



TECHNICAL SPECIFICATION

MARINE RADIO RECEIVER TYPE B 285 CU

Power supply:

12-24-32-36-110-220 volts D.C.
110-220 volts A.C.
according to power pack fitted.

The interchangeable built in power pack has for the voltages mentioned below the designation:

12 volts D.C.:	B 420	
24 - D.C.:	B 421	
32 - D.C.:	B 422)	transformer re-set for
36 - D.C.:	B 422)	appropriate voltage
110 - D.C.:	B 423	
220 - D.C.:	B 424	
110 volts A.C.:	B 425)	transformer re-set for
220 - A.C.:	B 425)	appropriate voltage

Circuit:

Superheterodyne receiver with band pass input circuit, low impedance input, intermediate frequency 447 kHz on range 1-3-4-5-6 and 175 kHz on range 2, beat oscillator, push pull output circuit.

Tuning range:

1. 100 - 275 kHz
1. 195 - 535 -
3. 500 - 1350 -
4. 1300 - 3600 -
5. 3500 - 10000 -
6. 8500 - 23000 -

Tuning mechanism:

Slow motion friction drive with clock type indicating mechanism with two pointers (slow and fast), absolutely free of backlash. Dial calibrated in kHz; when using the vernier scale the effective length of the scale is 4500 mm on each frequency band.

Sensitivity:

50 milliwatts output for 1-3 microvolts input with a 10 db signal to noise ratio (30% modulated signal/no signal), yet about 10 microvolt input on 100 kHz.



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Selectivity:

Bandwidth at 447 kHz I.F.

3 db down for $\pm 2,5$ kHz detuning
60 - - - ± 9 - -

Bandwidth at 175 kHz I.F.:

3 db down for ± 1 kHz detuning
60 - - - $\pm 3,8$ - -

Image rejection:

In the middle of range 1:	at least 80 db
- - - - - 2:	- - 80 -
- - - - - 3:	- - 80 -
- - - - - 4:	- - 80 -
- - - - - 5:	- - 75 -
- - - - - 6:	- - 35 -

Intermediate frequency breakthrough:

447 kHz on ranges 1-3-4-5-6:	60-80 db
175 - - - 2:	50-80 -

Muting:

24 volts relay, operated by the key, disengages the built in loudspeaker and shorts the loudspeaker winding of the output transformer, when key is pressed. The relay also desensitizes the receiver, when operated.

Overvoltage protecting device:

Aerial safety lamp for protecting input circuit, whenever the transmitter's carrier is on.

Direction finding facilities:

In connection with a suitable frame aerial, for instance B 135 or B 278, the receiver may be used as a first class direction finder on ranges 1-2-3-4 as special input transformers and separate sense resistors have been supplied on these ranges.

Output:

Maximum output to 500 Ω external loud speakers:

About 8 watts, except on 110 volts D.C. mains, in which case the output is about 2 watts.

Maximum output to built-in speaker:

2 watts (0,5 watts on 110 volts D.C.)

Output impedance:

500 Ω for extra loudspeakers (if any),
nominal: 50 Ω for headphones.
- : 1,5 Ω for built-in speaker.

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CW-reception:

Separate beat oscillator provided for. Beat note variable by separate knob -2 kHz.

Automatic gain control:

4 valves controlled by the A.V.C.-diode voltage conditions a good output regulation for varying input. If for instance at 2000 kHz the input is increased from 5 microvolts to 100000 microvolts the output will vary some 15 db.

The A.V.C. is automatically cut off when working CW.

Stability:

Semi-variable air dielectric trimmers are used throughout and the I.F. transformers are temperature compensated for maximum stability.

Metering:

A milliammeter and switch are provided for measuring anode current of each individual valve. Meter may be used as a good tuning indicator.

Illumination:

The scale is illuminated by two flash light bulbs, each 6 volts 0,15 amps. Switch for dimming illumination is provided.

Tubes and diodes:

Radio frequency amplifier	UF 89
Oscillator and frequency changer	UCH 81
First intermediate frequency amplifier	UF 89
Second - - - - -	UF 89
Signal rectifier	OA 91
A.V.C. rectifier	OA 200
Audio frequency amplifier	UF 89
Beat frequency oscillator	UF 89
Output tubes	2 type UL 84
Aerial safety lamp	110 V 15 W
Dial bulbs	2 type 6 V 0,15 amp.

Controls:

- Tuning
- Frequency range
- RF gain
- AF gain
- B.F.O. pitch
- Mains on/off
- Dial light (dimming)
- Internal loudspeaker on/off
- External loudspeakers on/off
- Tube current



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- Switch: 1) Phone-MCW, A.V.C. on
2) Phone-MCW, A.V.C. off
3) CW, A.V.C. off
4) D.F., MCW
5) D.F., CW

Minimum/sense

General construction:

Heavy aluminium chassis built integral with but electrically insulated from the metal front plate, resting in insulated quideways in a metal cabinet, lacquered in grey colour and connected to earth.

All radio frequency coils with their associated trimmers and padding capacitors are contained in a rotatable turret which permits an extraordinary clear and practical layout of the radio frequency circuits. Solid silver contacts in ceramic mountings are a guarantee for long and troublefree service.

Lid of cabinet may be raised when 4 knurled nuts are removed. Similarly the whole receiver may be withdrawn from the cabinet when 4 other knurled nuts are turned up.

All connections from outside to the receiver are established through plugs and sockets, a coax set for a coax cable for aerial lead in, a twin connector set for a screened twin lead from the frame aerial and a 10-pole plug-and-socket for all other connections. Ample cable length allows for the receiver being withdrawn without breaking connections. The complete receiver is mounted on heavy shock absorbers.

Loudspeaker for bulkhead mounting supplied separately (on special order).

Weight and dimensions:

The weight is: 30 kgs.

Height: 300 mm + 30 mm shock absorbers

Width: 520 -

Depth: 335 - + knobs.

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Diagram:

One stage of radio frequency amplification with band pass input on all bands for satisfactory duplex telephony working, good image selectivity and minimum cross modulation, when operated near powerful transmitters.

Low impedance input circuit for correct matching to shielded aerial lead in (co-ax cable).

Special input transformers for frame aerial connection on bands 1-2-3-4.

Frequency changer and oscillator stage with a triode-hexode valve.

Two stages of intermediate frequency amplification with one 4-circuit filter and two 2-circuit filters.

Intermediate frequency: 447 kHz on ranges 1-3-4-5-6 and 175 kHz on range 2.

Semiconductor diode signal rectifier and also diode for automatic volume control A.V.C. One stage of audio frequency amplification.

+2 kHz by a knob in the frontplate.

Push pull pentode output stage.

Built-in loudspeaker with on/off switch. Maximum power available for the built-in speaker about 2 watts except on 110 volts D.C. mains, where only about 0,5 watt is available.

Special 500 Ω winding in output transformer - also equipped with on/off switch - for supplying up to 8 watts of power for external loudspeakers. On 110 volts mains yet only 2 watts. All speakers may be switched on and off without affecting output to earpiece (of microphone handset) or headphones.

Frequency range:

1:	100 -	275 kHz
2:	195 -	535 -
3:	500 -	1350 -
4:	1300 -	3600 -
5:	3500 -	10000 -
6:	8500 -	23000 -



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Dial:

Friction drive with small knob on handle for quick rotating of same. Clock type indicating mechanism with two pointers, one rotating 360° (100 divisions) the other one ten times 360° for a 180° rotation of the shaft of the tuning capacitor. The pointers are actuated through spring loaded gears from the shaft of the tuning capacitor, independent of the driving mechanism, thus completely avoiding backlash. The dial is calibrated direct in kHz, and besides a 100 division scale is furnished giving an effective length of the scale of about 450 cm (16 ft.) when the quick rotating pointer is used.

Stability and frequency drift:

For maximum mechanical and electrical stability, trimmers and padding capacitors in the radio frequency circuits are of the midget air dielectric type. Tuning capacitors in the I.F. circuits are of the protected silvered mica type combined with small ceramic capacitors with negative temperature coefficient for compensation. Trimmers for I.F. 175 kHz are of the semi variable ceramic type.

Sensitivity:

If sensitivity is defined as the signal 30% modulated, which, fed to the input terminals of the receiver through a standard artificial aerial, will give an output of 50 milliwatts with a ratio of at least 10 db between the signal output and the output noise of the receiver without any signal applied, the sensitivity is:

1-3 microvolts on all ranges,
yet about 10 microvolts on 100 kHz.

Selectivity:

For the I.F. proper the bandwidth is as the following table shows:

I.F. 447 kHz:

3 db down:	5 kHz	($\pm 2,5$ kHz detuning)
20 - - - :	9,2 -	($\pm 4,6$ - - -)
40 - - - :	13,6 -	($\pm 6,8$ - - -)
60 - - - :	18 -	(± 9 - - -)

I.F. 175 kHz:

3 db down:	2 kHz	(± 1 kHz detuning)
20 - - - :	4,2 -	($\pm 2,1$ - - -)
40 - - - :	6,0 -	($\pm 3,0$ - - -)
60 - - - :	7,6 -	($\pm 3,8$ - - -)

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On range 1 the R.F. input circuits will affect the bandwidth slightly, the final bandwidth being a little more narrow than above stated for the I.F. alone.

Spurious responses:

Image rejection:

In the middle of range 1:	at least 80 db
- - - - - 2:	- - 80 -
- - - - - 3:	- - 80 -
- - - - - 4:	- - 80 -
- - - - - 5:	- - 75 -
- - - - - 6:	- - 35 -

Intermediate frequency breakthrough:

447 kHz on range 1-3-4-5-6:	60-80 db
175 - - - 2:	50-80 -

Muting and over voltage protecting devices:

In order to prevent signals from the ship's own transmitter from being heard in the earpiece and the built-in loudspeaker a muting relay has been fitted to the receiver. The relay is fed from a 24 volt D.C. source of one of the transmitters to which the receiver is engaged. (The relay will operate for voltages ranging from 12 to 36 volts). The relay operates, when the telegraph key is pressed or, when working simplex telephony, when the push button of the microphone handset is pressed. The relay has two contacts, one breaking the screen grid supply of the I.F. tubes and grounding the screen grids of these tubes, the other one disengaging the built-in loudspeaker and earpiece, and shorting the L.S. winding of the output transformer.

In order to protect the receiver input coil against the heavy current induced in the receiving aerial by the ship's transmitter, an ordinary lamp (light bulb) has been inserted in the aerial lead. The lamp will limit the current through the input coil to 0,15 amps.

When the lamp is cold (i.e. no current through the filament) the resistance of the filament is so small, that the sensitivity of the receiver practically is not affected by its presence. When hot (i.e. when current induced by the transmitting aerial flows through the lamp) the resistance of the filament is about 10 times the resistance when cold and the lamp thus will effectively protect the aerial coil of the receiver.

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Notwithstanding the just mentioned muting of the receiver by the built-in muting relay, the built-in loudspeaker will be cut out as soon as the pushbutton of the handset is pressed (also when working duplex) when the receiver is used in connection with telephone transmitters type A 190, A 198, A 199, A 240, A 261 and others. The earpiece of the handset is not cut out by the relay of the transmitter.

The correct connections between receiver, loudspeaker and transmitter are shown in the diagram of the receiver.

If the receiver is used without being connected to a transmitter, terminals 5 and 6 of the terminal board belonging to the receiver should be strapped (shorted).

Control of amplification:

Two potentiometers have been fitted, one controlling R.F. and I.F. amplification, the other one A.F. amplification, giving the greatest flexibility of control.

The potentiometer of the R.F. and I.F. control is connected across a resistor in the common negativ lead of anode current supply. The moving contact of the potentiometer is through a suitable filter connected to the control grids of the R.F. and I.F. tubes. Thus a variable negativ bias is led to these tubes according to the setting of the potentiometer.

A.V.C. voltage is superposed on the manually adjusted grid bias when the mode-of-reception-switch has been set to "Phone-MCW, A.V.C. on".

The potentiometer of the A.F. control of amplification represents the load resistor of the signal diode rectifier, the moving contact of the potentiometer being connected to the grid of the A.F. amplifier.

Please note:

When working C.W. (beat oscillator on) best results are obtained with "A.F. gain" set to maximum, and volume of the beat note adjusted by the "R.F. gain" control knob.

Metering:

In the front plate of the receiver a milliammeter and a switch have been built in. By means of the switch the anode current of each individual valve may be checked.

With the said switch in position 1 and with the receiver working with A.V.C. the meter may be used as a tuning indicator.

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With the switch in position "Output" the milliammeter may be used as an outputmeter, being fed through a semi conductor rectifier coupled to the output transformer. The outputmeter is very convenient when taking bearings and for determining "sense". Also when the receiver is employed for omnidirectional reception of "Consol" signals the outputmeter may be very valuable.

Power supply:

12-24-32-36-110-220 volts D.C.,
110-220 volts A.C.

according to power pack fitted. Type of power pack for the different voltages is indicated in the specification (see this paragraph).

The current consumption on the different voltages is approximately:

12 volts D.C.:	7,0 amps.
24 - D.C.:	3,3 -
32 - D.C.:	2,1 -
36 - D.C.:	1,9 -
110 - D.C.:	0,26-
220 - D.C.:	0,24-
110 volts A.C.:	0,62 amps.
220 - A.C.:	0,31 -

Direction finding:

In connection with a suitable frame aerial for instance A 135 for indoor installation (in a wooden wheel house) or A 278 for outdoor installation (water proof model) the receiver may be used as a direction finder on the ranges:

100 -	275 kHz
195 -	535 -
500 -	1350 -
1300 -	3600 -

Individual matching transformer on each frequency band has been fitted and minimum sharpening facilities are also provided, making the receiver a real high grade direction finder. Moreover in the band 195-535 kHz, where the radio beacons have been placed, the selectivity of the receiver has been greatly increased in proportion to the selectivity on the other frequency bands, where telephony requires less selectivity - wider bandwidth.

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In the 195-535 kHz band bearings on radio beacons and broadcasting stations can be determined with an accuracy of less than one degree, provided signals are not drowned by electrical interference or statics, and on the condition that the minimum sharpening knob is properly operated.

Before using the direction finder for navigation, calibration for quadrantal error, originating from the ship's hull and rigging, must take place.

NOTICE:

Error depends on frequency, so the calibration chart must only be used for frequencies in the neighbourhood of the frequency for which calibration has taken place.

On the higher frequencies good bearings may be obtained, but very great errors may be present. Especially must aerial circuits of the ship's transmitter tuned to frequencies in the neighbourhood of the D.F. frequency be avoided. So the best thing is to disconnect the transmitting aerial from the transmitter's aerial tuning elements during direction finding. (this is in many modern type transmitters carried out automatically when the transmitter is in its off-position.)

Bearings in the band 1300-3600 kHz should not be used for navigating in narrow waters, but only for hunting up other ships in open waters.

For sense determination each frequency band has been fitted with a sense resistor, which must be adjusted according to the aerial being used for sense determination. Such adjustment generally takes place simultaneously with the calibration of the direction finder.

As mentioned above the outputmeter is very useful for sense determination.

When taking bearings to unmodulated (A1) radio beacons and to broadcasting stations the operating switch must be set to position "D.F., CW". Also when receiving modulated signals (A2) it may prove advantageous to operate the receiver in the "D.F., CW" position, especially when noise or other interference is present.

When operating the receiver as a direction finder best signals are produced in the loudspeaker or headphone when "A.F. Gain" is set to maximum and "R.F. Gain" set to give a suitable signal strength when the frame aerial is near its minimum signal position.

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If the receiver is delivered from the factory without any frame aerial, a compensating coil has been fitted to the terminals Ra1 - Ra2.

If a frame aerial is connected up later on, the said coil must be removed.

Tubes and diodes:

Radio frequency amplifier	UF 89
Oscillator and frequency changer	UCH 81
First intermediate frequency amplifier ..	UF 89
Second - - - - -	UF 89
Audio frequency amplifier	UF 89
Signal rectifier	OA 91
A.V.C. rectifier	OA 200
Beat frequency oscillator	UF 89
Output tubes	2 type UL 84
Aerial safety lamp	110 V 15 W
Dial bulbs	2 type 6 V 0,15 amp

Controls:

- Tuning
- Frequency range
- R.F. gain
- A.F. gain
- B.F.O. pitch
- Mains on/off
- Dial light (dimming)
- Internal loudspeaker on/off
- External loudspeakers on/off
- Tube current
- Switch:
 - 1) Phone-MCW, A.V.C. on
 - 2) Phone-MCW, A.V.C. off
 - 3) CW, A.V.C. off
 - 4) D.F., MCW
 - 5) D.F., CW
- Minimum/sense

Mechanical construction:

A heavy aluminium chassis built integral with, but electrically insulated from, the metal front plate, resting in insulated guideways in a metal cabinet lacquered in grey colour, and connected to earth, thus making the receiver shock proof and at the same time totally insulating the mains from earth also in 110 and 220 volts D.C. installations.

All radio frequency coils with their associated trimmers and padding capacitors are contained in a rotatable turret which permits an extraordinary clear and practical construction of the radio frequency circuits. Solid silver contacts in ceramic mountings are a guarantee for long and trouble-free service.



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The cabinet has a lid which may be raised when 4 knurled nuts are turned up. The whole receiver unit may be withdrawn from the cabinet when 4 other knurled nuts are turned up.

All connections from outside to the receiver are established through plugs and sockets, a co-ax set for a co-ax cable for aerial input, a twin connector set for a screened twin lead from the frame aerial and a 10-pole plug-and-socket for all other connections. For the latter purpose a cable with a plug in each end (shock proof construction) has been supplied, one plug being inserted in a socket in the chassis, the plug in the other end being inserted in a socket in a terminal board (also supplied with the receiver) screwed to the bulkhead. The cables have ample length, permitting the chassis to be withdrawn from the cabinet for inspection without breaking connections.

If the receiver chassis is housed in a cabinet common to receiver and transmitter, the 10 way connecting cable is terminated in a terminal strip inside the cabinet instead of being led to a bulkhead connecting board.

Dimensions: (Receiver only in cabinet)

Height: 300 mm + 30 mm shock absorbers

Width: 520 -

Depth: 335 - + knobs

Weight: 30 kgs.