BECKER
AVIONIC SYSTEMS

Navigation-Receiver

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

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

Installation and Operation

Manual		DV 60603.03
Issue	1	July 1997
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Section 1 GENERAL INFORMATION

1.1 Introduction

The RN 3320 - ( ) / RN 3330 - ( ) remote-control navigation receivers are described in the following manuals. These navigation receivers are controlled by a CU 5301 - ( ) control unit (or equal).

The manuals DV 60603.03 “Installation and Operation” and DV 60603.04 “Maintenance and Repair” contain the following sections :

Section		DV 60603.03	DV 60603.04
1	General Information	X	X
2	Installation	X	X
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6	Illustrated Parts List		X
7	Modification and Changes		X
8	Circuit Diagrams		X

1.2 Purpose of equipment

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

The navigation receiver RN 3320 - (02) is designed to receive VOR and LOC signals on 200 channels in the frequency range between 108.00 MHz and 117.95 MHz. It supplies the NAV composite signal to an external VOR/LOC converter. Both navigation receiver RN 3320 - (01) / -(2) 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 MHz and 117.95 MHz.

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

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

1.3 Variants survey

The different variants of the RN 3320 - ( ) / RN 3330 - ( ) navigation receiver are listed in the following table. They differ externally only in the number of connectors and antenna socket. The dimensions are the same for all variants.

Part-No.:	Identifying characteristics	Article - No.:
RN 3320 - (01)	Navigation receiver with VOR/LOC and GS functions and convert	0505.706-911
RN 3320 - (02)	Navigation receiver with VOR/LOC function without convert (NAV composite output) and GS functions with convert	0506.141-911
RN 3330 - (01)	Navigation receiver with VOR/LOC functions and convert	0506.151-911
RN 3330 - (02)	Navigation receiver with VOR/LOC functions without convert (NAV composite output))	0506.168-911

1.4 General description

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

The following connectors are mounted on the connection side of the unit.

- The BNC antenna socket for the VOR/LOC-receiver.
- The TNC antenna socket for the GS-receiver.
- The 15-pole D-subminiature connector (female) for the outputs of the VOR/LOC converter board (in the RN 3320 - (01) or RN 3330 - (01) only).
- The 9-pole D-subminiature connector (female) for the outputs/inputs of the RS 422 interface.
- The 25-pole D-subminiature (male) equipment connector.

The electronic components of the unit are mounted on the following circuit boards, which are interconnected with each other through connectors.

1. Chassis board
2. VOR/LOC receiver board
3. VOR/LOC converter board in RN 3320 - (01/RN 3330 - (01) only
4. GS receiver board in RN 3320 - (01) and RN 3320 - (02) only
6. Processor board
8. Interface board.

The interface and processor boards can be plugged into each other and are held together by five bolts. Both together are secured to the front face by three bolts.

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

The GS receiver board is arranged above the chassis board, the VOR/LOC receiver board and the VOR/LOC converter board below the chassis board. All three circuit boards are each secured to the chassis by four bolts.

The VOR/LOC receiver is a three-conversion superheterodyne receiver and operates in the frequency range from 108.00 MHz to 117.95 MHz with a channel separation of 50 kHz. The oscillator frequency for the receiver is generated in a VCO (voltage controlled oscillator). The VCO is controlled by digital frequency synthesizer which is mounted on the chassis board. The operation of the digital frequency processing and the storage is processor 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 RN 3320 - (02) and RN 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 from 329.150 MHz to 335.000 MHz with a channel separation of 150 kHz. The oscillator frequency for the receiver is generated in a VCO. The VCO is controlled by digital frequency synthesizer which is mounted on the chassis board. The operation of the digital frequency processing and the storage is processor controlled. The evaluated glidepath signals are indicated by the GS needle of the connected VOR/ILS indicator.

The self test of the navigation receiver can be carried out by pressing the TEST button on the control unit. This performs a functional check of the VOR/LOC evaluation and GS evaluation.

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

Power supply voltage	+ 13,75 V oder + 27.5 V DC
Current consumption of RN 3320 - (01)	typ. 340 mA
Current consumption of RN 3320 - (02)	typ. 320 mA
Current consumption of RN 3330 - (01)	typ. 260 mA
Current consumption of RN 3330 - (02)	typ. 240 mA
Overcurrent capacity of internal fusing	1,5 A
Recommended external overcurrent protection	1 A
Operating temperature range	- 55° 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	
with mounting plate	139 x 50 x 253 mm H x B x T
Weight of	
RN 3320 - (01)	approx. 0,820 kg
RN 3320 - (02)	approx. 0,770 kg
RN 3330 - (01)	approx. 0,680 kg
RN 3330 - (02)	approx. 0,630 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
Sensitivity (audio)	≤ -93 dB for ≥ 6 dB SINAD
Bandwidth	≥ 12 kHz at 6 dB

Selectivity	≥ 65 dB at ΔF ≥ ± 50 kHz
AGC	≤ 3 dB from -87 dBm . . . . -10 dBm
Distortion	≤ 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	≤ ± 2°
Bearing error under all environmental influences listed in JTSO 2C40c with 95% probability	≤ ± 2.7°
Course deviation for full scale deflection	± 10°
LOC centering error under all environmental conditions, with 95% probability	≤ 11% of standard deviation

RN 3320 - (01) and RN 3330 - (01) only

Resolver output	standard value as per ARINC 407
VOR/LOC needle output	max. of 3 pointers and/or flags with 1 kΩ each
VOR/LOC warning flag output	max. of 3 pointers and/or flags with 1 kΩ each
TO/FROM output	max. of 3 pointers and/or flags with 1 kΩ each
Autopilot output	for VOR course tracking and ILS mode

1.5.4 GS receiver and functions in the RN 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	≤ -80 dBm 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
GS-autopilot output	max. of 3 needles and/or flags with 1 kΩ eac

1.5.5 Indicators

VOR/LOC indicator (crosspointer) for RN 3320 - (01)	IN 3300 - (3) / - (5) / - (8) or equivalent indicator
VOR/LOC indicator (singlepointer) for RN 3330 - ( )	IN 3300 - (4) / - (9) 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 and the frequency memory are controlled by a microprocessor.

The associated software was classified as software level C in accordance with the guidelines of RTCA document DO-178

1.7 Ratings and airworthiness specifications

LBA equipment no.	10.922/94 JTSO
BAPT equipment no.	A132 882 J
Specifications	
RTCA DO-192	JTSO - C34e
RTCA DO-195	JTSO - C36e
RTCA DO-196	JTSO - 2C40c B
FTZ	17 TR 2010
Software	ED-12B/DO-178/B Level C
Environmental categories	D2-BA(MN)XXXXXXZBABATAXXX

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	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
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	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 RN 3320 - (01) / - (02))	Article-No. 0725.900-277

Handbooks

Installation and Operation	Article-No. 0511.609-071
Maintenance and Repair	Article-No. 0511.617-071

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Section 2 INSTALLATION

2.1 General

Installation of the navigation 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 navigation 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, bent or cracked pins, cracked plug or jack inserts.

3. Missing screws.

2.3 Mechanical installation

The navigation 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. 2-1. The navigation receiver is then pushed into the mounting plate and locked in place by two quick-release bolts.

2.4 Installation wiring

The Installation wiring diagram of the RN 3320 - ( ) and RN 3330 - ( ) navigation receiver with the CU 5301 - ( ) control unit is shown in Fig. 2-2 and 2-3.

CAUTION

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 Connection of additional pointers or flags

It is possible to connect up to two 1-kW supplementary instruments with VOR/LOC pointer, VOR/LOC warning flag, TO/FROM indication and GS pointer and GS warning flag to the RN 3320 - (01) / - (02) parallel to the indicator without altering the receiver.

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

The navigation receivers are equipped with outputs for connection of an autopilot. The corresponding pin assignments on P1 are shown in Figs. 2-2 to 2-3 (+ VOR/LOC and - VOR/LOC and, for (+ GS and - GS).

CAUTION

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

2.4.3 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. 2-2) that are controlled by the SUPERFLAG CONTROL outputs. Since the switching is done by transistors inside of the navigation receiver whose open collectors feed pin 7 of receiver plug J 3 and pin 8 of receiver plug J 2, 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).

2.4.4 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.

2.4.5 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. 2-2 and 2-3).

2.4.6 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 navigation receiver and may be connected.

2.4.7 Connection of the 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 P 1 pin 11 Audio Out (150 mW/300 Ohm) and equipment connector J 2 pin 9 Audio Low (ground).

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

2.4.8 Asymmetric wiring of the audio output (from 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. J 2 pin 9 (Audio Low) is then connected to the unit ground.

2.4.9 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 control unit, navigation 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 navigation receiver functions

1. Switch on the navigation system at the control unit. The last frequencies used are shown in the LC displays after the power on reset. The mode selected before power off is also active. In the channel mode it must be possible to store the channel frequencies.

2. Press the TEST button. The digits 188.88 should flash on and off (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 navigation receiver RN 3320 - (01) / - (02) 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. Set a 114.9 MHz frequency on the control unit.

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 ± 2° 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. Set a 110.9 MHz frequency on the control unit. 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 RN 3320 - (01) / - (02)

1. Connect the GS signal generator to a suitable GS antenna.

2. Set a 108.95 MHz frequency on the control unit (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.

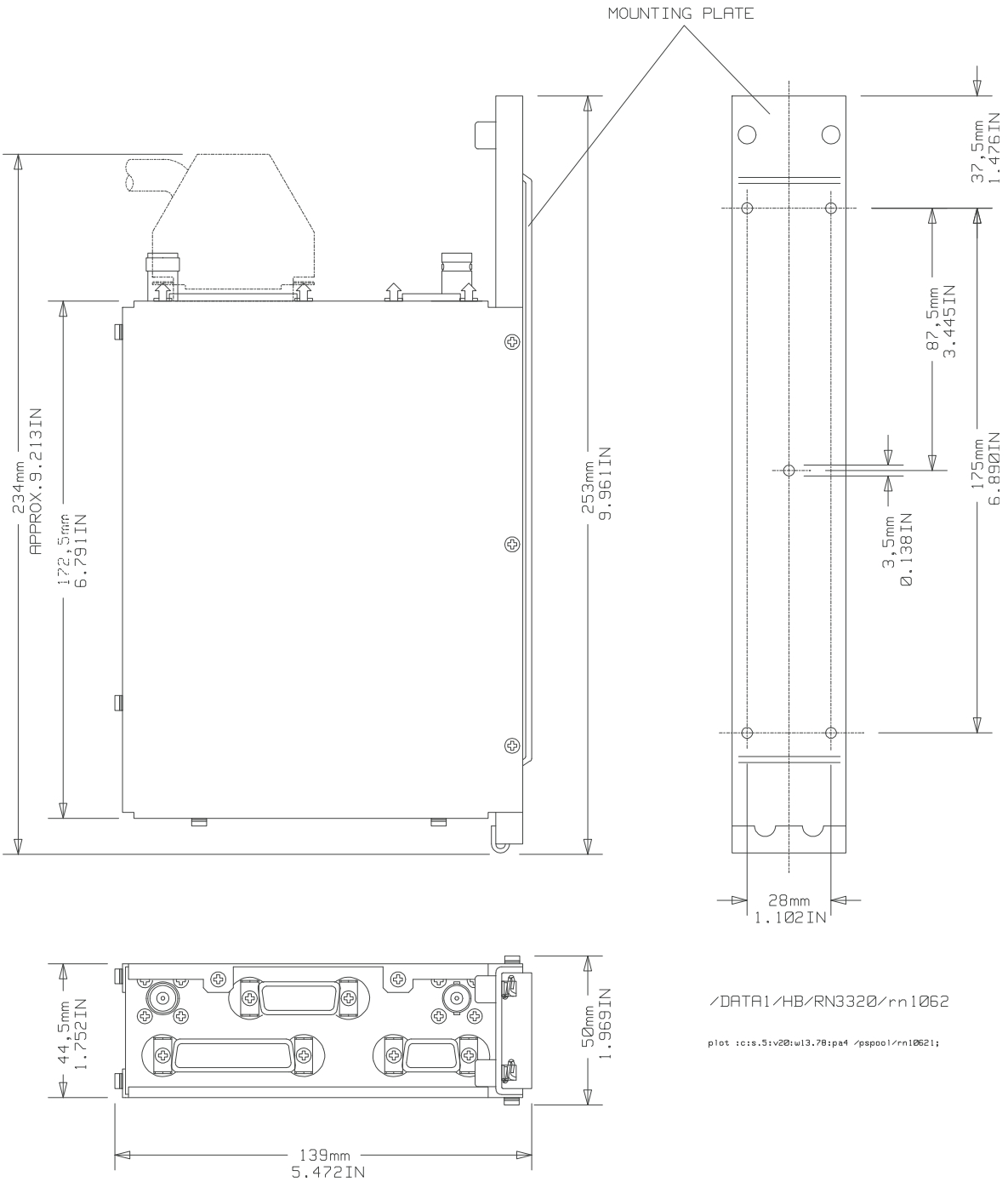
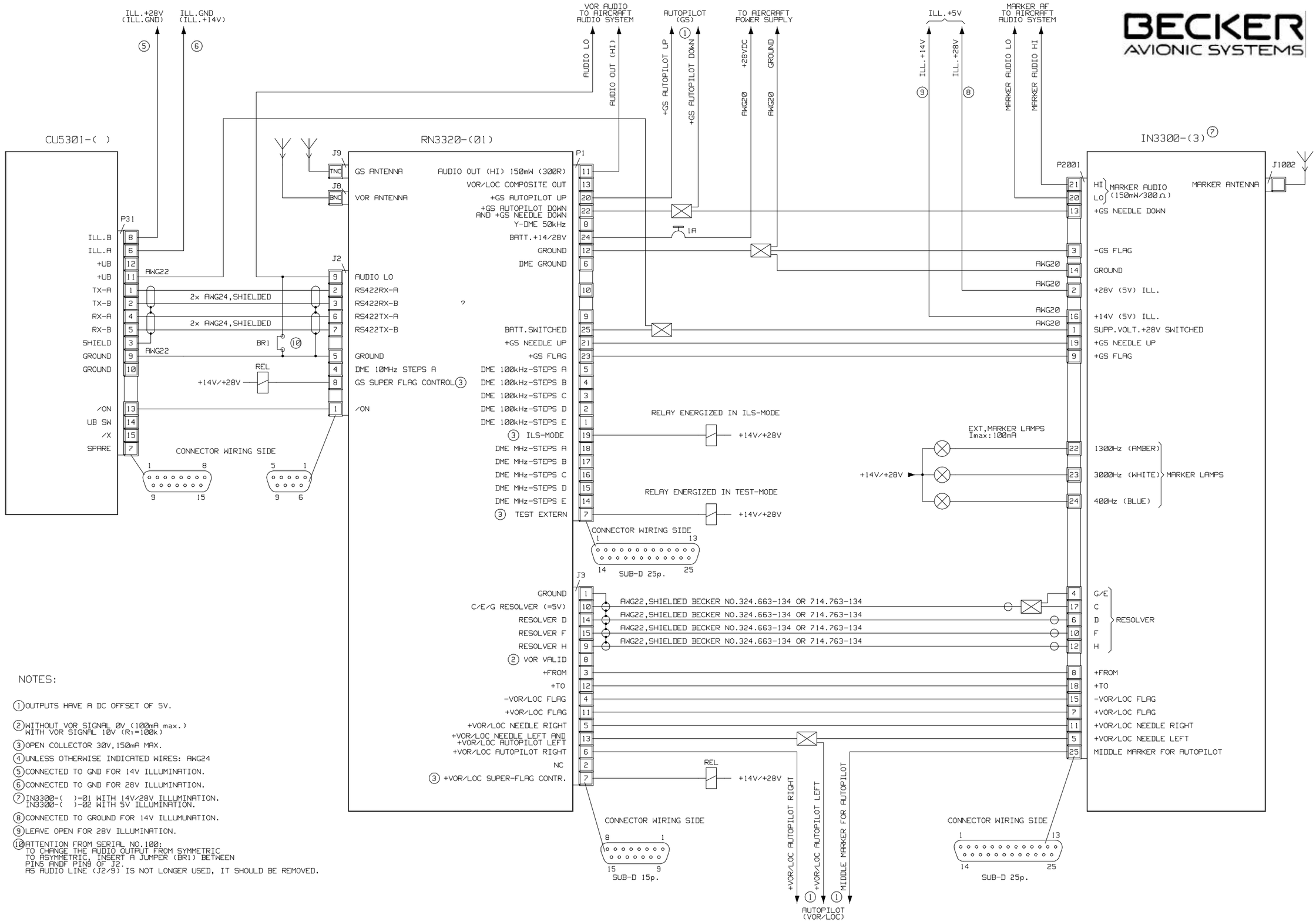


Fig. 2-1 Installation dimensions for the navigation receiver



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 GND FOR 14V ILLUMINATION.

⑥ CONNECTED TO GND FOR 28V ILLUMINATION.

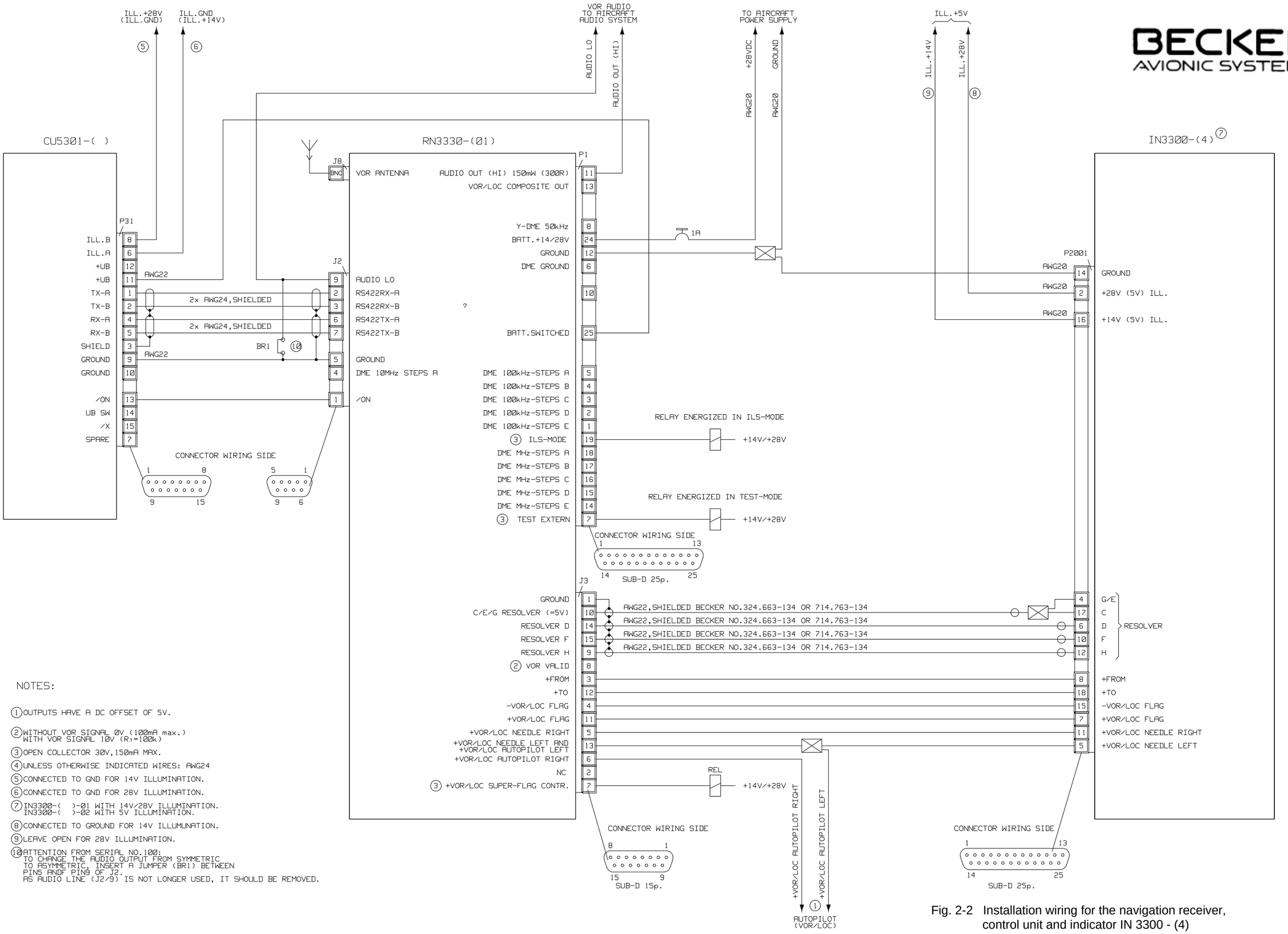
⑦ IN3300-( )-01 WITH 14V/28V ILLUMINATION.
IN3300-( )-02 WITH 5V ILLUMINATION.

⑧ CONNECTED TO GROUND FOR 14V ILLUMUNATION.

⑨ LEAVE OPEN FOR 28V ILLUMINATION.

⑩ ATTENTION FROM SERIAL NO.100:
TO CHANGE THE AUDIO OUTPUT FROM SYMMETRIC TO ASYMMETRIC, INSERT A JUMPER (BR1) BETWEEN PIN5 ANDF PIN9 OF J2.
AS AUDIO LINE (J2/9) IS NOT LONGER USED, IT SHOULD BE REMOVED.

Abb. 2-2 Installation wiring for the navigation receiver, control unit and indicator IN 3300 - (03)



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 GND FOR 14V ILLUMINATION.

⑥ CONNECTED TO GND FOR 28V ILLUMINATION.

⑦ IN3300-( )-01 WITH 14V/28V ILLUMINATION.
IN3300-( )-02 WITH 5V ILLUMINATION.

⑧ CONNECTED TO GROUND FOR 14V ILLUMUNATION.

⑨ LEAVE OPEN FOR 28V ILLUMINATION.

⑩ ATTENTION FROM SERIAL NO.100:
TO CHANGE THE AUDIO OUTPUT FROM SYMMETRIC TO ASYMMETRIC, INSERT A JUMPER (BR1) BETWEEN PIN5 ANDF PIN9 OF J2.
AS AUDIO LINE (J2/9) IS NOT LONGER USED, IT SHOULD BE REMOVED.

Fig. 2-2 Installation wiring for the navigation receiver, control unit and indicator IN 3300 - (4)