Boat Monitoring System
Operation Manual

Relay Box

Battery Box &
Temperature Sensor

Intruder, Humidity &
Temperature Detector Box

Bilge Box with Gas &
Float Sensor

IMPORTANT SAFETY INSTRUCTIONS

For your personal safety, please read these instructions. Do not operate the product if you do not understand how to use it safely. Save these instructions for future reference.

Warning Symbols used in these instructions

Safety cautions are included in these instructions. These safety instructions must be followed to avoid possible injury and avoid possible damage to the product

WARNING!
Where there is a risk of personal injury or injury to others, comments appear supported by the warning triangle symbol. Where there is a risk of damage to the product, associated equipment, process or surroundings, comments appear supported by the word 'Caution'

ELECTRIC SHOCK.
Where there is a risk of electric shock, comments appear supported by the hazardous voltage warning triangle.

Please note the Network system used to interconnect these items is not intended to be connected to any existing networks. The system is only to be used to interconnect the Boat Monitoring system components.

Connecting into any other networks may cause damage to this and/or any other network components!

Always power off the main box before connecting new boxes into the network.

Boat Monitoring System Operation Manual

Contents

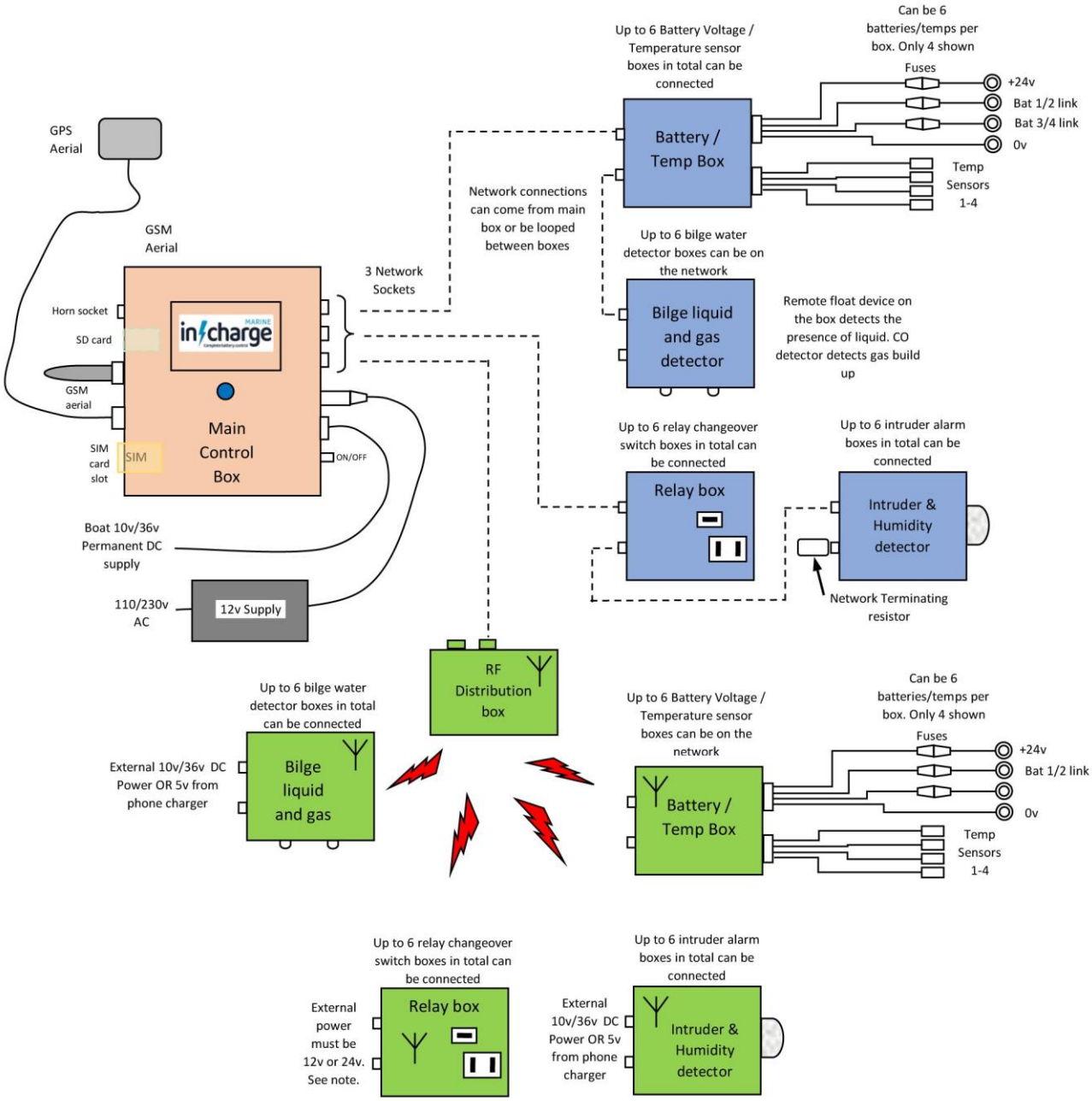
General Features

- The remote boat monitoring system provides a fully comprehensive way of monitoring your boat from a remote location (anywhere in the world).
- One way to check the boat status is by sending text messages which provide a reply with details of the function you have queried.
- An easier way of checking is by monitoring a mobile friendly website on your computer or smart phone which provides information on all of the details that can be monitored on the boat.
- Text message alarms can be set to automatically send you a text message if something exceeds the parameters you have set in the system. (E.g., battery voltage or temperature).
- Low running costs! The only on-going costs of running the system are for a sim card which is capable of sending and receiving text messages, and a small amount of data if you wish to monitor on the website. Typically, £6 per month for unlimited texts depending on sim supplier.
- No router or connection to a broadband network is necessary.
- The system can be expanded from the basic system, with 'peripheral boxes' which add additional monitoring of things as described below.

System Components

- The basic system consists of a '**Main Control Box**' which provides GPS monitoring and tracking, and an 'AC Loss' function which will let you know if the boat has lost AC power.
- Up to 6 of each type of peripheral box can be added to monitor extra functions. These can be connected using standard network cables, or by the addition of an RF distribution box, they can connect wirelessly to the main control box.
- **Battery Box**:- Up to 6 battery 'boxes' can monitor up to 6 batteries in each box. This includes individually monitoring each 12v battery in a 24v system. The temperature of each battery is also monitored to provide warnings if any battery is being overcharged.
- **Bilge Box**:- Up to 6 bilge boxes monitor any liquid in the bilge, and also check for CO and other flammable gases which may be building up in the bottom of the boat.
- **Intruder Box**:- Up to 6 intruder boxes check for human movement up to 12m from the box. These boxes also provide humidity and temperature measurement at the box location.
- **Relay Box**:- Up to 6 relay boxes can be remotely controlled to switch items on the boat such as lights or small battery chargers. They can switch up to 20 amps DC or AC, up to 240volts. They can be switched manually by a text message or setup to switch according to 'timed' settings.

Installation Example Diagram



Notes:-
RF Battery Boxes do not need an external power supply as they are powered by the battery they are connected to.
RF Relay boxes need external power of either 12v or 24v which needs to be specified when ordering.
Box connections may be mixed between Network or RF.
Network connections can be 'looped' between boxes including the RF distribution box. Note the terminating connector on the network which is supplied with the main control box.
Boxes bought for RF connection can also be used to plug into the network.

System Basics

- A SIM card is used in the main control box to allow text messages to be sent to and from the boat. The SIM does not require a data contract if you are only using text messages and quite often PAYG Sim's can be used which give you 'Free Unlimited Text Messages'. With the addition of a small amount of data per month you can use the website to monitor the status of all the detection systems fitted to your boat.
- Phone numbers of people who are allowed to access the system are programmed into the control box. Up to 15 numbers can be stored. The first 4 numbers stored in positions 0-3, can receive error messages from the boat and allow settings to be remotely changed using text messages. The other 11 phone numbers in positions 4-14 can send texts to request the status of any of the systems being monitored, but these numbers are not allowed to make changes to settings and will not receive error messages.
- The basic system comes with the main control box which has a built in GPS/GLONASS satellite receiver, as well as the AC loss detection function. Additional 'peripheral' boxes can be added at any time and wired into the system using standard network cables.
- Peripheral boxes currently available are Battery Boxes (Up to 6 batteries in each box), combined Bilge and Gas sensing boxes, Relay switch boxes, and Intruder alarm boxes which also include a humidity and ambient temperature sensor. Up to 6 boxes of each type can be connected to the main box for monitoring. Connection can be either by standard network cables or by RF if the peripheral box is a long way from the main control box.
- A local alarm is built into the main control box, but an external 'Horn' can be added to provide a very loud warning to intruders! Text message alarms and local alarms can be independently enabled or disabled for each of the monitored systems.
- The main control box has an LCD display and 'navigation' switch which enables full monitoring and setting up of all the connected peripheral boxes. Comprehensive text messages are also available to remotely change settings.
- The GPS system allows easy detection of boat movements using a defined circle with pre-settable radius, allowing easy monitoring if the anchor drags, causing the boat to move outside the circle. This is done by a text warning message from the boat if you leave it to go to the beach or a restaurant.
- The 'AC loss' detection system is built into the main control box and provides a warning (text or local alarm) if AC power to the boat is lost. A further message will be sent when the AC is restored.
- All battery boxes are completely isolated from each other and the main control box. Although the boat internal wiring probably connects all the battery negatives together, this may not be the case and wiring multiple battery boxes into the system does not join the negatives together. The battery boxes take only a few milliamps (7ma @ 24v, 10ma @12v) from the batteries so will not cause batteries to significantly discharge if charging is lost for long periods of time. All connections to the batteries have individual low amperage fuses very close to the battery terminals to prevent any possibility of problems caused by short circuits in the wiring. Other peripheral boxes are powered over the network cables or an external supply in the case of RF boxes.

SIM Card setup

The SIM Card can be any full-size SIM which would work in a mobile phone. It is sometimes an advantage to use a SIM from the same supplier as that used in your own mobile phone. This is by no means essential though, and many sims are available free, with either PAYG or cheap monthly contracts providing unlimited numbers of free text messages.

The appendix at the end of this manual shows some of the more common suppliers. Contract costs are changing all the time of course, so it's best to check regularly for the best deals. If the boat is in a different country, then you need to consider whether to get a sim from a local company, and possibly have to pay for texts sent to your location or getting a sim from the country in which you live, and possibly having to pay for outgoing text messages to the boat. Some company's sims allow you to use them abroad with no extra charges though by giving you the same deal as when you are at home. GiffGaff are highly recommended as the sims are free and there is no contract. For £6 per month, you get unlimited free texts at home and in lots of other countries.

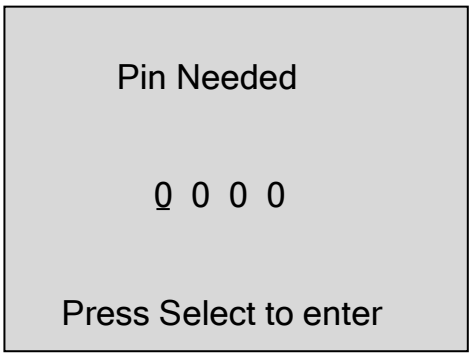
The LCD screen shown here is displayed during system start-up. The first message to appear on the screen is 'Checking Boxes'. This looks for all the possible connected peripheral boxes. After this the message 'Starting…'. shows that system is connecting and registering on the phone network.

There will be a message saying, 'Checking SIM'. If there is no SIM present you can still monitor the complete system without a SIM card by following the option to 'Click Right' which will enter the main menu without checking other features associated with the SIM card.

If a SIM card is detected there will then be a line saying SIM Card, followed by a message from the SIM card itself, probably saying 'READY', but possibly saying 'NOT READY', or 'SIM PIN'. Assuming for now it says 'READY' this will be followed by a 'Registering…' message showing it is trying to register with one of the local service providers. This will be followed by either 'Registered HOME' or 'Registered ROAMING' depending on whether the SIM card is in its home country or not. Immediately after this the screen will jump to displaying the main menu. The menus are fully described in the Main Menu section of this manual.

If the SIM card says SIM PIN, then it will move on to the screen shown here asking for the pin no. Use the Left/Right navigation switches to move the cursor to the number to be set, and the Up/Down switches to change the number. When the number is entered correctly, press the centre switch and you should receive a 'Success' message on the next screen before the system will re-start as described earlier.

You will only get 3 attempts at entering the correct PIN no. If this fails, then you will need to get the PUK no. of the SIM card from the SIM provider and put the SIM into a mobile phone to reset the PUK and PIN numbers. If you have to do this, then at the same time you can disable the PIN no. entry to save having to go through the process again here.



If you have entered the correct pin number, then that will be remembered and entered automatically by the system which will not ask for it again.

There are two LEDs to the left side of the SIM card slot. The upper green one shows that the SIM card is powered and the lower yellow one shows when the system is connected to the phone network. If the SIM has trouble connecting to the network, or it loses its connection, it may occasionally turn off the SIM power and start again. The yellow led will flash quite quickly when not connected to a network but then reduce to flashing about every 2-3secs when fully connected and registered on the network. If the GPRS data is turned on to allow monitoring on the website, then the yellow LED will blink very rapidly to show the data connection is working.

Check the Appendix for details of typical sim card default pin numbers, together with other relevant sim card details.

Phone No. Setup

Before any text monitoring messages can be sent to the main unit SIM card, the phone numbers that are allowed to do this must be setup using text messages.

There are 15 locations which can hold phone numbers designated 0 – 14. It is best to keep a record of which positions have been used and the numbers stored in each position. The locations don't have to be filled in order, any location can be programmed with a phone number which can then access the system.

Locations 0-3 are special in that numbers stored in these locations will receive error messages from the boat (if those messages are enabled). Those phone numbers stored in locations 0 - 3 can also send messages which change settings stored in the system.

Locations 4-14 can only send text messages to view the current status of any of the systems. They will not receive error messages from the system or be able to change any of the system parameters.

To store a phone number, send a text in the following format:-

#{0-14}=+447860382881 Always use the international dialling code format starting with the + symbol. This is followed by the country code and then the number. Spaces are not allowed anywhere in the text message. The maximum no. of digits including the + sign and country code is 15 which meets international standards. However, longer numbers can be stored if the location following that being stored, is left blank.

Sending a message to a location that has already been used will simply overwrite the previously stored number. However, a number can be deleted by sending #{0-14}= with nothing following the = sign.

After the message has been sent you should receive a reply stating, 'No. stored OK'. Otherwise, you may receive a message saying, 'Message not understood'. Don't send a new message until a reply has been received. If nothing has been received for at least 1 minute, then you can assume that message did not get through for some reason and you can try again.

When sending a text message to request information from the system, the reply will only be sent to the phone number that sent the message.

Main Control Box

The main control box shown here has an LCD display and small 'navigation' switch which allows monitoring of the connected peripheral boxes. Settings can also be made here for all the various parameters which must be met before an alarm is generated.

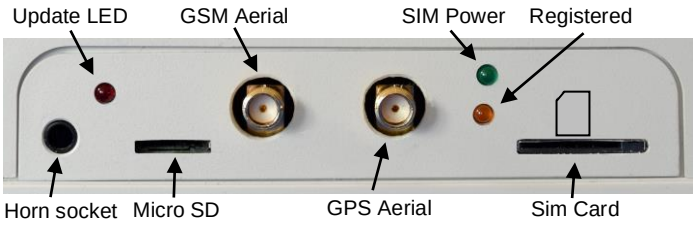
The box has both an internal alarm and also provision for an external 'horn' which is an option providing a very loud alarm sound.

Alarms can be enabled or disabled separately for all the functions, both for the local alarms and text message alarms. This can be done from this control box or using text messages.

Although it could be useful to have the box fitted somewhere on the boat where you can view it all the time, this is not essential. When outside cell tower range the local alarms will still work, although the box must be in a location where you can hear (and cancel) the alarm! Using the 'RF' option greatly simplifies any cabling, although the peripheral boxes (except battery boxes) will then need a local power supply. Fitting will be completely dependent on the type of boat and number of peripheral boxes being fitted. Anything that can be set with the menus shown on the LCD screen can also be set using text messages. (Except for local alarm enabling).

Control box connections

Before describing the box operation in detail, it is worth mentioning the various connections provided on the box itself.

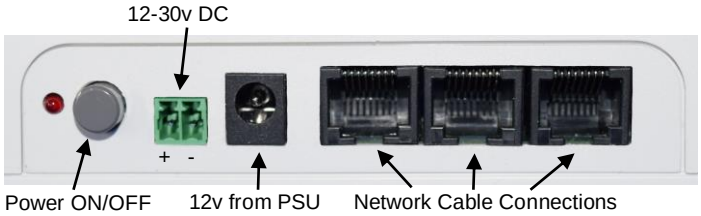


On the left-hand side there are two aerial sockets. The left hand one is for the GSM phone signal and can normally be a small stubby aerial as provided with the system. The right hand one is for the GPS/GNSS satellite system. The supplied aerial for this has a 3m cable enabling the aerial to be mounted further away from the box in the case where the box might be in the engine room for instance. The system is very sensitive, and the aerial does not need to be mounted on the outside of the boat. As long as it is not shielded by any metal structures it should work reliably. It is magnetic so can be mounted onto a metal surface as long as the metal surface is not between the aerial and the sky!

To the right of the GPS aerial socket is the slot for the SIM Card. This will be described in more detail later, as you will need a SIM Card to enable the text messaging system to operate to remote mobile phones. This has two associated led's to show if it is powered and connected to the local phone network.

To the left of the GSM aerial is a small slot which allows a Micro SD Card to be inserted. This is used purely for updating the internal software of the unit. More detail on this later.

There is also a 3.5mm jack socket here as well. This is used to plug in the external horn sounder if required.



On the right-hand side of the box towards the right side are three network sockets. These are used to connect to the peripheral boxes. The peripheral box network connections can also be extended as they all have two network sockets each, to allow the system to have more than just the three boxes that can be connected to the main box. The limit of boxes on the network is approximately 10 (depending on cable lengths etc.) For more than 10 boxes on the system it is best to use the RF connection method. There is no limit to the number of boxes connected by RF. The system allows some boxes to be connected using the network cables and others to use the RF system.

To the left is a DC connector for the mains 12v PSU supplied with the system. Next to that is a 2 pin DC connector which should have local permanent DC from the boat's batteries. The voltage here can be anything from 10v – 36v. This is required so that the system still has power to send a warning text message if the boat loses its AC mains supply unexpectedly. The DC power consumption here is around 50ma on average if the AC power is lost.

An ON/OFF push switch with associated led indicator allows the system to be switched on and off. The switch switches off both the 12v power from the PSU, and the 10v-36v DC input.

Control box menus - The following describes the available menu options.

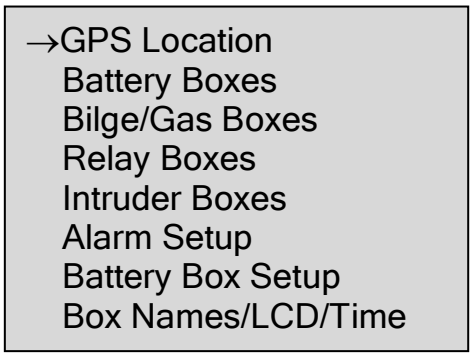
The 'navigation' switch has 5 built-in switches and can be moved in four directions and also pressed to select the various menu functions. In general, moving the switch to the left will return to a previous menu and moving to the right will select a sub-menu or function. Up/Down movements will usually increase or decrease values and the 'press' center function may also be used to select items. Anywhere in the manual where it mentions press the 'Select' key this means pressing the center of the navigation switch. Different menu screens may use the switch functions differently though and are described in detail here.

Main menu

The main menu shown here allows selection of individual sub-menus allowing everything to be setup and/or checked.

It can always be reached by continual pressing left with the navigation switch.

Moving the switch up or down will move the arrow up and down and then moving to the right will move into the next sub-menu. Moving up from the top position will jump to the bottom position and vice versa. This applies to all menus selected using an arrow to select items.



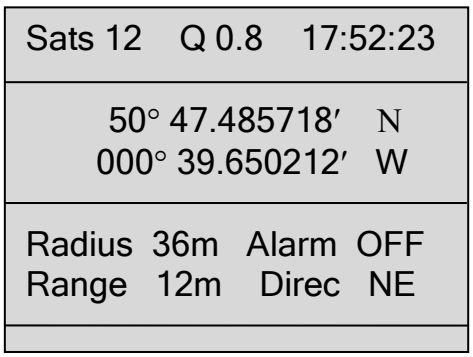
GPS Location Menu

The GPS screen shown here shows all the GPS functions and allows a couple of settings to be changed.

The top row shows the number of satellites being used for finding the current location. This is followed by the 'Q' number which represents how good the fix is in terms of the satellites position in the sky.

Following this is the current time derived from the satellites. This is known as UTC time which stands for Universal Time Coordinated.

In the center section of the display is the position in Lat and Long format of degrees and decimal minutes.



The lower section of the display shows the current 'Radius' of a circle which can be set to generate an alarm if the 'Range' exceeds this value. Moving the navigation switch up or down changes the radius value in 5m steps up to a maximum of 99m. Pressing and holding the center of the navigation switch for 3 seconds will reset the boat location to the center of the circle. Hold the Select switch down until the range changes to 0m showing the center point has been reset. The Alarm shows ON or OFF depending on whether the location text message alarm has been enabled. This is done in the Alarm Setup menu described later. Finally, the direction shows the direction of the boat from the originally set center point of the circle.

GPS associated text messages:- *(Note all characters can be in upper or lower case)*

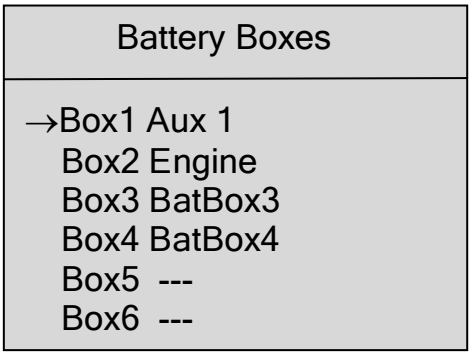
Text Alarms: An alarm will be sent to a phone (see later how phone numbers are setup to receive error messages) if GPS text alarms are enabled, and the boat moves outside the radius of the circle. The alarm message will show the current location, no. of satellites and Q value together with the current range setting, and distance/direction of the boat from the circle center point. Another text with similar details will be sent if the boat moves back inside the circle. A local alarm can also be set to sound the box internal alarm in a similar situation while onboard.

Text Messages to check/set GPS status: The following text messages can be sent to the system. LOCATION will return the current status of the GPS system showing position, no. of

satellites, Q value, radius, range, and direction. LOCATION=ON will turn on the text alarm messages and set the boat position to the center of the circle. LOCATION=OFF will turn off the text alarm messages for GPS functions. LOCATION=ON:45 will turn on the text alarms and set the radius of the circle to a new value. Values can be entered as 1 – 99 and represent distances in meters. LOCATION=56 will just change the radius of the circle without changing the ON/OFF status. A message LOCATION=GPS can also be sent. This returns a location position as a URL where you can just touch the reply message on your phone to take you directly to a 'maps' app on your phone to display the boat position.

Battery Boxes Menu

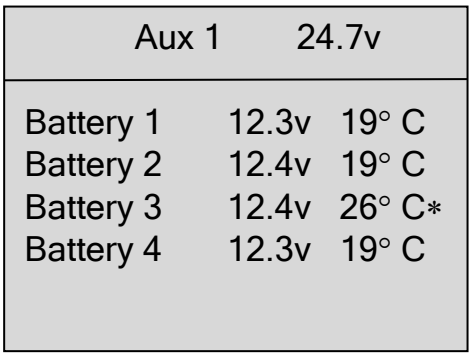
The 2nd item on the main menu is 'Battery Boxes' There are 6 sub menus here to cover the possible 6 separate battery boxes.



All boxes can be given individual names to make them more meaningful. The top 2 here have been named 'Aux 1' and 'Engine'. Boxes which have not been discovered on the system have dashes to show they do not exist. The default 'BatBox' names can be changed in a later menu, or by text message.

Select the box you want to check using the up/down switches and then click right to select that box.

A new menu will be displayed as shown here showing all the volts and temperatures of the batteries in the selected box.



The top line of the display will show the total voltage of the box with individual battery voltages and temperatures shown below. Note that batteries 1 and 2 are a 'pair' of 12v batteries in a box making up the 24v in that box. Their total voltage will always equal the total voltage shown at the top of the display. Similarly, for batteries 3 and 4. The number of batteries in a box is worked out automatically by checking the connections made to the box. In the case of 24v systems where there is a connection to the junction point of a 'pair' of batteries this is used to work out the number of batteries. For 12v systems where there are only two connections to the battery box, the number of temperature sensors in the system is used to automatically work out the total number of batteries. See later for full wiring details of battery boxes.

Battery system text messages:- *(Note all characters can be in upper or lower case)*

Text Alarms: An alarm will be sent to a phone if the battery voltage or temperature text alarms are enabled. Text alarm messages show a screen like the LCD display, but with the addition of the preset values that you have set to show the limits of voltage and temperature that you allow the system to tolerate before sending an alarm. A * will show the reason for the alarm text being sent. A second message will be sent later saying that the fault has been cleared if say it was caused by the battery charger going into a high charge mode, or the engines being started, increasing the voltage above the preset level due to charging.

Text Messages to check/set battery status: The following text messages can be sent to the system. BB{1-6} will generate a text reply showing the volts and temps of all the batteries in that box, together with the preset values you have set for that box. These will be Volts Max, Volts Min, Volts difference, Temps Max and Temps difference. The reply will show the name you have set for that box, but it saves a lot of typing if you can just send – BB1 or Bb2 etc. BB{1-6}=ON will enable both temperature and voltage text error messages to be sent to allowed phones. BB{1-6}=OFFV will disable voltage error messages but still allow temperature error messages and BB{1-6}=OFFT will disable temperature error messages

while still allowing voltage errors to generate an error text message. BB{1-6}=”Engine” will change the default name for a box to the specified one. Spaces are allowed in the text between the “ ” but not anywhere else in the message. Numbers and most symbols are allowed. The maximum no. of characters allowed is 8.

BB{1-6}=ON:vmax:vmin:vdiff:tmax:tdiff is used to set the parameters separately for each box. Example:- BB1=ON:24.6:23.9:1.5:35:4 This would set the max overall box volts to be 24.6v, overall min volts to be 23.9v, max difference between any 2 batteries to 1.5v. Max individual battery temperature to be 35degC and max difference between battery temperatures to be 4degC. Any actual battery/temperature values outside this range will generate an error if errors are enabled.

Note that volts can be entered as 2.5 or 24.6 but must have a decimal point before the last digit. A 0 must be entered, e.g., 25.0 as just 25 is not allowed. Temperatures can be entered as 1 or 2 digits i.e., 34 or 6 etc. These settings are different for each battery box. If the message is sent to a battery box which does not exist, then a ‘Box not found’ error message will be returned. If there is a format error in the text entry, then a ‘Message not understood’ error will be returned.

Not all values must be sent. If a : is not present after a value, then only values previous to that will be updated. E.g., BB3=ON:27.3:24.1 will only update the vmax and vmin values in the system.

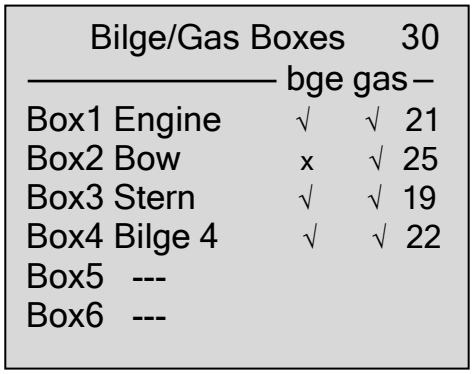
Note that these settings can be confirmed by issuing just a BB{1-6} message. The current max/min/diff values are displayed at the bottom of the returned message.

Any deviations in the values from the preset values will have a * by them. The temperature error shown here will have caused a text error message if texts have been enabled, or a local alarm if local alarms are enabled. Local errors will cause the system to jump immediately to the page showing the error and the alarm sound can then be cancelled by any movement of the navigation switch. This will disable all local alarms for 15minutes.

If the error clears, then another text will be sent saying that the error is cleared and displaying a message similar to the page on the LCD screen.

Bilge/Gas Boxes Menu

The next item on the main menu is Bilge/Gas Boxes. This menu does not have sub menus as all 6 boxes can be shown on a single screen as shown here.



The top row displays the title followed by a number. The number is the value above which a gas value will generate an error.

The default name for these boxes is Bilge 1, Bilge 2 etc. Here the first three boxes have been renamed Engine, Bow and Stern. Boxes 5 and 6 do not exist in the system. A tick shows that there is no water or gas being detected by those sensors whereas a cross is showing that there is some water in the bow bilge area. The numbers after the gas indication show the amount of gas being detected. The numbers do not show calibrated values just an indication of the level of either CO or other combustible gases being detected. The normal value may vary between about 1 – 20 but would normally stabilize at less than 10 after about 3 or 4 hours. If the value increases above this then suspect that some gas may be present. Exhaust gases will increase this value considerably so it can be useful for detecting exhaust leaks while motoring. The maximum value is 255. The level at which point an error is generated can be set by text message as shown below. The default error value is 30. The value can also be changed using the up/down switches on the control box.

Note that the time between gas checks is about 150 secs. This is because there is a special sequence of heating the gas detector element before taking a reading. For the first minute after switching on the value will show as 0.

Bilge/Gas system text messages:- *(Note all characters can be in upper or lower case)*

Text Alarms: An alarm will be sent to a phone if either water or gas is detected on any of the boxes that are fitted. The text has a similar format to the LCD screen display. A second text will be sent if the error is cleared.

Text Messages to check/set bilge/gas status: The following text messages can be sent to the system. BILGE by itself will return a text reply showing a display like the LCD screen showing the status of the sensors. BILGE=ON will enable error text messages, while BILGE=OFF will disable them. BILGE=ON:75 will turn on the error messages and set the point at which a Gas error message is generated. BG{1-6)="Stern" sets the name for a particular box. LCD screen displays and text message replies will then use this name instead of the default names. Note the gas value can also be added after the OFF command.

Relay Boxes Menu

The relay boxes have a 20A changeover relay in them which allows connecting or disconnecting electrical connections between items. They can switch either Mains AC 240v circuits or DC circuits at up to 20A. This can be useful for remote switching of external boat lights, small battery chargers or any other electrical equipment.

Relay Boxes	
→Box1 Relay 1	ON
Box2 Relay 2	OFF
Box3 Relay 3	OFF
Box4 Relay 4	OFF
Box5 ---	
Box6 ---	

Note that for safety reasons the Relay box should be mounted inside another 'safety' box if AC mains is being switched. Always use fully insulated terminals for the connections. If DC voltages are being switched, then the extra box is not required, although fully insulated terminals should still be used.

The main screen allows selection of individual boxes using the up/down and right navigation switch functions. It also shows the current state of any existing relay boxes.

Relay 1	ON
→Manual/Timed	Manual
Set ON/OFF	OFF

The next screen shown here allows settings to be made for each relay box.

Boxes can be set to operate either directly in 'Manual' mode where the relay will immediately follow the setting made on the menu screen, or it can be set to operate from a 'Timed' setting described below.

To set the relay state manually click down on the navigation switch to place the cursor opposite the Set line. Then use click right on the navigation switch to toggle the relay on and off. The ON/OFF display on the screen will change immediately to show your required setting, but the indication in the top row of the display will not change until a reply has been received from the relay box confirming that it has switched. The delay here may be up to 10 seconds as the boxes are controlled and monitored roughly every 10 seconds.

Relay 1	ON
→Manual/Timed	Timed
On Time	Tue 12:47
Off Time	Wed 22:06

To set a timed on/off function first move the cursor to the top line as shown here and click right to toggle between Manual and Timed. The timed display is shown here. The ON time is set by moving the cursor to the 'On' row and then clicking to the right. A flashing cursor will appear under the day of the week and the up/down switches will then step through the 7 days of the week and also provide an 'All' option. The All

option, if set on both On and Off times will switch the relay at the on and off times every day of the week. Once the day has been set, click to the right to set the on hours time and then to the right again to set the on minutes. The Off time is set in a similar way. Click to the left to move back to the column that allows moving the arrow up and down to select the different functions. If the setting is returned to manual mode, then any previously set times will be remembered if the timed mode is re-selected. Further clicks to the left will return to previous menus as usual.

IMPORTANT Note: If the on day is to ALL then you should also set the off day to ALL. Otherwise the relay may switch on or off at unpredictable times.

Relay system text messages:- *(Note all characters can be in upper or lower case)*

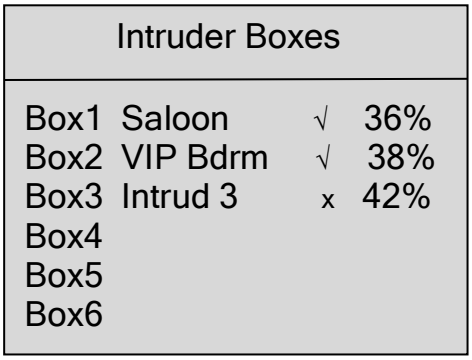
Text Alarms: There no text alarms associated with the relay boxes.

Text Messages to check/set relay status: The following text messages can be sent to the system. RELAY on its own will return a text message showing the current state of all relay boxes in the system. REL{1-6}=ON will set that particular relay to the ON position immediately. REL{1-6}=OFF will immediately turn OFF the chosen relay. REL{1-6}="Lights" sets the name for the given relay box. See previously for allowed parameters.

REL{1-6}=TIMED:onday:onhours:onmins:offday:offhours:offmins This message allows performing timed settings using a text message. If a : follows 'Timed' then the following data will set the timings. Day is 1 digit from 0-7 where 0 = 'All days', 1= Sunday – 7=Saturday. All values must have 2 digits apart from Days which is 1 digit. Example:-
REL2=Timed:2:11:23:3:22:41

Note that the times used for relay timings are 'Local' time rather than UTC. See later for how to set an offset in the hours to generate local time from UTC.

Intruder Boxes Menu



The intruder boxes have a PIR detector with a range of around 12m to detect human presence near the box. This can be used for detecting if someone has boarded your boat and is moving around within range of the box(es).

The Intruder box also has a humidity sensor with the humidity value shown to the right on this screen. A temperature measurement is also provided which can be monitored with text messages and on the website.

This one menu display shows the state of all the intruder boxes. A tick will show no detected movement, while a x will show movement is currently being detected. The default name for boxes is 'Intrud 1' etc. These can be changed as for any other type of box either from the menus or with a text message.

Text Alarms: If intruder text alarms are enabled then a text will be received showing a screen like the one on the LCD. When movement is no longer being detected another text will be sent saying the error is now clear.

Text Messages to check/set intruder status: The following text messages can be sent to the system. INTRUDER on its own will return a text message showing the current state of all intruder boxes in the system. INTRUDER=ON will enable the alarm text messages and INTRUDER=OFF will disable them. Local alarms can be set independently using the LCD menus only. IN{1-6}="Saloon" will set the names for individual boxes.

Alarm Setup Menu

The Alarm Setup menu sets which alarms are enabled or disabled. Text and local alarms are set independently, and text alarms can of course be turned on and off using text messages as described previously.

Alarm Enables	Text	Local
Location	√	√
Batteries	x	x
Temps	√	x
Bilge/Gas	√	√
Intruder	√	√
AC Loss	√	√

The local alarms consist of an internal sounder in the main control box with the option of a very loud 'Horn' which can be plugged in externally to the main control box.

The local alarm will sound for 30seconds and then cancel to prevent annoyance! One way to clear a local alarm immediately is to move the navigation switch in any direction. This will disable any local alarm. Another way to disable the local alarms immediately is to send the text message ALARM=OFF. Once the local alarms are disabled, they will remain disabled until they are enabled again by sending the text ALARM=ON or by changing any of the local alarm settings in the Alarm Setup menu on the main box.

If the local alarms have been disabled, a small 'x' will show in the top row after the words 'Alarm Enables' regardless of the state of any of the individual enables. The website will also show this with the message 'Local OFF' on the Alarms screen.

It is always a good idea to set the text alarm for any local alarms that are set, so that you know there has been a problem if you are not on board. The local alarms are particularly useful for bilge gas errors that might indicate an exhaust leak while your engines are running. Also, for location errors if you are anchored and want to know if you have drifted outside your preset radius.

The navigation switch works slightly differently on this menu. Clicking right will toggle between the text and local alarm status columns for the row containing the small underline flashing cursor. Pressing Select will toggle the status of the chosen alarm which is currently underlined by the flashing cursor. Up/Down will move the cursor up and down in the current column. Use a right click to move between columns. A left click will move from the local to the text column, or if it is already in the text column will return to the main menu.

The AC Loss settings will show if AC Mains power has been lost on the main control box. This is because the 12v power supply will be powered from AC. Therefore, a permanent DC feed is also required on the control box to power it if Mains is lost. There is a delay of 60secs after a power loss before a text is sent, and a delay of 30secs after power is restored. When power is lost the system will also perform a restart using the DC supply.

Battery Box Setup Menu

The next option working down the main menu selections is the battery box setup. This is where all the values are set for volts and temperature limits before an alarm is generated. There are six sub menus here, one for each battery box.

First, select the battery box where you want to set the limit values before an alarm is generated.

The top row of the selected box shows the box name followed by the overall voltage of that box. If it is outside the limits set by max or min volts, then a * will appear showing an error.

Aux 1	24.5v
Volts Max	28.0v
Volts Min	24.2v
Volts Diff	1.4v
Temps Max	35°C
Temps Diff	05°C

A flashing cursor shows which setting will be changed by the up/down navigation switch.

Clicking right will step through all the possible settings and then return to the top again. Settings for values before and after the decimal point are done separately to speed up the process!

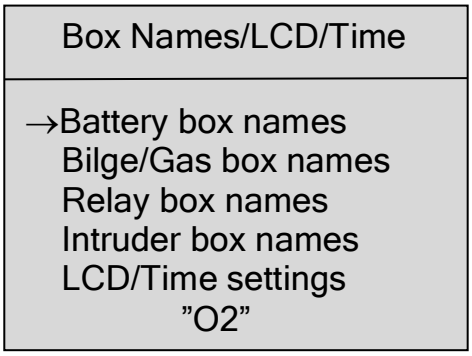
The Volts Max setting is the voltage where if the battery box exceeds this voltage, then an error will be generated. Volts

Min is the value where if the battery box volts drop below this then an error will be generated. Volts Diff is the value where if any two batteries have more than that difference in their voltages an error will be generated. The default voltage settings will be different if the system has detected that the box being set is a 12v box rather than a 24v one.

Temps Max is the value at which an error is generated if any battery temperature sensor exceeds this value. Temps Diff is the value at which an error is generated if any two batteries have a temperature difference greater than this value.

Box Names/LCD/Time Menu

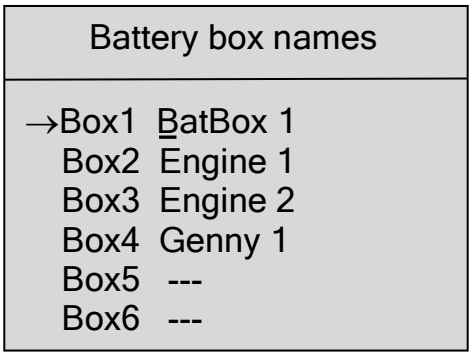
This is the final menu selection available from the main menu. Note that it may take a couple of seconds for this menu to appear after clicking right. There are sub menus available for all the items here. The bottom line shows the current state of the SIM Card and the network provider if the box is registered



The Box Names selections all work in a similar way so we can just look at the Battery box names here. The idea is to be able to set a meaningful name for each of the separate battery boxes you may have connected into the system. This name will then be used anywhere that box is being referenced.

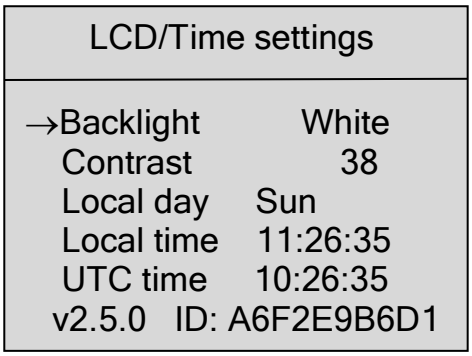
To change a name, it may be quicker to use the Text Message option described previously, but it is described here for completeness.

First, move the selection arrow to the row of the name to be changed. Then click right or press the Select on the navigation switch. The first character in the name will start flashing and the up/down switches will step through the upper- and lower-case characters, numbers, and space character. Moving left/right will move to the next or previous character. When the name is complete click left or press the Select switch again to finish the entry.



The same principle is used to set all the names for all four types of boxes which have names available.

The LCD and Local Time settings are done from the menu shown here.



The backlight colour of the LCD screen can be changed to any one of 7 colours, or off, depending on your preference. Click to the right with the navigation switch and a flashing arrow will appear to the left of the White label. Use the up/down switches to move through the different available colours, then click left once when finished.

Note that the backlight will automatically turn off after 20 mins of no movements of the navigation switch.

The Contrast of the LCD display is set in the same way. The range is 30-48 for this setting.

The local day may need setting initially depending on your time zone, so set this to the current day of the week.

The local time setting only allows changing of the hours, as the minutes and seconds are always taken from the UTC satellite time. The UTC time is generally always available even if there are no GPS satellites being received. This is because there is a battery to maintain the clock when the unit is switched off, or GPS signal lost.

The local time settings are only used for the 'Timed' relay function.

Text Alarms: There are no text alarms associated with the time functions.

Text Messages to check/set time status: The following text messages can be sent to the system. LOCALTIME (No spaces) will return a text message showing the current UTC and Local times. LOCALTIME=day:hour sets the current day and the hours difference between UTC and local time. Note this is the time difference and not the actual local hour! The current day (1-7 for Sunday to Saturday) is entered after the = sign, then the difference in time between UTC and local time. The hour must be in 2 digits. E.G., 01,02,03,12,13 etc. -ve values are not allowed so to set local time to one hour earlier than UTC set the value to be 23. The returned message will show both the UTC and new current times.

The bottom line of this display shows the software version number and the Box ID code. The ID code is necessary to view your boat data on the website. It also prevents any unauthorized access to view your boat data unless you know this code.

GPRS Data system

The GPRS data system will send data to a server which makes it available to be monitored on a website. The website address is www.inchargemarine.com

This can be a very useful way to monitor all the boat systems including seeing the boat location on a map without having to send text messages. Data updates from the main control box to the website can be made as frequently as once per minute.

The amount of data required on the SIM contract is minimal for this, and update rates to the server can be set from once per minute up to once every 4.25 hours. At once per minute the data used will be approx. 35mb per month.

Sending a text message to the system which causes a change in the settings, or an error text message from the system, will automatically generate an update to the server data immediately. The website display will auto refresh either every 30 or 60 seconds. You can manually refresh your browser to see a change immediately of course.

Connecting the SIM card data system is probably the most difficult thing to get working! Different SIM suppliers have different requirements regarding the data connection. This connection is known as 'GPRS'.

The system is disabled by default but can be enabled and disabled using text messages. The enable message can also set the time delay between updates. GPRS=ON to turn the system on and GPRS=ON:15 to set the time delay to 15 minutes. GPRS=OFF will turn the system off.

If you can see the main control box then the yellow LED will start blinking rapidly if the GPRS data system is fully connected. If you are away from the box then sending a text message of just GPRS will return the details of the GPRS system and show whether it is connected or not. If you have turned on the GPRS system and the connection is not working for some reason then it will automatically keep trying to connect until it is successful. If it never connects then you can still send text messages to try to fix the problem. However, once the system has connected successfully then it is unlikely to need any further attention.

The most likely problem is if the SIM supplier requires an 'APN' for a data connection. The APN is an 'Access Point Name'. This can usually be found quite easily from the SIM providers website. It can be entered into the system using a text message such as APN="wap.vodafone.co.uk" for the Vodafone UK sim cards. Note there are no spaces and the APN must have " " around the text. The entry can be checked using the text GPRS which returns the status of the connection.

If your SIM needs the APN to be set then this should be done before sending the GPRS=ON message. It may take longer to make the connection if the GPRS is turned on before the APN is set.

After sending the GPRS=ON text message, wait a couple of minutes before using the GPRS text message to check the status of the connection.

The website has a heading menu which allows selection of any of the installed systems. If you have not yet bought a system then you will be able to see sample data on all the web pages.

If a system has been purchased then you can 'Register' your details under the 'Login' heading together with the unique control box ID code. The pages will then show the actual data from your system. Your details can also be updated later using the 'Edit Profile' option.

The top left of all the pages will show a date and time which is the last time the web page received data from your boat.

The Downloads option is available to download the latest versions of this manual and the quick start guide.

There is an option for a single user to monitor more than one boat. This will be useful for people who own more than one boat! (Or dealers looking after multiple boats).

Under the Login/Logout menu choose ‘Add boats’ to add new boat names and Box ID details. Then use the ‘Choose boat’ option to select the required boat from up to 8 added boats. This gives rapid access to viewing multiple boat details.

Web address:- www.inchargemarine.com

Text messages

This section of the manual gives details of all the possible text messages that can be sent to the system, together with possible replies.

The format of text messages is fairly strict and if an incorrect message is sent it may well return a reply of *'Message not understood'*. If that happens check that the message follows these examples exactly. No extra spaces should be used (except for box names where they are permitted).

Any characters entered may be in upper or lower case. Examples shown here are all in upper case, but this is not essential as even the 1st character can be lower case.

Anything shown between { } brackets gives the possible values that can be entered in that position of the message. The brackets themselves should not be included in the message! Where there is an option for either ON or OFF in a message this will be shown as {ON/OFF} and either ON or OFF can be entered here but without the { } brackets.

Note that all texts sent should receive a reply of some sort to show the message has been received. Expect to wait up to 30 seconds for a reply. The system can handle 2 messages before getting the 1st reply. If there is still no reply after about 60 seconds, try sending again.

Phone number storage

Text to be sent:	#{0-14}=+447860382881	
Example:	#3=+447860382881	
Notes:	Single or double digits may be entered after the # symbol.	
	No spaces permitted anywhere.	
Alternatives:	#12=	
Notes:	Deletes the number stored in location 12.	
	Numbers stored in locations 0-3 will receive any enabled error messages and be able to send messages to change settings in the boxes. Numbers stored in locations 4-14 will not receive error texts and can only view the status of boxes, not make changes to settings. If the phone number including the + sign is more than 15 digits this will still be OK as long as the location following is left blank.	
Possible replies:	No. stored OK, Message not understood.	

Battery Box messages

Text to be sent:	BB{1-6}	
Example:	BB2	Request status of batteries in battery box 2
Possible replies:	List of all batteries in the box showing volts and temperatures. Preset voltage and temperature settings at the bottom.	
	Box not found, Message not understood.	
Alternatives:	BB1=ON	Turns on error text messages for volts and temps
	BB1=OFF	Turns off error text messages for volts and temps
	BB1=OFFT	Turns off error text messages for temperature errors
	BB1=OFFV	Turns off error text messages for voltage errors
Possible replies:	Box settings updated, Box not found, Message not understood. Settings not allowed from this phone. (Because the no. is not stored in locations 0-3	
Notes:	The no. following BB above is irrelevant for ON/OFF settings as it applies to all boxes. The no. must be for an existing box though!	

Alternatives:	BB3=”Engine 2”	Changes the name of battery box 3 to Engine 2
Notes:	The name must be sent between “ ” quote marks. Spaces and symbols ok.	
Alternatives:	BB1=ON:vmax:vmin:vdiff:tmax:tdiff	Update settings for battery box 1
Example:	BB1=ON:24.6:23.9:1.5:35:4	
Notes:	vmax sets overall box maximum volts before an error is generated.	
	vmin sets overall box minimum volts before an error is generated.	
	vdiff sets permitted difference between battery volts before an error is generated.	
	tmax sets the maximum temperature of any battery before an error is generated.	
	tdiff sets the permitted temp difference between batteries before an error.	
	Must be a decimal point before the last digit for voltages. Temps can be 1 or 2 digits.	
Possible replies:	Box settings updated, Box not found, Message not understood. Settings not allowed from this phone.	

Bilge/Gas messages

Text to be sent:	BILGE{=ON/OFF}	
Example:	BILGE	Request status of all bilge and gas boxes.
Possible replies:	List of all bilge and gas sensor status in all boxes. The error setting value is also displayed here at the bottom.	
	Box not found, Message not understood.	
Alternatives:	BILGE=ON	Turns on error text messages for bilge and gas boxes
	BILGE=OFF	Turns off error text messages for bilge and gas boxes
	BILGE=ON:82	Turns on error text messages for all bilge and gas errors and sets the point at which gas errors will be generated to 82. The value can also follow an OFF setting. Note that the value can be entered as 1,2 or 3 digits. Maximum no. is 255.
Possible replies:	List of all error text status settings, Box not found, Message not understood. Settings not allowed from this phone.	
Alternatives:	BG2=”Stern 1”	Changes the name of bilge/gas box 2 to Stern 1
Notes:	The name must be sent between “ ” quote marks. Spaces and symbols ok.	

Relay Box messages

Text to be sent:	RELAY	
Example:	RELAY	Request status of all relay box relays
Possible replies:	List of all relay boxes showing whether relay is on or off.	
	Message not understood.	
Alternatives:	REL2=ON	Turns on the relay in relay box 2
	REL1=OFF	Turns off the relay in relay box 1
	REL3=TIMED	Returns time settings for relay box 3

Possible replies:	Box settings updated, Box not found, Message not understood. Settings not allowed from this phone.
Notes:	If the box is in Manual mode when the 'Timed' message is sent it returns the current manual setting of that box.
Alternatives:	REL1="Lights 1" Changes the name of relay box 1 to Lights 1
Notes:	The name must be sent between " " quote marks. Spaces and symbols ok.
Alternatives:	REL{1-6}=TIMED:onday:onhours:onmins:offday:offhours:offmins
	Update settings for relay box 1-6
Example:	REL1=TIMED:3:10:45:4:15:25
Notes:	onday sets the day (0-7) for relay ON. (0=every day, 1-7=Sun to Sat) onhours sets the hour for relay turning ON. offday sets the day (0-7) for relay OFF. (0=every day, 1-7=Sun to Sat) offhours sets the hour for relay turning OFF. The above example sets the relay to come on Tuesday at 10:45 and then go off on Wednesday at 15:25.
Possible replies:	Box settings updated, Box not found, Message not understood. Settings not allowed from this phone.

Intruder messages

Text to be sent:	INTRUDER{=ON/OFF}
Example:	INTRUDER Request status of all intruder boxes.
Possible replies:	List of all Intruder box status, humidity and temperature value in all boxes. Box not found, Message not understood.
Alternatives:	INTRUDER=ON Turns on error text messages for Intruder boxes INTRUDER=OFF Turns off error text messages for Intruder boxes
Possible replies:	List of all error text status settings, Box not found, Message not understood. Settings not allowed from this phone.
Alternatives:	IN2="Saloon" Changes the name of Intruder box 2 to Saloon.
Notes:	The name must be sent between " " quote marks. Spaces and symbols ok.

GPS location messages

Text to be sent:	LOCATION
Example:	LOCATION Request status and location of boat etc.
Possible replies:	Details of texts ON/OFF error message status, current boat location, No. of satellites and fix quality. The circle radius setting and distance of boat from the centre of the circle. No GPS fix, Message not understood.
Alternatives:	LOCATION={ON/OFF:radius}
Example:	LOCATION=OFF Turns off error messages for boat location errors. LOCATION=ON Turns on error messages for boat location errors. LOCATION=ON:30 Turns ON error messages and sets radius to 30m. LOCATION=54 Sets radius to 54m without changing ON/OFF status.

Possible replies:	GPS no fix, Box settings updated, Message not understood. Settings not allowed from this phone.	
Notes:	The number for the radius can be 1 or 2 digits 1-99 and is in meters	
Alternatives:	LOCATION=GPS	
Example:	LOCATION=GPS	Requests location which is returned as a URL.
Possible replies:	A message in a format that will take you directly to a 'Maps' App on your phone showing the location of the boat.	
	No GPS fix, Message not understood.	

AC messages

Text to be sent:	ACTEXTS={ON/OFF}	
Example:	ACTEXTS=ON	Turns on error messages for when AC is lost.
Possible replies:	Box settings updated, Message not understood. Settings not allowed from this phone.	

Status message

Text to be sent:	STATUS	
Example:	STATUS	Request status of error messages, AC, GPRS.
Possible replies:	List of all text error message ON/OFF status, AC power present or lost, GPRS status, Software version number, Box ID of this main control box.	
	Message not understood.	

Alarm message

Text to be sent:	ALARM={ON/OFF}	
Example:	Alarm=OFF	Cancel and turn off local alarms by text message
Possible replies:	Box settings updated, Message not understood. Settings not allowed from this phone.	

GPRS messages

Text to be sent:	GPRS	
Example:	GPRS	This will return details of the GPRS connection status.
Possible replies:	List showing GPRS ON/OFF and time setting, APN ON/OFF, APN name GPRS connection status. Message not understood.	
Alternatives:	GPRS={ON/OFF:timedelay}	
Example:	GPRS=OFF	Turn off GPRS data. This turns off data updates to the Website.
Example:	GPRS=ON	Turn on GPRS data. This turns on data updates to the Website.
Example:	GPRS=ON:10	Turn on GPRS data and set the delay to 10 minutes between updates. Time can set from 1 to 255 which gives a delay of 1 minute up to 4.25 hours.
Possible replies:	GPRS turned off, GPRS turned on, Message not understood. Settings not allowed from this phone.	

Text to be sent: APN={OFF/"APN name"}
Example: APN="wap.vodafone.co.uk" This is the APN for Vodafone UK.
Example: APN=OFF This turns off the use of an APN, although the most recent APN will still be shown from the GPRS message
Possible replies: Message not understood. Settings not allowed from this phone.

Note:- Website address is :- www.inchargemarine.com

ALLTEXTS message

Text to be sent: ALLTEXTS={ON/OFF}
Example: ALLTEXTS=ON Sets the 'alltexts' function to ON
Possible replies: Settings updated, Message not understood.
Notes: Sending this message opens the system to receive all incoming texts from any phone number. These are then passed on to the mobile phone that sent the 'AllTexts' message.
This allows pin codes to be read when they are sent to the system SIM card. This is useful if the SIM provider wants a pin code when you set up a mobile app to check your balance. They will only send this PIN code to the SIM card which you are trying to check the balance of!
After receiving the reply, the function is automatically cancelled, although you can send ALLTEXTS=OFF message to cancel the function as well.

RESTART

RESTART
Example: RESTART Restarts the main box the same as a switch on.
Possible replies: Restarting! Please wait 2minutes, Message not understood.
Notes: This can only be sent by phones in locations 0-3. It causes a re-boot of the software which may fix unknown problems.

FACTORY

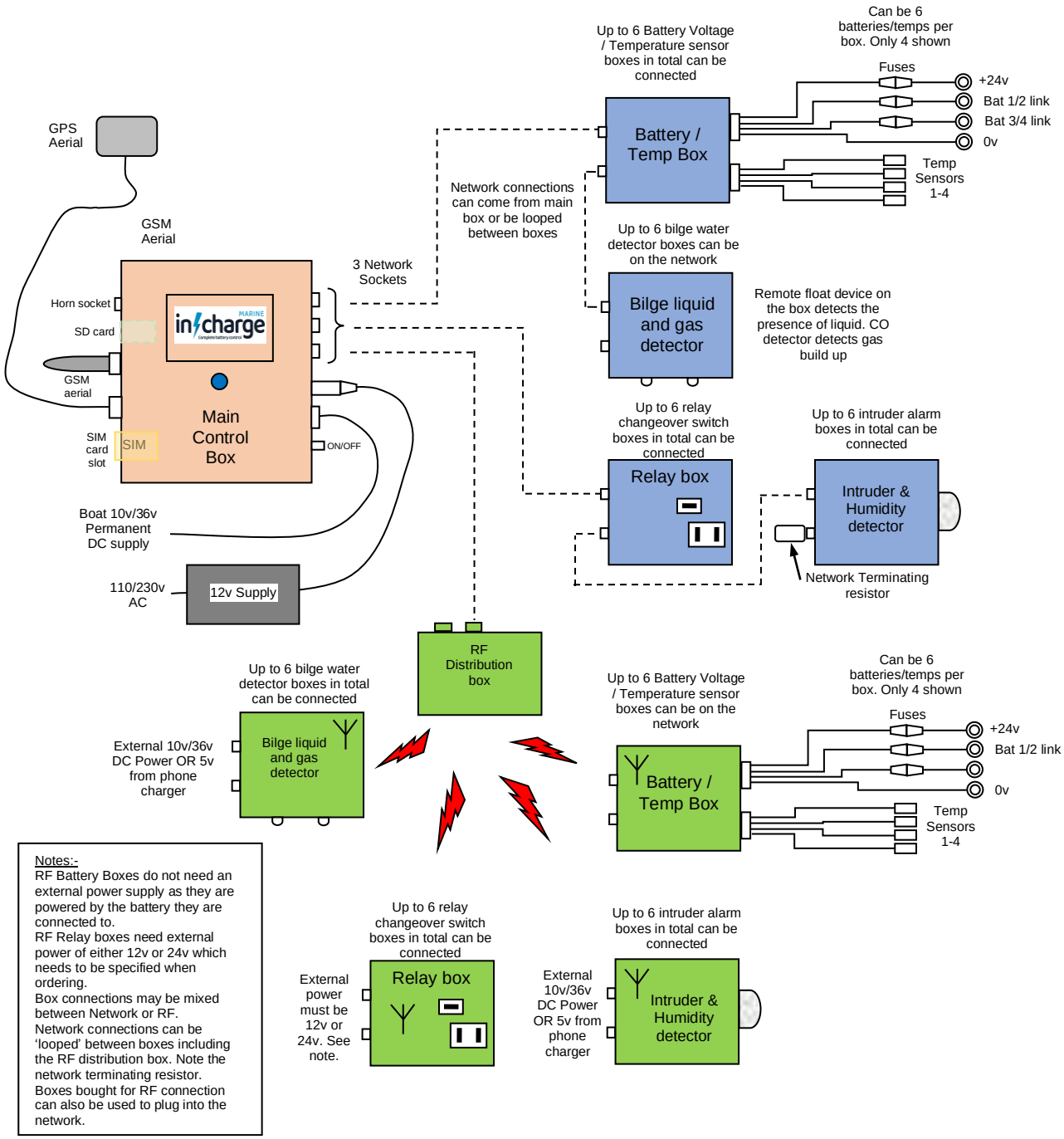
FACTORY
Example: FACTORY Restarts to main box resetting default values.
Possible replies: Factory Reset! Please wait 2minutes, Message not understood.
Notes: This can only be sent by phones in locations 0-3. It causes a re-boot of the software also resetting to all default values.

Overall System Wiring

The overall wiring of the system is very straightforward as everything is connected using standard 8way network cables. The system is proprietary though, as the peripheral boxes (apart from the battery boxes) are powered using the network cables. Normal network extender boxes will not work and may be damaged if you try to connect into any existing systems on your boat!

The main control box has 3 network sockets, but each peripheral box has 2 connectors enabling the system to be extended easily where boxes are quite close together. Note that the network terminator supplied with the Main Control Box must be put on the end of the longest cable run.

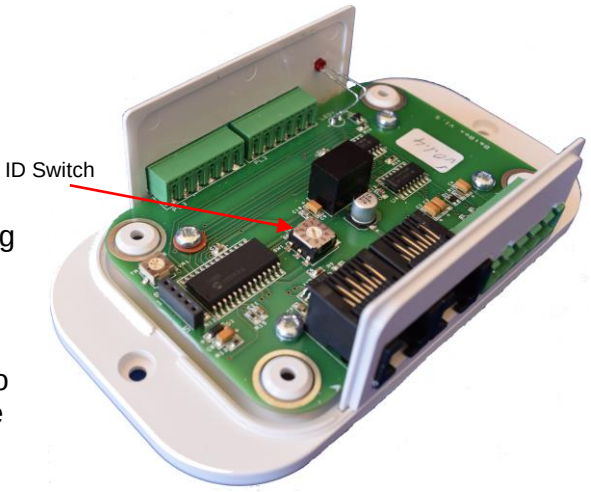
The boxes can also be connected using an RF link. A local power supply will be required by all except battery boxes for this though. A mix of network and RF connections is permissible.



Notes:-
RF Battery Boxes do not need an external power supply as they are powered by the battery they are connected to.
RF Relay boxes need external power of either 12v or 24v which needs to be specified when ordering.
Box connections may be mixed between Network or RF.
Network connections can be 'looped' between boxes including the RF distribution box. Note the network terminating resistor.
Boxes bought for RF connection can also be used to plug into the network.

Peripheral box ID setting

All peripheral boxes have an internal ID selector switch to identify them on the network. By default, all switches will be set to position 1 which is fine for each different type of box. However, if you have 2 peripheral boxes of the same type, then they must have different ID numbers.



To set the ID number remove the top cover by removing the four screws from the underside of the box. The top cover will lift off to reveal the printed circuit board and the ID switch as shown in the photograph here.

Rotate the switch with a small flat bladed screwdriver to select the ID for that box. Note that it is only if there are 2 or more boxes of the same type, then they need to have increasing ID numbers. Single boxes of one type should have the ID set to 1.

E.G. If you have 3 battery boxes then the ID's need to be set to 1,2 and 3 for those 3 boxes.

The purpose of the ID is to identify each box when there is more than one box of a certain type. On the main box LCD display you will see all the boxes of a particular type listed, and you can then see the data for each particular box.

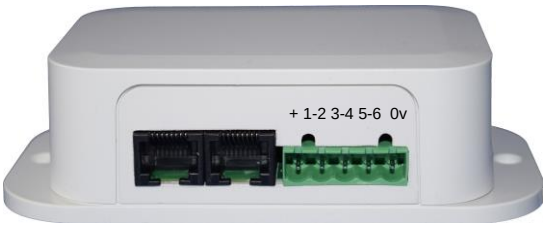
Each box can be given a name to identify it to help with remembering its location on the boat. The name will display on the LCD for data to do with a particular box, and text messages received from the boat will also show the box name. The names can be set or changed both from the main box and by text message.

Battery Boxes

⚠ The battery boxes have quite a few external connections and the way these are wired will depend on the type of boat battery box being monitored. Most possibilities are covered below.

The Connector details are as follows:- All connectors are supplied with the boxes.

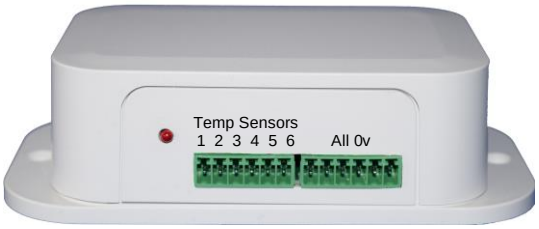
Battery Connector – 5 way, pin 1 on left



1. Main +ve connection to batteries.
2. 1st junction of batteries 1&2 in a 24v system
3. 2nd junction of batteries 3&4 in a 24v system
4. 3rd junction of batteries 5&6 in a 24v system
5. Main -ve connection to batteries

Temperature Sensor connectors – 2 x 6 way pin1 on left

Left hand connector



1. Either wire from temp sensor on battery 1
2. Either wire from temp sensor on battery 2
3. Either wire from temp sensor on battery 3
4. Either wire from temp sensor on battery 4
5. Either wire from temp sensor on battery 5
6. Either wire from temp sensor on battery 6

Right hand connector

1 – 6 All connections here are 0v earths. The second wire from each temp sensor can go to any of these connections.

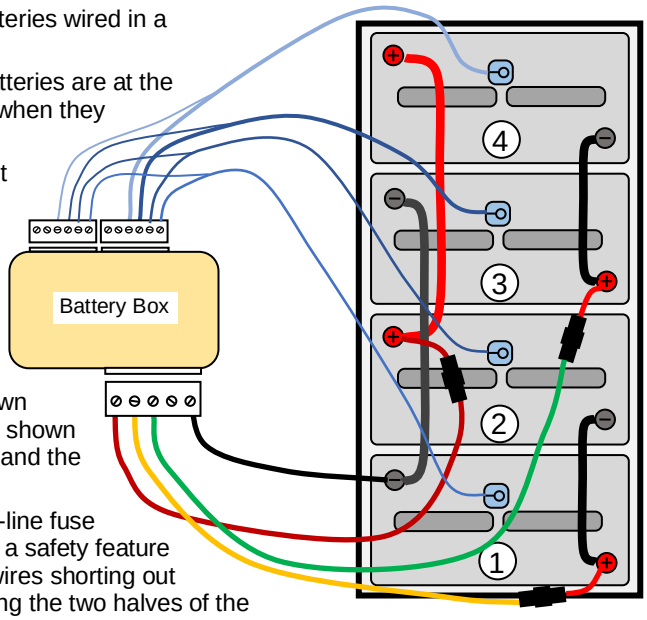
The red LED will flash once every 10 seconds if the box is connected to the network and receiving data.

24v battery box example with 4 batteries

This diagram shows a typical 24v battery box with 4 x 12v batteries wired in a series/parallel arrangement to give a 24v output.

Always number the batteries and ensure that No.1,3 and 5 batteries are at the earth end of a pair. This makes identifying them much easier when they appear on the system.

The temperature sensors have been shown in slightly different colour blues for clarity, in practice all the cables are 1 colour. Note that with the temperature sensors each sensor has a pair of wires. They can be wired either way round as the sensors don't have a polarity. It is important that they go to the correct terminal on the Temps block, but on the earths block all terminals are common earths.



The battery connections need to go to the correct terminals as shown here. The left terminal goes to the 24v box O/P shown in red. The right hand terminal goes to the box -ve connection shown black. The Yellow wire goes to the junction of batteries 1 & 2, and the green wire goes to the junction of batteries 3 & 4.

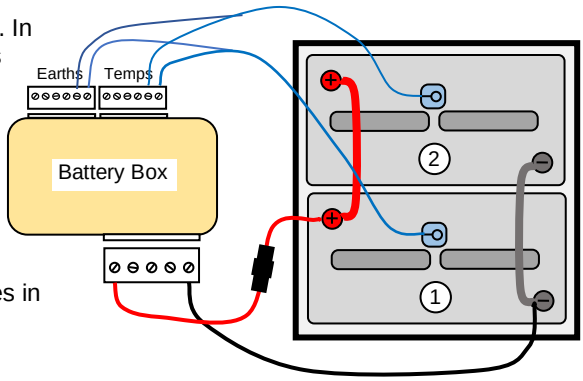
⚠ In practice all the battery cables (except 0v) have an in-line fuse near to the ring terminal. This has a 500ma fuse and is a safety feature that is very important as it prevents any possibility of battery wires shorting out without blowing the fuse. The fuses are removed by unscrewing the two halves of the fuse holder. Terminal 4 has no connection shown here. This would be used for the junction of batteries 5 & 6 in a 6 battery box system.

The battery wires provided have terminals that will fit most battery posts. The temperature sensors have sticky pads on their base and the covering strip will need removing before the sensor is pressed onto a 'clean' battery suface as near the middle of the battery as possible.

Don't forget to set the ID switch inside the box if you have more than 1 battery box connected into the network.

Connect the wires to the terminal block plug 1st, before connecting to the batteries to reduce the chance of shorting out battery connections and blowing the fuses! The fuse type is 5x20mm rated at 500ma.

12v Battery Box example with 2 batteries

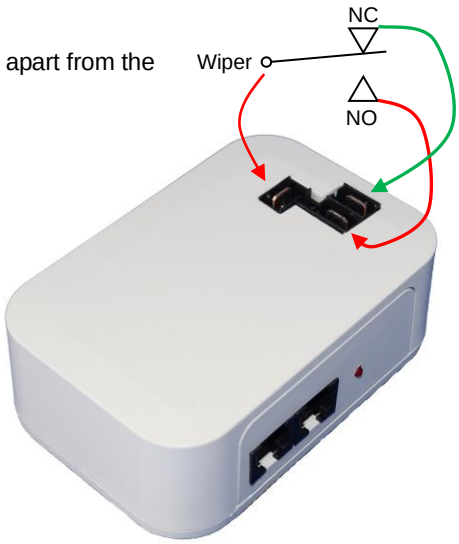


⚠ This diagram shows a typical 12v battery box with 2 batteries. In many cases it might just be a single battery where the connections would be the same but with just 1 temperature sensor.

The system will automatically work out how many batteries are in the box by checking how many temperature sensors are fitted, and setup the displays accordingly.

With the 24v systems it gets the number of batteries from the voltages it sees on the main box O/P. If this O/P is less than about 17v it then looks at how many temperature sensors are connected and uses those to determine the number of 12v batteries in the box.

Relay Boxes



⚠ The picture here shows a Relay box. The only external connections here apart from the network cable(s) are the connections to the relay itself.

These connections are standard spade terminals which just push on and pull off. The relays are rated at 20A at up to 250v so can be used to switch either DC low voltages, or AC mains voltages. If high voltages are being switched then spade terminals MUST be fully insulated and the box should be mounted inside a ‘safety’ enclosure.

The relays have change over (C/O) style contacts which means that there is one connection which is disconnected when the relay operates and another connection which connects when the relay operates.

The photograph here shows how the connections operate. NC stands for ‘Normally Closed’ and NO stands for ‘Normally Open’. When the relay operates, the wiper moves from the normally closed position to the normally open position. See previously in this document how the relay operation can be done directly or using a timed setting.

There is a red LED on the side of the box which shows when the relay is activated. When the relay is not ‘on’ the red LED will flash once every 10 seconds showing the box is receving data from the main control box.

Don’t forget to set the ID switch inside the box if you have more than 1 relay box connected into the network.

Bilge/Gas Boxes

This picture shows the bilge box with its liquid sensor.

The box should be mounted in the bilge low enough to detect any low lying gas but not so low that it is likely to get covered by water or any other liquid.

The liquid sensor is simply a float device and in fact any device which provides a ‘short circuit’ on the 2 pin connector could be used. The cable on the sensor is approx. 30cm long but could be extended if the box is mounted further away than this.

Do not connect into any existing wiring though, as any volts present on the connector will cause incorrect readings and quite possibly damage the electronics in the bilge box. The float on the sensor can be removed by unclipping the circlip on the end of the shaft and reversed to change the direction of operation.

The supplied gas sensor senses carbon monoxide and other flammable gases. It is also very sensitive to exhaust gas. It is possible that other boxes with different types of gas sensor could be provided to special order. The sensitivty of the sensor can be changed from the default by sending a text message as described earlier. If you are getting gas errors when you know there is no gas present, try increasing the sensor level setting. It can take up to an hour before the sensor reaches its working temperature so allow for this before changing the setting.

The gas sensor goes through a routine of heating and cooling before it makes a reading. The readings are taken and checked against the error value about every 2 minutes 30 seconds.

There is a red LED on the side of the box which shows continuosly when the liquid sensor is activated. If there is no error then It will normally flash every 10 seconds to show that the box has been recognised on the network and is sending and receiving data from the main control box.

Don't forget to set the ID switch inside the box if you have more than 1 bilge/gas box connected into the network.

Intruder Boxes

The intruder boxes have no external connections apart from the network cables.

The movement sensor has a range of about 12m so the box can be positioned almost anywhere where the sensor is covering the required area. This will keep the network cabling as simple as possible.

The small hole on the top edge of the box contains a humidity sensor and ambient temperature sensor. This will show the humidity and temperature in the location of the box from an intruder text message, as well as on the LCD screen.. (Note the temperature is only shown on the website data and in text messages, not on the LCD screen).

There is a red LED on the side of the box which shows when the movement detection sensor is activated.

If possible mount the box with the long edge vertical. This is the most sensitive position for detecting movement.

RF Peripheral Boxes

The RF boxes are very similar to the normal network connection boxes but with some additional settings.

There is a maximum limit of 10 boxes allowed on the network cables, but with RF boxes there is no limit, so this can be a very powerful way of adding boxes if more than 10 are required. It also allows boxes to be a long way from the main box without having to install long network cables.

The only downside is that local power must be provided for the boxes. (Except the battery boxes which get their power from the batteries themselves). The power can be either DC 10v-36v on a circular coaxial style connector, or 5v from a phone charger with a micro USB cable.

The exception is the relay box where the standard relay coil is 12v and will overheat if a 24v supply is used. A 24v relay can be supplied instead of the standard 12v one if specified on the order.

The RF distribution box is required to transmit and receive data to and from the peripheral boxes. Only 1 distribution box is required as this deals with all the possible RF peripheral boxes. It plugs into the network just like like a normal peripheral box. The aerial is internal to the box.

Inside the distribution box there are 4 links which set the channel frequency of the chosen license free frequency. All the RF boxes MUST have the same setting for the links as they will not send or receive data if they are set to a different frequency!

It is unlikely that the frequency will need to be changed from the supplied setting, but if for some reason the RF system seems to be unreliable, then this may be due to interference on the chosen channel. It is quite straightforward to change the links of all the RF boxes to try a different frequency.

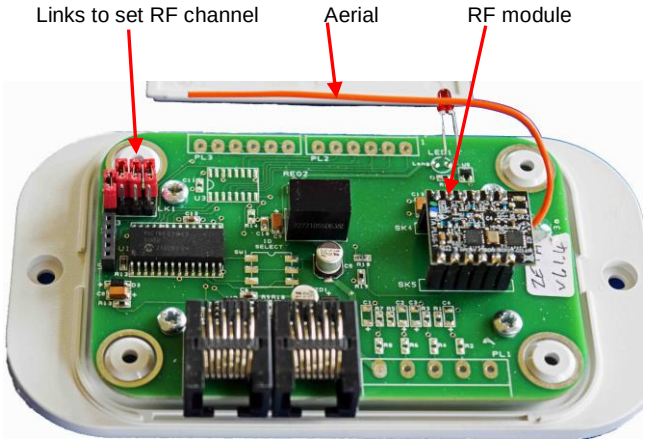
RF Peripheral Box Settings

The photo here shows the RF distribution box. There is no ID switch to set here as the box handles all the remote peripheral boxes at the same time.

The only settings are links 1 - 4 and these will have been pre-set to match any other RF boxes that may have been purchased at the same time. If an RF box is purchased at a later date then it may be necessary to check the link settings in the new box are the same as in the RF distribution box.

The 4 links give a possible 16 different frequencies. All RF peripheral boxes must have the links set exactly the same as the RF distribution box.

The orange wire is the aerial for transmitting and receiving data from the peripheral boxes.



The RF module is the device that converts the data to RF for transmitting and receiving. Even with the simple aerial used inside the boxes, the range should be adequate for most boats.

The RF module unplugs and can be added later to peripheral boxes if they are being upgraded to RF operation.

Peripheral boxes also have the ID switch as described earlier and this must be set to a different ID for any boxes of the same type.

RF Peripheral box power

When the peripheral boxes are used in RF mode they need external power, which would normally be provided over the network cable for non RF boxes.

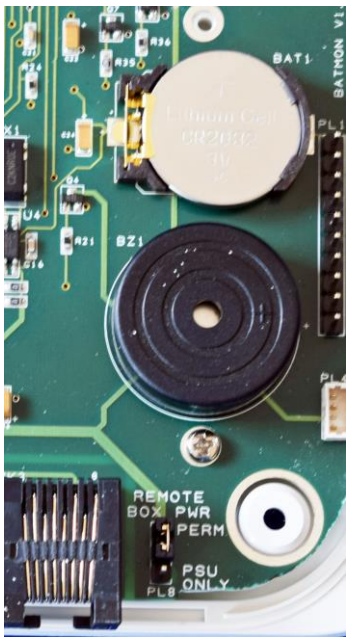
There are 2 connectors on the rear of the RF boxes to allow powering from either a 10-36v DC source such as the boat batteries or an AC supply, or a 5v micro USB connector which can be powered from a normal phone charger with a USB socket.

Exceptions to this are the battery boxes which are powered from the batteries themselves, and the Relay boxes which must have the correct voltage for the specific type of relay fitted in the box. This can be either 12v or 24v and must be specified when ordering an RF relay box. Boat batteries can be used for this as the 12v relay will work from 10v up to 14v, and the 24v relay will work from 20v up to 28v.

For the 868Mhz frequency band the actual frequencies are as detailed in the following table.

Channel	Frequency Mhz	Link1	Link2	Link3	Link4
0	869.50	ON	ON	ON	ON
1	869.75	OFF	ON	ON	ON
2	870.00	ON	OFF	ON	ON
3	870.25	OFF	OFF	ON	ON
4	870.50	ON	ON	OFF	ON
5	870.75	OFF	ON	OFF	ON
6	871.00	ON	OFF	OFF	ON
7	871.25	OFF	OFF	OFF	ON
8	871.50	ON	ON	ON	OFF
9	871.75	OFF	ON	ON	OFF
10	872.00	ON	OFF	ON	OFF
11	872.25	OFF	OFF	ON	OFF
12	872.50	ON	ON	OFF	OFF
13	872.75	OFF	ON	OFF	OFF
14	873.00	ON	OFF	OFF	OFF
15	873.25	OFF	OFF	OFF	OFF

Main Control Box PCB description



The photograph here shows part of the main control box printed circuit board. There are only two things here which are important.

There is a link which can be set to 2 positions. This controls the power sent to the peripheral boxes. The link sets whether the boxes still receive power when the AC mains is missing and the power would then come from boat battery feed to the main control box, or whether no power is sent to the peripheral boxes from the boat batteries.

The reasoning behind this choice is that if the boat is likely to lose power for any length of time, then the peripheral boxes would not be draining the batteries constantly.

This does not apply to the battery boxes as they are always powered from the batteries themselves, but only taking a few milliamps which would never actually drain the batteries.

The two link positions are labelled as ‘Perm’ or ‘PSU only’. The ‘Perm’ position will supply power to the peripheral boxes even when there is no AC available. (Assuming there is a DC 12-30v power input present).

In practice the only boxes which take much power are the relay box (only in the relay ‘ON’ condition), and the bilge boxes where the gas detector is permanently being heated to a set temperature. Also, the software will turn off any relays in the system automatically unless AC power is present regardless of the link setting. The default is for the link to be in ‘perm power’ position.

The only other thing which may need attention is the CR2032 battery mounted under the LCD display. The display can be lifted away from the main PCB quite easily to access this battery. The purpose of the battery is to keep the GPS memory of satellite positions and the clock running to keep the time accurately when the main control box is switched off. It should last 3-5 years before needing to be changed.

To access this, remove the top of the main control box by removing the four screws at the rear. The top lifts off leaving the side panels in place. Remove the LCD panel which has a connector at each end by pulling it upwards. The CR2032 3v battery can be carefully removed by pushing it to the left.

Take care when replacing the top cover of the box that the side panels slide correctly into the slots in the box lid.

Appendix 1 – Sim cards

There is a large choice of SIM cards which will work in the main control box. The choice will depend on your home country and the location of your boat. The only thing to check when choosing a sim card is how much it costs to send text messages. No data is required, (unless you want to monitor the status of everything on the website), and this can make deals very cost effective. Even if you want to use the option of monitoring things on the website then the amount of data required is very small. Probably less than 50mb per month.

The SIM card needs to be a ‘Standard’ size SIM. Most companies now supply all SIM cards in a format where you can get Micro and Nano sizes by ‘breaking’ them out from a standard size SIM, but as long as the SIM you purchase is the full size then there should be no problems.

Some SIMs come with a PIN number in them which you need to disable. The main control box will check whether the SIM is PIN protected and allow you to enter the pin no. on screen. Once entered, the PIN will be remembered and entered automatically for you every time the system is switched on. You only get 3 goes at entering the correct PIN though, and then it will require a PUK code where you get 10 goes at getting it correct. After that the SIM is usually disabled and you need to get a new one!

The current system does not allow PUK code entry so you will have to put the SIM into a mobile phone if you need to do this. You can easily break the large sim card down to the nano size if that is what your phone uses, and then put the sim back together into the large size after setting it up in your phone!

Always check when purchasing a SIM card if it has a default PIN as the ones listed below may change.

Some typical 'Default' PINs for various companies are shown here:-

GiffGaff	5555
Vodafone	0000
Orange	1111
EE	1111
3 mobile	0000
T-Mobile	1210
Virgin Mobile	7890
O2	0000, 5555 or 1234
Tesco Mobile	5555

SIM Balance checking

Because of the many different ways companies use to check the balance left on the SIM card, it has not been possible to build that into the system. Most companies provide an App which can be used on your mobile phone to check the balance left on the SIM card. Some companies insist on sending a code to your SIM to setup or top-up using the app, and clearly your sim is not in a phone so you cannot see the necessary code that is sent.

A special feature can be used though, which passes the code to your own phone from the SIM in the control box. See the earlier information about using the 'ALLTEXTS' command to achieve this.

APN names

Some SIM providers need you to set their APN name into the system before their SIM will send data to a website. The APN name can usually be found on the providers website and then it should be entered using the APN text message described earlier. These names will be updated as we test more sims from different providers.

The following providers have been tested and do not require the APN to be setup (unless you are outside your home country):-

GiffGaff, Tesco.

The following definitely require the APN to be setup to send GPRS data:-

Vodafone UK	APN is wap.vodafone.co.uk so text APN="wap.vodafone.co.uk"
EE	APN is everywhere so text APN="everywhere"

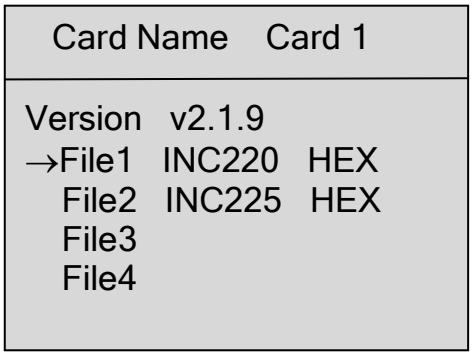
The GiffGaff APN for use when abroad is :- APN="giffgaff.com"

If this is set then it will still work in the UK where the APN is ignored.

Appendix 2 – S/W updates

Note that this feature may not be fully operational in prototype units and can only be used for certain types of software upgrade.

Occasionally, it may be useful to update the software in the main control box to add new features, fix bugs etc. This can be done using the Micro SD card slot which is close to the GSM aerial on the main control box.



The system is fairly basic and can only use Micro SD/HC cards formatted in FAT32. This is actually the default standard format for these cards. The HC cards only go up to 32Gb but any size up to that will do as the file for the update is only approximately 150kb. Larger capacity cards are usually specified as 'XC' and cannot be used. If you are using an old card that has been used for storing a large number of files in the past then you should re-format it in FAT32 format using the 'Full format' option, and not just the 'quick format' option.

The SD card needs to have the update file on it. Only 4 files maximum should be on the SD card and no directories. The update file may be obtained from an email we send out or from our website. The filename should not be longer than 8 characters.

First, switch off the unit. Insert the Micro SD card (this uses a push-push style to insert and eject it). You may need a thin flat bladed screwdriver to push in the card. With the SD card in place, switch on the unit and a new screen should appear.

The existing version no. of the software in the unit is displayed and up to 4 files can be on the SD Card. The file name will represent the version no. of the new software. E.g., the files shown have versions 2.2.0 and 2.2.5 on them.

Use the up/down navigation switch to select the file to use for the update and then click to the right. Another message will appear asking you to push to the right again to start the update.

The LED beside the SD Card slot will illuminate during the update and then go out when it is finished. The LCD will now show the new version of the software which has just been updated.

Switch off the unit and remove the SD card, switch on again and the startup sequence should begin as usual. None of the previous settings or stored phone numbers will have changed during the update.

Note that the current software version can always be seen in the LCD/Time settings menu display.

Appendix 3 – GPS/GLONASS notes

The GPS unit built into the main control box is extremely sensitive and receives both GPS and GLONASS satellites. GPS is the system developed by the USA with 31 satellites and GLONASS is the Russian system with 24 satellites. They both have similar accuracy and when combined provide better coverage than either system alone.

When first switched on it may take a long time (3-4 hours possibly) to achieve a position lock. The clock should start showing the correct time first, which shows that some satellites have been found and shows the system is working.

After a position fix has been found, switching on again will only take a few minutes at most to achieve a position lock, as the backup battery helps the system to remember the satellite orbits.

The aerial does not have to be mounted on the outside of the boat but should be in a position where there are no large metal surfaces between it and the sky. To get a good accurate position should always be possible if 15 or more satellites have been found. Even with fewer satellites quite

accurate positions can be obtained especially if the Q value drops below .6. The lower the Q value the better the accuracy of the fix.

The position accuracy and number of satellites being received will change during the course of the day as the satellite orbits change continuously. Normally, expect an accuracy of about 2-3m but occasionally this may increase to about 10m for short periods. Exceptionally, during testing we have seen errors in position of up to 30m or 40m, but this seems to be very rare and is most likely to be due to poor aerial positioning.

Make sure the GPS aerial is mounted with the label on the underside (it is magnetic so may be mounted on a metal surface as long as the aerial is on the sky side of the metal mount!). The clearer the view of the sky in all directions the better will be the accuracy of the position.

Remember that if the boat is anchored or tied to a buoy the boat may swing around and cover a large area of sea from when you first preset the circle center. (Either by pressing the navigation switch on the main box until the range shows as 0, or by sending the text message Location=On.)

Appendix 4 – Possible problems.

Problem	Possible Causes	Solution
SIM will not register on a network	GSM aerial on main box not fitted or faulty.	Fit the supplied aerial into the GSM aerial socket and screw fully home. Check the pin has not been pushed back inside the aerial connector.
	No service in your location	If you have a mobile phone signal, then check the aerial as described above.
	PIN not entered correctly	If the PIN cannot be entered properly using the control box, try putting the SIM into a mobile phone, then enter the PIN and disable the PIN requirement in the future.
No data is being seen from your box on the website	GPRS is turned OFF by default. You must enable it with a text message. The Sim may require an APN to be entered. Or you haven't yet registered on the website with the box ID code.	Turn on GPRS with text GPRS=ON. See earlier in this manual how to setup an 'APN' for your sim card. Register on the website with your box ID which can be obtained on the LCD screen or by text message STATUS
No reply when texts are sent to the control box	The phone number sending the text has not been stored in the control box yet.	See previously in the manual how to store phone numbers in the control box. There should be a reply saying, 'Number stored OK'.
	Your SIM has run out of funds!	If the action you request with a text appears to be correct, but you don't get a reply message, then this almost certainly indicates lack of funds on the SIM.
Text reply saying 'Message not understood'	Incorrect wording of the text message sent to the box.	All text can be in upper or lower case, but spaces must not be included anywhere in the text message. See the text message details in the manual for the exact formats required
Text reply saying 'Settings not allowed from this phone'	Phone sending the text is not stored in locations 0-3	Texts which change settings in the system are only allowed from phone numbers stored in locations 0-3
Text error messages not being received from the system when errors occur	Phone number not stored in locations 0-3	Only phone numbers stored in locations 0-3 will receive error messages from the system.
	Text error not enabled in the system	Text error messages can be enabled or disabled in the system separately for each type of error. This can be done from the main box, or by text message. (Only from phone numbers stored in locations 0-3).

Problem	Possible Causes	Solution
Navigation switch on the control box seems intermittent or slow to react to clicks	The box is busy internally checking remote boxes connected to the system, or receiving/sending a text message or data stream	If there is no response to a click on the navigation switch press again until the response is as expected. While receiving or sending text messages or data, the system appears to lock up until it has finished. Note that any incoming text messages to change settings will cause those changes to instantly appear on the LCD screen if you are viewing the screen associated with that setting.
One of the remote boxes on the network does not show up on the LCD display	Faulty network cable	Try a known good cable and check again
	Incorrect ID set inside the remote box	Check the ID setting inside the remote box. If just one of that type of box is on the system, the ID should be set to 1.
	Too many boxes connected on the network	The limit of boxes on the network is about 10 depending on length of cables etc. This number of boxes can be increased by using RF boxes.
RF boxes not being detected or inaccurate data	Link settings different between boxes	Check links 1 – 4 are set the same in all RF boxes.
If you can get no response from the box and do not have access to the box.	Unknown problem causing loss of text message responses	Phone the number of the SIM card. This will cause a complete reset of the box. Then try sending text messages again after about 5minutes.

Specifications

Main control box:-

Sim frequency bands	850/900/1800/1900MHz
GPRS class 12	speed up to 85.6Kbps
GPS/GNSS	33 tracking / 99 acquisition channels
Aerial	28db LNA gain preamp 1575.42 Mhz
Sensitivity	Tracking -167dBm
Accuracy	Horizontal position <2.5m CEP
LCD display	128x64 pixels
LCD Backlight	7 colours, auto off after 20 minutes
Battery backup	CR2032 3v battery for clock and GPS satellites
Internal Alarm	Built in 3.2khz min 75db @ 30cm
Network system	Proprietary half-duplex 38,400 baud system using RJ45 standard cables
	Fully isolated for battery boxes up to 3.5kv isolation voltage
12v PSU	Input voltage 100v AC to 240v AC. 60W 12v 5A efficiency >88%. IEC input connector
	Safety standards IEC60950, EN60950, UL60950, GB4943
Battery DC input	10v – 36v accepted range. Consumption average 45mA, peak 2A during text sending

Battery Boxes

Batteries monitored	Up to 6 batteries per box
Current consumption	7ma @ 24v, 8.5ma @ 12v
Voltage range	0v – 32v measured with ±0.1v accuracy
Temperature range	0 °C – 99 °C
Isolation	All battery box earths are isolated from each other and the main control box Isolation up to 3.5kv RMS. Power for the system comes from the batteries themselves

Bilge Boxes

Liquid detector	Float switch of any type providing a short when liquid detected
Gas Sensor	MQ-9 sensor. Carbon monoxide (CO), Methane (CH4), LPG and combustible gases
	Detecting range 20ppm-2000ppm CO, 500ppm-10000ppm CH4, 500ppm-10000ppm LPG
Sensing time	Heating time 60 secs, measuring time 90 seconds repeating cycle
Power	Box powered from 10v-12v on network, or external DC 10-36v, or 5v micro USB if RF version

Relay Boxes

Switching voltage	Rated voltage 250v AC. Max switching voltage 480v AC.
Switching current	20A Resistive load. Frequency of operation 360 cycles per hour.
Approvals	UL508, IEC61810
Connections	0.25", 6.3mm Quick connect terminals
Software control	Direct on/off by text message or main control box menus.
	Timed operation by text message or main control box menus. Daily or weekly on/off.
Power	Box powered from 10v-12v on network, or external DC 12v or 24v, depending on box spec.

Intruder Boxes

Sensor type	Movement sensor type Panasonic WL series.
Detection performance	12m range. Detectable difference in temperature between target and background of 4°C
	Movement speed 1m/s. Human body detection size 700mm x 250mm.
Detection angle	Horizontal angle 102° Vertical angle 92°. (Box mounted vertically)
Humidity measurement	Range 20-90%. Accuracy ±5%. Temperature range 0-50°C. Accuracy ±2%.
Power	Box powered from 10v-12v on network, or external DC 10-36v, or 5v micro USB if RF version

RF System

Frequency	Choice of 433Mhz, 868Mhz or 915Mhz license free frequency bands
Channels	16 channels selectable on each band
Duty cycle required by license regs.	Maximum duty cycle with 36 peripheral boxes is < 1%

Remote Boat Monitoring System
Operation Manual