SSB receiver DEBEG 2800

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1. Scope of applications

The SSB receiver DEBEG 2800 has been specially conceived for use on yachts. It fulfills the technical specifications of the Deutsche Bundespost in accordance with recommendation FTZ 171 R 41 which contents also the nautical qualification of the DHI. The self interferences are below degree of interference K.

This receiver was designed with the latest synthesizer technology and operates in a frequency band from 100 kHz to 9.9999 MHz. It is tuned in steps of 100 Hz. The FM band from 87.5 MHz to 107.9 MHz can also be received. In this case, the receiver is tuned in steps of 100 kHz.

The receiver frequency can be entered on a keyboard or selected by means of search-scan and is indicated by 7-segment LED's. The frequency and mode are stored and, if the receiver is switched off, remain stored until deleted.

The following modes are possible:

A1, A2/A3, A3J, F3 and DF.

A high selectivity is achieved by means of steep crystal filters. In mode A3J, it is possible to switch to the upper or lower sidebands. The BFO is variable.

Low-loss voltage stabilisation is achieved by the use of a regulated power supply unit. The power supply unit provides 12 V dc to 24 V dc.

It is possible to activate and deactivate the receiver by means of a quartz clock with automatic timer. The timer is displayed by LED's.

The DEBEG 2800 receiver is distinguished by its compact, modular design. The direction-finding attachment DEBEG 7481, 7480, G 701 and the manual direction-finder BK 171 can be connected. It is also possible to connect a cassette recorder, a second loudspeaker, a pair of headphones and a weather chart plotter.

2. Technical data

Reception bands

Band I	100 kHz to 9999.9 kHz
Band II	87.5 MHz to 107.9 MHz

Frequency processing and setting by synthesizer via keyboard

Band I	100 Hz steps
Band II	100 kHz steps
Frequency accuracy	± 10 ppm
Frequency display	7-segment LED's

Reception modes

Band I	A1, A2, A2H, A3, A3A, A3H, A3J (LSB/USB)
Band II	F3

Bandwidths

Band I	± 1.2 kHz with - 6 dB
	± 2.1 kHz with -66 dB
	± 3.75 kHz with - 6 dB
	± 8.50 kHz with -66 dB
Band II	± 115 kHz with - 6 dB
	± 220 kHz with -40 dB

automatic switchover in accordance with received type of modulation

Sensitivity

S/N -10 dB	A1	0.5 uV
	A2/A3	2 uV
	A3J	0.5 uV
S/N -20 dB	F3	4 uV
IF suppression	65 dB	
Image rejection	65 dB	
Near-end crosstalk attenuation	60 dB	
Blocking level	90 dBuV	

Cross-modulation	90 dBuV
AGC range	80 dB
BFO range	± 150 Hz
AF output power at 4 Ohms	2 W min, K = 10 %
Power supply	12 V dc to 24 V dc +30 %/-20 %
Total power consumption	maximum 21 W
Power consumption with clock display switched off	maximum 3 W
Power consumption with clock display switched on	maximum 7 W
Digital quartz clock	4-digit display of hours/minutes, programmable switch-on, switching contact for activation/deactivation of external devices
S-meter	for display of relative field strength
Monitor loudspeaker	integrated
Headphone connection	⌀ 6.3 mm jack, 4 Ohms

Connection possibilities for direction-finding attachments: DEBEG 7481, 7480, G 701, BK 171, cassette recorder for recording/playback, external loudspeaker, DEBEG 7911 weather chart plotter.

Weight 6.5 kg

The technical data are not binding. We reserve the right to make alterations.

3. Functional units drawing number 7233-7

Electrical abbreviations in brackets are used to elucidate the functional blocks in the block diagrams. These abbreviations can be found in the circuit diagrams of the device as component designations.

The first one or two digits of the components designations consist of the circuit board number and the last two digits represent the component number.

The component designations used in the description always indicate the decisive components in the functional block. The synthesizer of the unit is shown in block diagram drawing number 7233-290 as functional block which provides the oscillator frequency for the AM receiver section and which is required to tune the AM/FM receiver section. The synthesizer is described on the basis of block diagram, drawing number 7233-3.

With its additonal possibilities of reception and operation, the SSB receiver DEBEG 2800 consists of seven electrical functional units.

3.1 The operating unit with the keyboard for receiver frequency selection, displayed by LED segments, mode selection, clock programming with automatic timer switching and display and the controls for RF gain, AF gain and BFO setting, permits optimum utilisation of the modules:

3.2 Receiver for AM and A3J in the upper and lower sidebands of the LW, MW, GW and SW bands.

3.3 FM receiver.

3.4 Synthesizer which generates the oscillator frequency of the AM receiver by three PLL loops and which controls the FM receiver by one loop.

The reference crystal of the synthesizer also provides the control frequency for the clock.

3.5 Programmable timer switch.

3.6 AF amplifier for internal and external loudspeaker and headphones.

3.7 Power supply with variable input voltage range.

4. AM receiver
LP 23 and LP 24, block diagram drawing number 7233-290 and circuit diagram drawing number 7233-292

4.1 The antenna signal of the main antenna or the output of a goniometer is selected by means of the signal line x at the antenna selector by means of diodes (D 2301, D 2302) and

4.2 then reaches the 10 MHz low-pass filter.

4.3 Signals up to 10 MHz are amplified in the first RF stage

4.4 (T 2304) and mixed to the IF in the mixer (M 2301) with the oscillator signal from the synthesizer.

4.5 Through the filterselector (D 2303 - D 2306) and corresponding impedance-matching transformer the IF-signal will reach the filter.

4.6 Filter selector 1 and filter selector 2 (D 2307, D 2308) are controlled via the signal line x in order to automatically switch the signal to the correct bandwidth, depending on the mode.

4.7 The „narrow band" SSB filter (Fi 2301), with a bandwidth of + 1.2 kHz, is connected into the signal flow in modes A1, A3J/DF. The modes A2/A3/DF control the signal via the „wideband" AM filter (Fi 2302) with a bandwidth of ±3.75 kHz.

4.8 The 1st IF stage (IC 2301) and the 2nd IF stage (IC 2402) amplify the IF signal and are gain-controlled. The 3rd IF stage (T 2409) amplifies the regulated IF signal for the AM/SSB demodulator (IC 2403).

4.9 The BFO is a crystal oscillator (T 2410) with two switchable crystals (Q 2401, Q 2402) and is activated in SSB and A1 mode. SSB reception can be switched to upper or lower sideband via signal path W (T 2412, T 2413).

The frequency shift in each respective sideband can be modified by ±150 Hz by means of the BFO control.

4.10 The demodulator (IC 2403) is a combined module which receives no signal fro the BFO in AM mode (A2/A3) and which generates a carrier-dependent regulation voltage which feeds the AGC amplifier (IC 2405).

4.11 If the BFO is activated and connected to the demodulator by way of the signal line x , an AF-dependent regulation voltage is generated in the SSB-AGC module (IC 2404). This regulation voltage reaches the AGC amplifier.

4.12 In DF mode, the AF voltage in IC 2408 for connected direction-finding attachments is amplified with the correct phase relationships.

A carrier-dependent AGC is generated in each direction-finding mode. When the antenna is switched over to DF operation, the AF-dependent AGC is deactivated (T 2417).

4.13 The carrier-controlled and AF-controlled regulation voltage is routed via an AGC amplifier (IC 2405, 2406) to the IF amplifier, to the S-meter and, if necessary, to the goniometer attachment. The AGC amplifier is also influenced by the potentiometer „RF gain", which permits manual setting.

4.14 FM receiver/AF section circuit board LP 14. The antenna signal of the main antenna reaches the VHF/FM tuner (Tun. 1401) via the high-pass filter.

The tuner, fitted as a compact unit on circuit board Lp 14, is tuned by means of the synthesizer.

4.15 By way of the IF filter (F 1401), the oscillator signal reaches the IF amplifier and the VHF/FM demodulator (IC 1401). The S-meter display is picked up by the amplifier via the diode (D 1411) and routed to the ADC amplifier (circuit board Lp 24, IC 2405).

4.16 In the same way as the AF coming from the AM or SSB demodulator, the AF from the FM demodulator is selected at the AF selector (D 1403 - D 1405) by the mode keyboard (signal line x).

4.17 Depending on the mode, the variable AF amplifier (IC 1402) amplifies the switch AF for the internal and external loudspeakers and headphones.

4.18 Keyboard 2/4 circuit board Lp 15/16. The key functions (Ta 1501 - Ta 1504), for operation of the unit, the automatic system and mode selection, are supported by a contact bounce elimination and memory logic (Lp 16) and prepared for the signal paths x and z . The value of the displayed received frequency (kHz/MHz LED 0701/LED 0702) is laid down by the selected mode.

4.19 Timer with switching functions Lp 15/17.

By means of the 4-digit digital time display (DIS 1501DIS 1504), it is possible to read off the adjustable times accurate to the minute.

4.20 The times for the continuous time display and the required switch-on and switch-off time for the timer can be set by means of the keyboard 3 (Ta 1508 - TA 1510).

By means of the timer, the unit can be switched on and off automatically (signal path y) in addition to some external equipment (tape recorder, weather chart plotter etc.).

External units are switched by a potential-free contact (Rel. 2101).

These functions and the time display are controlled by an integrated clock module (IC 1707) which processes a crystalfree reference frequency from the synthesizer.

4.21 Power supply Lp 21/24

The unit's power supply is provided by three switching regulators (IC 2101 - IC 2103) which convert an input voltage from 9.6 - 32 V to the required supply voltages U1, U2, U3.

A negative voltage, required on circuit board Lp 24, is generated by a dc/dc converter (IC 2407) on this circuit board.

5. Synthesizer, block diagram drawing number 7233-3 and circuit diagram drawing number 7233-291

The frequency is set in the tuner by a three-loop synthesizer oscillator.

Each respective oscillator frequency is derived from a 10 MHz reference oscillator.

5.1 Each digitally set received frequency is stored and, until cleared, remains in the frequency loops as the programmable division factor. The regulation voltage for three voltage-controlled oscillators (VCO) changes until the programmable divided VCO frequency agrees with the reference frequency.

The synthesizer module is divided up into six functional groups.

5.2 Frequency input with display, memory and adder. The received frequency is selected by means of a keyboard (Ta 701 - Ta 711/Ta 713/Ta 714), entered by depressing the pushbutton „enter" (Ta 716) and cleared once again with the „C" button (Ta 715). In A3J mode, the button „SB" (Ta 712) with the sideband display USB/LSB (LED 703/LED 704) offers the possibility of sideband selection (signal path W).

5.3 After elimination of contact bounce and coding (IC 703), a selected received frequency is routed to the frequency store (IC 910 - IC 914) and then to the display (DIS 801 - DIS 805).

5.4 In order that the correct division factor is programmod in the frequency loops for each mode, fixed, coded values must be added to the programmed values. The fixed factors are selected via the signal line x (circuit board Lp 2).

5.5 Reference frequency generation

The reference frequency of the synthesizer and the control frequency for the timer are generated by a 10 MHz crystal oscillator (T 606, T 607). The reference frequency of the loops differs so that each frequency loop can generate a certain frequency range. For the first loop, the 10 MHz are divided by 200 (IC 610/IC 611) to 50 kHz and, for the second loop and VHF, are divided by 400 to 25 kHz. The control frequency for the timer is 50 Hz and is picked up at the end of the divider chain (IC 612).

Frequency loops

The 10.7 MHz intermediate frequency and the AM reception band from 100 kHz to 10 MHz impose the task on the synthesizer oscillator of generating each output frequency between 10.8 MHz and 20.7 MHz with a resolution of 100 Hz.

5.6 In frequency loop 1, the VCO 1 (T 401) oscillates between 10.6 MHz and 20.5 MHz. A received frequency generated in this loop can be programmed with this frequency range up to 9.9 MHz in steps of 100 kHz (signal path 1).

This corresponds to the first two decimal positions of the frequency display (DIS 801/DIS 802).

5.7 With VCO 2 (T 301), frequency loop 2 generates the frequencies for the last three decimal positions of the frequency display (DIS 803 - DIS 805). This is programmable via signal path 2.

Frequency loops 1 and 2 operate in accordance with the same principle:

The programmable divider divides the VCO frequency.

Once divided down, the VCO is compared in the frequency/phase comparator (IC 314 / IC 410) with the reference frequency. From the difference between these two frequencies, a voltage is generated in the comparator circuit which changes proportionally to the frequency difference.

5.8 The third frequency loop forms the output VCO 3 of the synthesizer oscillator. The loop operates with the frequency of the second loop divided by 25 (IC 313) and the frequency of the first loop.

The frequency of the first loop is mixed with the VCO-3-frequency (T 507) in a mixer (IC 501) and routed by a lowpass filter (C 513) and amplifier (T 510 - T 513) to the frequency/phase comparator (IC 502). The frequency of the second loop serves as the reference frequency of the comparator.

A frequency change in the second loop also changes the reference frequency in the comparator. The regulation voltage change of the comparator regulates VCO 3.

The regulation voltage also affects VCO 3 if a frequency change occurs in loop 1.

Due to the interaction of the two loops in the third loop, a crystal-exact oscillator frequency is generated in 100 Hz steps from 10.8 MHz to 20.6999 and is picked up at the isolating amplifier (T 519).

FM frequency tuning

Frequency tuning for the FM band is carried out in 100 kHz steps by the programmable divider of loop 2.

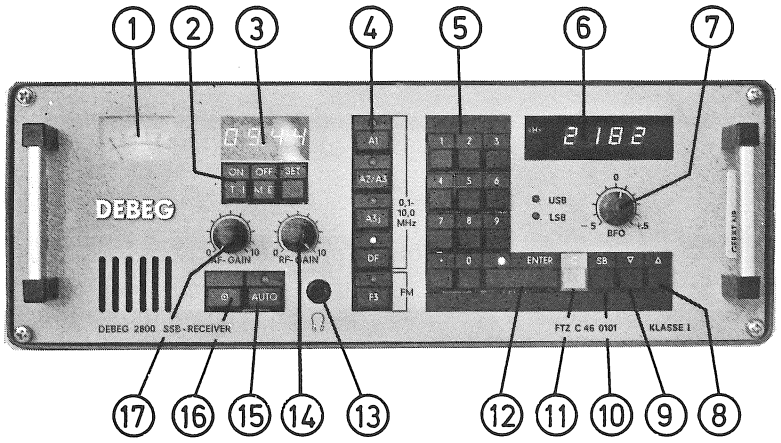
F3 mode selection switches the oscillator signal of the FM tuner (signal path x) in the AM/FM switchover circuit (IC 310) through to the divider of the second loop.

A high-speed divider (IC 613/IC 614) divides down the oscillator frequency so that the divider programming can also be used in the FM frequency band.

The divided frequency is compared with the reference frequency in the F/P comparator (IC 615).

The voltage resulting from the frequency difference reaches the VHF tuner through a low-pass filter as the tuning voltage.

1) Field strength display
2) Clock setting
3) Clock display
4) Mode selection
5) Setting the received frequency
6) Received frequency display
7) BFO
8) Tuning to higher frequencies
9) Tuning to lower frequencies



10) Sideband changeover in A3j mode and sideband display
11) Clearing the set frequency
12) Storage of set frequency
13) Headphone socket
14) RF gain adjustment
15) Automatic switching function on/off
16) Manual switching on/off
17) AF volume control

6. Operating instructions

After connecting the unit to the power supply, four zeros become visible on the time display panel (3), divided up into two 2-digit entities (hours and minutes) separated by a dot.

Switching on the unit

Press button (16).

To verify that all functions are operable, all segment bars of the display light up on the RECEIVED FREQUENCY display panel (6). The lighting for the scale of the S-meter (1) and the LED of the ENTER button (12) are operable.

Mode selection

With the MODE SELECTION keyboard (4), it is possible to choose between the five modes described below.

Mode A1

Depress the A1 button.

It is possible to receive unmodulated telegraphy broad-cast by means of a superimposed local-oscillator frequency generated in the unit.

Mode A2/A3

Depress the A2/A3 button.

All amplitude-modulated broadcasts can be received (radio/modulated continuous wave telegraphy).

Mode A3J (SSB)

Depress the A3J button.

The unit is now automatically set for reception of single sideband broadcasts in the upper sideband.

USB lights up on the sideband display (10).

In A3J mode it is possible to change the sideband by operating the „SB" button (10) and to improve intelligibility of the received signals with the BFO control (7).

DF reception mode

Depress the DF button.

This mode is only possible with supplementary equipment and is described in the section entitled „direction-finding with the DEBEG 2800".

Mode F3

Operate the F3 button.

All VHF stations (FM) can be received within the scope of the unit's reception band.

A mode change from the AM to the FM frequency band automatically deletes the entered frequency.

In the AM band, the received frequency is displayed in kHz and, in the FM band, it is displayed in MHz.

The display changes over automatically.

Setting the received frequency

The desired received frequency is set on the keyboard (5). Incorrect settings can be cleared by means of the pushbutton C (11). The setting can then be repeated.

After frequency setting, by operating the ENTER button (12) the input keyboard is locked and the AF amplifier is enabled. After completion of this procedure, the LED in the ENTER button (12) is extinguished.

The receiver tuning can also be changed by operating the buttons (9) and (8).

By operating the buttons (8) or (9), a received frequency is changed in 100 Hz steps in the AM band and in 100 kHz steps in the FM band. This frequency change can be carried out in single frequency steps or, if the button is kept depressed, in rapidly changing steps.

Frequency settings, which do not lie within the reception band of the mode or the receiver itself, are not accepted for storage. The LED in the ENTER button (12) then lights up continuously.

Setting the RF gain

This is set with the RF GAIN knob (14). The setting is only effective in the AM band. During normal reception, the control can be set to maximum by means of the automatic gain control of the receiver.

RF gain is only used in modes A1 / A3J or DF.

Setting the AF volume

This is set with the AF GAIN knob (17). The AF volume setting influences the volume of the monitor loudspeaker/headphone connection (13) and an externally connected loudspeaker.

6.1 Setting the time

The time (3) and the switch-on/switch-off time are set with three pushbuttons (2).

When the two TIME buttons are depressed, an additional illuminated dot appears next to the illuminated dot in the centre of the display and indicates whether or not the hours or minutes are being changed. The hours or minutes are changed by depressing the TIME buttons once again. The desired time can be set by additionally depressing the SET button.

After the first setting, the illuminated dot in the centre of the display begins to flash and thus signalises that the clock is functioning.

Setting the switching times

The switching times are set in the same way as the normal time of the day is set.

In this case, the switch-on time is set by depressing the ON button and the switch-off time is set by depressing the OFF button.

When set, display (3) always indicates the time of day. However, switch-on and switch-off times can always be checked by operating the ON or OFF button.

Attention: before programming a new switch-on time, the switchclock must run once over the switch-off time. If necessary, this process will be effected by setting the switch-off time. If there is no switch-off time programmed, it will be effect a switch-off within a 24 h cycle at zero o'clock each time.

Automatic switch-on and switch-off

Operate the AUTO button (15).

Automatic switching is switched on and off by means of the AUTO button (15). The LED in the button indicates operation. Button (16) must be switched to „off" to make sure that the receiver does not stay switched on all the time. Switching times apply to each 24-hour cycle.

Please note that a switching function can only be realized if there is at least one minute difference between the switch- on and the switch-off time.

Manual switch-off

Operate the pushbutton (16).

The displays of the received frequency, the LED's of the mode and ENTER buttons and the instrument lighting are extinguished. The time display can be switched on and off by actuating both TIME buttons.

6.2 Direction-finding with the DEBEG 2800

Connectable direction-finding equipment is connected to the DEBEG 2800 receiver by means of the socket BU 002. Actuating the DF button and entering the transmitter frequency of the transmitter to be found suffices to hear the transmitter in A1 mode. Mode of indication: LED DF- and A1.

Depressing the DF once again switches off the superimposed tone, thus permitting A2/A3 reception. Mode of indication: LED DF and A2/A3.

6.3 Sound recording equipment connected to the DEBEG 2800

Conventional tape recorders can be connected to the socket BU 003. A tape recorder must have a remote control connection if it is to be operated by way of the receiver's automatic switching system. If there is no such connection, the power supply of the type recorder can also be switched. For noise-free tape recorder playback, reception of the receiver 2800 must be muted with the clear button (11).

6.4 Weather chart plotter connected to DEBEG 2800

Weather chart plotters with AF evaluation can be connected to socket BU 003. On the receiver, the frequency must be set to 900 Hz less than the set frequency (for example: set frequency = 8000 kHz minus 900 Hz = 7999.1 kHz). Note also the tuning aid of the weather chart plotter. Switch to mode A1.

Pin assignments: PIN 3 AF PIN 2 ground

7. Installation instructions

The wires for the power supply, the switch output for

external equipment and for the additional loudspeaker are connected with pull-relief to a terminal strip on the rear of the unit. The wires for the direction-finder, tape recorder, weather chart and antenna are connected by means of corresponding connectors.

The antenna is allowed to be an isolated astern stag, or a shoud. The length of the antenna, if possible, not less than 3 m and not more than 15 m. In each case a coaxial cable (50 Ohm) down lead to the receiver is necessary. The receiver use this antenna nevertheless as a FM-antenna. A ground connection is established by means of a copper strip. This is linked to the wall bracket. A flexible lead is connected from the wall bracket to the ground pin on the SSB receiver DEBEG 2800.

Wire length must be dimensioned in such a way,that the unit can be moved from the wall bracket or that the module can be removed from the case, while still guaranteeing proper functioning of the unit.

7.1 Wall mounting

Refer to drawing number 5042 - 2 in the appendix for wall mounting.

7.2 Device connection

Drawings number 5042 - 3 and 5042 - 4 in the appendix provide the necessary information for all foreseen device combinations.

The internal switchcontact is potentialfree conducted at the clamp 1 and 2. The contact will be controlled from the switchclock and has a maximum carrying capacity from 30V/1A.

7.3 Dimensions

Refer to drawing number 5042 - 1 in the appendix for the dimensions.

7.4 Care and maintenance

The unit, including the front panel, should be occasionally cleaned with a moist cloth soaked in a mild detergent.