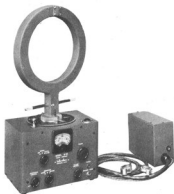


Operating Instructions
for the
hallicrafters
Model S 30 Radio Compass



Manufactured By

the **hallicrafters** *co.*

2611 Indiana Avenue

Chicago, U. S. A.

THE MODEL S-30 RADIO COMPASS
INSTRUCTIONS FOR INSTALLATION - OPERATION AND SERVICE

INSTALLATION

It is recommended that, upon receipt, the carton and then the instrument itself be examined for any damage which might have accrued in transit. Should any sign of damage be apparent, file claim immediately with the carrier stating the extent of the damage.

MOUNTING

The Model S-30 RADIO COMPASS should preferably be mounted on its own shelf or bulkhead. The rose of the loop should be well below eye level and sufficient head room provided for 360° rotation of the loop itself.

LOCATION

In selecting the location for the RADIO COMPASS remember that it should be as close as possible to the Ship's Compass and chart table. So locating the COMPASS will enable the helmsman and radio compass operator to readily exchange readings. Do not mount the RADIO COMPASS too close to: - Wiring, pipes, tanks, stays or other metal objects which would distort the field of the received signal and seriously affect the accuracy of results.

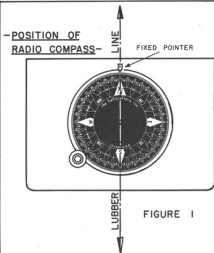


FIGURE 1

IMPORTANT

Position the cabinet of the S-30 RADIO COMPASS so that the fixed pointer mounted on the top of the cabinet will be in direct line with the lubber line of the boat. (See Figure 1)

If you are not sure that the instrument is

properly positioned with respect to the lubber line you can later alter the location when the RADIO COMPASS is CALIBRATED.

POWER

The Model S-30 RADIO COMPASS derives its power from a 6 volt Storage Battery. The external S-30 power pack is connected to the battery by means of the two flexible leads to which battery clips are connected. The battery clip bearing the Red marking goes to the + or positive terminal of the battery. The 6 foot cable with plugs at each end connects the S-30 COMPASS receiver to its power pack. Place the power pack as far from and below the loop of the receiver as possible, so that it will have no effect on the accuracy of bearings.

OPERATION

The controls on the Model S-30 RADIO COMPASS have been kept to an absolute minimum consistent with ease and speed of operation.

After the power supply has been connected to the 6 volt battery and the RADIO COMPASS installed as above recommended the unit is then ready to be operated.

The rotatable loop antenna is the medium through which signals reach the receiver. The maximum pickup of energy from the transmitting station will occur when the loop is parallel to or pointing at the transmitter. With the loop rotated 90° from this position, the pickup of energy from the same transmitter will be at a minimum.

FREQUENCY RANGE

The Model S-30 RADIO COMPASS covers the following frequencies in three ranges:

- 1 - 220 to 540 kc - BEACON BAND
- 2 - 535 to 1340 kc - BROADCAST BAND
- 3 - 1200 to 3000 kc - MARINE BAND

Proper selection of any one of these three ranges is accomplished by turning the BANDSWITCH knob to the desired position. To familiarize yourself with the operation of the instrument tune it on the Standard Broadcast Band first.

The RADIO COMPASS is turned ON and OFF with the control in the upper left hand corner by placing that control in the NORMAL position. (Static Filter treated later in DIRECTION FINDING.) Turn the "SHARPNESS CONTROL" as far as it will go to the right, or until the switch, which is mounted on this control, operates. Pull AVC, or Automatic Volume Control action is now secured. Adjust the "VOLUME CONTROL" until the signal, which has been selected by moving the TUNING control knob, is of the desired volume in the headphones which are supplied with the unit and plugged in to the PHONE jack.

If the matching 8-30 speaker is used, the switch directly below the headphone jack should be in the **SPEAKER** position. In order to properly connect it to the receiver, the speaker socket is screwed into its accommodating plug on the rear of the receiver. Using the receiver on the Broadcast band will show what function each control performs. The adjustment of these controls will be slightly different when taking a bearing and will be treated in detail later.

DIRECTION FINDING

The frequencies used by beacons, lightships, etc., will be found by referring to your Navigation charts. Be sure that the station selected is transmitting at the time a bearing is to be taken.

As mentioned before, the maximum in Signal Strength will occur when the loop is pointed at the transmitting station. Taking a bearing by maximum signal is sometimes necessary should receiving conditions make the NULL difficult to determine. When taking a bearing in this manner, however, is not as accurate as finding the point at which minimum signal, or NULL, exists.

Place your receiver in operating condition as follows:

Place OFF switch to NORMAL position. When bearings are being taken during extremely heavy atmospheric disturbances, place the OFF switch in the "STATIC FILTER" position. You now will more easily and readily be able to hear the beacon signal because the static filter passes only a narrow band peaked at 1000 cycles.

"Volume" and "Sharpness" full on

Bandswitch in proper range to cover desired signal.

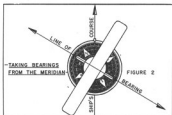
Headphones plugged into "PHONES" jack

Main dial adjusted to desired frequency

After desired signal has been heard adjust "Sharpness" control until the signal is at a comfortable level.

TAKING A TRUE BEARING

Adjust RADIO COMPASS rose with knob provided for that purpose so that the fixed pointer on the top of the cabinet indicates the corrected true course as shown by the ship's compass (See Figure 2).



NULL ADJUSTMENT

Rotate the loop slowly until the strength of the signal decreases. A point will be found at which the signal is definitely weakest. (90° rotation from the maximum signal.) This is indicated not only aurally by the strength of the signal in the headphones, but visually by the maximum opening of the NULL indicator (magic eye). The NULL indicator also serves the purpose of keeping the eye of the radio compass operator off the compass rose. This will prevent him from biasing his judgment of the NULL point when adjusting the loop.

Instruct the helmsman to keep the boat "Steady-On". Should the boat be yawing or pitching he should call "ON" only when the ship's compass so indicates.

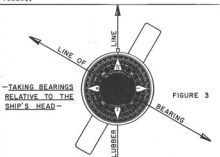
NOTE: If the NULL point occupies more than 7 degrees for this preliminary rough adjustment, the RADIO COMPASS operator should turn the "SHARPNESS" control to the left to lower the signal strength. The AVC switch will operate as he turns the control to the left, but the NULL indicator will still show the position of weakest signal, or NULL. Complete AVC action is necessary when broadcast stations are being received to keep the set from overloading.

Once more establish the NULL by carefully adjusting the loop. By subsequent adjustments, the NULL, in most cases, should occupy only 1 or 2° depending upon the proximity of the transmitting station and the care used in making the adjustments.

The Pointers connected to the loop now indicate the "line of bearing" from the meridian and will be used to determine your ship's position.

TAKING A RELATIVE BEARING

It is sometimes necessary to determine your position relative to the location of other vessels. In this case, set the 0 (north) mark of the Radio Compass rose opposite the fixed indicator. (Figure 3) The line of bearing will determine the angle between your ship's head and the other vessel.



To differentiate between a correct and reverse bearing a hasty dead reckoning will usually suffice. Should you still be in doubt, it will then be necessary to run a straight course for a short distance, after which you will note the change in bearings. It might be well to remember that the correct bearing will change towards the stern - an incorrect towards the bow.

PLOTTING BEARINGS

Referring to Figure 4 will show two methods for plotting the line of bearing. The small dots indicate readings which have been taken (not necessarily plotted in practice) - the large dot represents the AVERAGE of these readings which will determine the average line of bearing. Should you be sure that no danger exists on your established course, this measurement is sufficient. In cases of bad weather or possible danger you are advised to assume a CONE OF ERROR of approximately 3° .

HOMING - OR RUNNING DOWN A BEARING

Remember that the DISTANCE OFF is the most important and sometimes quite difficult factor to determine. The following steps will apply when using the procedure outlined in Figure 5.

1 - Taking Soundings.

Useful if bottom is indicative of position.

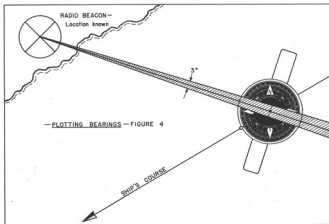
2 - Synchronized beacons (see enclosed Light List Charts). These Distance-Finding Stations have synchronized foghorn and radio beacon signals. Since radio waves travel with the speed of light and sound at the speed of 1100 feet per second it is only necessary in determining the distance off-shore to multiply the time difference in radio and foghorn signals by 1100 to get the distance in feet from land.

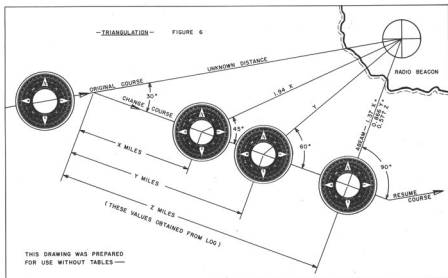
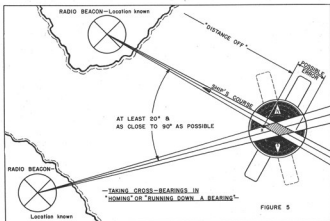
3 - CROSS BEARINGS - Another beacon is required for this determination. You will recognize that the beacon transmissions are sometimes on the same frequency but transmit alternately. Locating both beacons is easily accomplished by swinging the loop (shown by the dotted line). The intersection of the two cones of bearing will result in the shaded area of "POSSIBLE ERROR". Assume for safety the boat to be at the most dangerous position (X). IMPORTANT! - It is evident that the shaded or POSSIBLE ERROR area increases in length as the angle between beacons decreases. In taking cross bearings angles less than 20° should not be used whereas angles closer to 90° will be most accurate.

4 - Most Beacons are placed to allow bearings to be taken almost simultaneously from three transmitters. If the three bearings taken are well spaced this method will be the most accurate.

5 - Combined pelorus and radio compass bearings will prove quite accurate when conditions permit.

6 - TRIANGULATION - - used for accuracy in bad weather where beacon is not of the synchronized type and another is not in the vicinity. When doubt occurs as to the "DISTANCE OFF", the course is changed to put the beacon on a different bearing, at least 20° different for accuracy - an even angle of 30° being most convenient. A log is required to determine the length of one leg of the triangle as shown in figure 6, the "DISTANCE OFF" at 45° 60° and 90° (ABEAM) will be the factor shown multiplied by the various distances obtained from the log. Figure 6 may only be used as a simplification of triangulation when tables are not handy.





ALIGNMENT OF MODEL S-30 RADIO COMPASS RECEIVER

It is advisable to have a competent radio service man align the receiver section of the Model S-30 RADIO COMPASS at least once a year. You then will be assured that the unit is operating at its maximum sensitivity, selectivity and accuracy of frequency or dial calibration.

NOTE: Aligning adjustments of the receiver will in no way affect the accuracy of previous or future radio compass indications.

Equipment needed for aligning:

- 1 - an all wave signal generator which will provide an accurately calibrated signal at the test frequencies indicated
- 2 - Output indicating meter connected to speaker socket.
- 3 - Non-metallic screw driver
- 4 - .1 mfd condenser for dummy antenna

Setting of controls prior to I. F. Alignment

- 1 - "OFF" control to NORMAL
- 2 - "Volume" on full
- 3 - "Sharpness" on full

- 4 - main tuning dial set at 3 mc
- 5 - Bandswitch - Marine Band
- 6 - Connect signal generator to grid of 6X5 tube. Ground lead of generator to chassis of receiver
- 7 - Adjust indicated trimmers as per instructions.

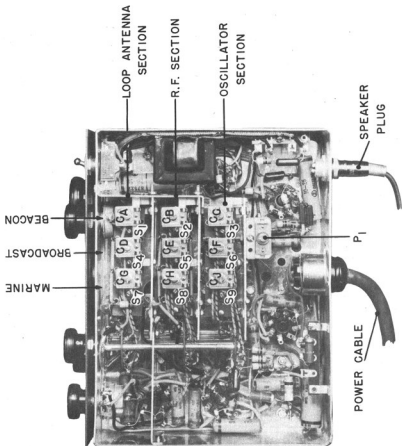
Setting of controls for R. F. Alignment

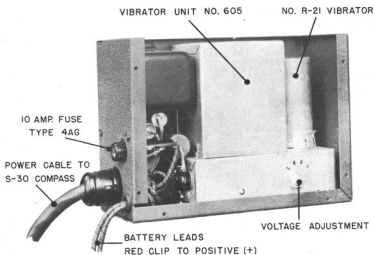
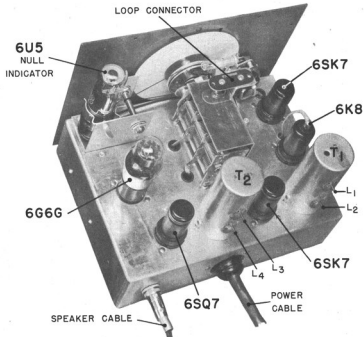
- 1 - All controls similar to I. F. alignment
- 2 - Receiver dial adjusted to the aligning frequency
- 3 - **NOTE:** Generator connected to receiver inductively by forming a loop with a few turns of wire and placing it in the field of the loop on the receiver - leave end of wire free.

NOTE: On the beacon band the slug S_3 , is used for calibrating the center of the band - the pad, P_1 , for calibrating the low frequency end of the band.

Allow receiver and signal generator to reach operating temperature before making adjustments.

RANGE	SIG. GEN. & TUNING DIAL SETTING	DUMMY ANTENNA	PAD	TRIMMERS OR SLUGS	ADJUSTMENT
IF	175 kc 3 mc Marine	.1 mfd	None	$L_1-L_2-L_3-L_4$ on sides of I. F. cans T_1 & T_2	Adjust to maximum output
Beacon	250 kc	inductive	P_1	$S_1-S_2-S_3$	"
	500 kc	loop	None	$C_A-C_B-C_C$	"
Broadcast	600 kc	loop	Fixed	$S_4-S_5-S_6$	"
	1200 kc	loop	None	$C_D-C_E-C_F$	"
Marine	1300 kc	loop	Fixed	$S_7-S_8-S_9$	"
	2800 kc	loop	None	$C_G-C_H-C_I$	"





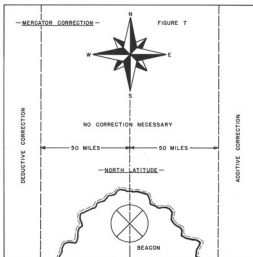
PARTS LIST

RESISTORS

NO.	OHMS	WATTAGE
1	200,000	1/2
2	10,000	R. F. Gain Control
3	400	1/2
4	200,000	1/2
5	250,000	1/2
6	50,000	1/2
7	300	1/2
8	30,000	1
9	1,000	1/2
10	400	1/2
11	200	1/2
12	50,000	1/2
13	2,000	1/2
14	200,000	1/2
15	500,000	Audio Gain Control
16	500,000	1/2
17	1 Meg.	1/2
18	500	1/2
19	200	1/2
20	1 Meg.	1/2
21	1 Meg.	1/2
22	1 Meg.	1/2
23	2 Meg.	1/2
24	200	1/2
26	15,000	1
27	30,000	1/2
28	15,000	1/2

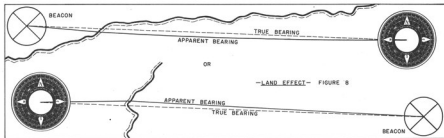
CONDENSERS

NO.	CAPACITY	VOLTAGE	TYPE
1	530 mmf	Per Section	Air
2	50 mmf		Ceramicon
3	50 mmf		Ceramicon
4	.05 mfd	400	Paper
5	.05 mfd	400	Paper
6	0.1 mfd	400	Paper
7	10 mmf		Ceramicon
8	.05 mfd	400	Paper
9	.05 mfd	400	Paper
10	.02 mfd	400	Paper
11	.05 mfd	400	Paper
12	.01 mfd	400	Paper
13	.01 mfd	400	Paper
14	.0001 mfd		Mica
15	10 mfd	25	Elect.
16	.0001 mfd		Mica
17	.01 mfd	400	Paper
18	.00025 mfd		Mica
19	.01 mfd	400	Paper
20	.0075 mfd		Mica
21	20 mfd	50	Elect.
22	.01 mfd	600	Paper
23	.01 mfd	1600	Paper
24	.02 mfd	600	Paper
25	.5	200	Paper
26	8 mfd	450	Elec.
27	30 mfd	25	Elec.
28	8 mfd	450	Elec.
29	30 mfd	25	Elec.
30	.25	400	Paper
31	.0001 mfd		Mica
32	.001 mfd		Mica
33	No. 44066 800 mmf		Variable Pad
34	.0019 mfd		2 1/2% Mica
35	.0037		5% Mica



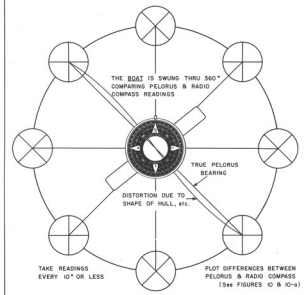
ERRORS TO BE CONSIDERED

- 1 - THE OPERATOR - Errors of the operator which depend entirely on his experience, may be difficult to predict. After he has familiarized himself with adjustment of the "SHARPNESS" control, he need only allow about $\pm 1/2$ degree on strong static-free signals that produce a NULL of about 2 degrees width. If the NULL should cover some 10 degrees after complete adjustment, he cannot allow less than ± 2 degrees.
- 2 - MOTION OF THE VESSEL - Yawing and pitching usually only affect the ship's course. The HELMSMAN must apply the correct magnetic deviation to the compass indication and must sometimes estimate possible error at the time readings are taken.
- 3 - MERCATOR ERROR - occurs in plotting the earth - a spherical volume, on the conventional MERCATOR CHART - a plane area. Since MERCATOR CORRECTION is necessary only on rare



—CALIBRATION OF THE RADIO COMPASS—

FIGURE 9



occasions, as shown by Figure 7, it will not be treated in detail.

- 4 - **LAND EFFECT** - occurs when the signal passes over land before its course over water. In this respect, radio waves are comparable to light passing thru materials of various

density. (Figure 8 illustrates the error).

CAUTION - Do not rely on readings taken over land or along a shoreline.

- 5 - **NIGHT EFFECT** - is most noticeable at sunrise and sunset. More radio waves are reflected back to earth at night than during daylight. It is evident by a broadening of the NULL and possible shifts in apparent bearings taken at distances greater than 250 miles. Over short ranges the effect is negligible.
- 6 - **RADIO COMPASS DEVIATION** - must be determined and accounted for as in the magnetic compass. A calibration curve (figure 10) determined as indicated by the self-explanatory Figure 9, must be made with the aid of the PELORUS, immediately after installation.

If the RADIO COMPASS is not in line with the LUBBER LINE, the CALIBRATION curve will be similar to that shown by the dotted line.

If the RADIO COMPASS is located too close to a metal object (see LOCATION) a curve similar to the other broken line will result.

REMEDIES are immediately evident to the operator.

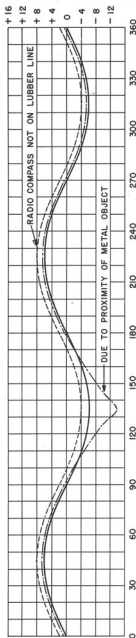


GUARANTEE

This instrument is guaranteed to be free from any defect in workmanship and material that may develop within a period of ninety (90) days from date of purchases, under the terms of standard guarantee, as designated by the Radio Manufacturers Association. Any part or parts that prove defective within this period will be replaced without charge when subjected to examination at our factory, providing such defect, in our opinion, is due to faulty material or workmanship, and not caused by tampering, abuse or normal wear. All such adjustments to be made F.O.B. the factory. Should it be necessary to return any part or parts to the factory, a "Return Material Permit" must be obtained in advance by first writing the Adjustment Department, who will issue due authorization under the terms of the guarantee. The Hallcrafters, Inc., reserve the right to make changes in design or add improvements to instruments manufactured by them without incurring any obligation to install the same in any instrument purchased.

ALL HALLICRAFTERS transmitters are built under Patents of the Radio Corporation of America and the American Telephone and Telegraph Co.

-TYPICAL CORRECTION CURVES - FIGURE 10



-CORRECTION CHART TO BE PLOTTED AFTER INSTALLATION OF THE S-30 RADIO COMPASS - FIGURE 10-a

