

**SEA-ME**

**THE ACTIVE RADAR TARGET ENHANCER**

**USER HANDBOOK**

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# WELCOME TO Sea-Me

## THE ACTIVE RADAR TARGET ENHANCER

### INTRODUCTION

The modern yacht or motor cruiser is most likely to be built of GRP and to be inherently a poor reflector of radar signals. Since radar is the most effective pair of eyes on board a ship, having a long range and being largely impervious to fog and darkness, it is important that we do whatever we can to improve the probability that our vessel will be visible to radar. It is worth remembering that the visibility problem occurs not only in fog and mist but also at night – boats under 20m LOA are only required to carry lights with a visible range of 3nm, a distance which will be covered by a ship making 20 knots in 9 minutes.

As yachtsmen we need to be as visible as possible, not only so that we can give other vessels as much time as possible to avoid us but also so that we can be found more easily by the rescue services should the need arise.

The prime purpose of the Sea-me Radar Target Enhancer is to increase the probability that your vessel will be seen on the radar of commercial shipping. It aims to achieve this by returning an improved radar signal.

Sea-me receives the incoming signal from an X Band (9.32-9.5GHz) radar. It then amplifies that signal by at least 50dB and transmits it omni-directionally.

### COMPONENTS

Sea-me comprises an antenna unit and a control box, the two being connected by a 2 core cable.

The antenna unit contains the bulk of the electronics and the antennae. These are housed in an ultra-violet stabilised PVC radome which not only provides structure and environmental protection but which also provides the means of mounting the antenna unit on the vessel. The antenna unit should be mounted as high as practical and it should not be obscured by other parts of the vessel. Naturally the higher it is the greater the range at which its output can be detected and the more likely it is to be clear of sea clutter. It has been shown that even if it is mounted at a height of only 2m above sea level it can be detected by a 25kw radar at a range of at least 8nm.

The control box provides the on/off switch and indicator lights which show power on and when the system is transmitting (active). It contains an internal, changeable Quickblow 0.5A fuze to protect the system against power spikes and reverse polarity connection. It will normally be mounted in the navigator's area.

### WARNING

**IF YOU ARE NOT SURE THAT YOU CAN SAFELY CARRY OUT ANY PART OF THE INSTALLATION YOU ARE ADVISED TO SEEK THE SERVICES OF A SUITABLY COMPETENT PERSON**

The antenna unit should be mounted as high as is practical on the vessel. The base of the antenna unit is threaded to take a standard antenna mount of 14 threads per inch and there are a number of suitable types readily available.

**Step 1.** Fix a suitable antenna mount at the desired position. There is generally some competition for space at the top of the mast and a stand-off mount will often be the best option. The presence of the tricolour, VHF antenna and wind instruments should not affect the correct working of the system provided that the antenna unit is not mounted directly adjacent, in the horizontal plane, to such items. Do not fix it to a crosstree as the mast will then partially obscure the antenna. The unit will also be vulnerable to sail damage. If Sea-me is being fitted elsewhere, say on a radar arch, care must be taken to ensure that it is above the superstructure of the vessel and that it is not within the vertical beamwidth of any radar which may also be fitted. Normally this means that the Sea-me antenna unit must be above or below a 30° line from the centre of a radar antenna but you will need to refer to your radar manual to confirm this. Although Sea-me contains limiting circuitry to protect it against very strong radar signals it is possible that, because it will inevitably be close to your own radar, damage may occur if it is in the direct path of your own transmissions.

Whilst no effect on compasses have been observed, it is advisable to maintain a compass safe distance of 1m.

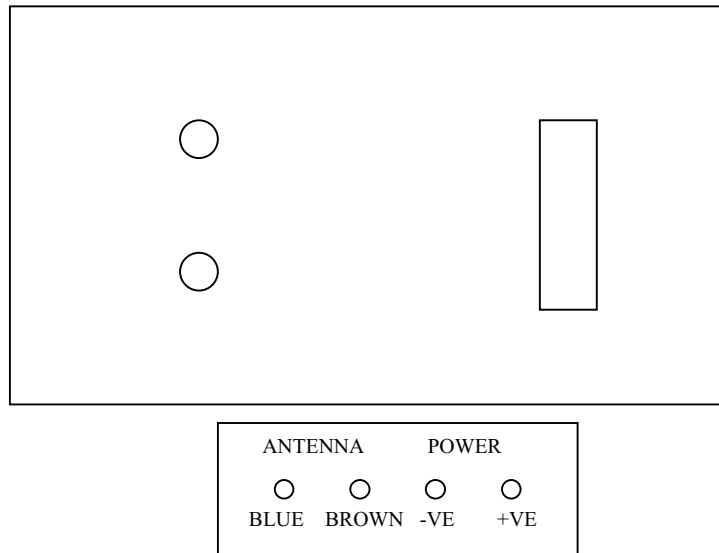
**Step 2.** Pass the cable down through the mount and screw the Sea-me antenna unit to the mount until it is strong hand tight. When screwing the unit to the mount make sure that you allow the cable to turn with the unit so that it does not become twisted. For optimum performance align the antenna unit so that the exclamation mark, which forms part of the CE mark, is in a fore and aft direction. This will minimise the effects of vessel heel on the performance of the system. A thread sealing compound such as Loctite or plumbers tape may be used to ensure that the antenna unit can be screwed down tightly onto the mount. Although the Sea-me antenna unit is sealed it is good practice to leave a small loop of cable below the mount so that water drips from the bottom of this and does not rest at the cable entry to the antenna unit.

**Step 3.** Route the cable to the control box as desired. It is perfectly acceptable to cut the cable so that through-deck plugs can be used, although it is better practice to use a through-deck gland. Remember to match colour for colour when rejoining it. It is also acceptable to shorten the cable. If it is necessary to lengthen it by more than 10m the advice of Munro Engineering Limited should be sought. Any additional cable used should be of the same or a similar type to that provided with the unit. You should not use cable rated at less than 3A at 300V as this will cause an unacceptable voltage drop. The cable gland in the base of the antenna unit provides both water and strain protection. Nonetheless you should not apply strain directly to the cable entry.

**Step 4.** Fix the control box in the required position. This is not a sealed unit and so it should be located where it will not be exposed to the elements.

**Step 5.** Provide a 12V DC supply from the vessel's electrical system. The control box contains a 0.5A Quickblow fuze and so there is no need to use an in-line fuze on this supply. It is good practice to provide this supply from one of the vessel's control panel circuit breakers rather than direct from the vessel's batteries.

**Step 6.** Connect the cables from the antenna unit and from the power supply to the plug provided as shown below:



**Step 7.** Insert the plug into the control box.

**Step 8.** Switch on the unit. The power on LED should glow green. Note that it will not do so unless the antenna unit is connected. If it does not check:

- That there actually is power at the power supply cable and that the plug has been correctly wired.
- That conductors have been correctly rejoined if the cable to the antenna unit has been cut.
- That any cable plugs or glands used have been correctly fitted.
- That the fuze in the control box has not blown. It can be found by removing the back panel of the control box. The outside face of this panel has a protective film and, when the panel is replaced, this film should again be on the outside.

Note that it is normal for the red LED to flash when the unit is switched on.

You will probably switch Sea-me on for the first time in harbour. It is possible that radars will be working closeby and that radar signals will be reflected by surrounding buildings etc. It is therefore possible that the red LED may be on all the time or that it may occur in

an irregular manner. None of this means that there is a problem but simply that you are in an area where there are a lot of radar signals.

## **OPERATION**

When Sea-Me is required, switch it on at the control box and check that the power LED glows green (it is normal for the red LED to flash when the system is switched on). Sea-me is now on and will remain in an alert (quiescent) state until it is struck by an incoming radar signal. When it detects such a signal it will amplify it and transmit it and the active LED on the control box will flash red, indicating that you are within the range of the interrogating radar. This of course does not guarantee that the watchkeeper has actually seen you. The duration of the flash of the active, red LED is 100ms. Should it flash more than once every 2.5s, the typical sweep period of a radar, this indicates that you are being struck by more than one radar. In waters with many vessels using radar the active LED will be more on than off. Sea-me does not give any indication of the direction from which a radar signal has come.

Sea-me is only drawing its active current consumption of 260mA when the red LED is on. The average draw is therefore less than this and depends upon the number of radar signals which it is receiving.

Should your vessel have its own radar it is likely that the Sea-me red active LED will be permanently on when your radar is transmitting. This is because radars have many leakage paths and so Sea-me can be put into its active state (which has a duration of 100 milliseconds after the last received pulse) the whole time. However Sea-me only transmits in response to an incoming pulse and so it will respond to any which arrive in the spaces between the pulses put out by your own radar. Typically the ratio of space to pulse is 1000:1 and so there are 999 microsecond spaces for every 1 microsecond pulse received. Thus there is only a very small chance that your own radar will inhibit Sea-me from responding to a particular incoming pulse and it is virtually inconceivable that such a clash will occur again. This effect does however mean that Sea-me, because the active light is on, will be unable to tell you that you are being struck by another radar. If this is a concern then you are advised to switch your radar into its standby mode when you are not actually using it. You probably do this anyway in order to save power. Provided that you have not mounted the antenna unit in the direct path of the beam of your own radar (see above) this effect will not cause damage.

When you have fitted your Sea-me it will be natural that you may ask a fellow sailor with a radar to look at you with your Sea-me switched on and switched off. When doing this you should be aware that, if he can see you with Sea-me switched off, he may not detect any difference when you switch Sea-me on. This is because his radar is already "painting" you on his screen. Most small boat radars use 4 step grey scaling on their screens and it takes experience to be able to detect a difference between adjacent steps. However you should be aware that a small boat radar with a typical output of only 2kw is unlikely to trigger Sea-me at ranges of greater than about 4nm. This is not an issue because 4nm gives plenty of time for a small vessel to take avoiding action if necessary. The radars on big ships, our main concern, have outputs of at least 10kw, and quite likely 25kw, and these will trigger Sea-me at much greater ranges, theoretically at least 20nm given adequate heights.

The sea state, and thus the amount of sea clutter and the pitch and roll of the two vessels, will have an effect on how easily you will be seen. Sea clutter is reduced using the gain control on the radar and most radar manufacturers recommend that this be set to automatic although an experienced operator will occasionally override this to look into the clutter. An increase in the gain setting makes the receiver more sensitive and thus increases the probability that a return will be detected. Equally it increases the chances of clutter appearing on the screen. The pitch and roll of the vessels means that it is certain that, on occasion, the two beams will not be pointing at each other and therefore it is certain that the radar will not detect all returns.

Most ships today are fitted with ARPA (Automatic Radar Plotting Aid) radar. These systems can identify you as a target provided that the ratio of paints to scans is at least 50% and can sound a warning if you are within their guard zone. Once you have been identified as a target the watchkeeper can allocate you a target number and can easily monitor your course, speed and distance from him. When you have been retained as a target for sufficient time for ARPA to determine your course and speed it will use its algorithms to predict your future position and to reacquire you even if the ratio of paints to scans falls below the critical 50% level. There is of course a limit to how long it will continue to maintain you as a target if it fails to detect a return. By improving the return signal Sea-me aims to make it possible for the watchkeeper to earlier allocate you a target number and to start to track you sooner, thus reducing the probability that a risk of collision or a near miss will arise. As in all things with a human involvement, the more efficient the watchkeeper the more likely you are to be tracked!

## TECHNICAL INFORMATION

The following table provides the salient technical parameters of the Sea-me active Radar Target Enhancer:

PARAMETER	DATA
Operating Frequency	X Band (9.32 – 9.5GHz)
Dimensions of antenna unit	416mm long by 50mm diameter
Weight of antenna unit excluding cable and mount	410gms
Dimensions of control box	112mm * 64mm * 33mm
Connecting cable	BASEC approved 16*0.2mm rated for 3A at 300V. Outside diameter 5.3mm
Maximum gain at 9.4GHz	58.9dB
Minimum gain at 9.4GHz	50dB
Polarization	Horizontal
Antenna vertical beamwidth	+/-2.4dB at +/-15°
Response time	1.27 nanoseconds
E.I.R.P.	Max 630mW
Power supply	12v DC
Current consumption in quiescent state	60mA
Current consumption when transmitting	260mA
Control box fuze	0.5A Quickblow 20mm

## **GUARANTEE**

Your Sea-me Radar Target Enhancer is guaranteed for a period of 12 months from the date of purchase.

Subject to the terms listed below the guarantee provides for the replacement of the complete system or of either of the component parts (the antenna unit with cable or the control box) at Munro Engineering Limited's discretion which is identified and agreed as being faulty or below standard.

The conditions of the guarantee are as follows:

- The guarantee shall only apply to defects that occur within the 12 month guarantee period.
- This guarantee does not apply to any faults or defects caused by accidents, misuse, fair wear and tear, neglect, tampering or any attempt at repair.
- This guarantee shall apply only if the equipment has been installed in accordance with the instructions contained within the User Handbook.

This guarantee does not affect your statutory rights.

## **MUNRO ENGINEERING LIMITED**

### **Declaration of Conformity**

#### **Sea-me Radar Target Enhancer**

We, Munro Engineering Limited, of Stoke Trister, Wincanton, Somerset BA9 9PL declare that the product identified below complies with the essential requirements of Council Directive 99/05/EC according to the conformity assessment procedure laid down in Annex IV of the Directive.

Product:

Sea-me 9GHz Radar Target Enhancer.

This product is labelled with the CE conformity marking and the identification of the notified body consulted in the conformity assessment procedure.

Wincanton

10<sup>th</sup> July 2001

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