



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 1 of 72

Document No: AD-INSOP-800

Revision: 1.6

TITLE:

INSTALLATION AND OPERATION MANUAL
AD20 Standby Altimeter

DOCUMENT NO.:

AD-INSOP-800

REVISION:

1.6

PROJECT:

Solid State Flight Instrument Family

MANUFACTURER:

REVUE THOMMEN AG
CH-4437 Waldenburg
Switzerland

ISSUING OFFICE:

Development Department

	Name	Signature	Date
Author:	M. Baumann		07-Sep-2009
Project Management:	R. Wehrli		22-Sep-2009
Development Management:	R. Wehrli		22-Sep-2009
Quality Management:	O. Thommen		28.9.09

© Copyright by REVUE THOMMEN AG, CH-4437 Waldenburg Switzerland



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 2 of 72

Document No: AD-INSOP-800

Revision: 1.6

Change History				
Rev.	Modification / Description	Date	Author	checked
1.0	First release of document	18-Aug-2006	R. Eichhorn	R. Wehrli
1.1	Minor corrections	09-Nov-2006	R. Wehrli	M. Baumann
1.2	- Metric unit selection discrete input added - RF susc. Cat. [WW] and harness with unshielded power wires added	28-Feb-2007	R. Wehrli	M. Baumann
1.3	- lighting curve selection numbers corrected - lighting curve adjustment changed - env. Qualification Explosion Cat. X corrected	12-Sep-2007	R. Wehrli	M. Baumann
1.4	- HIRF-Test added acc. to FAA AC No 20-158 (DO-160D Section 20.0, Cat. XW (with special test levels)	08-Jan-2008	M. Baumann	R. Wehrli
1.5	Correct baro setting value in section 2.2.2.1.4	05-May-2008	M. Baumann	R. Wehrli
1.6	Update section 2.4.1	07-Sep-2009	M. Baumann	R. Wehrli



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 3 of 72

Document No: AD-INSOP-800

Revision: 1.6

TABLE OF CONTENTS

1 SECTION I.....	10
1.1 Introduction.....	10
1.1.1 Purpose of the manual	10
1.1.2 Equipment Specification.....	10
1.1.2.1 Applicable Documents	10
1.1.2.2 Identification	13
1.1.2.2.1 Type Identification Drawing	13
1.1.2.2.2 Identification/Name Plate	14
1.1.2.3 Installation Kit	15
1.1.3 Technical Specification	15
1.1.4 Equipment Dimensions	16
1.1.5 Pneumatic Pressure Port	17
1.1.6 Interface Block diagram	18
2 SECTION II.....	19
2.1 General Information	19
2.2 Description.....	19
2.2.1 Instrument Description	19
2.2.2 Functional Description.....	20
2.2.2.1 Display	21
2.2.2.1.1 Digital Altitude Display	21
2.2.2.1.2 Altitude Pointer	21
2.2.2.1.3 Altitude Scale Setting ft/m.....	21
2.2.2.1.4 Baro Setting Display	21
2.2.2.1.5 Baro Scale Setting inHg/hPa	21
2.2.2.1.6 Battery Engagement Indicators A, B and C.....	21
2.2.2.2 Controls	22
2.2.2.2.1 Baro Setting Knob.....	22
2.2.2.2.2 Push to Standard Knob.....	22
2.2.2.2.3 UNIT Button.....	22
2.2.2.2.4 TEST Button.....	22
2.3 Operations.....	23
2.3.1 Theory of Operation	23
2.3.1.1 Power Supply	23



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 4 of 72

Document No: AD-INSOP-800

Revision: 1.6

2.3.1.2 Micro Controller	23
2.3.1.3 ARINC 429 Interface (optional)	23
2.3.1.4 Pointer Positioning	24
2.3.1.5 Dial and Display	24
2.3.1.5.1 Dial and Display Lighting Default Function.....	25
2.3.1.6 Configuration Identification.....	26
2.3.1.7 RS232 Serial Interface	26
2.3.1.8 Operating Range, Limiting Values and Tolerances.....	26
2.3.1.9 Battery Status Display Overview (optional)	27
2.3.1.10 Digital Display.....	28
2.4 TESTING	30
2.4.1 Startup BIT Sequence	30
2.4.1.1 Display of all LCD segments / white lighting.....	30
2.4.1.2 Display of battery charge / amber lighting (optional)	30
2.4.1.3 Display Config ID and A/C type	31
2.4.1.4 Display current altitude and baro setting	31
2.4.2 Built-in-Test	32
2.4.2.1 BIT Overview	32
2.4.2.2 Start Up BIT.....	32
2.4.2.3 Initiated BIT	32
2.4.2.4 Continuous BIT.....	32
2.4.3 Failure Modes.....	33
2.4.3.1 Fault Code Handling Overview	33
2.4.3.2 Non critical or tolerable Failures	34
2.4.3.3 Critical Failure Indication.....	35
2.4.3.4 Power Failure	35
3 SECTION III.....	36
3.1 Approvals	36
3.1.1 General	36
3.1.2 Instructions for Continued Airworthiness	36
3.1.3 Environmental Qualification	37
3.1.3.1 Electromagnetic Environment (EME).....	40
3.1.3.2 Electromagnetic compatibility (EMC).....	40
3.1.3.3 Electromagnetic interference (EMI)	40
3.1.3.4 Pointer position error	40
3.1.3.5 Scale error	40



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 5 of 72

Document No: AD-INSOP-800

Revision: 1.6

3.1.3.6 Hysteresis	40
--------------------------	----

4 SECTION IV 41

4.1 Installation..... 41

4.1.1 General	41
4.1.2 Unpacking and Inspecting	41
4.1.3 Pre and Post Installation Check	41
4.1.4 Electrical Interface	41
4.1.4.1 Overview of electrical interface	41
4.1.4.2 Power Control (DC Primary)	41
4.1.4.3 Power Consumption	41
4.1.4.4 Power Failure indication	42
4.1.4.5 Groundings and Shielding	42
4.1.4.5.1 Harness with shielded power wires, RF Susceptibility Cat. [YY]	42
4.1.4.5.2 Harness with unshielded power wires, RF Susceptibility Cat. [WW]	43
4.1.5 Electrical connector	44
4.1.5.1 Pin Assignments	44
4.1.5.2 Wiring Diagram (shielded power wires, RF Susc. Cat. [YY])	46
4.1.5.3 Wiring Diagram (unshielded power wires, RF Susc. Cat. [WW])	47
4.1.6 Digital Data Interface	48
4.1.6.1 ARINC 429 (optional)	48
4.1.6.1.1 ARINC 429 Data bus Interface	48
4.1.6.1.2 ARINC 429 BIT Rate	48
4.1.6.1.3 ARINC Label Formats	48
4.1.6.1.4 Label 203 (Pressure Altitude)	49
4.1.6.1.5 Label 204 (Baro corrected altitude #1)	50
4.1.6.1.6 Label 217 (Static Pressure)	51
4.1.6.1.7 Label 234 (Baro correction hPa #1)	52
4.1.6.1.8 Label 235 (Baro correction inHg #1)	53
4.1.6.1.9 Label 270 (Discrete word #1)	54
4.1.6.1.10 Label 350 (Maintenance word #1) (Provision)	55
4.1.6.2 Discrete I/O's	56
4.1.6.2.1 Discrete Inputs	56
4.1.6.2.2 Discrete Input Functions	56
4.1.6.2.3 Aircraft Type Selection	56
4.1.6.2.4 Discrete Outputs	57
4.1.6.3 RS232 Serial Interface	57



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 6 of 72

Document No: AD-INSOP-800

Revision: 1.6

5 SECTION V	58
5.1 Trouble shooting	58
5.2 Maintenance.....	59
5.3 Manual Maintenance Mode.....	60
5.3.1 Entering Manual Maintenance Mode	60
5.3.2 Display 1: Battery Capacity Test (provision).....	60
5.3.3 Display 2: High Resolution Altitude.....	61
5.3.4 Display 3: Lighting Curve Selection	62
5.3.5 Display 4: Lighting Curve Adjustment.....	64
6 APPENDICES	67
6.1 APPENDIX I: Function Overview	67
6.2 APPENDIX II: Failure Codes.....	70
6.3 APPENDIX III: Altimeter Calibration Table	72

LIST OF FIGURES

FIG. 1-1 TYPE IDENTIFICATION DRAWING	13
FIG. 1-2 EQUIPMENT SIDE VIEW	16
FIG. 1-3 EQUIPMENT BACK VIEW AND EQUIPMENT CUT-OUT	17
FIG. 1-4 INTERFACE BLOCK DIAGRAM	18
FIG. 2-1 FRONT VIEW	20
FIG. 2-2 DIAL AND DISPLAY LIGHTING	25
FIG. 2-3 DISPLAY OF ALL LCD SEGMENTS / WHITE LIGHTING	30
FIG. 2-4 DISPLAY OF BATTERY CHARGE / AMBER LIGHTING (OPTIONAL)	30
FIG. 2-5 DISPLAY CONFIG ID AND A/C TYPE	31
FIG. 2-6 DISPLAY CURRENT ALTITUDE AND BARO SETTING	31
FIG. 2-7 INDICATION OF NON-CRITICAL OR TOLERABLE FAILURES.....	34
FIG. 2-8 INDICATION OF CRITICAL FAILURES	35
FIG. 4-1 HARNESS SHIELDING RF CAT. [YY]	43
FIG. 4-2 WIRING DIAGRAM (SHIELDED POWER WIRES)	46
FIG. 4-3 WIRING DIAGRAM (UNSHIELDED POWER WIRES)	47
FIG. 5-1 BATTERY TEST DISPLAY.....	61
FIG. 5-2 HIGH RESOLUTION ALTITUDE	61



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 7 of 72

Document No: AD-INSOP-800

Revision: 1.6

FIG. 5-3 LIGHTING CURVE SELECTION DISPLAY	62
FIG. 5-4 LIGHTING CURVE ADJUSTMENT	64
FIG. 5-5 LIGHTING CURVE ADJUSTMENT DISPLAY	65

LIST OF TABLES

TABLE 1-1 CERTIFICATION STANDARDS	11
TABLE 1-2 MIL-STANDARDS	11
TABLE 1-3 OTHER STANDARDS	12
TABLE 1-4 REVUE THOMMEN STANDARDS, PLANS AND DOCUMENTS	12
TABLE 1-5 REFERENCED DOCUMENTS (GUIDANCE MATERIAL)	12
TABLE 1-6 INSTALLATION KIT	15
TABLE 1-7 TECHNICAL SPECIFICATION	15
TABLE 1-8 PNEUMATIC PRESSURE PORT	17
TABLE 2-1 FUNCTIONAL DESCRIPTION	20
TABLE 2-2 ARINC 429 LABELS	24
TABLE 2-3 DIAL AND DISPLAY LIGHTING	25
TABLE 2-4 OPERATING RANGE, LIMITING VALUES AND TOLERANCES	26
TABLE 2-5 BATTERY STATUS DISPLAY OVERVIEW	27
TABLE 2-6 DIGITAL DISPLAY IN FEET	28
TABLE 2-7 DIGITAL DISPLAY IN METER	28
TABLE 2-8 ALTITUDE DISPLAY RESOLUTION IN FEET	29
TABLE 2-9 ALTITUDE DISPLAY RESOLUTION IN METER	29
TABLE 2-10 BUILT-IN TEST OVERVIEW	32
TABLE 2-11 FAULT CODE HANDLING	33
TABLE 3-1 ENVIRONMENTAL QUALIFICATION	39
TABLE 4-1 POWER CONSUMPTION	42
TABLE 4-2 PIN ASSIGNMENTS	45
TABLE 4-3 ARINC 429 DATA BUS INTERFACE	48
TABLE 4-4 LABEL 203 (PRESSURE ALTITUDE)	49
TABLE 4-5 LABEL 204 (BARO CORRECTED ALTITUDE #1)	50
TABLE 4-6 LABEL 217 (STATIC PRESSURE)	51
TABLE 4-7 LABEL 234 (BARO CORRECTION HPA #1)	52
TABLE 4-8 LABEL 235 (BARO CORRECTION INHG #1)	53
TABLE 4-9 LABEL 270 (DISCRETE WORD #1)	54
TABLE 4-10 LABEL 350 (MAINTENANCE WORD #1) (PROVISION)	55
TABLE 4-11 DISCRETE INPUTS VOLTAGE LEVELS	56



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 8 of 72

Document No: AD-INSOP-800

Revision: 1.6

TABLE 4-12 DISCRETE INPUTS FUNCTIONS	56
TABLE 4-13 AIRCRAFT TYPE SELECTION	57
TABLE 4-14 DISCRETE OUTPUTS	57
TABLE 5-1 TROUBLE SHOOTING PROCEDURES	58
TABLE 5-2 MAINTENANCE MODES	59
TABLE 5-3 LIGHTING CONDITIONS	62
TABLE 6-1 FUNCTION OVERVIEW	69
TABLE 6-2 FAILURE CODES	71
TABLE 6-3 ALTIMETER CALIBRATION TABLE	72



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 9 of 72

Document No: AD-INSOP-800

Revision: 1.6

LIST OF ABBREVIATIONS AND ACRONYMS

Abbreviation	Description
A/C	Aircraft
Abs	Absolute
ARINC	Aeronautical Radio Inc.
ASCII	American Standard Code for Information Interchange
BIT	Built In Test
CPU	Central Processing Unit
DC	Direct Current
EASA	European Aviation Safety Agency
EMI	Electro Magnetic Interference
ETSO	European Technical Standard Order
FAA	Federal Aviation Administration (USA)
FAR	Federal Aviation Regulation
FI	Flight Instruments
FIG	Figure
HW	Hardware
ICAO	International Civil Aviation Organization
IF	Interface
LCD	Liquid Crystal Display
N.A.	Not applicable
NC	Not Connected
REV	Revision
RTCA	Radio Technical Commission for Aeronautics
RTW	REVUE THOMMEN AG, Waldenburg
SW	Software
TBD	To Be Defined
TSO	Technical Standard Order
HIRF	High Intensity Radiated Field



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 10 of 72

Document No: AD-INSOP-800

Revision: 1.6

1 Section I

1.1 Introduction

1.1.1 Purpose of the manual

This manual provides the specifications, installation instructions, equipment operation and system maintenance in details for the REVUE THOMMEN AD20 Standby Altimeter. This manual also defines interface design requirements including mechanical and electrical characteristics for the AD20 Standby Altimeter.

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 procedures in this manual are to be performed by qualified personnel familiar with REVUE THOMMEN AD20 Standby Altimeter Equipment.

Note 1 : This manual is applicable for all Solid State Flight Instruments Family with part number as AD20.(.).

1.1.2 Equipment Specification

1.1.2.1 Applicable Documents

The following table shows the list of relevant applicable documents which forms the basis of approvals of the REVUE THOMMEN AD20 Standby Altimeter.

Certification Standards

Identifier	Document Title	Issue / Date
FAR 23	Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplanes	1 Feb. 2001
CS-23	Normal, Utility, Aerobatic, and Commuter Category Airplanes	14/11/2003
AC 23.1309-1C	Equipment, Systems, and Installations in Part 23 Airplanes	12/03/99
FAR 25	Airworthiness Standards: Transport Category Airplanes	9/14/2000
CS 25	Certification Specifications for Large Airplanes	17/10/2003
FAR 25.1333	Instrument systems	
AC 25-11	Transport Category Airplane Electronic Display Systems	16/07/87
AMJ 25-11	Transport Category Airplane Electronic Display Systems	27 May 1994
AMJ 25.1309	System Design and Analysis	11/05/90
FAR 27	Airworthiness Standards: Normal Category Rotorcraft	Jan. 21, 2000



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 11 of 72

Document No: AD-INSOP-800

Revision: 1.6

Identifier	Document Title	Issue / Date
CS-27	Certification Specifications for Small Rotorcraft	14/11/2003
AC 27-1B	Certification of Normal Category Rotorcraft	9/30/99
TSO-C10b	Altimeter, Pressure Actuated Sensitive Type	01/09/59
ETSO-C10b	Altimeter, Pressure Actuated Sensitive Type	24.10.03
SAE AS392C	Altimeters, Pressure Actuated Sensitive Type	1 February 1959
SAE AS8009B	Pressure Altimeter Systems	2005-09
ED-26 (Edition 2)	Minimum Performance Specification for Airborne Altitude Measurement and Coding Systems	30/03/79
ARINC 706-4	Mark 5 Subsonic Air Data System	11/01/88
ED-12B RTCA/DO-178B	Software Considerations in Airborne Systems and Equipment Certification	01/12/92
ED-14D RTCA/DO-160D	Environmental Conditions and Test Procedures for Airborne Equipment with - Change 1 - Change 2 - Change 3	29/07/97 14.12.2000 12.06.2001 05.12.2002

Table 1-1 Certification Standards

MIL Standards

Doc-No.	Document Title
MIL-C-14806	Coating, reflection reducing, for instrument cover glasses and lighting wedges
MIL-C-26482G	Connectors, Electrical
MIL-L-27160C	Lighting, Integral, Aircraft Instrument Cover Glasses and Lighting Wedges
MIL-STD-810E	Method 505.3, Solar Radiation (Sunshine)
MS 33649	Bosses, Fluid Connection - Internal Straight Thread

Table 1-2 MIL-Standards



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 12 of 72

Document No: AD-INSOP-800

Revision: 1.6

Other Standards

Doc-No.	Document Title
FED-STD-595a	Colors
ANSI/J-STD-001	Standard Requirements for Electrical and Electronic Assemblies

Table 1-3 Other Standards

REVUE THOMMEN Standards, Plans and Documents

Doc-No.	Document Title
ADMD-RCP-930	ADMD2X Re-Certification Plan
ADAC-PSA-420	ADAC32 Plan for Software Aspects of Certification
ADAC-SVP-420	ADAC32 Software Verification Plan
ADMD-FME-931	ADMD2X Safety Analysis / FMEA Report
FI-QAP-020	FI Software Quality Assurance Plan
FI-CMP-020	FI Software Configuration Management Plan
RT-SRS-020	RT Software Requirements Standards
RT-SDS-020	RT Software Design Standards
RT-SCS-020	RT Software Code Standards
RTW-MM-05	REVUE THOMMEN Management Manual

Table 1-4 REVUE THOMMEN Standards, Plans and Documents

Referenced Documents (Guidance Material)

Identifier	Document Title	Issue / Date
ARINC 607-3	Design Guidance for Avionic Equipment	12/08/98
ARINC 429	Mark 33 Digital Information Transfer System	9/95
ED-80 RTCA/DO-254	ED-80 / RTCA/DO-254 Design Assurance Guidance for Airborne Electronic Hardware	04/00
FAA Memorandum	Information: Policy Statement with respect to All Electrical Attitude, Altitude, Direction and Airspeed Systems using Battery Standby Power	APR 27 2001

Table 1-5 Referenced Documents (Guidance Material)



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 13 of 72

Document No: AD-INSOP-800

Revision: 1.6

Order of precedence

In the event of a conflict between the text of this specification and the references cited herein, (except for associated detail specifications or specification sheets), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

1.1.2.2 Identification

1.1.2.2.1 Type Identification Drawing

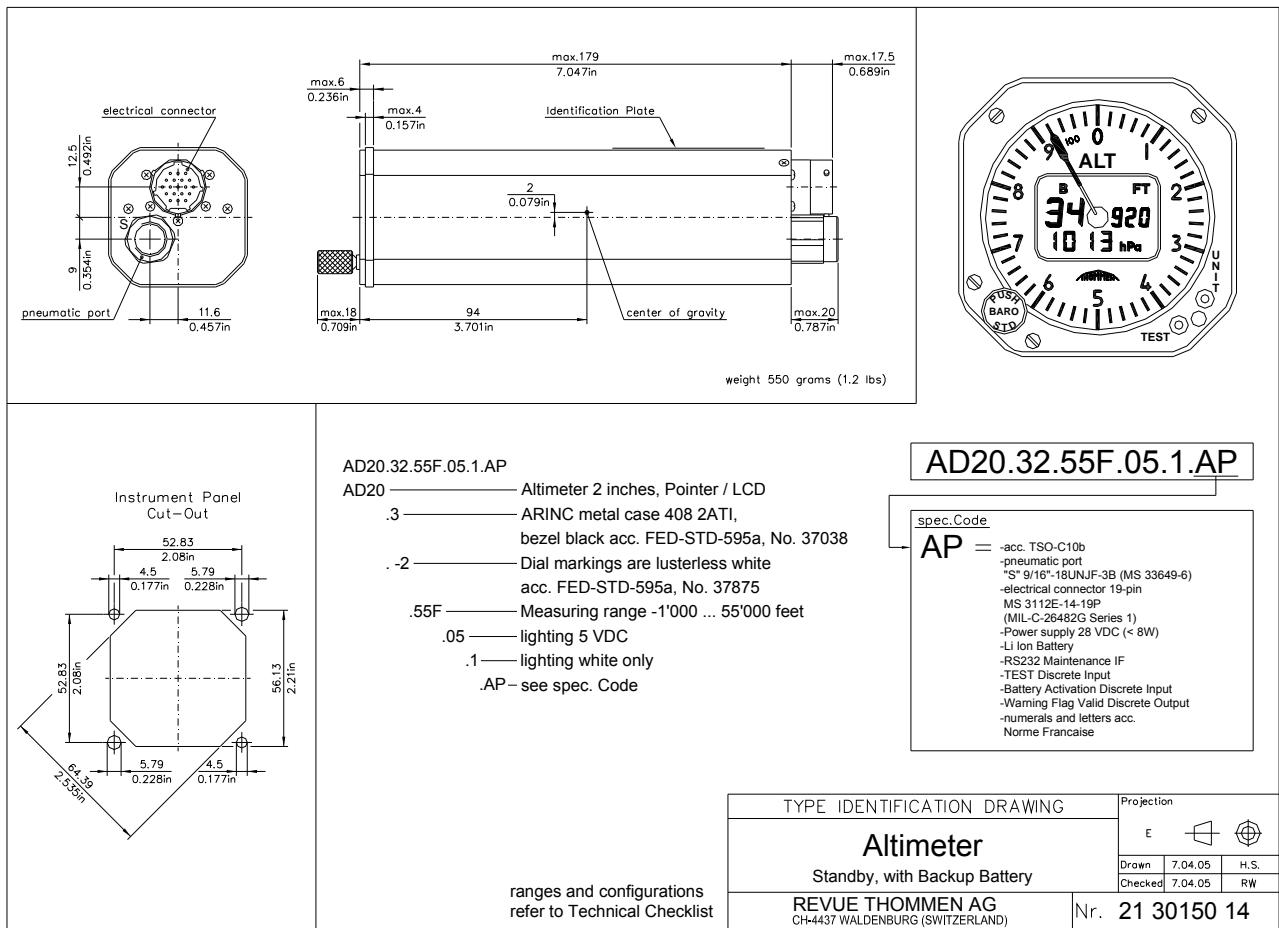


Fig. 1-1 Type Identification Drawing



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 14 of 72

Document No: AD-INSOP-800

Revision: 1.6

1.1.2.2.2 Identification/Name Plate

The Identification/Name plate is attached on the instrument case of AD20 Standby Altimeter. The sample of Identification/Name plate of AD20 Standby Altimeter is shown below:

ETSO/TSO-Nameplate (sample)

REVUE THOMMEN AG CH-4437 WALDENBURG		
ALTIMETER		
CERTIFIED ETSO/TSO-C10b	WT 550 gm (1.2 lbs)	
RTCA/DO-160D ENV.CAT. [F1]CBB[(TB1)(TR)]XWFDFSZAZZ[YY]M[A3J33]XXA		
RTCA/DO-178B LEVEL A	CONFIG ID	
PART/TYPE NO AD20.32.55F.05.1.AP	- 85XX	
SER NO	XXXXXXX	PWR SUPPLY 28 VDC
RANGE	-1'000 ... 55'000 FEET	LIGHTING SUPPLY 5 VDC
MFR DATE month / year		
SWISS MADE	PHONE +41 61 965 22 22	info@thommen.aero

Version/MOD Label (sample)

REVUE THOMMEN AG CH-4437 WALDENBURG		
HW Version 1.XX		
SW Version 6.XX		
MOD	01	02
	03	04
	05	06
	07	08
	09	10
	11	12
	13	14
	15	16
SWISS MADE	PHONE +41 61 965 22 22	info@thommen.aero

NOTE: The configuration ID code allows identifying the individual configuration of the instrument. Instruments with the same config. ID codes are identical.



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 15 of 72

Document No: AD-INSOP-800

Revision: 1.6

1.1.2.3 Installation Kit

Part Number	Quantity	Description
AD20.XX.XXX.XX.X.XX	1	REVUE THOMMEN AD20 Standby Altimeter
AD-INSOP-800	1	REVUE THOMMEN AD20 Standby Altimeter Installation and Operation Manual
AD-DDP-XXX	1	Declaration of Design and Performance

Table 1-6 Installation Kit

NOTE: As per ordered by the Installer.

1.1.3 Technical Specification

Characteristics	Specifications
Primary Power	28 VDC
During startup	max. 4.0 W / 140mA
Normal operation	max. 1.7 W / 60mA
Emergency Power	28 VDC
Lighting power	5 VDC (opt. 28 VDC)
Physical Dimension	
Height	56.13 mm (2.2 in)
Width	56.13 mm (2.2 in)
Length	179 mm (7.047 in)

Table 1-7 Technical Specification



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 16 of 72

Document No: AD-INSOP-800

Revision: 1.6

1.1.4 Equipment Dimensions

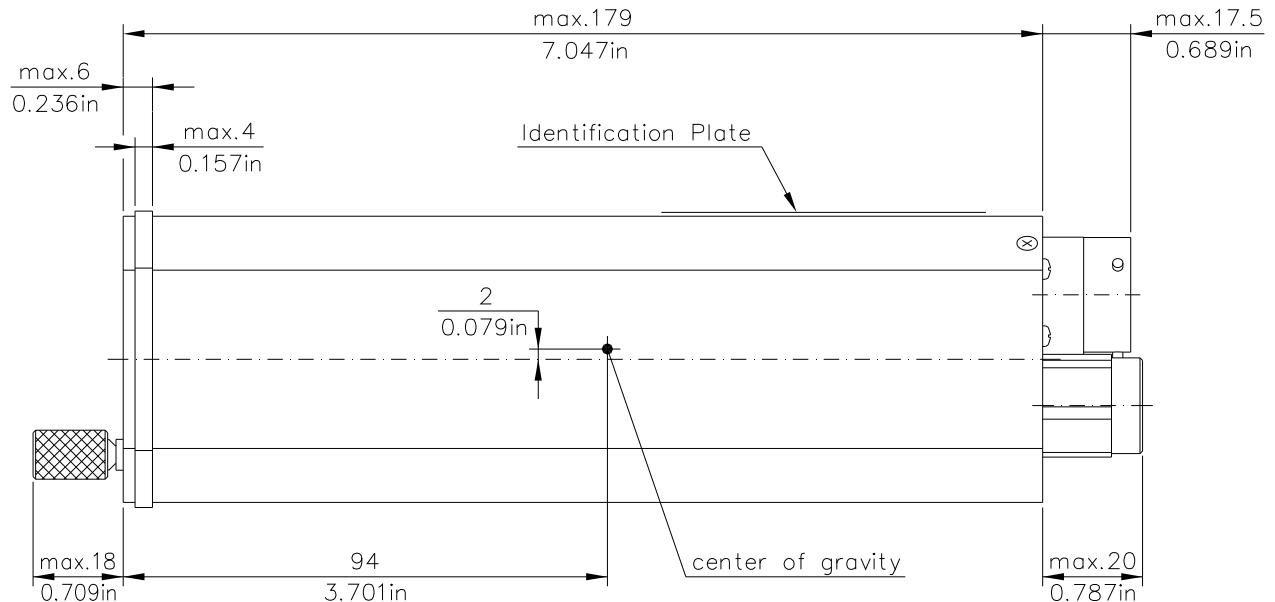


Fig. 1-2 Equipment Side View

NOTE: The dimensions are in millimeters or inches

NOTE: Not to scale.



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 17 of 72

Document No: AD-INSOP-800

Revision: 1.6

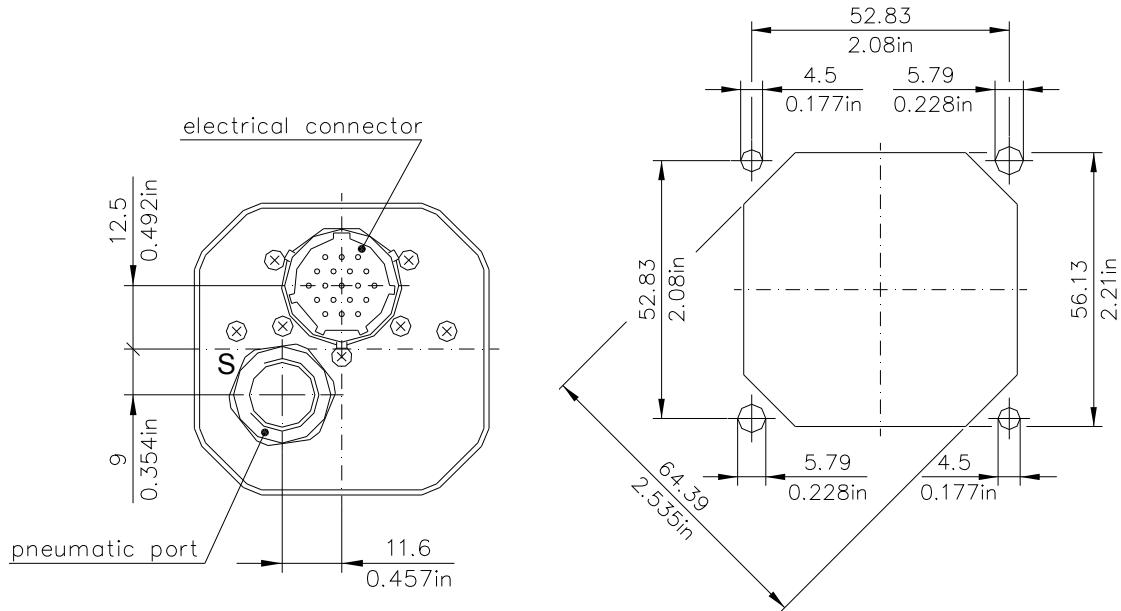


Fig. 1-3 Equipment Back View and Equipment cut-out

1.1.5 Pneumatic Pressure Port

	Mechanical 1)	Pressure range	Over pressure capability
Static Port "S"	1/2"-20UNJF-3B (MS33649-5)	100 ... 1050 hPa abs	1500 hPa abs
Static Port "S"	9/16"-18UNJF-3B (MS33649-5)	100 ... 1050 hPa abs	1500 hPa abs

Table 1-8 Pneumatic Pressure Port

1) Note: refer to the Type Identification Drawing of your specific instrument type for the correct pressure port dimension.



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 18 of 72

Document No: AD-INSOP-800

Revision: 1.6

1.1.6 Interface Block diagram

Fehler! Keine gültige Verknüpfung.

Fig. 1-4 Interface Block Diagram



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 19 of 72

Document No: AD-INSOP-800

Revision: 1.6

2 Section II

2.1 General Information

This Section provides the description, the theory of operation and functional modes required to understand and operate of AD20 Standby Altimeter unit. Refer to the following paragraph for the brief description of the instrument. The AD20 Standby Altimeter belongs to the Solid State Flight Instruments Family of REVUE THOMMEN AG.

2.2 Description

2.2.1 Instrument Description

The implementation of the AD20 Standby Altimeter provides measured barometric (corrected) altitude. The static pressure is sensed by the integrated solid state pressure sensor and computed internally. 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).

It can be configured for different installations as per parameter upload via the RS232 serial maintenance interface. The corrected Altitude is displayed in digital format on a high contrast LCD and by a stepper motor driven pointer.

The extensive Built-In-Test (BIT) guarantees safe operation using watch dog circuitry on each power on. The low power consumption and its low weight have been optimized for applications in state-of-the-art avionics.

The REVUE THOMMEN AD20 Standby Altimeter is a simple designed modular unit and hence having easy maintenance. By RS232 serial maintenance interface the AD20 Standby Altimeter can be configured for different applications as per the aircraft requirements. Therefore its application range reaches from Business Aviation up to Regional Aircraft, Transporters and Helicopters.

The REVUE THOMMEN AD20 Standby Altimeter meets or exceeds the requirements of ETSO/TSO-C10b.



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 20 of 72

Document No: AD-INSOP-800

Revision: 1.6

2.2.2 Functional Description



Fig. 2-1 Front View

Display		Controls	
A	Digital Altitude Display	G	Baro Setting / Push-to-Standard Knob
B	Altitude Pointer	H	UNIT Button
C	Altitude Scale Setting ft / m	I	TEST Button
D	Baro Setting Display		
E	Baro Scale Setting inHg / hPa		
F	Battery Engagement Indicators		

Table 2-1 Functional Description



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 21 of 72

Document No: AD-INSOP-800

Revision: 1.6

2.2.2.1 Display

2.2.2.1.1 Digital Altitude Display

The aircraft's altitude is displayed on the digital display window with the range from –1'000 up to 55'000 ft, in 10, 20, 50 or 100 ft increments.

2.2.2.1.2 Altitude Pointer

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

2.2.2.1.3 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 (hPa/ft, inHg/ft, hPa /m) by pushing the UNIT setting button.

2.2.2.1.4 Baro Setting Display

The Baro Setting Display shows the barometric pressure which ranges between 20.67 to 31.00 inHg or 700 to 1050 hPa.

2.2.2.1.5 Baro Scale Setting inHg/hPa

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

2.2.2.1.6 Battery Engagement Indicators A, B and C

A – Indicates that the Battery is aged and must be replaced.

B – Indicates that the Battery is activated.

C – Indicates that the maintenance mode (calibration) is in progress.



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 22 of 72

Document No: AD-INSOP-800

Revision: 1.6

2.2.2.2 Controls

2.2.2.2.1 Baro Setting Knob

Barometric pressure is a four digit readout in the lower part of the display and is used to adjust barometric setting. By rotating the Baro Setting knob the barometer setting value changes ranging between 20.67 to 31.00 inHg or 700 to 1050 hPa. The knob also allows the altimeter to indicate zero altitude with any existing ground level pressure ranging between 20.67 to 31.00 inHg or 700 to 1050 hPa as selected. This extended adjust range allows QFE settings so altimeter reads zero at field elevation.

2.2.2.2.2 Push to Standard Knob

By pushing the Baro setting knob (push-to-standard) function 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 hPa.

2.2.2.2.3 UNIT Button

Pressing the UNIT button results in a barometric scale display change to indicate 'inHg' or 'hPa' as applicable. Optionally the altitude setting scale is displayed in 'feet' or 'meter' according to the configuration.

The altimeter continuously operates to display the scale selected for all subsequent flights until the selection is changed again. This is possible "in flight" also. The following combinations are parametric:

- hPa / ft, hPa / m (fixed hPa)
- hPa / ft, inHg / ft (fixed feet)
- hPa / ft, inHg / ft, hPa / m (all combinations)

2.2.2.2.4 TEST Button

The "TEST" button is flush mounted and located on the bezel of the AD20 Standby Altimeter. By pushing and holding the TEST button for few seconds, the instrument performs the self test function (Built-In-Test) for the internal circuitry and the LCD. If the Built-In-Test (BIT) fails "Err" (Error) word appears on the altitude display window.



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 23 of 72

Document No: AD-INSOP-800

Revision: 1.6

2.3 Operations

This part of the manual is to familiarize the reader with the REVUE THOMMEN AD20 Standby Altimeter instrument and to give a brief operational description.

Caution:

The REVUE THOMMEN AD20 Standby Altimeter 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.

2.3.1 Theory of Operation

2.3.1.1 Power Supply

The REVUE THOMMEN AD20 Standby Altimeter is designed to operate from a 28 VDC power supply in accordance with RTCA/DO-160D Section 16.0 Category Z. The instrument requires maximum of 1.4 W power consumption for normal operation (without display lighting power consumption). The power consumption of 1.7 Watts maximum is with lighting.

2.3.1.2 Micro Controller

The Micro Controller is a flash type micro controller. The CPU has an internal 32-bit architecture which is provided with sixteen 16-bit general registers and a concise, optimized instruction set 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.

2.3.1.3 ARINC 429 Interface (optional)

The ARINC 429 module in REVUE THOMMEN AD20 Standby Altimeter supports the ARINC-I/O interface and the bus interface to the CPU.

The ARINC 429 offers the following main features:

- Two transmitter 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 REVUE THOMMEN AD20 Standby Altimeter :

Label	Signal Name	Operational Range 1)	Unit	Resolution	Update Rate per s
203	Pressure altitude (1013.25 hPa)	-1000 ..+55,000	feet	1	16
204	Baro corrected altitude #1	-1000 ..+55,000	feet	1	16
212	Altitude Rate	0 .. 20,000	ft/min	16	16
217	Static pressure	0 .. +64	inHg	0.0009765	8
234	Baro Correction mb #1	700 .. 1050	mbar / hPa	0.1	8
235	Baro Correction inHg #1	20.67 .. 31.00	inHg	0.001	8
270	Discrete Word #1	--	--	--	2
350	Maintenance Word #1	--	--	--	2

Table 2-2 ARINC 429 Labels

2.3.1.4 Pointer Positioning

The pointer on the dial display of REVUE THOMMEN AD20 Standby Altimeter makes one revolution (360 deg) for each 1,000 feet (meters) of altitude 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 ft (m). The pointer stops at indicated altitude level when the current aircraft altitude overrides the altitude range design limit of the instrument [maximum tolerance level ($> 55,610$ or $< -1,020$ feet OR > 55000 feet or < -1000 feet) is included in the range limit].

2.3.1.5 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 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 inHg or hPa (as per the scale selected). The display of barometric pressure setting is not affected by altitude display failures.

The display is consistent all the time with the uniformity of other panel displays and the integral lighting of the cockpit.



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 25 of 72

Document No: AD-INSOP-800

Revision: 1.6

2.3.1.5.1 Dial and Display Lighting Default Function

When external dial lighting is off or less than the threshold voltage V_{TH} then the LCD light is at full intensity. But when the external dial lighting voltage is more than the threshold voltage V_{TH} it is controlled externally. The lighting control is parametrical and set acc. to customer requirements.

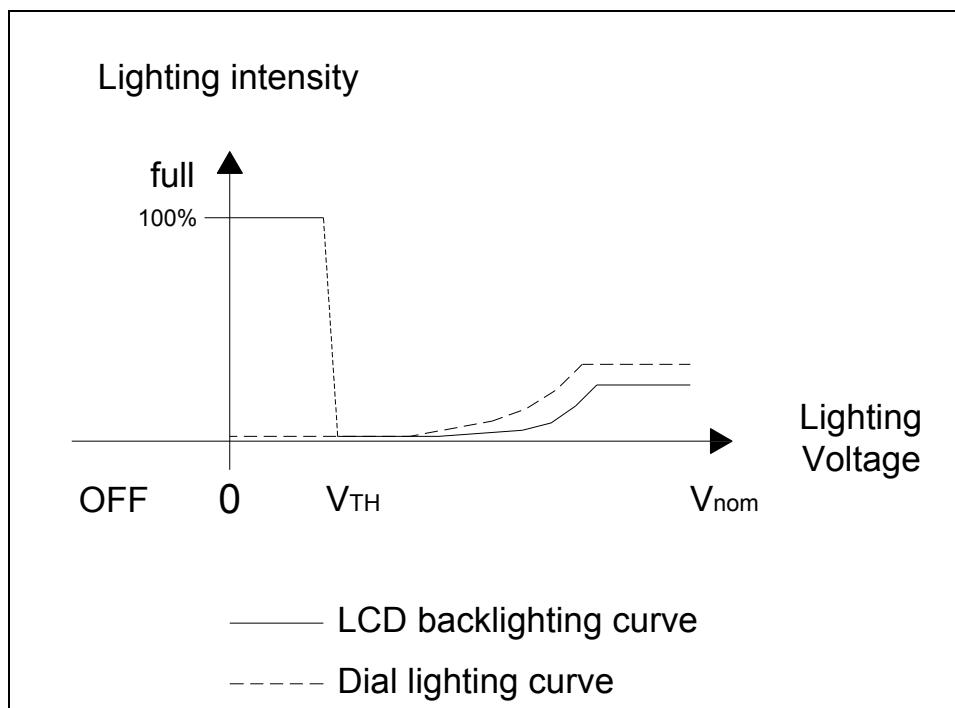


Fig. 2-2 Dial and Display Lighting

	Threshold Voltage(V_{TH})
	acc. to customer requirements
Condition	Display Lighting Intensity
Lighting 0 V / OFF	full
Lighting < V_{TH}	full
Lighting $\geq V_{TH}$	controlled

Table 2-3 Dial and Display Lighting



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 26 of 72

Document No: AD-INSOP-800

Revision: 1.6

2.3.1.6 Configuration Identification

The configuration identification defines a specific instrument configuration parameterized by the individual parameter lists for each REVUE THOMMEN AD20 Standby Altimeter instrument, which in turn explains the different parameter requested by the installer. So for every new AD20 Standby Altimeter a different Configuration ID number is designated.

Configuration ID 8501 (example)

2.3.1.7 RS232 Serial Interface

The AD20 Standby Altimeter has a RS232 serial interface for maintenance and calibration purpose only. This interface is not accessible for normal operation in the aircraft.

The RS232 Interface has the following transmission parameters:

9600 Baud	No Parity	1 Stop Bit
-----------	-----------	------------

2.3.1.8 Operating Range, Limiting Values and Tolerances

Air data	Operating range 1)	BIT Limit MIN/MAX 2)	ETSO/TSO- Tolerance @ 25 / 71 °C (-4 / +160 °F)	Remarks
ALTP Pressure Altitude	-1,000 ft + 55,000 ft -305 m + 16,764 m	-1,060 ft + 55,610 ft -323 m + 16,950 m	- 20 / - 60 ft + 305 / 610 ft - 6 / -18 m + 93 / 186 m	
ALTC Baro corrected Altitude	-1,000 ft + 55,000 ft -305 m +16,764 m	-1,060 ft + 55,610 ft -323 m + 16,950 m	- 20 / - 60 ft + 305 / 610 ft - 6 / -18 m + 93 / 186 m	
ALT Rate Altitude rate	- 20,000 ft/min. + 20,000 ft/min.	- 30,000 ft/min. + 30,000 ft/min.	(± 10 % rdg.) (refer to SAE/AS8016)	
Static Pressure	30 ... 1100 hPa	30 ... 1100 hPa	--	absolute pressure

Table 2-4 Operating Range, Limiting Values and Tolerances



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 27 of 72

Document No: AD-INSOP-800

Revision: 1.6

1) Operating range:

- nominal operating range where instrument shall be within specs

2) BIT limits

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

2.3.1.9 Battery Status Display Overview (optional)

Status / Condition	LCD Indicator	LCD color	Discrete output
Battery Charge Status	The current charge status of the battery shall be checked and displayed during startup of the instrument.		
In operation mode			
Battery disabled	No indication	white	High (inactive)
Battery activated	constant 'B'	white	High (inactive)
Battery supply active	constant 'B'	white	Low (active)
Low Battery	flashing 'B'	amber	Alternating high/low
Battery charge not accepted (invalid Temp.)	flashing 'C'	amber	High (inactive)
Battery aged (capacity < 70%)	constant 'A'	Depending on conditions above	Depending on conditions above
Battery charging	No special indication – The battery is charged automatically under all conditions if temperature is acceptable. It has not necessarily to be activated.		
In maintenance mode			
Battery test running - normal	flashing 'A' constant 'B'	white	Low
Battery test running - low bat	flashing 'A' flashing 'B'	amber	Alternating high/low

Table 2-5 Battery Status Display Overview

Note: In the preflight check make sure there is no amber display indicating low battery!



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 28 of 72

Document No: AD-INSOP-800

Revision: 1.6

2.3.1.10 Digital Display

The following table shows the altitude indication and the baro setting on the display of the REVUE THOMMEN AD20 Standby Altimeter:

The altitude display in feet is shown in the table below:

Measured Altitude [feet]	LCD Indication [feet]	Rem.
> 55,610	-- Err	2)
10,000	10 000	
1,000	01 000	
100	0 100	
10	010	1)
1	01	1)
0	- - - 00	
-100	- 0 100	
-1,000	- 1 000	
< -1,060	-- Err	2)

Table 2-6 Digital Display in feet

The altitude display in meter is shown in the table below:

Measured Altitude [meter]	LCD Indication [meter]	Rem.
> 16,950	-- Err	3)
10,000	10 000	
1,000	01 000	
100	0 100	
10	010	1)
1	01	1)
0	- - - 00	
-100	- 0 100	
< -323	-- Err	3)

Table 2-7 Digital Display in meter



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 29 of 72

Document No: AD-INSOP-800

Revision: 1.6

Remarks:

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

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	1)
	> 10,000	20	
>= 750 ... < 2,500	--	20	
>= 2,500 ... < 6,000	--	50	
>= 6,000	--	100	

Table 2-8 Altitude display resolution in feet

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	1)
	> 3,000	10	
>= 250 ... < 2,000	--	10	
>= 2,000	--	20	

Table 2-9 Altitude display resolution in meter

- 1) Resolution configurable (see parameters for m or ft indication)



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 30 of 72

Document No: AD-INSOP-800

Revision: 1.6

2.4 TESTING

2.4.1 Startup BIT Sequence

As soon as the instrument is powered all segments and annunciations 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. After finding the reference position the pointer moves to the measured altitude indication.

The self-test (TEST button pushed) executes the startup BIT sequence.

2.4.1.1 Display of all LCD segments / white lighting

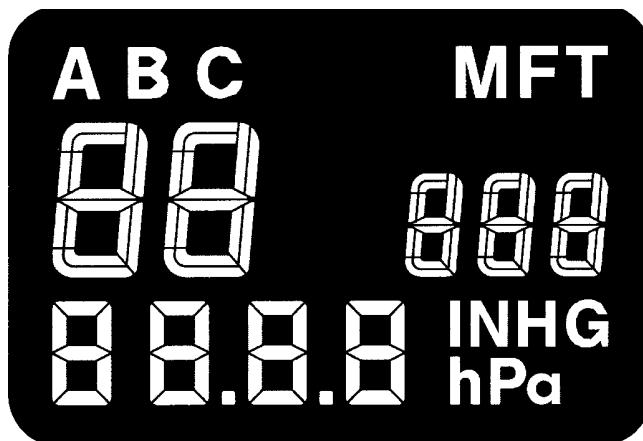


Fig. 2-3 Display of all LCD segments / white lighting

2.4.1.2 Display of battery charge / amber lighting (optional)



Fig. 2-4 Display of battery charge / amber lighting (optional)



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 31 of 72

Document No: AD-INSOP-800

Revision: 1.6

The 'Bar-Graph' displays the current battery charge in 20% steps while the lower number shows the charge in %. The aircraft should not start before a minimum charge of 20 % is available.

2.4.1.3 Display Config ID and A/C type



Fig. 2-5 Display Config ID and A/C type

The selected A/C type is displayed on the upper line (e.g. L45, also refer to 4.1.6.2.3 on page 56), the config ID (e.g. 8501) on the lower line.

2.4.1.4 Display current altitude and baro setting



Fig. 2-6 Display current altitude and baro setting



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 32 of 72

Document No: AD-INSOP-800

Revision: 1.6

2.4.2 Built-in-Test

2.4.2.1 BIT Overview

BIT	When?	Action	Duration
Startup BIT	primary, emergency or battery power switched on after power off condition (reset released)	- display all LCD segments - find pointer null - test internal circuits - test lightings white/amber - display battery charge - display Config ID - display selected A/C type	As long as pointer resets < 10 s totally
Initiated BIT	TEST (EXTERNAL) activated	- same as Startup BIT	- same as Startup BIT
Continuous BIT	Background operation, once within 10 s	- test internal circuits and operating cond.	--

Table 2-10 Built-in Test Overview

2.4.2.2 Start Up BIT

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

2.4.2.3 Initiated BIT

The flight instrument can be initiated for built in Test (BIT) function, by pushing the “TEST” button. Then the Startup LCD including Startup BIT sequence is repeated.

2.4.2.4 Continuous BIT

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



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 33 of 72

Document No: AD-INSOP-800

Revision: 1.6

2.4.3 Failure Modes

2.4.3.1 Fault Code Handling Overview

There are three types Failure Modes:

Critical Failures Mode (ref. also to 2.4.3.3 on page 35):

It requires an immediate shutdown of the instrument in any case.

Non Critical Failures Mode (ref. also to 2.4.3.2 on page 34)

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 (ref. also to 2.4.3.2 on page 34)

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 pushed) function can be performed by flight crew or maintenance personnel if any failure occurs, to perform the self test function of the instrument.

If AD20 Standby Altimeter 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 discrete (WFVOUTD) can indicate an error.

The display of failures at the LCD and the reaction of the pointer and the operation mode of the instrument in case of fault indication shall be according to the following definition:

Failure Class	BIT	Action	Display
critical	Startup Initiated Continuous	<ul style="list-style-type: none">- Warning Flag Valid discrete output is set to invalid- ARINC 429 communication shall mark all labels as "failure warning"- Pointer is stopped at its current position- Failure Code is stored and displayed (Fxx)- instrument is set to idle mode	(ref. to 2.4.3.3 on page 35)
non critical or tolerable	Startup Initiated Continuous	<ul style="list-style-type: none">- Warning Flag Valid discrete output is set to invalid as long as the Fault exists- ARINC 429 communication shall continue operation, invalid labels shall be marked as "failure warning"- Failure Code is stored- 'Err' indication shall be intermittent	(ref. to 2.4.3.2 on page 34)

Table 2-11 Fault Code Handling



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 34 of 72

Document No: AD-INSOP-800

Revision: 1.6

NOTE:

If a non critical BIT allows to continue operation but invalid values would lead to wrong calculations ARINC 429 labels is marked as "failure warning" (SSM).

If any error is indicated on LCD at startup the lighting is activated before the instrument goes into idle mode.

Dashes will be indicated if no valid data can be displayed

The REVUE THOMMEN AD20 Standby Altimeter has the ability to find possible failures via extensive built in test (BIT) functions. To read the BIT history the AD20 Standby Altimeter can be connected via the RS232 serial data interface to PC. The failure codes are then uploaded with the maintenance Software.

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

2.4.3.2 Non critical or tolerable Failures

Non Critical Failures are indicated by the lower three digits of the altitude display showing altering 'Err' and altitude.



Fig. 2-7 Indication of Non-critical or tolerable Failures

The instrument operation will continue and the ARINC 429 communication will mark invalid labels as "failure warning".



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 35 of 72

Document No: AD-INSOP-800

Revision: 1.6

2.4.3.3 Critical Failure Indication

Critical Failures are indicated by the lower three digits of the altitude display showing steady 'E r r'.



Fig. 2-8 Indication of Critical Failures

The pointer will stop at its current position and the instrument is set to idle mode. The ARINC 429 communication shall mark all labels as "failure warning".

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

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

2.4.3.4 Power Failure

In case of total power fail or switching off the instrument's power supply the instrument will

- set the warning flag valid discrete output to invalid (WFVOUTD)
- switch off lighting
- switch off ARINC 429 interface
- set the LCD blank
- leave pointer in current position



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 36 of 72

Document No: AD-INSOP-800

Revision: 1.6

3 Section III

3.1 Approvals

3.1.1 General

The approval of the REVUE THOMMEN AD20 Standby Altimeter Instrument is being accomplished under ETSO/TSO-C10b, RTCA/DO-160D / DO-178B Level A.

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.

3.1.2 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 REVUE THOMMEN AD20 Standby Altimeter (description, Installation, testing, etc.) is contained in AD20 Component Maintenance Manual CMM 34-16-03.
- (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 Battery Pack replacement: | On Condition
or acc. to
replacement date
marked on battery |
| d. Recommended Periodic recalibration interval : | On Condition |
| e. Recommended Periodic Inspections : | On Condition |
| f. Recommended Periodic Structural Inspections : | On Condition |

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



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 37 of 72

Document No: AD-INSOP-800

Revision: 1.6

3.1.3 Environmental Qualification

The flight instrument will indicate readings within the limits specified under the following environmental conditions:

Environmental Criteria	Requirement RTCA/DO-160D	Remarks
Temperature & Altitude <i>Temperature:</i> Continuous operation Ground Survival Temperature Operating Low Temperature Operating High Temperature Short Time Operating High Temperature	RTCA/DO-160D Section 4.0 Cat. [F1] from -30 to +70 °C (-22 to 158 °F) from -55 to +85 °C (-67 to 185 °F) Section 4.5.1 -30 °C (-22 °F) Section 4.5.3 +70 °C (158 °F) Section 4.5.2 +70 °C (158 °F)	LCD limited to - 30 °C (-22 °F)
Altitude	Section 4.6.1 55,000 ft	
Decompression	Section 4.6.2 55,000 ft	
Overpressure static port of the instrument	Section 4.6.3 -15,000 ft	
Temperature Variation	RTCA/DO-160D Section 5.0 Cat. C 2 °C/min. (36 °F/min.)	
Humidity up to 95 %rH	RTCA/DO-160D Section 6.0 Cat. B	
Shock and Crash Safety: Operational Shock	RTCA/DO-160D Section 7.0 Cat. B 6g, 11 ms	
<i>Crash Safety:</i> Impulse Sustained	Section 7.3 20g, 11 ms	
Vibration	RTCA/DO-160D Section 8.0 Cat. [(TB1)(TR)] without shock mounts	
Explosion	RTCA/DO-160D Section 9.0 Cat. X (Environment II)	no test required



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 38 of 72

Document No: AD-INSOP-800

Revision: 1.6

Environmental Criteria	Requirement RTCA/DO-160D	Remarks
Waterproofness	RTCA/DO-160D Section 10.0 Cat. W	
Fluids Susceptibility	RTCA/DO-160D Section 11.0 Cat. F	Solvent and cleaning Fluids, Lubrificating Oils
Sand and Dust: Sand and dust particles as encountered in desert areas	RTCA/DO-160D Section 12.0 Cat. D	
Fungus: Fungus growth as encountered in tropical climates	RTCA/DO-160D Section 13.0 Cat. F	
Salt Spray: Exposure to salt-sea atmosphere	RTCA/DO-160D Section 14.0 Cat. S	
Magnetic Effect	RTCA/DO-160D Section 15.0 Cl. Z < 0.3m	
Power Characteristics DC	RTCA/DO-160D Section 16.0 Cat. Z	
<i>Normal operating conditions</i>	28 VDC	
Max. voltage	30.3 VDC	
Nominal voltage	28.0 VDC	
Min. voltage	22.0 VDC	
Emergency operation voltage level	18.0 VDC	
Ripple voltage	up to 1000 ms	
Momentary power interruptions	up to 50 V for 50 ms	(without activated emergency battery)
Normal surge voltage	10.0 to 20.5 VDC	
Engine starting under-voltage operation		
<i>Abnormal operating conditions</i>		
Voltage steady state	32.2 VDC	
Maximum	20.5 VDC	
Minimum		
Low voltage conditions	0 to 20.5 VDC	
Momentary under-voltage operation	12.0 VDC for 7 s	
Abnormal surge voltage	up to 80 V for 100 ms up to 48 V for 1 s	



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 39 of 72

Document No: AD-INSOP-800

Revision: 1.6

Environmental Criteria	Requirement RTCA/DO-160D	Remarks
Voltage Spikes	RTCA/DO-160D Section 17.0 Cat. A	
Audio Frequency Conducted Susceptibility	RTCA/DO-160D Section 18.0 Cat. Z	
Induced Signal Susceptibility	RTCA/DO-160D Section 19.0 Cat. Z	
Radio Frequency Susceptibility	RTCA/DO-160D Section 20.0 Cat. [YY] / [WW]	Cat. [YY] with shielded power wires Cat. [WW] with unshielded power wires
Radio Frequency Emission	RTCA/DO-160D Section 21.0 Cat. M	
Lightning Induced Transient Susceptibility	RTCA/DO-160D Section 22.0 Cat. [A3J33]	
Lightning Direct Effects	RTCA/DO-160D Section 23.0 Cat. X	no test required
Icing	RTCA/DO-160D Section 24.0 Cat. X	no test required
Electrostatic Discharge (ESD)	RTCA/DO-160D Section 25.0 Cat. A (15 kV)	
Other Tests		
Solar Radiation (Sunshine)	MIL-STD-810E Method 505.3 Procedure II / 3 cycles	
HIRF	FAA AC No 20-158 High-Intensity HIRF Environment	

Table 3-1 Environmental Qualification



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 40 of 72

Document No: AD-INSOP-800

Revision: 1.6

3.1.3.1 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.

3.1.3.2 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.

3.1.3.3 Electromagnetic interference (EMI)

The generation of EMI by the REVUE THOMMEN AD20 Standby Altimeter and its susceptibility to EMI is controlled to the limitation in accordance to RTCA/DO-160D and as modified REVUE THOMMEN AD20 Standby Altimeter specification. The requirements are met in all operating modes.

3.1.3.4 Pointer position error

The pointer position error does not exceed 5 feet maximum.

3.1.3.5 Scale error

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

3.1.3.6 Hysteresis

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



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 41 of 72

Document No: AD-INSOP-800

Revision: 1.6

4 Section IV

4.1 Installation

4.1.1 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 REVUE THOMMEN AD20 Standby Altimeter Instrument.

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

4.1.2 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.

4.1.3 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 REVUE THOMMEN AD20 Standby Altimeter does not require any in-aircraft adjustment. All adjustments procedures are accomplished by the manufacturer.

4.1.4 Electrical Interface

4.1.4.1 Overview of electrical interface

The following are the electrical interfaces for REVUE THOMMEN AD20 Standby Altimeter:

- Primary Power Supply
- Lighting Power Supply
- Digital Communication Interfaces (optional ARINC 429 data bus, RS232 Maintenance IF)
- Discrete I/O's

4.1.4.2 Power Control (DC Primary)

The REVUE THOMMEN AD20 Standby Altimeter is designed for 28 VDC power supply in accordance with RTCA/DO-160D Section 16.0 under Category Z.

4.1.4.3 Power Consumption

The following table shows values of power consumed by REVUE THOMMEN AD20 Standby Altimeter instruments with the full operating functionality. The instruments e.g. without ARINC429 module or without sensors have less power consumption.

The power consumption by the REVUE THOMMEN AD20 Standby Altimeter at different stages of operation are shown below in the table:



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 42 of 72

Document No: AD-INSOP-800

Revision: 1.6

AD20 Standby Altimeter (no Battery, no ARINC429)		Power Consumption	
Operation		Lighting on / maximum (5 VDC)	Lighting off / minimum (5 VDC)
Primary Power	28 VDC		
During startup	max.	4.0 W / 140 mA	max. 3.4 W / 120 mA
Normal operation	1.7 W / 60 mA	1.4 W / 50 mA	

Table 4-1 Power Consumption

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 draw form lighting power supply is less than <15 mA).

4.1.4.4 Power Failure indication

In case of power supply failure or switching off the warning flag valid output discrete (WFVOUTD) will be set to invalid (open = invalid condition, ground = valid operation).

4.1.4.5 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 run-up, and
- protect personnel from electrical shock hazards.

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

4.1.4.5.1 Harness with shielded power wires, RF Susceptibility Cat. [YY]

The GROUND strap should be electrically connected to the mating connector with conductive over-braided shielding and the other end shall be connected to aircraft ground.

NOTE: The maximum length of the GROUND strap : 30 cm (12 inches)

To meet RTCA/DO-160D, RF Susceptibility, Section 20, Cat. [YY], all wires shall be shielded according to 4.1.4.5.1 Harness with shielded power wires, RF Susceptibility Cat. [YY].



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 43 of 72

Document No: AD-INSOP-800

Revision: 1.6

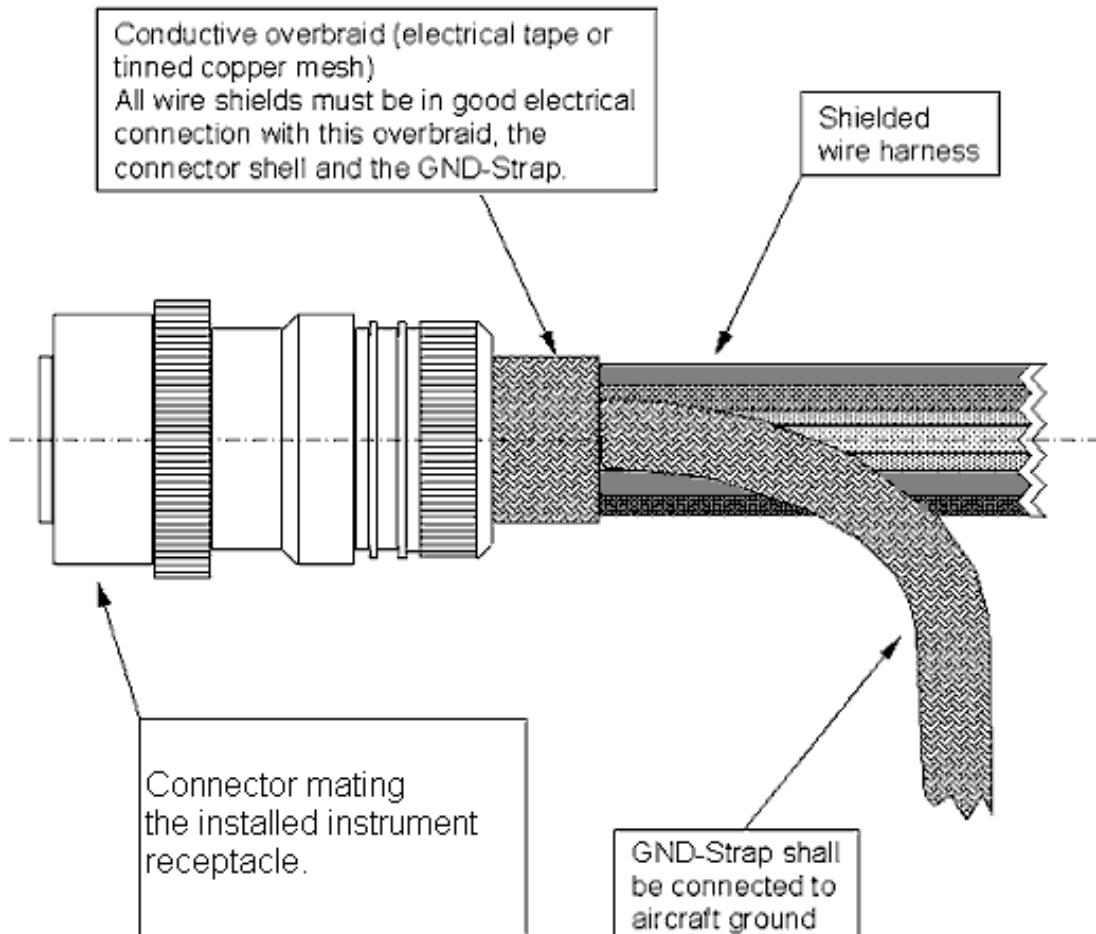


Fig. 4-1 Harness Shielding RF Cat. [YY]

4.1.4.5.2 Harness with unshielded power wires, RF Susceptibility Cat. [WW]

The GROUND strap should be electrically connected to the mating connector with conductive overbraided shielding and the other end shall be connected to aircraft ground.

NOTE: The maximum length of the GROUND strap : 1 m (40 inches)

To meet RTCA/DO-160D, RF Susceptibility, Section 20, Cat. [WW], the harness shall be done according to 4.1.5.3 Harness with unshielded power wires, RF Susceptibility Cat. [WW]. Only the discrete wires shall be shielded.



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 44 of 72

Document No: AD-INSOP-800

Revision: 1.6

4.1.5 Electrical connector

4.1.5.1 Pin Assignments

The following connector Type shall be used: MS3112E-14-19P (acc. to MIL-C-26482 Series 1). Assignment of Pin-Numbers see table below:

Pin #	Signal Name	Function	Signal Type	EMC cat.	Remarks
E	Primary Power supply	Primary Power supply	analogue	em./susc.	28 VDC
F	Primary Power return	Primary Power return / System Ground (Common)	analogue	em./susc.	
U	Lighting supply	Dial Lighting Power supply	analogue	susc.	5 or 28 VDC lighting control
J	Lighting return	Dial Lighting Power return	analogue	susc.	
R	RS232 TxD	Serial IF Transmit	data	--	1),2),3), only for maintenance
S	RS232 RxD	Serial IF Receive	data	--	
L	ARINC429 TxD 1A (RS422 TxD 1A)	Serial Interface Bus Transmit Channel 1	data bus	em./susc.	2), optional
K	ARINC429 TxD 1B (RS422 TxD 1B)	Serial Interface Bus Transmit Channel 1	data bus	em./susc.	
M	ARINC429 TxD 2A (RS422 TxD 1A)	Serial Interface Bus Transmit Channel 2	data bus	em./susc.	2), optional
N	ARINC429 TxD 2B (RS422 TxD 1B)	Serial Interface Bus Transmit Channel 2	data bus	em./susc.	
C	Discrete Input 0	External Test Input	Discr. In (0)	susc.	ground / open
T	Discrete Input 1	Battery activation or Metric Unit Selection	Discr. In (1)	susc.	
P	Discrete Input 2	Day/Night switch	Discr. In (2)	susc.	



REVUE THOMMEN AG
CH-4437 Waldenburg

AD20 Standby Altimeter

Page 45 of 72

07-Sep-2009

Document No: AD-INSOP-800

Revision: 1.6

Pin #	Signal Name	Function	Signal Type	EMC cat.	Remarks
B	Discrete Input 3	A/C Type - A	Discr. In (3)	susc.	
D	Discrete Input 4	A/C Type - B	Discr. In (4)	susc.	
V	Discrete Output 0	Warning Flag Valid Out Discrete	Discr.Out (0)	susc.	Open drain max. 1 A
A	Discrete Output 1	Battery Status	Discr.Out (1)	susc.	
H	NC	spare	--	--	ground
G	Chassis GND	GND	--	--	

Table 4-2 Pin Assignments

Remarks:

- 1) Short-circuit RS232 TxD and RxD on aircraft installation
- 2) Shielded twisted pair
- 3) Transmit and Receive Signals are seen from the instrument's view



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 46 of 72

Document No: AD-INSOP-800

Revision: 1.6

4.1.5.2 Wiring Diagram (shielded power wires, RF Susc. Cat. [YY])

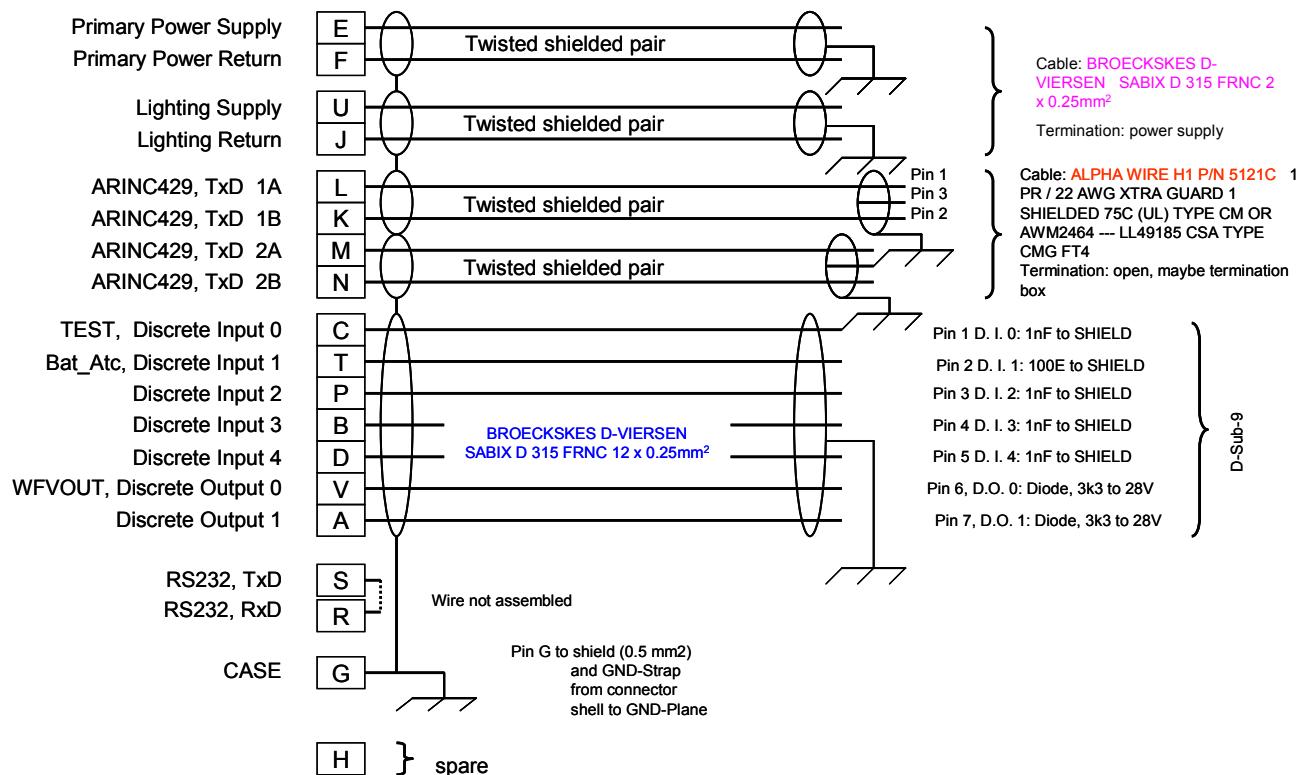


Fig. 4-2 Wiring Diagram (shielded power wires)



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 47 of 72

Document No: AD-INSOP-800

Revision: 1.6

4.1.5.3 Wiring Diagram (unshielded power wires, RF Susc. Cat. [WW])

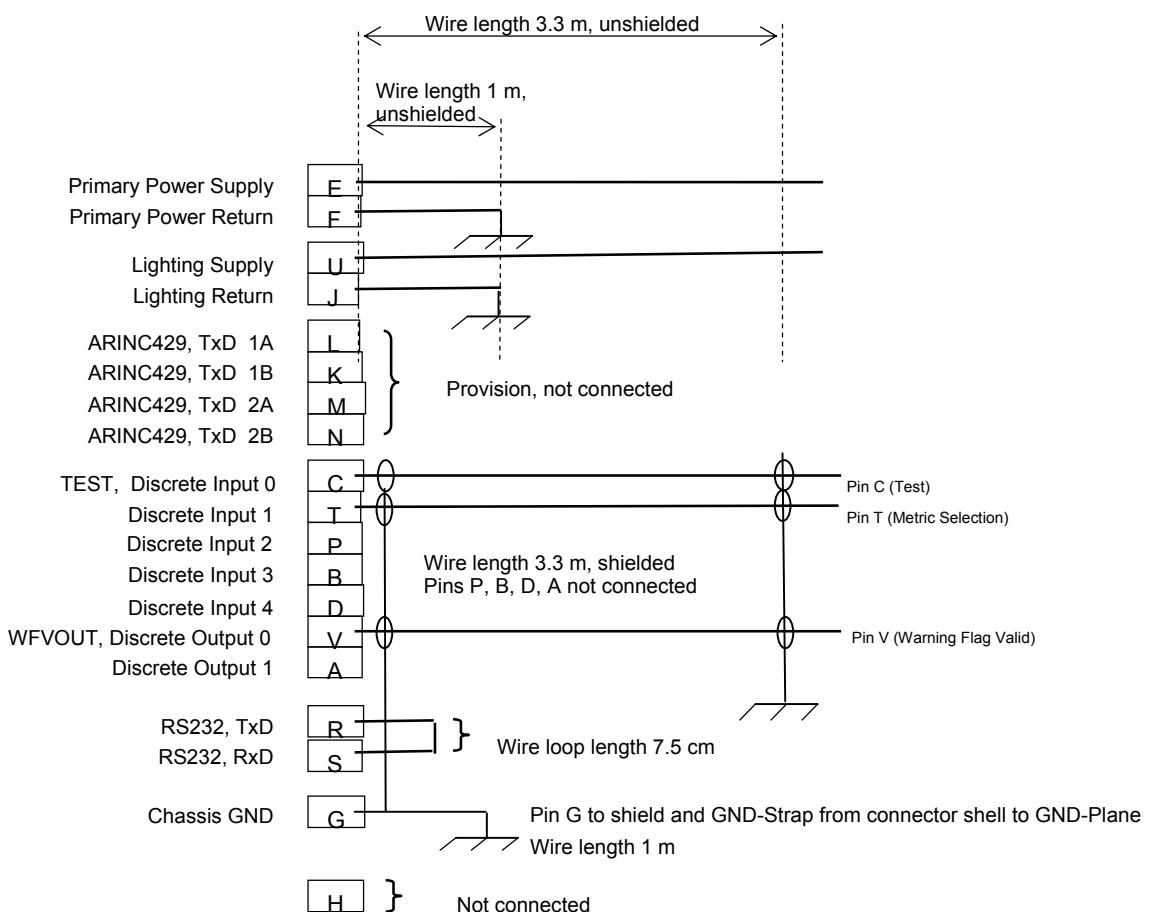


Fig. 4-3 Wiring Diagram (unshielded power wires)



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 48 of 72

Document No: AD-INSOP-800

Revision: 1.6

4.1.6 Digital Data Interface

4.1.6.1 ARINC 429 (optional)

4.1.6.1.1 ARINC 429 Data bus Interface

Digital Data Standards are acc. to ARINC 429 Mark 33 DITS and ARINC 706 ADS

Label	Signal Name	Unit	Resolution	Update Rate	Transfer
203	Altitude (1013.25 hPa)	feet	1	16	Output
204	Baro Corrected Altitude #1	feet	1	16	Output
212	Altitude Rate	ft/min.	16	16	Output
217	Static Pressure	inHg	0.0009765	8	Output
234	Baro Correction mb #1	hPa	0.1	8	Output
235	Baro Correction inHg #1	inHg	0.001	8	Output
270	Discrete Word #1	--	--	2	Output
350	Maintenance Word #1	--	--	2	Output

Table 4-3 ARINC 429 Data Bus Interface

Operational ranges are defined to meet customer requirements.

4.1.6.1.2 ARINC 429 BIT Rate

The ARINC 429 data bus is designed for:

- High Speed: 100 kbits/s, half load (max. 16 receivers) for both transmit channels

Optionally it can be configured for:

- Low Speed : 12.5 kbits/s, full load (max. 32 receivers) for both transmit channels

4.1.6.1.3 ARINC Label Formats

Format according to ARINC 429 Mark 33 DITS, equipment ID 006 (Air Data System)



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 49 of 72

Document No: AD-INSOP-800

Revision: 1.6

4.1.6.1.4 Label 203 (Pressure Altitude)

Label 203 (Pressure Altitude)	
BIT	
1	Label LSB
2	
3	
4	
5	
6	
7	
8	Label MSB
9	SDI
10	SDI
11	PAD
12	Value BNR LSB
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	Value BNR MSB
30	SSM
31	SSM
32	PARITY

Table 4-4 Label 203 (Pressure Altitude)



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 50 of 72

Document No: AD-INSOP-800

Revision: 1.6

4.1.6.1.5 Label 204 (Baro corrected altitude #1)

Label 204 (Baro corrected altitude #1)	
BIT	
1	SAL LSB
2	
3	
4	
5	
6	
7	
8	SAL MSB
9	SDI
10	SDI
11	PAD
12	Value BNR LSB
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	Value BNR MSB
30	SSM
31	SSM
32	PARITY

Table 4-5 Label 204 (Baro corrected altitude #1)



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 51 of 72

Document No: AD-INSOP-800

Revision: 1.6

4.1.6.1.6 Label 217 (Static Pressure)

Label 217 (Static Pressure)	
BIT	
1	SAL LSB
2	
3	
4	
5	
6	
7	
8	SAL MSB
9	SDI
10	SDI
11	PAD
12	PAD
13	Value BNR LSB
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	Value BNR MSB
30	SSM
31	SSM
32	PARITY

Table 4-6 Label 217 (Static Pressure)



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 52 of 72

Document No: AD-INSOP-800

Revision: 1.6

4.1.6.1.7 Label 234 (Baro correction hPa #1)

Label 234 (Baro correction hPa #1)	
BIT	
1	SAL LSB
2	
3	
4	
5	
6	
7	
8	SAL MSB
9	SDI
10	SDI
11	Value BCD LSB
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	Value BCD MSB
30	SSM
31	SSM
32	PARITY

Table 4-7 Label 234 (Baro correction hPa #1)



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 53 of 72

Document No: AD-INSOP-800

Revision: 1.6

4.1.6.1.8 Label 235 (Baro correction inHg #1)

Label 235 (Baro correction inHg #1)	
BIT	
1	SAL LSB
2	
3	
4	
5	
6	
7	
8	SAL MSB
9	SDI
10	SDI
11	Value BCD LSB
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	Value BCD MSB
30	SSM
31	SSM
32	PARITY

Table 4-8 Label 235 (Baro correction inHg #1)



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 54 of 72

Document No: AD-INSOP-800

Revision: 1.6

4.1.6.1.9 Label 270 (Discrete word #1)

Label 270 (Discrete word #1)		
BIT		
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	1 = FAIL, 0 = GOOD
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 not available
17	Left Side Angle Of Attack	1 = ON, 0 = OFF not available
18	Right Side Angle Of Attack	1 = ON, 0 = OFF not available
19	VMO / MMO Overspeed	1 = ON (WARN), Provision
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 not available
27	Angle Of Attack Alternate	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 not available
30	SSM	
31	SSM	
32	PARITY	

Table 4-9 Label 270 (Discrete word #1)



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 55 of 72

Document No: AD-INSOP-800

Revision: 1.6

4.1.6.1.10 Label 350 (Maintenance word #1) (Provision)

The content of the maintenance label is to be defined.

Label 350 (Maintenance word #1)	
BIT	
1	SAL LSB
2	
3	
4	
5	
6	
7	
8	SAL MSB
9	SDI
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

Table 4-10 Label 350 (Maintenance word #1) (Provision)



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 56 of 72

Document No: AD-INSOP-800

Revision: 1.6

4.1.6.2 Discrete I/O's

4.1.6.2.1 Discrete Inputs

Five (5) discrete inputs are available. The use and logic of the discrete I/Os are parametrical.

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	

Table 4-11 Discrete Inputs Voltage Levels

4.1.6.2.2 Discrete Input Functions

No.	Discrete Input Functions	Description	Activation (default)
0	n/a	No function	--
1	TEST (EXTERNAL)	Performs a restart of the instrument	high = Normal low = activate initiated BIT
2	Battery activation	Activates internal Battery as emergency Power Supply	high = Normal low = activate internal Battery
3	A/C Type - A	Selects aircraft type	high = (refer to 4.1.6.2.3) low = (refer to 4.1.6.2.3)
4	A/C Type - B	Selects aircraft type	high = (refer to 4.1.6.2.3) low = (refer to 4.1.6.2.3)
5	Day/Night switch	Controls lighting in emergency mode	high = Night operation low = Day operation
6	Metric Unit Selection	Bypasses unit button and selects Metric units only	high = unit button selection low = metric only (hPa / m)

Table 4-12 Discrete Inputs Functions

Note: The functions shall be assignable to discrete input pins by parameterization.

4.1.6.2.3 Aircraft Type Selection

The instrument shall detect by pin strapping in which aircraft it is installed. Preset A/C specific parameters for VMO/MMO and lighting characteristics shall be used. Two discrete inputs shall be used to detect the A/C Type. The function shall be assignable to the discrete inputs.

	Aircraft Type			
Discrete Input	A/C Type # 0	A/C Type # 1	A/C Type # 2	A/C Type # 3
A/C Type - A	High (open)	High (open)	Low (ground)	Low (ground)
A/C Type - B	High (open)	Low (ground)	High (open)	Low (ground)



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 57 of 72

Document No: AD-INSOP-800

Revision: 1.6

Table 4-13 Aircraft Type Selection

Depending on the selected aircraft the model number (parametric) shall be indicated during startup.

4.1.6.2.4 Discrete Outputs

No.	Discrete Output Function	Description	Activation (default)
0	n/a	No function	--
1	Warning Flag Valid Output Discrete WFVOUTD	indicates proper operation and no critical failure	open = invalid condition ground = valid operation
2	Battery Status	Indicates status of emergency battery	open = battery not active ground = battery active alternating 2 Hz = low power warning

Table 4-14 Discrete Outputs

Note: The functions shall be assignable to discrete output pins by parameterization.

4.1.6.3 RS232 Serial Interface

The flight instrument has a RS232 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 RS232 TxD and RxD must be jumpered in the connector on the aircraft side to avoid inadvertent interferences!



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 58 of 72

Document No: AD-INSOP-800

Revision: 1.6

5 Section V

5.1 Trouble shooting

The table below shows the general troubleshooting information to assist in locating and correcting any malfunctions with the REVUE THOMMEN AD20 Standby Altimeter .

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	electronic module failure	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 Dial Lighting module
brightness of digital display does not change	CPU module Dual Lighting module	make sure/repair CPU module make sure/repair of Dial Lighting module

Table 5-1 Trouble Shooting Procedures

NOTE: For any malfunction of REVUE THOMMEN AD20 Standby Altimeter not listed in the table above, the manufacturer can be contacted for assisting in the trouble shooting.



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 59 of 72

Document No: AD-INSOP-800

Revision: 1.6

5.2 Maintenance

The Maintenance of the REVUE THOMMEN AD20 Standby Altimeter instrument must be performed by the manufacturer representative or certified personnel.

The following is the summary of maintenance modes which are provided for maintaining the instruments:

RS232 Maintenance Mode	Allows to initialize, calibrate, configure and test the instrument via the RS232 interface and a maintenance software. NOTE: For clear understanding and use refer to the Maintenance Software Manual.
Manual Maintenance Mode	Allows to check and adjust the instrument when it's installed in the cockpit or for bench test without use of Maintenance SW: <ul style="list-style-type: none">• Emergency Battery test and capacity measurement• 1 foot resolution at Altitude display• Lighting curve selection for 4 different aircraft• Individual Lighting curve adjustment The Manual Maintenance Mode shall be only accessible by service staff and may not be used for regular operation. Provisions are made to avoid unintentional access.

Table 5-2 Maintenance Modes

5.3 Manual Maintenance Mode

The manual maintenance mode gives access to internal settings and maintenance functions.
The sub modes of the manual maintenance mode are:

- Display 1: Battery Capacity Test
- Display 2: High Resolution Altitude
- Display 3: Lighting Curve Selection
- Display 4: Lighting Curve Adjustment

5.3.1 Entering Manual Maintenance Mode

The manual maintenance mode is entered by pushing the UNIT button (or the equivalent button at MD21 bezel) during startup of the instrument.

Then display 1 appears, indicator "C" is displayed and WVF discrete output is set high (invalid).

Push the UNIT button to select the next display. Display 4 will roll over to display 1.

The manual maintenance mode can be left by pushing the TEST button for > 3 s.

5.3.2 Display 1: Battery Capacity Test (provision)

This test determines the current capacity of the battery. Activate the battery test by the following procedure:

- 1.) Apply primary power and charge battery completely for at least 4 h
- 2.) Activate battery activation discrete input
- 3.) Enter manual maintenance mode and select battery capacity test display
- 4.) Disconnect primary power supply to start the test

Note: The battery test is only possible if the battery is completely charged. If it is not possible indicator 'B' blinks.

During battery test indicator 'A' blinks. The discharged accumulated current in mAh is displayed at center line and decimals are indicated on the right side at bottom line. Display 1 is indicated at bottom line on the left side.

Refer to example of display 1 below indicating 1500.25 mAh:



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 61 of 72

Document No: AD-INSOP-800

Revision: 1.6

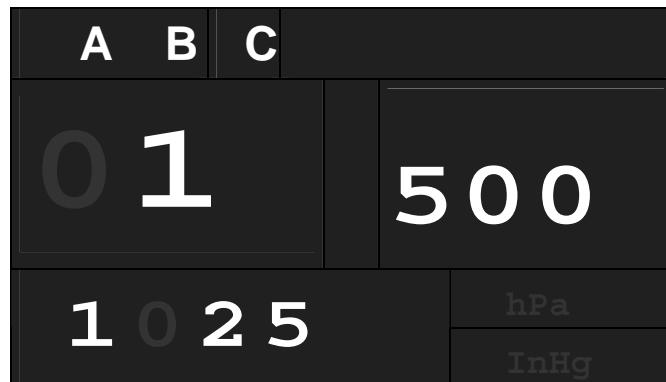


Fig. 5-1 Battery Test Display

The battery test stops if the manual maintenance mode is left or if the battery is discharged completely.

The totally measured accumulated current is stored as battery capacity in mAh.

5.3.3 Display 2: High Resolution Altitude

The high resolution display indicates the baro corrected altitude in 1 foot resolution. Baro setting is displayed as set:

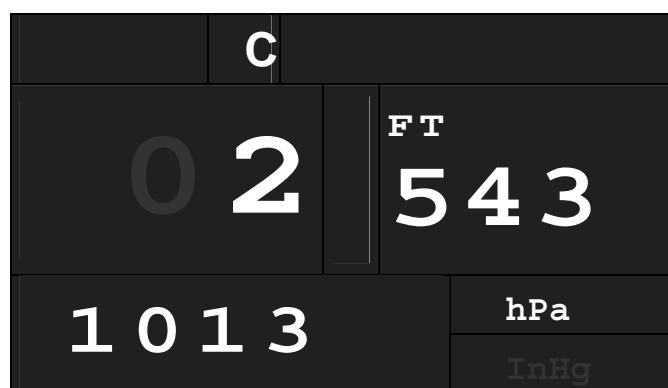


Fig. 5-2 High Resolution Altitude



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 62 of 72

Document No: AD-INSOP-800

Revision: 1.6

5.3.4 Display 3: Lighting Curve Selection

For four different aircraft types the lighting curves can be selected individually. Each lighting curve is assigned to one of the four lighting conditions shown in table below.

The adjustment for lighting configuration is related to the A/C type selected by the discrete inputs.

Lighting Condition Number	Lighting Condition Description
1	Dial Light Normal Mode
2	Dial Light Emergency Mode (only if battery equipped)
3	Back Light Normal Mode
4	Back Light Emergency Mode (only if battery equipped)

Table 5-3 Lighting conditions

To configure the lighting curves and to assign them to an A/C type the following procedure shall be performed :

- 1.) Enter manual maintenance mode and select Lighting Curve Selection display.
- 2.) The lighting condition number is shown in center line on the left side. The currently configured lighting curve number for this lighting condition is shown on the right side. Display 3 is shown at bottom line.

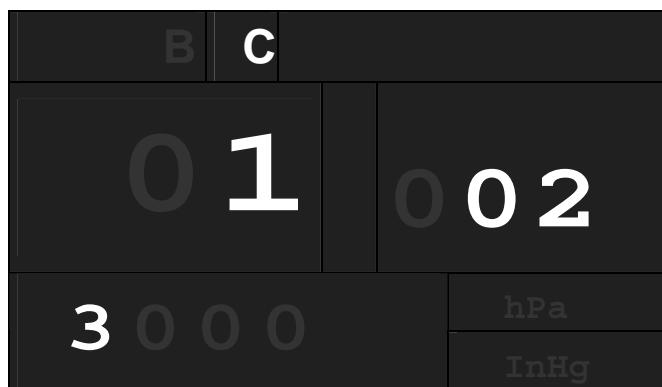


Fig. 5-3 Lighting Curve Selection Display

- 3.) Start the configuration by pushing TEST button once shortly. The currently configured lighting curve number on the right side blinks.



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 63 of 72

Document No: AD-INSOP-800

Revision: 1.6

- 4.) The lighting curve number is increased by pushing the UNIT button.

Select the lighting curve number that shall be assigned to the selected lighting condition number.

If the upper limit of lighting curve numbers is reached the lighting curve number rolls over to the first lighting curve.

- 5.) Confirm the selected lighting curve by pushing the TEST button.

The selected lighting curve is stored and the next lighting condition number appears. The currently configured lighting curve number for this lighting condition blinks.

- 6.) Repeat step 4.) and 5.) until the lighting curve for lighting condition number 4 is selected and confirmed.

Note: The new setting is stored and used by the instrument after lighting condition 4 is confirmed.

Cancel adjustments by pushing the TEST button for > 3 s during adjustment (restarts the instrument). The previous settings will be used and all changes are disregarded.

5.3.5 Display 4: Lighting Curve Adjustment

This function is used to adjust the lighting characteristics of the instrument. Each dim step can be adjusted in relation to the applied lighting voltage.

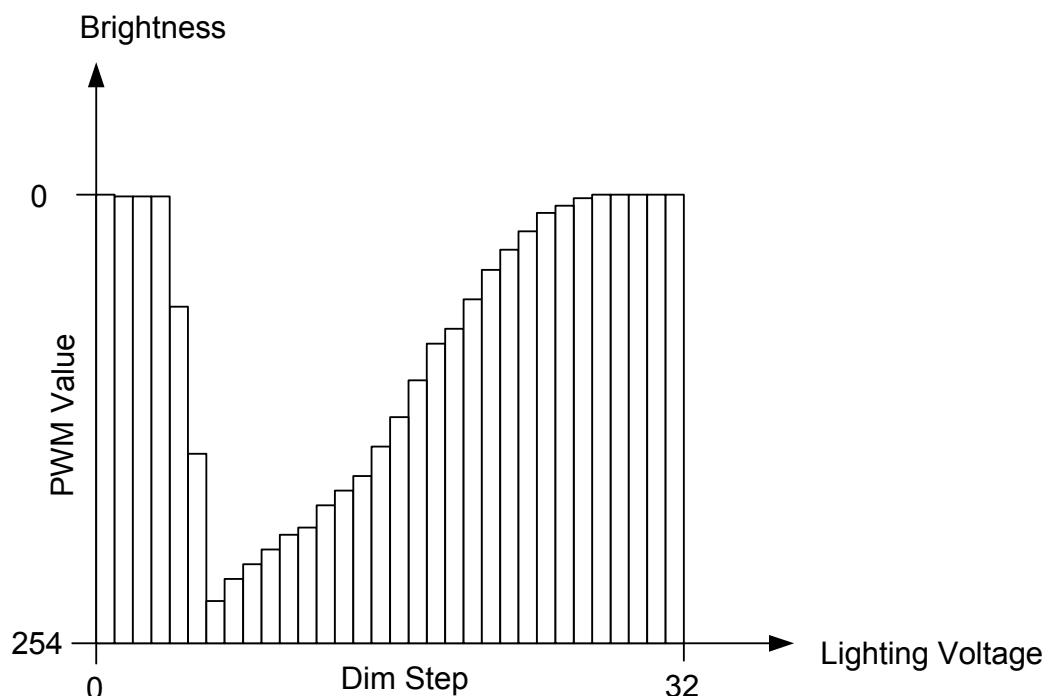


Fig. 5-4 Lighting Curve Adjustment

The following procedure shall be performed to set new brightness levels:

- 1.) Enter manual maintenance mode and select lighting curve adjustment display 4
- 2.) The selected lighting condition number and the current dim step (according to the applied lighting voltage) are shown.

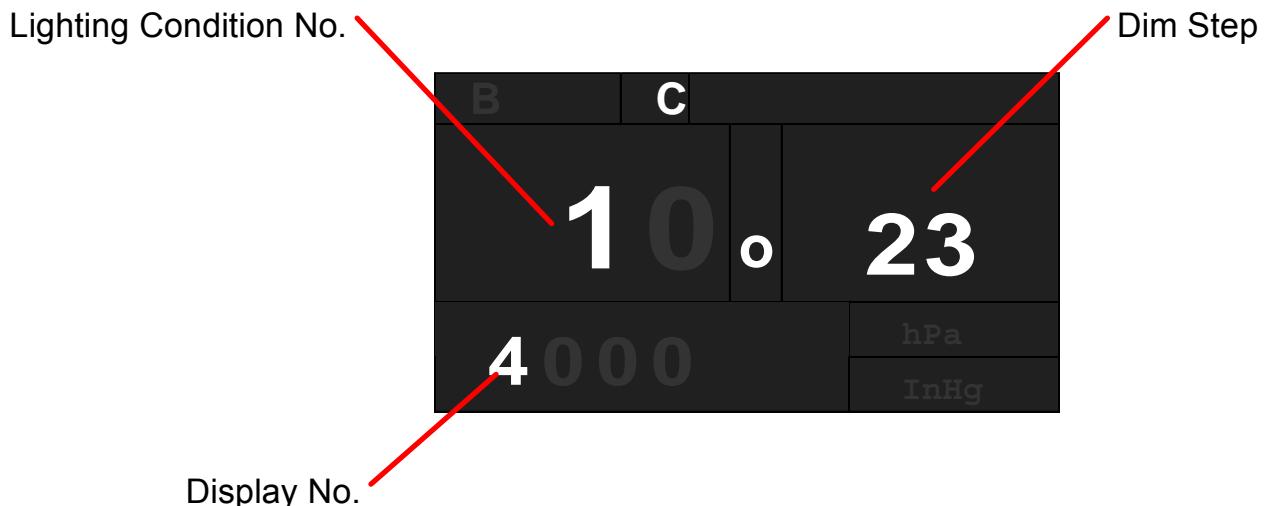
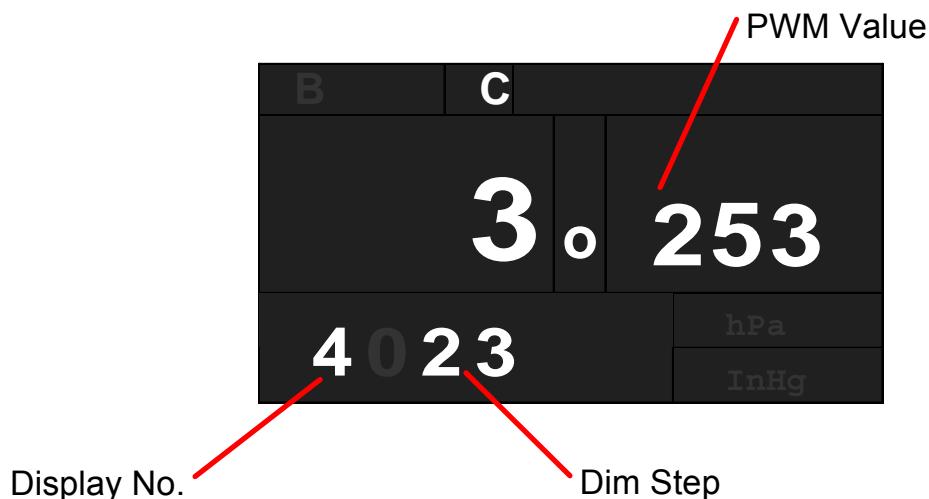


Fig. 5-5 Lighting Curve Adjustment Display

- 3.) Start the adjustment by pushing the TEST button once shortly.
The currently selected lighting condition number on the left side blinks.
- 4.) Select the lighting condition number that shall be modified by pushing the TEST button.
The lighting condition number is increased by pushing the test button.

If the upper limit of lighting condition numbers is reached the lighting condition number rolls over to the first lighting condition and the adjustment is cancelled.
- 5.) Select the dim step to be adjusted by varying the external lighting voltage.
The dim step increases if the lighting voltage is increased and vice versa.

- 6.) Confirm the adjustment by pushing the UNIT button. The following display appears. The current PWM value for the selected dim step blinks.



- 7.) The PWM value is increased while pushing the UNIT button and decreased while pushing the TEST button.
Increasing the PWM value will reduce the display brightness and vice versa.
- 8.) Save the adjusted PWM value by pushing the TEST button twice shortly (double click) (Minimum two dim steps must be adjusted / remaining dim steps are interpolated / extrapolated).
- 9.) Continue with step 4.) until the lighting characteristic is adjusted to your requirements
- 10.) **Save** the lighting curve by pushing the TEST button twice shortly (double click).
Cancel the lighting curve adjustment without saving by pushing the TEST button for > 1 s.



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 67 of 72

Document No: AD-INSOP-800

Revision: 1.6

6 Appendices

6.1 APPENDIX I: Function Overview

● = standard feature ○ = optional feature

Features	Specification	AD20
Basic Functions		
Altitude Range	- 1,000 ... 55,000 ft	●
Certification	ETSO/TSO-C10b	●
	RTCA/DO-178B, Level A	●
Baro Setting Knob		●
Baro Setting push to Standard	Reset to 29.92 inHg / 1013.25 hPa	●
Unit Selection button	inHg / hPa, ft / m	●
Test button		●
Lighting	Lighting color white	●
Power Supply		
Primary power supply	28 VDC	●
Emergency Battery power supply	Internal Battery	○
Lighting power supply	5 VDC or 28 VDC	●
Inputs		
TEST activation	Discrete input	●
Battery activation	Discrete input	○
A/C Type selection	Discrete input	●
Day/Night switch	Discrete input	●
Metric Unit Selection	Discrete input	●



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 68 of 72

Document No: AD-INSOP-800

Revision: 1.6

Features	Specification	AD20
Outputs		
ARINC 429	2 transmit channels	○
Warning Flag Valid Output	Discrete output	●
Battery Status	Discrete output	○
Interfaces digital		
RS232	For maintenance & repair	●
Air Data Parameters	via ARINC 429 - Interface	○
Pressure altitude (1013.25 hPa)	Label 203	○
Baro corrected altitude #1	Label 204	○
Baro Correction mb #1	Label 234	○
Baro Correction inHg #1	Label 235	○
Altitude Rate ROC	Label 212	○
Static Pressure	Label 217	○
Discrete Word #1	Label 270	○
Maintenance Word #1	Label 350	○
Functions		
BIT Failure memory		●
Battery low power Warning	Amber LCD, Indicator "B" blinking, Battery Status alternating discrete output	○
Display		
LCD / Pointer		●
LCD Backlight	with external brightness control	●
Altitude Unit	Feet / Meter selectable by user	○
Baro counter display	inHg / hPa selectable by user	●



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 69 of 72

Document No: AD-INSOP-800

Revision: 1.6

Features	Specification	AD20
Case	ARINC 408, 2 inches	●
Electrical Connectors	MS3112E-14-19P (MIL-C-26482 Series 1)	●
Environmental Conditions	RTCA/DO-160D	●
Operating temperature	-30 ... 70°C (-22 / +158 °F)	●
Storage temperature.	-55 ... 85°C (-67 / +185 °F)	●
Software	RTCA/DO-178B Level A	●
Diverse	Maintenance SW Package	O
	CMM	O
	MTBF, calculated (version without battery and without ARINC 429-IF)	54'000 h

Table 6-1 Function Overview



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 70 of 72

Document No: AD-INSOP-800

Revision: 1.6

6.2 APPENDIX II: Failure Codes

The test duration determines the time span in which the failure shall be detected after the test is executed. After the failure is detected the failure must obtain for the time span of the confirmation period before it is handled and indicated.

FC	Description	Failure Class / Criticality	Instrument Reaction for user
001	Program checksum invalid	CRIT	According to Failure Class Definition
002	Parameter checksum invalid	CRIT	According to Failure Class Definition
005	RAM Test failure	CRIT	According to Failure Class Definition
006	CPU Test failure	CRIT	According to Failure Class Definition
007	Watchdog error during initiated test or critical fail occurs ten times in sequence (prevent from permanent restart)	CRIT	According to Failure Class Definition
010	ARINC 429 Interface Hardware Failure	CRIT	According to Failure Class Definition
012	I2C bus interface failure	CRIT	According to Failure Class Definition
013	Configuration not valid or not initialized	CRIT	According to Failure Class Definition
014	Configuration register read back of the I/O expander are not correct	CRIT	According to Failure Class Definition
021	Power failure of +3.3V	CRIT	According to Failure Class Definition
022	Power failure of +5V	CRIT	According to Failure Class Definition
024	Power failure of +15V or +15 over current	CRIT	According to Failure Class Definition Disable +15V supply in case of over-current
025	Power failure of -15V or -15 over current	CRIT	According to Failure Class Definition Disable -15V supply in case of over-current
027	Internal A/D-C reference not present for > 1 s	CRIT	According to Failure Class Definition
028	Error in the Power backup system detected	TOL	According to Failure Class Definition
040	A/D-C Error of Static pressure sensor detected	CRIT	According to Failure Class Definition



REVUE THOMMEN AG
CH-4437 Waldenburg

AD20 Standby Altimeter

Page 71 of 72

07-Sep-2009

Document No: AD-INSOP-800

Revision: 1.6

FC	Description	Failure Class / Criticality	Instrument Reaction for user
042	Static Pressure range exceeded < 30 hPa OR > 1100 hPa for >2 s or A/D-C Values of pressure sensor are out of range (label 270)	CRIT	According to Failure Class Definition
044	Altitude (ALTC or ALTP) range exceeded < MINALT OR > MAXALT for >2 s	NONC	According to Failure Class Definition
051	Altitude Rate range exceeded > MINMAX ALTRATE for >2 s (label 212)	NONC	According to Failure Class Definition
055	A/D-C Error of Static Sensor Temperature sensor detected	CRIT	According to Failure Class Definition
060	Pointer Position not valid for three times black/white sectors of motor movement detection disc shall be checked	CRIT	According to Failure Class Definition
061	LCD data feedback not correct	CRIT	According to Failure Class Definition
070	Control of WFVOutput switch not correct for >2 s	TOL	According to Failure Class Definition
80	Instrument is not initialized	CRIT	According to Failure Class Definition
81	Battery fault detected	TOL	According to Failure Class Definition
255	An unknown error code was detected. This failure is a provision for the error handler to handle any error code in a well defined state.	CRIT	According to Failure Class Definition

Table 6-2 Failure Codes



REVUE THOMMEN AG
CH-4437 Waldenburg

07-Sep-2009

AD20 Standby Altimeter

Page 72 of 72

Document No: AD-INSOP-800

Revision: 1.6

6.3 APPENDIX III: Altimeter Calibration Table

Altitude [feet] (Baro setting 1'013 hPa)	Tolerance acc. to ETSO/TSO-C10b ± [feet]	
	@ 25 °C (77 °F)	@ - 30 / + 71°C 1) (-22 / +160 °F)
-1'000	20	--
0	20	40
500	20	--
1'000	20	--
1'500	25	--
2'000	30	--
3'000	30	--
4'000	35	--
6'000	40	60
8'000	60	--
10'000	80	--
12'000	90	90
14'000	100	--
16'000	110	--
18'000	120	120
20'000	130	--
22'000	140	--
25'000	155	155
30'000	180	--
35'000	205	205
40'000	230	--
45'000	255	--
50'000	280	280
55'000	(305)	--

Table 6-3 Altimeter Calibration Table

1) allowable change from room temperature scale error test indication