Automatic Direction Finder

ADF 3500 System

upwards serial no.: 1001

System Manual

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Section I GENERAL INFORMATION

1.1 Introduction

The following system manual describes the automatic direction finding equipment ADF 3500 - ( ) (upwards serial no. 1001). The manual DV 30613.03 contains the following section:

Section		DV 30613.03
1	General Information	X
2	Installation	X
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1.2 Purpose of equipment

The ADF 3500 system comprises automatic radio compass direction finding equipment which operates in the 190 kHz - 1799.5 kHz range and at 2182 kHz ± 5 kHz and which has been developed for use in aircraft. The equipment has been designed to meet the requirements of JTSO-2C41d. For operational requirements under environmental conditions, EUROCAE/RTCA ED-14C/DO-160C has been taken as a standard. In the certified Environmental Categories, there are practically no restrictions for use of the receiver, the RMI converters in rigid airframe attachment, as well as for use of the indicator in the instrument panel of aircraft.

In demonstration tests, all systems were shown to be functional at operating pressures equivalent to altitudes of up to 50.000 feet.

1.3 Variants survey

ADF 3500 System		
Variant ADF 3502 - ( )	consist of	AD 3502 - ( ) ADF- Receiver or RA 3502 - ( ) ADF- Receiver, remote controlled by a CU 5502 - ( ) ID 3502 - ( ) Indicator AN 3500 Antenna
Variant ADF 3503 - ( )	consist of	AD 3502 - ( ) ADF- Receiver or RA 3502 - ( ) ADF- Receiver, remote controlled by a CU 5502 - ( ) AC 3503 - ( ) RMI Converter Standard synchro x, y, z AN 3500 Antenna
Variant ADF 3504 - ( )	consist of	AD 3502 - ( ) Receiver or RA 3502 - ( ) ADF- Receiver, remote controlled by a CU 5502 - ( ) AC 3504 - ( ) RMI Converter sin/cos Output AN 3500 Antenna

Table 1-1 List available variants of the Radio Compass System

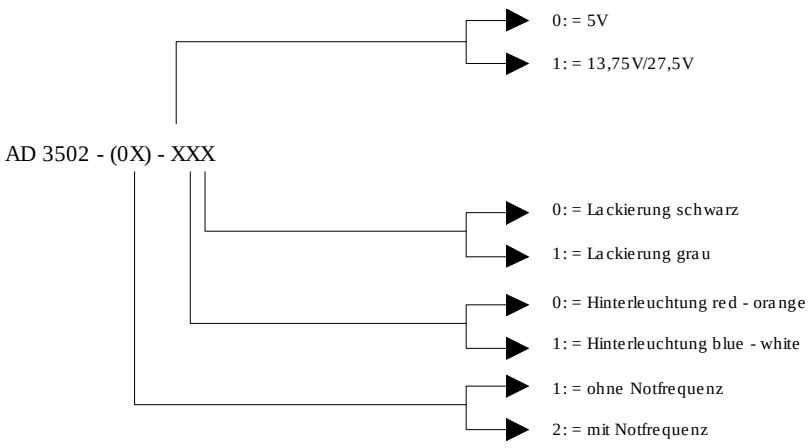
1.3.1 Variants survey Receiver AD 3502 - ( )

The following table lists the variants models of the ADF- Systems. Externally, the variants are identical, i.e. their dimensions, mounting depth etc. are the same in all cases.

Type designation / Part No.: / Article-No.:	Panel illumination		additional 2182 kHz	Illumination behind		Panel-surface	
	13.75 V / 27.5 V DC	5 V AC/DC		red-orange	blue-white	black	grey
AD 3502 - (01) - (110) 0514.209-912	X	-	-	-	X	X	-
AD 3502 - (01) - (110) 0515.310-912 CIG	X	-	-	-	X	X	-
AD 3502 - (01) - (111) 0511.803-912	X	-	-	-	X	-	X
AD 3502 - (01) - (010) 0514.233-912	-	X	-	-	X	X	
AD 3502 - (01) - (011) 0511.821-912	-	X	-	-	X	-	X
AD 3502 - (02) - (110) 0514.217-912	X	-	X	-	X	X	
AD 3502 - (02) - (111) 0511.811-912	X	-	X	-	X	-	X
AD 3502 - (02) - (010) 0514.241-912	-	X	X	-	X	X	-
AD 3502 - (02) - (011) 0511.838-912	-	X	X	-	X	-	X

Table 1-2 List available variants of the ADF- Receiver AD 3502 - ( )

Code of the type designation



1.3.2 Variants survey ADF- Receiver RA 3502 - ( ) remote controlled

Type designation Part- No.	Article-No.:	Frequency range 190 -1799.5 MHz	additional 2182 kHz
RA 3502 - (01) mounting plate included mounting plate not included	 0505.757-912 0576.786-912	X	
RA 3502 - (02) mounting plate included mounting plate not included	 0506.133-912 0576.794-912	X	X

Table 1-3 List aviable variants of the ADF- Receiver RA 3502 - ( ) remote controlled.

1.3.3 Variants survey Control Unit CU 5502 - ( )

Type designation Part-No.:	Article-No.:	Background lighting		Panel surface	
		red-orange	blue-white	Powder coated	Painted
CU 5502 - (1) - 101	0503.800-911	X			X
CU 5502 - (1) - 111	0508.500-911		X		X

Table 1-4 List aviable variants of the Control Unit CU 5502 - ( )

1.3.4 Variants survey Converter and Indicator ID 3502-( )

Type designation Part- No.:	Article-No.:	Panel illumination	Panel illumination	
		13.75 V / 27.5 V DC	5 V AC / DC	
ID 3502-(1)-(01)	0855.995-912	X		
ID 3502-(1)-(02)	0856.002-912		X	
ID 3502-(2)-(01	0574.821-912	X		Master
ID 3502-(3)-01	0574.831-912	X		Slave

Table 1-5 List aviable variants of the Converter and Indicator ID 3502-( )

1.3.5 Variants survey RMI Converter AC 3503 - ( ) / AC 3504 - ( )

Type designation Part-No.:	Article-No.:	Standard RMI x, y, z	sin/cos 2 - 5 V DC	sin/cos 5 - 10 V DC
AC 3503 - (1) mounting plate included	0822.590-912	X		
AC 3504 - (1) mounting plate included mounting plate not included	 0856.010-912 0576.808-912		X	
AC 3504 - (2) mounting plate included	0856.029-912			X

Table 1-6 List aviable variants of the RMI- Converter AC 3503 - ( ) / AC 3504 - ( )

1.4 General description

The mechanical design of the receiver is robust and well-suited for installation in all types of aircraft. The receiver was developed to meet the requirements of JTSO-2C41d (RTCA DO-179). In the environmental categories for which it is certified, there are no restrictions for use of the unit in instrument panels, operating consoles or direct rigid attachment to the airframe of all aircraft.

1.4.1 ADF- Receiver AD 3502 - ( )

The receiver was developed as a single-block unit. Its dimensions correspond to the ARINC standard for control equipment. It is held in place by means of four DZUS fasteners. All controls, indicators and displays are located on the front plate. The back of the unit contains: the unit connector plug for connection to the aircraft wiring system, and the antenna jack.

The receiver AD 3502 - (2) can be used to receive 2182 kHz (additional emergency frequency). The frequencies are indicated by two LC displays. The required active working frequency can be set using the frequency selector switches. The outer rotary switch engages at steps of 100 kHz / 10 kHz and the inner rotary switch at steps of 2 kHz / 500 Hz. In the frequency preselection mode, a faster frequency change between the set active frequency and the preset frequency is achieved by pressing the (<->) exchange key.

The ADF receiver is switched on using the volume control. In the REC mode the ADF receiver operates as a receiver in the A2/A3 mode, in the ADF mode as a radio direction finder and in the BFO mode it operates in reception mode as an A1 beat frequency operator and radio direction finder.

The volume is set using the volume control.

1.4.2 ADF- Receiver RA 3502 - ( ) remote controlled

The navigation receiver is designed for installation in the avionics compartment.

On the front side are mounted :.

The equipment connector for connecting to the aircraft system.
The antenna socket for connecting the AN 3500 antenna.

The electronic system of the unit consists of the following circuit boards, which are connected to each other by connectors.

- 1. Chassis board
- 2. Receiver board
- 3. Processor board
- 4. Interface board

The interface board and processor board are plugged into each other and held together by five bolts. Both together are then secured to the front panel by three bolts.

The microcontroller as well as the necessary storage and peripheral components are located on the processor board.

The receiver board is mounted over the chassis board and secured to it by four bolts.

The ADF- Receiver is designed as a single superheterodyne receiver and operated in the 190.0 to 1799.5 kHz frequency range with a channel separation of 500 Hz. The oscillator frequency for the receiver is generated in a VCO (voltage control oscillator). The VCO is controlled by a digital frequency processing circuit on the chassis board. The digital frequency processing and storage are processor-controlled.

The ADF- Receiver RA 3502 - (02) also can receive on the 2182 kHz emergency frequency.

1.4.3 Control Unit CU 5502 - ( )

The control unit is designed for installation in the instrument panel of an aircraft. The dimensions correspond to the ARINC standard for instruments of 60 mm (2 1/4") diameter. Installation is by means of four bolts (back panel mounting).

All the controls and indicators are located on the front panel. The equipment connectors are fitted on the back.

The control unit consists of the following circuit boards:

Display Board,
Switch Board,
Processor Board,
Power Supply Board.

1.4.4 Converter and Indicator ID 3502 - ( )

The converter and indicator ID 3502 - ( ) presents the bearing information relative to the centerline of the aircraft in which an RF-Signal is incident. The converter and indicator is located in the instrument panel.

A variable resistance control permits quadrantal error correction to approx. 20° on the front panel without having to remove the indicator.

1.4.5 Antenna AN 3500

The antenna AN 3500 comprises the loop antenna, the sense antenna and the corresponding amplifier and the electronic switch.

1.4.6 RMI Converter AC 3503 - ( )

The RMI converter AC 3503 supplies a 3 wire standard synchro-signal to drive max. two RMI-Indicator (Standard ARINC-synchros x, y, z).

1.4.7 RMI Converter AC 3504 - ( )

The RMI converter AC 3504 - ( ) supplies control signals sinus/cosinus 2V - 5V DC-voltage or sinus/cosinus 5V - 10V DC-voltage to drive a RMI-Indicator.

1.4.8 Operation at 14 V DC supply voltage

Using the voltage converter VR 3001 - (1), variant ADF 3502 can be operated from a 14 V DC power supply voltage.

1.5 Technical data

1.5.1 General data

Power supply

AD 3502 - ( )	27.5 V DC
RA 3502 - ( )	27.5 V DC
CU 5502 - ( )	27.5 V DC
ID 3502 - ( )	27.5 V DC
AC 3503 - ( )	27.5 V DC; 26 V / 400 Hz AC
AC 3504 - ( )	27.5 V DC
AN 3500	Power supply via AD 3502-()/RA 3502-()

Current consumption

AD 3502 - ( )	0.650 A
RA 3502 - ( )	0.650 A
CU 5502 - ( )	0.060 A
ID 3502 - ( )	0.200 A
AC 3503 - ( )	0.450 A
AC 3504 - ( )	0.450 A
AN 3500	0.050 A

Illumination

AD 3502 - ( )

Operating voltage DC	13.75 V / 27.5 V
Current consumption typ.	0.5 A / 0.3 A
Operating voltage AC	5 V
Current consumption typ.	1.4 A

CU 5502 - ( )

Operating voltage DC	13.75 V / 27.5 V
Current consumption typ.	0.16 A / 0.08 A

ID 3502 - ( )

Operating voltage DC	13.75 V / 27.5 V
Current consumption typ.	0.08 A / 0.04 A
Operating voltage AC	5 V
Current consumption typ.	0.24 A

1.6 System Specifications

Receiver type	Single conversion superheterodyne
Frequency range	190 kHz - 1799.5 kHz additional 2182 kHz ± 5 kHz
Channel spacing	500 Hz
Selectivity	1 kHz = 0 dB 1.5 kHz ≥ 6 dB 2 kHz ≥ 12 dB 3 kHz ≥ 30 dB 4 kHz ≥ 45 dB 5 kHz ≥ 60 dB 6 kHz ≥ 75 dB 7 kHz ≥ 80 dB
Sensitivity	70mV/m for ≥ 6 dB $\frac{S + N}{N}$; m = 30%
Bearing accuracy	≤ 3° at 70mV/m (190 kHz - 850 kHz) ≤ 8° at 70mV/m (≥850 kHz)
AGC characteristic	≤ 8 dB from 100mV/m - 0.5 V/m
Audio frequency range	≥ 6 dB from 350 Hz - 1100 Hz
Audio output	≥ 5.5 V / 300 W

1.6.1 Environmental data

AD 3502 / CU 5502 - ( ) / ID 3502

Operating temperature	- 20° C . . . + 55° C shorttime + 70° C
RA 3502 - ( ) upwards serial no.: 2000	- 40° C . . . + 55° C shorttime + 70° C
Storage temperature	- 55° C . . . + 85° C
Operating altitude	50.000 ft.
EUROCAE/RTCA ED-14C/DO-160C	Env.Cat. [A1D1]-BA(MN) XXXXXXZBABATZXXX

AC 3503 / AC 3504 / AN 3500

Operating temperature	- 55° C . . . + 70° C
Storage temperature	- 55° C . . . + 85° C
Operating altitude	50.000 ft.
EUROCAE/RTCA ED-14C/DO-160C	Env.Cat. D2-BA(MN) XXXXXXZBABATZXXX

1.6.2 Mechanical Dimensions and Weights

Receiver AD 3502 - ( )

Front panel	146 x 47.5 mm
Casing depth	245 mm
Weight	1 kg

Receiver RA 3502 - ( ) remote controlled

Front panel	139 x 50 mm
Casing depth	253 mm
Weight	1 kg

Control unit CU 5502 - ( )

Front panel	61.3 x 61.3 mm
Casing depth	62 mm
Weight	0.26 kg

Converter and Indicator ID 3502 -( )

Front panel	82.55 x 82.55
Casing depth	135 mm
Weight	0.5 Kg

RMI-Converter AC 3503 - ( ) / AC 3504 - ( )

Dimension	214 x 139 x 54 mm
Weight	0.75 kg

Antenna AN 3500

Dimension	330 x 190 x 54 mm
Weight	1.7 kg

1.6.3 Certifications

LBA no. 10.921/53JTSO

BZT approval no.

AD 3502 - ( )	A107418D LB
ID 3502 - ( )	
AC 3503 - ( ) / AC 3504 - ( )	
RA 3502 - ( )	A132 880 J
CU 5502 - ( )	

1.6.4 Software

Synthesis, storage and indication of frequencies are microprocessor controlled. The corresponding software has been assigned to criticality level ESSENTIAL LEVEL 2

as defined in the guidelines of EUROCAE/RTCA ED-12A/DO-178A

It has been assigned to the following User Class: CLASS X

1.6.5 Design Specification

JTSO-2C41d

RTCA DO-179 Category A

EUROCAE/RTCA	ED-14C/DO-160C
EUROCAE/RTCA	ED-12A/DO-178A

1.7 Environmental Qualification AD 3502 - ( ) / CU 5502 - ( ) / ID 3502 - ( )

The following performance standards under environmental test conditions have been established in accordance with the procedures set forth in EUROCAE/RTCA ED-14C/DO-160C Env. Cat. [A1D1] -BA(MN)XXXXXXZBABATZXXX.

Environmental condition	ED-14C/ DO-160C	Category	Performance
Temperature	4.0	A1 D1	
Low operating temperature	4.5.1		- 20° C
Low ground survival (storage temperature)			- 55° C
High short-time operating temperature	4.5.2		+ 70° C
High operating temperature	4.5.3		+ 55° C
High ground survival (storage) temperature			+ 85° C
Min. operating pressure (equivalent altitude)	4.6.1		50.000 ft.
Decompression	4.6.2		from 8000 ft. to 50.000 ft. altitude
Overpressure	4.6.3		- 15.000 ft.
Temperature variation	5.0	B	
Humidity	6.0	A	48 hrs at up to 50° C and 95% relative humidity
Shock :	7.0		
Operational shocks	7.2		11 ms at 6 G for all three dimensional axes
Crash safety shocks	7.3		11 ms at 15 G for all three dimensional axes acceleration 12 G
Vibration	8.0	MN	
Magnetic effect	15.0	Z	Deflection of 1° of compass at a distance of ≥30 cm
Power input variation	16.0	B	Test confirmed that the equipment functions on a 20 volt emergency power supply
Resistance to voltage spikes on equipment power leads	17.0	A	
Audio-frequency conducted susceptibility	18.0	B	
Susceptibility to induced magnetic and electric fields at 400 Hz	19.0	A	
Radio-frequency interference susceptibility	20.0	T	
Spurious RF emissions	21.0	Z	

1.8 Environmental Qualification AC 3503 - ( ) / AC 3504 - ( ) / AN 3500

The following performance standards under environmental test conditions have been established in accordance with the procedures set forth in EUROCAE/RTCA ED-14C/DO-160C Env. Cat. D2-BA(MN)XXXXXXZBABATZXXX.

Environmental condition	ED-14C/ DO-160C	Category	Performance
Temperature	4.0	D2	
Low operating temperature	4.5.1		- 55° C
Low ground survival (storage temperature)			- 55° C
High short-time operating temperature	4.5.2		70° C
High operating temperature	4.5.3		+ 55° C
High ground survival (storage) temperature			85° C
Min. operating pressure (equivalent altitude)	4.6.1		50.000 ft.
Temperature variation	5.0	B	
Humidity	6.0	A	48 hrs at up to 50° C and 95% relative humidity
Shock :	7.0		
Operational shocks	7.2		11 ms at 6 G for all three dimensional axes
Crash safety shocks	7.3		11 ms at 15 G for all three dimensional axes acceleration 12 G
Vibration	8.0	MN	
Magnetic effect	15.0	Z	Deflection of 1° of compass at a distance of ≥30 cm
Power input variation	16.0	B	Test confirmed that the equipment functions on ≥20 volt emergency power supply
Resistance to voltage spikes on equipment power leads	17.0	A	
Audio-frequency conducted susceptibility	18.0	B	
Susceptibility to induced magnetic and electric fields at 400 Hz	19.0	A	
Radio-frequency interference susceptibility	20.0	T	
Spurious RF emissions	21.0	Z	

1.9 Accessories

Handbook

System manual ADF 3500 - ( ) DV 30613.03	Article-No.: 0514.942-071
Operating instructions upwards serial no. 1001	Article-No.: 0515.851-071

1.9.1 ADF- Receiver AD 3502 - ( ) (upwards serial no. 1001)

ADF- Receiver AD 3502 - ( ) (upwards serial no. 1001)	Article-No.: see variants survey

Connector kits

CK 3501-S for RA/AD 3502-(xx), soldering	Article-No.: 0835.374-954
includes:	
cable connector 37 pin	Article-No.: 0211.184-277
Connector shell with sliding closure 1	Article-No.: 0775.231-277
Coding pin	Article-No.: 0782.211-277
Coax Plug	Article-No.: 0725.706-277
Label ”ADF”	Article-No.: 0711.136-258
CK 3501-C for RA/AD 3502-(xx), crimp	Article-No.: 0523.925-954
includes:	
cable connector 37 pin	Article-No.: 0780.677-277
Connector shell with sliding closure 1	Article-No.: 0775.231-277
Coding pin	Article-No.: 0782.211-277
Coax Plug	Article-No.: 0725.706-277
Label ”ADF”	Article-No.: 0711.136-258

Handbooks

Installation and Operation DV 30612.03	Article-No.: 0514.977-071
Maintenance and Repair DV 30612.04	Article-No.: 0514.985-071

1.9.2 ADF- Receiver RA 3502 - ( )

ADF- Receiver RA 3502 - (01) mounting plate included	Article-No.: 0505.757-912
ADF- Receiver RA 3502 - (01) without mounting plate	Article-No.: 0576.786-912
ADF- Receiver RA 3502 - (02) mounting plate included	Article-No.: 0506.133-912
ADF- Receiver RA 3502 - (02) without mounting plate	Article-No.: 0576.794-912
Mounting plate	Article-No.: 0821.128-283

Connector kits

CK 3501-S for RA/AD 3502-(xx), soldering	Article-No.: 0835.374-954
includes:	
cable connector 37 pin	Article-No.: 0211.184-277
Connector shell with sliding closure 1	Article-No.: 0775.231-277
Coding pin	Article-No.: 0782.211-277
Coax Plug	Article-No.: 0725.706-277
Label ”ADF”	Article-No.: 0711.136-258
CK 3501-A for RA/AD 3502-(xx), crimp	Article-No.: 0523.925-954
includes:	
cable connector 37 pin	Article-No.: 0780.677-277
Connector shell with sliding closure 1	Article-No.: 0775.231-277
Coding pin	Article-No.: 0782.211-277
Coax Plug	Article-No.: 0725.706-277
Label ”ADF”	Article-No.: 0711.136-258

Handbooks

Installation and Operation DV 60604.03	Article-No.: 0511.641-071
Maintenance and Repair DV 60604.04	Article-No.: 0511.651-071

1.9.3 Control Unit CU 5502 - ( )

Control Unit CU 5502 - ( )	Article-No.: see variants survey
4 Phillips head screw	Article-No.: 0868.590-203
or	
4 countersunk screw	Article-No.: 0889.350-204
Equipment cable socket 15-pole (crimped version)	Article-No.: 0774.030-277
Equipment cable socket 15-pole (soldered version)	Article-No.: 0344.801-277
Housing with push-in locking	Article-No.: 0774.049-277

Manuals

Installation and Operation DV 60531.03	Article-No.: 0511.481-071
Maintenance and Repair DV 60531.04	Article-No.: 0511.498-071
Operating instructions	Article-No.: 0511.757-071

1.9.4 Converter and Indicator ID 3502 - ( )

Converter and Indicator ID 3502-(1)	Article-No.: see variants survey
15 pin Cable connector set soldering	Article-No.: 0891.576-954
consisting of	
Cable connector 15-pin	Article-No.: 0726.303-277
Case with mounting Articles	Article-No.: 0774.049-277
Label ADF	Article-No.: 0711.136-258
15 pin Cable connector set crimp	Article-No.: 0523.933-954
consisting of	
Cable connector 15-pin	Article-No.: 0812.803-277
Case with mounting Articles	Article-No.: 0774.049-277
Label ADF	Article-No.: 0711.136-258
9 pin Cable connector set crimp	Article-No.: 0566.688-954
consisting of	
Cable connector 9-pin	Article-No.: 0832.448-277
Case with mounting Articles	Article-No.: 0799.191-277
Contact pin	Article-No.: 0832.456-258

Manuals

Maintenance and Repair DV 30650.04	Article-No.: 0870.870-071

1.9.5 RMI- Converter AC 3503 - ( ) / AC 3504 - ( )

RMI- Converter AC 3503 - (01)	Article-No.: see variants survey
RMI- Converter AC 3504 - (01)	Article-No.: see variants survey
RMI- Converter AC 3504 - (02)	Article-No.: see variants survey
Mounting plate	Article-No.: 0310.794-283

Connector kits

CK 3503-S for AC 350X-(X), soldering	Article-No.: 0836.036-954
includes:	
Cable connector 25 pin	Article-No.: 0725.021-277
Case with mounting articles	Article-No.: 0775.479-277
Coding Pin	Article-No.: 0782.211-277
Label ”AC”	Article-No.: 0711.160-258

CK 3503-C for AC 350X-(X), crimp Article-No.: 0523.909-954
includes:
Cable connector 25 pin Article-No.: 0472.921-277
Case with mounting articles Article-No.: 0775.479-277
Coding Pin Article-No.: 0782.211-277
Label ”AC” Article-No.: 0711.160-258

Manuals

Maintenance and Repair DV 30640.04 Article-No.: 0870.862-071

1.9.6 Antenna AN 3500

Antenna AN 3500 (mounting kit included) Article-No.: 0832.601-912

Antenna AN 3500 (mounting kit not included) Article-No.: 0576.816-912

Mounting kit MK-AN3500-(1) with Gasket Article-No.: 0354.759-954

The mountink consist of:

Mounting washer metal	3 pieces
Head Screw M5x40	3 pieces
Gasket	1 pieces
Stencil	1 pieces

Mounting kit MK-AN3500-(2) without Gasket Article-No.: 0580.392-954

The mountink consist of:

Mounting washer metal	3 pieces
Head Screw M5x40	3 pieces
Stencil	1 pieces

Connector kits:

CK 3504-S for AN 3500, soldering Article-No.: 0518.468-954
includes:
Cable connector Article-No.: 0715.492-277

CK 3504-C for AN 3500, crimp Article-No.: 0576.824-954
includes:
Cable connector Article-No.: 0858.188-277

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Section II INSTALLATION

2.1 General

Installation of the ADF 3500 system components will depend on the aircraft type and equipment fitted, and thus only general instructions can be provided in this section.

2.2 Preinstallation Check

Unpack the equipment and inspect all assemblies for signs of damage. Check that all controls operate satisfactorily.

For bench testing the system, make up a test harness to interconnect antenna, receiver and indicator. In such cases, use an ADF test box (e.g. TIC CES - 116A) for testing correct operation of the ADF.

2.2.1 Operational Check

1. Connect the receiver, indicator and antenna together. Connect headphones and apply power supply.
2. Switch on the receiver and tune to different frequencies. Check the sensitivity.
3. Switch to ADF operating mode and tune to various frequencies. The bearing indicator shall move according to the position of the selected bearing of the ADF-TIC-Box. The indicated direction does not necessarily need to agree with the transmitter bearing at this stage.
4. Switch to BFO mode, and tune to various A0/A1 NDB stations. A tone of approx. 1000 Hz must be audible.

2.3 Mechanical Installation

2.3.1 Installing the Receiver AD 3502 - ( )

The receiver is designed for instrument panel or control console mounting in the aircraft.

The equipment is secured to the airframe by four DZUS fasteners. Mounting information for the fastener strips is compiled in Fig. 2-3, Fig. 2-2 shows all dimensions relevant to installing the receiver.

If a cutout having a width of 161 mm to 163 mm is already available in the instrument panel (American type aircraft) the remaining gap on either side may be closed by means of aluminium strips (8 x 20 mm). Smaller tolerances can be compensated by means of additional 1 mm gauge aluminium strips.

In aircraft where no panel cutout is provided, it can be produced in accordance with the dimensional requirements as per Fig. 2-3, it being good practice to use the flat fastener strips as shown in Fig. 2-3.

2.3.2 Installing the Receiver RA 3502 - ( )

The ADF receiver is designed for installation in an avionics compartment. To do this, the mounting plate must first be secured to an appropriate point in the avionics compartment using five bolts. The installation dimensions are given in Fig. 2-4. The ADF receiver is then pushed into the mounting plate and locked in place by two quick-release bolts.

2.3.3 Installing the Control Unit CU 5502 - ( )

The control unit is designed for installation in the instrument panel of an aircraft. It is constructed for rear panel mounting. The circular cutout and the attaching holes are to be drilled to suit a small instrument size. The necessary dimensional details are given in Fig. 2-5. The unit is attached using four bolts.

2.3.4 Installing the Indicator ID 3502 - ( )

The ID 3502 - ( ) indicator is manufactured according to standard instrument dimensions, so it can be installed in a standard cutout in the instrument panel. Installation should be located in the panel so that the pilot is able to read the instrument with minimum parallax error.

The indicator can be mounted from behind or from the front of the instrument panel. The dimensions and drilling templates are shown in Fig. 2-4.

2.3.5 Installing the Antenna AN 3500

The aircraft manufacturer usually provides information concerning the location of a loop antenna, which is equally suitable for locating the AN 3500 antenna. It is mandatory that the following requirements are checked prior to installing the antenna in the absence of any other information:

- The AN 3500 antenna can be mounted either above or below the fuselage, however, as near as possible to the aircraft centreline. In addition, the selected location should be away from airframe projections (fixed undercarriage, tail plane or radar) and as far away as possible from other antennas. This is essential to avoid signal distortion and thus inaccurate bearing indication. Furthermore, the antenna and its feeders must not be located in the vicinity of sources of RF interference such as inverters, motors, regulators, generators and their wiring. It should also be noted that inverters can give rise to magnetic interference and thus be detrimental to reception even though good screening may be provided.

- The AN 3500 antenna is designed to correct a quadrantal error of approx. 7° to 8°. If this built-in correction is not achieved after installation, additional correction of up to ± 20 ° can be provided by means of an infinitely variable adjustment on the indicator.

- In aircraft with a wooden or plastic airframe, an electric counterweight plate or panel must be located within the fuselage at the antenna location with a minimum dimension of 80 x 80 cm. A good connection between the electrical counterweight plate or panel and aircraft ground is required.

The installation dimensions is given in Fig. 2-8.

2.3.6 Installing the RMI-Converter AC 3503 - ( ) / AC 3504 - ( )

The RMI-Converter is intended for installation in the avionics compartment of the aircraft. The dimensions are shown in Fig. 2-7.

2.4 Installation Wiring

2.4.1 General

Fig. 2-9 - Fig. 2-12 shows the wiring needed in the aircraft for the Series ADF 3500 equipment for 28 V aircraft system power supply.

Only suitable aircraft cable should be used. Use AWG 22 for all wiring.
In addition, the following should be observed:

- Pull rubber sleeves over the soldered connections on unit connectors.
- A fuse or circuit breaker must be installed in the power supply line.
- Before switching on the equipment, carefully check the wiring, making particularly sure that the positive and negative poles have not been confused anywhere.

CAUTION !

No high-frequency cables should be tied in together with the wiring of the navigation system. The connecting lines must also not be laid together with cables carrying audio signals or pulsed information (e.g. IFCS, DME, XPR, slaved gyro). The same holds for the supply and control lines of autopilots.

2.4.2 Panel lighting ADF- Receiver AD 3502 - ( ) / Converter and Indicator ID 3502 - ( )

The ADF Receiver and the converter and indicator are equipped with panel lighting. The panel lighting may be connected to 5 V AC or to 13.75 V DC, or to 27.5 V DC supply voltage. If the panel lighting is connected to 13.75 V and 27.5 V respectively, the minus terminal of the lamps is internally grounded. For 5 V panel lighting both lamp terminals are run to the outside. Unless agreed otherwise, the units are set to 13.75 V or 27.5 V panel lighting, respectively. Adaptation for 5 V AC or 5 V DC is described in the circuit diagrams. In addition, 5 V lamps must be used.

Pin assignment of **ADF- receiver AD 3502 - ( )** (connector P 2)

5 V DC	Pin 9 (+) Pin 10 (-)
5 V AC	Pin 9 (~) Pin 10 (~)
13.75 V DC	Pin 10 (+)
27.5 V DC	Pin 9 (+)

Pin assignment **converter and indicator unit ID 3502 - ( )** (connector P 1)

5 V DC	Pin 8 (+) Pin 15 (-)
5 V AC	Pin 15 (~) Pin 8 (~)
13.75 V DC	Pin 8 (+) Pin 15 (-)
27.5 V DC	Pin 15 (+)

2.4.3 Panel and display lighting Control Unit CU 5502 - ( )

The control unit is fitted with panel and display lighting. It can also be connected via a dimmer system.

Connection panel and display lighting	13,75 V Power supply	27,5 V Power supply
P 31 - Pin 6 ILL.A	+ 13,75 V	Ground
P 31 - Pin 8 ILL.B	Ground	+ 27,5 V

NOTE

The panel and display lighting is not switched off when the unit is switched off ON/OFF switch).

2.5 Post-installation Check

2.5.1 General

After installing the equipment, check if the indicator reading is correctly and determine whether or not quadrantal error correction is necessary. If so, correction should be first carried out on the ground, then in the air. It is also necessary to establish whether any equipment in the aircraft electrical system is generating interference.

2.5.2 Operational Check

1. Locate the aircraft on the correction platform and using the bearing compass point the nose of the aircraft to a radio beacon in boundary range.
2. Switch on the ADF, adjust to the correct frequency and observe the indicator in the ADF operating mode. The indicator should read 0° relative bearing.
3. Turn the aircraft about its vertical axis to a larger heading; the indicator should move to the left.
4. Turn the aircraft about its vertical axis to a smaller heading; the indicator should move to the right.

If the reading is incorrect, or should the indicator move in the wrong direction, check the wiring of the equipment in accordance with the interwiring diagram and correct as necessary (antenna mounted top or bottom).

If the aircraft is accurately aligned with the NDB beacon, but a relative bearing reading of 0° is not indicated, this is an indication that the antenna has been wrongly installed. Recheck the antenna in accordance with the centreline of the aircraft and correct if necessary.

2.5.3 Electrical Interference

With the engines running and the aircraft electrical system on, check if radio beacons at boundary range can still be received without interference (compare with post-installation check as described above).

Should the reading be influenced by local interference, trace the source by systematically switching off the electronic equipment, generators, etc. on the aircraft to find out which component is causing interference. Then suppress interference accordingly.

Typical Sources of Interference are:

1. Generators, regulators

   Suggested inteference suppression procedure:

a) While fitting the antenna and the associated feeders wiring, make sure that these items of equipment are as far away as possible from the positive lead (from generator to battery).

b) Block the positive lead from the generator to the regulator with an electrolytic capacitor (max. 500µF) at the regulator end.

c) In the case of alternators, insert a filter (10 - 50µH, 10 - 100nF, e.g. Bosch 0290 002 002) in the lead connecting the regulator to the alternator field winding.

d) Insert a filter (e.g. Bosch 0290 003 009 / 75A) in the positive lead from the generator to the battery in the vicinity of the generator.

Proceed with suppression work as described in a) above until no further interference is detected.

2. Static inverters, choppers, DC converters:

   For interference suppression we suggest inserting a filter (e.g., Bosch 0290 003 006 / 6A) into the positive power supply lead close to the item concerned in order to isolate the harmonics of the chopper frequency from the aircraft wiring system.

3. RF interference:

   Interference resulting from the operation of transponder, DME or communications equipment may occur if the associated antenna has poor ground contact and the screen for the antenna connecting lead is thus causing radiation.

It is mandatory to always proceed in accordance with FAA AC 43.13-1A and FAA AC 43.13-2A requirements !

2.5.4 Quadrantal Error Correction

Ground Procedure

1. Point the nose of the aircraft to the NDB so that the indicator shows 0° relative bearing.
2. Set the aircraft directional gyro to 0°.
3. Turn the aircraft to 45° relative heading. The indicator should show 315°.
4. Turn the aircraft to 315° relative heading. The indicator should show 45° relative bearing.

If the indicated bearing deviates by more than 3°, when the aircraft ist turned to 45°, correct quadrantal error with the variable Resistor, which is located e.g. on the back of the

RMI-Converter AC 3503 - ( ) / AC 3504 - ( ) R 79
Converter and Indicator ID 3502- ( ) R 60

Variable Resistor R 60 is accessible on the front of the converter and indicator, when the left hand top mounting screw of the internal mounting hole circle is still to be inserted.

Flight Checking Procedure

Effects due to the ground of the undercarriage may cause the quadrantal error in the air to change from that established during ground testing, especially when the loop antenna is located under the fuselage.

1. Align the aircraft to a radio beacon roughly 60 km away (indicator = 0° relative bearing).
2. Set the direction of gyro to 0° relative heading.
3. Fly the aircraft as described in Fig. 2-1. Total deviation should not exceed ± 5.° The Table (Page 2-8) may be used during this procedure.

Alterations to indicator readings compared with the results of the ground test can be performed on the indicator during flight with the aid of the variable resistor R 60 or R 79. As described in the ground testing procedure, this control is accessible through the hole for the upper left mounting screw when this screw is removed prior to commencing the test flight (R 60). R 79 is accessible on the back of the RMI-Converter.

4. Fly over a radio beacon and note the behavior of the indicator. The bearing indicator should swing continously through 90° or 270° to a back bearing.

While flying directly over a NDB an uncertainity in bearing indication may occur for a certain time depending on the flight altitude. This uncertainty is caused by the cone of silence of the NDB. Within this cone of silence NDB reception is not possible. When leaving the cone of silence the bearing indicator will immediately show the correct bearing.

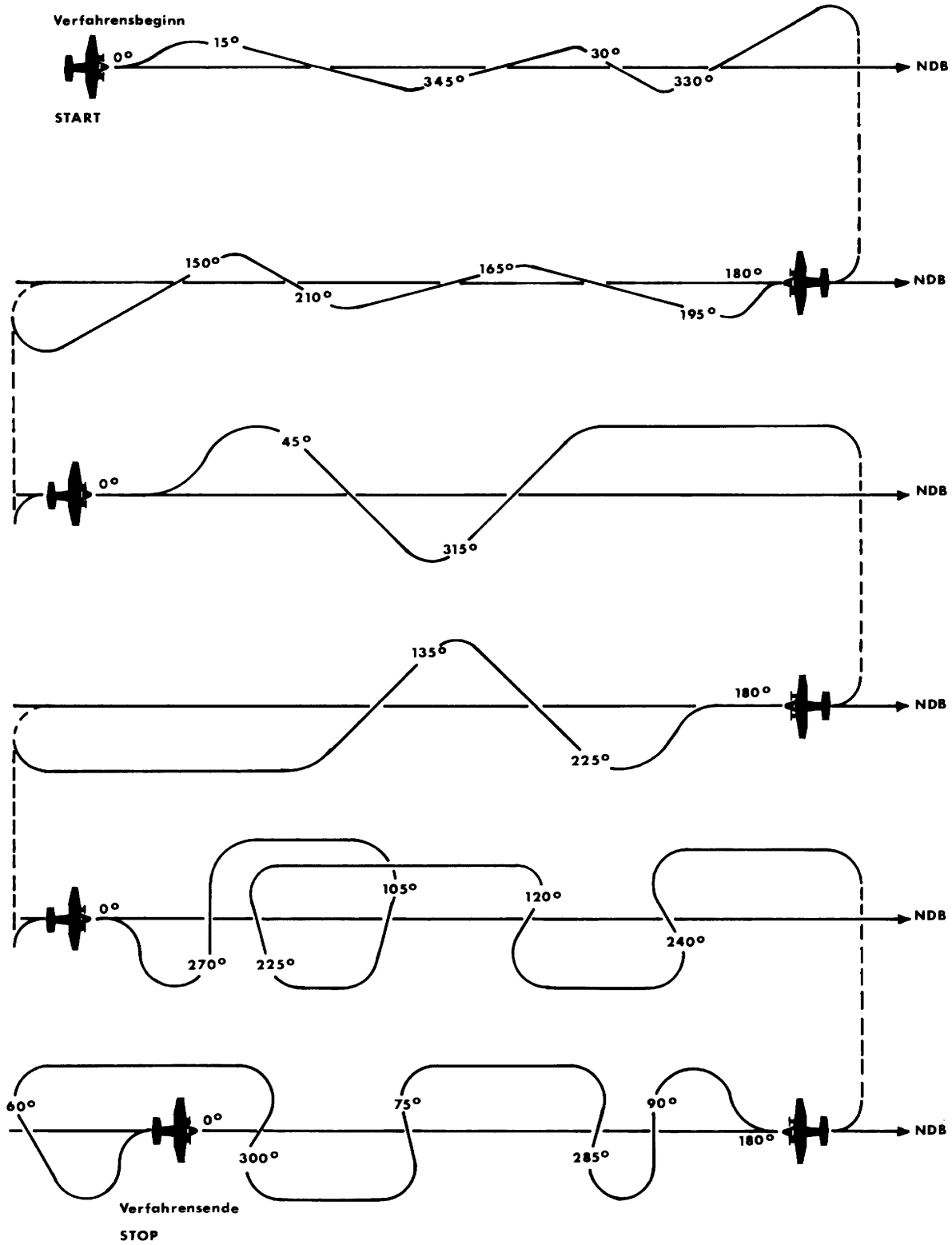

Fig. 2-1 Flight test procedure

Tabelle Quadrantenkorrektur
Q. E. Correction Table

NDB Station Used _____ Pilot Pilot _____ Bezugspunkt Reference Point _____ Luftfahrzeug-Muster Aircraft-Type_____	Frequenz Frequency _____ Prüfer Recorder _____ Datum Date _____ _____ Kennzeichen Aircraft No. _____ __

Peilanzeige vor Quadrantenkorrektur Bearing before Q. E. Correction		Peilanzeige nach Quadrantenkorrektur Bearing after Q. E. Correction	
Relativer Kompaßkurs Relative Heading	Relative Peilung Relative Bearing	Peilanzeige Indicator Reading	Peilanzeige Compensated Indicator Reading
0	360		
15	345		
30	330		
45	315		
60	300		
75	285		
90	270		
105	255		
120	240		
135	225		
150	210		
165	195		
180	180		
195	165		
210	150		
225	135		
240	120		
255	105		
270	90		
285	75		
300	60		
315	45		
330	30		
345	15		
360	0		

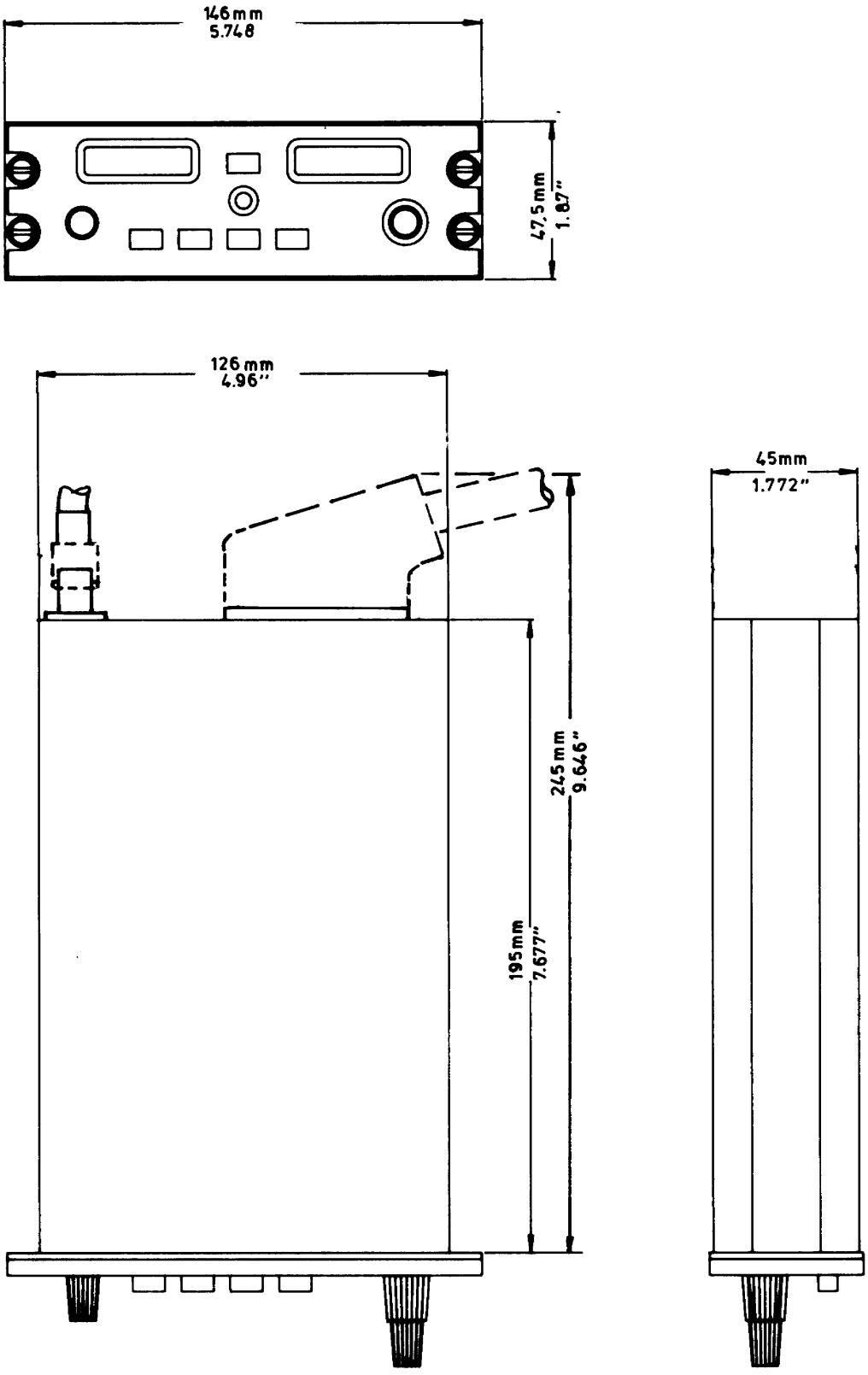

Fig. 2-2 Dimensions AD 3502 - ( )

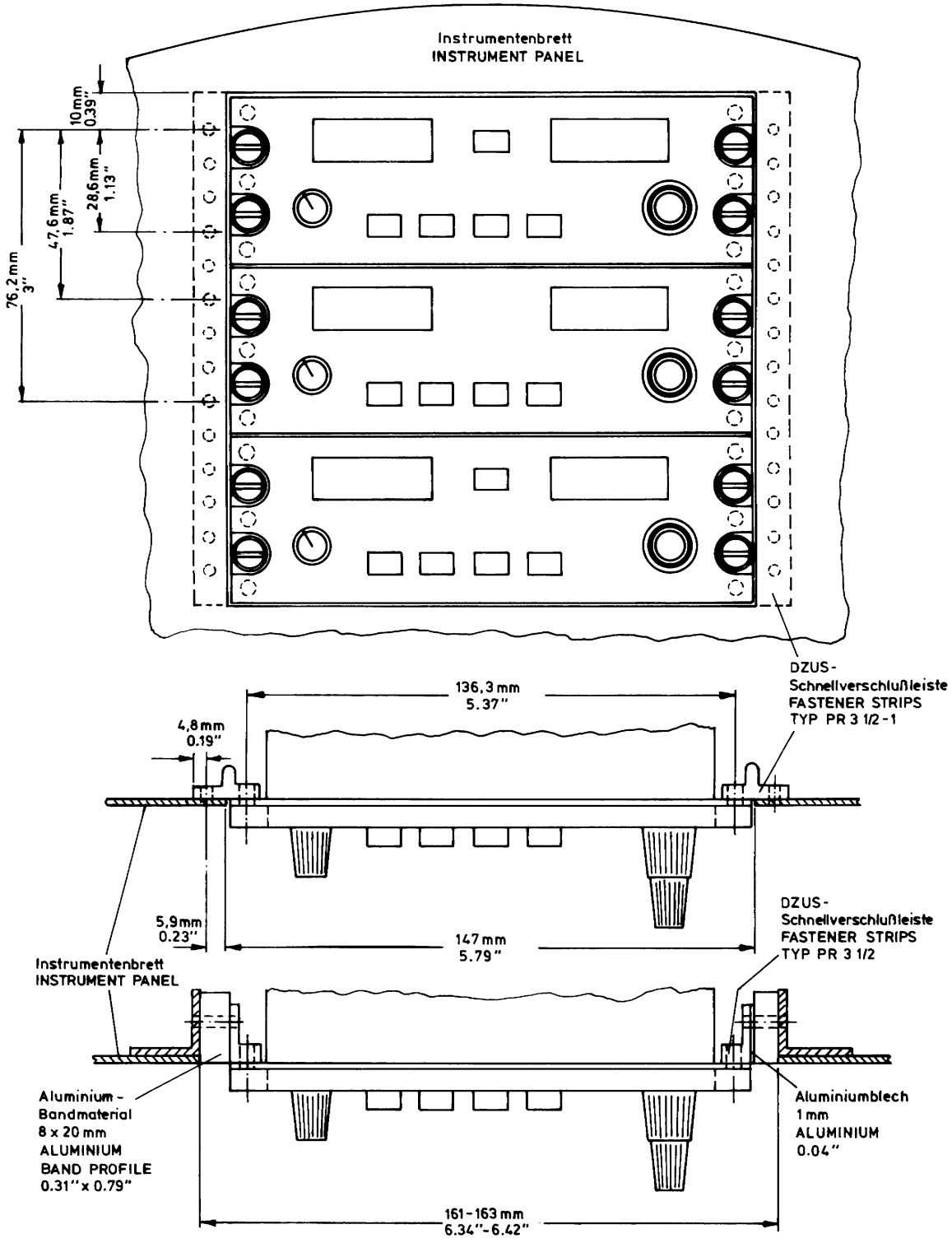

Fig. 2-3 Installation of fastener strips

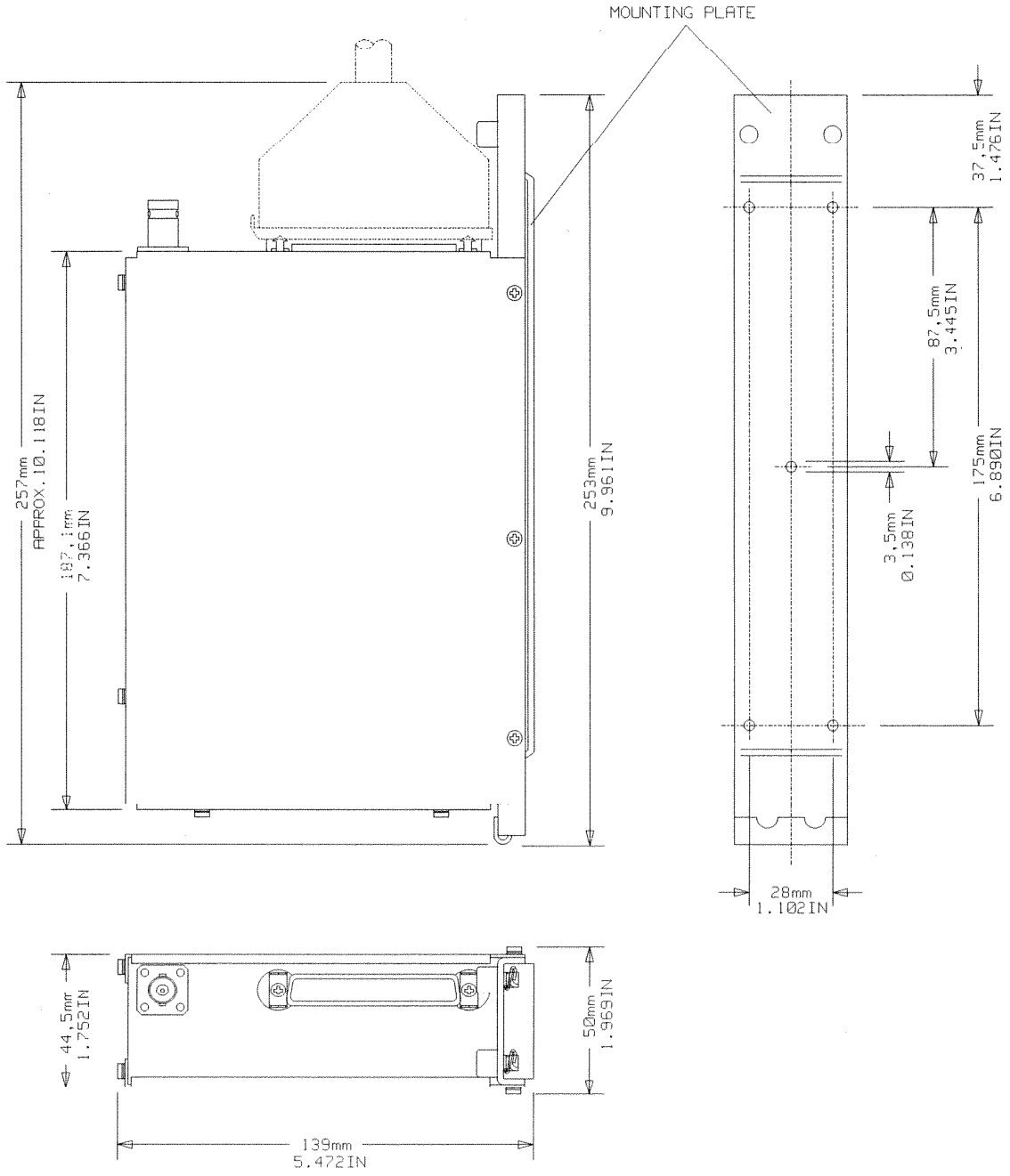

Fig. 2-4 Dimensions ADF- Receiver RA 3502 - ( )

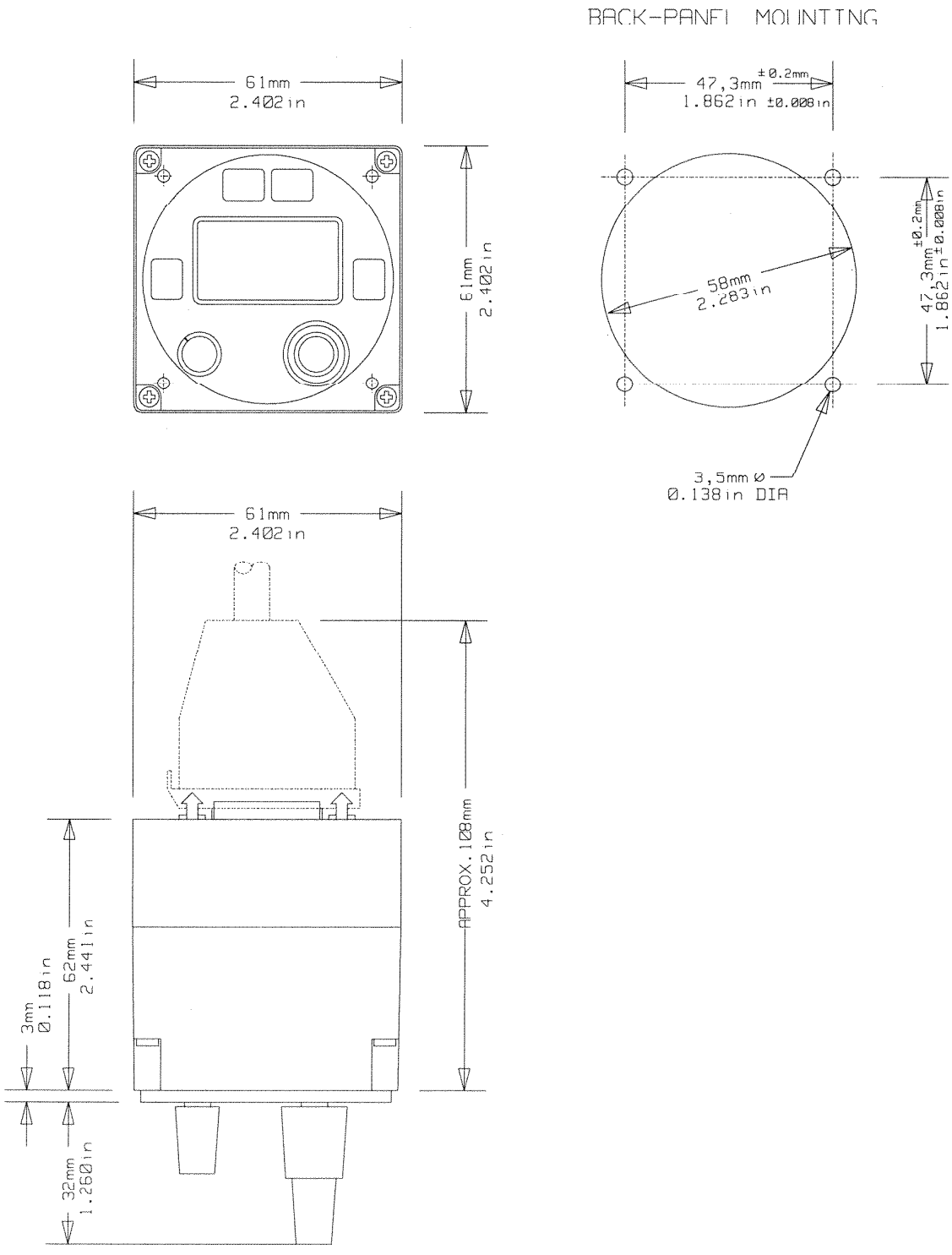

Fig. 2-5 Dimensions CU 5502 - ( )

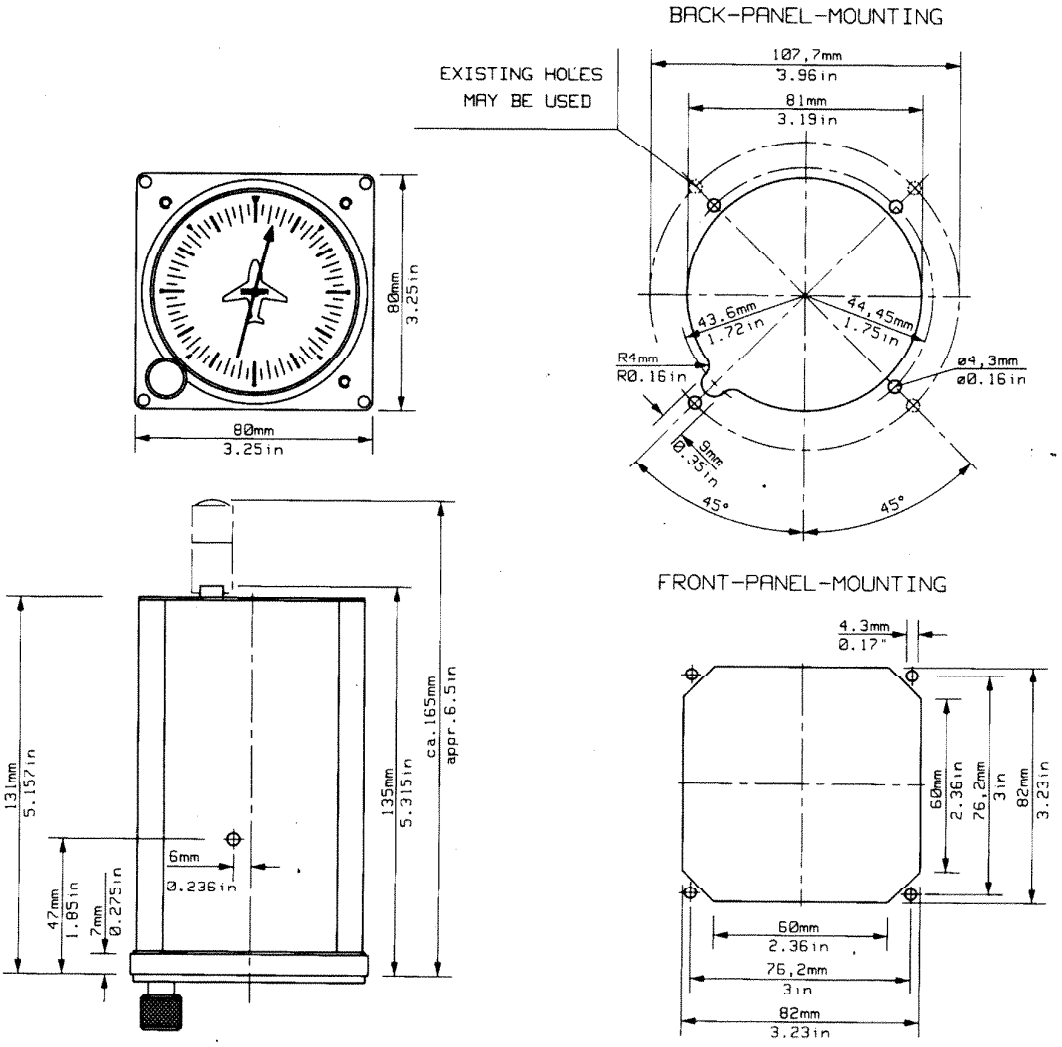

Fig. 2-6 Dimensions ID 3502 - ( )

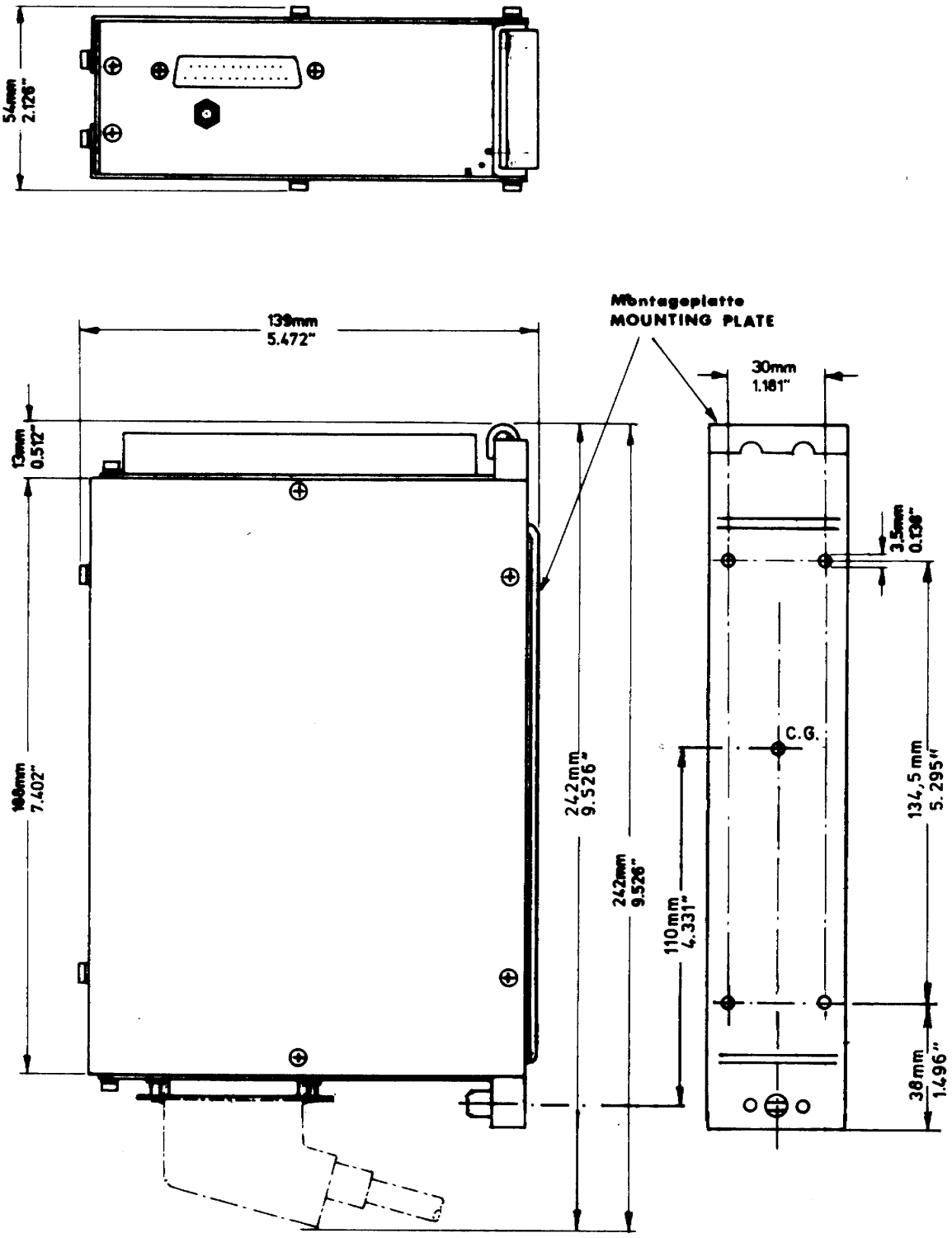

Fig. 2-7 Dimensions AC 3503 - ( ) / AC 3504 ( )

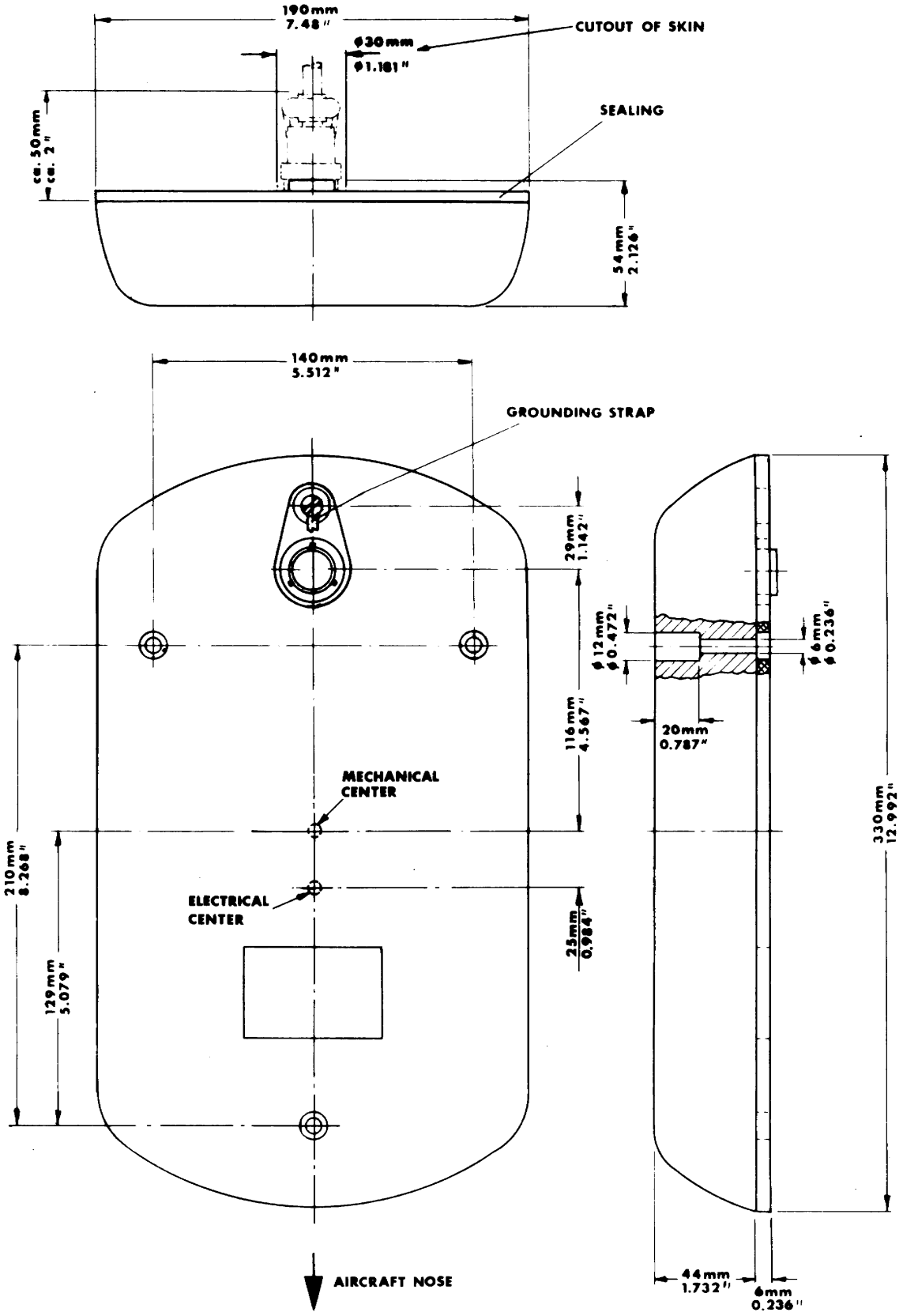

Fig. 2-8 Dimensions Antenna AN 3500

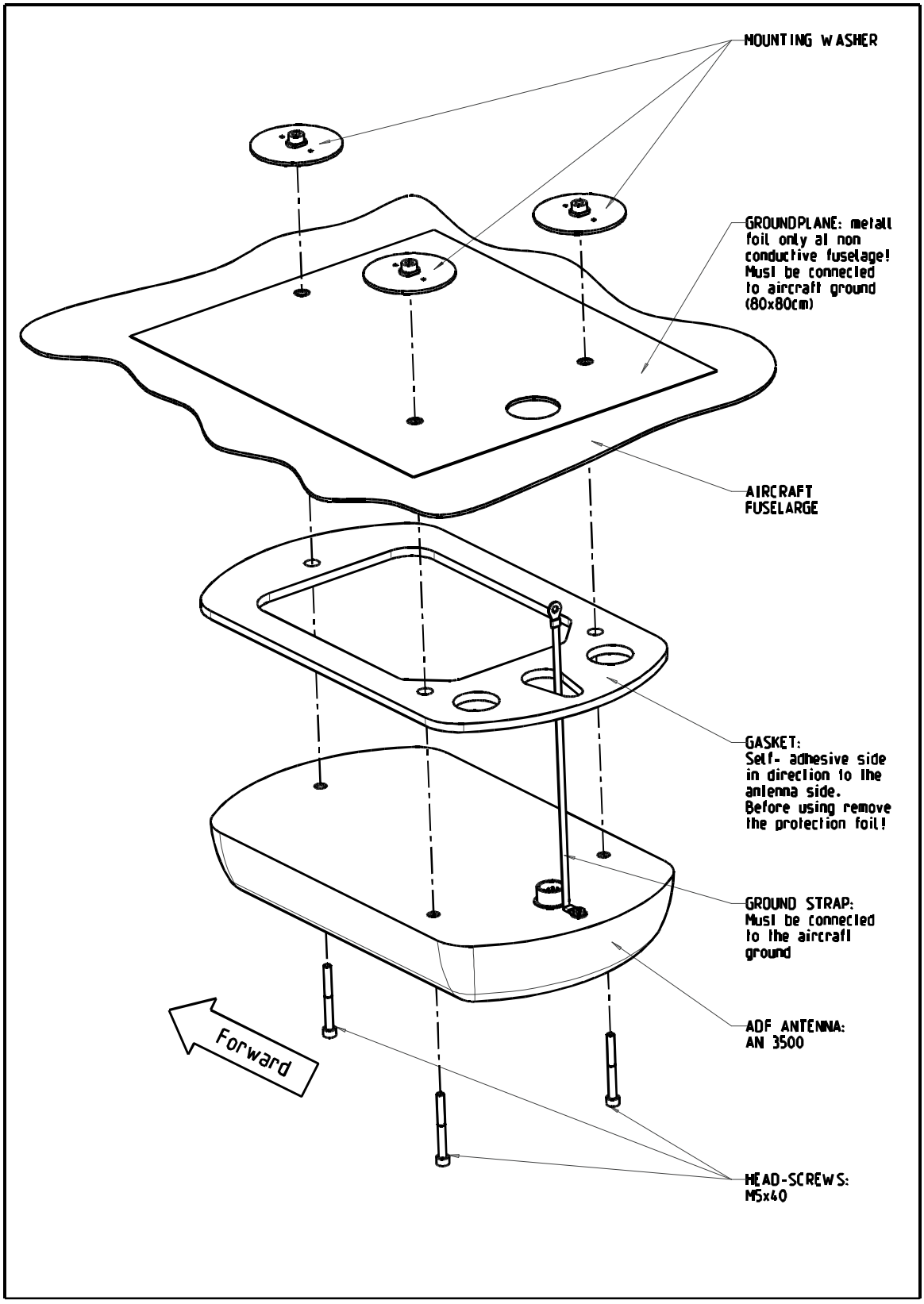

Fig 2-9 - Installation Antenna AN 3500 with gasket

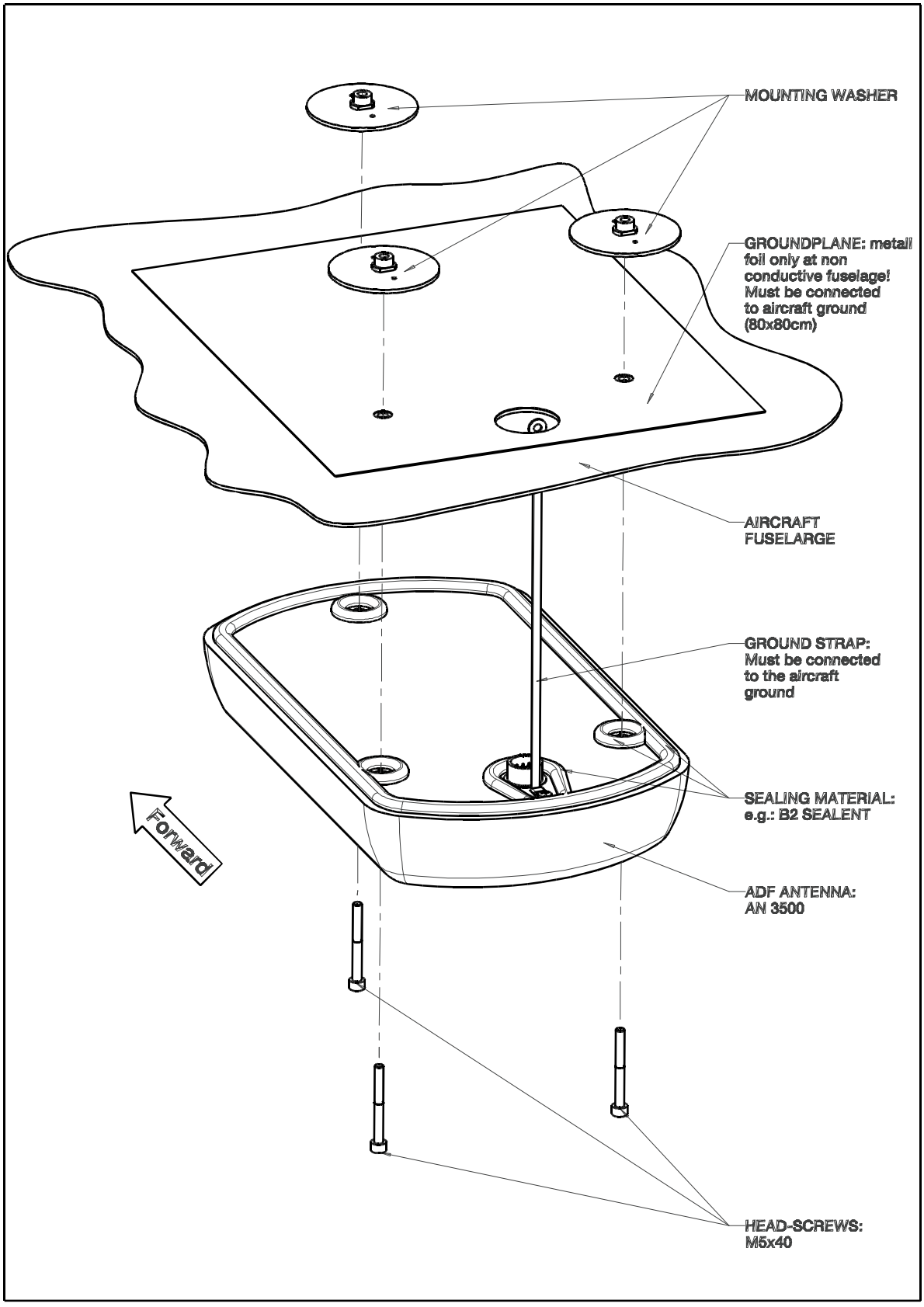

Fig 2-10 - Installation Antenna AN 3500 without gasket

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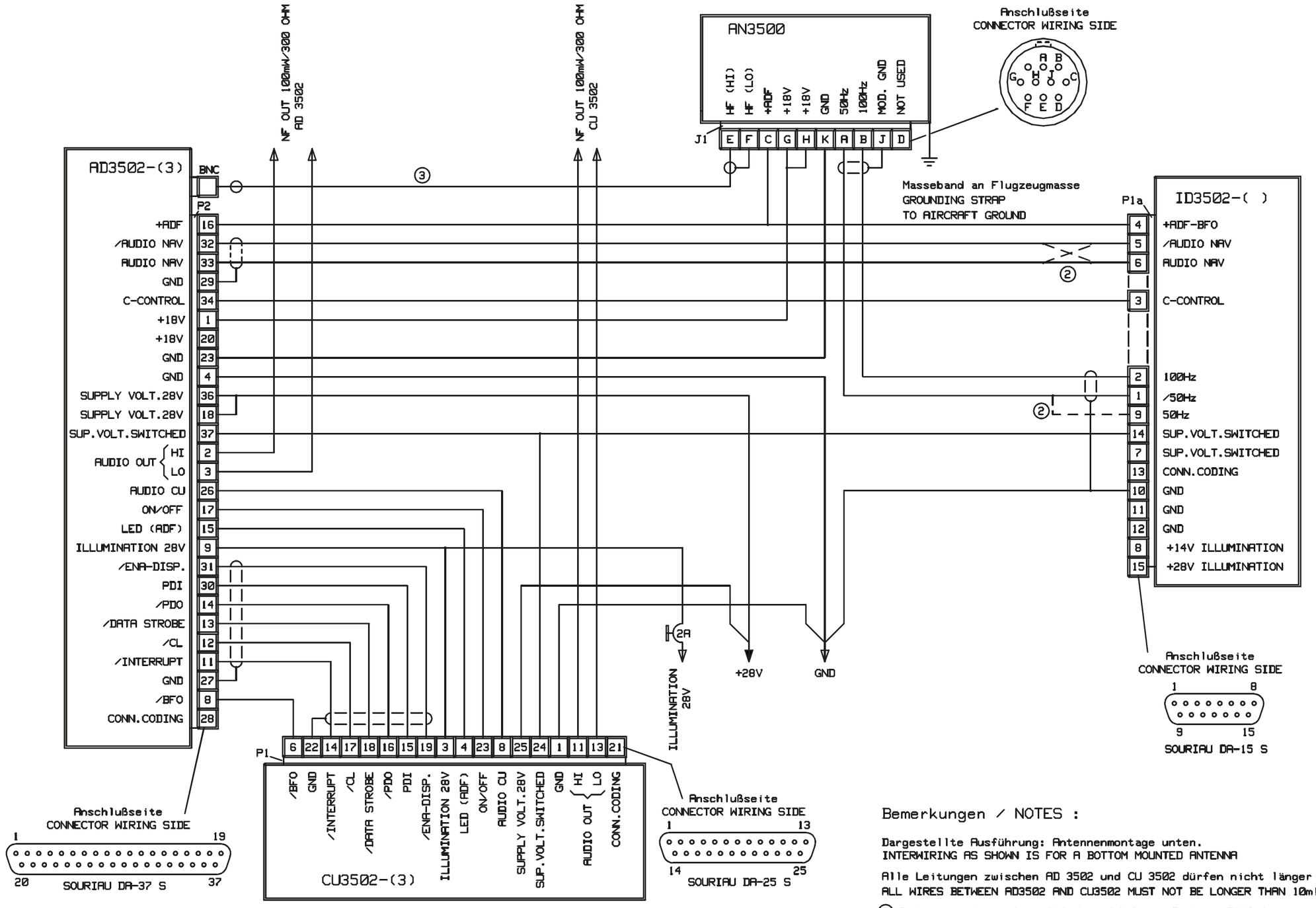


Bemerkungen / NOTES :

Dargestellte Ausführung: Antennenmontage unten.
INTERWIRING AS SHOWN IS FOR A BOTTOM MOUNTED ANTENNA

Alle Leitungen zwischen AD 3502 und CU 3502 dürfen nicht länger sein als 10m!
ALL WIRES BETWEEN AD3502 AND CU3502 MUST NOT BE LONGER THAN 10m!

② Antennenmontage oben: Kabelanschluß von P1/1 an P1/9 legen.
Abschirmkabelanschlüsse P1/5 und P1/6 vertauschen.
FOR TOP MOUNTED ANTENNA CHANGE SOLDERING CONNECTIONS FROM P1/1 TO P1/9.
INTERCHANGE SHIELD CABLE CONNECTIONS FROM P1/5 TO P1/6.

③ RG58A/U, oder anderes gleichwertiges 50 Ohm Koaxkabel verwenden.
USE RG58A/U,OR OTHER EQUIVALENT 50 OHM COAXIAL CABLE

④ Alle nicht bezeichneten Kabel AWG22.
UNLESS OTHERWISE NOTED: ALL WIRES ARE TO BE AWG22.

Fig 2-11 Interwiring of ADF Receiver AD 3502-(), Control Unit CU 3502-(3)
Antenna AN 3500 and Converter and Indicator ID 3502-()

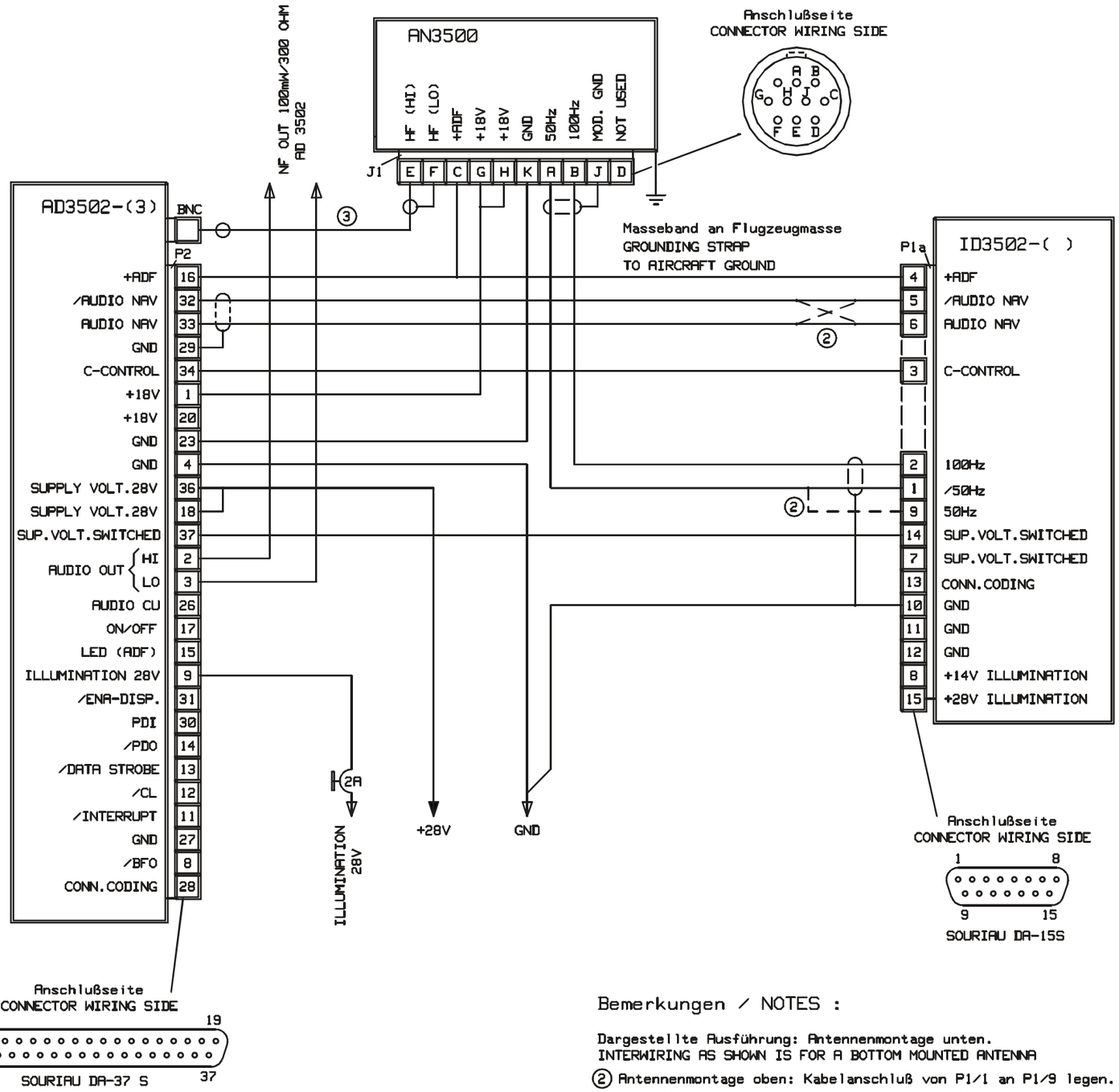


Fig 2-12 Interwiring of ADF Receiver AD 3502-(), Antenna AN 3500 and Converter and Indicator ID 3502-()

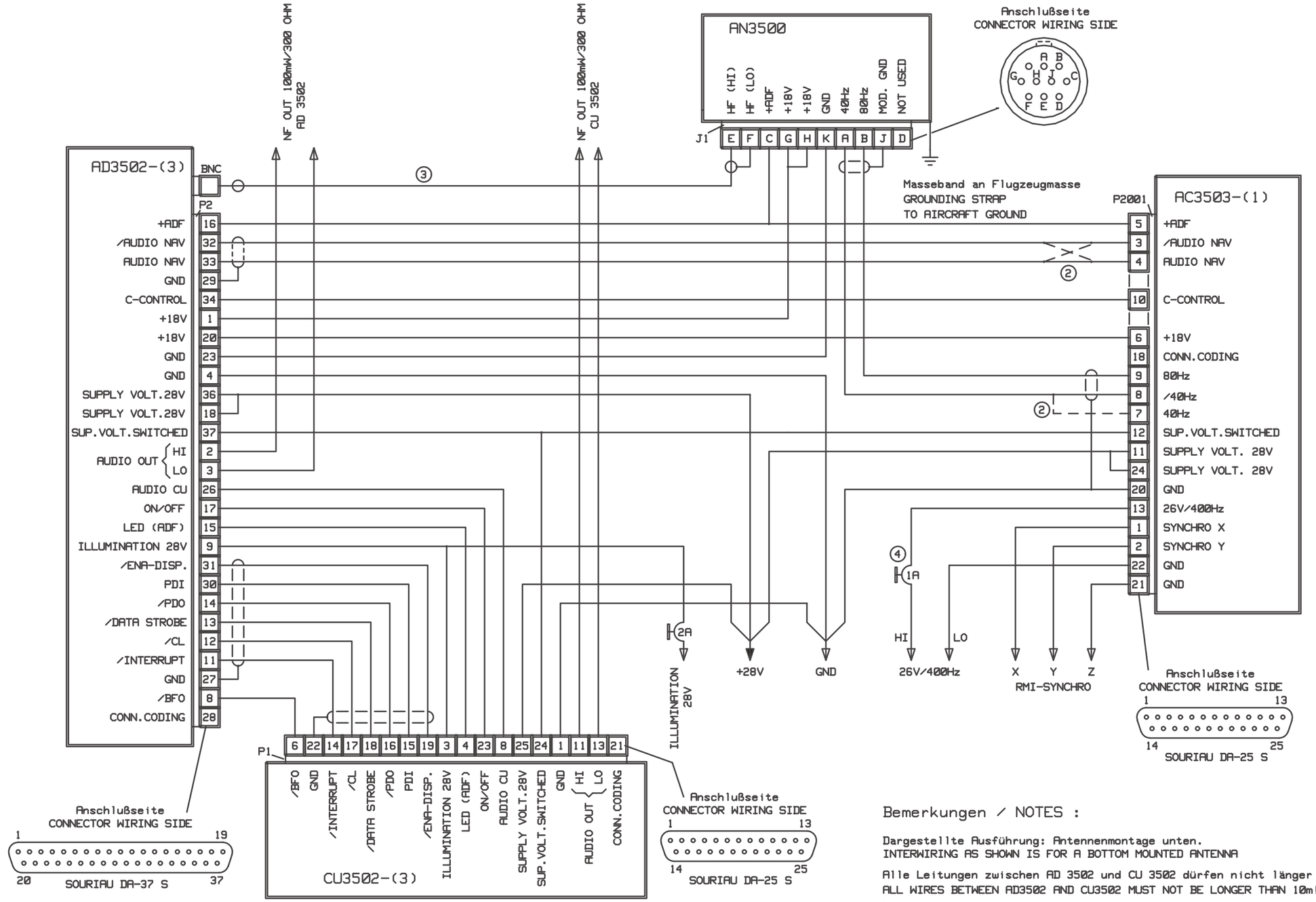
Bemerkungen / NOTES :

Dargestellte Ausführung: Antennenmontage unten.
INTERWIRING AS SHOWN IS FOR A BOTTOM MOUNTED ANTENNA

② Antennenmontage oben: Kabelanschluß von P1/1 an P1/9 legen.
Abschirmkabelanschlüsse P1/5 und P1/6 vertauschen.
FOR TOP MOUNTED ANTENNA CHANGE SOLDERING CONNECTIONS FROM P1/1 TO P1/97.
INTERCHANGE SHIELD CABLE CONNECTIONS FROM P1/5 TO P1/6.

③ RG58A/U, oder anderes gleichwertiges 50 Ohm Koaxkabel verwenden.
USE RG58A/U,OR OTHER EQUIVALENT 50 OHM COAXIAL CABLE

④ Alle nicht bezeichneten Kabel AWG22.
UNLESS OTHERWISE NOTED: ALL WIRES ARE TO BE AWG22.



Tandem Version not longer aviable since 1998

Bemerkungen / NOTES :

Dargestellte Ausführung: Antennenmontage unten.
INTERWIRING AS SHOWN IS FOR A BOTTOM MOUNTED ANTENNA

Alle Leitungen zwischen AD 3502 und CU 3502 dürfen nicht länger sein als 10m!
ALL WIRES BETWEEN AD3502 AND CU3502 MUST NOT BE LONGER THAN 10m!

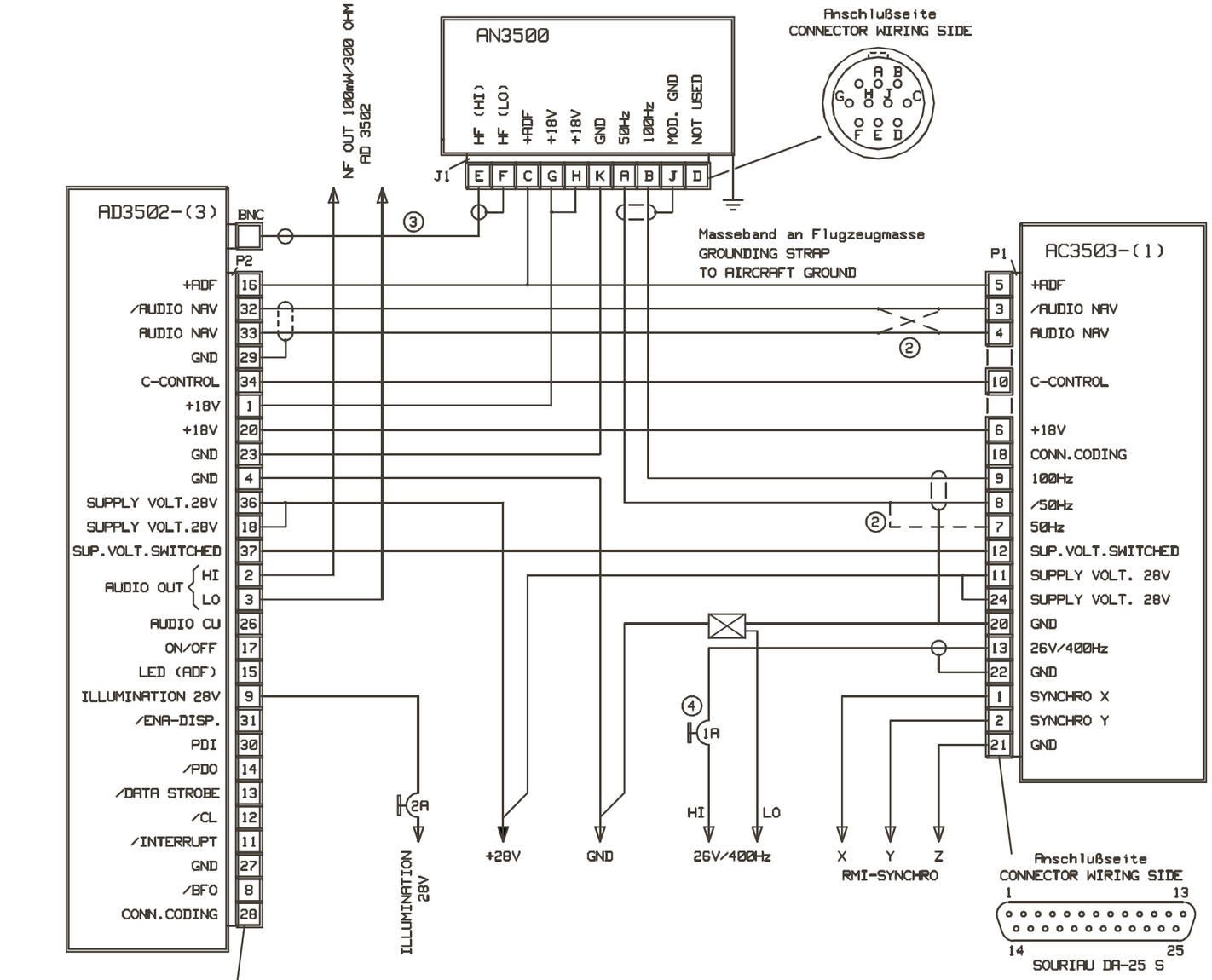
② Antennenmontage oben: Kabelanschluß von P2001/8 an P2001/7 legen.
Abschirmkabelanschlüsse P2001/3 und P2001/4 vertauschen.
FOR TOP MOUNTED ANTENNA CHANGE SOLDERING CONNECTIONS FROM P2001/8 TO P2001/7.
INTERCHANGE SHIELD CABLE CONNECTIONS FROM P2001/3 TO P2001/4.

③ RG58A/U, oder anderes gleichwertiges 50 Ohm Koaxkabel verwenden.
USE RG58A/U,OR OTHER EQUIVALENT 50 OHM COAXIAL CABLE

④ Sicherung kann entfallen, wenn der Converter gegen Überlast geschützt ist.
FUSE IS NOT REQUIRED IF CONVERTER IS PROTECTED AGAINST OVERLOAD.

⑤ Alle nicht bezeichneten Kabel AWG22.
UNLESS OTHERWISE NOTED: ALL WIRES ARE TO BE AWG22.

Fig. 2-13 Interwiring of ADF Receiver AD 3502-(), Control Unit CU 3502-(3)
Antenna AN 3500 and Converter AC 3503-8()



Bemerkungen / NOTES :

Dargestellte Ausführung: Antennenmontage unten.
INTERWIRING AS SHOWN IS FOR A BOTTOM MOUNTED ANTENNA

(2) Antennenmontage oben: Kabelanschluß von P1/8 an P1/7 legen.
Abschirmkabelanschlüsse P1/3 und P1/4 vertauschen.
FOR TOP MOUNTED ANTENNA CHANGE SOLDERING CONNECTIONS FROM P1/8 TO P1/7.
INTERCHANGE SHIELD CABLE CONNECTIONS FROM P1/3 TO P1/4.

(3) RG58A/U, oder anderes gleichwertiges 50 Ohm Koaxkabel verwenden.
USE RG58A/U,OR OTHER EQUIVALENT 50 OHM COAXIAL CABLE

(4) Sicherung kann entfallen, wenn der Converter gegen Überlast geschützt ist.
FUSE IS NOT REQUIRED IF CONVERTER IS PROTECTED AGAINST OVERLOAD.

(5) Alle nicht bezeichneten Kabel AWG22.
UNLESS OTHERWISE NOTED: ALL WIRES ARE TO BE AWG22.

Fig. 2-14 Interwiring of ADF Receiver AD 3502-()
Antenna AN 3500 and Converter AC 5303-()

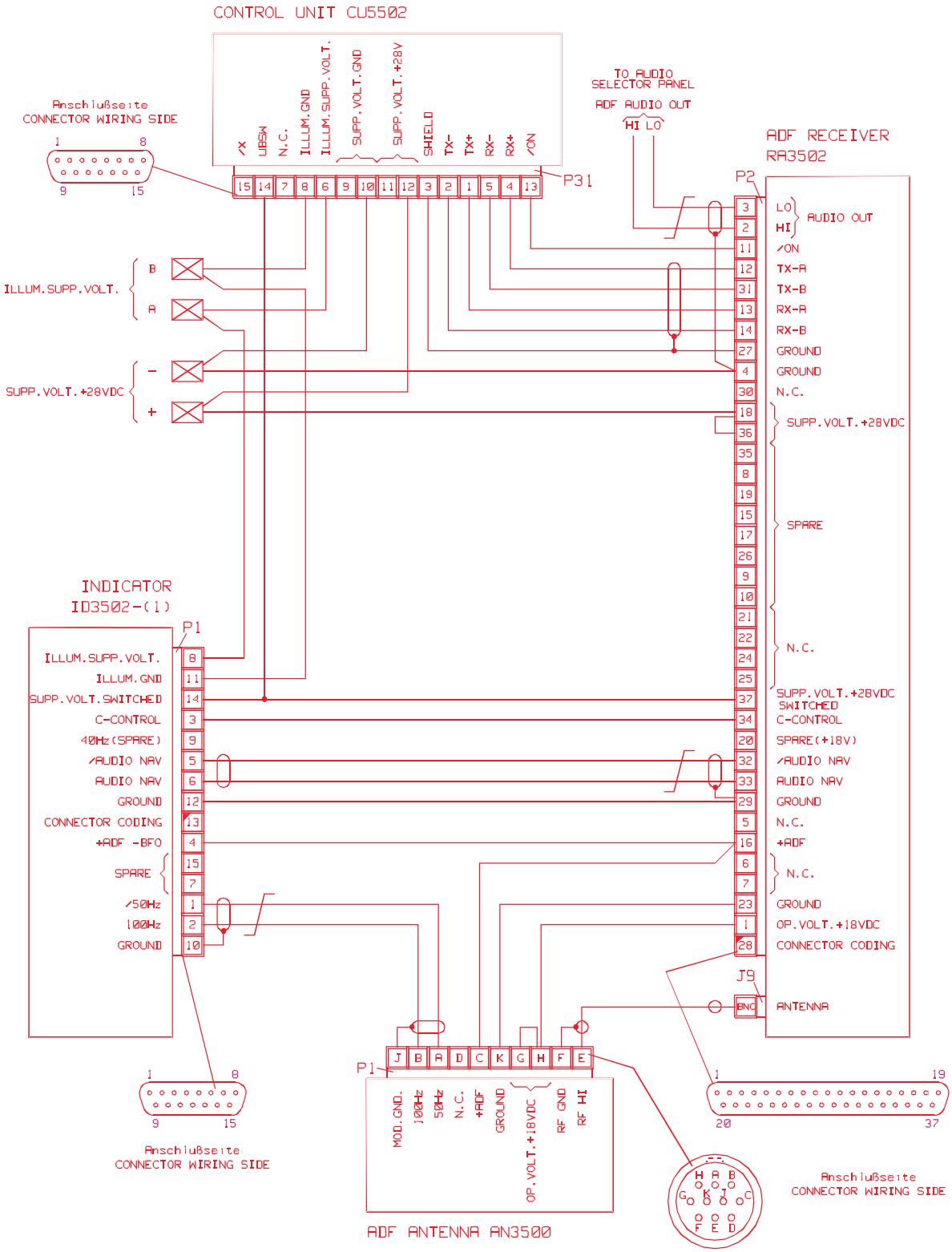


Fig. 2-15 Interwiring of ADF- Receiver RA 3502 - ( ), Control Unit CU 5502 - ( ), Antenna AN 3500 and Converter and Indicator ID 3502 - ( )

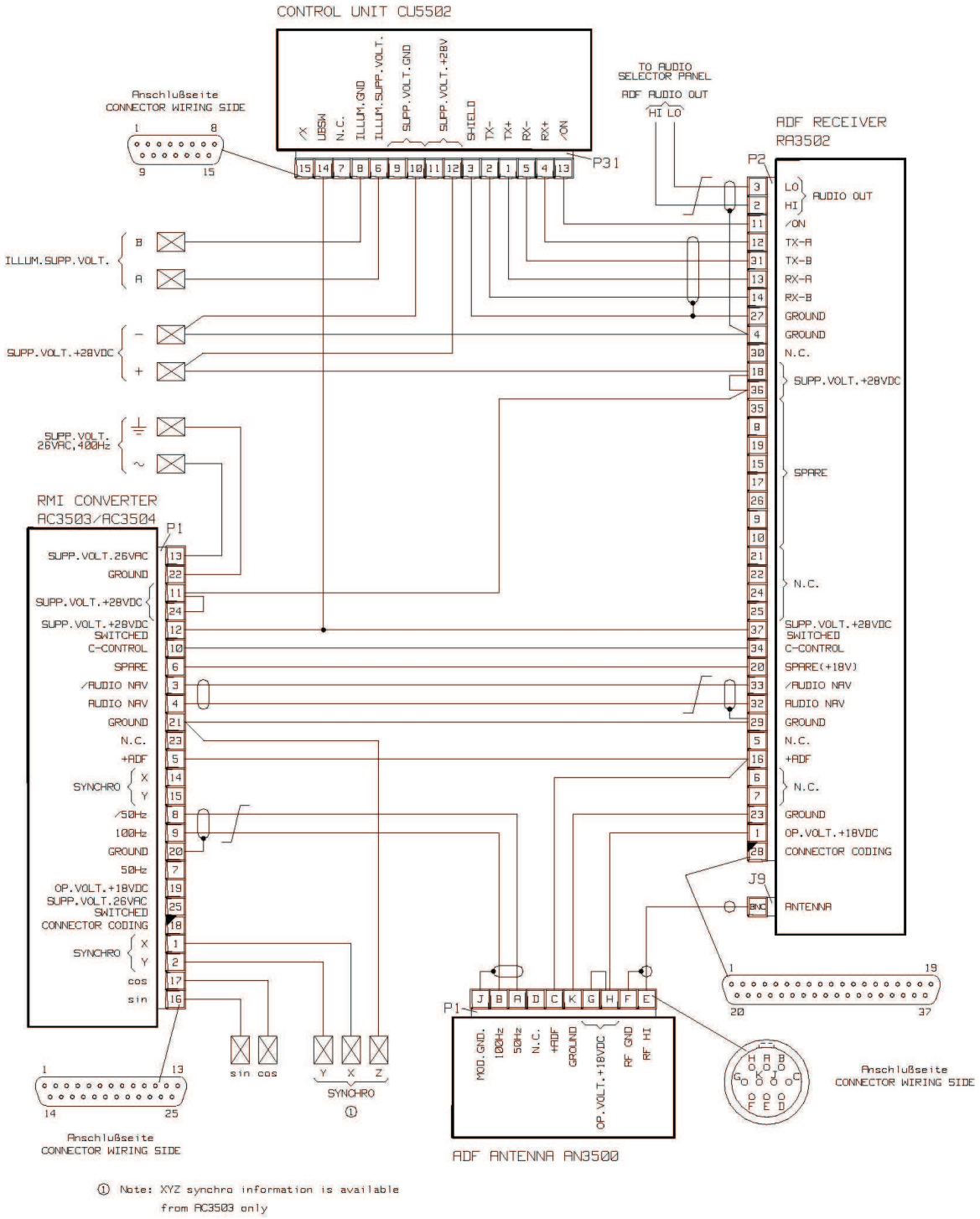


Fig. 2-16 Interwiring of ADF- Receiver RA 3502 - ( ), Control Unit CU 5502 - ( ), Antenna AN 3500 and Converter AC 3503 - ( ) / AC 3504 - ( ).

Pin assignment Control Unit CU 5502

Connection panel and display lighting	13,75V Power supply	27,50V Power supply
P31-Pin6 ILL.A	+13,75V	Ground
P31-Pin8 ILL.B	Ground	+27,50V

Pin assignment Converter and Indicator Unit ID3502

Connection panel and display lighting	13,75V Power supply	27,50V Power supply
P1-Pin8 ILL.A	+13,75V	
P1-Pin15 ILL.B	Ground	+27,50V

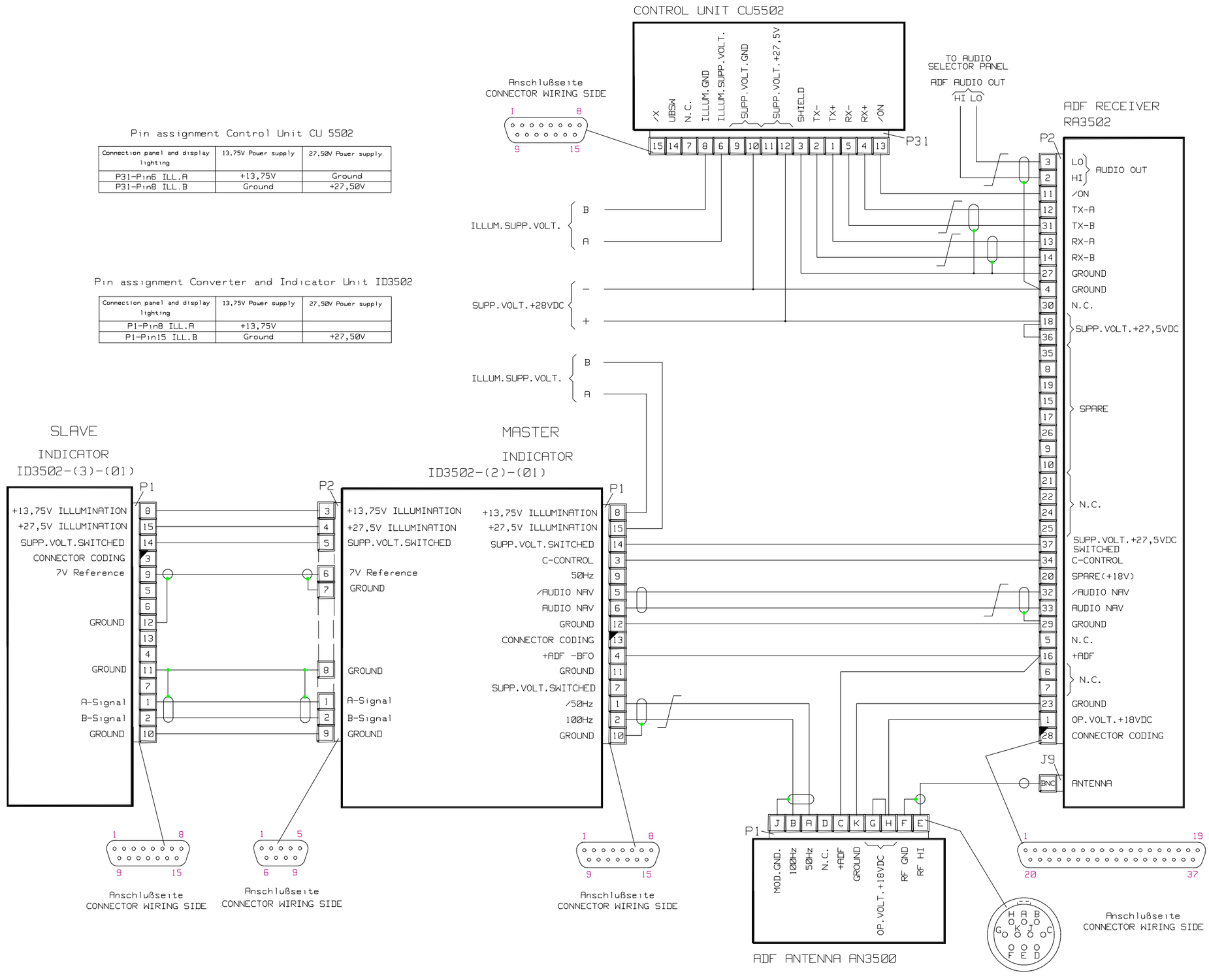


Fig 2-17 Interwiring diagram ADF Receiver RA 3502-( ), Control Unit CU 5502-( ),Antenna AN 3500-( ), and Converter and Indicator ID 3502-(2) and ID 3502-(3)

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Section III OPERATION

3.1 Controls and indicators

3.1.1 Controls and indicators Receiver AD 3502 - ( )

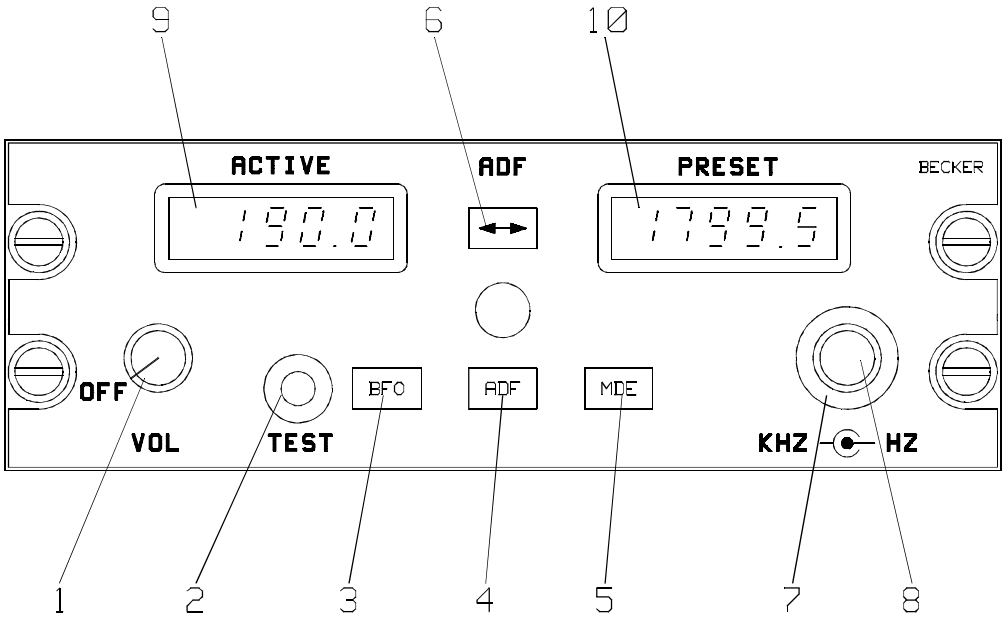
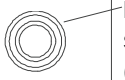
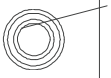


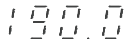
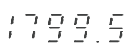
Fig. 3-1 Front panel of the ADF- Receiver AD 3502 - ( )

Meaning of symbols on the controls and indicators

	Symbol	Description	Function
	MDE	Function key	Selection of mode and selecting the parameter in the service mode.
	◄►	Exchange key	Frequency preselection: Exchange of preset frequency and active frequency.
	BFO	BFO key	Switching ON and OFF of BFO mode.
	ADF	ADF key	Switching ON and OFF of ADF mode.
	TEST	TEST key	Switching on TEST mode.

	Symbol	Description	Function
		kHz-Frequency selector switch (outer rotary switch)	Switches the displayed frequency in steps of 10 kHz upwards or downwards. If rotated quickly, the change takes place in steps of 100 kHz.
		Hz-Frequency selector switch (inner rotary switch)	Switches the displayed frequency in steps of 500 Hz upwards or downwards. If rotated quickly, the change takes place in steps of 2 kHz.
		ON/OFF switch combined with volume control	ON/OFF switch of ADF receiver and control unit and volume control.

LCD elements (Liquid crystal display)

	Symbol	Description	Function
		(left indication) (active frequency)	Indication of active reception frequency.
		(right indication) (preset frequency)	Indication of preset reception frequency.
		(right indication)	ON indication.
		(right indication)	OFF indication.
		(right indication)	Indication of frequency deviation from emergency Frequency

Rear of unit

BNC	50 Ohm antenna connecting socket ADF- Receiver
37-pin D sub-male	Equipment connector for connecting the installation wiring

3.1.2 Controls and indicators control unit CU 5502 - ( )

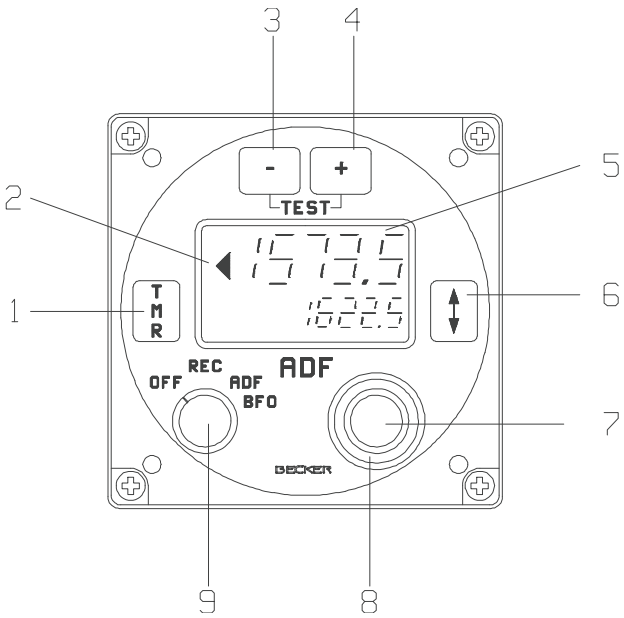
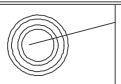


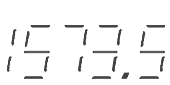
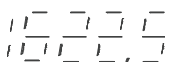
Fig. 3-2 Front panel of control unit CU 5501 -( )

Meaning of symbols on the controls

	Symbol	Description	Function
1	**TMR**	Function key	Switching the stopwatch on and off
3	-	Minus key	Reducing the volume
4	+	Plus key	Increasing the volume
6	◄►	Exchange key	Press key and hold for more than 2 seconds Changeover between the frequency setting mode and frequency presetting mode Press key for less than 2 seconds Exchange of preset frequency and active frequency
	TEST		Pressing the - and + keys simultaneously activates the test function. The needle of the display unit moves to approximately 90° and all digits flash.
7		Frequency selector switch (outer rotary switch)	Switches the displayed frequency in steps of 10 kHz upwards or downwards. If rotated quickly the change takes place in steps of 100 kHz.

8		Frequency selector switch (inner rotary switch)	Switches the display frequency in steps of 500 Hz steps upwards or downwards. If rotated quickly the change takes place in steps of 2 kHz.
9		Mode switch with four detent positions	OFF position Control unit and ADF receiver switched off. REC position The system operates in reception mode. ADF position The system operates in ADF mode. The arrow is visible in the top line of the LC display. BFO position The system operates in the ADF/BFO mode.

Liquid crystal display

	Symbol	Description	Function
5		(Top line) (active frequency)	Display of the active reception frequency
5		(Bottom line) (preset frequency)	Display of preset rececption frequency
2		(Top line)	Arrow visible: ADF mode switched on Arrow not visible: ADF mode switched off
	T	(Bottom line)	Display of the stopwatch

Connector on back of unit

15-pole subminiature, male Push-in locking	Equipment connector for connecting the aircraft cabling

3.1.3 Converter and indicator ID 3502 - ( ) controls

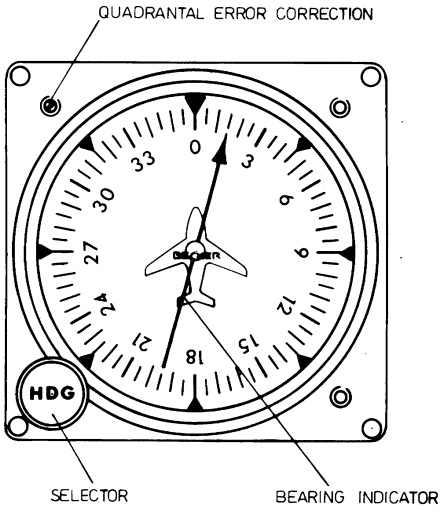


Fig. 3-3 Converter and indicator ID 3502 - ( )

Controls and indicator	Description	Function
Heading selector	Knob for rotating 360° card	Serves to set relative heading.
Bearing indicaton	Rotating pointer driven by DC repeater	Indicates direction of NDB relative to A / C heading.

3.1.4 Operating instructions RMI-Indicator controls

The operating instructions are the same as for ID 3502 - ( ), exept that indication provided is a QDM indication to NDB on the chart.

Controls and indicator	Description	Function
Compass card	360° card	Indicates course of slaved gyro.
ADF indicator	Synchro driven pointer	Indicates QDM to NDB on card.
VOR indicator	Synchro driven pointer	Indicates QDM to VOR on card.

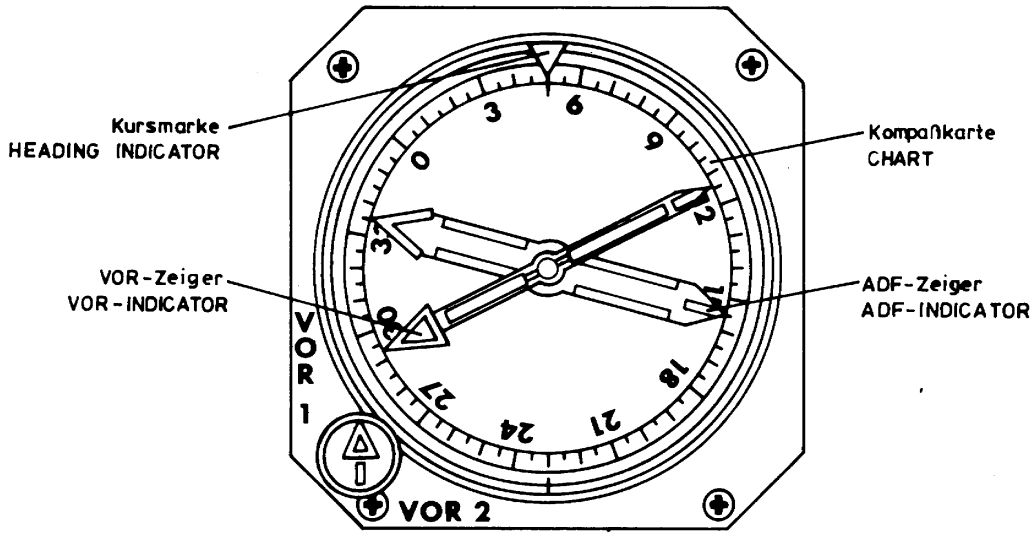


Fig. 3-4 RMI-Indicator

3.2 Operating instructions

1. Switch receiver function selector to REC / TEST and rotate HDG setting so that its scale indicates 0° / 360°.
2. Switch receiver to TEST mode and press test key.

   Test function :

   The pointer of the indicator must go to the three o'clock position (90°)!

   Both LCDs must show the numbers 188.88 flashing (unit test approximately 2 seconds). If the test is positive, the receiver automatically switches to the mode which was selected before switch-off. If the test is negative, the LCD flashes for approximately 5 seconds. A fault report can be called up by pressing the store key. After approximately 5 seconds the receiver automatically switches to the mode which was selected before switch-off.

   The following fault signals are possible :

   - E2 Synthesizer failed
   - E3 Fault in EEPROM

3. Select NDB frequency by means of the frequency selector switches and compare station identification (set function selector to BFO when NDB is transmitting in mode A1).
4. After checking station identification, return selector to ADF. The pointer leaves the 90° position and turns to the direction of the NDB.
5. Set heading using HDG selector depending on flight procedure.

3.3 Operation of the various modes ADF- Receiver AD 3502 - ( )

The ADF receiver contains various functions which are performed under two modes. The individual modes are selected by pressing the **MDE** key.

Frequency setting mode

Display of the active frequency in the left indication. The right indication is switched off. The active frequency can be directly changed using the frequency selector switches.

Frequency preselection mode

Display of the active and preset frequency. The preset frequency can be set using the frequency change switches. Pressing the exchange key changes over from the active to the preset frequency.

NOTE

All setting or frequency changes are automatically stored after two seconds. This means that changes which are made immediately before switching off are not stored.

3.3.1 Frequency setting mode

The left display indicates the active frequency. The right display is switched off.

The active frequency can be changed with the **kHz** and **Hz** frequency selector switches.

The set frequency is held even if the unit is switched off.

Change of mode

To change the mode, press the **MDE** key.

3.3.2 Frequency preselection mode

Select the mode using the **MDE** key. The last indicated active and preset frequency are shown in the left and right indication respectively.

The preset frequency (bottom line) is set using the **kHz** and **Hz** frequency selector switches. Pressing the **<-> exchange** key changes over between the active and preset frequency.

NOTE

The ADF receiver is always ready to receive on the frequency shown in the left indication.

Change of mode

To change the mode, press the **MDE** key.

3.3.3 Emergency frequency selection

Select frequency selection or frequency preset using the **MDE** key.

Frequency selection

Select emergency frequency using the **kHz** and **Hz** frequency selector switches. The receiver will change to 2182 kHz if one of the frequency selector switches is turned clockwise when the display shows 1799.5 kHz. The left display will show 2182 kHz, the right one shows “0.0". The frequency can be varied by ± 5 kHz using the Hz frequency selector switch.

Frequency preset

Select emergency frequency on the right display using the **kHz** and **Hz** frequency selector switches. The display will change to 2182 kHz if one of the frequency selector switches is turned clockwise if the display shows 1799.5 kHz. Press **EXCHANGE** key to exchange the active and the (preset) emergency frequency. Press the **MDE** key. The left display will show 2182 kHz, the right one shows “0.0". The frequency can be varied by ± 5 kHz using the Hz frequency selector switch.

3.4 Operating instructions Control Unit CU 5502 - ( )

3.4.1 Preparation

Switch on the aircraft power supply (check that the circuit breaker for the ADF system is set).

WARNING

Do not switch on the control unit if engines or motors are being started up or shut down.

3.4.2 Switching on the control unit

a. Set the mode switch to REC.

NOTE

System initialization takes place, i.e. data is transmitted between the control unit and the ADF receiver, for the first 5 to 10 seconds after power on. After completion of the initialization, the mode which was set before power off appears.

In all modes, disturbances of the ADF system are displayed in the form of fault messages.

- E2 synthesizer failed, lock detect error
- E5 interface fault

A comprehensive description of the various modes follows the general operating instructions.

3.4.3 REC/ADF/BFO mode

a. Press both **-** and **+** keys simultaneously (test modes). All the segments in the LC display shall flash and the needle of the connected display unit shall simultaneously deflect by approximately 90°.
b. Set the HDG setting on the display unit so that the 0° / 360° scale appears.
c. Using the frequency selector switches, set the required NDB station and monitor the identification signal. For A1 identification the BFO mode must be selected (set the mode switch to BFO).
d. After checking the identification signal, select the ADF mode (set the mode switch to ADF). The needle moves in the direction of the set NDB station.
e. Depending on the flight procedure, set the compass heading using the HDG setting.

3.4.4 Adjusting the volume

The volume is adjusted for monitoring received signals by using the “+” and “-” keys. The volume is shown in the bottom line by means of a numerical value between"0" (quiet) and “63" (loud). The symbol ”V" is placed before the numerical value. The indicated value remains visible for approximately 1 second after the key is released.

3.5 Operation of the various modes control unit CU 5502 - ( )

The ADF system contains various functions which are performed under two modes. The modes are selected by pressing and holding the **exchange** key on the control unit for more than 2 seconds.

Frequency setting mode

Display of the active frequency in the top line. The bottom line is switched off. The active frequency can be directly changed using the frequency selector switches.

Frequency preselection mode

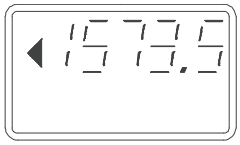
Display of the active and preset frequency. A new frequency can be preset using the frequency selector switches. Pressing the **exchange** key changes over between the active and preset frequencies.

NOTE

All mode or frequency changes are automatically stored after 2 seconds. This means that changes which are made immediately before switching off are not stored.

3.5.1 Frequency setting mode

The active frequency is shown in the top line and the bottom line is switched off.



The active frequency can be changed using the frequency selector switches.

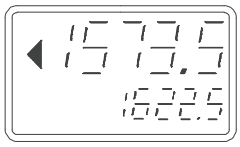
The set frequency remains stored even with the unit switched off.

Change of mode

To change the mode, press the **exchange** key and hold for at least 2 seconds.

3.5.2 Frequency preselection mode

The last active and preset frequencies appear in the top and bottom lines respectively.



The preset frequency (bottom line) is set using the frequency change switches.
Pressing the **exchange** key changes over between the active and preset frequencies.

NOTE

The ADF receiver is always ready to receive on the frequency shown in the top line.

Change of mode

To change the mode, press the **exchange** key and hold for at least 2 seconds.

3.5.3 Switching on the stopwatch

a. Pressing the **TMR** key starts the stopwatch. The frequency setting mode is immediately selected and the previously set mode is stored. The time is counted up 1 second at a time starting at 0 and displayed in the bottom line. The symbol “T” appears before the time.

b. Pressing the **TMR** key a second time stops the stopwatch. The elapsed time is shown in the bottom line and the “T” is shown flashing to the left of the time.

c. Pressing the **TMR** key a third time resets the stopwatch to 0. The symbol “T” is deleted from the bottom line. If the stopwatch is not re-started within 2 seconds, a changeover to the previously stored mode takes place.

3.5.4 Display the Software-Version

Press and hold the **+** key whilst the unit is being switched on and wait until the version number is displayed. As long as the **+** key is held pressed, the following is shown in the top line.

> On the left, two positions of the version number of the ADF-Receiver.
> Right two positions of the version number of the Control Unit.

Release the **+** key. The ADF receiver is always ready to receive on the frequency shown in the top line.

3.6 Safety information

- Switch off the system while starting engines!
- The equipment should be protected from the aircraft supply by a circuit breaker.
- ADF equipment is sensitive to radio interference. This includes:

  Atmospheric interference caused by weather conditions (thunder storms, thunder storm conditions).

  Static charging of the aircraft airframe when flying in wet conditions with ice particles;

  Both these cases can lead to uncontrolled deflections of the indicator. In the case of static charging, the reception of an NDB station can be completely lost for several minutes;

  Interference in the aircraft supply system caused by generators or ignition systems can considerably reduce the range to NDB stations. The following checks can be made during flight;

  When there is interference when receiving an NDB station:
  a) switch off the generator for a short period and observe the effect;
  b) In the case of piston-engine aircraft switch the ignition from magneto 1 to magneto 2 and to 0 in succession. Observe the affect. If the cause of the interference is identified, initiate ground maintenance procedures!

- Effect during twilight and night: Unusable bearings can occur particularly during twilight if the change in the ionisation layer effect the phases of ground and space waves. It is also possible for that those effects to occur at night.
- Coastal errors: When flying over the sea, bearing errors can occur due to refraction of electromagnetic waves at the coast. Further possible causes of incorrect bearings are: steep banking flight; flying with the landing gear down.
- When overflying an NDB station, the pointer of the indicator should ideally move through 90° (station on the right) or 270° (station on the left) before stabilizing in the 180° direction after the overflight.

  Due to a cone of uncertainty of ± 45°, which is due to physical conditions, it must be borne in mind that an unstable indication during the flight will be produced by the cone of uncertainty resulting in multiple pointer deflections. After the aircraft has left the cone, the indication stabilizes at 180°. This can differ from NDB to NDB.

- Correct approaches to radio broadcast transmitters are therefore only possible if they are expressly performed as navigational aids in the AIP.

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Section V PERFORMANCE TEST

5.1 General

Whenever the system has been subject to a major overhaul or major repair, all items of the system must be given a final check on the test bench. For this purpose the antenna AN 3500 is operated in a shielded room or in a suitable simulation of the shielded room (TIC test box) to establish the bearing sensitivity µV/m.

5.1.1 Minimum signal requirements

1.	Sensitivity in REC mode or a signal-to-noise ratio of 6 dB established at 20% of the reference output (2.4 V)	better than 70µV/m
2.	Frequency accuracy	≤ ± 0.2 kHz
3.	Response from 100µV/m to 0.5 V/m Negative control	≤ 8 dB ≤ - 2 dB
4.	Bearing sensitivity and accuracy over the input voltage range at 0° bearing	≤ ± 3° at 70µV/m to 0.5 V/m
5.	Bearing accuracy over bearing range at 1 mV/m	≤ ± 3° 190 - 850 kHz ≤ ± 8° ≥ 850 kHz
6.	Audio amplifier	
6.1	Audio output voltage 1000 Hz into 300 Ohm at 1 mV/m, m = 30%	≥ 5.5 V
6.2	Distortion factor at 1000 Hz and Vout = 5 V	≤ 25%
6.3	Audio frequency response measured at 400 Hz, relative to 700 Hz	≤ 6 dB 350 Hz - 1100 IHz

5.1.2 Necessary instrumentation and accessories

For repairs and adjustments of the unit, test equipment is required which has sufficient accuracy and precision for the work at hand. If the following test instruments are not available, only equivalent or superior equipment should be used in order to ensure that the required levels are present and/or attained for repairs, adjustments and final testing.

No.	Description	Type	Make
1.	RF-Generator	3300A	Adret
2.	RF-Voltmeter	URV	Rohde & Schwarz
3.	RMI-Indicator	26 V 400 Hz -	Aring-Synchro x, y, z
4.	Sweeper	Polyskop IV	Rohde + Schwarz
5.	Audio Generator	Model 147	Wavetek
6.	Audio Voltmeter	UVN	Rohde + Schwarz
7.	Digitalmulitmeter	3 1/2 digit	
8.	Frequencycounter	9917	Racal
9.	Distortion meter	331 A	Hewlett Packard
10.	Oscilloscope	OS 300 B	Advance
11.	Switching attenuator	SA 50	Texscan
12.	Synchro/Resolver	Angle indicator Modell SR-202 ILC	DATA DEVICE Corp.
13.	Screened room	TIC-Box	Tel-Instruments USA

5.1.3 Recommended testing aids

5.1.3.1 General

The Test cable harness is shown in Fig. 5-1. For testing the ADF-System, the following cables are required:

Connecting cable AD 3502 - ( )	AK 3500 - (2)
Connecting cable ID 3502 - ( )	AK 3500 - (4)
Connecting cable AC 3503 - ( )	AK 3500 - (3)
Connecting cable AC 3504 - ( )	AK 3500 - (3)
Connecting cable AN 3500 - ( )	AK 3500 - (5)
Testbox	PG / AD 3500 - (1)

Connect the converter and indicator ID 3502 - ( ) with connecting cable AK 3500 - (4) to connector P 3 (Test cable harness Fig. 5-1).

a) Test cable harness

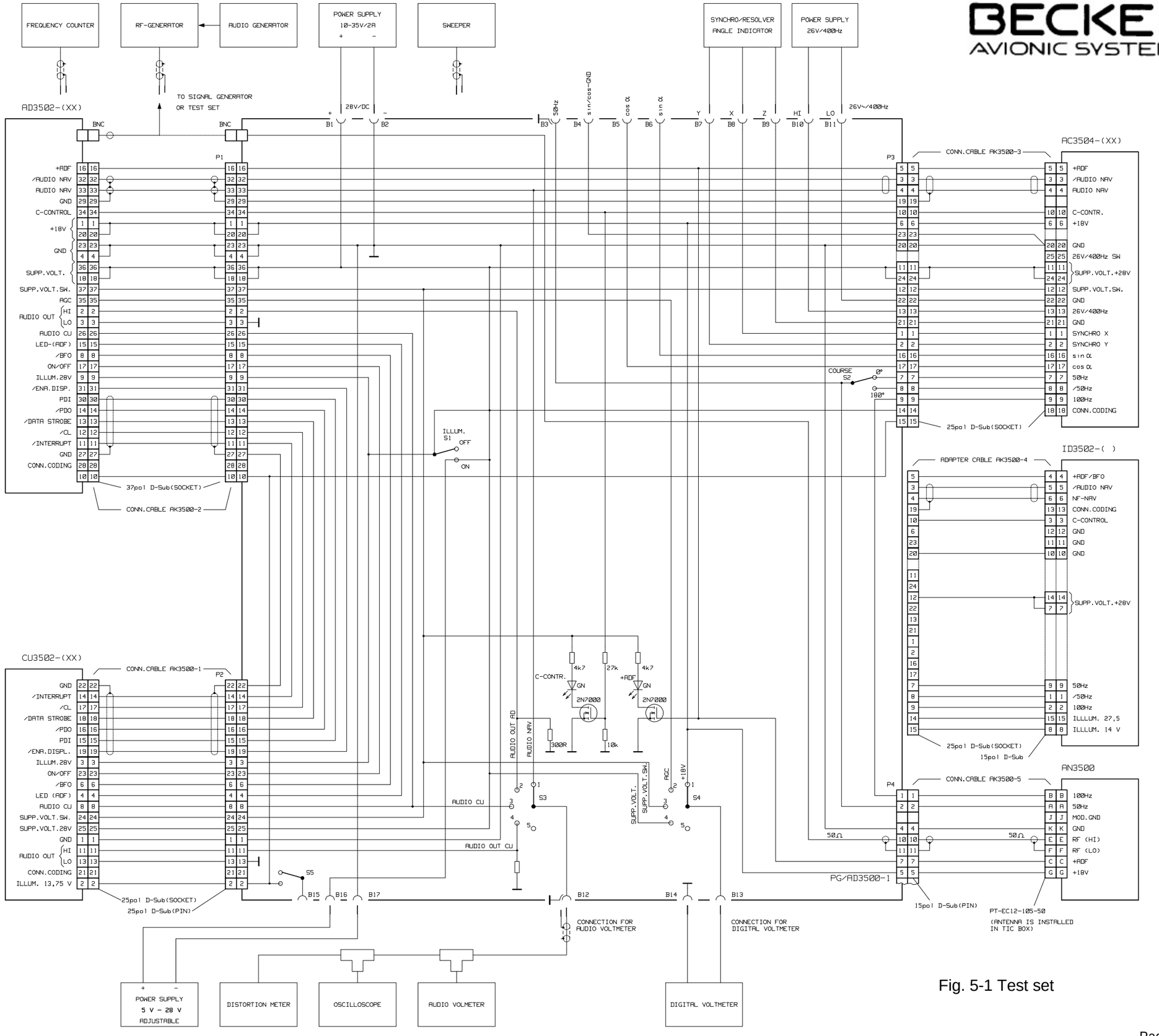

Fig. 5-1 Test set

b) Test setup TIC test box

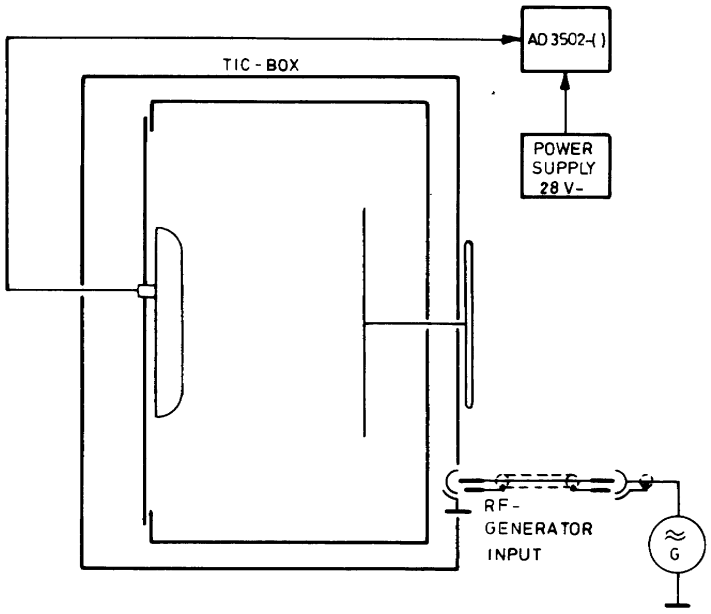

Fig. 5-2 Test setup TIC test box

c) Mounting panel

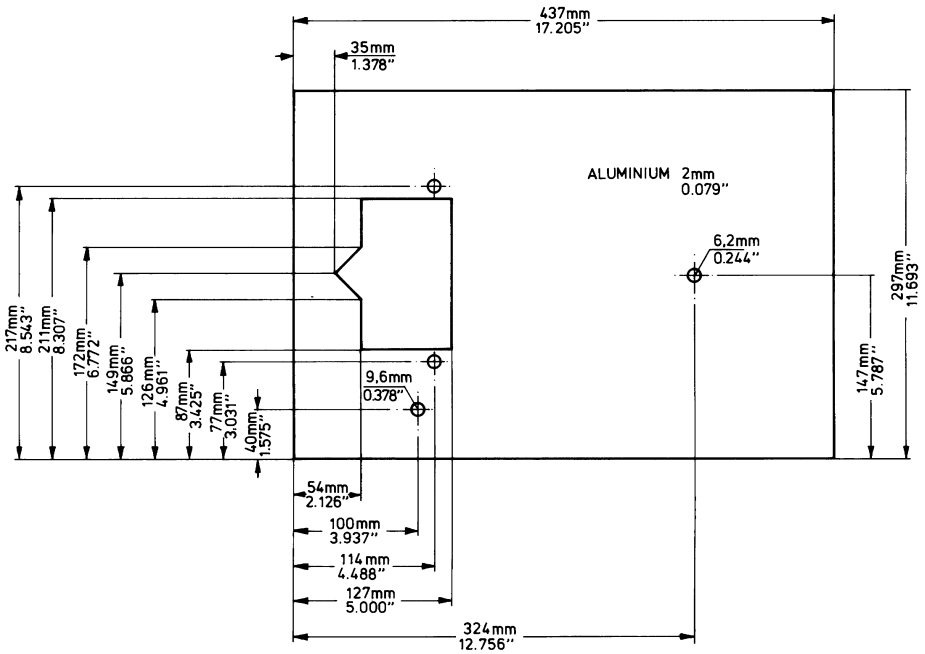

Fig. 5-3 Mounting panel AN 3500 for TIC test box

d) Adapter cable 1 for connecting TIC test box - RF-Generator

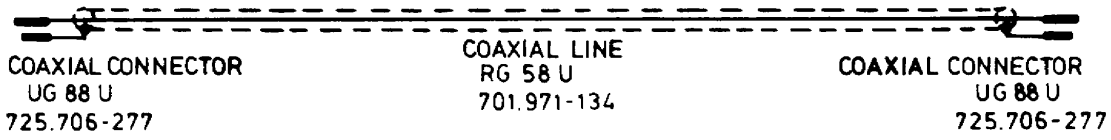

Fig. 5-4 Adapter cable 1

5.1.4 Final checkout procedure

Place the AN 3500 antenna in the shielded room in the TIC test box. Connect the signal generator to the feed points.

NOTE

All voltages set on the signal generator have to be divided by the room factor of the shielded room or the TIC test box to obtain the field strength present in the µV/m. When using the TIC test box, the room factor is 5.

While establishing the bearing accuracy, take into account that a quadrantal error correction must be made in the aircraft for compensating the field distortion of the aircraft.

There is no field distortion in the shielded room or in the TIC test box and thus the quadrantal error established must also be taken into account when establishing the bearing accuracy. On an average, this is 45°, 350°, 135° and 225° for the feeder devices related to the maximum error of approx. 7° to 9°. If the precompensated quadrantal error is evenly distributed, there is no need to correct the results of final checkout.

5.1.4.1 Final setting of the sensitivity (2.1)

a) Set the signal generator to 215 kHz.

b) Set the output voltage of the signal generator to 350µV / 400 Hz / 30% mod. This corresponds to a field strength of 70µV/m for a spatial factor of 5.

c) The signal-to-noise ratio at the audio must be ≥ 6 dB. Enter result in Test Report.

d) Repeat measurements for 285 kHz, 330 kHz, 470 kHz, 600 kHz, 1000 kHz and 1500 kHz.

5.1.4.2 Frequency accuracy (2.2)

a) Set receiver and signal generator to 200 kHz respectively 1799 kHz (in REC mode).

b) Modulate the signal generator with 400 Hz / 30% and set to an output field strength of approx. 50µV/m.

c) Set the volume control so that an audio output voltage of approx. 2.45 V is attained.

d) Change the setting of the signal generator above and below the required frequency until - 6 dB of the audio output is indicated. Establish the frequencies of the 6 dB points and form the average.The frequency offset must be within ± 0.2 kHz.

e) Enter the established offset in the Test Report. Check the frequency accuracy over the frequency range.

5.1.4.3 AGC characteristic (in REC mode) (2.3)

a) Set signal generator to 400 kHz and modulate with 400 Hz / 30% and couple into the receiver at 100µV/m.

b) Set volume control to U_{out} = - 6 dB in range of 3 V.

c) Set signal generator to 1 mV/m; 10 mV/m; 100 mV/m; 0.5 V/m. A negative voltage≥ 2 dB is not allowed. Enter the result in the test report form.

5.1.4.4 Establishing the bearing sensitivity and accuracy over the input voltage range (2.4)

a) Set the receiver and signal generator to a frequency of 250 kHz m = 80% / 400 Hz.

b) Set the bearing scale of the TIC test box to 0°.

c) Bearing indicator must point to 0° relative bearing for medium field strength.

d) Step by step alter the input field strength to 0.5 mV/m (see test report) through the range of 70mV/m. The bearing indicator must safely indicate with an accuracy of ± 3° with respect to 0° relative bearing through the entire input voltage range.

e) Repeat measurements at the frequencies listed in the test report.

5.1.4.5 Establishing bearing accuracy (2.5)

a) Set the receiver and signal generator to a frequency of 335 kHz, m = 80% / 400 Hz.

   Alter the test radiator of the TIC test box by 1 mV/m over the rotary angle range of 45° to 45° and establish the bearing offset.

b) In the directions 0° / 180° and 90° / 270° the bearing accuracy must be within ± 3°.

c) In the 45° directions, the errors must be evenly distributed when a quadrantal error correction setting is made.

5.1.4.6 Audio amplifier (2.6)

a) Terminate the audio output of the receiver with 300 Ohm.

b) Set the signal generator and receiver to an arbitrary frequency having a field strength of 1 mV/m.

c) The depth of modulation for all measurements must be 30%.

5.1.4.7 Audio power output (2.6.1)

a) Set the volume control to max. audio voltage across the load resistor.

b) The audio output must be 5.5 V.

5.1.4.8 Distortion factor (2.6.2)

Measure the distortion factor at 1000 Hz and 5 V output voltage. Distortion factor must not exceed 25%.

5.1.4.9 Audio frequency response (2.6.3)

a) Modulate signal generator with 700 Hz.

b) Set the volume control to an audio output of approx. 0 dB (3 V Range).

c) Modulate the signal generator with 350 Hz and after that 1100 Hz. The audio voltage must not be down by more than 6 dB at 350 Hz and 1100 Hz.

5.1.4.10 Checking the BFO function (2.7)

a) Switch the receiver to BFO.

b) Switch off the modulation of the signal generator.

c) Set signal generator to U_{in} = 150 µV/m.

d) The 1000 Hz tone must be audible.

e) Operate the signal generator with keyed modulation. The 1000 Hz tone must continue to be audible in synchronism with the keying without distortion.

5.1.4.11 Checking the test function (2.8)

a) Set the signal generator to 100 µV/m.

b) Switch the receiver to the ADF mode and allow to set a 0° bearing.

c) Set the receiver to REC mode. The pointer must run to approx. 90°. Switching back the ADF mode the pointer again returning to the 0° bearing.

5.1.4.12 Checking ADF function (2.9)

a) Press the ADF button on the receiver.

b) It must be possible to switch the ADF function on and off regardless of the position of the ADF function on the receiver. Enter the result in the test report form.

5.1.4.13 Checking the lighting (2.10)

Check lighting for uniform lighting and proper function.

5.2 The final test RA 3502 - ( ), CU 5502 - ( ), AN 3500 with ID 3502 - ( ), and AC 3503 - ( ) / AC 3504 - ( )

The final test and final test report are given in the Handbook Maintenance and Repair RA 3502 - ( ) DV 60604.04 article-no. 0511.651-071.

FINAL TEST REPORT

PB 30613.03

1. Equipment

AD 3502 - ( ) or RA 3502 - ()/CU 3502 Serial-No.:. . . . . .
ID 3502 - ( ) Serial-No.:. . . . . .
AC 3503 - ( ) Serial-No.:. . . . . .
AN 3500 Serial-No.:. . . . . .

2. Receiver

2.1 Sensitivity

	min.	Requirements	max.	Measurements
215 kHz	6			. . . . . dB
285 kHz	6			. . . . . dB
330 kHz	6			. . . . . dB
470 kHz	6			. . . . . dB
600 kHz	6			. . . . . dB
1000 kHz	6			. . . . . dB
1500 kHz	6			. . . . . dB

2.2 Frequency accuracy

200 kHz				
- 6 dB		- Δ f		max. 0.2 kHz
+ 6 dB		+ Δ f	((+ $\overline{\Delta}$ f) + (- Δ f))/2	. . . . . kHz
1799 kHz				
- 6 dB		- Δ f		max. 0.2 kHz
+ 6 dB		+ Δ f	((+ $\overline{\Delta}$ f) + (- Δ f))/2	. . . . . kHz

2.3 AGC characteristic

100µV/m -	- 2		+ 8	. . 0 . . . . dB
1 mV/m	- 2		+ 8	. . . . . dB
10 mV/m	- 2		+ 8	. . . . . dB
100 mV/m	- 2		+ 8	. . . . . dB
0,5 V/m	- 2		+ 8	. . . . . dB

2.4 Establishing the bearing sensitivity and accuracy over the Input voltage range

250 kHz				
70µV/m	- 3°	0°	+ 3°	. . . . . °
100µV/m	- 3°	0°	+ 3°	. . . . . °
1 mV/m	- 3°	0°	+ 3°	. . . . . °
10 mV/m	- 3°	0°	+ 3°	. . . . . °
100 mV/m	- 3°	0°	+ 3°	. . . . . °
500 mV/m	- 3°	0°	+ 3°	. . . . . °

		min.	**Requirements**	max.	**Measurements**
400 kHz					
	70µV/m	- 3°	0°	+ 3°	. . . . . °
	100µV/m	- 3°	0°	+ 3°	. . . . . °
	1 mV/m	- 3°	0°	+ 3°	. . . . . °
	10 mV/m	- 3°	0°	+ 3°	. . . . . °
	100 mV/m	- 3°	0°	+ 3°	. . . . . °
	500 mV/m	- 3°	0°	+ 3°	. . . . . °
650 kHz					
	70µV/m	- 3°	0°	+ 3°	. . . . . °
	100µV/m	- 3°	0°	+ 3°	. . . . . °
	1 mV/m	- 3°	0°	+ 3°	. . . . . °
	10 mV/m	- 3°	0°	+ 3°	. . . . . °
	100 mV/m	- 3°	0°	+ 3°	. . . . . °
	500 mV/m	- 3°	0°	+ 3°	. . . . . °
1200 kHz					
	70µV/m	- 8°	0°	+ 8°	. . . . . °
	100µV/m	- 8°	0°	+ 8°	. . . . . °
	1 mV/m	- 8°	0°	+ 8°	. . . . . °
	10 mV/m	- 8°	0°	+ 8°	. . . . . °
	100 mV/m	- 8°	0°	+ 8°	. . . . . °
	500 mV/m	- 8°	0°	+ 8°	. . . . . °
1500 kHz					
	70µV/m	- 8°	0°	+ 8°	. . . . . °
	100µV/m	- 8°	0°	+ 8°	. . . . . °
	1 mV/m	- 8°	0°	+ 8°	. . . . . °
	10 mV/m	- 8°	0°	+ 8°	. . . . . °
	100 mV/m	- 8°	0°	+ 8°	. . . . . °
	500 mV/m	- 8°	0°	+ 8°	. . . . . °
2182 kHz					
	70µV/m	- 8°	0°	+ 8°	. . . . . °
	100µV/m	- 8°	0°	+ 8°	. . . . . °
	1 mV/m	- 8°	0°	+ 8°	. . . . . °
	10 mV/m	- 8°	0°	+ 8°	. . . . . °
	100 mV/m	- 8°	0°	+ 8°	. . . . . °
	500 mV/m	- 8°	0°	+ 8°	. . . . . °

	min.	**Requirements**	max.	**Measurements**
2.5 Establishing bearing accuracy				
0°	- 3°	0°	+ 3°	. . . . . °
38°	- 3°	45°	+ 3°	. . . . . °
90°	- 3°	90°	+ 3°	. . . . . °
142°	- 3°	135°	+ 3°	. . . . . °
180°	- 3°	180°	+ 3°	. . . . . °
218°	- 3°	225°	+ 3°	. . . . . °
270°	- 3°	270°	+ 3°	. . . . . °
322°	- 3°	315°	+ 3°	. . . . . °
2.6 Audio amplifier				
2.6.1 Audio Power output				
	5.5			 V
2.6.2 Distortion				
			25	. . . . . %
2.6.3 Audio frequency response				
350 Hz		700 Hz 0 dB	6	. . . . . dB
1100 Hz		700 Hz 0 dB	6	. . . . . dB
2.7 BFO function				
		o.k.		. . . . .
2.8 Test function				
		o.k.		. . . . .
2.9. ADF function				
		o.k.		. . . . .

min.	**Requirements**	max.	**Measurements**
2.10 Check lighting			
	o.k.		. . . . .

The system is airworthy / not airworthy

Place and date : . . . . . Tested by : . . . . . .