User Manual

LIFOS FORT PV

BATTERY STORAGE UNIT

Model Num:

LF1010SPVG
LF1020SPVG
LF1035SPVG

LF1010SG
LF1020SG
LF1035SG

INDEX

Introduction

This manual aims to provide the information and basic instructions to safely transport, install, operate and maintain the Lifos FORT. It is essential that all the safety rules and warnings are read carefully before, during and after the FORT has been put into operation.

DO NOT MODIFY or use this equipment for any application other than for which it was designed.

The information in this manual is based on FORTs in production at the time of publication. Technological advances and updates to regulations may require us to implement modifications without notice. Lifos reserve the right to change any part of this information without notice.

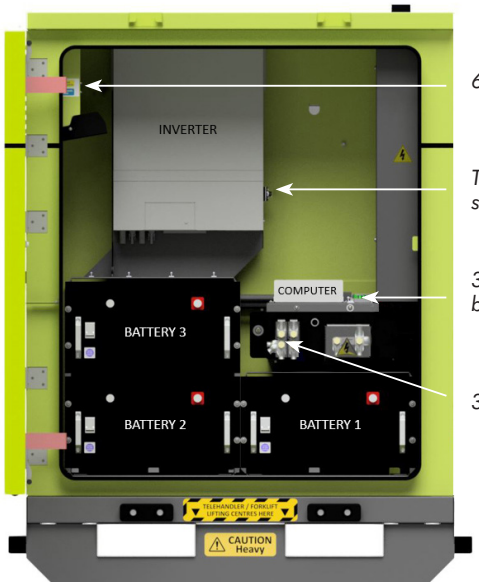
Additional copies of this manual and further information are available at www.Lifos.co.uk or contact hello@lifos.co.uk

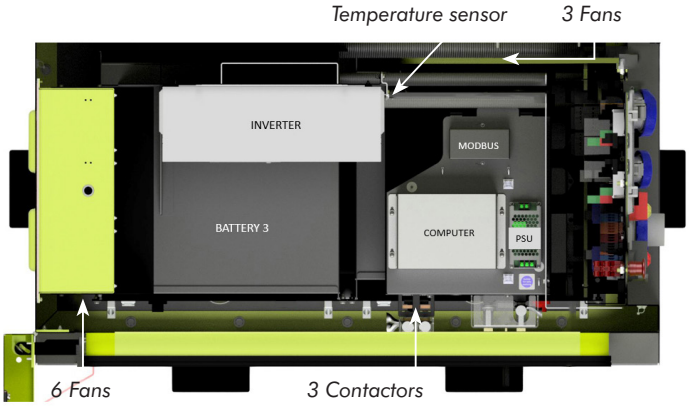
This is a general manual used for the Lifos FORT PV. It is possible that there are components, instructions or safety standards mentioned in this manual which are not applicable or are insufficient for the specific FORT that has been acquired. In this case you must evaluate and determine which instructions are valid for your FORT, supplementing them if necessary. Please contact **www.Lifos.co.uk** in the event of any doubts.

In accordance with European Directives concerning the Protection of Consumers and Users, Lifos is excluded from any liability resulting from the defective installation and/or the improper use of the FORTs or from failure to comply with the rules contained in this manual.

THE FORT

Main component layout





Safety

GENERAL SAFETY

Before using the FORT, you must read and understand all the instructions. DO NOT modify this equipment. Installation, operation, maintenance and repairs must only be carried out by authorised and competent personnel. The owner of the FORT is responsible for ensuring these operations are conducted safely. Parts and accessories must be replaced if they are not in safe working condition. If any part of the FORT becomes damaged, immediately switch off **DO NOT USE THE FORT** and notify the owner.

The following points should be practised at all times:

- Personnel using the equipment must be authorised and qualified. They must know and follow all safety guidance for the correct use and operation of the equipment.
- **Do not** open the FORT in the dark please ensure you have adequate light before opening the main door of the FORT and make sure any working area is well lit.
- **Do not** allow unauthorised persons to access the FORT.
- **Do not** smoke or cause sparks near the FORT.
- It is prohibited to by-pass and/or remove the safety features of the FORT or to try and access the main control unit, inverter and batteries.
- **Do not** switch on a FORT in need of repair or with any damage.
- **Do not** stand on or lean against the FORT.
- **Do not** lean items against the FORT or place anything on top.
- **Do not** insert objects through the ventilation slots.
- **Do not** obstruct or impede the passage of air through the ventilation slots.
- To perform an emergency, stop on the FORT, press the '**emergency stop**' button located on the outer panel of the FORT.
- **Do not** lift by magnetic lift or electromagnet.
- **Do not** clean the FORT with a power washer or any type of steam cleaner. Refer to the cleaning section.
- **Please note:**
  - Rated voltage = 230V AC
  - Number of phases = 1
  - Frequency = 50Hz
  - Distribution type is 'dependent upon installation mode',
  - Full load current for incoming supply = 32A.
  - The Solar input is protected at 20A .
  - The single phase 230V 50Hz L N E is protected at 32A and 16A for their respective sockets·

UNPACKING, UNLOADING AND HANDLING

Unloading, handling and transportation of the FORT must be carried out by suitably qualified personnel using the appropriate lifting machinery and equipment for this kind of load. See specification for dimensions and weights.

Before unloading or handling the FORT please check that the equipment and lifting elements used (safety hooks, clamps, slings, chains, etc.) are in good condition and are adequate for the load to be moved.

Before each operation, it is necessary to check the position and proper grip of the lifting elements and the good condition of the attachment points; always using the lifting points and skids intended for such operations as directed in this manual, previously verifying the proper condition of the points mentioned.

Unpacking

The FORT comes with its own bag for protection during transportation.

This is held in place with four clips to the base. Please unclip these and lift the bag from the FORT. Do not attempt to cut the bag away with a sharp instrument.

During use the bag can be stored in the solar panel section of the FORT. Do not block the filter. The bag should be put on the FORT when stored unused.

General instructions

Upon receipt of the FORT check that the product received corresponds to the delivery order, and that the merchandise is in good condition.

If the FORT is damaged for any reason during transport, storage, and/or unloading it should not be put into operation without being checked first by a qualified person.

Check that the machinery, lifting equipment, chains and/or straps which are going to be used are able to carry the load in a safe and controlled manner, keeping the FORT in a level horizontal position.

Do not place FORT on wet or poorly draining ground or under foliage.

Labels related to safety must be kept clean and in the places predetermined by the manufacturer.

The FORT must not be used for any medical or critical infrastructure power supply.

Unloading and handling

Unloading, handling and transportation of the FORT must be carried out by suitably qualified personnel using the appropriate lifting machinery and materials for this kind of load.

If the FORT is dropped or severely jolted users must consult a qualified person before using the product.

To avoid the risks involved in these activities, it is important to ensure the correct use of work equipment by trained personnel, checking that the equipment and lifting elements used (safety hooks or clamps, slings, chains, etc.) are in good condition and are adequate for the loads to be moved, as well as monitoring and displaying information so that loads do not pass above other workers or third parties.

Before each operation, it is necessary to check the position and proper grip of the lifting elements and the good condition of the attachment points; always using the lifting points and skids intended for such operations as directed in this manual, previously verifying the proper condition of the points mentioned.

Do not load any other objects in addition to the FORT that could modify its weight and centre of gravity.

Check the weight of the FORT from the rating plate (Located under the front control panel - see left image below) and check that the machinery and the lifting elements which are going to be used are able to carry the load in a safe and controlled manner, keeping the FORT in a level horizontal position.

Before unloading, it is important to ensure the floor is able to support the load of the FORT.

We recommend placing the FORT in a clear, easily accessible position which is as close as possible to the installation or transportation area. It should also be near as practically possible to the input power source (solar, mains or generator) and to the area being powered.

Prior consideration should be given to the movement of the load and the route taken, so that there are no obstacles or power lines which may be affected by the loads.

If moving the FORT please ensure that the solar transit plate is fitted to hold the panels and drawer in place.


Solar transit plate

Lifting by forklift or telehandler

The FORT base incorporates slots where the forks of the forklift truck, telehandler or pallet truck must be inserted. There are also slots for a pump truck,

It is recommended that the forks be longer than the width of the FORT.

According to the weight of the FORT, the machinery used must be checked to ensure it is able to carry the load in a safe and controlled manner.

A forklift may only be used to transport the FORT, if excessive heights are avoided during transport and if it is possible to carry out the appropriate operations in a controlled and safe manner. Under no circumstances may lifting be carried out by placing the forks under the base of the FORT, outside the coupling skids.

The base of the FORT is flat allowing the FORT to be dragged across a flat surface without causing damage to the FORT. Please use appropriate straps and ensure they are fitted before attempting to drag the FORT.

Check lifting points for pump truck

Lifting by straps

If lifting by straps please remove the storage bag first to allow you to fit straps in the lifting guides.

We recommend checking the correct alignment of the lifting straps in the marked lifting points, as they tighten slightly while also checking the stability and safety of the operation and making sure the FORT is properly secured after being raised off the ground

Lifting devices (slings) may only support the lifting points designed for such use, avoiding contact with any of the other components forming FORT.

Check lifting points on skid base for forklift or telehandler

TRANSPORTATION

When transporting the FORT please check its gross weight and ensure your vehicle or trailer is capable of carrying this weight. Please load carefully and to avoid damage to the paint work. Always transport the FORT with its transit cover fitted and secured by its own straps and buckles.

Always secure the FORT with appropriate loading straps and FORT has multiple points where such straps can be tethered or threaded through.

Lifos FORT contains lithium batteries so a Dangerous Goods Note should always be supplied to the driver whenever transporting it. Please ensure the warning labels fitted to the FORT transit cover are clearly visible.

Do not transport FORT with its batteries anymore than 30% fully charged and the batteries inside the FORT must be switched off.

SITING THE FORT

The FORT is designed for outdoor use.

The FORT is recommended for use at less than 1000m above sea level. It is not recommended for use greater than 1000m. If using with the solar rail please follow guidance on altitude levels in the installation of solar panels section of these instructions.

We recommend placing the FORT in a clear, easily accessible position which is as close as possible to the installation or transportation area. It should also be as near as practically possible to the input power source (solar, mains or generator) and to the area being powered.

It is important to check that the doors of the FORT can be opened completely, allowing access to materials for maintenance and inspections.

Please allow a 2 metre perimeter around the FORT for servicing and easy removal of any components.

There is a door stay on the main door to hold it open while maintenance and repair procedures are carried out.

There should also be adequate ventilation and space around the fan housings so that these vents are not blocked.

In general, the area where the FORT is installed must be closed off to prevent access by unauthorised persons but leave free access to both the control panel, and the emergency stop device. At the same time, it is necessary to place appropriate entry prohibition and danger signs in visible areas.

Site the FORT in an area not prone to flooding or the accumulation of snow, also avoid secondary heat sources from being located close to the FORT (i.e. boilers, other engines...).

Do not site the FORT next to water.

Protect the FORT from exposure to airborne contaminants such as vapours, abrasive or conductive dust, oil mist, smoke, lint and other contaminants.

Avoid siting in areas of motor vehicles or forklift trucks and where there is the possibility of impact from falling objects.

In the case of installing multiple FORTs, the instructions to be followed are the same. The installation of each of the FORTs will be carried out following the instructions shown in this manual.

Door stay

Earthing

The metal parts of the installations, which are exposed to contact with people, because of an insulation fault or other accidental causes, could become live.

To ensure the protection of people the electrical installation and attached equipment, the customer must earth the FORT.

To carry out the earthing, the FORT has a main earthing terminal located on the front panel identified by the following symbol.

The choice and dimensioning of the conductors and earthing rod will be the responsibility of the installer performing the installation and must take into account relative local and national regulations.

The customer must connect their earthing rod to the FORTs earthing point via an insulated copper conductor with a minimum section of 16 mm^2 or with a bare copper conductor with a minimum section of 25 mm^2.

The materials, dimensions and depth of the earthing rod should be chosen so as to withstand corrosion and have appropriate mechanical strength. It should be installed vertically into the ground. The resistance of the earthing rod depends on its size, its shape and the resistivity of the soil in which it is embedded. This resistivity usually varies from one place to another, and varies according to the depth.

The earth bonding should be checked on installation and by a qualified engineer and at regular intervals.

Where an existing AC generation source is provided and has been installed by authorised and qualified personnel it may not be rnecessary to fit an additional earthing rod. This will be dependent upon site and application.

If FORT is in PV only mode it needs to be earthed. If FORT has a generator input it is the responsibility of the generator to supply the earth.

STORAGE

FORT should be stored in a dry, covered place away from inclement weather and sudden changes in temperature. The FORT should be fully charged before being placed in storage.

To switch the FORT off for storage you can press the emergency stop button.

The power to the computer will also be switched off when the emergency stop is pressed. The computer will no longer be communicating with the inverter and will not be transmitting location data.

If the unit is to be stored for >1 month then to maximise battery lifetime and operational readiness it is recommended to turn the batteries off. Please ensure the computer is powered down first.

Please ensure that the batteries are switched off in the main FORT compartment. The main FORT compartment should only be opened by a competent person. Please note each battery has an individual on/off switch.

Please note that switching off the batteries will result in no location data being transmitted.

If the FORT is not being used the computer should be closed down before the batteries are switched off. The computer is located inside the main compartment.

If the FORT is to be stored for an extended period of inactivity i.e. over 1 week without the computer and batteries first being switched off then the following must be carried out every 2 weeks.

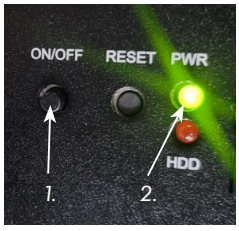
The batteries must be recharged either from solar, mains power or a generator set. Please ensure the batteries are charged to at least 80% full.

Before using the FORT after extended periods of inactivity please visually check external and internal parts of the FORT for any wear or damage.

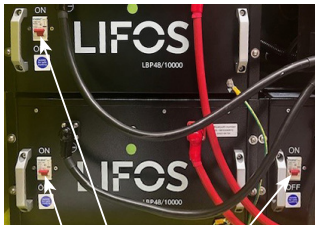
Failure to follow the above and maintain the health of the batteries by keeping them charged will invalidate the warranty.

How to switch off the computer

1. Press the ON/OFF button for 3 seconds.
2. After 60 seconds the green light will go off (see right).
3. The computer is now off.



Computer switch off



On/off button locations

Switch in 'on' position

Operation

SET UP OF FORT

Please read all safety information before proceeding to switch on the FORT. In particular take note on the section Siting the FORT, see page 7.

Setting up the FORT and its accessories must be performed by qualified personnel. In the event of any difficulty during installation, consult the distributor or contact Lifos at **www.Lifos.co.uk**

Please note that when operating, the FORT is almost silent. Although there is limited noise there is still power outputting please read all safety advice before operation.

Do not modify the original protection devices on the FORT.

Do not leave disassembled parts, tools or any other accessories in or on the FORT casing.

Do not store any equipment or materials that are not part of the FORT in the solar panel section.

Never leave flammable liquids or rags soaked with flammable liquids near the FORT or electrical appliances or electrical installation parts.

Take all possible precautions to avoid risk of electrocution; where appropriate connect the earth point provided on the FORT and its accessories, ensuring this earthing is carried out in compliance with the relevant legislation and by a competent person see section on Earthing, see page 8.

Do not allow access to the operating area of the FORT by people who are unfamiliar with the safety conditions.

The person in charge of FORT operations and functioning must remain alert and ready to respond to and interpret a situation appropriately, and never work while physically or mentally fatigued or under the influence of medication, drugs or alcohol.

It is advisable to have a minimum of two people present during operations that may pose a health risk, especially due to electrical hazards.

Do not touch the FORT cables, terminals and battery connections, as they are live. In the case of an electric shock, the first thing to do is safely stop the FORT by using the emergency stop. If this is not possible, try to free the victim from the source of electrical energy using a non-conductive element and seek medical attention immediately.

Check and make sure the electrical connections for power and the auxiliary services are properly executed.

Make sure that the power cables are installed in compliance with the requirements of all corresponding regulations, as the use of unsuitable cables may result in serious damage to both the equipment and people due to hazardous electrical conditions.

Locate the position of the emergency stop button and any other possible emergency systems on the FORT. Check the operation of the FORT emergency stop button.

Check all seals and doors are properly sealed and closed before using.

Check the FORT is clean, and the surrounding area is clean and unobstructed. Check for blockages in the vents.

Check all connectors and switches are in good working order before switching on the FORT.

Never connect loads which are above the power range of the FORT. Details of accepted loads are present on the rating plate of the unit.

Never disconnect the batteries while the FORT is on.

Stop the FORT immediately if any kind of abnormal operation is detected, such as excessive vibration, heat, smoke or loss of output power.

Keep doors of the FORT closed and locked at all times during operation or when not attended by qualified / authorised personnel.

INSTALLING AND CONNECTING SOLAR PANELS

The FORT is designed to be used with the supplied Lifos solar panels. The solar panels can be set up on their own kick stands or built onto a frame (supplied as an extra). This frame can be put onto a 20ft container or split onto 2 x 10ft containers. It works with standard ISO fix container corner fittings. Please contact Lifos if you require fitting kits for other containers other than 20ft.

The frame should be built on level ground. If using the panels on the ground on their own kickstands they should point south and be weighted down.

If using Lifos recommended PV configuration PV inputs have up to 230V potential with respect to earth.

The FORT is provided with 2x MC4 connectors. Ensure solar isolator is off before attaching any PV cables. Attach the solar cabling to these MC4 connectors ensuring that the polarity of the connectors is correct before insertion.

Once solar cables are attached turn the solar isolator on. PV power will assist in providing power to output loads and charge batteries when no load is attached.

If moving the FORT please ensure that the solar transit plate is fitted. If using your own solar panels please follow the instructions at the bottom of the page.

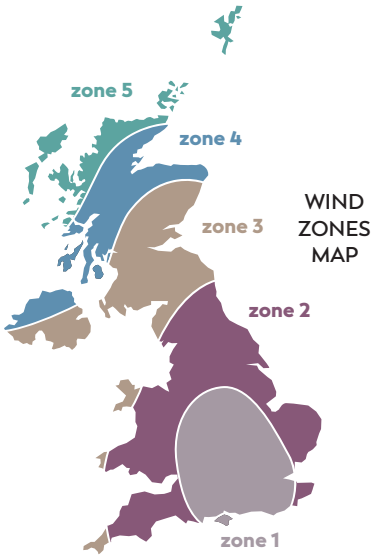
Solar panel array siting instruction

Please follow the guidance (right) when using the solar panel array system.

The loads allow for an array to be sited at the following heights above sea level:
Wind Zones 1 Max 300m ASL (at sea level) Inland and Max 100m ASL Coastal
Wind Zones 2 Max 300m ASL Inland and Max 100m ASL Coastal
Wind Zones 3 Max 200m ASL Inland and Max 50m Coastal
Wind Zones 4 Max 150m ASL Inland and Max 40m Coastal

The link below allows you to zoom in to any location and assess its height ASL.
https://en-gb.topographic-map.com/place-tj/United-Kingdom/

Do not site a container alongside tall buildings.

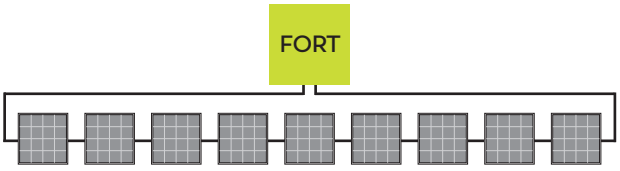


Wiring diagram for panels being used on kick stands

9S ARRANGEMENT

Put 9 panels out in a line. Daisy chain panels using the cables already directly attached to the panels. Use the provided cables to attach from each side of the string to the FORT.

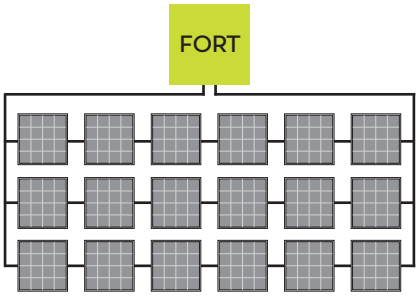
Check polarity before attaching to the + and – marked on FORT. Isolate before attaching/inserting cables to FORT.



6S3P ARRANGEMENT

Place 6 panels out in a line and daisy chain together to connect each of the 6 in series. Repeat by placing two additional lines of 6 panels as per below.

Use loom 1 and loom 2. Loom 1 is marked with red and connects to positive side. Loom 2 is not marked with red and connects to negative side. Check polarity before connecting to FORT using MC4 connectors.



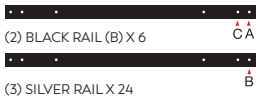
General notes: 1. Isolate before connecting/disconnecting for safe working. **2.** Use MC4 to connect to FORT. **3.** Use MC3 to connect to panel strings **4.** Prevent shadowing to panels wherever possible.

LIFOS Solar Roof Frame ASSEMBLY INSTRUCTIONS

CONTENTS

(1) BLACK RAIL (A & C) X 12

(2) BLACK RAIL (B) X 6



(3) SILVER RAIL X 24

(4) SILVER LONG JOINT X 28

(5) SILVER SHORT JOINT X 16

(6) BLACK SHORT JOINT X 12

(7) MID RAIL SADDLE X 12

(8) END RAIL SADDLE X 4

(9) & (10) LIFTING EYE (RH & LH) X 4 EACH

(11) CAP SCREWS:
(11a) M6 X 35MM X 96
(11b) M8 X 35MM X 160
(11c) M8 X 80MM X 24

(12) CABLE CATCH MEMBRANE X 6

(13) END CLAMP INC CAP SCREW X 24

(14) MID CLAMP INC CAP SCREW X 24

(15) WIRING LOOMS 2 & 3 X 1 OF EACH
(Looms 1 & 4 are supplied as standard with FORT PV)

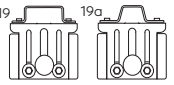
(16) LIFTING SHACKLE X 4

(17) PURPLE LIFTING STRAP X 4

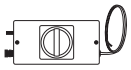
(18) END ROOF FIXING X 4

(19) CENTRE ROOF FIXING X 2

(19a) SIDE ROOF FIXING X 4
(Both items supplied separately to FORT PV in a carry sack)



(20) SOLAR COMBINER BOX X 1 (Supplied as standard with FORT PV)



Step 1: Build Frames

Two identical frames need to be built, each to accommodate nine solar panels, and these two frames will cover the roof of a 20ft container or cabin. If there is only a single 10ft container to cover then only build one frame. Each frame will be lifted independently and the two connected on top of the container or cabin. This system is designed to be assembled many times, but it is your responsibility to check all parts for signs of wear and damage prior to assembly. Each frame is built as follows:

1.1 Assemble 3 x Black Struts, each comprising 3 Black Rails

Each strut comprises 2 x Black Rails A & C (1) joined by a Black Rail B (2) - see Fig 1 below. Slide in two Silver Long Joints (4) as shown below, taking care to line up the holes.

To reinforce the strength of the joint between each Black Rail, fit a Mid Rail Saddle (7) over the joint taking care to line up A & C on the Saddle with A & C on the Rail. Now fix in place using Cap Screw 11b but leaving hole B empty. Repeat this for the rest of the Black Rail Sections.

Insert the Black Short Joints (6) into the end of each Black Strut keeping the plastic cap on the outside. Before fixing in place, slide the end of the rail into the Lifting Eyes (9 & 10) noting the orientation below. Now insert the Cap Screw 11b but leave hole C empty (see Fig 2).

Repeat the above until 2 x Black Struts all have Lifting Eyes fitted. The remaining Black Strut needs the End Rail Saddles (8) fitting to each end – ensuring the up-turned end is facing inward – and using Cap Screw 11b to secure, leaving the inner hole empty (see Fig 2).

Please note: Both Fig 1 and Fig 2 show bird's eye, or top down, views of the struts.

Fig. 1

Fig. 2

1.2: Assemble 4 x Silver Struts, each comprising 3 Silver Rails

Each Silver Strut can be assembled in the same way as described above, using Cap Screw 11b.

Ensure each hole closest to the end of the Silver Strut is empty, along with the centre hole.

PLEASE NOTE: There are smaller holes on the silver rails (M6) but these should be ignored for this stage as they are there to secure the solar panels to the frame and will be used later in the build process. All frame bolts used in this stage are M8.

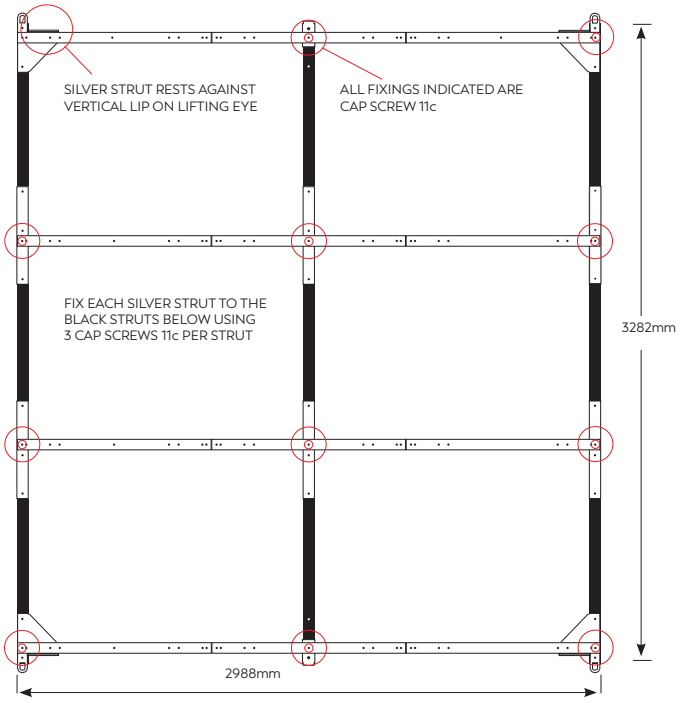
1.3: Make frame: fix Silver Struts to Black Struts

Lay out the Black Struts approx. one metre apart and lay the Silver Struts on top as shown right.

It is advised to fix the outer struts first using three Cap Screws 11c per Silver Strut.

The first Frame is now complete. Build the second frame in the same way.

Fig. 3



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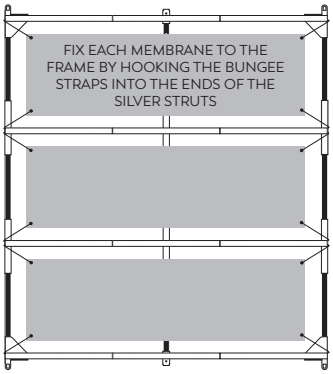
Technical Helpline 01952 200198

Step 2: Fix Panels to Frame

Fig. 4



2.1: Fit Cable Catch Membranes

The Cable Catch Membrane (12) is designed to prevent damage to the solar panel cables when the competed frames are lifted and lowered. Fit the bungee hooks at each corner to the positions shown right.

2.2: Attach Cabling and Fix Panels to the Frame

Position both Solar Frames in front of the cabin or container which the completed arrays will be lifted onto with the Black Rail far right, far left and in the centre of the two frames. Now unravel the four Wiring Looms (15) and position as shown in Fig. 4, threading each under the silver struts to ensure they don't get crushed when fitting the solar panels.

Lay the three solar panels on the far left of the left hand frame onto the top of the frame with the Lifos logo closest to the container (see Fig. 5). Connect the cable from the rear of the solar panel furthest left into the mating connector on Loom 1, and repeat with the other two panels. Once all three panels are coupled to Loom 1, lay the second column of solar panels but as each panel is lowered, connect one of the cables on the rear to the mating cable on the neighbour panel on the first column. Now repeat this process with panels in column three but also connect the far right solar cables into Loom 2. You should now have a single cable exiting the far left and right of the frame.

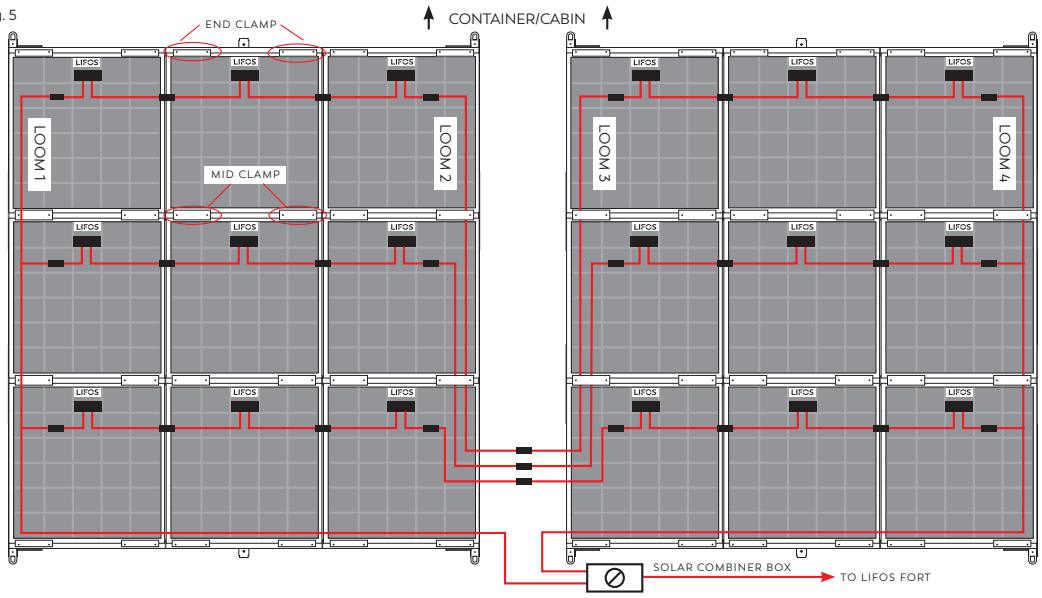
Now fix the solar panels to the frame using the End and Mid Clamps (13 & 14) as shown below. The Clamps have M6 Cap Screws pre fitted and these fit in mating holes on the Silver Struts as shown below. We recommend all the Clamps and Cap Screws are loosely fitted to begin with, so adjustments can be made. Please ensure the solar panels do not overhang the Black Struts. Now tighten all the Clamp Cap Screws.

Finally, cable tie both loose cables (from Looms 1 & 4) to the frame so they remain out of the way during the lift of the frame.

Repeat the above for the right hand Solar Frame, using Loom 3 on the left side and Loom 4 on the right.

You will now have two Solar Frames ready to lift onto the container or cabin.

Fig. 5



Step 3: Fix Frames to Cabin/Container

3:1: Lifting the Frames

Lift each solar frame separately, taking note of environmental factors including wind and space availability. Attach a Shackle (16) and Lifting Strap (17) to each Lifting Eye (9 & 10) of the left hand solar frame and the other end of the Strap to the hook of your crane or telehandler.

Lift the Solar Frame and position on the left hand top of the container with the Black Strut being parallel to the end of the container and each silver side overhanging equally each long side. Before removing the Shackle and Strap, secure the Black Strut to the container using the 2 x End Roof Fixings (18) with the top hat section positioned on top of the black rail and over the ISO hole of the container.

3:2 Fixing in place

Insert the U-Bolt through the ISO hole so the threaded end protrudes through the locating holes in the End Roof Fixing and fit and tighten both nuts to secure. Now remove the Shackles from the Lifting Eyes and the purple Lifting Strap and allow the crane operator to re position the lifting boom over the second (right hand) Solar Frame. Repeat the above for the second frame being careful to ensure both centre black frames are butted against each other.

Once each of the two frames are secured to the container, first fit the Centre Roof Fixing (19) to each side using the two central Black Struts. Position the top hat section so it spans both centre black rails. Fit the main part of the Centre Roof Fixing (19) to the top hat using the supplied bolts and nuts, ensuring the black conical pad faces the side of the container. Once the Centre Roof Fixing (19) is firmly fitted, the external hex drive on the thread of the conical pad can be tightened creating a strong friction fit against the side of the container.

Now fix The Side Roof Fixing (19a) to the single Black Struts either side of the two central struts. There are two each side of the solar array.

Complete the process by tightening the lock nut on the internal part of the thread to ensure the conical pad cannot accidentally loosen. Ensure both sides of the frame are clamped in the centre.

Step 4: Connect to Lifos FORT

Cut the temporary cable ties holding looms 1 and 4 and position the Solar Combiner Box (20) central to the side of the container or either side of a central door if there is one. The Combiner Box can be screwed or cable tied to a wooden stake or similar but also can be left on the ground. Take the ends of Loom 1 and 4 and connect to the mating connectors of the Combiner box.

The Combiner Box has a trailing cable fitted, the end of which connects directly into the Fort ports marked PV+ and PV- . Once coupled the Combiner Box has a DC Isolator fitted and this can now be turned to the ON position.

You can check the solar system is delivering power by waiting for bright light and viewing the LiQ system that shows real time solar input.

To remove the Solar System from a container or cabin, reverse these steps.

lifos.co.uk hello@lifos.co.uk Technical Helpline 01952 200198

MADE IN BRITAIN

CONNECTING TO A GENERATOR

The FORT battery storage system can be connected to a diesel generator. Power can be passed through the FORT from the generator and the generator can also be used to recharge the batteries.

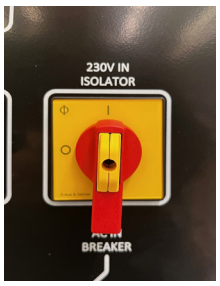
Before connecting the FORT to a generator please ensure the AC isolator switch is in the off position see below:

Connect a 32 amp single phase socket blue capped cable to the input socket on the FORT. The cable can then be connected to the single phase socket equal to or greater than 32A on any generator.

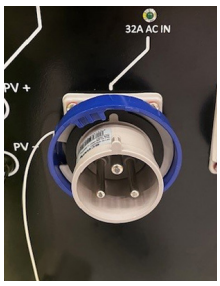
For the 16A output socket please use a minimum of 4mm^2 cable and for the 32A output socket please use a minimum of 6mm^2 cable in accordance with BS 7671.

Please make sure this cable is connected securely before turning on the generator and the FORT.

You can now start the generator. You can now turn the isolator switch to the on position: and the green light (32AC in) will be on when power is coming in.



AC isolator switch 'on' position



3 pin socket blue

AC isolator switch 'off' position

Connect 3 pin standard single phase (230V) cable to the 32A input socket and then to 32amp single phase output on generator

Auto start/stop feature

The FORT comes with an auto start feature. This allows for the FORT to automatically activate the generator when the batteries need charging. It also allows the FORT to automatically stop the generator when the FORT batteries are fully charged. This only works on generators that support this feature so please refer to your generator manual to see if it is compatible.

The FORT comes with an auto start cable this can be connected to the autostart connector on the FORT control panel (see image right) and then to the relevant connector on the generator.

As auotstart connections are not standardised an Amphenol four pin to 2 bare-wire autostart cable can be purchased directly from Lifos if needed.

Please refer to the generator manual for instructions on this.

Most generators need to have the auto start feature activated on the control panel.

In the case of gensets which are automatically operated, it is also recommended to:

Place a warning sign indicating the possibility of the machine unexpectedly starting automatically.

Place a sign indicating that 'All maintenance operations must be performed with the genset in the LOCKED position and autostart de-activated'

To perform an emergency stop of the FORT, press the 'emergency stop' button located on the genset N.B. Familiarise yourself with the location of the emergency stop on your FORT as positions can vary.

Autostart connector

CONNECTING TO OTHER POWER SOURCES

The FORT can also be connected to other power sources for re charging the batteries including solar, mains and generators.

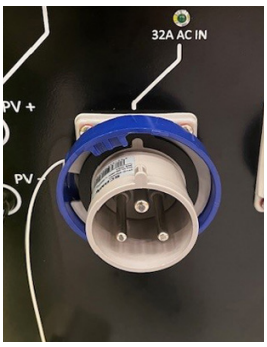
Before connecting the FORT to any power source including a mains supply please ensure the AC isolator switch is in the off position see below.

The input cable connected to the power source eg mains supply, must be connected to the 3 pin AC input connector on the control panel. See below.

Please make sure this cable is connected securely before turning on the power source and the FORT.

You can now start the generator. You can now turn the isolator switch to the on position: and the green light (32AC in) will be on when power is coming in.

AC isolator switch 'on' position



3 pin socket blue

AC isolator switch 'off' position

USING THE FORT

Emergency stop

Before using the FORT please familiarise yourself with the location of the emergency stop button. This is in the top left corner of the control panel (see image right).

The emergency stop button when pressed:

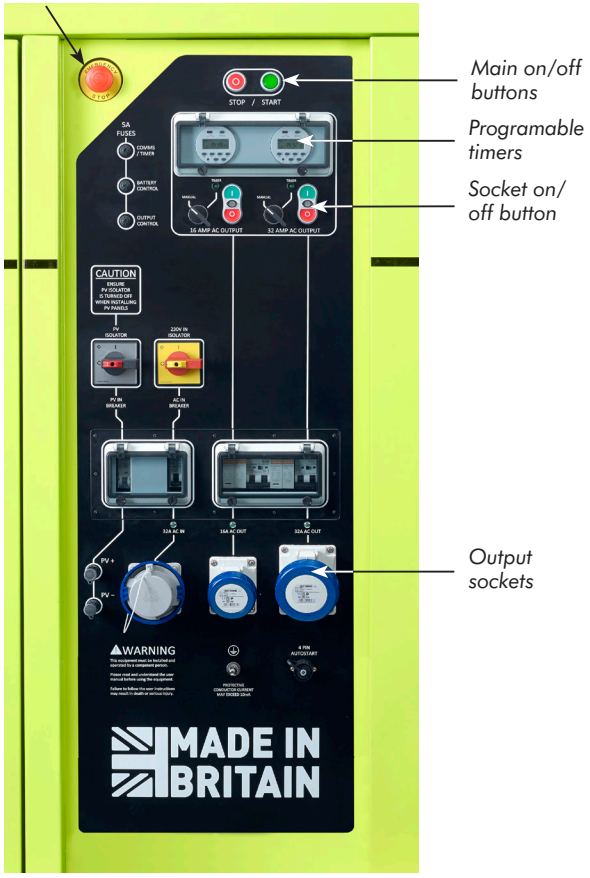
- Stops any output power. The 230V outputs on the 16A and 32A sockets are off.
- Stops input power through the AC socket whether from a generator or mains.
- There will still be solar input power to the inverter. Batteries will not charge.

The demand to the generator comes directly from the inverter (This is not interrupted) so its operation is dependent on the inverter set up.

- The battery input to the inverter is stopped.
- Please note the batteries remain powered up and supplying the control circuitry unless switched off at their individual on/off button on each battery pack.
- The power to the computer will also be switched off when the emergency stop is pressed. The computer will no longer be communicating with the inverter and will not be transmitting location data.
- The Fans are still connected to power from the inverter so if the Inverter generates 48v (via solar input) they may operate.

To restart the FORT, after the emergency stop has been activated, the emergency stop button needs to be twisted until it releases and pops back out. The FORT 'on' button will then need to be pressed and the green light will come on.

Emergency stop button



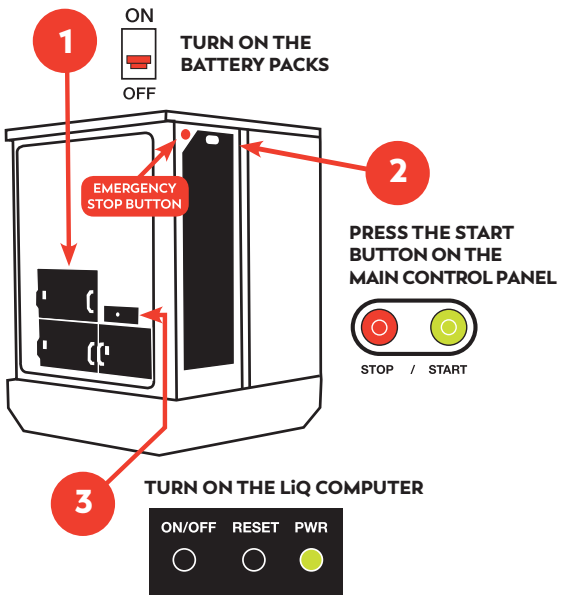
Please check the function of the emergency stop at regular intervals.

To switch on the telematic computer, press the on button for 3 seconds at the front of the computer box, a green light will come on.

Start up procedure

NOTE: Before starting FORT, check that the emergency stop button has not been pressed by turning it in a clockwise position – it will release if it has.

1. **Turn on the battery packs.**
   Switch the on/off control on the left of each battery's front face to the on (up) position.
2. **Press the start button on the main control panel.**
   Press the green start button at the top of the main control panel on the front of the FORT. It will glow green when on.
3. **Turn on the LiQ computer.**
   Press and hold the on/off button for 5 seconds.
   The 'PWR' light to the right will glow green when on.



Connect output cables

There are two output sockets one 32 amp and one 16 amp. They both take single phase industrial connectors (blue). Cables should be connected before switching on power to the output sockets.

Each socket has an independent on/off button depending on which output socket you want to use. The timer must be in 'on' mode for power to be available (see section on timer below).

If you want power from the 16 amp socket, press the 16 amp socket on button see image below. The green light will come on.

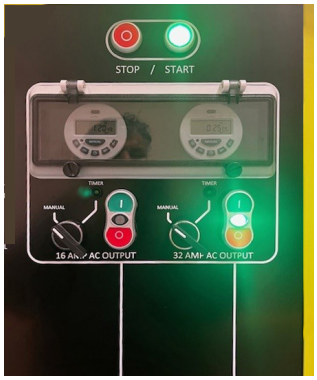
If you want power from the 32 amp socket, press the 32 amp socket on button see image below. The green light will come on.

Each output socket can be timer controlled.

If the toggle switch for the relevant channel is in the manual position then switch the button to the socket you want to activate (green light will come on) and power will be available.

If the toggle switch is in the timer position then switch the button to the socket you want to activate (green light will come on) and the timers need to be set to activate the socket.

16 Amp and 32 Amp output sockets



Power from 32 amp socket

Output socket timer control toggle switch

Toggle switch in timer position showing green light

Setting the timer

Each of the output sockets can be controlled by a timer allowing you to set when power is available per output socket.

If at any time the image ( ) appears on the screen press the C/R button 4 times to unlock the timer.

If this is the first time use of the product please press down on the c button using the end of a pin or similar.

The timer has three settings choose by pressing the (manual) button

Auto – the timer will allow power to activate from the programmed times

On – power will be activated at all times

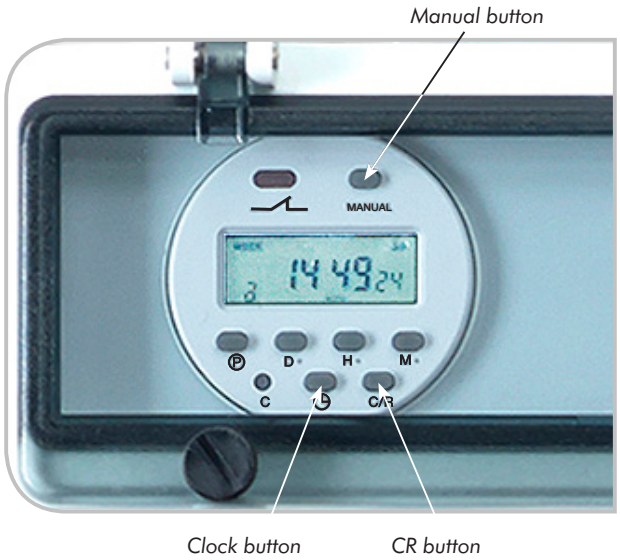
Off – no power will pass through.

- To set the time press the (clock) button once.
- Press the D+ button until the desired day is set.
- Press the H+ button until the desired hour is set. It is a 24 hour clock.
- Press the M+ button until the desired minute is set.
- The time is now set.

The timer can be programmed for up to 20 different programs. To set the program please follow instructions below:

If at any time the (backward 6) image appears on the screen press the C/R button 4 times to unlock the timer.

- Press P button the screen will display the number 1 and on. You can now set the timer to switch on
- Press the D+ button until the desired day/s are set that you want to set a program for
- Press the H+ button until the desired hour is set. It is a 24 hour clock.
- Press the M+ button until the desired minute is set.
- Press P button the screen will display the number 1 and off. You can now set the timer to switch off
- Press the D+ button until the desired day/s are set that you want to set a program for.
- Press the H+ button until the desired hour is set. It is a 24 hour clock.
- Press the M+ button until the desired minute is set.
- Press the clock symbol button and the program is now set.



- To set further programs press the P button twice to get to program 2 and repeat and three times for program 3 etc

Please note each timer needs to be set separately for each of the output sockets.

Shut down procedure

To switch the FORT off follow these steps:

1. **Press the stop button on the main control panel.**
   Press the red stop button at the top of the main control panel on the front of the FORT.
2. **Turn off the computer.**
   To turn off the computer inside the FORT, press and hold the power (on/off) button on the front face. The green 'PWR' light to the rightwill go off.
3. **Turn off the battery packs.**
   Switch the on/off control on the left of each battery's front face to the off (down) position.

DATA COLLECTION AND REPORTING – LIFOS IQ

Lifos have designed and developed their own software platform to monitor, control and report on the FORT PV. This allows you to produce reports showing usage of the product over any given period and give you data on diesel fuel saved and CO2 saved.

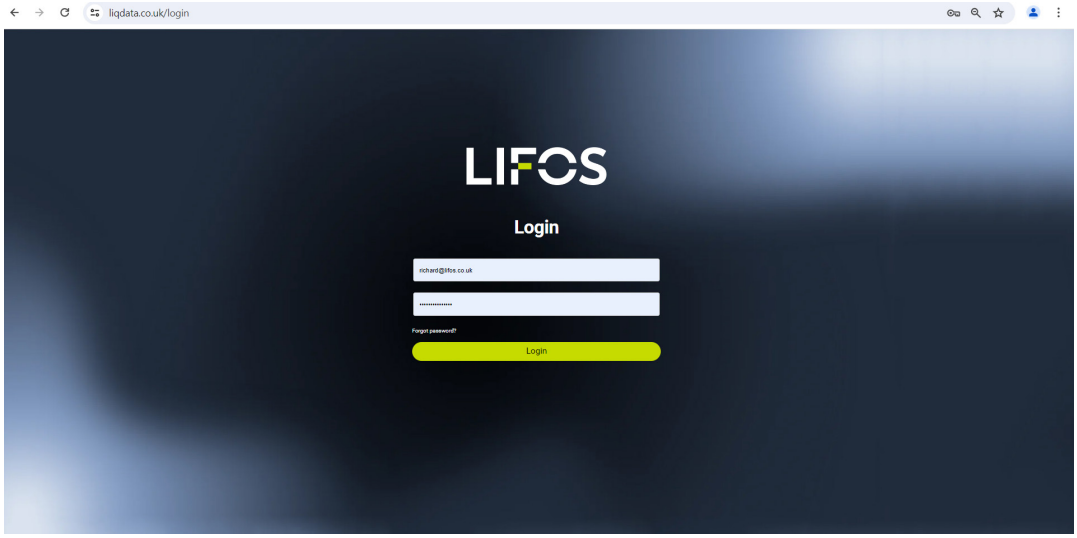
There are two tiers of user. The first is the customer who is the owner of the FORT and the second is the hirer who has hired the FORT. The customer needs to allocate the FORT to different hirers.

Upon purchasing a FORT you will be sent an email with instructions on setting your password. You will be able to add further colleagues and hirers once you are logged in (instructions below)

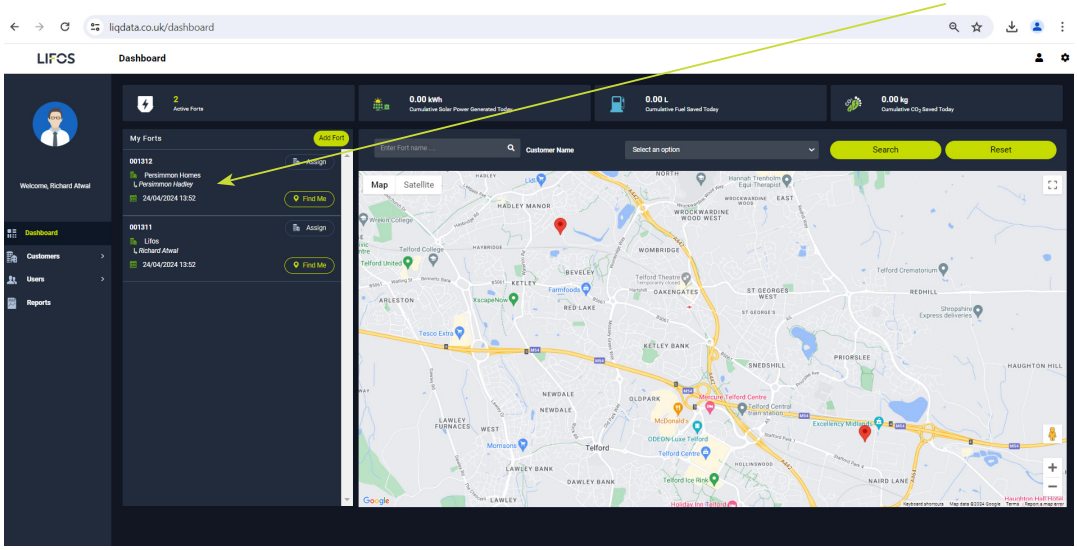
Login page

Go to www.liqdata.co.uk

Enter your email address and password. You will then be asked to enter letters from your memorable word.

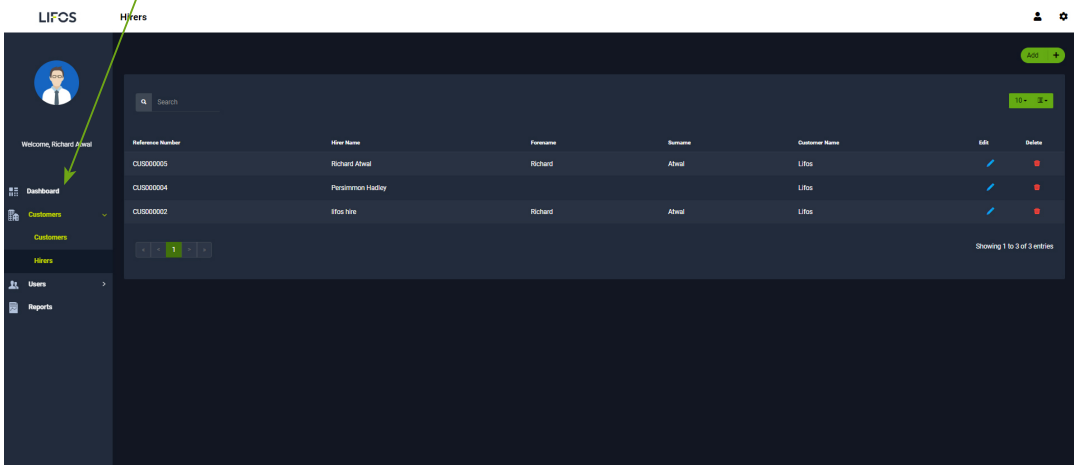


This will take you to the home page Your FORT (s) will be listed here and their location shown on the map.

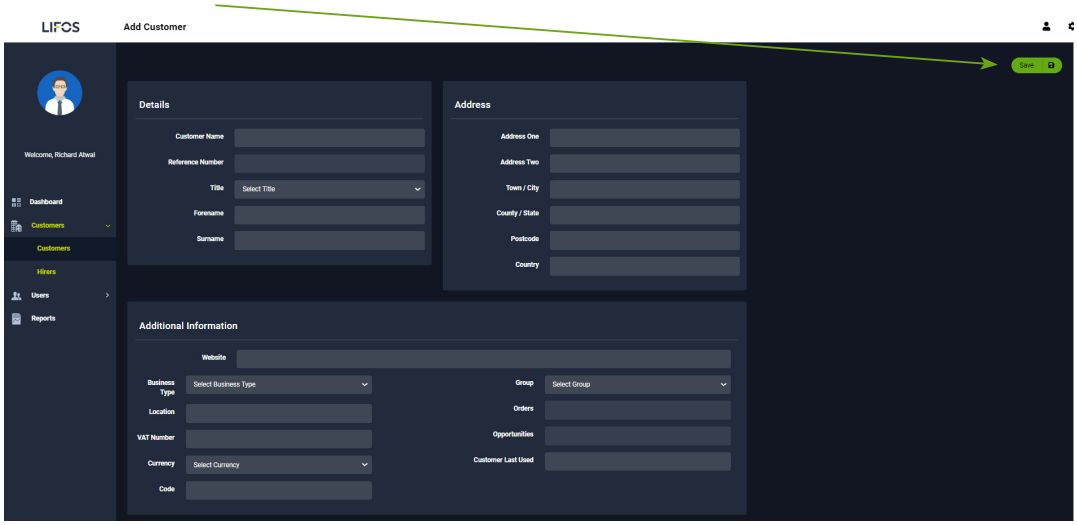


Adding colleagues

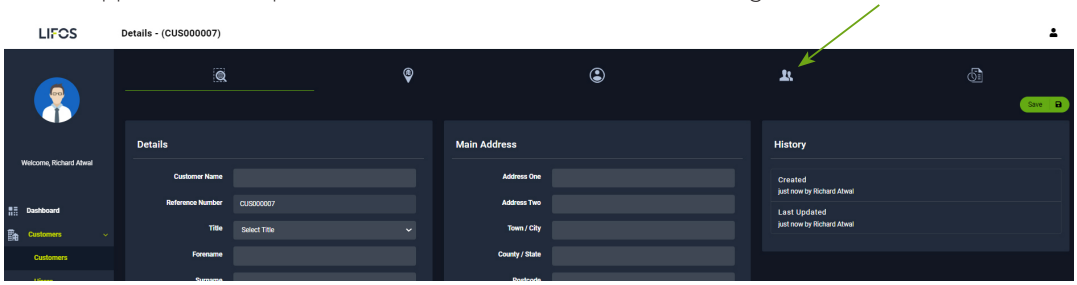
On the left hand side click on customer. Your details will appear. You can add colleagues by clicking add in the top right hand corner.



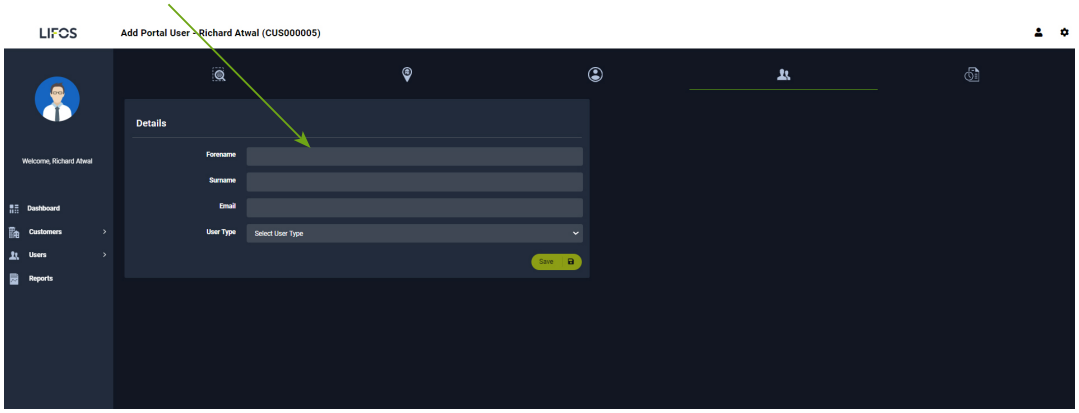
Complete the details and click save.



A set of icons will appear at the top of the screen, click on the fourth one along called user.

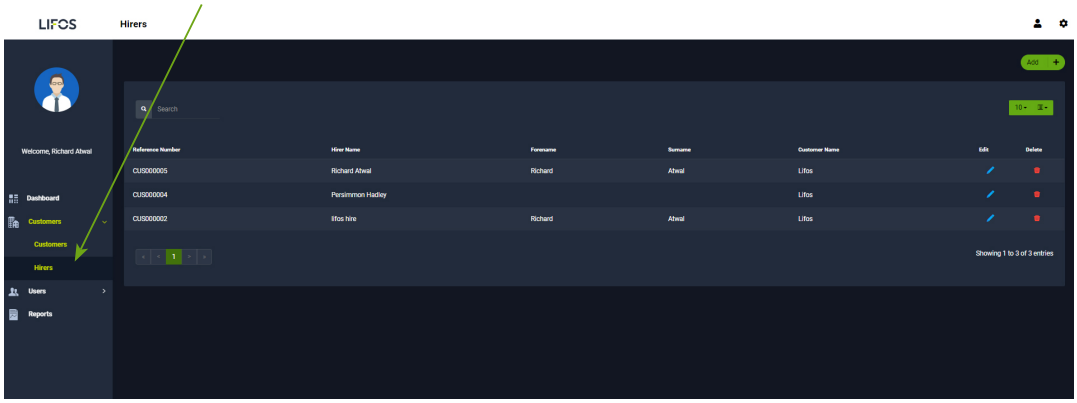


Fill in the details and click save. The person will receive an email with instructions to set a password and log in.



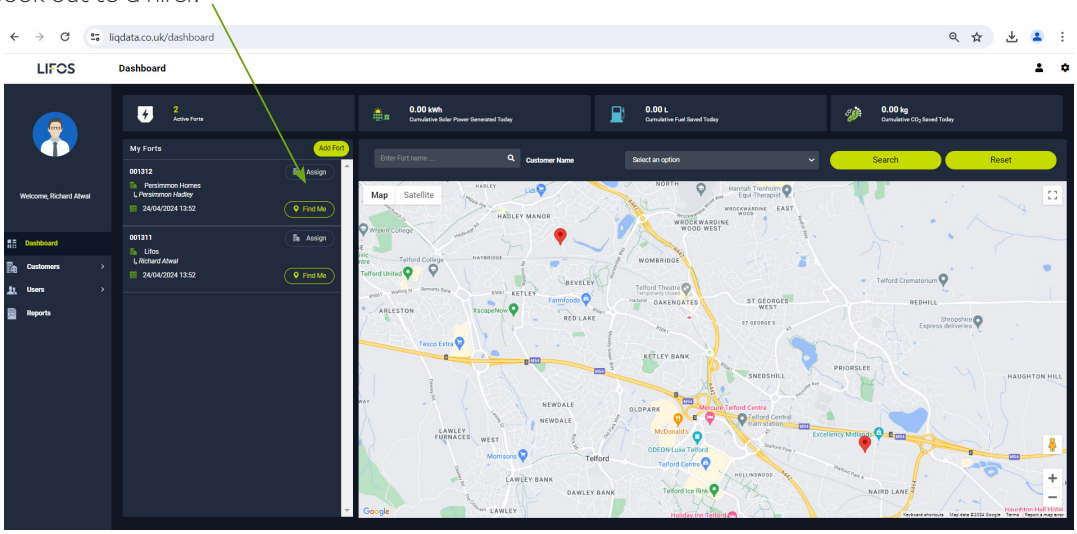
Adding hirers

Similar to adding colleagues but on the left hand side you need to click on hirers then follow the same process to add a hirer.



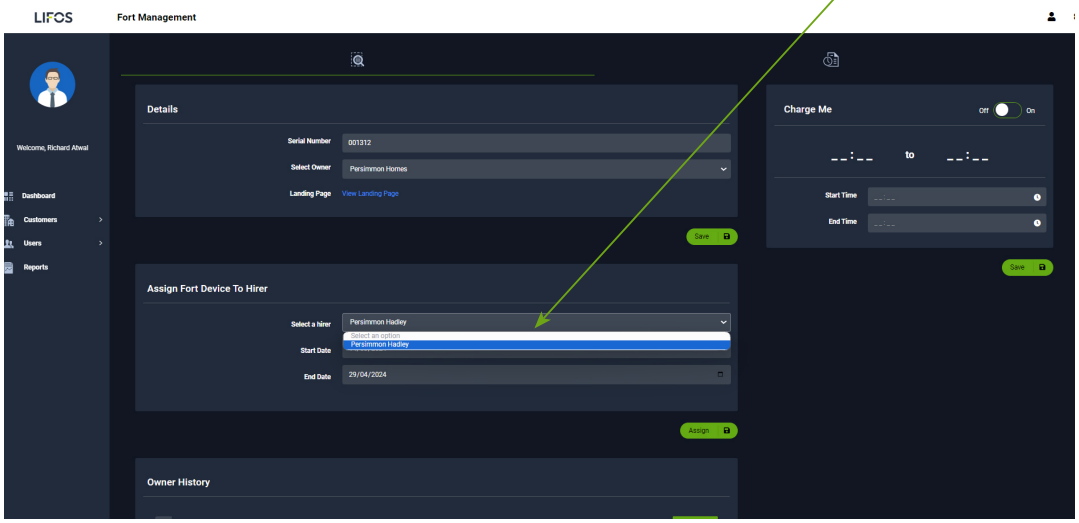
Assign a FORT to a hirer

To assign a FORT to a hirer go to the dashboard page and click on the assign button of the FORT you want to book out to a hirer.



You then go down to the 2nd block titled ‘assign FORT device to hirer’ select the drop down box and select the hirer you require and the dates you want the hire to be. Dates can be amended at anytime.

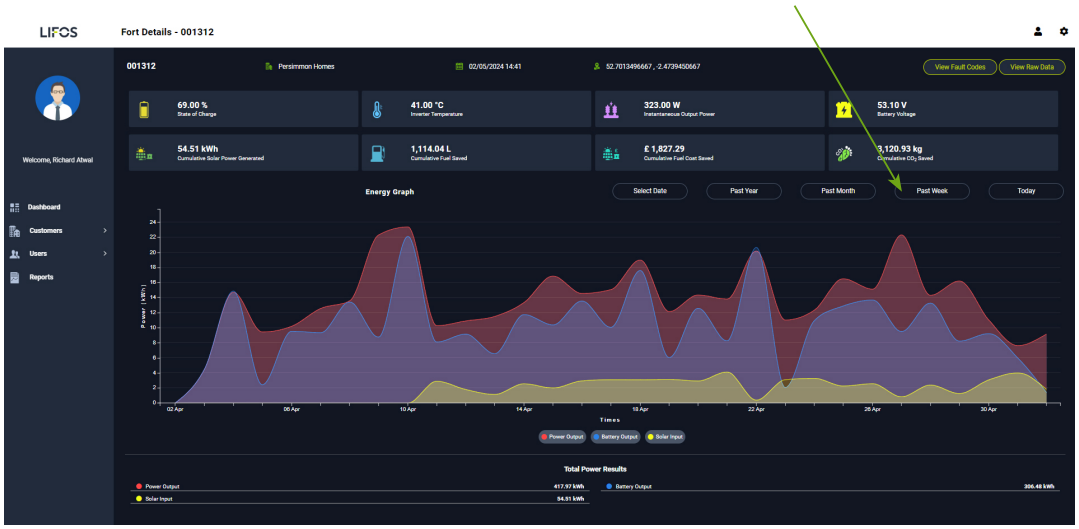
On this page by scrolling down you also have a history of the hirer of the FORT with a full date history and hirer details.



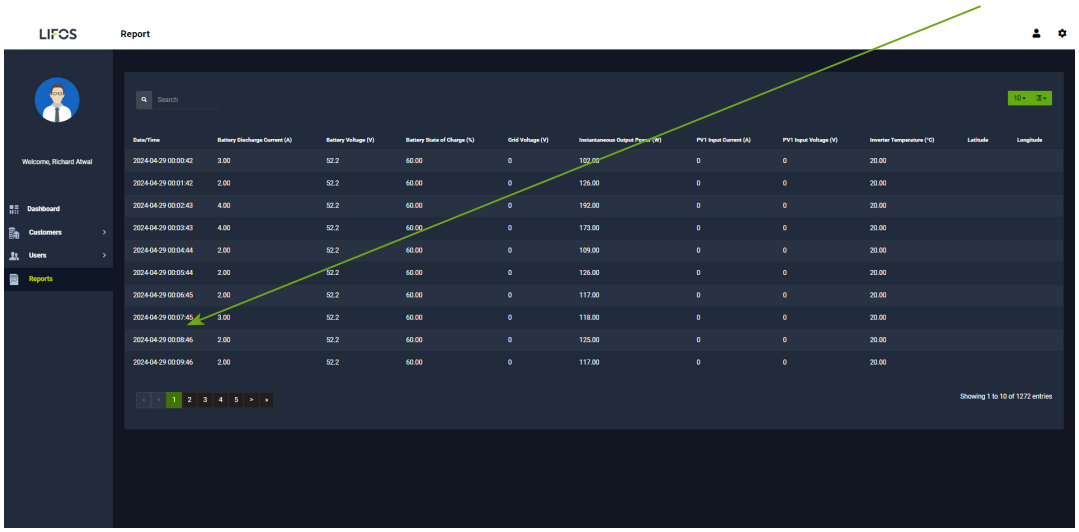
Reporting and data

The LiQ system records all the data of your FORTs performance and also data for ESG reporting including diesel saved, CO2 saved and money saved. This data can be presented within the LIQ system or downloaded into a CSV file and imported into any other compatible software.

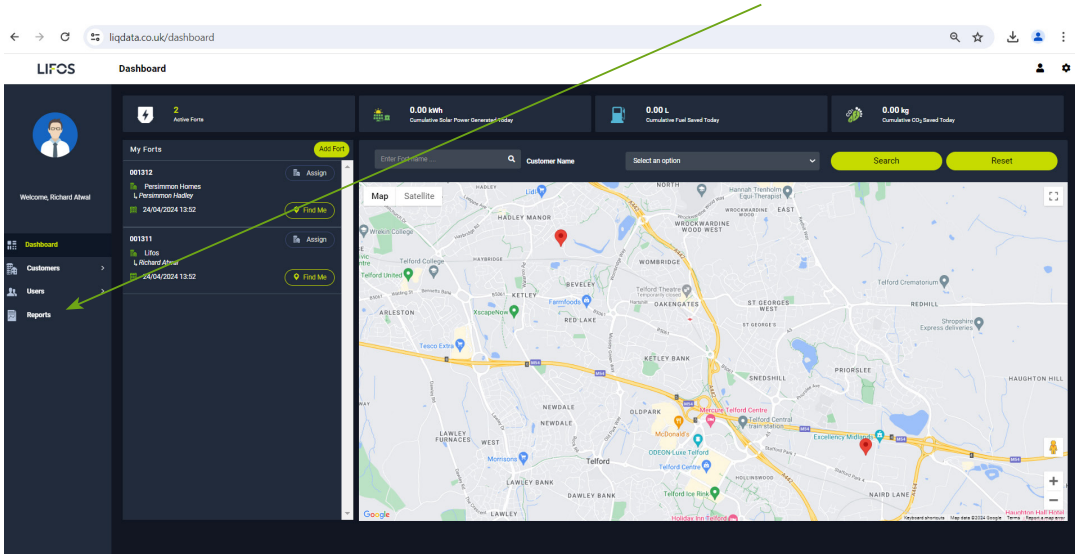
From the home page click on the FORT and you will go to the date page for that day. From here you can look at data for the past week, month or for a date range you select by pressing the tabs below.



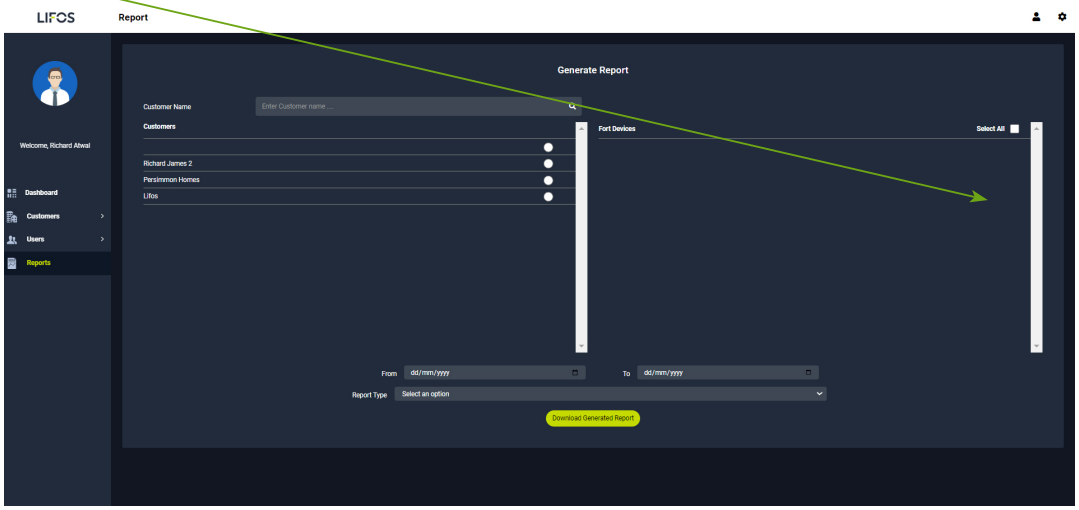
From this overview you can also look at granular raw data. This maybe useful if for example you want to see loads at specific times or when the diesel generator went on or off or the yield from the solar. Click on the today tab and then click on raw data in the top right hand corner. This will go to a page similar to the one below and you can scroll through the pages until you get to the time stamp you are looking for.



To export data from the home page click on the reports tab on the left hand side.



When you get to the page below select the customer or hirer you are looking for and enter the date range you require. If you have multiple FORTs you will need to select the FORT number you require on the right hand side.



You then have two options for the report format either full raw data or just the ESG data. Whichever you select the data will be downloaded into an excel CSV file that you can import into any other compatible program.

For further support on the LiQ system please email us on **hello@lifos.co.uk**

Maintenance and Care

GENERAL SAFETY

Before working on the FORT it is important to carefully read the safety advice and find out about any local requirements in terms of safety and earthing.

Installation, operation, maintenance and repairs must **only** be carried out by authorised and competent personnel, with the owner of the FORT responsible for ensuring these operations are conducted safely. Parts and accessories must be replaced if they are not in safe working condition.

For your own safety and that of others, pay particular attention to the following basic safety criteria:

- **Do not** allow unauthorised persons to access the FORT or people with pacemakers, due to possible electromagnetic interference on cardiac stimulation devices.
- It is prohibited to by-pass and/or remove the safety devices as well as modify the settings of the FORT.
- **Do not** lean on the FORT or leave objects on it.
- Ensure the autostart is disconnected before starting any maintenance work.
- **Do not** open the FORT in the dark please ensure you have adequate light before opening the main door of the FORT and make sure any working area is well lit.
- **Do not** work on the FORT in heavy rain without providing suitable cover.
- Maintenance operations must be carried out with the FORT switched off and the batteries individually switched to the off position when stopping the FORT.
- After a period of operation allow it to cool, taking care not to burn yourself as some components may be extremely hot when the FORT has recently stopped. Wait for at least a period of 5 minutes before checks / maintenance procedures are undertaken.
- The FORT has several safety and information labels affixed to it in order to attract the attention of the operator or technician regarding potential dangers and with explanations on how to act safely. Do not remove these labels.
- Before working on any components of the electrical system please switch the batteries to the off position.
- **Do not** remove the access panel between solar panel compartment and the main electrical cabinet.
- Before opening the main door authorised personnel should take the following precautions:
    - Disconnect the mains input to the FORT whether mains power or generator power.
    - Disconnect the solar power input and make sure all isolator switches are in the off position.
- Periodically check both the tightening and isolation of the connections.
- There must be an annual earth bond inspection to ensure there is no breakdown of the earth continuity. Figures for this must be recorded and stored for a period of 5 years.
- Please check the function of the emergency stop at regular intervals.
- **Do not** make modifications to the product without the express knowledge and authorization of Lifos Technical Department.
- Spare parts must correspond to the requirements defined by the manufacturer. Use only original spare parts. For spare parts only contact authorised spare parts distributors or workshops which are part of the Lifos network. To correctly identify the spare parts required, always specify the data indicated on the FORTs rating plate and serial number.
- Periodically check for water ingress.
- Periodically check any plastic parts on the exterior of the FORT have no cracks.
- **Do not** adjust the inverter or other components of the FORT to obtain performance characteristics which differ to those envisaged by the manufacturer.
- Before working on the control panel, disconnect the power supply and the batteries, putting the FORT into the OFF position.

- The electrical control panels, like all electrical equipment, may be affected by moisture and dust over time. Check for any signs of wear or damage from moisture or dust.
- Periodically check all door gaskets for signs of wear and tear. Please note if seals are damaged or worn the IP rating will be compromised. Please contact the manufacturer for new seals.
- Check the unit regularly for damage to paintwork including scratches and chips. Any damage should be treated with appropriate anti corrosion paints to maintain warranty and integrity of the unit.
- Cleaning: Only clean by application of a damp cloth using a mild detergent. Take care not to allow water ingress.
- **Under no circumstances** use Alkalis or disinfectants on the product.
- Please check filters on. a regular basis.

  It is recommended the fan filters are changed every 12 months or when they are showing signs they are dirty. The fan filters are located inside the solar panel compartment on the left side.

  The filter is changed by sliding up the foam mesh. Replacement filters are available from **www.Lifos.co.uk**

Slide up foam mesh to change filter

Changing the fuses

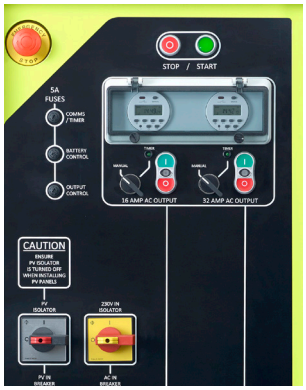
There are three 5A fuses fitted to the front of the control panel. Located as shown below.

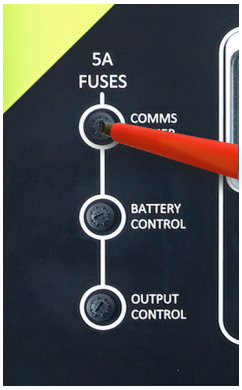
Each fuse is labelled with reference to the circuit function they protect. These are fuse number F8, F9 and F10 as per FORT PV schematic control panel layout, see page 32.

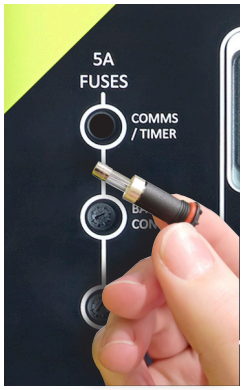
To check and / or change the fuse insert a flat head screw driver and twist anti clockwise and remove the fuse holder. The fuse should be checked by a competent person. If the fuse has blown a competent person should check the FORT to establish the cause. **Checks must be made before a new fuse is inserted.**

To change the fuse pull the fuse away from the holder and replace. Insert fuse holder back into panel and twist clockwise to tighten. You must ensure that the red ring on the fuse holder is not visible in order for the circuit to operate.

The fuses are 5x20mm 5A glass cartridge fuses.







Wrong

Correct

SERVICING

Accessing the FORT

Access to the main body is through the main door. This should only be opened by a qualified person.

Battery maintenance

The batteries incorporated in the FORT are maintenance free and should only be checked by a qualified person.

Periodically check the connections of the battery terminals to ensure they are clean, tight and protected from the weather.

Never invert the positive and negative terminals of the batteries when connecting them. An inversion may result in serious damage to the electrical equipment.

The batteries should only be replaced by a qualified person with permission of Lifos and using Lifos batteries otherwise the warranty is invalid.

In some countries the batteries are considered hazardous waste. Use appropriate containers or contact any organisations responsible for the collection of this waste.

Troubleshooting

FREQUENTLY ASKED QUESTIONS

What is a Lifos FORT PV?

The Lifos FORT PV is a battery energy storage system with its own solar panel system. The Lifos FORT PV offers up to 35kwh of battery storage.

Would a Lifos FORT PV replace my diesel generator?

This depends on usage. There are scenarios where it could replace the diesel generator but more likely it will work alongside the diesel generator and reduce diesel consumption by up to 90%.

Can a Lifos FORT PV be plugged into the mains?

Yes it can be connected to mains for recharging.

I can see a Lifos FORT PV offers single phase, Is 3-phase coming out?

Yes we will have 3 phase in 2025.

How do you use the solar panels?

The solar panels can be set up in 2 ways. There are 18 panels delivering 3.4 kw of power. They can be ground mounted and each come with their own kick stand or we have a framing system allowing them to be mounted to container or cabin.

Is the panel mounting system easy to assemble on site?

It will take 2 people approx. 1.5 hours to assemble the solar panel system. It can then be lifted with supplied straps onto a 10ft or 20ft container and locked on using the isofix points.

How long do the batteries last for in the Lifos FORT PV?

The batteries are warranted for 5 years but should last for 7 years giving peak performance. Overall 12 years can be expected. We also have a 7 year swap program where we will swap the batteries for new after 7 years and give a new 5 year warranty.

What happens to the batteries at the end of their life?

Since we build and monitor the battery packs we will be able to reuse the battery packs into other light power applications. If after this the battery is truly at the end of life we have a certified recycling partner.

Is there a way of monitoring the data from the Lifos FORT PV?

Yes the Lifos FORT comes with our own telematics system called Lifos IQ. This enables you to monitor and record data from the FORT. Amongst the information you can gather is how much solar and battery you have used over a day/week/month etc and also how much diesel and CO2 you have saved.

Can this Lifos IQ website be linked with our own telematics website to manage the fleet?

Yes the data can be exported to any other software package.

If you have any more questions about Lifos FORT please call us on 01952 200198 or email us at hello@lifos.co.uk

Specification Data

DATA SHEETS

LIFOS FORT PV

RENEWABLE HYBRID POWER

LIFOS
ADVANCED BATTERY TECHNOLOGY

Powering Possibilities

The greenest battery – **inside and out**

Power you can depend on – **guaranteed**

Delivers for 15 years **and beyond**

SPECIFICATION

LIFOS FORT PV	LF1010SPVG	LF1020SPVG	LF1035SPVG
Maximum continuous output		10kVA	
Battery storage capacity	11kWh	22kWh	33kWh
Manufacturer		Lifos	
AC Input voltage from mains / generator		170 - 280	
AC Input voltage frequency from mains / generator		50 / 60Hz (Auto Selector)	
Generator autostart		Yes	
Output voltage		230VAC / 50Hz	
Voltage phase		Single	
Voltage output waveform		Pure sine wave	
Performance without derating		8kVA	
Power factor		1	
Inverter efficiency AC mode		>93%	
Peak output power		22kVA	
Power input type		1 x 32 A, 230AC and 1 pair MC4 solar connectors, DC	
Power output type		1 x 16A and 1 x 32A, 230V AC	
Operating temperature range		0 to +40°C	

LIFOS SOLAR PANEL			
Panel power and qty		190w x 18	
Solar string type		6S3P (user configurable)	
Nominal total PV voltage		190.8V	
Max PV total open circuit voltage (OCV)		227.16V	
Total solar power		3.42 kW	
Approximate charge time using 3.4kw solar array (peak)	3.3 hrs	6.6 hrs	9.9 hrs
Solar panel mounting		Each panel is fitted with a ground stand or can be roof mounted using the optional roof top mounting system	

Average Solar Yield	Fort Solar Array Size	Daily Yield Spring	Daily Yield Summer	Daily Yield Autumn	Daily Yield Winter	Annual Yield	Carbon Emission Reduction (kg/Yr)
	3.42kw*	8.05kwh*	16.00kwh*	9.38kwh*	2.52kwh*	3289kwh*	1868kgs*

*Assumes the solar panels are positioned flat and the location is Gloucestershire, UK. Locations further South or North will deliver a higher or lower solar yield. Contact **hello@lifos.co.uk** who can confirm an accurate predicted solar yield in any given location.

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MADE IN BRITAIN

LIFOS FORT PV

RENEWABLE HYBRID POWER

LIFOS
ADVANCED BATTERY TECHNOLOGY

INVERTER SOLAR CONTROLLER	LF1010SPVG	LF1020SPVG	LF1035SPVG
Solar input compatible range, voltage		90 – 450VDC	
Max solar current		18A	

BATTERIES			
Chemistry		LiFePO4 (LFP)	
Number of Lifos battery packs	1	2	3
Guaranteed min. cycle lifetime at 25C, 80% DOD		3200	
Total battery capacity	11kWh	22kWh	33kWh
Approximate run time without power input at 75% load	1.2hrs	2.4hrs	3.6hrs
Approximate run time without power input at 100% load	0.8hrs	1.6hrs	2.4hrs

INCLUDED WITH ALL MODELS

1 x Lifos Fort PV	18 x Lifos 190wp/24v Solar Panels each with ground stand	1 x 5 year warranty
1 x 1m copper earth rod	1 x Solar panel cable bundle	1 x Lifos College Training Place
1 x DC isolator box with connection cable	1 x 12 month subscription to LiQ Data System	1 x Instruction manual and training

MONITORING / INTERFACES

LiQ for global monitoring	Physical on / off lights and LCD power monitor on equipment

PERFORMANCE IN HYBRID MODE	LF1010SPVG	LF1020SPVG	LF1035SPVG
Approximate charging time with 10kVA generator	1.6hrs	3.2hrs	4.8hrs

DIMENSIONS AND WEIGHT			
Dimensions (L x W x H)		1300 x 1300 x 1641mm	
Weight (approximate)	768kgs	858kgs	948kgs
For use on ground slope		<20 degrees from horizontal	

WARRANTY	
All operating parts	5 years
Paint warranty	2 years

STANDARDS

CE, UKCA, Rohs, UN38.3. Fort tested to EN 61000-6-3, EN 61000-6-2, ETSI EN 301 489-1 V2.2.3

OPTIONAL ACCESSORIES	
Roof top mounting system	An easy build mounting system to hold all 18 solar panels, which once built can be craned and locked into position on a standard 20ft container or cabin. All parts fit neatly into the Fort PV all weather enclosure
Additional battery packs	You can expand a Fort PV up to three battery packs
Additional Solar Panels	Add extra 190w Lifos Solar Panels to the existing 3.4kw array to expand the solar capability

LIFOS

Lifos reserve the right to modify any feature without prior notice.
Images are indicative and non contractual.

UN 38.3 RoHS CE UK CA

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MADE IN BRITAIN

LIFOS

HYBRID INVERTER 11KVA 48V

- Status indication with RGB lights
- Built-in 2 strings of MPP trackers
- Built-in Wi-Fi for mobile monitoring (Android/iOS App is available)
- Supports USB On-the-Go function
- Reserved communication port for BMS
- Replaceable fan design for ease of maintenance
- Battery independent design
- Configurable AC/PV output usage timer and prioritisation
- Selectable high power charging current
- Selectable input voltage range for home appliances and personal computers
- Compatible to Utility Mains or generator input
- Built-in anti-dust kit
- Parallel operation with 6 units

AXPERT MAX E SPECIFICATION

MODEL	
MODEL	INV11KW48
Rated Inverter Power	11000VA/11000W
PARALLEL CAPABILITY	YES, 6 units

INPUT	
Voltage	230 VAC
Selectable Voltage Range	170-280 VAC (For Computers) 90-280 VAC (For Home Appliances)
Frequency Range	50 Hz/60 Hz (Auto sensing)

OUTPUT	
AC Voltage Regulation (Batt. Mode)	230VAC ± 5%
Surge Power	22000VA
Efficiency (Peak)	93%
Transfer Time	10 ms (For Personal Computers) 20 ms (For Home Appliances)
Waveform	Pure sine wave
No Load Power Consumption	<70W
Dual Outputs	YES

BATTERY	
Battery Voltage	48 VDC / user definable
Floating Charge Voltage	54 VDC / user definable
Overcharge Protection	63 VDC / user definable

SOLAR CHARGER & AC CHARGER	
Solar Charger type	MPPT
Maximum PV Array Power	11000W (5500W x 2)
MPPT Range @ Operating Voltage	90 ~ 450 VDC
Maximum PV Array Open Circuit Voltage	500 VDC
Maxmum Solar Charge Current	150A
Maximum AC Charge Current	150A
Maximum Charge Current	150A

PHYSICAL	
Dimension, D X W X H (mm)	147.4 x 432.5 x 553.6
Net Weight (kgs)	18.4
Communication Interface	USB/RS232/RS485/Wi-Fi/ Dry-contact

OPERATING ENVIRONMENT	
Humidity	5% to 95% Relative Humidity (Non-condensing)
Operating Temperature	-10°c to 50°c
Storage Temperature	-15°c to 60°c

STANDARD	
Compliance Safety	CE

* Product specifications are subject to change without further notice

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V1.0

Appendix

CONTROL PANEL