

SEA-ME

THE ACTIVE RADAR TARGET ENHANCER

USER HANDBOOK

April 2005

©Munro Engineering Limited, Stoke Trister, Wincanton,
Somerset BA9 9PL Tel: 01963 34184 Fax: 01963 34184

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.

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. It is worth noting that one radar is, to all intents and purposes, invisible to another. It must be noted that Sea-me does not obviate you from your responsibility under the International Regulations for the Prevention of Collisions at Sea to both keep a good lookout and to take whatever action is required to avoid a collision.

OFCOM has advised us that you should show Sea-me as a SART on your radio licence.

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 also provides the voltage conditioning and protection circuitry and contains an internal, changeable Quickblow 0.5A fuze. It will normally be mounted in the navigator's area. It has provision for the connection of an audible sounder should you wish to fit one. There are 2 sockets to provide flexibility of installation – the plug is wired as shown on page 4, where the socket in the bottom face is illustrated, whichever is used.

INSTALLATION

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, vertically, as high as is practical on the vessel. The base of the antenna unit is threaded to take a standard stainless steel antenna mount of 14 threads per inch (1" – 14 – NF) 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, such as a Glomex V9173, 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. Do not fix it to a crosstree or spreader as the mast will then partially obscure the antenna. If Sea-me is being fitted elsewhere, say on a radar arch, 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 effects 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.

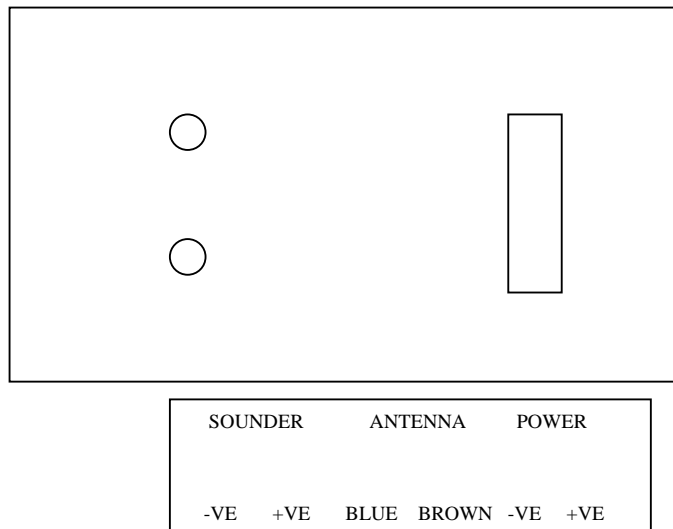
Step 3. Route the cable to the control box as desired. It is acceptable to cut the cable so that through-deck plugs can be used, although it is better practice to use a through-deck gland. It is also acceptable to shorten the cable. If it is necessary to lengthen it by more than 10m the advice of Munro 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. The control box has 2 sockets, one on the bottom face and one in the rear closure plate. You can use either depending on how you

wish to install the control box. Please note that the control box must be used. It 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 (wire positions are as looking from the front) as shown below:



Please note that a sounder, if used, must be a 12V DC sounder with a maximum current draw of 90mA. Sounders are polarity sensitive and must be connected as shown. The brown wire on sounders supplied by Munro Engineering is +ve.

Step 7. Insert the plug into the control box in the position required for your installation.

Step 8. Switch on the unit. The power on LED should glow green. Note that if the antenna is not properly connected both LEDs will flash. If it does not glow green check:

- That there is 12V DC at the antenna terminals when the control box is switched on. If there is not confirm that there is a 12V DC input at the power terminals. If the input voltage is OK check that the fuze in the control box has not blown. It can be found by removing the back panel of the control box.
- If the above actions do not resolve the problem put a multimeter, set to read current, in series with one of the antenna conductors. Switch the control box on. The current reading should be around 150mA when the unit is not receiving a radar signal. If the current reading is zero then there is either a fault in the antenna or there is damage to the antenna cable. If the current reading is correct then there is a fault in the control box.

Note that it is normal for the red LED to illuminate briefly 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 closely 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 occult 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. 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.

Note that the red LED is triggered by the rise in current consumption which occurs when the antenna unit transmits – if the red LED flashes a transmission must have occurred.

Radars have many leakage paths and so Sea-me will respond to your own radar's pulses (typically a pulse is 1 microsecond long and is repeated every 1 millisecond). The LED flash has been extended to 100 milliseconds to make it visible to the human eye and so it will be permanently on when your own radar is transmitting. However Sea-me 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, plenty of time for others to get in, even when electronic recovery time has been allowed for. 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.

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. Perhaps a better way to give yourself confidence that Sea-me is working is to have your fellow sailor monitor the ratio of paints to scans as he moves away from you. If he starts with Sea-me switched off and records the ratio until it falls to say 4 in 10 and then you switch Sea-me on he should see the ratio rise. Bearing in mind that we need to have a ratio of at least 50% for ARPA acquisition (see below) this improvement in return consistency is one of the key objectives of Sea-me. 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. 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 allocate you a target number earlier 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:

PARAMETER	DATA
Operating Frequency	X Band (9.32 – 9.5GHz)
Dimensions of antenna unit	416mm long by 50mm diameter
Thread in base of antenna unit for antenna mount.	1" – 14 - NF
Weight of antenna unit excluding cable and mount	410gms
Dimensions of control box	112mm * 64mm * 33mm
Connecting cable (24m supplied)	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 (tolerance to heel)	+/-2.4dB at +/-15°
Response time	1.27 nanoseconds
E.I.R.P.	Max 630mW
Power supply	12v DC
Current consumption in quiescent state	150mA
Current consumption when transmitting	350mA
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. It is governed by English Law.

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

10th July 2001

PAD Munro

Munro Engineering Limited

Intyg om överensstämmelse

Sea-me radarekoförstärkare

Vi deklarerar härmed att Sea-me 9 GHz Radar Target Enhancer (radarekoförstärkare) uppfyller de väsentliga fordringarna i Europeiska Rådets Direktiv 99/05/EG och att konformitet säkerställts enligt kraven i Bilaga IV. Produkten är märkt i överensstämmelse med EG märknings-regler och i samråd med beslutande myndighet.

Datum 10/07/2001

.....
PAD Munro

Munro Engineering Limited
Stoke Trister, Wincanton,
Somerset BA9 9PL
ENGLAND

MUNRO ENGINEERING LIMITED

KONFORMITÄTSERKLÄRUNG NACH R&TTE

Sea-me Radar Target Enhancer (Radarecho Verstärker)

Wir, Munro Engineering Limited, Stoke Trister, Wincanton, Somerset BA9 9PL – UK, erklären daß das unten angezeigte Produkt die grundsätzlichen Anforderungen der R&TTE 1999/5/EG entspricht und bezüglich der Konformitätsbewertung nach Annex IV der oben genannten Richtlinie zertifiziert ist.

Produkt:

Sea-me 9GHz Radar Target Enhancer (9GHz Radarecho Verstärker)

Dieses Produkt ist gemäß der Konformitätsbewertung mit dem CE Kennzeichen und Kennnummer der benannten Stelle (notified body) markiert.

Wincanton

10. Juli 2001

PAD Munro

MUNRO ENGINEERING LIMITED

Declaração de Conformidade

Reflector Activo de Radar Sea-me

Nós, Munro Engineering Limited, em Stoke Trister, Wincanton, Somerset BA9 9PL, declaramos que o produto abaixo identificado cumpre com os requisitos essenciais da Directiva 99/05/EC de accorda com a conformidade disposta no Anexo IV da mesma Directiva.

Produto:

Reflector Activo de Radar em 9GHz da marca Sea-me.

Este produto está devidamente rotulado em conformidade com a marca CE e identificação do organismo consultado no procedimento da respectiva conformidade.

Wincanton

10th July 2001

PAD Munro