 28 VDC primary power**	open = normal ground = Power FAIL
2	ALT comparison Warning	in dual installation pressure ALT, label 203 shall be compared. The warning shall be active if the difference exceeds the parametric value 'ALTcomparisonWARN'	open = inactive ground = Warning
4	On Altitude	low for "on time" value when altitude passes preselected altitude (label 102). Parameters used: on time: 0 … 1000 ms, hysteresis: ± 0 … 100 ft	open = inactive ground = active
3	IAS LOW Warning	Indicates when active that IAS is less than parametric value IAS LOW. A hysteresis of ± 1 knot shall apply.	open = inactive ground = Warning
5	VNE Warning	Indicates when active that IAS is higher than parametric value VNE. A hysteresis of ± 1 knot shall apply.	open = inactive ground = Warning
8	VFE Warning	Indicates when active that IAS is higher than parametric value VFE. A hysteresis of ± 1 knot shall apply.	open = inactive ground = Warning
7	CAS Warning	Indicates when active that CAS is higher than parametric value CAS limit. A hysteresis of ± 1 knot shall apply.	open = inactive ground = Warning
9	Airspeed Warning	Indicates when active that IAS exceeds airspeed limitations as specified in table A hysteresis of ± 1 knot shall apply.	open = inactive ground = Warning
10	VMO/MMO Warning	The warning shall be active if IAS exceeds VMO. A hysteresis of ± 1 knot shall apply.	open = inactive ground = Warning

Discrete Output **AIRSPEED WARNING** is added to indicate the result of the IASmax monitoring function.

Airspeed Warning Limitations

Monitoring function to detect IAS exceeding the IASmax threshold is implemented. The IASmax threshold is calculated in dependency of ALTp and OAT

If IAS exceeds airspeed limitations as specified in the table below (sample values) the Airspeed Warning discrete output shall be activated.

Airspeed Limitations = function of pressure altitude and temperature

Depending on the connected temperature probe TAT or OAT values shall be used.

CAS calibration

The CAS calculation is extended for consideration of a calibration table to perform an additional correction of the calibrated airspeed. The resulting CAS correction is derived via an interpolation algorithm from the CAS calibration table

IAS/CAS calibration

The IAS/CAS calculation is extended for consideration of a conversion table to perform a correction of the IAS and CAS is parametrically selectable

Discrete Input Functions

Function No.	Discrete Input Functions	Description	Activation (default)
--	TEST (external)	External BIT activation	high = normal (IBIT not used) low = activate initiated BIT
3	SSEC Selection	Selects normal or alternative SSEC curve	high = basic SSEC curve low = Alternative curve
4	Zero Mach SSEC	SSEC values are set to null	high = normal (SSEC used) low = Zero SSEC values
5	TAT probe heat	Detects TAT probe heater condition	high = Heater off low = Heater on
15	TAT / OAT probe selection	Selects TAT or OAT probe input	high = TAT selected low = OAT selected
6	ICAO Strobe	Detects encoder strobe signal	high = Code off low = Code on
7	Disable Instrument	Disables the instrument function (operation stop)	high = enabled (operation) low = disabled (stopped)
13	Disable CAS correction	Selects IAS or CAS to be transmitted on ARINC label 206	high = CAS is transmitted low = IAS is transmitted
14	Disable Mach correction	Selects corrected or indicated Mach number to be transmitted on ARINC label 205	high = corrected Mach is transmitted low = indicated Mach is transmitted
8	SDI detection pin A	Selects Source/Destination Identifier for ARINC-Labels	high = (refer to Appendix VIII) low = (refer to Appendix VIII)
9	SDI detection pin B		
10	Alert light control	controls on/off state of internal alert light	high = Alert light off low = Alert light on
11	Day/Night/NVG - A	Selects Lighting mode	high = (refer to Appendix X) low = (refer to Appendix X)
12	Day/Night/NVG - B	Selects Lighting mode	high = (refer to Appendix X) low = (refer to Appendix X)

TAT/OAT probe selection

TAT / OAT probe input parameter is added. TAT calculation is not be performed if OAT probe selected. In such case TAT is equal to OAT value.

TAT/OAT synchronisation

If the OAT probe input is selected then OAT (label 213) will be synchronised instead of TAT (label 211). Refer to F.1 TAT Synchronisation.

Airspeed measurement range extension

Measurement range of IAS, CAS extended up to 750 knots and Mach no. to 1.200.

ARINC 429 Databus Interface

Operational ranges have been updated:

Label	Signal Name		Operational Range NOTE 1	Unit	Resolution	Update Rate per s
102	Selected Altitude	NOTE 5	SEL ALT	-1000 ..+53,000	feet	1	8
203	Pressure Altitude (1013.25 mbar)		ALT_P	-1000 ..+53,000	feet	1	16
204	Baro Corrected Altitude #1	NOTE 6	ALT_{C1}	-1000 ..+53,000	feet	1	16
220	Baro Corrected Altitude #2	NOTE 6	ALT_{C2}	-1000 ..+53,000	feet	1	16
205	Computed Mach Number	NOTE 3	M_C	0 / 0.200 .. 1.200	--	0.0000625 knot	8
206	Computed Airspeed	NOTE 4	CAS	0 / 20 .. 750	knots	0.0625	8
207	Maximum Allowable Airspeed		VMO	150 .. 750	knots	0.25	8
210	True Airspeed		TAS	0 / 100 .. 1000	knots	0.0625	8
211	Total Air Temperature		TAT	-60 .. +99	°C	0.25	2
212	Altitude Rate		ROC	-32,768 .. +32,768	ft/min	16	16
213	Static Air Temperature		SAT	-99 .. +60	°C	0.25	2
215	Impact Pressure	NOTE 2	q_C	0 .. 512	mbar	0.03125	8
217	Static Pressure		P_S	0 .. 64	inHg	0.001	8
234	Baro Correction mb #1			700 .. 1066	mbar	0.1	8
235	Baro Correction inHg #1			20.67 .. 31.48	inHg	0.001	8
236	Baro Correction mb #2			700 .. 1066	mbar	0.1	8
237	Baro Correction inHg #2			20.67 .. 31.48	inHg	0.001	8
242	Total Pressure	NOTE 7	P_T	25 .. 2048	mbar	0.03125	8
270	Discrete Data #1			--	--	--	2
353	Indicated Airspeed		IAS	0 / 20 .. 750	knots	0.0625	8
377	Equipment Identifier			006	--	--	16

Table 0-1: ARINC 429 Labels

NOTES:
1) Operational ranges shall be defined to meet customer requirements.
2) If the calculation of impact pressure (qci) is less than zero, then the impact pressure shall be set to zero. ARINC label 215 (Impact Pressure) is not available if IAS > 520 knots. Label 215 is limited to 512 mbar.
3) Label 205 “computed Mach number” shall transmit “indicated Mach number” value if the discrete input “disable Mach correction” is activated.
4) Label 206 “computed airspeed” shall transmit “indicated airspeed” value if the discrete input “disable CAS correction” is activated.
5) Label 102 SEL ALT transmits alerter setting

6) Label 204 Baro corrected altitude #1 shall be computed using label 234 or 235 Baro correction #1
Label 220 Baro corrected altitude #2 shall be computed using label 236 or 237 Baro correction #2
7) and ARINC label 242 (Total pressure) is limited to 2048 mbar. The configuration shall consider maximum airspeed altitude.

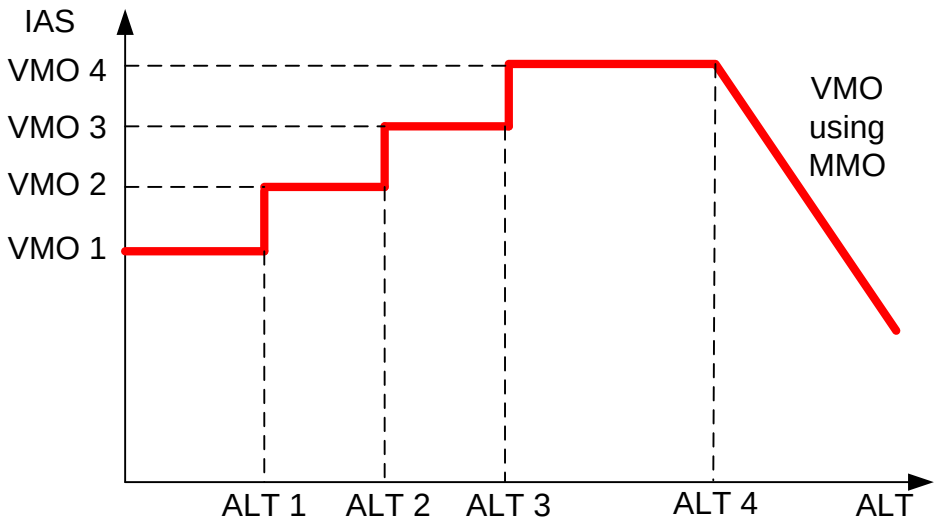
Forwarded ARINC 429 labels

Configurable forwarding ARINC 429 labels added

Label	Name
102	Selected Altitude
103	Selected Airspeed
162	(different meanings)
221	Indicated AOA
241	Corrected AOA
234	Baro Correction mb #1
235	Baro Correction inHg #1
236	Baro Correction mb #2
237	Baro Correction inHg #2
270	Discrete Data #1
271	Discrete Data #2
320	Magnetic Heading
350	Maintenance Word #1
351	Maintenance Word #2

Multiple configurable VMO

Four parametric VMO ranges added



NOTE: For use and assignment refer to the individual execution of instrument type in the AD3X.() Technical Checklist.

Appendix XV

Software Version SW 2.71:

Note 1): The wrap around test functionality of the Failure Code FC010 is deactivated from SW version 2.71 (refer to Failure Codes and BIT-Matrix in section Appendix I)

Appendix XVI

Software Version SW 2.72:

FC005: RAM Test Error is improved

a) SBIT/IBIT RAM Test
On start up the RAM is tested by an enhanced CPU Test.

b) CBIT RAM Test
Configuration and Calibration data that is hold in RAM after initialization is tested cyclic for data integrity by means of a checksum.
If checksum error is detected CBIT RAM error is indicated.
An additional failure number occur in the BIT history log-File.
One test cycle is completed within 30 seconds.
The RAM Test during Start up is replaced by an enhanced CPU Self-Test.

Appendix XVII

Liquid Cristal Display (LCD) of the AD32 Air Data Display.

a) The section “TESTING, Paragraph A, Startup LCD Testing Sequence” (Ref. Page 41) of this manual gives a test sequence indication that has been deleted. The LCD of the AD32 Air Data Display does not show the segments, annunciations and flags during the 1-second start-up Built-In-Test (BIT).

b) The deletion of the obsolete test sequence does not change the operation of the AD32 Air Data Display in any way or form.

INTENTIONALLY BLANK