

BECKER

AVIONIC SYSTEMS

Control Unit

CU 5301 - ()

Installation and Operation

Manual DV 60511.03
Issue 1 July 1997

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Section 1 GENERAL INFORMATION

1.1 Introduction

The CU 5301 - () control unit is described in the "Installation and Operation" DV 60511.03 and "Maintenance and Repair" DV 60511.04 manuals.

The manuals DV 60511.03 "Installation and Operation" and DV 60511.04 "Maintenance and Repair" contain the following sections:

Section		DV 60511.03	DV 60511.04
1	General Information	X	X
2	Installation	X	X
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1.2 Purpose

The CU 5301-() control unit is used to operate and control the RN 3320 - () or RN 3330 - () navigation receiver. Both enable the reception and evaluation of VOR and LOC signals in the 108.00 MHz - 117.95 MHz frequency range on 200 channels. The RN 3320 - () also contains a glidepath receiver for the reception and evaluation of glidepath signals in the 329.15 MHz to 335.00 MHz frequency range on 40 channels.

The mechanical construction of the control unit is such that it can be installed without limitation in aircraft. There is no restriction with regard to installation in the instrument panel or installation by rigid attachment to the fuselage in any aircraft, including rotary wing aircraft, in the verified environmental categories.

1.3 General description

1.3.1 Mechanical description

The control unit is designed for installation in the instrument panel of aircraft. The dimensions correspond to the ARINC standard for standard 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.

Mechanically the control unit consists of a front section and rear section. The front section contains the Display Board and the Switch Board and these boards are connected to each other by a connector and held in place within the unit by four bolts. The Processor Board, which is also secured to the front section by two bolts, is mounted on the switch board. The Power Supply Board is inserted into the rear section and secured from outside (back of rear section) by three bolts. After all the boards are assembled, the front and rear sections are joined and secured to each other by four bolts inserted from the front section.

1.3.2 Electrical description

After power on, an initialization phase takes place between the control unit and navigation receiver. During this period, data transmission takes place from the remote navigation receiver to the control unit. This is necessary because the data backup takes place in the remote navigation receiver. On completion of this phase, the mode which was set before power off is automatically displayed on the control unit.

The frequencies are indicated by means of an LC display. The required active working frequency can be set in the top line of the LC display by means of the MHz and kHz frequency selector switches. The MHz rotary switch engages at steps of 1 MHz, the kHz rotary switch at 50 kHz steps. 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.

A storage device enables 20 different frequencies to be stored, which are also retained when the unit is switched off.

Data transmission between the control unit and navigation receiver takes place through a bi-directional, serial RS 422 interface.

1.4 Technical data

Power supply	+ 13.75 V to + 27.5 V d.c.
Emergency power supply	+ 10 V d.c.
Power consumption (without panel lighting)	≤ 0.06 A at 13.75 V ≤ 0.06 A at 27.5 V
Panel lighting	≤ 0.160 A at 13.75 V ≤ 0.080 A at 27.5 V
Operating temperature	- 20° C . . . + 55° C
Storage temperature	- 55° C . . . + 85° C
Operating ceiling	50,000 ft
Interface	RS 422
Vibration resistance in accordance with EUROCAE/RTCA ED-14C/DO-160C	Cat. NM
Humidity resistance in accordance with EUROCAE/RTCA ED-14C/DO-160C	Cat. A / + 50° C; 95%, 48 h
Environmental performance class Env. Cat.	ED-14C/DO-160C D1-BA(MN)XXXXXXXXZBABATAXXX
Dimensions	61.3 x 61.3 x 62 mm H x W x D
Weight	0.26 kg

1.5 Software

All data such as the set frequencies, stored frequencies, selected mode etc. are stored in the navigation receiver. If the control elements are altered, a data transmission immediately takes place to the remote navigation receiver. The frequency display is controlled by a microcontroller. The software was classed as level C in accordance with the EUROCAE/RTCA Document ED12B/DO-178B.

1.6 Overview of variants

Table 1-1 shows the variants for the CU 5301 - () control unit. There is no external difference between the different variants, i.e. dimensions, installation depth etc. are the same for all the series.

Part-No.	Type designation	Background lighting		Panel surface	
		red-orange	blue-white	Powder coated	Painted
0503.789-911	CU 5301 - (1) - X01	X			X
0508.489-911	CU 5301- (1) - X11		X		X

1.7 Specification

LBA-No.: 10.922/94 JTSO

BAPT A132 880 J

Specifications

RTCA DO-192	JTSO - C34e
RTCA DO-195	JTSO - C36e
RTCA DO-196	JTSO - 2C40c
FTZ	17 TR 2010
Software	ED-12B/DO-178B Level C
Environmental categories	D1-BA(MN)XXXXXXXXZBABATAXXX

1.8 Environmental influences

The following resistances to environmental influences were verified in accordance with EUROCAE/RTCA ED-14C/DO-160C.

Environmental influence	ED-14C DO-160C	Environmental class	Influence variable
Temperature and altitude	4.0	D1	
Low operating temperature	4.5.1		- 20° C
Low storage temperature			- 55° C
High short-duration temperature	4.5.2		70° C
High operating temperature	4.5.3		55° C
High storage temperature			85° C
Negative pressure (altitude)	4.6.1		50,000 ft.
Temperature change	5.0	B	
Humidity	6.0	A	48 hrs at 50° C and ≥ 95% humidity
Impact under:	7.0		
Operating conditions	7.2		6 G/11 ms for the 3 axes
Crash landing conditions	7.3		Impact: 15 G/11 ms for the 3 axes
Vibration	8.0	MN	
Magnetic influence	15.0	Z	Deflection of a compass by 1° at a distance of ≥ 30 cm
Altered power supply	16.0	B	The functioning of the equipment on 10 V emergency power was verified
Voltage impulse on power supply	17.0	A	
Low frequency disturbing voltages	18.0	B	
Induced magnetic and electrical fields	19.0	A	
High frequency disturbing voltages and disturbing fields	20.0	T	
Unwanted radiation	21.0	A	

1.9 Scope of delivery

Control unit	Article-No.: refer to overview of variants
4 Phillips head screw	Article-No.: 0868.590-203
or	
4 countersunk screw	Article-No.: 0889.350-204
Operating instructions	Article-No.: 0511.749-071

1.10 Accessories (not included in scope of delivery)

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 60511.03	Article-No.: 0511.447-071
Maintenance and Repair DV 60511.04	Article-No.: 0511.455-071

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Section 2 INSTALLATION

2.1 General

The installation of the control unit depends on the type of aircraft and its equipment and therefore only general information can be given in this section.

2.2 Inspection before installation

Before installing the control unit in an aircraft, carry out a visual inspection for any transport damage, paying particular attention to the following.

1. Dirt, dents, scratches, corrosion, broken attaching parts on the housing and housing parts.
2. Dirt and scratches on the identification plate, front panel, LC display and marking.
3. Dirt, bent or broken pins, cracked connector inserts.
4. Dirt and mechanical damage to switches, keys and knobs.
5. Missing screws and bolts.

2.3 Mechanical installation

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. 2-1. The unit is attached using four bolts which are included in the scope of delivery. The aircraft wiring diagram is in Manual DV 60603.04 of the RN 3320 - () / RN 3330 - () navigation receiver.

2.4 Aircraft wiring

2.4.1 General

The following points are to be observed for the wiring.

- a.) Only cable fit for aviation (self-extinguishing) may be used. AWG 24 for power supply and AWG 24 for other cables.
- b.) The interface lines TX-A/TX-B and RX-A/RX-B are each to be laid as 2-core twisted and screened (AWG 24) cables.
- c.) Rubber sleeves are to be fitted over the soldering points on the equipment connector.

- d.) A 1 A fuse or circuit breaker should be fitted in the power supply.
- e.) No HF cable should be included in the cable harnesses. Laying connecting cables together with cables which carry LF power or impulses is also to be avoided.
- f.) Check the wiring carefully before switching on the unit, particularly that (UB+) and (GND) have not been mixed up.

2.4.2 Panel and display lighting

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	+ 27,5V

NOTE

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

2.4.3 Connector contact assignment for 15-pole P 31 connector

Pin	Connection	Description
1	TX-A	RS 422 interface
2	TX-B	RS 422 interface
3	Shield	Screen of RS 422 interface ground
4	RX-A	RS 422 interface
5	RX-B	RS 422 interface
6	ILL.A	Panel and display lighting A
7	Spare	Not wired
8	ILL.B	Panel and display lighting B
9	GND	Ground
10	GND	Ground
11	+UB	+ UB operating voltage
12	+UB	+ UB operating voltage
13	/ON	ON/OFF function
14	UBSW	Switched operating voltage
15	/X	Input special function low active

2.5 List of Abbreviations

The following abbreviations are used in this manual:

Abbreviations

Fig.	Figure
AC	Alternating current
AM	Amplituden modulation
ARINC	Aeronautical radio incorporation
ARINC 429 Line	ARINC 429 serial bus
ARINC 410 Line	ARINC 410 parallel bus
ATR	Avionics transport rack
Bite	Built in test equipment (Self test)
COM	Communication (Transceiver)
CU	Control Unit
dB	Dezibel
dBm	Dezibel refer to 1mW
DC	Direct current
D-GPS	Differential global positioning system
DME	Distance measuring equipment
EMK (EMF)	Electromotive force
EMV	Electrical magnetic interference
EEPROM	Electrical erasable programmable read only memory
EXT	External
FTZ	Fernmelde-Technisches Zentralamt
ft	Feet
ICAO	Internationale civil aviation organization

ILL.A	Illumination.A
ILL.B	Illumination.B
ILS	Instrument landing system
I/O ports	Input/Output ports
GS	Glideslope
GND	Ground
HSI	Horizontal situation indicator
Kbit/s	Data transfer rate
LBA	Luftfahrt-Bundesamt
LCD	Liquid crystal display
LOC	Localizer
MAX	Maximum
MKR	Marker
MLS	Mikrowave landing system
MTBF	Mean time between failure
NAV	Navigation
N.C.	Not connected
NF-Signal	Audio signal
NR	Navigation receiver
NOVRAM	Non volatile random acces memory
NVG	Night vision goggle
OUT	Output
/ON	ON/OFF function
PTT	Push-To-Talk
PRG	Program mode
PWR	Power
RAM	Random acces memory

RD	Read
RMI	Radio magnetic indicator
RX-A	RS 422 interface
RX-B	RS 422 interface
/SCK	Seriell clock display
SDA	Seriell data I ² c-bus
SCL	Seriell clock I ² c-bus
SPARE	Spare
SQL	Squelch
TO/FROM	Direction indicator
TR	Transceiver
TX-A	RS 422 interface
TX-B	RS 422 interface
UBSW	Operating voltage switched
V5	Internal operating voltage + 5 V
VOR	Very high frequency omnidirectional range
VOL	Volume
VHF	Very high frequency
/X	Input special function, low activ
ZF	Intermediate frequency

BACK-PANEL MOUNTING

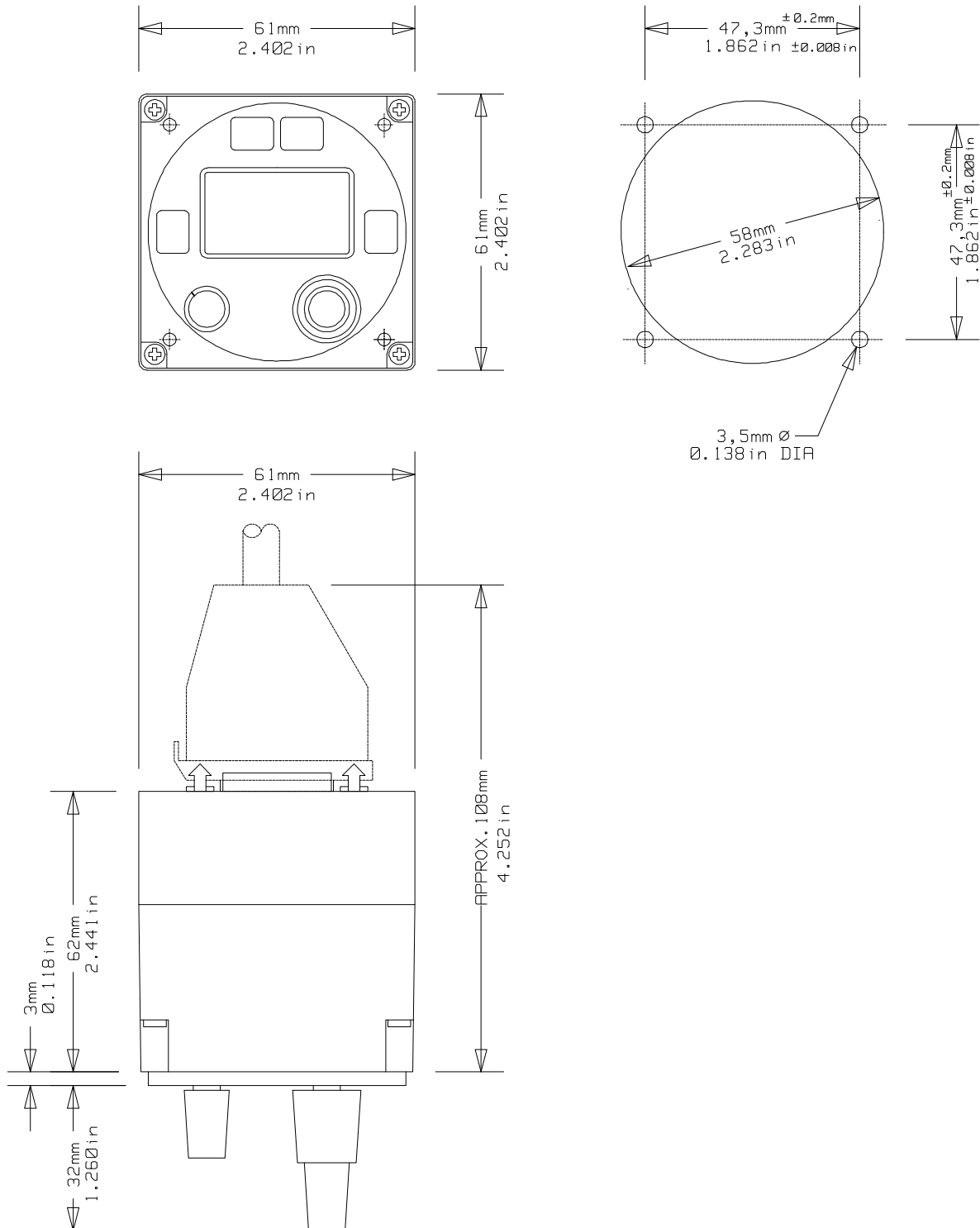


Fig. 2-1 Installation dimensions for the control unit CU 5301-()

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Section 3 OPERATION

3.1 Controls and indicators

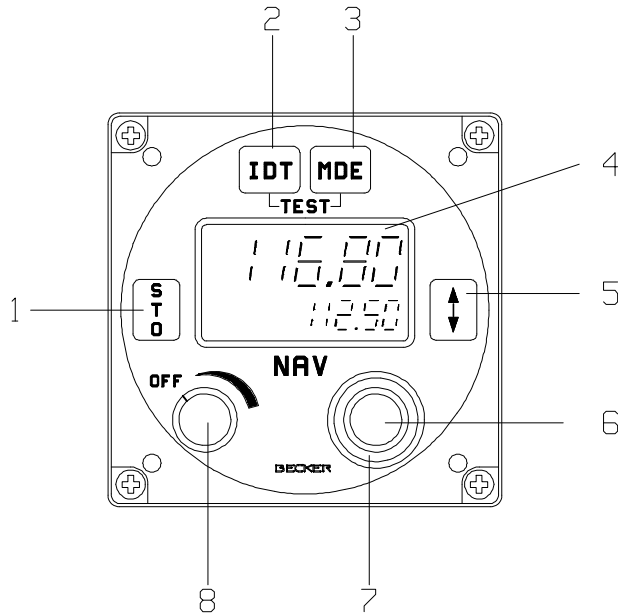




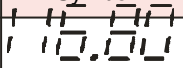
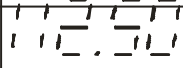




Fig. 3-1 Front panel of control unit

Controls

	Symbol	Description	Function
1	STO	Store key	Storing the set frequency and other settings in the service mode.
2	IDT	Ident key	Switching the suppression of the VOR identification on or off when monitoring flight and weather information.
3	MDE	Functions key	Choice of functions and selecting the parameter in the service mode.
5		Exchange key	Frequency preselection: Exchange of preset frequency and active frequency.
	TEST		Press IDT and MDE keys simultaneously. A functional test of the NAV system then takes place.
7		Frequency change switch (outer rotary switch)	Switches the indicated frequency in 1 MHz steps or the storage channel up or down by steps of 10 in each case.

6		Frequency change switch (inner rotary switch)	Switches the indicated frequency in 50 kHz steps or the storage channel up or down in single steps.
8		ON/OFF switch combined with volume control	ON/OFF switch of NAV receiver and volume control.

LC display

	Symbol	Description	Function
4		(Top line) (Active frequency)	Display of active reception frequency.
4		(Bottom line) (Pre-set frequency)	Display of pre-set reception frequency in the frequency preselection mode.
4		(Bottom line)	Display of the set storage channel in the channel setting mode.
4		(Bottom line)	CH display flashes: if an activated storage operation is not completed by pressing the STO key. ch = free channel: CH = occupied channel (can be overwritten).
4		(Bottom line)	ON indication
4		(Bottom line)	OFF indication

Connector on back of unit

15-pole subminiature, male
Push-in locking

Equipment connector for connecting the aircraft cabling

3.2 Operating instruction

3.2.1 Preparation

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

WARNING!

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

3.2.2 Switching on the control unit

- a. Rotate the volume control clockwise and switch on the navigation system.

NOTE

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

In all modes, disturbances of the navigation 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.

3.2.3 Test (self-test)

- a. Press both keys **IDT** and **MDE** simultaneously. All segments of the LC display shall flash. At the same time the VOR/LOC needle (vertical needle) of the connected display unit shall deflect halfway and the VOR/LOC warning flag disappear from the field of view. The GS needle (horizontal needle) of the connected display unit shall also be half deflected and the GS flag shall disappear from the field of 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 bottom line 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 bottom line 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 RN 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 system contains various functions which are performed under three modes. The individual modes are selected by pressing the **MDE** key on the control unit.

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

Channel setting mode

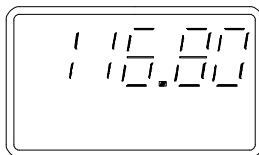
Display of the stored frequencies in the storage channels. The channels can be selected using the frequency selector switches.

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



The active frequency can be changed using the **MHz** and **kHz** frequency selector switches.

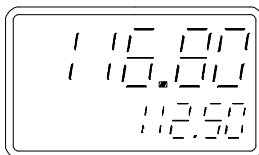
The set frequency is held even when the unit is switched off.

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 top and bottom lines respectively.



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

NOTE

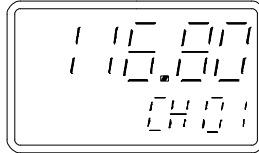
The navigation receiver is always ready to receive on the frequency shown in the top line.

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 bottom line and the stored frequency is shown in the top line. 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 function, 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.

- a. Press the **STO** key. The active frequency remains indicated in the top line. The navigation system is ready to receive on this frequency. The active frequency is shown flashing in the bottom line 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.
- b. 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.
- c. 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 configuration)

The service mode is designed to enable the technicians to set the equipment configurations on the ground, and must not be called up in flight.

The following parameters can be changed or set.

FrCh	Enabling the frequency setting (channel selection only) (ON/OFF)
ChSt	Enabling the frequency storage (ON/OFF)
dEL	Deleting stored frequencies
COdE	Entering the password to lock the equipment configuration

3.5.1 Calling up the service mode

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

On the left, two positions of the version number of the navigation receiver.
Right two positions of the version number of the control unit.

Release the **MDE** key. FrCh appears in the top line and OFF or ON in the bottom line.

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.

Enabling the frequency setting (channel mode only)

Select the FrCh parameter using the **MDE** key. The following characters are displayed.

Top line	FrCh
Bottom line	ON or OFF

Select the required setting using the **kHz** switch and press the **STO** key to store the selection.

OFF=	Frequency setting not possible. The navigation receiver can only operate on the frequencies stored in the individual channels.
ON=	Frequency setting possible (standard setting).

Enabling frequency storage

Select the ChSt parameter using the **MDE** key. The following characters are displayed.

Top line	ChSt
Bottom line	ON or OFF

Select the required setting using the **kHz** switch and press the **STO** key to store the selection.

OFF= It is not possible to store the frequencies in the individual channels. The navigation receiver can only operate on the already stored frequency when in the channel mode.

ON= Storage of frequency in the individual channels is possible (standard setting).

Delete stored frequency

Select the dEL parameter using the **MDE** key. The following characters are displayed.

Top line	dEL
Bottom line	Channel number

Using the **kHz** (single steps) and **MHz** (steps of ten) switches, select the channel to be deleted. Press the **STO** key to delete the stored frequency. The frequency set in channel 1 cannot be deleted, but can only be overwritten by another frequency.

Entry of password to lock the equipment configuration

Select the COdE parameter using the **MDE** key. The following characters are displayed.

Top line	COdE
Bottom line	0000 or valid code after it has been set

Using the **MHz** switch, select the character (selected character flashes) and then set the characters using the **kHz** switch. Store the numerical code by pressing the **STO** key.

NOTE

Immediately a password is given, 0000 is displayed in the bottom LC display when the service mode is called up. The numerical code must then be entered using the **MHz** and **kHz** switches and the **STO** key pressed. The service mode can only be entered if the correct numerical code is given. If the password is changed or deleted, the function code is to be called up in the service mode using the old password. Then enter the new numerical code (new password) or 0000 (delete password). Press the **STO** key to store the numerical code.

Ending the service mode

To end the service mode, switch off the navigation system at the control unit.

3.6 Deletion of all stored frequencies in the storage channels

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

3.7 Safety precautions

- † Switch off the control unit 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.