

BECKER

AVIONIC SYSTEMS

Navigation-Receiver

NR 3320 - (01) / - (02)
VOR/LOC and GS

NR 3330 - (01) / - (02)
VOR/LOC

Installation and Operation

Manual		DV 38001.03
Issue	1	August 1997
Change	1	August 1998

Becker Flugfunkwerk GmbH • Baden Airpark • 77836 Rheinmünster • Germany

Telephone +49 (0) 7229 / 305-0 • Fax +49 (0) 7229 / 305-217

<http://www.becker-avionics.com> • Email : info@becker-avionics.de

Becker Avionics Inc. • 10830 N.W. 27 Street Miami FL 33172 • USA

Telephone +1 (305) 597 0069 • Fax +1 (305) 597 8737

<http://www.beckerusa.com> • Email : info@beckerusa.com

FIRST ISSUE AND CHANGES

Issue 1 August 1997
Change 1 August 1998

LIST OF EFFECTIVE PAGES

Page No.:	Date :	Page No.:	Date :
Title	08/98		
1-I - 1-II	08/97		
1-1 - 1-12	08/97		
2-I - 2-II	08/98		
2-1 - 2-14	08/98		
3-1 - 3-II	08/97		
3-1 - 3-12	08/97		

Table of contents

Section	1	General information	Page
1.1		Introduction	1-1
1.2		Purpose of equipment	1-1
1.3		Variants survey	1-2
1.4		General description	1-4
1.5		Technical Data	1-6
1.5.1		General Data	1-6
1.5.2		VOR/LOC receiver	1-6
1.5.3		VOR/LOC system functions	1-7
1.5.4		GS receiver and functions in the NR 3320 - (01) / - (02)	1-8
1.5.5		Indicators	1-8
1.6		Software	1-9
1.7		Ratings and airworthiness specifications	1-9
1.8		Environmental Qualification Form	1-10
1.9		Accessories (not contained in the scope of delivery)	1-11

Blank

Section 1 GENERAL INFORMATION

1.1 Introduction

The following manuals describe the NAV receiver NR 3320 - () and NR 3330 - ()

The manuals DV 38001.03 "Installation and Operation" and DV 38001.04 "Maintenance and Repair" contain the following sections :

	Section	DV 38001.03	DV 38001.04
1	General Information	X	X
2	Installation	X	X
3	Operation	X	X
4	Theory of Operation		X
5	Maintenance and Repair		X
6	Illustrated Parts List		X
7	Modification and Changes		X
8	Circuit Diagrams		X

1.2 Purpose of equipment

The NAV receiver NR 3320 - (01) is designed to receive and convert VOR and LOC signals on 200 channels in the frequency range between 108.00 and 117.95 MHz.

The NAV receiver NR 3320 - (02) is designed to receive VOR and LOC signals on 200 channels in the frequency range between 108.00 and 117.95 MHz. It supplies the NAV composite signal to an external VOR/LOC converter. Both NAV receiver includet a glideslope receiver. The glideslope receiver is designed to receive and convert GS signals on 40 channels in the frequency range between 108.00 and 117.95 MHz.

The NAV receiver NR 3330 - (01) is designed to receive and convert VOR and LOC signals on 200 channels in the frequency range between 108.00 and 117.95 MHz.

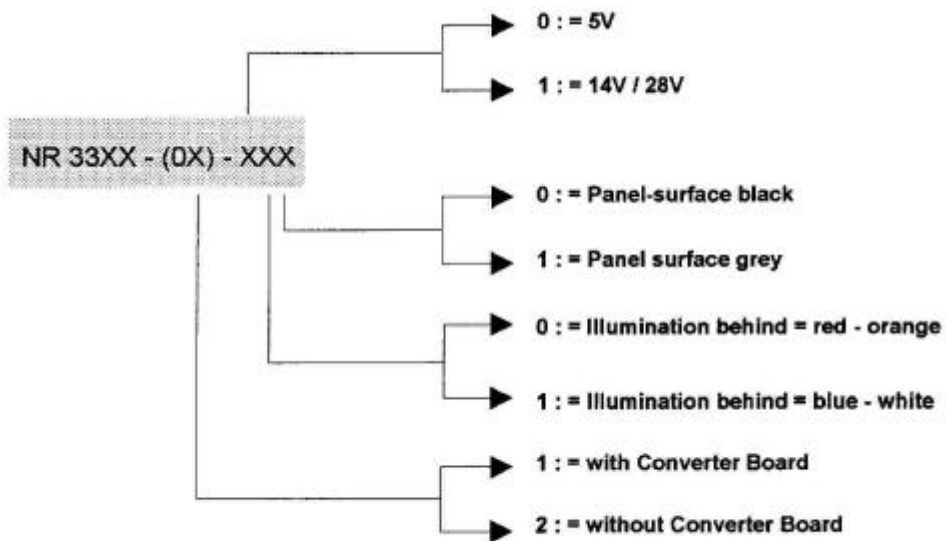
The NAV receiver NR 3330 - (02) is designed to receive VOR and LOC signals on 200 channels in the frequency range between 108.00 and 117.95 MHz. It supplies the NAV-composite signal to an external VOR/LOC converter.

1.3 Variants survey

The following table lists the variants models of the NAV receiver NR 3320 - () and NR 3330 - (). Externally, the variants are identical, i.e. their dimensions, mounting depth etc. are the same in all cases.

Typ designation	Identifying characteristics	Part no.
NR 3320 - (01) - 110 NR 3320 - (01) - 111	NAV receiver with VOR/LOC and GS functions and convert (panel illumination + 13.75/27.5 V)	0502.871-911 0512.044-911
NR 3320 - (01) - 010 NR 3320 - (01) - 011	NAV receiver with VOR/LOC and GS functions and convert (panel illumination + 5 V)	0503.045-911 0512.052-911
NR 3320 - (02) - 110 NR 3320 - (02) - 111	NAV receiver with VOR/LOC function without convert (NAV composite output) and GS functions with convert (panel illumination + 13.75/27.5 V)	0503.053-911 0512.060-911
NR 3320 - (02) - 010 NR 3320 - (02) - 011	NAV receiver with VOR/LOC function without convert (NAV composite output) and GS functions with convert (panel illumination + 5 V)	0503.061-911 0512.079-911
NR 3330 - (01) - 110 NR 3330 - (01) - 111	NAV receiver with VOR/LOC functions and convert (panel illumination + 13.75/27.5 V)	0503.071-911 0512.001-911
NR 3330 - (01) - 010 NR 3330 - (01) - 011	NAV receiver with VOR/LOC function and convert (panel illumination + 5 V)	0503.088-911 0512.011-911
NR 3330 - (02) - 110 NR 3330 - (02) - 111	NAV receiver with VOR/LOC functions without convert (NAV composite output) (panel illumination + 13.75/27.5 V)	0503.096-911 0512.028-911
NR 3330 - (02) - 010 NR 3330 - (02) - 011	NAV receiver with VOR/LOC functions without convert (NAV composite output) (panel illumination + 5 V)	0503.101-911 0512.036-911

Typ designation	Panel illumination		Illumination behind		Panel-surface	
	5 V	14 V / 28 V	red-orange	blue-white	black	grey
NR 33XX-(0X)-110	-	X	-	X	X	-
NR 33XX-(0X)-010	X	-	-	X	X	-
NR 33XX-(0X)-111	-	X	-	X	-	X
NR 33XX-(0X)-011	X	-	-	X	-	X



1.4 General description

The NAV receiver is designed as a single unit for installation in the instrument panel or operating console of aircraft. Its dimensions correspond to the ARINC standard dimensions for control equipment. It is held in place by four DZUS fasteners. All controls and indicators are located on the front panel.

The back side of the unit contains:

- the BNC-antenna jacks for the VOR/LOC-receiver
- the TNC-antenna jacks for theGS-receiver
- the 15-pole D-sub connector plug (female) for the outputs VOR/LOC converter board (NR 3320 - (01) only)
- the 9-pole D-sub connector plug (female) for the I/O Outputs RS 422 interface.
- the 25-pole D-sub connector plug (male) unit connector plug

The electronic elements of the unit are distributed among the following boards, which are linked with one another by means of p.c. connectors:

1. Chassis board
2. VOR/LOC receiver board
3. VOR/LOC converter board
4. GS receiver board
5. Processor board
6. Display board
7. Interface board

The interface board and the processor board are mounted and fastened by means of four screws on the frame of the control head. The display board with the two liquid crystal displays is located between the front plate and the panel.

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

The GS receiver board is above the chassis board; and the VOR/LOC receiver board and the VOR/LOC converter board are mounted below the chassis board. Each of these three circuit boards is attached to the chassis with four screws.

The VOR/LOC receiver is a three-conversion superheterodyne receiver and operates in the frequency range from 108.00 to 117.95 MHz with a channel separation of 50 kHz. The variable-frequency signal for the mixer is generated by a local voltage-controlled oscillator (VCO). The VCO is controlled by digital frequency synthesizer which is mounted on the chassis board. Digital frequency synthesis and storage are microprocessor-controlled.

The VOR/LOC conversion takes place on the VOR/LOC converter board. The converted signals can then be read off the VOR/LOC pointer of the connected VOR/ILS indicator.

The VOR/LOC converter board is omitted in the NR 3320 - (02) and NR 3330 - (02) type. This type supplies only the NAV composite signal to the VOR/LOC evaluation (for indicators with integrated VOR/LOC evaluation).

The GS receiver is designed as a single-conversion superheterodyne receiver and operates in the frequency range between 329.15 MHz and 335.00 MHz with a channel separation of 150 kHz. The oscillator frequency for the receiver is generated by a local voltage-controlled oscillator (VCO). The VCO is controlled by a digital frequency synthesizer which is mounted on the chassis board. The digital frequency synthesizer operates in conjunction with the microcontroller of the NAV receiver. The converted GS signals can be read off the GS pointer of the connected indicator.

The NAV receiver contains two liquid crystal frequency displays, on which two different frequencies can be set using the tuning dials. The microcontroller allows programming of an "active" and a "preset" frequency which can be quickly swapped during VOR/LOC operation by pressing the transfer button.

The NAV receiver possesses a built-in testing function. By pressing the TEST button it is possible to check the proper functioning of both liquid crystal displays, the VOR/LOC converter and the GS converter.

The tuning dials of the NAV receiver can also be used to remotely control a DME unit (parallel with 2-out-of-5 code).

1.5 Technical Data**1.5.1 General Data**

Supply voltage	+ 13,75 V oder + 27.5 V DC
Current consumption of NR 3320 - (01)	typ. 340 mA (without panel illumination)
Current consumption of NR 3320 - (02)	typ. 300 mA (without panel illumination)
Current consumption of NR 3330 - (01)	typ. 280 mA (without panel illumination)
Current consumption of NR 3330 - (02)	typ. 240 mA (without panel illumination)
Current consumption of panel illumination	typ. 230 mA at 27.5 V typ. 460 mA at 13.75 V typ. 1.4 A at 5 V
Overcurrent capacity of internal fusing	1,5 A
Recommended external overcurrent protection	1 A without panel illumination
Operating temperature range	- 20° C ... + 55° C (short-time to + 70° C)
Storage temperature range	- 55° C ... + 85° C
Interface	RS 422
Max. operating altitude	50 000 ft.

Dimensions

Front panel	47.5 x 146 mm
Casing depth	183 mm with antenna jack

Weight of

NR 3320 - (01)	approx. 0,885 kg
NR 3320 - (02)	approx. 0,835 kg
NR 3330 - (01)	approx. 0,745 kg
NR 3330 - (02)	approx. 0,695 kg

1.5.2 VOR/LOC receiver

Receiver type	three-conversion superheterodyne receiver
Frequency range	108.00 MHz - 117.95 MHz
No. of channels	200
Channel spacing	50 kHz

IF-Frequencies 1,2,3	71,05 MHz, 21,4 MHz, 455 kHz
Sensitivity (audio)	≤ -93 dBm for ≥ 6 dB SINAD
Bandwidth	≥ 12 kHz at 6 dB
Selectivity	≥ 65 dB at $\Delta F \geq \pm 50$ kHz
AGC	≤ 3 dB from -87 dBm -10 dBm
Distortion	$\leq 10\%$
Audio output	150 mW at 300 Ω symm.
NAV signal (composite)	500 mV at 30 Hz, mod = 30%
VOICE filter	≥ 20 dB reduction
DME remote control	parallel, with 2-out-of-5 code in accordance with ARINC 410

1.5.3 VOR/LOC system functions

Sensitivity	≤ -93 dBm for full direction sensitivity
Bearing error under normal conditions	$\leq \pm 2^\circ$
Bearing error under all environmental influences listed in JTSO - 2c40c, with 95% probability	$\leq \pm 2.7^\circ$
Course deviation for full scale deflection	$\pm 10^\circ$
LOC centering error under all environmental conditions, with 95% probability	$\leq 11\%$ of standard deviation
Resolver output	standard value as per ARINC 407
VOR/LOC needle output	max. of 3 pointers and/or flags with 1 k Ω each
VOR/LOC warning flag output	max. of 3 pointers and/or flags with 1 k Ω each
TO/FROM output	max. of 3 pointers and/or flags with 1 k Ω each
Autopilot output	for VOR course tracking and ILS mode

1.5.4 GS receiver and functions in the NR 3320 - (01) / - (02)

Receiver type	single-conversion superheterodyne receiver
Frequency range	329.15 MHz ... 335.00 MHz
No. of channels	40
Channel spacing	150 kHz
Sensitivity	≤ -80dBm for complete disappearance of warning flag
Bandwidth	≥ ± 20 kHz at 6 dB
Selectivity	≥ 42 dB at ΔF ≥ 150 kHz
Centering error under all environmental conditions, with 95% probability	≤ 13% of standard deflection
GS needle output	max. of 3 needles and/or flags with 1 kΩ each
GS warning flag output	max. of 3 needles and/or flags with 1 kΩ each

1.5.5 Indicators

VOR/LOC indicator (singlepointer) for NR 3330 - (01)	IN 3300 - (4) / - (9) or equivalent indicator
VOR/LOC indicator (crosspointer) for NR 3320 - (01)	IN 3300 - (3) / - (5) - (8) or equivalent indicator

Compatible indicators may also be used if they fulfill the relevant requirements. They must possess equivalent or better environmental performance characteristics than the indicators listed above as regards temperature, altitude, humidity and vibration.

1.6 Software

The frequency synthesizer, the frequency memory and the frequency displays are controlled by a microprocessor.

The corresponding software has been classified as in accordance with the guidelines of RTCA Document DO - 178B in level C.

1.7 Ratings and airworthiness specifications

LBA equipment no.	10.922/94 JTSO
BAPT no.	A132 880 J
Specifications	
RTCA DO-192	JTSO - C34e
RTCA DO-195	JTSO - C36e
RTCA DO-196	JTSO - 2C40c
BAPT	17 TR 2010
Software	RTCA DO -178/B Level C
Environmental categories	D1-BA(MN)XXXXXXXXZBABATAXXX

1.8 Environmental Qualification Form

The following performance standards under environmental test conditions have been established in accordance with the procedures set forth in EUROCAE/RTCA Document No. ED-14C/DO-160C.

Environmental condition	ED - 14C DO - 160C	Category	Performance
Temperature	4.0	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.
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
Vibration	8.0	MN	
Magnetic effect	15.0	Z	Deflection of 1° of compass at a dis- tance of ≥ 30 cm
Power input variation	16.0	B	The equipment functions on a 10-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	A	

1.9 Accessories (not contained in the scope of delivery)

1	Cable connector 9-pin male	
	Crimpversion	Article-No. 0820.970-277
	or	
	soldering version	Article-No. 0344.699-277
	Case	Article-No. 0799.191-277
1	Cable connector 15-pin male	
	Crimpversion	Article-No. 0812.803-277
	or	
	soldering version	Article-No. 0726.303-277
	Case	Article-No. 0774.049-277
1	Cable connector 25-pin female	
	Crimpversion	Article-No. 0472.921-277
	or	
	soldering version	Article-No. 0725.021-277
	Case	Article-No. 0344.834-277
	2 set springl	Article-No. 0725.560-277
1	Antenna connector VOR/LOC, BNC	Article-No. 0725.706-277
1	Antenna GS, TNC (only for NR 3320 - (01) / - (02))	Article-No. 0725.900-277

Handbooks

Installation and Operation	Article-No. 0504.971-071
Maintenance and Repair	Article-No. 0504.981-071

Blank

Table of contents

Section	2	Installation	Page
2.1		General	2-1
2.2		Pre-installation check	2-1
2.3		Mechanical installation	2-1
2.4		Installation wiring	2-1
2.4.1		Panel and display lighting	2-2
2.4.2		Connection of additional pointers or flags	2-2
2.4.3		Connection of an autopilot (VOR/LOC and GS)	2-2
2.4.4		Connection of VOR/LOC and GS superflags	2-3
2.4.5		Wiring for ILS-mode control function	2-3
2.4.6		Remote control of a DME unit	2-3
2.4.7		Connection of indicators of other makes	2-3
2.4.8		Connection of the symmetrical audio output	2-3
2.4.9		Asymmetric wiring of the audio output (from serial no. 99)	2-3
2.4.10		Asymmetric wiring of the audio output (upwards serial no. 100)	2-4
2.5		Post-installation check	2-4
2.5.1		General	2-4
2.5.2		Testing procedures	2-4
2.5.3		Retrofit NAV 2000	2-6
Fig. 2-1		Installation dimensions for the NAV receiver	2-7
Fig. 2-2		Installation of fastener strips	2-8
Fig. 2-3		Installation wiring for the NAV receiver NR 3320 - () with indicator NI 2020, NI 2021	2-9
Fig. 2-4		Installation wiring for the NAV receiver NR 3330 - () with indicator NI 2030 - () / NI 2031	2-10
Fig. 2-5		Installation wiring for the NAV receiver NR 3320 - () with IN 3300 - (3)	2-11
Fig. 2-6		Installation wiring for the NAV receiver NR 3330 - () with indicator IN 3300 - (4)	2-13
Fig. 2-7		Installation wiring for the NAV receiver NR 3330 - () with indicator IN 2040 and converter NC 2040/41	2-15
Fig. 2-8		Installation wiring for the NAV receiver NR 3330 - () with indicator HSI KING KI525 (A)	2-17
Fig. 2-9		Installation wiring for the NAV receiver NR 3330 - () with indicator KING KI204	2-19
Fig. 2-10		Installation wiring for the NAV receiver NR 3330 - () with indicator KING KI206	2-21

Blank

Section 2 INSTALLATION

2.1 General

Installation of the NAV receiver varies according to aircraft and equipment design. It is therefore only possible to provide general guidelines in this section.

2.2 Pre-installation check

Prior to installing the NAV receiver in an aircraft, a visual inspection should be carried out to determine whether any damage has been caused during transport. The following defects should be checked for :

1. Soiling, dents, scratches, rust, broken fasteners, chipped paint coat on housing or housing parts.
2. Soiling or scratches on type plate, front plate or lettering.
3. Soiling, bent or cracked pins, cracked plug or jack inserts.
4. Soiled, sticking or damaged pushbuttons, knobs, dials or potentiometers.
5. Missing screws.

2.3 Mechanical installation

The NAV receiver should be installed at a suitable location within the aircraft. As a rule, this will be either the instrument panel or the operating console. The dimensions relevant for mounting the NAV receiver are indicated in Fig. 2-1. The unit is fastened in place by means of four DZUS fasteners. The placement of the required fastener strips is illustrated in Fig. 2-2.

If a cut-out 161 to 163 mm wide is already available in the aircraft instrument panel (e.g. in American aircraft models), then the space left on each side between the instrument panel and the NAV receiver should be filled in using aluminum strips (approx. 8 x 20 mm) as shown in Fig. 2-2. Any spaces left after that can also be filled out with aluminum plates of suitable thickness.

If no cut-out of suitable size is present in the instrument panel, it is possible to make one with the dimensions indicated in Fig. 2-2. In this the case, we recommend using straight DZUS fastener strips.

2.4 Installation wiring

The required installation wiring for the NAV receiver is illustrated schematically in Fig. 2-3 to Fig. 2-10.

CAUTION

- Subsequent addition of a GS receiver to the NAV receiver NR 3320 - () may be done only by the manufacturer.
- No HF 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 supply and control lines of autopilots.

2.4.1 Panel and display lighting

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

The NAV receiver is available either a selectable panel illumination for + 13.75 / 27.5 V or a + 5 V DC or AC-panel illumination (more details for + 5 V panel illumination see Circuit Diagram display board SP 379xx-1000.000).

The panel illumination of the navigation receiver is set to + 13.75 / 27.5 V panel illumination on delivery.

Connection panel and display lighting	P1 UNIT-CONNECTOR	
+13,75 V Power supply	P 1 - Pin 9 ILL. +14V	- Connection internal to Ground
+27,5 V Power supply	P 1 - Pin 10 ILL. +28V	
+5 V Power supply DC or AC	P 1 - Pin 9 ILL. +14V	+ Connection
	P 1 - Pin 10 ILL. +28V	- Connection

NOTE

The panel and display lighting is not switched off, when the NAV receiver is switched off with ON/OFF switch).

2.4.2 Connection of additional pointers or flags

It is possible to connect up to two 1-kΩ supplementary instruments with VOR/LOC pointer, VOR/LOC warning flag, TO/FROM indication and GS pointer and GS warning flag to the NR 3320 - (1) / - (2) parallel to the indicator without altering the receiver.

2.4.3 Connection of an autopilot (VOR/LOC and GS)

The NAV receivers are equipped with outputs for connection of an autopilot. The corresponding pin assignments on J 3 (+ VOR/LOC AUTOPILOT RIGHT and - VOR/LOC AUTOPILOT LEFT) and P 1 (+ GS AUTOPILOT DOWN and - GS AUTOPILOT UP) are shown in Figs. 2-3 to 2-10.

CAUTION

The outputs are loaded with a DC offset voltage of + 5 V.

2.4.4 Connection of VOR/LOC and GS superflags

If it is wished for the converted VOR/LOC and GS signals to be fed to the SUPERFLAG inputs of course guidance systems, then 2 relays must be installed in the wiring (cf. Fig. 2-3 to 2-10) that are controlled by the SUPERFLAG CONTROL outputs. Since the switching is done by transistors inside of the NAV receiver whose open collectors feed pin 8 of receiver plug J 2 and pin 7 of receiver plug J 3, when doing the wiring it is vital not to exceed the current 150 mA at the supply voltage 30 V.

NOTE

According to ARINC 478/479, course guidance systems require 27.5-volt DC signals to indicate that the converted NAV signals are usable (reversing the warning flag function).

2.4.5 Wiring for ILS-mode control function

The ILS-mode control function can be used to operate an IFC (Instrument Flight Control) system or similar systems, such as automatic switching of an autopilot to VOR and ILS modes. The ILS-mode control feature consists of the ILS-mode transistor switch, the open collector of which feeds pin 19 or receiver plug P 1. The transistor is off during VOR operation and on during ILS operation. When doing the wiring it is vital not to exceed the current 150 mA at the supply voltage 30 V. If these conditions are not fulfilled, then an external control relay must be inserted.

2.4.6 Remote control of a DME unit

The NAV receiver is equipped for the connection of a remote DME unit with parallel signal-transmission in 2-out-of-5 code (cf. installation wiring diagram, Figs. 2-3 and 2-10).

2.4.7 Connection of indicators of other makes

Indicators made by other manufacturers that are equipped with a standard ARINC resolver are directly compatible with the VOR/LOC converter of the NAV receiver and may be connected.

2.4.8 Connection of the symmetrical audio output

The audio output of the navigation receiver is set to a symmetrical audio output on delivery. A symmetrical selection system or headset can be connected at P1 pin 11 Audio Out (150 mW/300 Ohm) and J 2 pin 9 Audio Low (ground).

To avoid unwanted coupling, this should be as close as possible to the selector system.

2.4.9 Asymmetric wiring of the audio output (up to serial no. 99)

If necessary, the audio output can also be changed to an asymmetric audio output. To change over, jumper Br 1 has to be connected to ground on the chassis board. The connection assignments do not change.

2.4.10 Asymmetric wiring of the audio output (upwards serial no. 100)

Upwards serial no. 100 attention the note in the interwiring diagram.

2.5 Post-installation check

2.5.1 General

After the NAV receiver and the indicator have been installed it is necessary to check the navigation system for proper functioning of the equipment. The procedures described below also include testing of the corresponding aircraft antennas for reliable operation.

2.5.2 Testing procedures

Internal NAV receiver functions

1. Switch on the power to the NAV receiver. The most recently stored channel frequencies should appear in the liquid crystal displays. If the PRESET display is not on, press the MDE key.
2. Press the TEST key. The digits 188.88 should flash on and off in both LCDs (display test). At the same time, the VOR/LOC pointer of the indicator should swing all the way out and the VOR/LOC warning flag should disappear. In NAV receiver NR 3320 - (1) / - (2) the GS pointer of the indicator should also deflect fully and the GS warning flag should disappear.

VOR system functions

1. Connect the RF output of the VOR/LOC signal generator to a suitable VOR antenna. The distance between the antenna and the aircraft should be approximately 20 meters. Set the standard VOR test signal to 330° FROM. Set the RF output attenuator to 50 mV, test frequency 114.9 MHz.
2. Tune the NAV receiver to 114.9 MHz.
3. Using the OBS dial on the indicator, set a course of 330° (upper scale marking " t "). The vertical needle is centered, the VOR/LOC warning flag disappears and the TO/FROM indicator should indicate FROM.
4. Set the VOR AF generator to 150°. The vertical needle should not deviate from center position by more than $\pm 2^\circ$ and the TO/FROM indicator should indicate TO.
5. Using the OBS dial, vary the course bearing by 10°. The vertical needle should indicate full deflection (5 points).

LOC system functions

1. Set the VOR/LOC signal generator to 110.9 MHz and 50 mV with the standard LOC centering signal.
2. Tune the NAV receiver to 110,9 MHz. The vertical needle should be centered and the VOR/LOC warning flag should disappear.

3. When the transmitter is set to standard LOC deviation signal, the vertical needle should deflect 3 points in the corresponding direction.

GS system functions in NR 3320 - (1) / - (2)

1. Connect the GS signal generator to a suitable GS antenna.
2. Tune the NAV receiver to 108.95 MHz (this corresponds to GS frequency 329.15 MHz).
3. Set the signal generator to 329.15 MHz and RF output level of 50 mV. Set the standard glideslope centering signal. The horizontal needle on the indicator should remain centered and the GS flag should remain out of sight.
4. Set the GS deviation signal for "down". The horizontal needle should deflect down while the GS flag stays out of sight.
5. Set the GS deviation signal for "up". The horizontal needle should deflect up while the GS flag stays out of sight.

2.5.3 Retrofit NAV 2000

The navigation receiver of the NAV 2000 system does not comply with the requirements for FM immunity in accordance with ICAO Annex 10 valid from 01.01.1995. The NR 3320 - () and NR 3330 - () navigation receivers can be fitted as replacements. Replacement is very simple and poses no problems. The dimensions comply with the ARINC standard for control units and attachment is by means of four DZUS fasteners. There is no need to change the aircraft cabling and connector P1 of new navigation receiver is pin-compatible with the connector of the navigation receiver of the NAV 2000 system.

The following points must be observed when replacing the NR 2020 / NR 2030 navigation receiver by a NR 3320 - (), or NR 3330 - () navigation receiver.

1. Connect bridge BR1 to the chassis board for asymmetric AF output from serial no. 99. Upwards serial no. 100 attention the not in the interwiring diagram.
2. An internal bridge in the NR 3320 / NR 3030 navigation receiver enables the + GS autopilot signal or the GS superflag to be applied as required to pin 20 of the connector. This changeover capability is also available on the NR 3320 - () and NR 3330 - () navigation receivers. The GS autopilot is connected to P1 pin 20 as standard (refer to chassis board circuit diagram, Note 1).
3. If navigation receivers of the NAV 2000 system are replaced by serial numbers up to 529, the aircraft cabling has to be changed as follows.
Remove the connection between the navigation receiver pin 19 and indicator unit pin 25.
Connect the 14 V lighting voltage at pin 10 of the navigation receiver to ground.
4. Navigation receiver NR 2029 can also be replaced by NR 3330 - (1) - 01. An additional adapter cable NR 3330 / NR 2029 is required in this case.

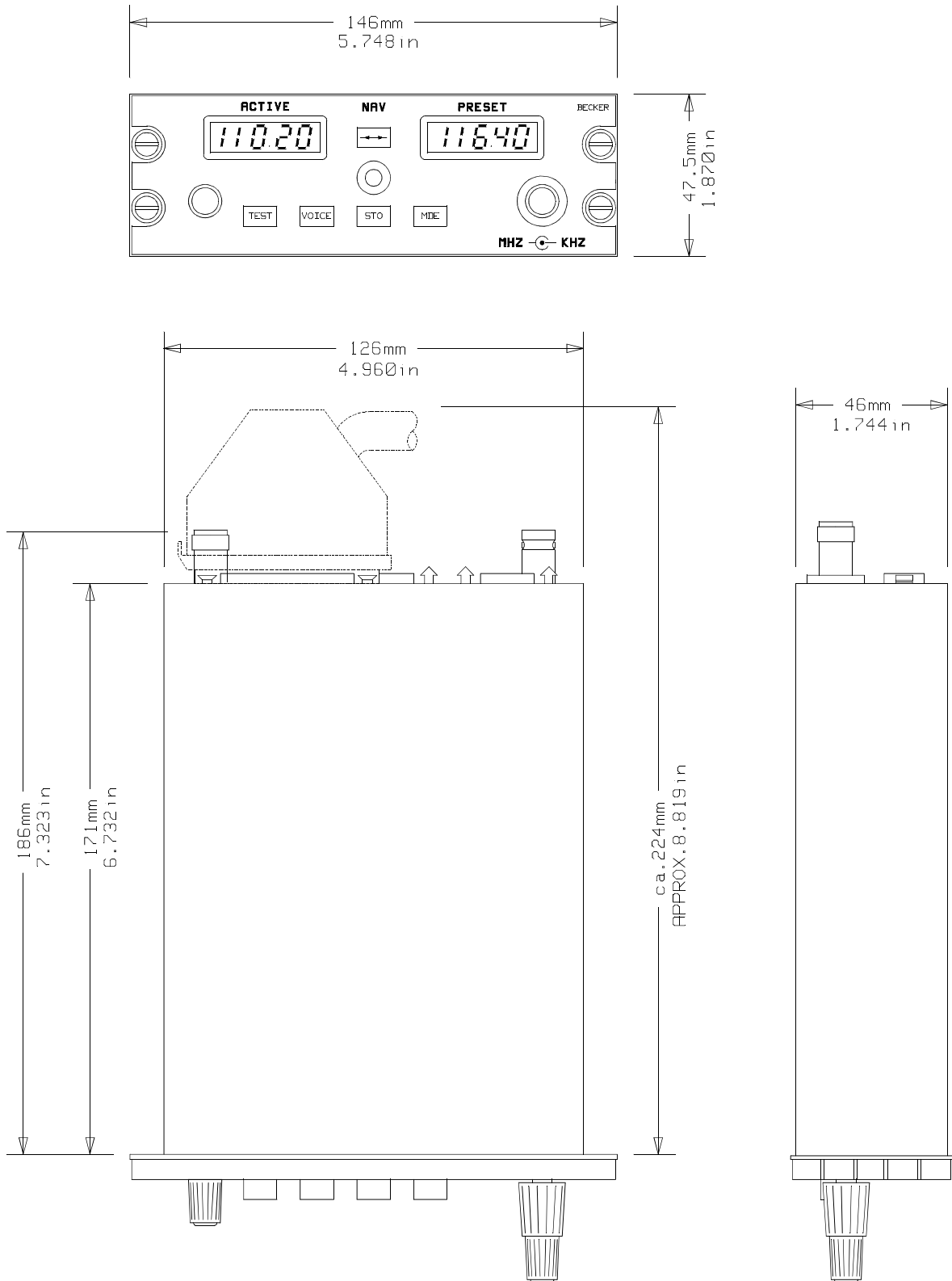


Fig. 2-1 Installation dimensions for the NAV receiver

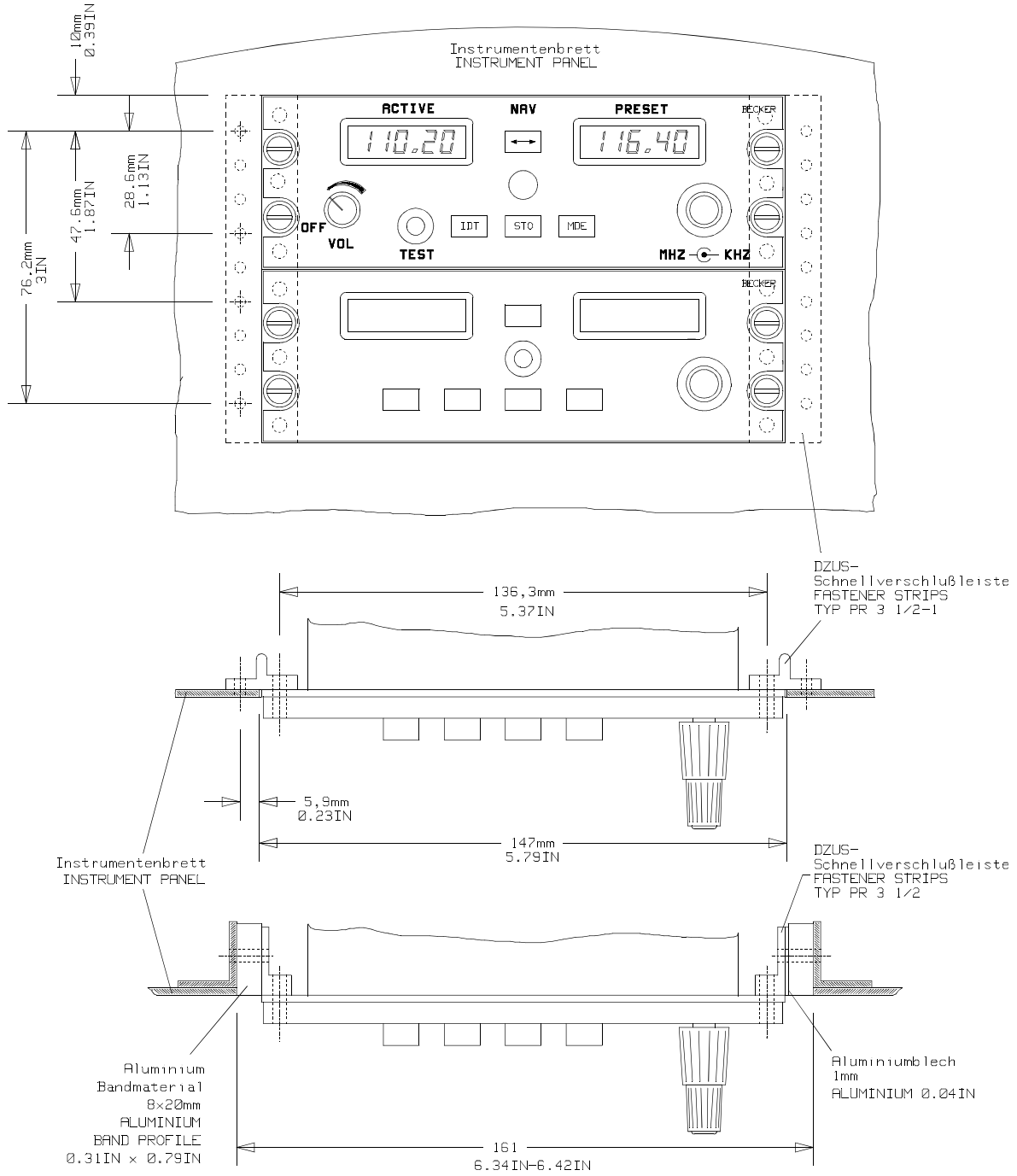


Fig. 2-2 Installation of fastener strips

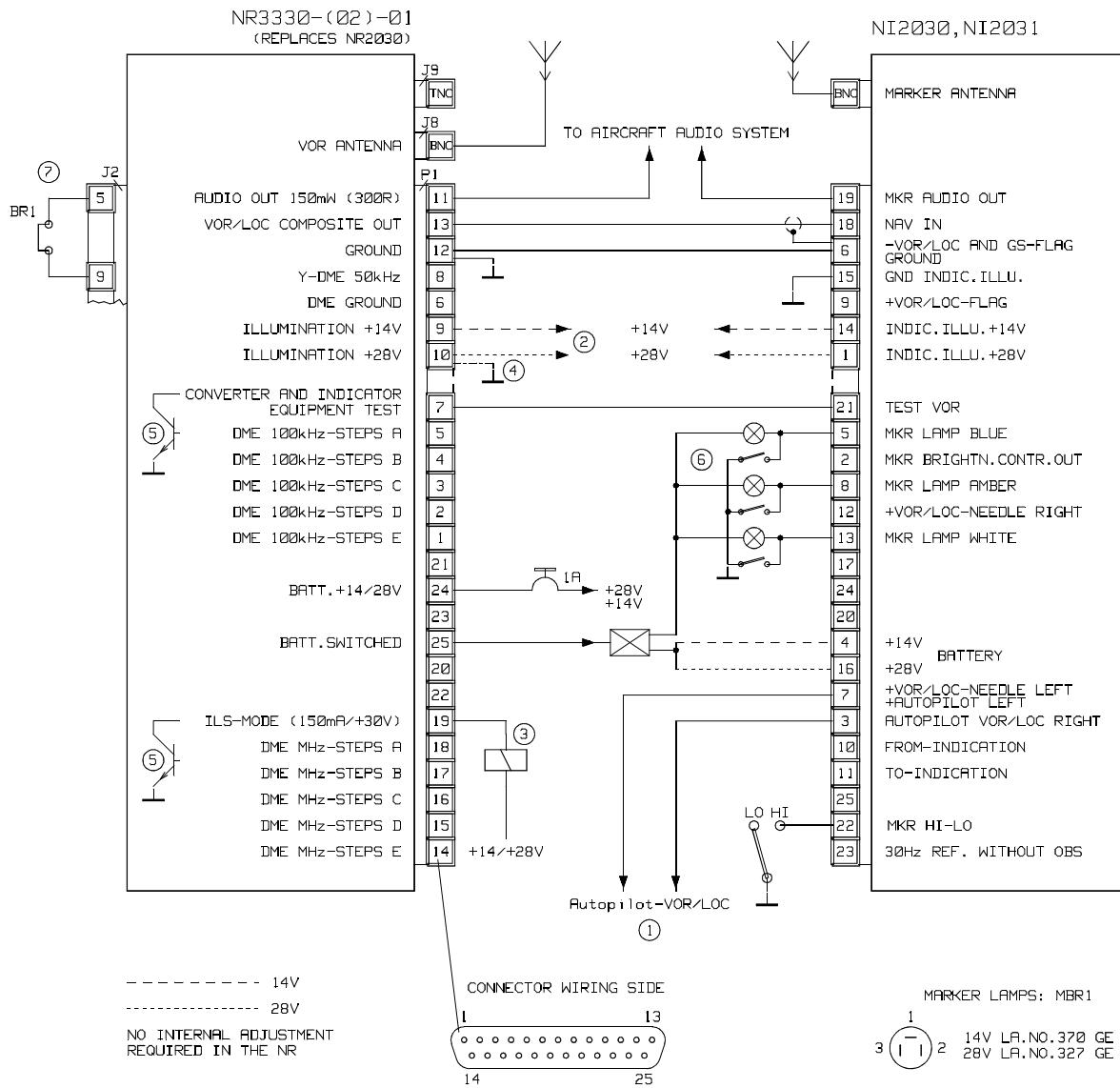


Fig. 2-4 Installation wiring for the NAV receiver NR 3330 - ()
with indicator NI 2030 - () / NI 2031

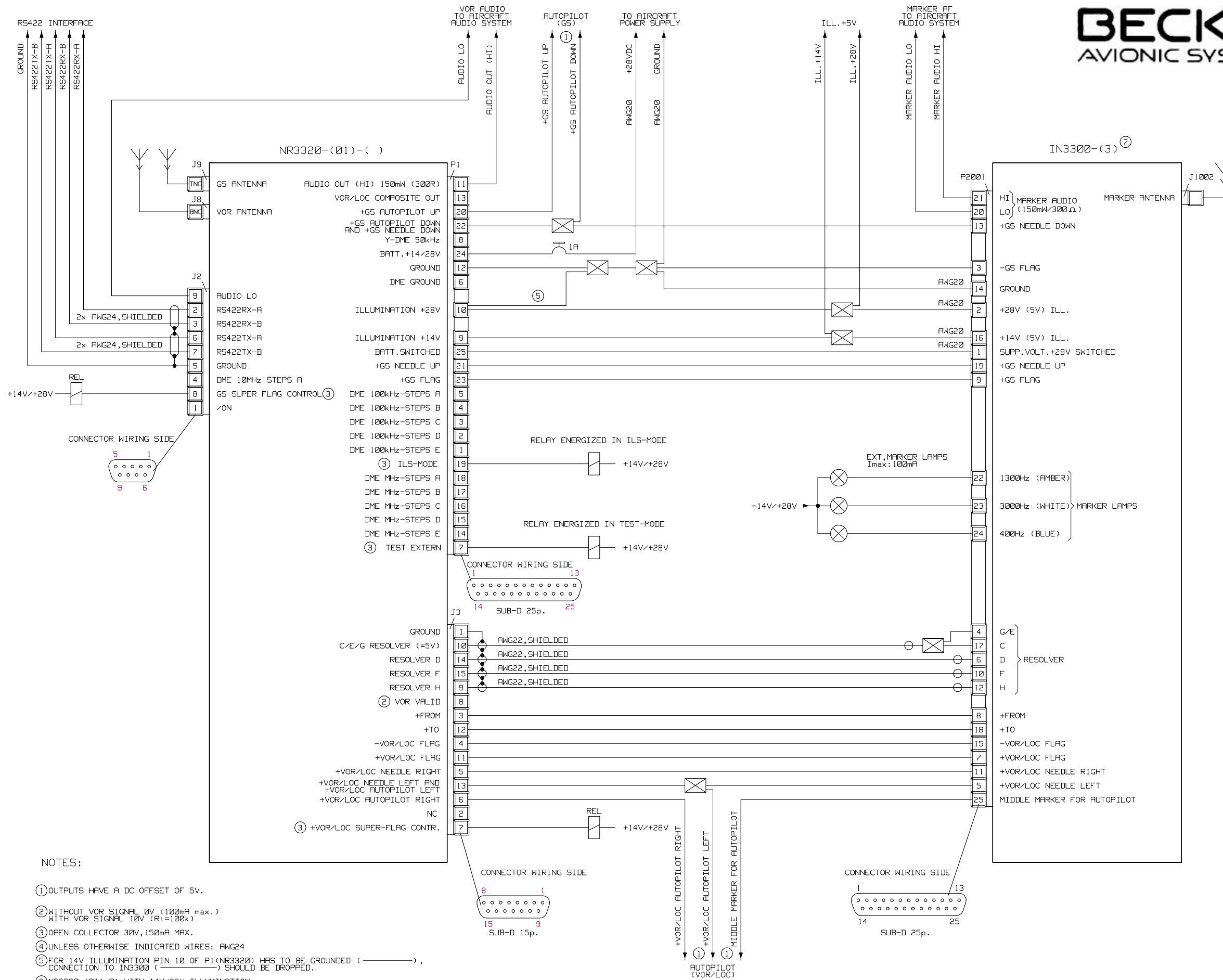


Fig. 2-5 Installation wiring for the NAV receiver NR 3320 - () with the indicator IN 3300 -(3)

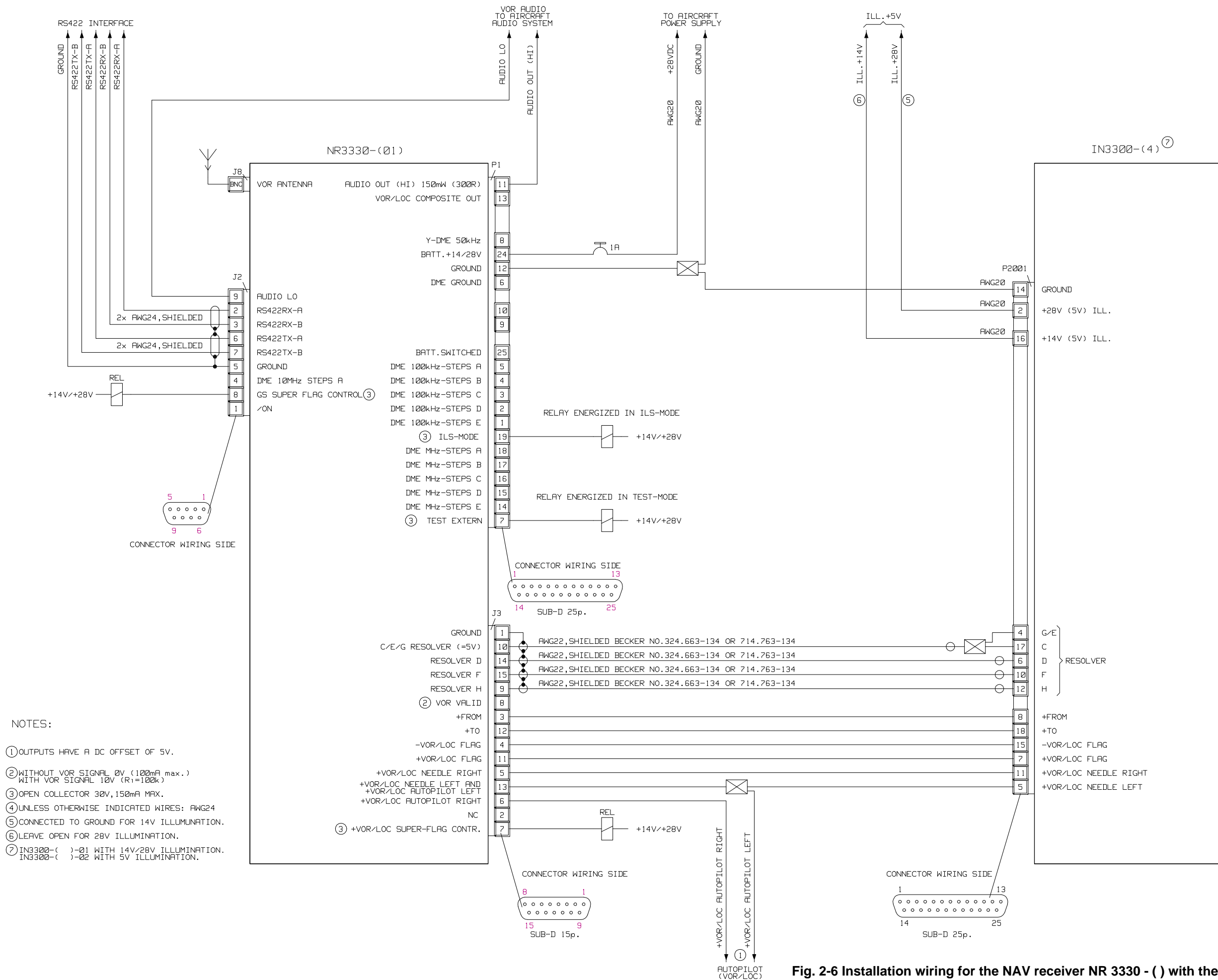


Fig. 2-6 Installation wiring for the NAV receiver NR 3330 - () with the indicator IN 3300 -(4)

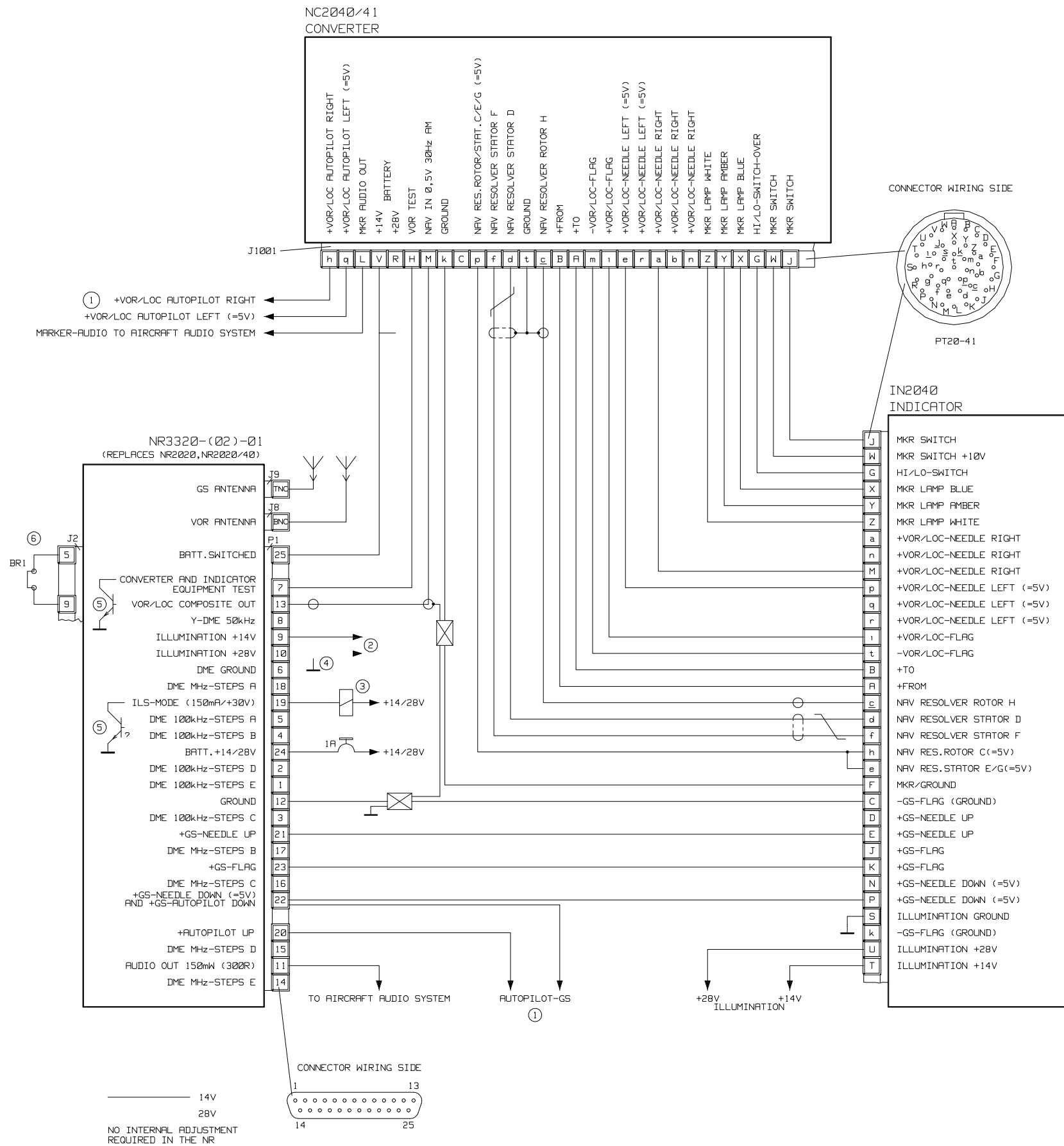
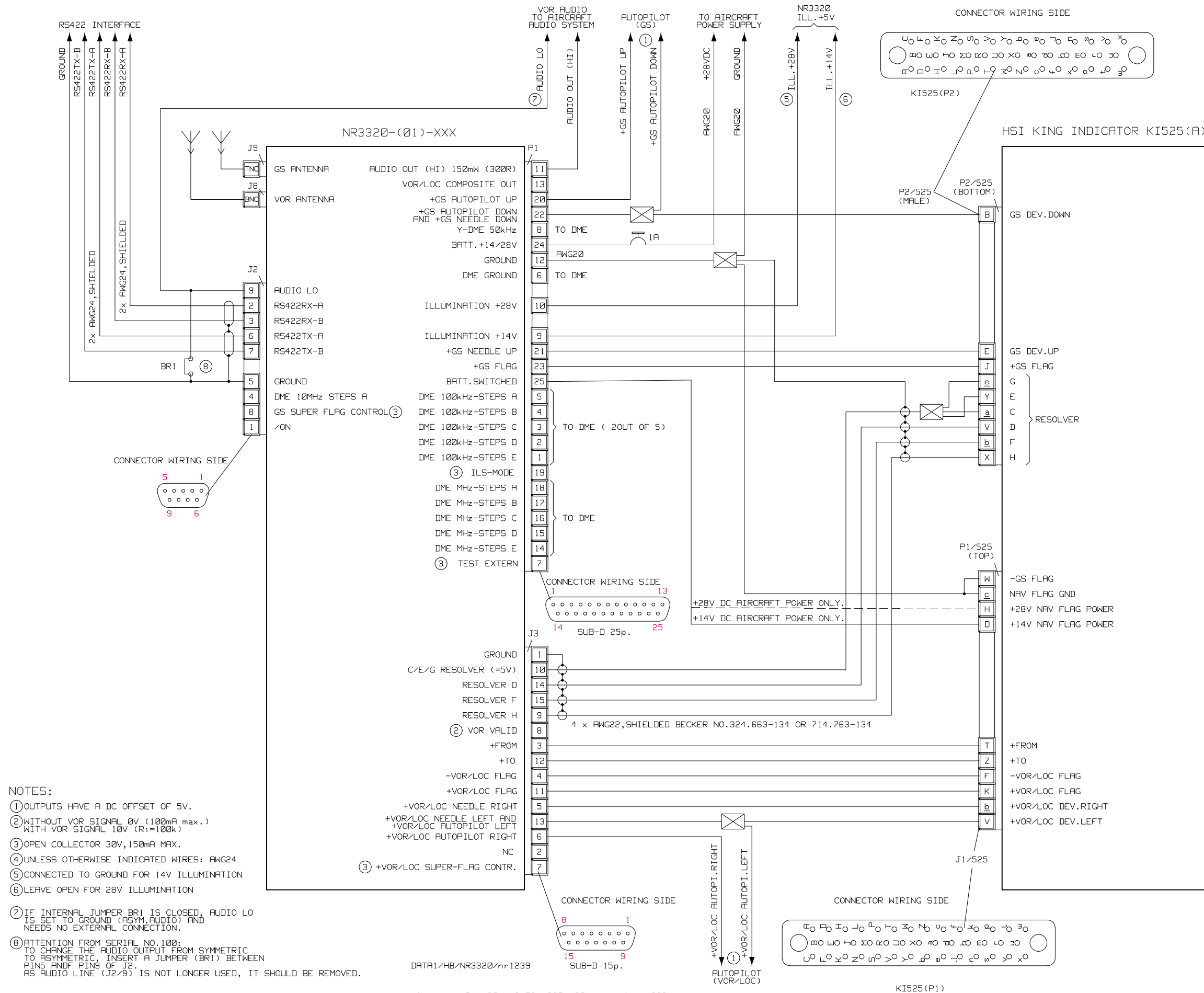


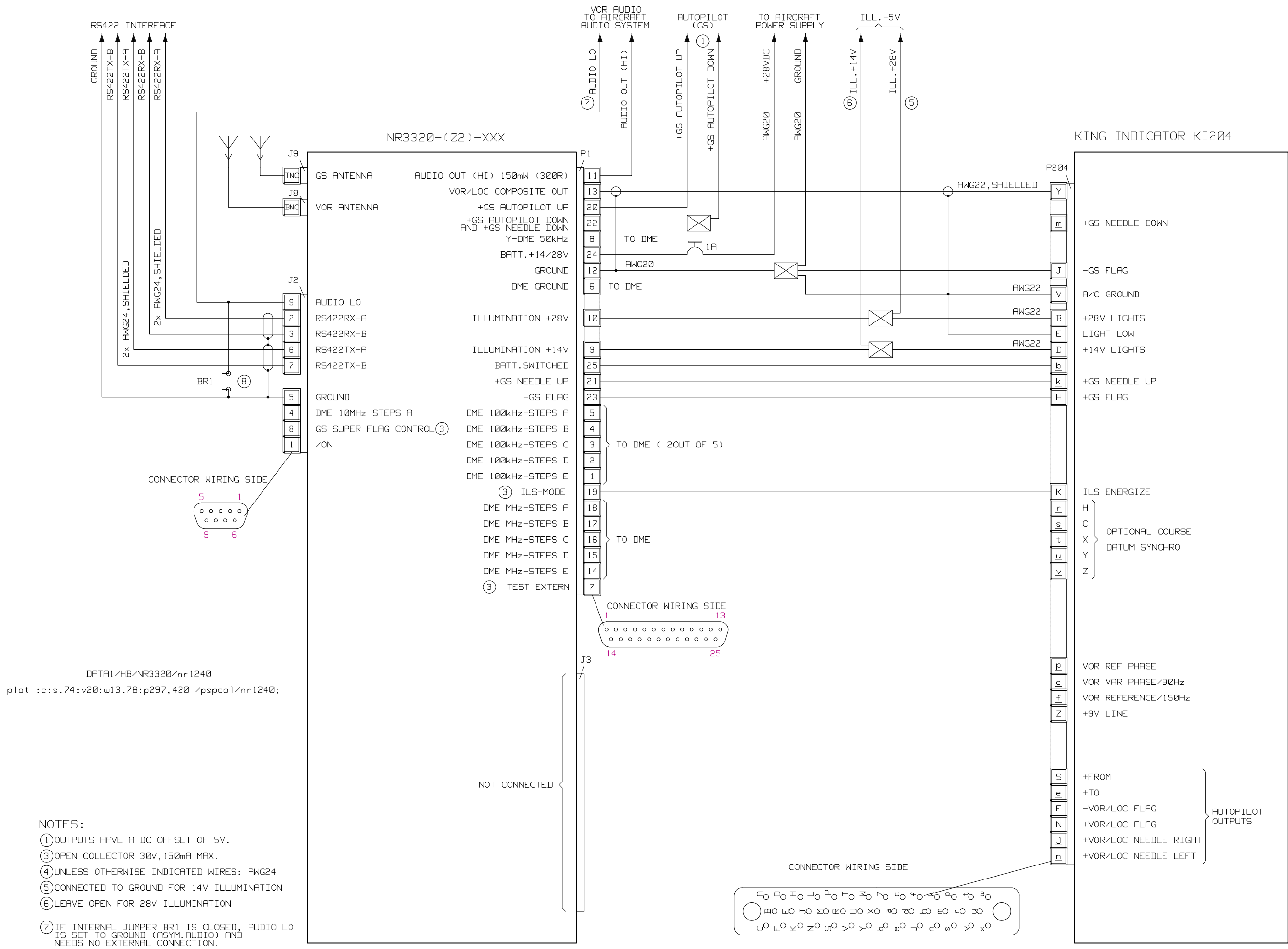
Fig. 2-7 Installation wiring for the NAV receiver NR 3320 - ()
with the indicator IN 2040 and converter NC 2040/41



- NOTES:
- ① OUTPUTS HAVE A DC OFFSET OF 5V.
 - ② WITHOUT VOR SIGNAL 0V (100mA max.) WITH VOR SIGNAL 10V (R_i=100k)
 - ③ OPEN COLLECTOR 30V, 150mA MAX.
 - ④ UNLESS OTHERWISE INDICATED WIRES: AWG24
 - ⑤ CONNECTED TO GROUND FOR 14V ILLUMINATION
 - ⑥ LEAVE OPEN FOR 28V ILLUMINATION
 - ⑦ IF INTERNAL JUMPER BR1 IS CLOSED, AUDIO LO IS SET TO GROUND (ASYM.AUDIO) AND NEEDS NO EXTERNAL CONNECTION.
 - ⑧ ATTENTION FROM SERIAL NO.100: TO CHANGE THE AUDIO OUTPUT FROM SYMMETRIC TO ASYMMETRIC, INSERT A JUMPER (BR1) BETWEEN PINS AND PINS OF J2. AS AUDIO LINE (J2/9) IS NOT LONGER USED, IT SHOULD BE REMOVED.

DATA1/HB/NR3320/nr1239
 plot :c:s.74:v20:w13.78:p297,420 /pspool/nr1239;

Fig. 2-8 Installation wiring for the NAV receiver NR 3320 - () with the indicator HSI KING KI525 (A)



DATA1/HB/NR3320/nr1240
 plot :c:s.74:v20:w13.78:p297,420 /pspool/nr1240;

- NOTES:
- ① OUTPUTS HAVE A DC OFFSET OF 5V.
 - ③ OPEN COLLECTOR 30V, 150mA MAX.
 - ④ UNLESS OTHERWISE INDICATED WIRES: AWG24
 - ⑤ CONNECTED TO GROUND FOR 14V ILLUMINATION
 - ⑥ LEAVE OPEN FOR 28V ILLUMINATION
 - ⑦ IF INTERNAL JUMPER BR1 IS CLOSED, AUDIO LO IS SET TO GROUND (ASYM.AUDIO) AND NEEDS NO EXTERNAL CONNECTION.
 - ⑨ ATTENTION FROM SERIAL NO. 100: TO CHANGE THE AUDIO OUTPUT FROM SYMMETRIC TO ASYMMETRIC, INSERT A JUMPER (BR1) BETWEEN PINS 5 AND 9 OF J2. AS AUDIO LINE (J2/9) IS NOT LONGER USED, IT SHOULD BE REMOVED.

Fig. 2-9 Installation wiring for the NAV receiver NR 3320 - () with the indicator KING KI204

Table of contents

Section	III	Operation	Page
3.1		Controls and indicators	3-1
3.2		Operating instruction	3-3
3.2.1		Preparation	3-3
3.2.2		Switching on the navigation receiver	3-3
3.2.3		VOR mode	3-4
3.2.4		Monitoring flight and weather information	3-4
3.2.5		LOC mode	3-4
3.2.6		GS mode with the NR 3320 - (1)	3-5
3.3		Operation of the various modes	3-5
3.3.1		Frequency setting mode	3-6
3.3.2		Frequency preselection mode	3-6
3.3.3		Channel setting mode	3-7
3.4		Storage procedure	3-7
3.5		Service mode (equipment configurations)	3-8
3.6		Deletion of all stored frequencies in the storage channels	3-10
3.7		Safety precautions	3-11
Fig. 3-1		Controls and indicators navigationreceiver	3-1

Blank

Section III OPERATION

3.1 Controls and indicators

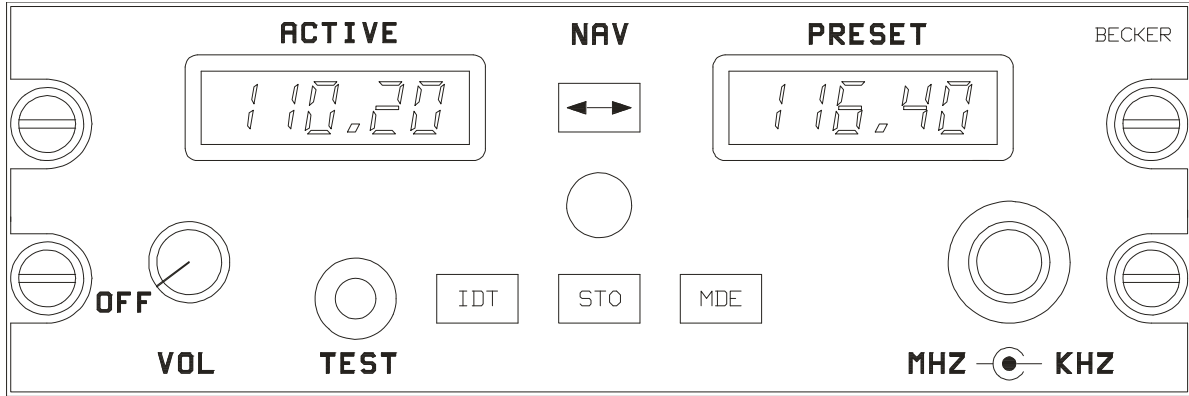
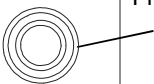
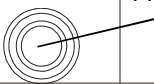




Fig. 3-1 Controls and indicators navigationreceiver

Meaning of symbols on controls and indicators

Symbol	Description	Function
MDE	Functions key	Selection of mode and selecting the parameter in the service mode
< - >	Exchange key	Frequency preselection: Exchange of preset frequency and active frequency
IDT	ID key	Switching the suppression of the VOR identification on or off when monitoring flight and weather information
STO	STO key	Storage of set frequency or other settings
TEST	TEST key	Tests functional status of both LCDs, the VOR/LOC- / GS-converter and the indicator
	Frequency selector	Switching the indicated switch frequency in 1 MHz (outer rotary switch) steps or the storage channel upwards or downwards in steps of 10.
	Frequency selector	Switches the indicated (inner rotary switch) frequency in 50 KHz steps or the storage by 1 step in each case upwards or downwards, without carry over.steps of 10.

		ON/OFF switch combined with volume control	ON / OFF switch and volume control
--	---	--	------------------------------------

LCD (liquid crystal display) elements

	Symbol	Description	Function
	110.20	left indication (active frequency)	Indication of active reception frequency
	116.40	(right indication)	Indication of preset reception frequency in the frequency preselection mode.
	CH 01	(right indication)	CH indication steady : indicates the storage channel.
		(right indication)	CH indication flashes : if the initiated storage operation is not completed by pressing the store key.
		(right indication)	ON indication
	OFF	(right indication)	OFF indication

Rear of unit

BNC VOR/LOC-Receiver	50 Ohm antenna connecting sockets
TNC	50 Ohm antenna connecting sockets GS-Receiver
25-pin D sub-male male	Equipment connector for connecting the installation wiring
15-pin D sub-female male	Equipment connector for connecting the installation wiring Indicator IN 3300 - ()
9-pin D sub-female	Equipment connector for connecting interface RS 422

3.2 Operating instruction

3.2.1 Preparation

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

WARNING!

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

3.2.2 Switching on the navigation receiver

- a. Rotate the volume control clockwise and switch on the navigation receiver.
- b. Both LCDs must show the numbers 188.88 flashing approximately 2 seconds. If the test is positive, the navigation receiver automatically switches to the mode which was selected before switch-off. If the test is negative, the LCD flashes for approximately 5 seconds.

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

- E.2** VOR/LOC Synthesizer failed,
- E2.** GS Synthesizer failed,
- E3** EEPROM fault

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

3.2.3 TEST mode (by pressing the TEST button)

Press the **TEST** key. All digits should flash on and off in both liquid crystal displays (display test). At the same time, the VOR/LOC pointer (vertical needle) of the connected indicator should deflect fully and the VOR/LOC warning flag should disappear from view. In the NAV receiver NR 3320 - (1) the GS pointer (horizontal needle) of the connected indicator should deflect fully and the GS flag should disappear from view.

3.2.4 VOR mode

1. Set the frequency of the required VOR station.
2. To monitor the identification signal, press the **IDT** key (ON appears briefly in the (right indication) of the LC display). Monitor the identification signal and compare it with the set identification signal of the required VOR station. Adjust the volume using the **VOL** control.
3. If an evaluable VOR signal enables a safe bearing to be established, the vertical needle deflects and the VOR/LOC flag disappears from the field of view.
4. Rotate the omnibearing selector (OBS) on the display unit until the TO/FROM display indicates TO and the vertical needle has settled in the mid position. The heading indication then indicates the magnetic course to the VOR station.
5. Course deviations during the approach are indicated in the direction of correction by the vertical needle (course correction in the direction of the needle deflection).
6. When overflying the VOR station, the TO/FROM display moves from TO to FROM. If the flight is continued on the same heading, the course indication shows the magnetic position line of the VOR station which the aircraft is approaching, with the vertical needle in the mid position.

3.2.5 Monitoring flight and weather information

1. Press the **IDT** key. The word OFF appears briefly in the (right indication) of the LC display. Identification transmissions are faded out.
2. The fading out of the VOR indication signal means that flight and weather information can now be monitored.
3. Press the **IDT** key again. The word ON appears briefly in the display. The identification signal can now be monitored.

3.2.6 LOC mode

1. Set the frequency of the required localizer.
2. Switch on the VOR identification (press the **IDT** key, ON appears briefly in the display). Monitor the Morse identification signal and compare it with the set identification signal of the required localizer.
3. The vertical needle (command needle) deflects during the approach to the localizer in the direction in which the course is to be corrected in order to obtain the correct landing course. A mid position of the needle means that the aircraft is on the correct line for landing.

3.2.7 GS mode with the NR 3320 - (1)

1. Set the frequency of the localizer.
2. Switch on the VOR identification (press the **IDT** key, ON appears briefly in the display). Monitor the Morse identification signal and compare it with the set identification signal.
3. If a glidepath signal of sufficient strength is present, the GS warning flag disappears from the field of view.
4. The GS needle (horizontal command needle) deflects during the approach in the direction in which the flight level has to be corrected in order to obtain the specified glidepath. A mid position of the needle means that the aircraft is on the glidepath.

3.3 Operation of the various modes

The navigation receiver contains various functions which are performed under three 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. Frequencies can also be stored in the individual storage channels.

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. Frequencies can also be stored in the individual storage channels.

Channel setting mode

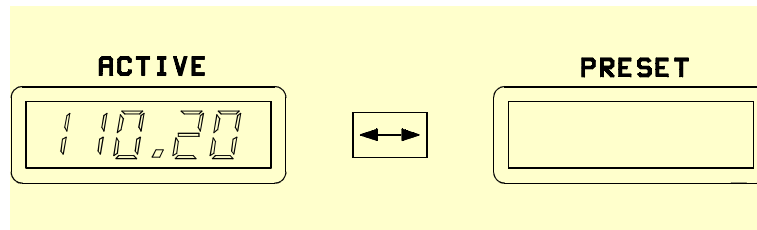
Display of the stored frequencies in the storage channels. The channels can be selected using the frequency selector switches.

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. This does not include deliberate storage operations performed using the **STO** key.

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 **MHz** and **kHz** frequency selector switches.

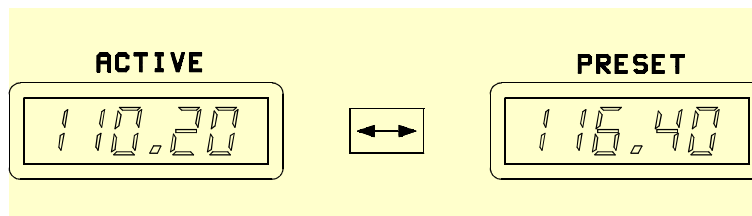
The set frequency is held even when the unit is switched off.

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 (right indication) is set using the **MHz** and **kHz** frequency selector switches. Pressing the <-> exchange key changes over between the active and preset frequency.

NOTE

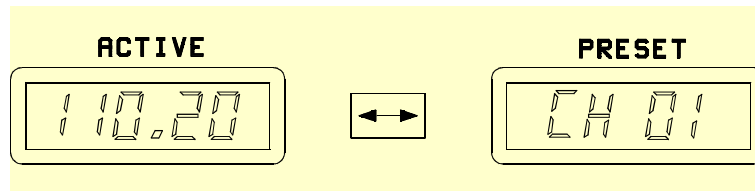
The navigation receiver is always ready to receive on the frequency shown in the left indication.

Change of mode

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

3.3.3 Channel setting mode

Select the channel setting mode using the **MDE** key. The last indicated storage channel appears in the right display and the stored frequency is shown in the left display. The navigation receiver is ready to receive on this frequency.



Select the require channel using the **kHz** frequency selector switch (single steps) or **MHz** frequency selector switch (steps of ten).

NOTE

Only occupied channels can be selected.

Change of mode

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

3.4 Storage procedure

A storage procedure can be performed at any time and is activated by pressing the **STO** key.

- Press the **STO** key. The active frequency remains indicated in the left display. The navigation system is ready to receive on this frequency. The active frequency is shown flashing in the right display and, in the frequency preselection mode, the preset frequency. Set the required frequency using the **kHz** frequency selector switch and the **MHz** frequency selector switch.
- Press the **STO** key. The next free channel is shown flashing "ch". The channel in which the frequency is to be entered is selected using the **MHz** and **kHz** frequency switches. Channels which are already occupied are indicated by "CH" and can be overwritten.
- Press the **STO** key. The frequency is stored in the selected channel and the storage procedure ended.

NOTE

If no input (action) takes place for more than 7 seconds during the storage procedure, the operation is automatically broken off. A storage operation can be broken off at any time by pressing the **MDE** key.

3.5 Service mode (equipment configurations)

The service mode is meant to enable the ground technicians to set the equipment configuration and must not be used in flight.

The following settings can be changed or set:

Fr	Inhibiting the frequency setting (channel selection only (ON/OFF)
CS	Inhibiting the frequency storage (ON/OFF)
dEL	Erasure of stored frequencies
COdE	Entering a password to interlock the equipment configuration
Poti	Release the volume control (ON/OFF)

Switch off the navigation receiver. Press and hold the **MDE** key whilst the navigation receiver is being switched on. The right display must show the version number and software Spec. approximately 2 seconds of the navigation receiver.

On the right two digits display the version number and left two digits display the software Spec..

“Fr” appears in the top line and OFF or ON in the bottom line after display the version number and software Spec.

NOTE

In the service mode, the navigation receiver is not ready for operation

The parameters are selected in stages in the service mode by pressing the **MDE** key.

Release the frequency setting (channel selection only).

Call up function Fr using the **MDE** key. The following display appears:

left LC-Display	Fr
right LC-Display	ON or OFF

Select the required setting using the **kHz** frequency selector switch and store the setting by pressing the **STO** key.

OFF = Frequency setting not possible. The navigation receiver can only work on the frequencies stored in the individual channels.

ON = Frequency setting possible (standard setting).

Release the frequency storage

Call up function CS using the **MDE** key. The following display appears.

left LC-Display	CS
right LC-Display	ON or OFF

Select the required setting using the **kHz** frequency selector switch and store the selection by pressing the **STO** key.

OFF = The storage of frequencies in the individual channels is not possible.
ON = Storage of frequencies in the individual channels is possible (standard setting).

Erase stored frequencies

Call up function dEL using the **MDE** key. The following display appears.

left LC-Display	dEL
right LC-Display	CH channel number

Select the channel to be erased using the **kHz** frequency selector switch (steps of 1) or **MHz** frequency selector switch (steps of 10) switch. Free channels are displayed with "ch" and occupied channels are displayed with "CH". The stored frequency is erased by pressing the **STO** key. The channel No. 1 cannot be erased.

"ch" = free channel
"CH" = occupied channel (can be overwritten).

Entry of password to interlock the equipment configuration.

Call up the COdE function using the **MDE** key. The following display appears.

left LC-Display	COdE
right LC-Display	0000

Set any 4-digit numerical code. Using the **MHz** frequency selector switch, select the character (two digit left) and **kHz** frequency selector switch, select the character (two digit right) . Store the numerical code by pressing the **STO** key.

NOTE

As soon as a password is given a "0000" appears in the right LC-Display when the service mode is called up. The numerical code must then be input using the **MHz**- and **kHz** frequency selector switch and press the **STO** key. If the navigation receiver detects a false numerical code, it automatically switches to the last mode. If the password is to be erased or changed, this is done by calling up the service mode using the old password. The COdE function is then chosen and either a "0000" is entered everywhere or the changed numerical code is entered.

Release the volume control

Call up function "Poti" using the **MDE** key. The following display appears:

left LC-Display	Poti
right LC-Display	ON or OFF

Select the required setting using the **kHz** frequency selector switch and store the selection by pressing the **STO** key.

OFF = The audio output signal is off and can not adjust with the volume control.

ON = The audio output signal can adjust with the volume control (standard setting).

Ending of the service mode

The navigation receiver must be switched off to end the service mode.

3.6 Deletion of all stored frequencies in the storage channels

Press and hold the **STO** and **MDE** keys whilst switching on the navigation receiver. All the stored frequencies in the storage channels are deleted, with the exception of channel 01.

3.7 Safety precautions

- Switch off the navigation receiver before starting or shutting down engines !
- The NAV system should be protected from the aircraft power supply by its own 1 A circuit breaker.
- Warning! Reception is only possible when there is a quasi-optical sight to the VOR station.
- When the warning flag in the display unit appears, the course deviation needle is in the mid position, it must then not be used in the continuing flight !
- Warning! When flying with the autopilot locked on to VOR, the OBS must not be rotated because any change in the off-course needle is followed by the autopilot !
- If the off-course needle instrument fails, no warning flag appears. Check the off-course needle by activating the TEST function. The off-course needle must deflect halfway. Important to check before approach to landing !
- During approaches on the back beam, a needle deflection no longer corresponds to a command indication. In this special case, course corrections must be made opposite to the needle deflection !
- When overflying VOR stations a cone of silence of $\pm 45^\circ$ occurs in which the warning flag appears and the off-course needle stays in the mid position.
- When flying over mountains the off-course needle may deviate about the mid position (reflections) when approaching or leaving VOR stations. VOR stations produce substantially more stable indications under these conditions.
- EMC note: If the antennas of RT equipment and the navigation receiver are not sufficiently decoupled, it is possible that the warning flag may appear during transmission or the off-course needle may deflect. Inadequate decoupling is possible with airframes made of wood or synthetic materials or where the antennas are mounted close together.

Blank