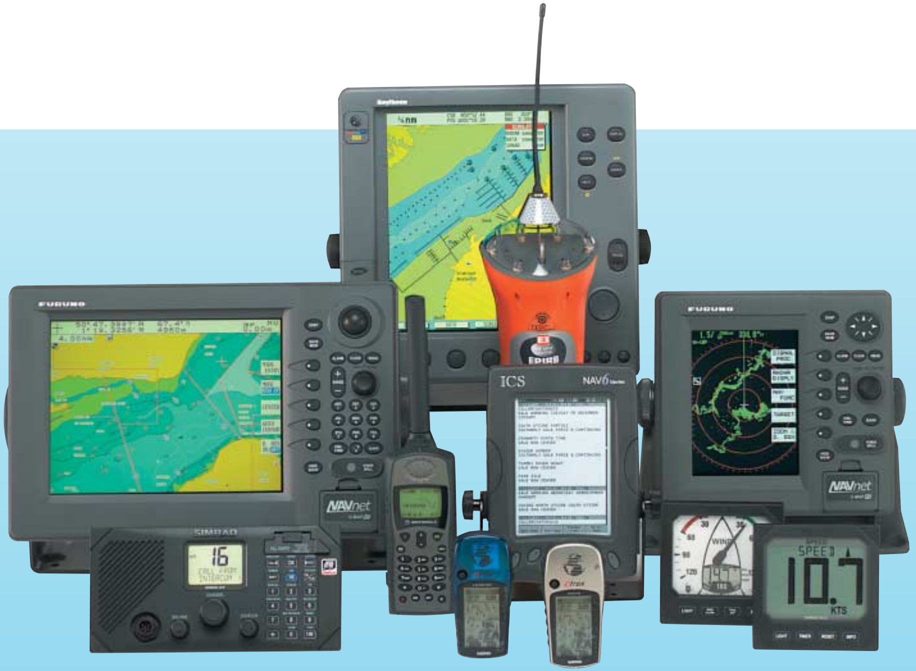
British Marine Electronics Association

Fourth Edition



BMEA

British Marine Federation

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BMEA INTRODUCTION

You wouldn't expect a hospital manager to perform brain surgery just because he works in the right building and knows a lot of doctors, or assume that a car salesman could fix the brakes on a Jaguar. So why trust your boat's vital intelligence and safety systems to the guy who drives the marina crane or paints its bottom?

The British Marine Electronics Association was formed more than ten years ago, but its roots go back much further, to when a group of marine electronics specialists got together in the Sixties, to swap ideas. That informal gathering has now grown into a respected organisation with over Eighty members including manufacturers and waterside dealers, who specialise in the installation and maintenance of marine electrical and electronic systems.

Number one in the Association's list of aims and objectives is to provide boat owners with a guaranteed level of quality service and support around the UK coast.

To that end, it has instituted a Code of Practice that requires its members to treat customers with courtesy and their boats with respect, to recommend and supply only equipment that is suitable for the marine environment, and to work to recognised standards that ensure every installation is as safe and reliable as possible.

Twenty or thirty years ago, perhaps, such safeguards were almost unnecessary. Marine electronics - at least on pleasure craft - was in its infancy. A typical yacht's fit-out probably included an echo sounder and possibly a radio direction finder, but that was about it. GPS and chart plotters were unheard of; radar was a rare and expensive luxury; and logs were mainly mechanical.

The electronics revolution has given boat-owners access to a bewildering array of ever-more sophisticated equipment. It undoubtedly improves the performance of their boats, increases the pleasure they provide, and enhances the safety and convenience of life on board - so long as the individual products are right for that particular job, and have been properly installed.

That's quite a big "if", however, because modern electronics depend on very sensitive radio receivers and data handling circuits. They have to amplify and process the very weakest of signals whilst at the same time being able to cope with radio and electrical interference from the engine's charging system, from domestic services such as fridges and fluorescent lights, and, increasingly, from other electronic equipment. There's no room in this high-tech environment for botched, careless, or badly thought-out installations, or for materials which corrode or fatigue when they are exposed to water, sunlight, or repeated movement.

That's what the BMEA is really all about: despite its name, it's more that just a trade association. it is committed to providing you — our customers — with the best products, sound advice and professional service at fair prices.

Radar prices have tumbled over the past few years. Several sets now have three-figure price tags and over a dozen different models are available for less than £2000.

Technological improvements have come hand-in-hand with falling prices, making modern small craft radars more capable, yet easier to use than ever before.

The most obvious leap forward in small craft radar technology came in the early eighties, with the development of raster scan or "daylight viewing" displays. Until then, all radars had such dim pictures that in daylight they could only be seen by peering through a deep, light-tight cowl.

Raster scan changed all that. Instead of building up the picture in stages, in step with the rotating scanner, a raster display uses the same information to update a picture stored in its electronic memory. Twenty five times a second, it flashes the latest update onto what is effectively a small television screen - generically called a cathode ray tube or CRT.

A second leap was the application of raster pictures to liquid crystal displays (LCDs). LCDs are slimmer, lighter, and use less power than CRTs, and are less vulnerable to water. A more recent innovation has been the introduction of colour liquid crystal displays that are suitable for viewing in bright daylight and the multi-purpose display screen allowing the user to select radar or chart plotter or fish-finder pictures depending on the sensors or antennas connected to the system. Furthermore, with the enhancement of data and video interfacing using high speed bus technology, waterproof repeater displays for radar or chart plotter are now a reliable and readily available option, bringing the necessary navigation information direct to the helmsman whether he be inside or out!

What makes a good picture?

The essence of a good picture is definition - how clearly it separates one blob from another. It's like the difference between a sketch map drawn in ballpoint and one drawn using a thick felt-tip. The felt-tip loses definition hiding details which are clearly visible in the ballpoint version.

Three factors dominate a radar's definition: -

BEAMWIDTH, as the name suggests, is the width of the radar beam, and ranges from 7° for the smallest sets down to less than a degree for a large ship's set. You can appreciate its significance if you imagine yourself looking for a narrow harbour entrance. If the entrance is to show up as a gap, the radar beam has to pass straight through it, without being reflected from either side. If it's 0.1 mile wide, for instance, a 1° beam will pass straight through when you're 6 miles away, but if the beam width is 6°, you'll need to be within a mile before it will show up.

PULSE LENGTH has a similar effect when it comes to discriminating between objects that are on the same bearing but slightly separated in range. Short pulses give better definition, but unfortunately a "long" (up to about a microsecond!) pulse may be required to produce an echo from small or distant targets. Manufacturers solve the problem by making radars that automatically change the pulse length to suit the range scale in use.

SPOT SIZE related to the graininess of the display. All raster pictures are made up of a huge number of spots, called pixels. If the pixels are small enough, the human eye can't distinguish them, so the picture can show smooth curves and fine detail. Larger pixels show up as distinct rectangles, so curves show up as a series of steps, and fine details merge together.

Noise and clutter

Other factors affecting the clarity of a radar picture can be lumped together under the heading of CLUTTER - unwanted blips that don't relate to anything you want to see, but which can obscure real contacts. Manufacturers build extra controls into their radars, allowing their performance to be subtly adjusted to eliminate clutter, but unfortunately anything that eliminates clutter can also eliminate weak targets. To overcome this, manufacturers are now developing ever mores sophisticated automatic controls to take over from the human operator.

NOISE - radio noise, not audible noise - is all around us, from sources as diverse as the sun, our on-board electrics, and even the radar itself. It's most obvious on radar when you turn the gain up too high, when it appears as a snowstorm of speckles that are the visual equivalent of the background hiss you get when you turn up the volume on a radio or tape player. A high quality receiver will avoid picking up extraneous noise and won't make much of a contribution itself: a lesser one will amplify everything, with the result that you have to turn the gain down to lose the noise, and risk losing weak contacts as well.

What am I paying for?

When you buy a radar, what you're paying for is a means of detecting solid objects, and of measuring their ranges and bearings. Even the smallest and cheapest of sets can do that for less than £1000.

As you move up the price range, one obvious change is that you're likely to get a more powerful transmitter. In most cases, this is matched by an increase in the set's nominal range, but it's important to appreciate you're not really buying range. The distance your radar can "see" is limited by the radar horizon, just as the distance you can see is limited by the visual horizon, so a 48-mile radar probably won't detect a ship any further away than a 24-mile set. The real virtue of power is that it enables the set to detect small targets without cluttering the screen with noise.

You're also likely to get a bigger antenna. This is important because beamwidth is largely determined by antenna size. A good big one will always beat a good little one.

The other obvious change is the display: a bigger budget is likely to give you a bigger screen, a choice of CRT, colour or monochrome LCD, and a dramatic increase in the number of pixels.

No one can tell you whether you spend one, two, or ten thousand pounds on your radar. You can certainly expect a £2000 set to be twice as good as one at half that price, but whether you need that extra quality depends on the size of your boat, the power available, and the use you make of it. Bear in mind, though, that any radar needs to be properly installed and set up if you are to get the best out of it, especially if it is to be interfaced with other equipment such as a compass, GPS, or chart plotter.

HOW RADAR WORKS

A transmitter, inside the scanner unit, produces very short pulses of super high frequency radio waves (microwaves), which are focused into a narrow beam by the rotating antenna. Pulses reflected back from solid objects such as land or other vessels are collected by the antenna, and passed to the receiver where they are amplified and processed.

Part of that processing involves measuring the time between the pulse being transmitted and the returning echo being received. Radio waves travel at a constant speed of 300 metres per microsecond, so that the time interval is directly related to the distance the pulse has travelled to and from the target.

Echoes are only received when the scanner is pointing straight at a target, so the direction in which the antenna is pointing when an echo is received corresponds to the target's bearing.

The distance and bearing are then passed to the display, which uses them to build up a map-like picture of the boat's surroundings.

HINTS AND TIPS

If possible, try before you buy. It's much easier to appreciate picture quality by looking at it than from printed specifications.

Don't be put off by the control panel or menu system. A typical radar has only eight main controls - the rest will be for features and functions that are intended to make life easier!

Make sure it is properly installed, and that you know how to use it.

Radical changes are taking place in VHF technology. New digital selective calling (DSC) equipment allows distress messages to be sent automatically, providing a pin-point location and nature of the distress. Coastguards will no longer have to keep a listening watch on CH 16 and the technology will also allow messages to be sent on an inter-ship basis.

The UK has adopted the stringent standards of Class D DSC: these involve having a dedicated DSC 'controller' which forms part of the VHF installation and is capable of sending and receiving digital messages. Many other European countries and the US have adopted the simpler Class F controllers, which effectively just allow the sending of a distress message.

This leaves UK yachtsmen with a narrower choice of VHFs, as few manufacturers have yet produced a Class D VHF for leisure use. Commercial users, however, needed to have systems implemented by February '99 so it makes sense to adopt the new standard as soon as possible.

DSC is the route to the future and provides some enhanced VHF features such a direct dial telephone contact, advanced messaging and message forwarding - effectively increasing the VHF range due to the digital nature of the information being transmitted.

With this equipment, lifting the 'lid' of the distress button and pressing it for four seconds will cause the distress alert to be transmitted. If in a panic situation, keeping the button pressed for a longer time will result in an 'undesignated' distress alert to be sent which will still contain your MMSI (your vessel's allocated identity number) your position in lat/long, the date and time.
When the alert has been transmitted, the receiver remains tuned to CH 70 awaiting a distress acknowledgement, also sent digitally from a shore station. If no such acknowledgement is received, the distress message will continue to be transmitted.

All DSC VHF radios within range will be warned both visually and audibly that a distress alert is in progress and the transmitted message will be displayed on the Controller.

When it is acknowledged, direct speech contact with the controlling station is established. Similar actions as described above will occur when a vessel is fitted with satellite communications (type A, B or C only), culminating with direct data or voice communication to the Maritime Rescue and Coordination Centre (MRCC).

What other equipment forms part of the GMDSS?

406 MHz EPIRBs (Emergency Position Indicating Beacons). When activated, one or more of the four COSPAS-SARSAT satellites will pinpoint your position. To aid the vessel identification, the EPIRB serial number should have been pre-programmed into the EPIRB, which must be registered with the MCA at Falmouth.

SARTs (Search and Rescue Transponders). When switched on, all radars within about 5 miles will show a series of 'blips' on their screens, emanating from your location.

Navtex receivers are dedicated to receiving maritime safety information such as navigation, gale warnings and weather forecasts.

Frequently asked questions

Do I need an Operator's Certificate?
Yes, ask the RYA or MCA for details.

Do I need a Licence?
Yes, application forms are available from the Radio Communication Agency. It is your responsibility to ensure that your equipment is UK approved so make sure you ask the question before handing over any money.

Can I update my old VHF?
Possibly, if you have a recent 'upper end' set, but you may find that it is more cost-effective to buy a new one. Consult your local BMEA dealer for advice.

Can I continue to use a normal VHF?
Yes, the UK Coastguard have said that they will continue to monitor CH 16 until February 1st, 2005, and shipping will do likewise when possible.

What about using GSM or other mobile phones?
Not recommended: RNLI lifeboats do not carry cellular phones and can only find and communicate with you in VHF.

What about installation?
The MCA endorse that all GMDSS equipment should be installed and commissioned by a GMDSS-trained BMEA engineer.

NETWORKED INSTRUMENTS

Once upon a time, a log was a log and a sounder was a sounder. They got on with their respective jobs, and that was it. Now, behind the scenes, your instruments could be chattering away to each other, making new information out of the same raw data.

On their own, instruments such as a sounder, log, and wind indicator provide a lot of useful information. So, too, do radar, a chart plotter, and a GPS. Link them together so that they can exchange information between themselves, however, and the capability of the system becomes very much greater than the sum of its parts.

One of the clearest examples of this is the effect of feeding information from a log to a wind instrument. Imagine, for instance, that you are motoring at 6 knots in a flat calm. Your own forward motion will produce an apparent wind of 6 knots, dead ahead, which will be shown by your wind instruments. They can't tell you that there is no real wind. Feed in the boat speed data from the log, however, and it becomes capable of showing you the true wind.

Linking a chart plotter to a GPS is an obvious application: one could even argue that without an input from the GPS, a chart plotter is wasted, and that without the ability to download waypoints from the chart plotter, the GPS is operating way below its capabilities.

Feeding heading information from a fluxgate compass into a radar immediately opens up the radar's stabilised display facilities: use its course-up mode for accurate, reliable collision avoidance, or its north-up mode to help relate what you see on the radar with what's on the chart. Link in a GPS as well, to display your waypoint on the radar screen, or to measure the lat and long of unidentified contacts.

The ideas of exchanging information between yacht instruments goes back to the late Seventies, when American autopilot manufacturers hit on the idea of using a position fixer (Loran, in those days) to control an autopilot. At first, each company developed its own methods but as the idea became more popular, it became obvious that there were advantages in using a standard system. In 1980, the first specification for a standard marine interface was published. It was called NMEA 0180 because it was developed by the National Marine Electronics Association (the US equivalent of BMEA).

NMEA 0180 served its purpose, but was limited in its capabilities: it quickly became obvious that a radical reworking would open up far wider applications, so NMEA 0182 was born, followed by NMEA 0183.

NMEA 0183 is still the current standard, providing simple two-wire connection between instruments, allowing them to send messages to each other as short, low-voltage electrical pulses - a kind of electronic Morse Code. In theory, NMEA 0183 allows any instrument with a NMEA (often pronounced "neema") output to talk to any instrument with a NMEA input. It usually works well, but occasional problems require expert attention to resolve. Sometimes, for instance, one instrument listens for a particular piece of information but doesn't recognise it when it comes from an instrument made by a different manufacturer: its like a Scotsman and Cornishman speaking the same English but sounding completely different!

As expectations grow and technology advances, NMEA 0183 is starting to show its age, and several manufacturers are using it only to communicate with other makes of equipment, while adopting much faster and more versatile interfaces for use between their own products. These, which may one day be co-ordinated to produce a standard NMEA 2000, already allowing multiple displays to be controlled from a single remote panel, letting several sensors feed data into a single display, and providing for multi-way exchanges of information between instruments so quickly that the responses of the whole system are virtually instantaneous.

Navigation is about getting yourself from somewhere to somewhere else, but for centuries human navigators have had to devote most of their efforts to answering the question "Where am I?". Electronic position fixers have changed all that, and chart plotters can relate our present position to the world around us easily, accurately and instantaneously.

Each of the past few decades has seen a major advance in navigation technology.

In the Seventies, it was a radio position fixing system called Decca. Receivers were expensive and it was bedevilled by legal and political wrangling, but it was the beginning of a breakthrough. In the Eighties, we saw the first civilian receivers for a satellite system known as 'Transit' followed in the Nineties by GPS (Global Positioning System).

Now, GPS receivers costing as little as £100 offer better than 20 metres accuracy whatever the weather, and whether you're in the Solent or the Southern Ocean. We also have access to a supplementary system that offers a 3-5 metre accuracy from equipment that costs less, in real terms, than a fairly basic Decca Navigator ten years ago.

GPS

GPS is based on a constellation of up to 30 satellites, each continuously broadcasting a signal which translates as "I am here…" and " the time is now …" Radio waves travel at a constant speed, so by comparing the time at which the message was sent with the time at which it arrives, a GPS receiver can calculate its distance from the satellite. Just as you can plot your position on a chart by knowing your distance from two or three landmarks, it can work out its position by knowing the range of three or four satellites.

The fact that radio waves travel at about 162000 nautical miles per second means that if the receiver's clock is out of synch with the satellite's clock by even a fraction of a millisecond, the measured range will be miles out. That's why the GPS receiver needs to listen to three or four satellites instead of two or three: comparing the results obtained from several satellites at once enables it to put its own clock right - so as well as telling you where you are, GPS is also the most accurate, self correcting clock you could wish for.

dGPS

There are plenty of reasons for wanting accuracy better than 20 metres, so some very clever brains have applied themselves to achieving it. What they've come up with is Differential GPS (dGPS).

You can get some idea of how it works by imagining someone standing beside a lighthouse with a GPS set and a radio. Knowing exactly where he is means that he knows how wrong his GPS is - so in theory, he could broadcast the information to anyone else in the vicinity, who could apply it as a correction to their own GPS positions.

In practice, it's all automated, and instead of transmitting corrections to the displayed position, the reference stations transmit corrections that are applied to the signals received from the satellites rather than to the position. The correction signals are quite different from those of GPS itself, so receiving them requires a piece of equipment called a

Differential Beacon Receiver (DBR). The DBR may be integrated with the GPS, but many are separate "black boxes" designed to enhance the performance of existing GPS sets.

A new differential system known as WAAS is appearing in many new GPS receivers. WAAS (Wide Area Augmentation System) has really been designed for the aeronautical industry and provides differential corrections via a different constellation of satellites that, in turn, re-transmit these corrections to the end user. In the USA, the system is up and running. A European version, EGNOS, is also undergoing trials and expected to be in operation around 2003/4. Positional accuracy is improved to around 3 metres and, because the corrections are transmitted on similar frequencies to GPS, you do not require an additional antenna!

What else will it do?

To an instrument capable of working out its position from signals broadcast from satellites thousand of miles away, many routine navigational calculations are child's play.

All GPS receivers, for instance, can store planned positions as "waypoints": you can tell it where you want to go, and it will tell you the direction and distance you have to travel.

If you need to zigzag round obstructions, you can make up a route by stringing several waypoints together like a child's join-the-dots picture.

By using what is known as the Doppler effect and also comparing your present position with your position a few seconds ago, a GPS set can calculate your direction and speed of movement.

It's probably in the last of these that dGPS really does come into its own. Small, random errors in an uncorrected GPS position don't make much difference on their own, but when you compare two positions a few seconds apart, they can produce quite significant errors in speed and direction - a knot or two in a boat moving at six knots. By reducing positioning errors, dGPS makes the speed and direction displays so much more accurate that racing sailors, for instance, can use them to assess the true effect tidal streams.

Plotters

Knowing where you are is one thing: relating that to the real world is quite another.

Navigators have been doing the job with paper charts for hundreds of years - probably since the magnetic compass was invented sometime in the twelfth century. It was almost inevitable that charts and compasses should develop side by side, because without a compass, it would have been impossible to produce a chart, and without charts, the value of a compass would have been pretty limited.

GPS is as dramatic a development as the compass was in its time, and it too is making us look at new ways of storing, organising and displaying navigational information.

Setting up a computer to display a GPS position on a lat-long grid is no great problem, and it's easy to mark a few fixed points on the grid to represent buoys or landmarks. The clever bit is in expanding this idea to show entire coastlines and contours.

Raster charts

In effect, a raster chart is an electronic photograph, produced by scanning a paper chart in much the same way as a fax machine scans a letter. The image is broken down into coloured dots, and information about the colour and position of each dot is stored on a computer disc or memory cartridge. When it's needed, this mass of data can be reassembled to produce a picture on the screen.

Vector charts

A vector chart is more complicated to produce because it involves electronically tracing a raster chart to produce an image in which lines are stored as lines, rather than as strings of unconnected dots. The process is largely automated, but it still takes time, skill, and sophisticated equipment: in return, it produces charts that typically take up only a hundredth of the memory occupied by equivalent raster charts. This makes vector charts particularly well-suited to dedicated chart plotters, whose memories and processor speeds may not match that of the latest personal computers, but whose internal organs are built to withstand life afloat and whose controls are more appropriate for the job.

Vector charts have other advantages, too. One is that they can be enlarged or reduced as much as you like: one minute you can be looking at a map of the British Isles, the next, you can zoom in to individual pontoons in a marina. Another is that the chart can be "layered", as though it were built up of a series of transparent sheets. Each sheet contains a different kind of information, so the picture can be de-cluttered by removing unwanted layers.

Of course there are drawbacks: the tracing process can introduce inaccuracies, or the chart editor may reduce "clutter" by omitting information. This was certainly common a few years ago, when the majority of chart plotters had small memories, slow processors and monochrome displays, but it's changing fast: the latest generation of electronic charts are incomparably better than their counterparts five years ago.

At present, we have two broad classes of electronic charts - raster and vector - with several incompatible brands competing in each class. Each has its own particular strengths, so different hardware manufacturers have adopted different brands. It pays to look carefully at all the options and take expert advice before committing yourself to one particular system.

Your investment in sophisticated electronic equipment could be pointless if you power system isn't up to the job of delivering volts when and where they are required. Danny Jones offers a few pointers to help keep your batteries topped up. Batteries are the critical element in a boat's electrical system, but there's a lot more to them than many people realise. The vast array of different types, terminology and prices bear this out, but unfortunately they also make it very easy to make an expensive mistake by choosing the wrong one.

There are particular factors that govern what type of battery should be used for a particular job and how it should be charged. These factors include the duty cycle, power demand, ambient temperature, depth of discharge, recharge time, electrolyte type and the space and budget available, but the choice isn't an exact science because some of these factors often conflict with each other. Getting it right requires knowledge and a little bit of good old nouse.

The most important initial decision is to choose the correct battery type: a battery designed and constructed for use in one application may not be suitable for another. Starting a diesel engine, for instance, calls for a battery that can discharge very high current in short bursts - known as cranking duty. By contrast , a battery used for services such as lighting or to run a fridge will be discharged more slowly but over a longer period, and considerably more of its capacity is likely to be used before it is recharged. This is described as deep cycle or cyclic duty, or sometimes as traction duty.

A cranking battery has larger, thinner plates than a cyclic duty battery, so if either type were regularly used for the wrong job they would quickly deteriorate. There are hybrid types, often referred to as leisure batteries, that can be used in both applications but they are inevitably a compromise: whilst perfectly acceptable for vessels that are used intermittently, they don't always offer the best long-term economy for extensive cruising. Another important matter is the capacity required. For starter batteries this is easy, as most engine manufacturers recommend the size to use. If not, you will have to find the 'Cold Cranking Amps' (CCA) drawn by the starter motor and then match the battery to this. All batteries intended for starter duty have their capacity stated in CCA with a reserve capacity stated in minutes.

It's more difficult to calculate the capacity needed for service batteries. First, you will need to establish how much energy the battery has to store for a typical duty cycle. Making this calculation is a subject in itself but it boils down to the average current figure that will be drawn from the battery multiplied by the time intervals between charges, giving a figure measured in Amp hours (Ah). It is important to appreciate that this represents the energy required - not the capacity of battery needed. To find the capacity required, you need to make an extra allowance for the average depth of discharge that you are prepared to accept. The life of a battery used for deep cycle duty is usually quoted as a number of cycles rather than a period of time, but depends to some extent on how deeply the battery is discharged: very deep discharges shorten the battery's life significantly, so a good compromise is to aim for an average duty cycle of 50%. This means that the Amp-hours consumed have to be doubled to arrive at an optimum battery capacity. You may also have to consider other factors such as the high peak currents drawn by equipment such as winches and inverters to ensure the battery can handle heavy discharges without adverse affect.

Having established the correct type and size of battery the problem becomes clouded by the vast array of types and styles of batteries available that all claim different capabilities and properties. For example, there are choices between traditional flooded or wet batteries (the type that require topping up), starved electrolyte, and gel types. They are all lead-acid batteries but with different electrolytes. Each has its own benefits and drawbacks, making them suitable for different purposes. Good advice is to discuss the pros and cons with alternative suppliers and establish what's best for you.

Mains battery chargers

Proper battery charging is just as important as choosing the right battery in the first place. First, it has to ensure long and trouble-free life with minimum maintenance and second, it has to ensure that there is always plenty of power available for the job in hand. Too small a battery charger will struggle to get the batteries fully charged; too large a charger will be a waste of money and space, and the wrong type of charger can cause problems by over or under charging.

Charger technology has advanced considerably in recent years and the use of switch mode design has led to a reduction in size, weight and cost as well as to improvements in efficiency and performance. Switch Mode Power Supplies (SMPS) dispense with heavy and inefficient transformers by using high frequency techniques to convert high voltage AC power to low voltage DC power, but although the principle is now used almost exclusively by charger manufacturers, there is still a wide variation in quality and specification.

The 'charge characteristic' determines how the product applies power to the battery. The properties of a battery change as it becomes charged, so a good charger will adjust the voltage and current it supplies to the battery accordingly. It is worth discussing this with individual suppliers and have them explain how their charger will get your batteries fully charged.

Engine-driven alternators

As they come, standard alternators are generally low in power output and relatively crude in their characteristics. This may be acceptable for starter batteries, but it's less suitable for service batteries because it is likely to leave them under-charged, and prone to an irreversible condition known as sulphation. This leads to a reduction in their available capacity and is ultimately the most common cause of battery failure. Products known as advanced alternator regulators, charge boosters or battery management systems are available that can be fitted to most alternators to significantly improve the charge characteristics and thus achieve full charge in the batteries.

It should be remembered that these devices only improve the characteristic of the alternator; they don't enable it to produce any more power. This may be sufficient in small systems but for quick, effective charging of large service batteries it may be better to replace the alternator with one designed for high output at slower running speed.

Charging Capacity

It is not difficult to deduce that there is a relationship between the output from the charging source (in Amps) and the time it will take to charge the battery. A battery of 300Ahrs that is charged with a 30A battery charger will obviously require at least 10 hours to become fully charged. In practice, however, the relationship is not quite that simple, because the rules change as the batteries become charged. It is possible to charge a battery to 80% if its capacity relatively quickly but once this level is achieved, the process has to slow down to avoid overcharging. It can take as long to put in the last 20% as it does to put in the first 80%.

We also have to allow for the fact that onboard services are likely to be consuming power at the same time as the battery is being charged: in effect, they will be deducting power from that available for charging. To make things simple a general rule of thumb is that the charging capability should be roughly 20% of the battery's capacity: a 300Ah battery, for instance, should be charged by a 60A source. Higher power will be of little advantage and lower power will result in extended recharge time. There are exceptions though. If the batteries are to be charged when the boat is not in use, a smaller capacity can be employed, down to a minimum of about 10% capacity. Whatever charger you use it's important to appreciate that the fastest any battery can be charged completely and safely is about 6 hours from flat.

This suggests that any power supply problem needs to be tackled by looking at the system as a whole: for instance, although it may seem logical to add another battery to get more power, you could be making matters worse if the charging system is already over-stressed.

The BMEA membership includes several suppliers and manufacturers specialising in electrical power equipment, all of whom have the skills and experience required to advise you on your power needs and put an end to your electrical power problems.

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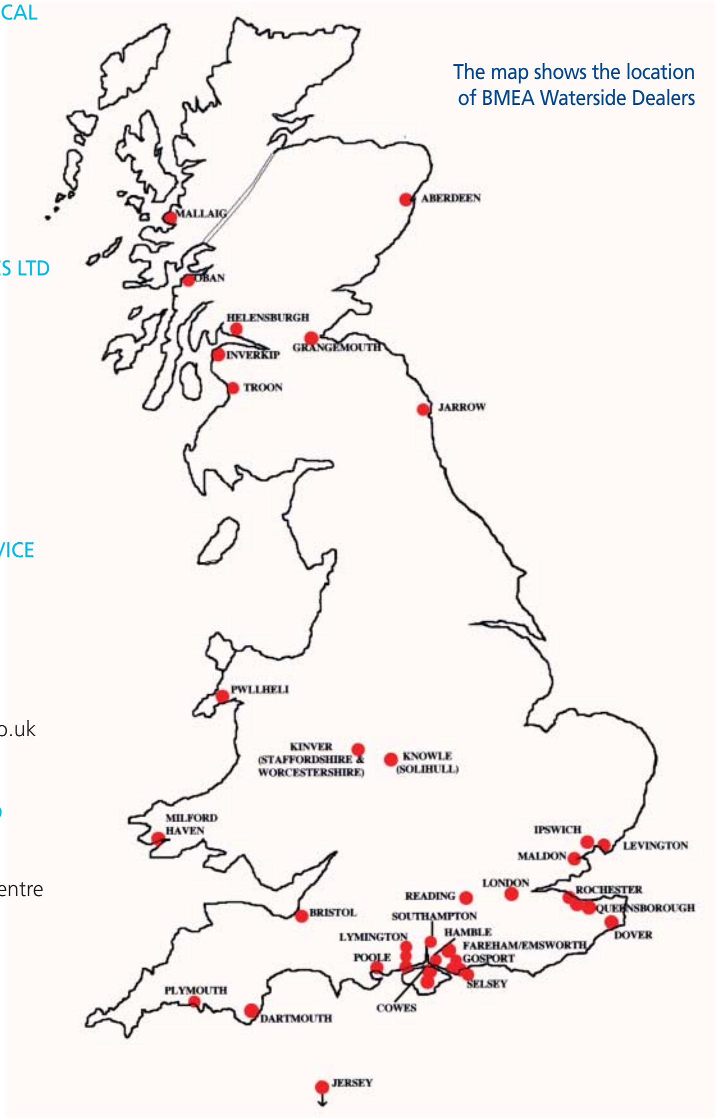

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