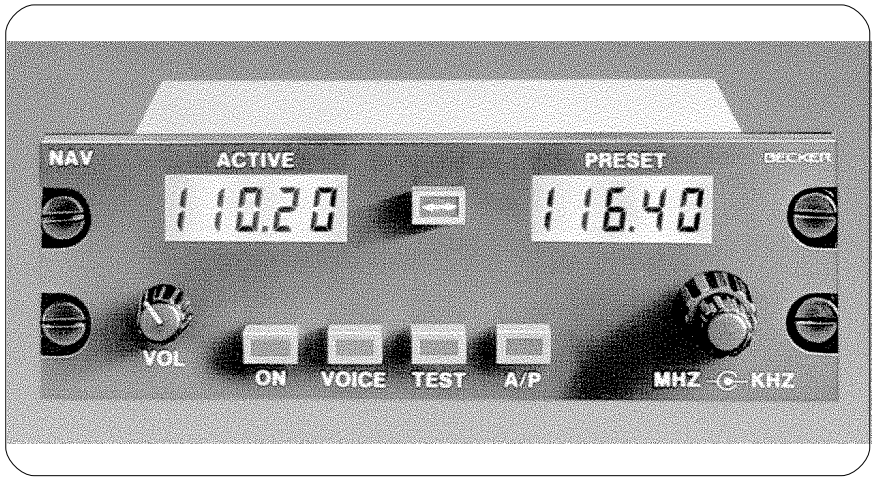
BECKER
AVIONIC SYSTEMS

OPERATING INSTRUCTIONS

Navigation-Receiver

NR 3320 - (01) / - (02)

NR 3330 - (01) / - (02)



BECKER
AVIONIC SYSTEMS

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Failure description

Unit type : Serial number :

Aircraft type :

Brief description of the failure :

.....

.....

.....

.....

Should the fault only occur sporadically, please answer the following questions :

The fault occurs after . . . . . minutes of operation.

The fault occurs under the following environmental conditions :

- ❒ low temperature
- ❒ high temperature
- ❒ high humidity
- ❒ vibration

The fault is engine speed-dependent and occurs above/below . . . . . rpm.

Should any problems arise, I may be contacted under the following adress :

..... I am available between 8 a.m.

..... and 4 p.m. under the following

..... telephone number :

..... office: .....

..... private : .....

REPAIR INSTRUCTIONS

If an equipment fault the unit may be sent to a Becker Dealer or the Becker Product Support together with a description of the fault. The completed fault description shortens the repair times and hence lowers the resultant costs.

These operating instructions do not replace the equipment manuals listed below.

❑ Equipment manuals

To be purchased from the manufacturer or Becker Dealer:

Installation and Operation
DV 38001.03 Article-No.: 0504.971-071

Maintenance and Repair
DV 38001.04 Article-No.: 0504.981-071

Operating Instructions Article-No.: 0516.718-071

TABLE OF CONTENTS

Centering error under all conditions, listed in RTCA DO-192 with 95% probability	13% of standard deflection
GS needle output	max. of 3 needles and/or flags with 1 k each
GS warning flag output	max. of 3 needles and/or flags with 1 k each

❑ 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 meet relevant requirements. They must have equivalent or better environmental performance characteristics as the indicators listed above with respect to temperature, altitude, humidity and vibration.

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

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

Receiver type	single-conversion super-heterodyne 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 F 150 kHz

IMPORTANT

Carefully read these operating instructions right through before attempting to operate the NAV receiver.

Keep these operating instructions carefully. They contain important safety and operating instructions for the NAV receiver.

INTRODUCTION

Thank you for purchasing the BECKER NAV receiver. The NAV receiver can be installed in the instrument panel or centre console or operating console and is easy to operate. The technology used is to the state of the art.

To fully utilise the capabilities of your NAV receiver, please carefully read these operating instructions right through before you start operating the set.

If you have any questions regarding the operation of the NAV receiver, please get in touch with your nearest Becker Dealer or with the Becker Product Support.

The WARNING, CAUTION and NOTE highlights have the following meanings:

WARNING	Failure to comply, or incorrect compliance, with these instructions or procedures can lead to injuries or fatal accidents.
CAUTION	Failure to comply, or incorrect compliance, with these instructions or procedures can lead to damage to equipment.
NOTE	Feature to which attention should be drawn.

CAUTION

- Never connect the NAV receiver to alternating current voltage or to voltage sources exceeding 32 V DC.
- Never connect the NAV receiver with reversed polarity to a voltage source.
- The installation of the NAV receiver in ambient temperatures below - 55° C or above + 85° C is to be avoided.
- Switch off the unit when starting or shutting down engines.

AGC dBm	3 dB from -87 dBm . . . -10
Distortion	10%
Audio output	150 mW into 300 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

❑ VOR/LOC system functions

Sensitivity	-93 dBm for full direction sensitivity
Bearing error under normal condition	2°
Bearing error under all conditions listed in RTCA DO-196, with 95% probability	2.7°
Course deviation for full scale deflection	10°
LOC centering error under all conditions, listed in RTCA DO-195 with 95% probability	11% of standard dflection

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

❑ **VOR/LOC receiver**

Receiver type	triple-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 F 50 kHz

SAFETY PRECAUTIONS

- Switch off the navigation receiver before starting or shutting down engines !
- The NAV system should be connected to 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 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 course deviation 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 45° occurs in which the warning flag appears and the course deviation needle stays in the mid position.
- When flying over mountains the course deviation needle may deviate about the mid position (reflections) when approaching or leaving VOR stations. Doppler VOR stations produce substantially more stable indications under these conditions.

- EMC note: If the antennas of transmitting equipment and of the navigation receiver are not sufficiently decoupled, it is possible that the warning flag may appear during transmission or the course deviation needle may deflect. Inadequate decoupling is possible with airframes made of wood or synthetic materials or where the antennas are mounted close together.

TECHNICAL DATA

❑ General data

Supply voltage	+ 13.75 V or + 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

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

Ending of the service mode

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

❑ 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.

GENERAL INFORMATIONS

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 MHz 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 MHz and 117.95 MHz. It supplies the NAV composite signal to an external VOR/LOC converter. Both NAV receiver include a glideslope receiver. The glideslope receiver is designed to receive and convert GS signals on 40 channels in the frequency range between 329.15 MHz and 335.00 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 MHz 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 MHz and 117.95 MHz. It supplies the NAV-composite signal to an external VOR/LOC converter.

❑ Short description of NAV receiver

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 the GS-receiver

the 15-pole D-sub connector plug (female) for the outputs of the VOR/LOC converter board (NR 3320 - (01) and NR 3330 -(01) only)

the 9-pole D-sub connector plug (female) for the I/O Outputs of the 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.

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 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. 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).

The microcontroller as well as its 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 triple-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 injection signal for the mixer is generated by a 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 injection frequency for the receiver is generated by a 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).

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

“Fr” appears in the left indication and OFF or ON in the right indication 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).

2. 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.
3. 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 aborted off. A storage operation can be aborted off at any time by pressing the **MDE** key.

❑ 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.

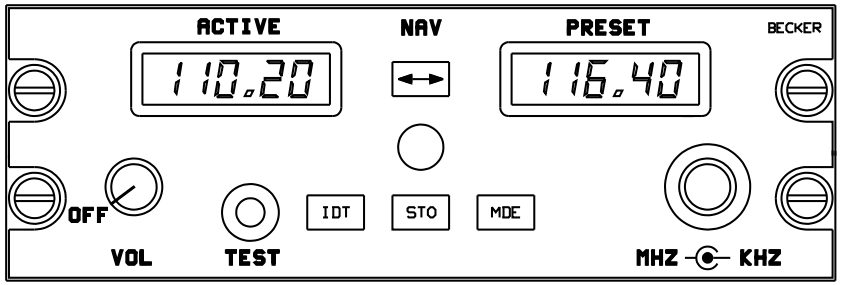
The following settings can be changed or set:

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.

CONTROLS AND INDICATORS

❑ NAV receiver



Meaning of symbols on controls and indicators

	Symbol	Description	Function
1		ON/OFF switch combined with volume control	ON/OFF switch and volume control.
2	**TEST**	TEST key	Tests functional status of both LCDs, the VOR/LOC- / GS-converter and the indicator.
3	**IDT**	IDT key	Switching the suppression of the VOR identification on or off when monitoring flight and weather information.
4	**STO**	STO key	Storage of set frequency or other settings.

	Symbol	Description	Function
5	**MDE**	Function key	Selection of mode and selecting the parameter in the service mode.
6	**< - >**	Exchange key	Frequency preselection: Exchange of preset fre-quency and active frequency.
7		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.
8		Frequency selector	Switches the indicated (inner rotary switch) frequency in 50 kHz steps or the storage channel by 1 step in each case upwards or downwards, without carry over.

❑ 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 storage channels can be selected.

Change of mode

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

❑ Storage procedure

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

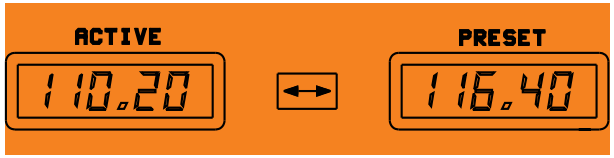
1. Press the **STO** key. The active frequency remains indicated in the left display. The navigation system is ready to receive on this frequency. The active frequency is shown flashing in the right display and in the frequency preselection mode, the preset frequency. Set the required frequency using the **kHz** frequency selector switch and the **MHz** frequency selector switch.

Change of mode

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

❑ 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.

LCD (liquid crystal display) elements

	Symbol	Description	Function
9	110.20	(left indication) (active frequency)	Indication of active reception frequency.
10	116.40	(right indication)	Indication of preset reception frequency in the frequency preselection mode.
10	CH 01	(right indication)	CH indication steady: Indicates the storage channel.
10	CH	(right indication)	CH indication flashes: If the initiated storage operation is not completed by pressing the store key.
10	On	(right indication)	ON indication.
10	OFF	(right indication)	OFF indication.

Rear of unit

BNC	50 Ohm antenna connecting sockets VOR/LOC-Receiver
TNC	50 Ohm antenna connecting sockets GS-Receiver

25-pin D sub-male	Equipment connector for connecting the installation wiring
15-pin D sub-male	Equipment connector for connecting the installation wiring Indicator IN 3300 - ( )
9-pin D sub-male	Equipment connector for connecting interface RS 422

Channel setting mode

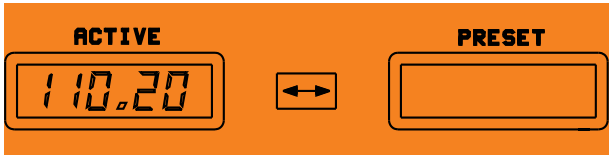
Display of the stored frequencies in the storage channels. The channels can be selected using the frequency selector switches.

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.

❑ Frequency setting mode

The left display indicateds 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.

❑ GS mode with the NR 3320 - ( )

1. Set the frequency of the localizer.
2. Switch on the VOR/LOC identification (press the **IDT** key, ON appears briefly in the display). Monitor the Morse identification signal and compare it with the identification signal of the wanted localizer.
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.

❑ 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.

OPERATING INSTRUCTIONS

❑ Operating instructions NAV receiver

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.

❑ Switching on the navigation receiver

1. Rotate the volume control clockwise and switch on the navigation receiver.
2. 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.

- E2 synthesizer failed,
- E3 EEPROM fault

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

❑ 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.

❑ VOR mode

1. Set the frequency of the wanted 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 identification signal of the wanted 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.

❑ 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/LOC indentification 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.

❑ LOC mode

1. Set the frequency of the required localizer.
2. Switch on the VOR/LOC identification (press the **IDT** key, ON appears briefly in the display). Monitor the Morse identification signal and compare it with the identification signal of the wanted 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.