Marine Radio Receiver B 285 CV.

Diagram:

One stage of high frequency amplification with band pass input circuit on all bands for satisfactory duplex telephony working and minimum cross modulation respectively. Low impedance input circuit for correct matching to shielded aerial lead in (co-axial cable). Special aerial transformers on bands 1, 2, 3 and 4 for connection of frame aerial for direction finding (se below).

Frequency changer and oscillator stage with triode-hexode.

Two stages of intermediate frequency amplification with 8 tuned circuits.

Intermediate frequency: 447 kc/s on bands 1-3-4-5-6 and 175 kc/s on band 2.

Diode signal rectifier and diode for automatic control of the volume (gain) - (A.V.C.) - combined with one stage of audio frequency amplification.

Oscillator for CW-reception (B.F.O.)

Pentode output stage.

Frequency range:

1)	100	-	275	kc/s	(3000	- 1091	m)
2)	195	-	535	-	(1540	- 561	-)
3)	500	-	1350	-	(600	- 222	-)
4)	1300	-	3600	-	(231	- 83	-)
5)	3500	-	10000	-	(86	- 30	-)
6)	8500	-	23000	-	(35	- 13	-)

Dial:

Friction drive with separate micrometer dial working on the clock principle with two pointers driven through spring loaded gears for completely avoiding backlash, vernier pointer revolving ten times for each revolution of main pointer, giving a very high degree of accuracy when logging stations, effective length of scale being 450 cm. (18 ft.). Main scale is calibrated in frequency (kc/s).

Stability and frequency drift:

For maximum electrical and mechanical stability all trimmers in the high frequency circuits are of the semi-variable air dielectric or ceramic type; so are the variable part of the padding capacitors, the main part of latter being of the protected silvered mica type.

Sensitivity:

If sensitivity is defined as the signal modulated 30% which through a normal artificial aerial should be applied to the input terminals in order to give an output of 50 mW with a 10 db signal to noise ratio (modulated signal/no signal), the sensitivity is:

Band 1:	3-5	microvolts
Band 2:	2-3	-
Band 3:	2-3	-
Band 4:	2-3	-
Band 5:	4-5	-
Band 6:	8-15	-

In case of CW-reception sensitivity is at least equal. If on the higher frequencies (nand 5 and 6) sensitivity should prove insufficient in that end of the band where the LC proportion is bad the corresponding frequency should be tuned in on the adjacent band as very ample overlapping has been provided for on these frequencies.

Selectivity:

For the intermediate frequency amplifier alone the band widths are as stated in in the table below, where the first column indicates the detuning off the resonance frequency, the second column the attenuation of the signal measured in decibels at the detuning stated, applying to the intermediate frequency 447 kc/s, while the third column shows the corresponding attenuation applying to the intermediate frequency 175 kc/s.

±					
1	kHz	1	db	8	db
2	-	6	-	28	-
3	-	13	-	50	-
4	-	22	-	65	-
5	-	31	-		
6	-	40	-		
7	-	48	-		
8	-	55	-		

On the lower frequencies the overall selectivity of the receiver is somewhat higher than the selectivity of the intermediate frequency, as the input circuits will increase the selectivity slightly.

Output:

The output is about 2 watts.

Over voltage protecting devices:

In order to protect the input circuit (aerial coil) of the receiver an ordinary incandescent lamp has been inserted in the aerial lead. The lamp will limit the current induced in the aerial by the near-by transmitter (when operated) 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 (when R.F. 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. Also if by some reason or other the current induced in the receiving aerial should become dangerously high the lamp will burn out leaving the aerial coil intact. Please note: If aerial lamp has been burnt out signals may be heard in the receiver due to stray capacity coupling to the aerial but the signal to noise proportion will become very bad.

For muting the receiver when operating telegraphy and telephony simplex (especially when transmitting and receiving on the same frequency) a relay built into the receiver will disconnect earpiece and speaker, and short circuit loud speaker winding of output transformer when telegraph key or push button of handset is pressed. The relay is fed from a 24 volt D.C. source in one of the transmitters with which the receiver is engaged. (The relay will operate for voltages ranging from 12 volts to 36 volts). An extra contact of the relay will break the screen grid voltage of the IF-tubes and connect the screen grids of the tubes to zero potential as long as the key or push button of the handset (at simplex) is pressed thus desensitising the receiver during the "on" period of the transmitter.

The value of screen grid decoupling capacitors of the IF-tubes have been chosen rather high, so recharging of the capacitors through the common screen grid resistor, when key or push button is released, will last a small fraction of a second, leaving the receiver desensitised long enough for avoiding key clicks yet not impairing break-in listening.

Notwithstanding the just mentioned muting of the receiver by the built in safety relay the loud speaker will be cut out as soon as the push button of the handset is pressed (also when working duplex) when the receiver is used in connection with telephone transmitters type A 198, A 199, A 208, A 215. The earpiece of the handset is not cut out by the relay of the transmitter.

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

If the receiver is installed without any transmitter present, terminals 5 and 6 of the terminal board belonging to the receiver should be strapped.

Control of amplification:

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

The potentiometer of the R.F. control of amplification form part of a voltage divider across the plate voltage source, the moving contact of the potentiometer being connected to the cathodes of the R.F. and I.F. amplifying valves. Thus the higher positive voltage applied to the said cathodes the less the R.F. amplification will become.

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.

Both potentiometers operates as well on "A.V.C. on" as on A.V.C. off". Please note: When working CW (beat oscillator on) best results are obtained with A.V.C. cut off, "A.F. amplification" set rather high and volume adjusted by the "R.F. amplification" control.

For the sake of convenience the receiver is automatically switched to "A.V.C. off" when the switch "Radio/Direction Finding" is set to position "Direction Finding".

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. on the meter may be used as a tuning indicator.

With the said switch in position "output" the milliammeter may be used as an outputmeter, being fed from an oxide rectifier coupled to the output transformer. The outputmeter is very convenient when taking bearings, especially for determining "sense". Also when taking berarings by the Consol system the outputmeter may be very valuable.

Power supply:

220 or 110 volts A.C., adjustable by strapping contacts in power transformer.

Consumption: about 55 watts.

Controls:

Main tuning control.
Frequency band switch.
Gain controls, R.F. and A.F.

Switch: A.V.C. ("automatic volume control") on/off

Switch: Loud speaker on/off. In position "off" the output Transformer is loaded by a resistance. Position "off" is supplied if for any reason headphone reception alone is preferred.

Switch: Telephony, M.C.W./C.W. (beat frequency oscillator on)

Knob: Pitch (detuning of B.F.O.)

Switch: with 9 positions to be used for measuring the anode current of each individual valve in connection with built in milliammeter.

Switch: "Pejling" (direction finding) / "Radio" (omnidirectional reception)

Knob: "Minimum" for sharpening of minimum when taking bearings, combined with switching arrangement for sense determination.

Switch: Mains on/off.

Valves:

Rectifier	EZ 40
Radio frequency amplifier	EF 41
Frequency changer and oscillator	ECH 42
I.F. amplifiers	2 type EF 41
Detector and A.F. amplifier	EBC 41
Beat oscillatlor	EF 41
Output valve	EL 41
Aerial safety lamp	110 volts, 15 watts
Dial lights	2 bulbs 6 volt 0,3 amps. (B 285 CV)

General Construction:

Heavy aluminium chassis with strong reinforcements built integral with the metal front plate, mounted in guide bars in a metal box, lacquered in grey colour and connected to earth. All radio frequency coils with accompanying trimming capacitors and padding capacitors are contained in a rotary turret which permits an extraordinary clear and practical construction of the high frequency circuits. Each coil assembly is totally enclosed in its individual compartment giving a very effective shielding with consequently high stability of the receiver.

All connections from outside to the receiver are made through plugs and sockets, one set for a co-ax cable (aerial input) another set for a screened twin core cable (frame aerial) and a third set (with 10 terminals) for all other connections. For the latter purpose a cable with a plug in each end has been fitted, one plug being inserted in a socket on the chassis, the plug in the other end being inserted in a socket in a terminal board mounted on the bulkhead. The cable has ample length, permitting the chassis to be withdrawn from the box for inspection or valve replacement without breaking connections.

Direction finding:

Used in connection with loop antenna type B 135 for inside mounting or type B 278 (water proof model) for outside mounting the receiver B 285 CV can be used for taking bearings to transmitters transmitting on frequencies between 100 and 3600 kc/s, special transformers being fitted in the input circuit on band 1 (100-275 kc/s), 2 (195-535 kc/s), 3 (500-1350 kc/s) and 4 (1300-3600 kc/s) of the receiver.

Since radio beacons are separated by only a few kilocycles (normally 2,3 kc/s as compared with the 9 kc/s separation between broadcast stations) the selectivity of band 2 (I.F. 175 kc/sec.) has been made about three times as great as on the other bands (the receiver's bandwidth on band 2 being one third the bandwidth of all other bands).

In the 195-535 kc/s band bearings on radio beacons and broadcast stations can be taken with an accuracy of up to ½ degree as long as the signals are not spoiled by static or electrical interference. This is possible because the receiver is provided with a compensating condenser for sharpening of the minimum as on conventional direction finders.

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).

Also in the frequency bands 500-1350 and 1300-3600 kc/s bearings to land and ship stations may be taken, but the higher the frequency the greater the risk of navigating according to the bearings taken, as the errors become greater and variabel (vary small changes in the rigging may seriously affect the quadrantal error). For sense determination each of the four bands is fitted with its own individual sense resistance, placed in the same coil compartment as the appropriate aerial transformer and adjustable with a screwdriver when the coil turret is in such a position that the coils belonging to the band in question are switched in. Adjustment of sense resistance must take place during calibration of the direction finder.

For modulated beacons switch "CW-MCW" may be set to MCW, for broadcasting stations and unmodulated beacons (mostly harbour beacons) the switch must be set to CW. When interference is bad (caused by other beacons) it may often be an advantage to use the CW position also for modulated beacons.

When the receiver is used in connection with a frame aerial, the small coil placed inside the receiver near the compensating condenser and connected to the terminals RA 1 and RA 2 should be removed as the input circuit of the receiver is correctly ganged with the remaining circuits with either a frame connected up or the small coil connected (but not both).

Please note: Aerials tuned to frequencies in the neighbourhood of the frequency on which bearings are being taken may very seriously affect the bearings, so always be sure that aerials connected to transmitters onboard, either are disconnected from aerial tuning elements of the transmitter or at any rate not connected to a transmitter the aerial circuit of which may be tuned to frequencies near the frequencies on which bearings are being taken.

Size:

Height:	300 mm + 25 mm rubber shock absorbers
Width:	520 mm
Depth:	335 mm + knobs
Weight:	30 kgs.

(B 285 CV)

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