
1 The first cut


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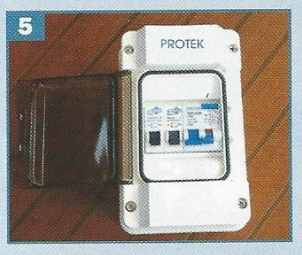
4 Out with the old



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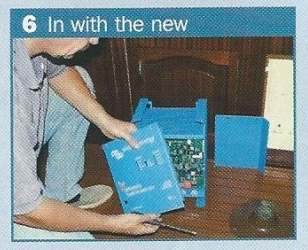
6 In with the new


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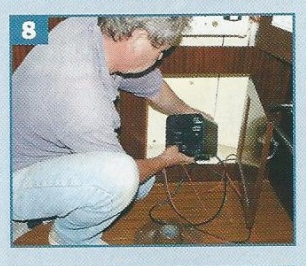
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1: As you can see, there was very little clearance behind the panel in the chosen location, so I opted for the simple approach. After carefully peeling back the carpet trim I just cut out an opening to allow the switch to slide snugly onto the ply with just enough of the fascia overlapping to allow it to be screwed properly into position.

2: The switch was then placed temporarily in position.

3: That's how it would stay for the time being. Once the connections had been finalised later on in the project the carpet trim could be replaced over the face of the switch.

4: I now moved on to the next phase. Before it was possible to fit anything else I first had to remove the old consumer unit together with the main switch for the immersion heater to prepare for the rewiring and eventual installation of the new box.

5: The new 'harsh environment' consumer unit, together with the RCBO and MCBs was soon assembled and ready to be connected up. To save time, it's considerably easier to wire these small units before you actually mount them on the bulkhead, especially if they have to be positioned in tight corners. That's why, in this case, both the old and new units were left in their boxes until the new cabling had been run through the boat.

6: With the consumer unit's position finalised the next stage was to temporarily install the Phoenix. Before placing it in position the top and front covers were removed ready for the subsequent connection of the various cabling.

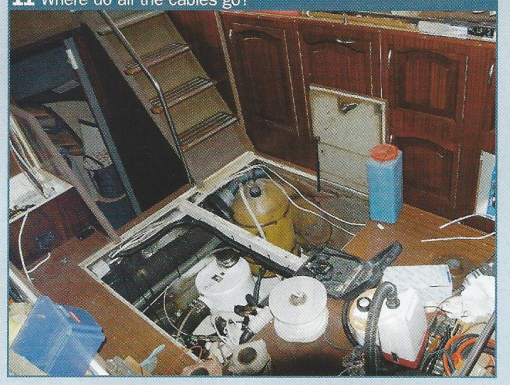
7: The separate charger and 400 watt inverter that the Phoenix was replacing now had to be removed along with the shelving arrangement on which both had previously been installed.

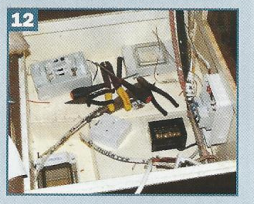
8: I started by removing the original inverter. The next step was to take out all the old shelving along with the QL 30 amp charger.

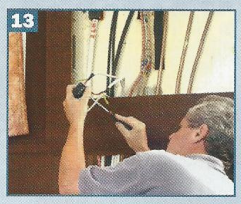
9: This gave me the chance to do some spring cleaning! So, after having swept out the locker, it was time to move in the relatively heavy Phoenix. As I carefully lifted it into place I was extremely careful not to damage any of the exposed components while the covers were off.

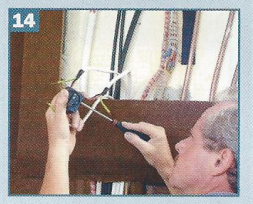
10: Once the new unit was in place fixing screws were placed through the mounting grommets on the rear panel. This is when I encountered my first minor problem. Having discovered that the holes in the bottom panel for additional fixing screws were impossible to reach beneath the main body, I decided to fit the bottom screws through two additional holes that I drilled in the feet and which would be easily accessible from the front.

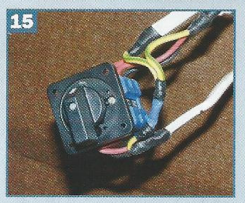
11 Where do all the cables go?



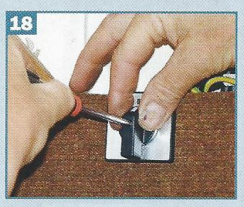








16 Connecting the switch



11: Now that the position of both ends of the cabling had been dictated by the location of the equipment, the hard work began. It meant lifting the floors causing havoc and general disruption as I ran cables right throughout the wheelhouse. Here, the main cables had been run and were ready for connection later on. As each cable was run it was numbered with an indelible pen to help identification during the connection phase.

12: The most complex part of the connection stage was fitting the two consumer boxes and the change-over switch, so this is where I began.

13: I first ran the cables between the consumer boxes and the change-over switch, labelling them as I went. After that I then made all the necessary connections into the switch itself.

14: The cables were all terminated and their ends sealed before connecting them up. Note that I'm using domestic twin and earth cable. This is now outlawed for use on new installations, because multi-strand cable such as 'Artic Blue' is mandatory due to its greater resistance to vibration and mechanical damage. So, on new installations you must use multi-strand, but since the original wiring on *Pershilla* is all domestic cable and has shown no problems in 18 years I decided to stick with the same thing.

15: Since it's a double pole switch, both live and neutral pass through it and are connected in pairs side by side. The earth cables are connected outside the switch using crimp terminals.

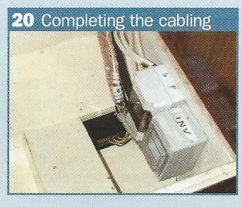
16: Once all the connections had been made, the switch was slid into position in the bulkhead and the front panel screwed into place to make it secure.

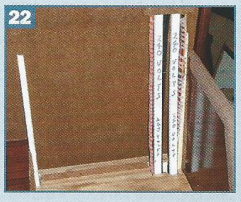
17: The face plate was snapped on to cover the fixing screws.

18: The final job was to attach the switch knob and secure it with the single screw supplied.

19: I was really pleased with this bit! With the panel finally back in place the new switch looks as though it's always been there!

20 Completing the cabling





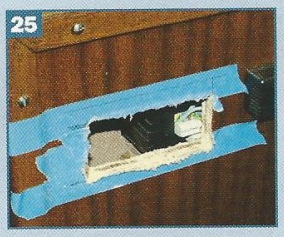
20: I then went back to the consumer units situated below the switch and completed all the connections within the boxes, including the ones supplying the feed to the battery charger portion of the Phoenix and the feed from the inverter portion back into the consumer box. Note the numbering on the cables to avoid any unnecessary confusion during connection.

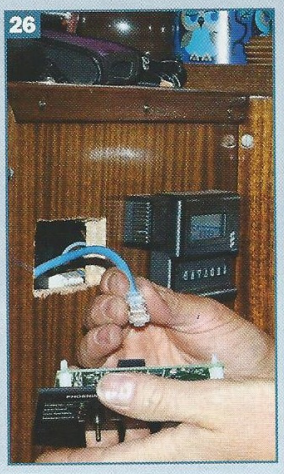
21: At this stage I was getting rather fed up with constantly falling into the engine compartment so decided to get the cables into trunking right throughout the boat so I could refit the floor panels and make life a lot easier when moving around in the wheelhouse. I used domestic snap-lid trunking for the mains supply because it provides good damage protection and can be clearly marked with an indelible pen to warn of mains current.

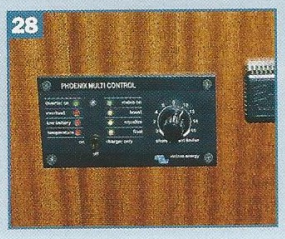
22: I decided to use the same trunking between the switch and consumer units. That way I could differentiate between mains and 12 volt circuits.

23: With the seat refitted, it's fair to say that the whole system is extremely well protected.

24 Fitting the control panel







24: I eventually decided on final position for the remote control panel on the logical basis that it was more domestic than operational and also because of the length of the 5 metre pre-wired cable that came with it. In an effort to avoid damaging equipment already installed behind the chosen panel, I masked the area and 'unstitched' the section by drilling lines of small bore holes to allow the panel to be removed with the minimum amount of damage.

25: Despite enormous care I still managed to catch the connector block on the back of the gas detector. Luckily there was minimal damage and I only had to run a couple of new cables to it.

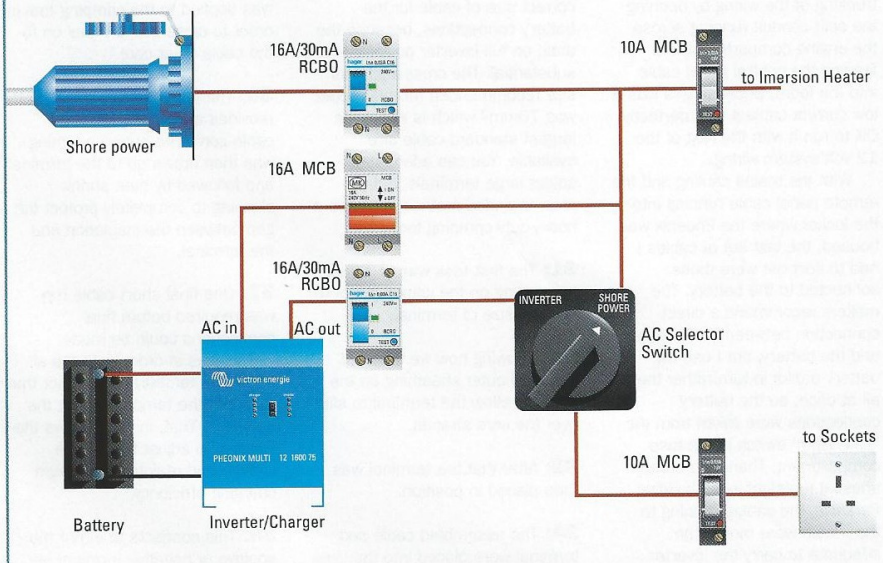
26: The telephone style plug snaps securely into its socket on the rear of the remote panel.

27: The panel was then secured in position using matching black-headed screws provided.

28: The remote control offers the same functions as those provided on the front of the Phoenix panel and, once connected, over-rides the controls while also giving a constant visible read-out of what's happening, whether it's battery charging or providing mains power from the inverter.

Diagram 1

Wiring schematic. In practice it all worked out fairly easily on my boat, largely because I already had an AC facility



All non-battery circuits include live, neutral and earth

through the boat to and from the consumer unit, the battery and the Inverter/Charger itself.

Most modern boats have a proper marine mains-in panel with the appropriate circuit breakers: RCCBs (Residual current or earth leakage circuit breaker), RCBOs (Earth leakage circuit breakers and miniature circuit breakers combined) and MCBs(Miniature circuit breakers).

"The first question you must ask is how much mains power are you likely to need?"

If that's so, the work will be greatly simplified, because feeding on-board mains power from the inverter into the system should be fairly straightforward.

For those with older boats or no shore-power system, the system must be designed to suit the individual requirements of the owner. In my case, the shore-power in *Pershilla* was quite basic consisting of just two circuits protected by an RCCD with 10 amp MCBs to protect the separate circuits. One supplies the immersion element in the calorifier, the other supplies the socket outlets throughout the boat plus the mains supply for the two way fridge. This sufficed for many years because our previous 400 watt inverter was used solely for powering the TV and charging the batteries of the laptop, both of which were plugged directly into the three pin sockets on the inverter front.

The new system was no more complex although one minor problem did slightly complicate matters. That's because it was important to ensure the inverter could never inadvertently be switched on to power the hot water immersion element since that would quickly flatten the batteries. The answer was to divide the systems so that when running on shore-power the immersion was automatically energised, but when running on the inverter it was isolated. After some thought

we made it work by including a change-over switch in the system. That made it impossible for the inverter to connect to the immersion. Diagram 1 shows the final wiring scheme. Without the need to split the circuits in this way the wiring is somewhat simpler and in practice the change-over switch is always left in the Gen' (Inverter) position because when running on shore-power, electricity from the mains is automatically passed through the inverter to the boat's electrical system. So, in the event of a power cut, this allows the inverter to seamlessly switch from shore to battery power with no noticeable loss of power, which is particularly useful when working with a computer. The switch also offers the choice of by-passing the inverter in the highly unlikely event of a total failure.

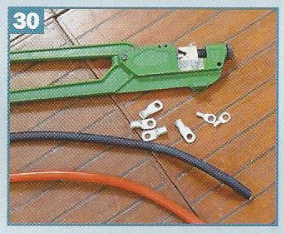
Since the original domestic consumer unit in the 240 volt system was of an older (but still accepted) pattern I decided to keep it and add a second separate unit to make the splitting of the circuits more logical. The local electrical wholesaler was offering a special deal on 'harsh environment' consumer units designed for garage use, complete with two MCBs and an RCBO, which was exactly what we needed. All mains equipment must be installed in a dry and protected area on the boat, but the extra protection of this particular unit gave an added degree of safety at reasonable cost.

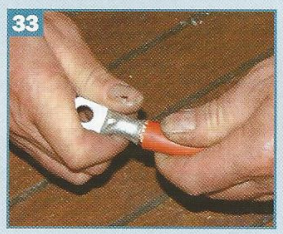
Where does it fit?

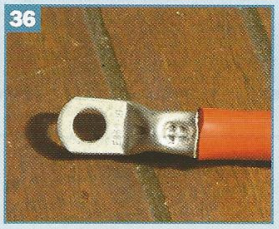
The layout was pretty well decided by the original equipment installation. The new consumer unit would be mounted alongside the original one beneath one of the lounge seats adjacent to where the shore-power was fed in. The Victron Multi would be installed in place of the small inverter and the QL automatic battery charger. The optional remote control panel was finally positioned next to the hot air heating control, which seemed logical, because both are involved with onboard comfort.

I began the work by installing the change-over switch to control the energy source – either shore-power or inverter. It was located close to the point where the shore-power came on-board near the consumer units. The switch I chose is a double-pole model labelled "Shore-Off-Gen", I know that in my case 'Gen' refers to the inverter so here's no confusion. As always I aimed to fit the switch to make it look 'part of the furniture'.

29 Running wiring in conduits







29: I could now complete the trunking of the wiring by opening the split conduit running across the engine compartment and feeding the control panel cable into the loom. Because this was a low current cable it was perfectly OK to run it with the rest of the 12 volt system wiring.

With the mains cabling and the remote panel cable running into the locker where the Phoenix was housed, the last set of cables I had to sort out were those connected to the battery. The makers recommend a direct connection betweenthe Phoenix and the battery, but I use my battery banks in turn rather then all at once, so the battery connections were taken from the '1, 2, Both' switch in the fuse compartment. Thanks to some unusual foresight when building *Pershilla*, the cables running to the switch were more than adequate to carry the inverter current.

30: It's important to use the correct size of cable for the battery connections, because the drain on full inverter power is substantial. The cross-sectional size recommended for this model was 70mm^2 which is about the largest standard cable size available. You can adequately solder large terminals, but the recommended method is to use a heavy-duty crimping tool.

31: The first task was to adjust the setting on the crimping tool to suit the size of terminal.

32: Showing how we trimmed back the outer sheathing on the cable to allow the terminal to slip over the core strands.

33: After that,the terminal was then placed in position.

34: The assembled cable and terminal were placed into the jaws of the crimping tool.

35: Firm and steady pressure was applied to the crimping tool in order to close the terminal on to the cable inner core.

36: The final crimped effect provides a secure grip on the cable core. The outer sheathing was then drawn up to the terminal and followed by heat shrink sleeving to completely protect the gap between the insulation and the terminal.

37: One final short cable run was required before final connections could be made.

This was in order to fit the all-important temperature sensor that monitors the temperature at the batteries. That, in turn, allows the Phoenix to adjust the charge voltage and maintain maximum charging efficiency.

38: This connects to either the positive or negative terminal on the main battery; either is OK


38 Connecting the temperature sensor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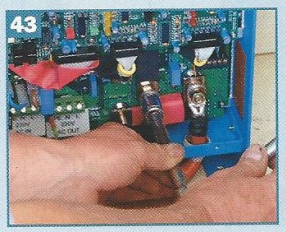
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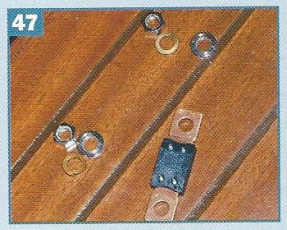
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since it's not polarity conscious although, in fact, connection to the negative post is preferred as there's no voltage present.

The cable runs were now all complete and work could begin on the final connections into the Phoenix Multi. Note that at this stage most of the work, apart from connecting the consumer units and change-over switch, consisted of running cables, fitting trunking and conduit, and installing equipment. This is what takes the time and costs money in labour charges. The final connections take a professional only a few hours!

39: The first connection you have to make into the Phoenix Multi is the earth lead from the body of the unit to a suitable ground plate usually beneath the hull. The terminal is located beneath the unit and means it must be connected before installation. Or in this case by removing and then refitting the unit!

40: In the case of *Pershilla's* steel hull this connection was made to the ground connection on the hull inside the engine compartment. I plan to install an external ground plate, which will be fully insulated from the rest of the hull, during the winter haul out to avoid any possibility of electrolytic corrosion.

41: Beginning with the battery cables I first cut out the centres of the seals, which were provided with the Phoenix . . .

42: . . . and slipped them over the cables prior to installation.

43: All the cables are fed in from the bottom. The battery cables were brought in first and loosely connected on to their appropriate terminals, which are all clearly labelled or colour coded.

They were then tightened using a socket. At this stage the cables weren't connected to the batteries so there was absolutely no danger of short circuits).

44: Next came the mains cables, again clearly labelled AC IN (the mains feed in to the charger section) and AC OUT (power out from the inverter).

45: The temperature sensor cable terminates in a removable block that simply unplugs from the circuit board to allow access to the securing screws.

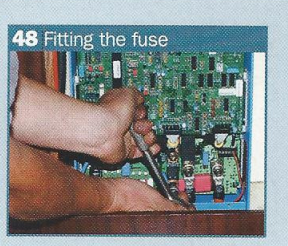
NOTE:
This block is the connection for two further optional features that I wasn't intending to use. One is the voltage sensor cable that compensates for voltage loss through the wiring, but with short runs and heavy cables I don't think that should be a problem.
The other is a low amperage trickle-charge for the engine starting battery that allows the battery to be charged without connecting it to the domestic batteries – but I prefer to select the battery to be charged via a separate switch.

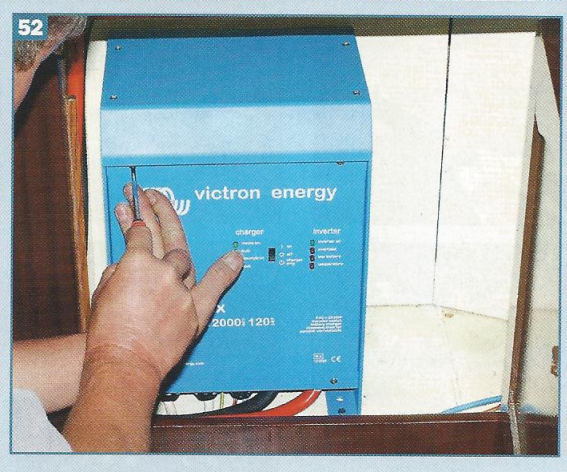
46: Final cable connection into the Phoenix was the remote panel cable that simply plugs into a dedicated socket identical to the one on the panel itself.

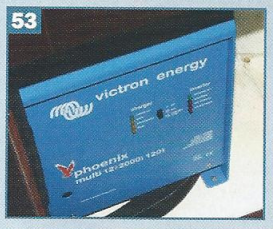
47: Last of all, the 300 amp Megafuse was fitted using the nuts and washers provided.

48: This fits alongside the battery cable connections and was again carefully tightened using a socket.

At this point the connections to the battery can be made, or, as here, to the change-over switch. Once power is available from the battery, take care not to short circuit anything within the Phoenix. This is especially important when the final settings are being made, because the unit must be running with the







covers off. That's why the instructions say that only qualified technicians should make these adjustments, not because there's anything particularly complex or difficult about them.

49: The final set-up involves using the Dip switches located at the top left of the circuit board, the two push buttons adjacent to the Dip switches, and the warning lights that in set-up mode show the setting being made.

50: After referring to the installation handbook for details of the many settings that can be applied to the Phoenix Multi the first task was to set the top Dip switch to 'on', which puts the Phoenix into set-up mode. You then move the other Dip switches to the combination for the setting to be adjusted.

51: The warning lights come on in sequence to show the current setting. Each light provides a different value depending on whether it's flashing or steady and the combination of lights illuminated gives the current setting. It sounds complicated but in practice it's easy.

Once again the installation manual provides clear instruction. The setting is then adjusted by pressing the up or down button until the value required is shown by the warning lights.

When the required setting has been finalised, the Dip switches must be moved to another setting mode before you return the top Dip to the operating position. If you do that without moving to another setting mode the new setting won't be accepted and will return to the previous or default setting. Even so, setting up the Phoenix is reassuringly straightforward.The default settings will suit the majority of boats with possibly the battery type being the only one that may need any alteration. This was certainly true in our case. The settings that can be changed include: Voltage Frequency (50Hz or 60Hz),Battery Type – and Charging functions

52: The moment of truth! Once all the required settings have been sorted out and finally completed you can put the covers back on and start testing the unit itself to make sure it's OK.

53: In this particular installation the final task I had to undertake was really just a question of finishing off and involved finding a practical way of protecting the cables within the locker.

As you can see right at the bottom of this shot of the cover I decided to use split conduit for the battery cables;I also opted for snap-top trunking for the mains cables.

54: Once you have the Phoenix up and running – or to be slightly more technical in 'operation mode' – the remote control panel lights will illuminate automatically.

SO, WAS IT WORTH IT?

With care, the job's not unduly difficult, especially if you're familiar with mains equipment. The Phoenix Multi is a sophisticated piece of equipment that automatically switches from shore power to inverter power in the event of power failure. And it does it instantly, with no detectable break in supply, which is ideal when you're working on a computer for example. When power is restored it automatically synchronises with the supply before switching off and returning to battery charging mode. Several Multis may be linked to double or treble the power if one is insufficient; alternatively three may be linked to provide a three-phase supply.

The Phoenix Multi Plus is even more sophisticated since it will augment low shore power supply to provide the required power for high draw on-board equipment. Most of these facilities are beyond our needs, but who knows what we may need in the future.

MANUFACTURER'S REPLY:

Rather than fitting a manual bypass switch we would recommend making full use of the internal transfer switch. In that way, the Power Control and Power Assist will automatically compensate your system for shortages in the shore power. So, if you have only 6A available from shore but, for a short period, you need 16, the battery charger will stop and the inverter will add power. Then, switching the kettle on for a minute or two won't trip the shore supply.

Once the kettle has boiled the unit continues charging the batteries. You might also make use of the earth relay that makes a connection between the neutral and earth when the inverter is running – to ensure that your RCD works properly.

Since the article was written, we've introduced the Compact 'Easy' version which combines all the functions of the Multi with an in-built distribution panel which makes the installation of a sophisticated system really simple.