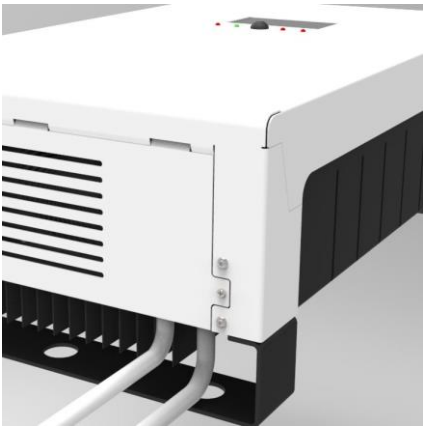
mlt INVERTERS



+ OASIS

User Manual

4th Edition – September 2019

Table of Contents

Figures

1. Introduction

1.1 Warnings and Cautions

A safety instruction (message) includes a hazard alert symbol and a signal word, WARNING or CAUTION. Each signal word has the following meaning:

HIGH VOLTAGE: This symbol indicates the presence of a high voltage. It calls your attention to items or operations that could be dangerous to yourself or others operating this equipment. Read the message and follow the instructions carefully.

WARNING: Indicates a potentially hazardous situation which, if not avoided, can result in serious injury or death.

CAUTION: Indicates a potentially hazardous situation which, if not avoided, can result in minor to moderate injury, or serious damage to the product. The situation described in the CAUTION may, if not avoided, lead to serious results.

GENERAL WARNINGS

DANGER OF ELECTRIC SHOCK. There are no user serviceable parts inside the inverter. DO NOT attempt to make repairs or alterations to the unit.

WARNING: This equipment should be installed, adjusted, and serviced by qualified electrical maintenance personnel familiar with the construction and operation of the equipment and the hazards involved. Failure to observe this precaution could result in personal injury.

GENERAL CAUTIONS

CAUTION: Always wear personal protective equipment (protective clothing, gloves, and safety boots) while performing an installation or maintenance, to avoid the danger of injuries.

CAUTION: Proper grounds, disconnecting devices, e.g. bypass boxes and other safety devices and their location are the responsibility of the user and are not provided by MLT Inverters.

CAUTION: Do not cover the device or operate it in a small space - always keep it well ventilated and well away from flammable gases or powders. Components in the device could potentially cause a small electric spark that could ignite flammable gas or powders. Flammable gases are created by batteries and can become a hazard in poorly ventilated spaces.

CAUTION: For indoor use only and MUST be installed in a dry area free from conductive liquids or conductive debris. If part of the inverter becomes submerged in water look for a safe way to isolate it at the distribution board and if possible at the batteries.

1.2 Contacting MLT Inverters

1.2.1 Product Support

When contacting Product Support via telephone, email or fax please provide the following information for the fastest possible service:

- Type of Inverter
- Serial number
- Battery type
- Battery bank capacity
- Battery bank voltage
- A description of the event

Note that the serial number is available on the serial plate that is attached to the bottom of the machine inside the cover.

1.2.2 Contact Details

Telephone: +27 (0) 21 201 1335

Email: info@mltinverters.com

Address: 97 Garfield Road
Kenilworth 7708
Cape Town
South Africa

1.2.3 Telephone

You can reach technical support by telephone directly Monday to Friday between 08h00 and 17h00 (GMT +2 hours). Queries outside of these hours should be directed to support@mltinverters.com and will be answered at the earliest opportunity. When contacting technical support, please ensure that you have the information listed above available.

1.3 System Specifications

1.3.1 System Ratings

	Oasis 5H48	**Oasis 8H48**	**Oasis 10H48**
Rated Voltage / Frequency	1ø / 230 V / 50 Hz	1ø / 230 V / 50 Hz	1ø / 230 V / 50 Hz
Rated Output Power	4 kVA	6 kVA	8 kVA
Half-hour Output Power	5 kVA	8 kVA	10 kVA
Rated Output Current	17 A (40 A with AC source)	26 A (60 A with AC source)	35 A (60 A with AC source)
Max Output Current	22 A (for 30 mins), 34 A (for 2s), 40 A (with AC source)	35 A (for 30 mins), 52 A (for 2s), 60 A (with AC source)	43 A (for 30 mins), 70 A (for 2s), 60 A (with AC source)
THD V (at rated power)	< 5 %		
Protection	Surge, Overload, Short circuit, Over temperature, Reverse power, Low / High battery voltage, Source over/under voltage/frequency		
Changeover time	Less than 30ms changeover time after source failure.		

1.3.2 AC Input

Input Voltage Range	185 .. 250 V	185 .. 250 V	185..250V
Input Frequency Range	42 .. 65 Hz	42 .. 65 Hz	42..65 Hz
Rated Input Current	40 A	60 A	60A

1.3.3 DC Specifications

Battery Voltage (Nom.)	48V	48V	48V
Max. Charging Current	20 / 40A	30 / 60A	40 / 80A
Battery Technology	Lead-Acid, Li-Ion (Contact MLT Inverters for details on supported Batteries)		

Connection Requirements

DC Input	10 x 35 mm² Lugs	10 x 50 mm² Lugs	10 x 70 mm² Lugs
AC Input / Output	10 mm² Terminal	16 mm² Terminal	16 mm² Terminal

1.3.4 Efficiency

	Oasis 5H48	**Oasis 8H48**	**Oasis 10H48**
Efficiency	Up to 94 %	Up to 94 %	Up to 94%
No Load Power Consumption (On)	< 35 W	< 45 W	<55W
No Load Power Consumption (Load Sense)	6 W	8 W	10 W

1.3.5 General Specifications

Mounting Method	Wall Mounted		
Dimensions (W x H x D)	355x580x210mm	395x665x218mm	395x665x218mm
IP/NEMA Rating	IP20 / NEMA1		
Colour	RAL9002, RAL9011		
Weight	43 kg	62 kg	70 kg
Architecture	Galvanically Isolated, Forced Air Cooling		

1.3.6 Climatic Conditions

Ambient Temperature	-5 .. 45 °C
Ambient Transport Temperature	-25 .. 70 °C
Maximum Ambient for Rated Power	35 °C
Maximum Ambient for Half-hour Rated Power	20 °C
Relative Humidity (Non-Condensing)	5 .. 85 %
Maximum Altitude for Rated Power	1000 m above sea level (Decrease power for High Altitude)

1.3.7 Operator Panel

Display Type	Full Colour Touch Screen 4.3" LCD; 24h logs of source power, load power, battery state of charge and Events

All specifications listed above performed at nominal voltage, frequency and temperature unless otherwise noted.

1.3.8 Altitude Derating

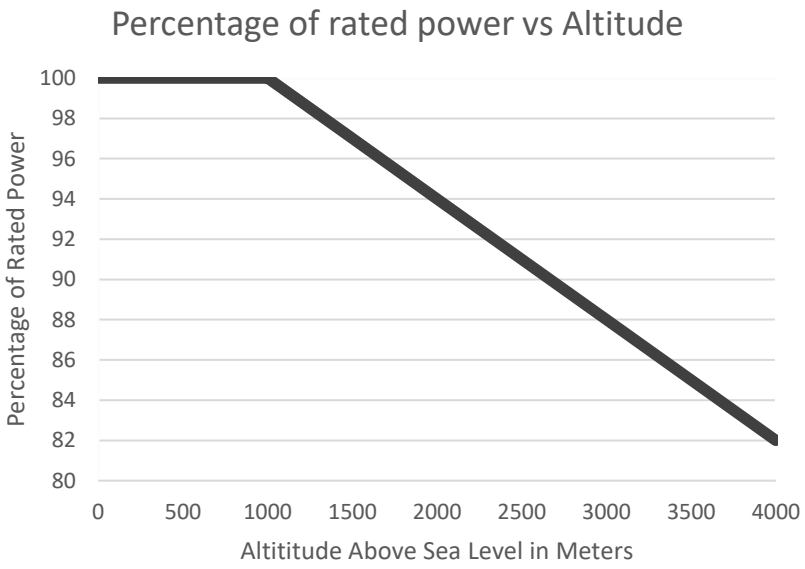


Figure 1: De-rating the Oasis inverter output power at high altitude

1.4 System Description

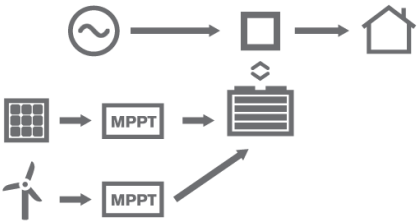
The Oasis inverter range offers a cost-effective and reliable solution to the home or farm owner faced with unreliable or no grid electricity supply.

The inverter operates at low-voltage DC and is transformer-based, which translates to a robust and safe product that guarantees trusted power in the harshest environments.

The Oasis inverter system can be configured in various ways, and some examples are shown below.

1.4.1 Typical Off-grid or Self Consumption Application

The Oasis inverter is ideal for off-grid installations where the renewable source of power is fed directly into the batteries. The Oasis converts the battery power into clean AC power that the load can use. The built-in battery charging function allows the use of a backup generator or the grid without the need for external battery chargers.

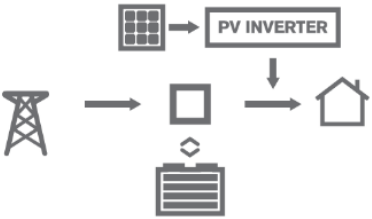


The Oasis can be configured to maximise self-consumption of renewable power by disconnecting from the grid during specified times, enabling optimal use of all available renewable power.

1.4.2 Typical Grid-tied Application

The Oasis inverter will act as a backup supply to provide power from the batteries in the event of a grid failure.

Installing a solar PV inverter on the load side will allow efficient use of solar energy and any excess generated power will automatically be used to charge the batteries or be exported to the grid.



1.4.3 Basic Generator Control

In off-grid systems, the Oasis inverter can automatically start the generator when the battery voltage is low or an overload occurs. The Oasis synchronises with the generator before connecting the load. When the charge cycle is complete, the Oasis will turn off the generator and transition back to stand-alone mode.

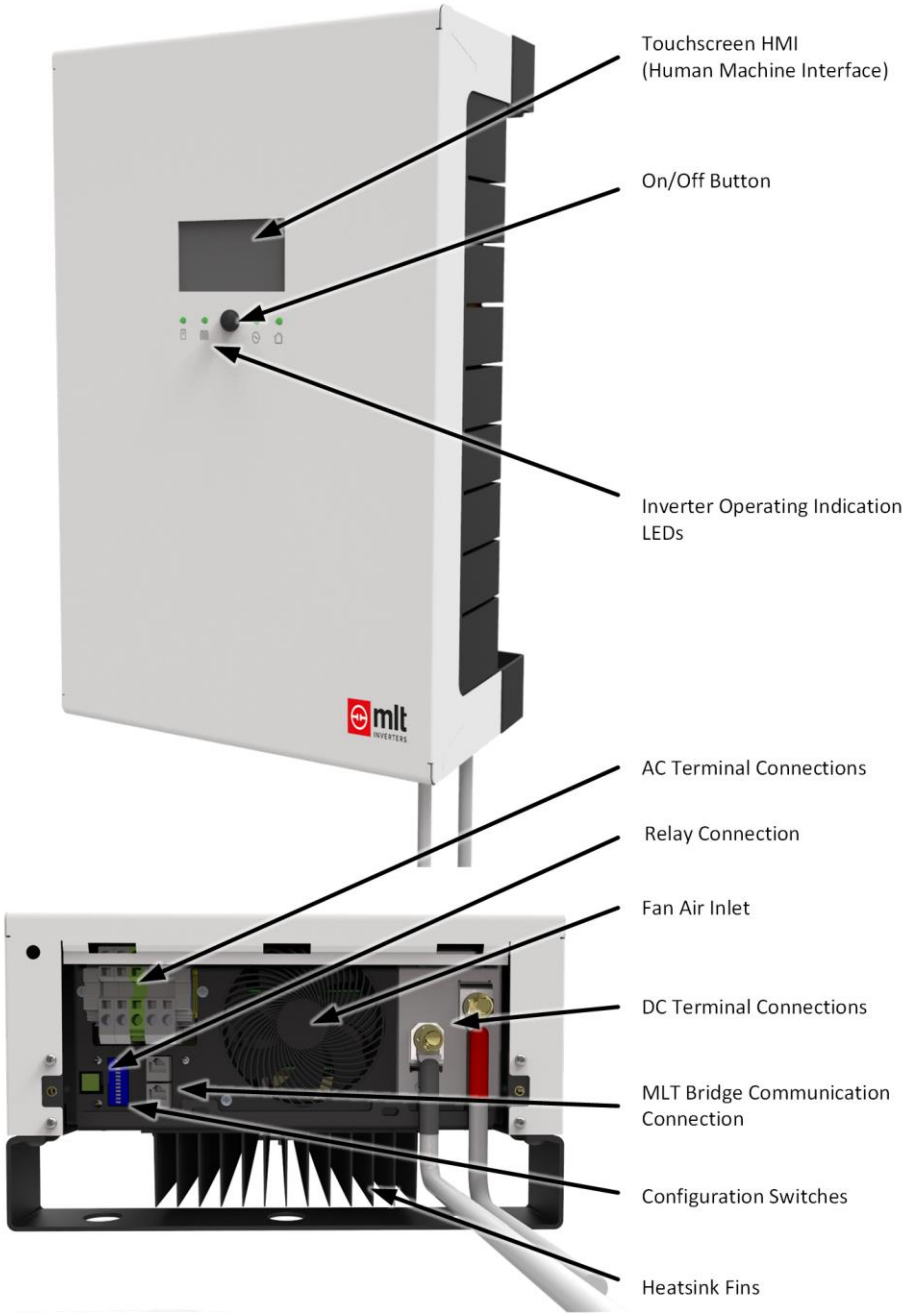


Figure 2: Identifying parts of the Oasis

2. Advanced Features

2.1 Battery Cycling

The Oasis can be configured to maximise self-consumption of renewable power by disconnecting from the grid or source during specified user determined times, enabling optimal use of all available renewable power. In some cases where peak demand prices are increased, the Oasis can thus be programmed to utilise battery power through these periods.

2.2 Auxiliary Relay control

A single, no voltage auxiliary relay can be controlled with three user settings. This relay can be used to control external load relays, a generator or any other simple binary logical circuit you can think of.

2.2.1 Battery Critical

If the battery bank is being depleted, with no external recharging, eventually a battery low state will occur. If this continues for long enough a Battery Critical state is reached. When a Battery Critical stage is reached, the auxiliary relay will be engaged.

This allows, for example, a generator to be connected and automatically start.

2.2.2 High Load

If the inverter's capacity is approaching close to the maximum rated capacity, the auxiliary relay will be engaged.

This allows, for example, a contactor to be connected and automatically engage to connect the source to the load whenever the load is high, saving battery capacity and decreasing operational costs.

2.2.3 Overload

When an overload flag is set, the auxiliary relay will be engaged.

This allows, for example, a contactor to be connected to the grid and automatically engage to connect the source to the load whenever the load is exceeded.

Since there is only one relay, setting more than one option will perform action for all three states. The typical use for the setting all three is to start a generator when the battery goes low or the load is higher than is economical to run purely off batteries.

2.3 Load Sense

The load sensing feature is used to save power on batteries when there is no load (at night with all the lights and geyser off). The Oasis draws more power when operating (converting AC to DC) that when in standby (no AC output) therefore if there is no load to supply, the inverter will go into a "sleep mode" to conserve battery power and check every few seconds if there is load connected to its output. If a load has suddenly been connected (someone turns on a light) then the oasis will power that load.

2.4 MLT Bridge Communications (Optional Add-on)

The Bridge external optional add-on enables browser-based internet monitoring and control of the Oasis inverter. The Bridge must be connected to an internet network.

Visit our website for further details.

3. Mounting and Electrical Connections

3.1 Installing the Oasis inverter

For optimal performance, please refer to the following instructions regarding the installation and setup of your newly purchased Oasis.

3.1.1 Selecting a suitable location

When selecting a location to mount your Oasis inverter, take note of the following:

1. The Oasis should be mounted indoors, in a well-ventilated area out of direct sunlight, where the ambient temperature does not exceed 45°C (inverter derating applies).
2. The Oasis is designed to be wall-mounted, and must therefore be installed upright in a vertical position, with a clearance of 200mm above and below, to allow sufficient cooling and airflow. The wall must be able to take the full weight, otherwise use a mounting frame.
3. The battery leads should be as short as possible, so that the Oasis inverter will need to be in close proximity to the batteries. (Standard cables are supplied with the inverter).
4. While charging the batteries, the Oasis inverter will emit an audible hum. This should be taken into account when selecting a suitable location.

Note: At high altitudes natural thermal convection (natural thermal cooling) of the all electrical equipment is degraded. This is due a lower air density available to remove heat from the heatsink. In accordance with the standards, the Oasis is rated for altitudes up to 1000m above sea level. If it is going to be installed in an area where the altitude is greater than 1000m above sea level, refer to the power derating graph (Figure 1) to establish the maximum continuous load.

3.1.2 Mounting

The Oasis is designed to be wall-mounted. Once a suitable location has been chosen, use the following information as a guide to make the mounting process easier:

1. Using a 10mm masonry drill bit, drill 3 holes 55mm deep and 124mm apart. It is recommended to use the bracket as a template.
2. Insert the M8 wall anchor bolts through the bracket into the holes, and tighten with a 13mm spanner, fixing the bracket to the wall.
3. Using at least two people, hold the Oasis vertically and lift it onto the mounting bracket.

Caution: The Oasis is quite heavy; dropping it could result in personal injury and damage to the machine. It is therefore recommended that this step be performed by a minimum of two people, or using a mechanical block-and-tackle.

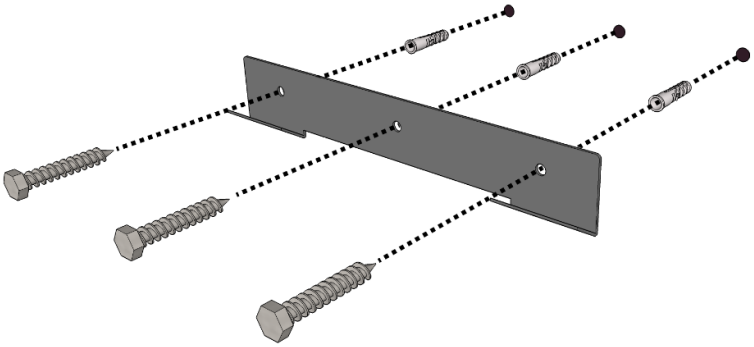


Figure 3: Wall mounting

3.1.3 Making the electrical connections

Once your Oasis has been mounted on the wall, you can begin making the electrical connections. Follow these steps to make the task as simple as possible.

Caution: Failure to follow these instructions carefully could increase the risk of personal injury, death or damage to property or equipment.

Ensure that any electrical connections is dead before touching any potential live wiring. Certain electrical connections must be performed by a qualified electrician. If in doubt about anything, contact MLT Inverters for assistance.

1. Remove the screws that secure the removable bottom cover.
2. The 'Load' connections inside the Oasis will need to be connected into your distribution board to provide power to your house. These connections should be made with a minimum size of 10mm² for the 5kVA model, and 16mm² for the 8kVA and 10kVA models. Take care to connect the Live wire to the 'L' terminal and the Neutral wire to the 'N' terminal.
3. If you are installing a generator, make sure it is switched off and any 'Automatic starting' circuitry is disabled before continuing. Referring to Figure 4, bring 10mm² for the 5kVA model, and 16mm² for the 8kVA and 10kVA models, cables into the 'Generator' terminals of the Oasis. Take care to connect the live wire to the 'L' terminal and the neutral wire to the 'N' terminal. Connecting the generator incorrectly could cause damage to the unit.
4. If the Oasis is being used without a generator, the 'Generator Neutral' terminal inside the unit must be connected to the Earth so that external earth-leakage protection

devices can operate correctly. In installations with a generator, the generator chassis must be grounded to the same earth as the Oasis.

5. The 'Earth' terminal inside the Oasis must be grounded to reduce the risk of electrical shock and to ensure that external earth-leakage protection device can operate correctly.

6. Connect the battery cables to the DC terminals, taking care to observe the polarity. The recommended cable sizes are as follows: 35mm² for the 5H model, 50mm² for the 8H model and 70mm² for the 10H model.

7. Once all the electrical connections have been made, double-check that they are secure, as a loose connection could get hot enough to cause a fire.

Note: External protection devices such as fuses, circuit breakers and earth-leakage protection are the responsibility of the owner, and not of MLT Inverters. MLT Inverters cannot be held responsible for personal injury, death or damage to property or equipment caused by the improper use or installation of this equipment. It is therefore recommended that all the electrical connections must be made by a qualified electrician or an MLT Inverters approved installer.

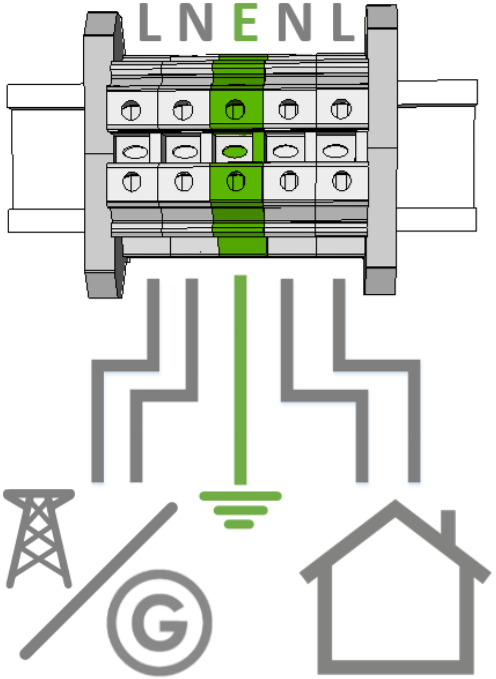


Figure 4: AC Input/output Connections on the Oasis

3.1.4 Battery Bank Size

If using a lead-acid battery bank, please ensure that the battery bank size is a minimum of 400Ah for a 10kVA, 300Ah for an 8kVA and 200Ah for a 5kVA Oasis. Having a too small a battery bank might cause system instability.

These are values are guidelines and depending on the type and quality of battery, and size of the load, a smaller bank might be acceptable.

3.1.5 Powering up the Oasis

1. Make sure all source (Generator or utility) and load AC wires and the DC cables are connected correctly to the Oasis.
2. Make sure the battery connections are secure.
3. The Oasis has large capacitors on the DC input which can draw a lot of current when the battery is connected and make a large spark which can damage battery terminals and lugs etc. It is therefore recommended to pre-charge the Oasis. This is typically done by connecting the Oasis to the battery via a resistor that will limit the current until the voltage on the Oasis is close to the battery voltage, before connecting the Oasis directly to the battery. MLT Inverters sells a DC disconnect box with fuses and a pre-charge circuit.

3.1.6 Powering down the Oasis

If it is necessary to turn off or disconnect your Oasis for some reason, follow these simple steps:

1. Turn off the inverter.
2. If a source such as a generator or utility is connected, make sure it is turned off, and that the breakers to the source are disconnected.
3. If required, the Oasis can now be disconnected from the batteries.

4. Inverter Operation Indicators

On the front panel of the Oasis inverter are three LED status indicators:

Battery status Source status Load status

4.1 Battery Status

The battery status LED is green when the battery voltage is within the expectable voltage levels, orange when the battery is low, and red when the battery voltage is critically low or high.

When the inverter is charging the LED's will flash, with the same red for critically low, orange for low and green for good colour scheme used.

4.2 Source Status

If the source is unavailable it is off, green when the source is available and within specifications, and lastly red when the source is not within acceptable limits.

4.3 Load Status

This LED is off if the Oasis is off and green if the Oasis is running and the load is acceptable.

The following red LED states can exists:

- Solid red implies a short circuit event.
- A slow red flash when the inverter is overloaded.
- When a continuous overload state exists, the LED will flash in a fast manner.

4.4 Special Combinations

When an AC connection error occurs, the source and load LED will both be red. With an over temperature fault, both the source and load LED will flash red.

5. Interface

The Oasis HMI (Human Machine Interface) is a full colour 4.5" touchscreen interface. This chapter covers using the interface to set up the Oasis.

5.1 On/Off Button

This push button turns the inverter on and off.

5.2 System Icons

There are four system icons on the right hand column. Pushing on the icon changes the current screen.

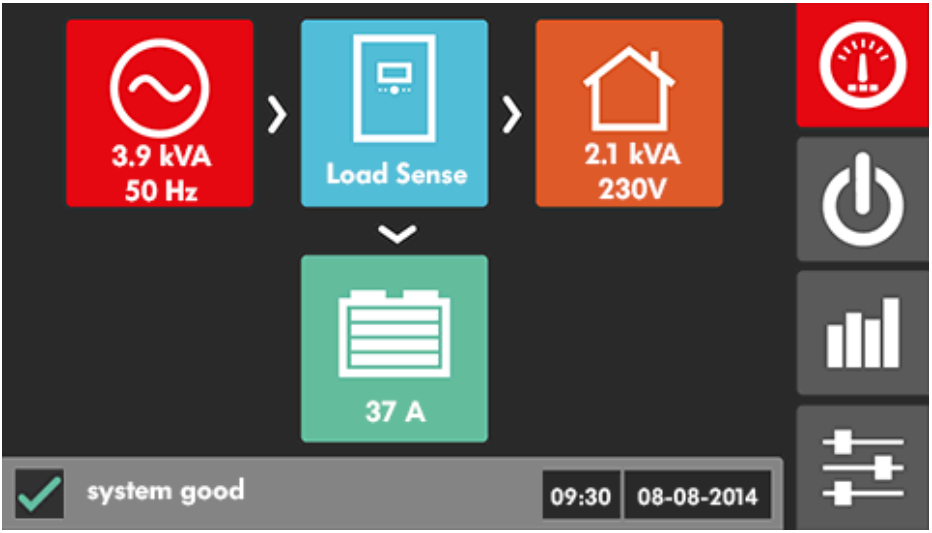
Dashboard

Control Panel

Graphing

Settings

5.3 Dashboard



The Dashboard screen shows an overview of the current inverter operation. Power drawn from the source, battery charging current and load size is shown. Clicking on each of the icons takes you to the individual graphing screens.

From the top left, the source power draw and frequency is indicated underneath the **red Source** icon.

The **blue Inverter** icon indicates the mode that the inverter is in.

The **orange Load** icon shows the power and the voltage that is being consumed by the load.

If there are Nomad MPPTs on the CAN bus then there will be a **blue solar** icon displaying the total solar power going to the battery.

The **green Battery** icon is subscripted by the current that is charging or draining the battery, with a positive value indicating charging, and a negative value indicating discharge. The bars within the icon are an indication of the state charge of the battery bank, with four bars implying a full charge and one bar implying battery critical.

If there is a Solar MD logger on the CAN bus and it is configured as "Oasis Battery Connector" then an icon will appear that shows the remaining energy and time till full / empty.

The **directional arrow** indicates which direction the power is flowing. If the arrow points towards the battery, the battery is getting charged. If the arrow points away from the battery, the battery is being used to power the load.

The bottom part of the screen contains a bar, showing system status and indicates any known issues. Next to it is the current date and time.

5.4 Control Panel

There are five buttons here with the followings functions:

Reset will clear any active event messages and turn the inverter on. If the event message is still present, it will not turn on.

Load Sense toggles between turning on and off the load sensing option. When the icon is darker, it is considered on.

Battery Cycle icon toggles between turning on and off the battery cycle option. The battery cycle option can be set up on the settings menu. See section 2.

On will turn on the inverter. When on, the icon will change to **Off,** which will turn off the inverter.

Export limit (*Software v214 and higher only*) will attempt to stop any form of power export from a grid-tied inverter connected to the output of the inverter. If the power goes negative and exports to the source, the Oasis inverter will disconnect from the source. If the battery voltage goes above the float charge it will start to increase the output frequency in an attempt to reduce the PV-power.

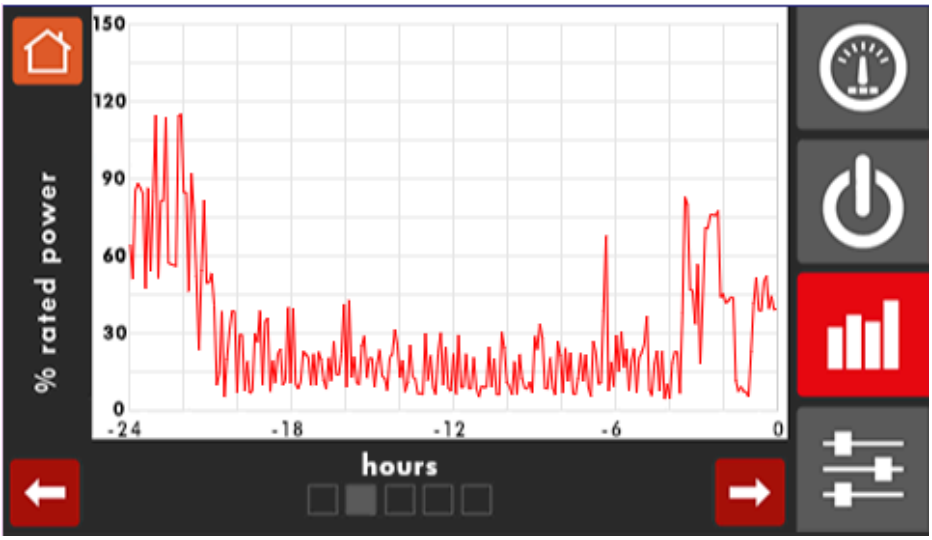
The inverter will reconnect to the source if power has been taken from the batteries for at least five minutes or battery voltage has dropped below the Battery Cycle setting.

5.5 Graphing and Logs

5.5.1 Source Graphs

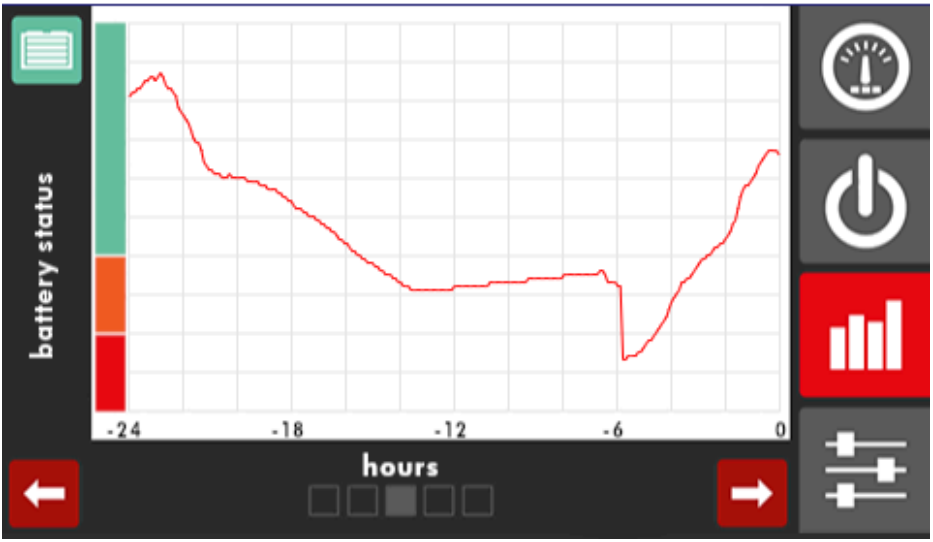
The source graph screen graphically shows the power. The grid power or source power can be as high as 150% of the inverters rated input.

5.5.2 Load Graphs



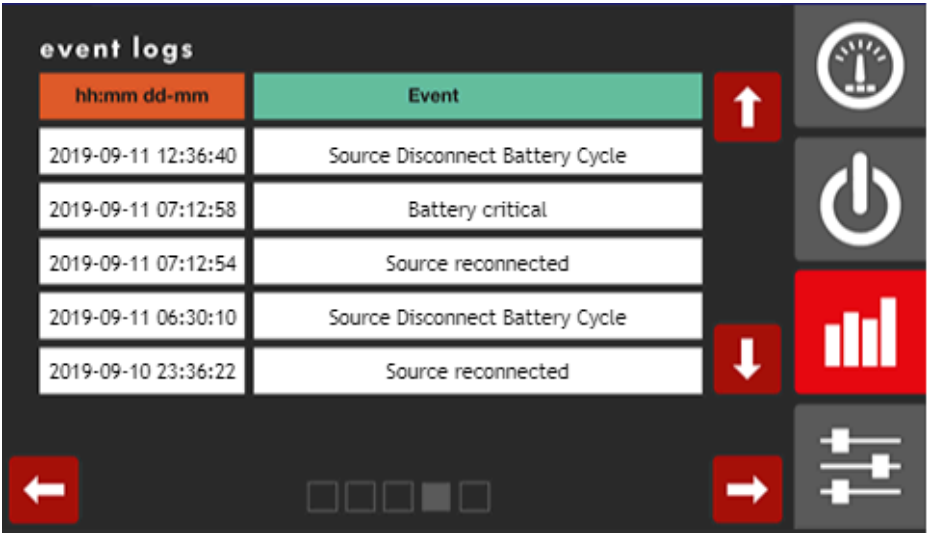
The load graph screen graphically shows the total power consumed by the load as a % of the inverters rated output.

5.5.3 Battery Graphs



The battery graph screen graphically illustrates the depletion or replenishing of the battery bank. The green, orange and red bar on the left is a rough indication of charge left. If connected to a Lithium battery with CAN-comms, this graph corresponds to the reported state of charge.

5.5.4 Event logs



Event logs are viewable on this interface screen. It is sorted in a descending list by time and date. General events are marked in black and critical events, typically causing inverter shutdown, are marked in red. The following events are logged:

5.5.4.1 Source Disconnect: High Freq

The source has been disconnected because the frequency was higher than the maximum allowed and the inverter is now running from the battery.

5.5.4.2 Source Disconnect: Low Freq

The source has been disconnected because the frequency was lower than the minimum allowed and the inverter is now running from the battery.

5.5.4.3 Source Disconnect: High Voltage

The source has been disconnected because the voltage was higher than the maximum allowed and the inverter is now running from battery.

5.5.4.4 Source Disconnect: Low Voltage

The source has been disconnected because the voltage was lower than the minimum allowed and the inverter is now running from battery.

5.5.4.5 Source Disconnect: Reverse Power

(Only available if Export Limit is enabled) The Source was disconnected to prevent reverse power flow.

5.5.4.6 Source Disconnect: Battery High

(Only available when on Lithium batteries with CAN communication) The Source was disconnected because the battery voltage was higher than the maximum allowed. Disconnecting the source means the inverter is running from the battery to help bring the voltage down to a safe level.

5.5.4.7 High Source Voltage

Whenever the source voltage is too high to connect to, this event is logged.

5.5.4.8 Source Reconnected

The inverter connected to the source

5.5.4.9 Overload

The inverter has experienced an instantaneous overload, higher than the rated capacity of the inverter. If this persists, a Continuous Overload will occur.

5.5.4.10 Continuous Overload

Inverter has shut down due to a continuous overload.

5.5.4.11 Short Circuit

An overcurrent fault has occurred, typically a short circuit or a load that was bigger than 200% of the inverter's rated capacity.

5.5.4.12 Operating Temperature Limit Reached

The inverter has overheated and shut down. Please ensure that the inverter is in a properly ventilated area, and if using at high altitude or in areas with high ambient temperatures, that the inverter load is appropriately de-rated.

5.5.4.13 AC Connection Error

AC detected on output while inverter is off, typically caused by incorrect wiring. Alternatively, if the error persists, a possible internal source contactor fault has occurred, please contact MLT inverters.

5.5.4.14 Battery Critical

A low battery condition has occurred, if no external source is available, it will shut down shortly with a Battery Empty warning.

5.5.4.15 Battery Empty

The Oasis inverter has shut down due to a critically low battery condition.

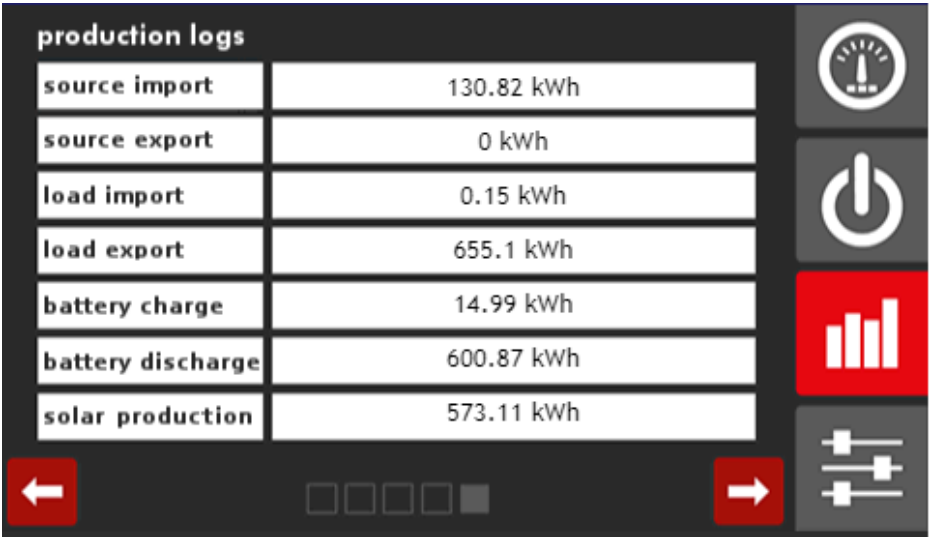
5.5.4.16 High Battery Voltage

Battery voltage has exceeded maximum safe voltage, forcing the inverter to shut down. This is typically caused by a faulty or incorrectly configured external battery charger or regulator.

5.5.4.17 Battery communication failure

CAN communication to the battery has stopped working.

5.5.5 Production Logs



Notice: Measurements should not be used for billing purposes.

5.5.5.1 Source Import

The total energy (measured in kWh) taken from the source. The source is typically the grid or alternatively a generator.

5.5.5.2 Source Export

The Oasis **cannot** export, but if a grid-tied inverter is connected to the output of the Oasis, the Oasis will measure any power exported by the external grid-tied inverter.

5.5.5.3 Load Import

Total amount of energy imported by the load port. Any power pushed back by an external grid-tied inverter will be logged as Load Import. Some of the energy imported will go into the batteries (Battery Charge), and the rest will be exported to the source (Source Export).

5.5.5.4 Load Export

Energy supplied to the Load.

5.5.5.5 Battery Charge

Total energy used to charge the battery from the source or grid-tied inverter connected to the output.

5.5.5.6 Battery Discharge

Total energy taken from the battery.

5.5.5.7 Solar Production

If there are Nomad MPPTs on the CAN bus, this will display the total energy produced by the Nomads. This may differ slightly from the totals displayed on the Nomads themselves as the Oasis logs what goes into the battery while the Nomads log what comes from the Solar Panels.

5.6 Settings

5.6.1 Settings Menu

Selecting Alarms, Date & Time, Relay Control, Battery Cycle and Battery Setup will take you to their respective setting screen.

5.6.2 Setup Alarms

5.6.2.1 Beep

Click on the beep square to toggle on and off. Beep implies that the inverter will sound an audible noise, at a once per second interval.

Warnings include the following conditions:

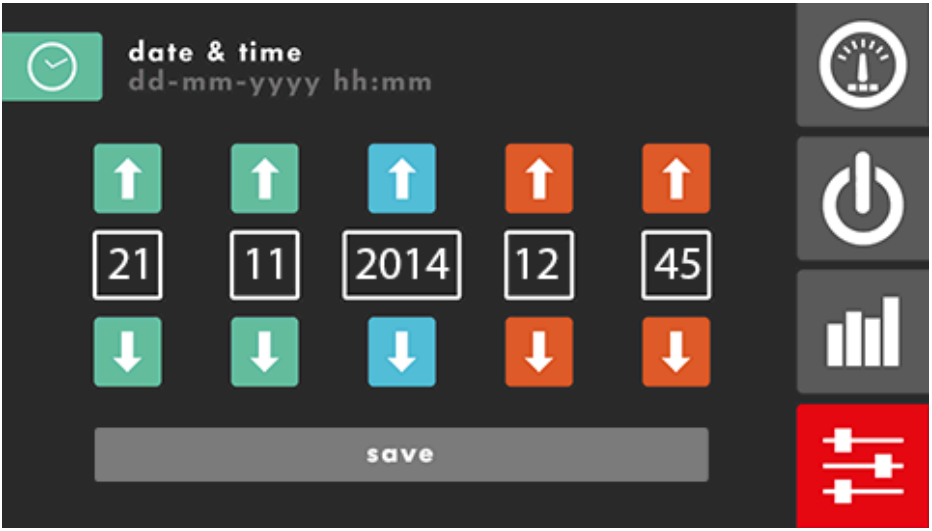
(Description of the warning available above in section 5.5.4 Event logs)

Continuous overload, Over-temperature, Short Circuit, AC connection error, Battery empty, Battery voltage too high, Grid Loss

5.6.2.2 SMS

The SMS function is only available if a Bridge communications module is attached to the Oasis.

5.6.3 Date & Time

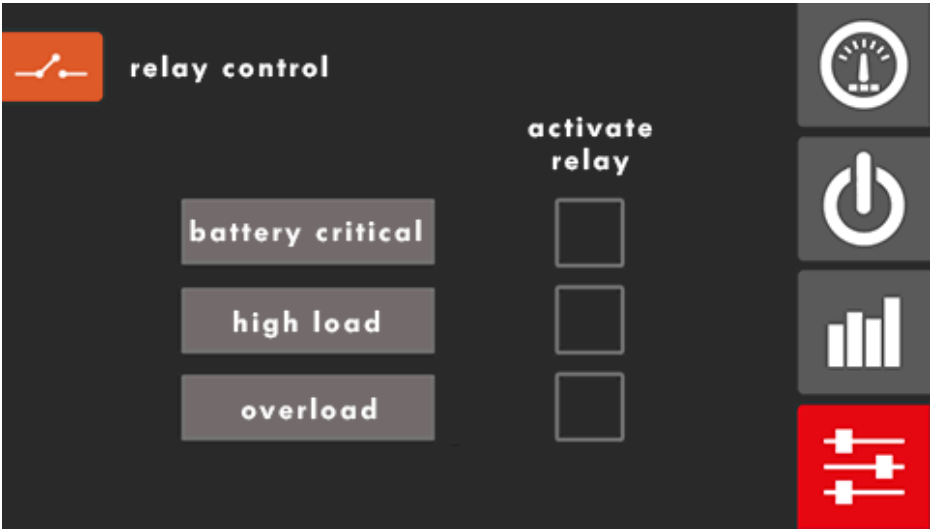


Set the date and time to the current time, using the up and down arrows. In this example the date is the 21st of November 2014, with the time being 12h45 in the afternoon.

Green and blue is for setting the date in the day-month-year format, and the orange buttons are for setting the time in the 24-hour time format.

Use up and down arrows to change the time/date and the save button to make the changes permanent.

5.6.4 Relay Control



A single, no voltage auxiliary relay can be controlled with the above three user settings. See Figure 2: Identifying parts of the Oasis for the location of the relay.

Maximum current is

5.6.4.1 Battery Critical

When a battery critical flag is set, the auxiliary relay will be engaged.

5.6.4.2 High Load

When a high load flag is set, the auxiliary relay will be engaged.

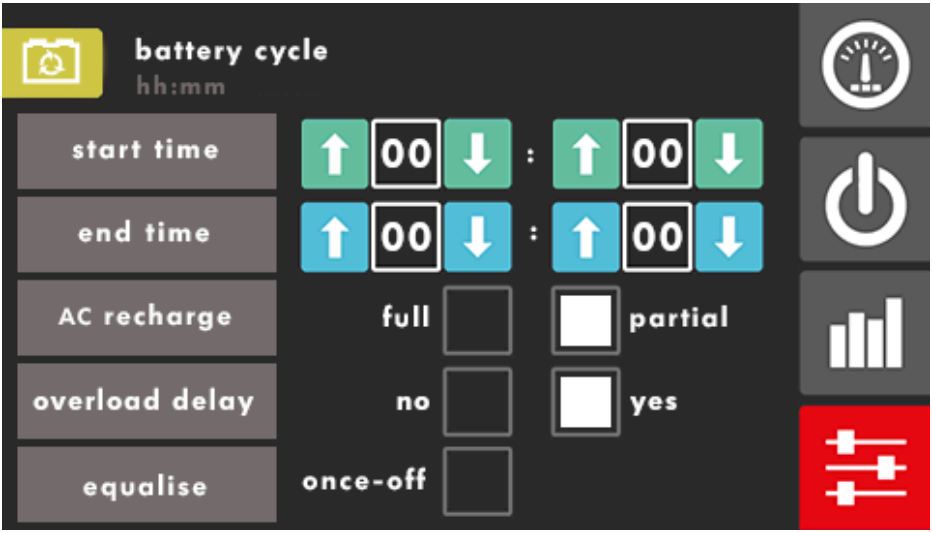
5.6.4.3 Overload

When an overload flag is set, the auxiliary relay will be engaged.

Since there is only one relay, setting more than one option will perform action for all three states. The typical use for the setting all three is to start a generator when the battery goes low or the load is higher than is economical to run purely of batteries

The relay will open again once a bulk charge is completed.

5.6.5 Battery Cycle



5.6.5.1 Start and End Times

When the battery cycle is activated in the settings menu, the following system operation will be applicable (Please ensure that the Date & Time is set correctly.):

1. When the Start Time is reached on the clock, the inverter will disconnect from the Source. If the source is a generator, the generator relay will disconnect.
2. The system will *reconnect* to the source when the batteries reach a *low state of charge* or *high load*. The generator contact will close in order to start the generator.
3. If the batteries are *fully charged*, the inverter will again *disconnect* from the source.
4. If the End Time is reached, the inverter will remain connected, or reconnect to the source.

5.6.5.2 AC Recharge

Once the inverter is connected to the source, it will start charging the batteries.

The AC recharge toggle allows you to switch between a full charge of the batteries or just a partial recharge. This behaves differently depending on the type of batteries you have.

For Lead Acid batteries, 'full' does an absorption charge of the batteries and 'partial' aborts the charge once float voltage is obtained.

For Lithium batteries without CAN, 'full' stops once the battery has been at the full voltage for 2 hours or until the charging current has dropped below 2A while 'partial' stops as soon as the full voltage is reached. (see Battery settings for the full voltage)

For Lithium batteries with CAN, 'full' stops once the BMS reports 100% SOC while 'partial' stops once the SOC has reached the cycle high SOC. (see battery settings)

If you have no external charging sources, e.g. solar or wind, battery cycling is not recommended.

5.6.5.3 overload delay

This toggle selects the behaviour when the Inverter is overloaded. If overload delay is set to 'no' then the source will be reconnected as soon as the inverter's rated power is exceeded. When it is set to 'yes' the source will only e reconnected when the inverter is close to turning off with a 'Continuous Overload' fault.

5.6.5.4 Equalise

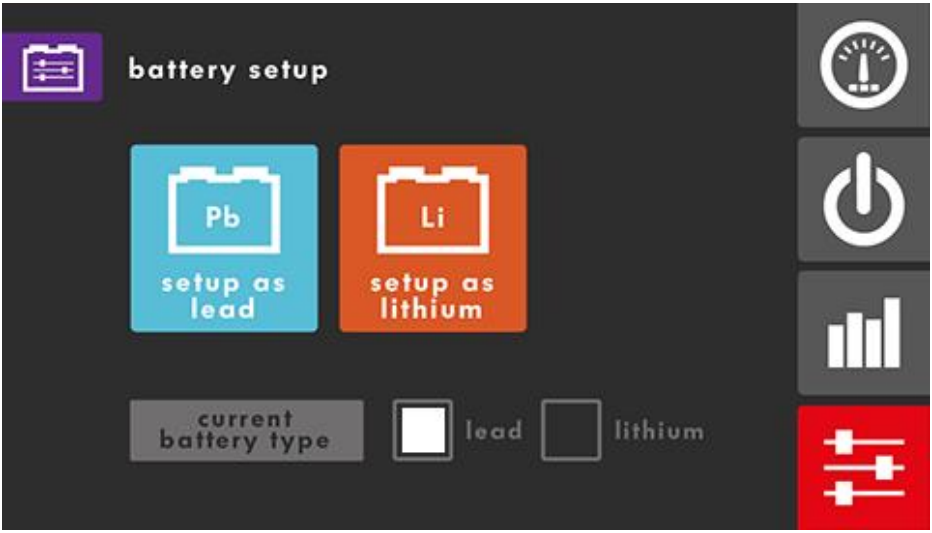
An equalise charge is nothing more than a forced overcharge of a Lead-Acid battery. This helps if a battery is suffering from sulfation and stratification. Sulfation is the gradual build-up of amorphous lead sulfate into stable crystalline structures that deposit on the negative plates during extended periods of discharge. Stratification is the separation of acid and water within the electrolyte.

If the flooded DIP switch is enabled (DIP switch 1) and the battery type is Lead-Acid, the user can enable the once-off equalise charge. This is performed at 2.55VPC for one hour. Once complete, check the specific gravity of your batteries. If required, perform an equalise charge again until the battery is within manufacturer specifications.

When the battery is being equalised, the battery icon changes to the symbol on the right.

Typically you would perform an equalisation charge if individual battery specific gravity levels differ significantly. This should only be performed if your battery manufacturer recommends equalisation.

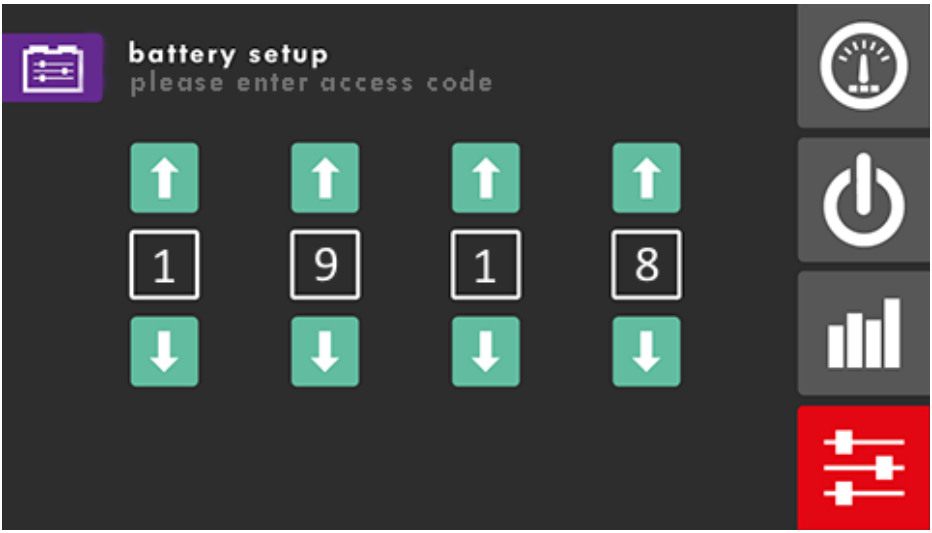
5.6.6 Battery Setup



The Battery Setup screen allows custom battery settings. It is only accessible if DIP Switch 9 is enabled.

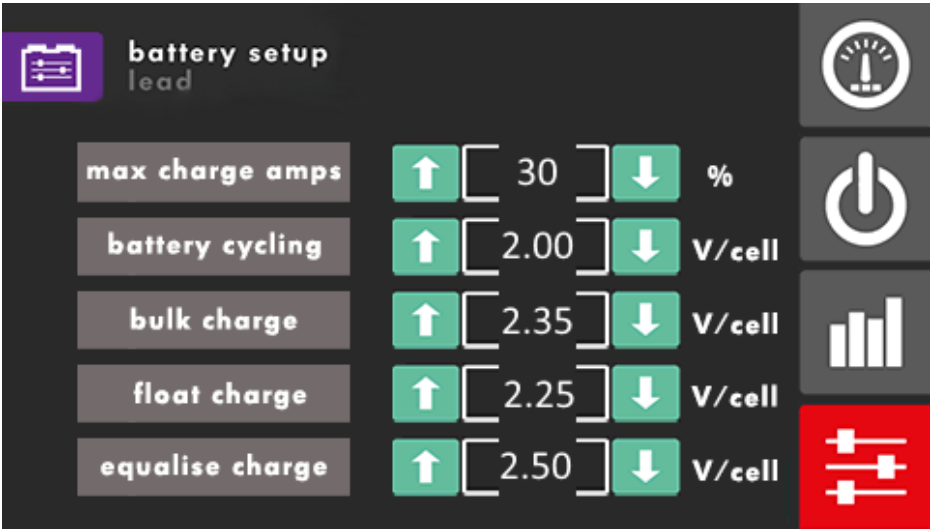
The Current Battery Type icon cannot be toggled directly, but will update depending on the last battery type that was set up.

5.6.6.1 Battery Setup – Access Code



Certain settings require a password. The password is hard coded to 1918.

5.6.6.2 Battery Setup – Lead Acid

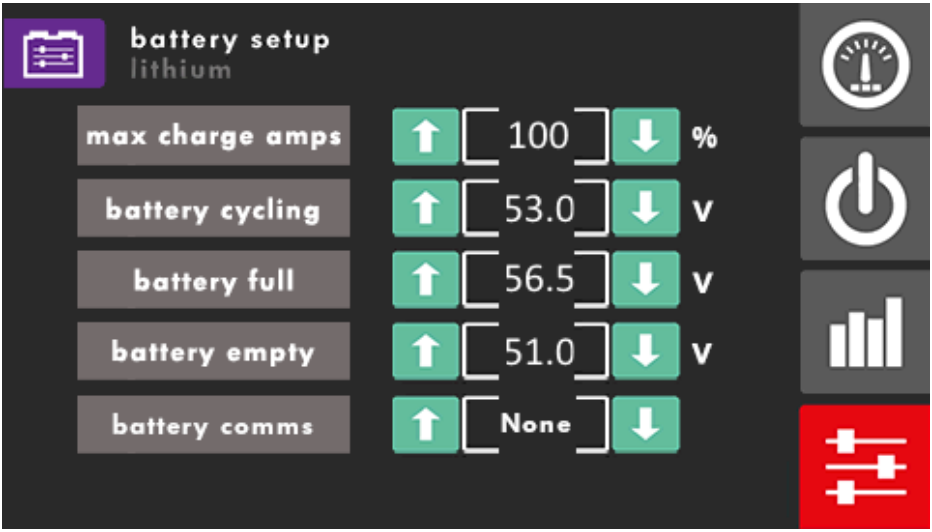


Under the Battery Setup for Lead Acid configuration page it is possible to fine-tune and adjust the various battery charging options. Please set according to the battery manufacturers specifications.

The setting *max charge amps* is a percentage of the rated maximum inverter charge amps or the ADMD limit, whichever is lowest. See *System Specifications* on page 8 for your specific model.

The bulk charge will always be for a period of two hours or until the charging current is zero. See section *10.5 Lead-Acid Battery Charging.*

5.6.6.3 Battery Setup – Lithium



Under the Battery Setup for Lithium Batteries configuration page it is possible to fine-tune and adjust the various battery charging options.

The setting *max charge amps* is a percentage of the rated maximum inverter charge amps or the ADMD limit, whichever is lowest. See *System Specifications* on page 8 for your specific model.

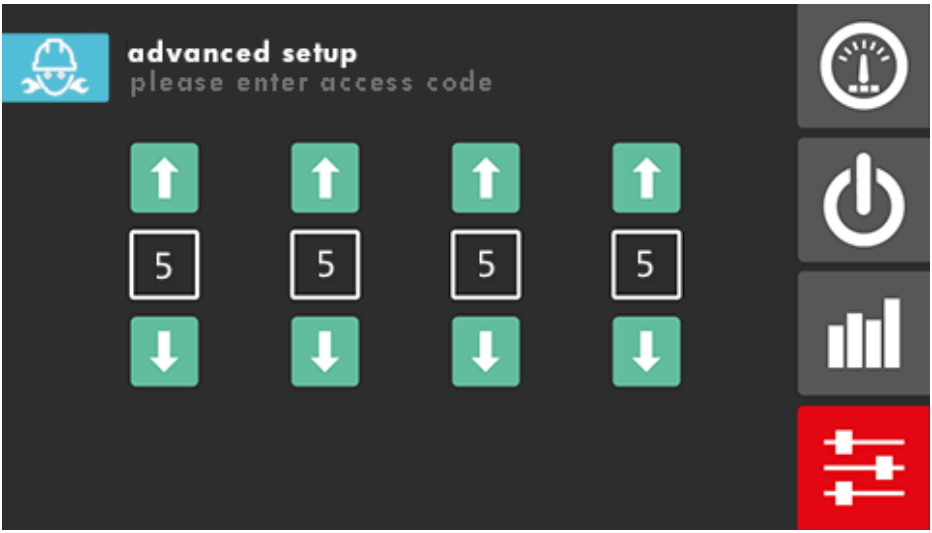
The *battery comms* and *CAN baud* enables communications with a Lithium battery pack (Software V300+ only). Please contact MLT for compatible Lithium batteries, as it is constantly being updated.

When using CAN communication, it is advisable to set the voltages on the 'no-comms' screen to values that are safe for the battery you are using because if the CAN communication fails the Oasis will revert back to using the voltages on the 'no-comms' setup screen. Be sure to leave the battery comms setting in the 'CAN' state when you are done though.

Warning: Incorrect settings of battery voltages can cause permanent and irreparable damage to the battery pack. Always set according to the battery manufacturers specifications.

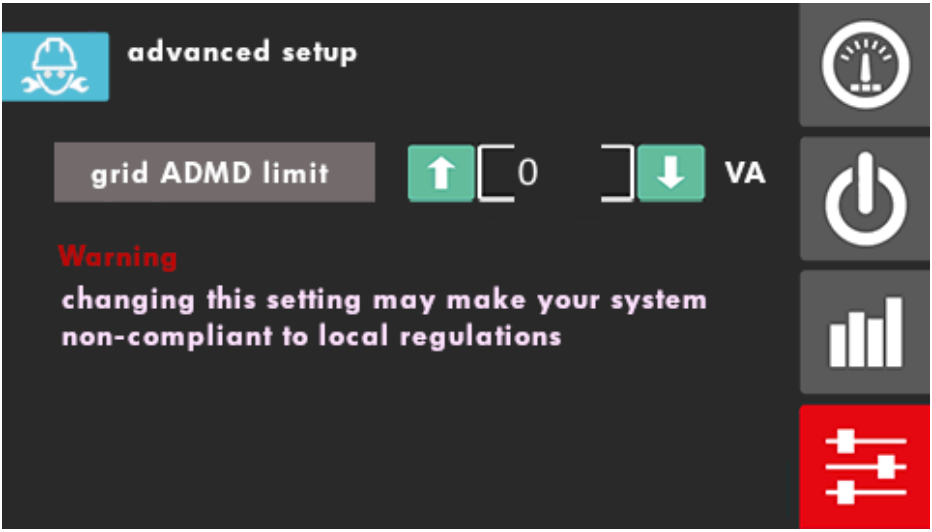
5.6.7 Advanced Setup

5.6.7.1 Advanced Setup - Access code



The access code for the advanced setup is 5555.

5.6.7.2 Advanced Setup



Some municipalities require inverters to have a limit (either software or hardware) on the maximum current that may be used from the grid for battery charging. If you are in such an area, then the grid ADMD limit must be set to the maximum value that local regulations allow. For example: In some instances this is specified as 25% of your main breaker size. In that case, if you have a 60A main breaker then this must be set to 3500VA. Setting this to 0 (the factory default) disables the limit.

This limit sets the maximum power that may be used from the grid for battery charging when the "max charge amps" setting is at 100%, although depending on the model of Oasis (5H, 8H or 10H) and the DIP switch settings, the actual limit may be lower than this setting.

6. Communication Port

6.1 RJ45 Multipurpose Socket

At the bottom of the inverter is two RJ45 sockets. These can be used for either CAN-bus communications (Software v300+) or UART communications, typically a Bridge module.

The pinout for the cable is shown below:

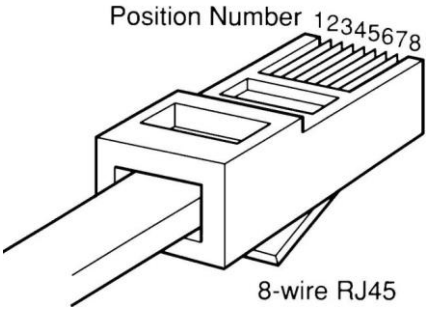


Figure 5 - CAN Pinout

Pin	Bridge	CAN
1	GND	--
2	--	GND
3	--	--
4	--	CANH
5	--	CANL
6	--	--
7	UART TX	--
8	UART RX	--

Note: If both CAN and UART are used, do not populate the CAN wires on the UART connector as this can cause problems with the CAN comms.

7. Configuration

7.1 DIP Switch configuration

7.2 Connecting an external AC source

It is recommend using a generator with a larger VA rating than the inverter.

Follow these steps when connecting an external AC source such as a generator or utility to ensure your safety.

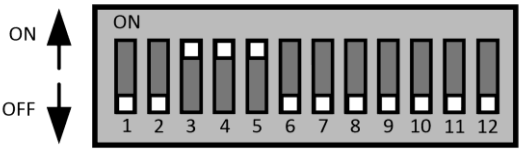
7.2.1 Preparation

Before starting the installation ensure that you read the owner's handbook for the generator that you are installing and that you are fully aware of requirements such as minimum cable size and generator siting information. MLT Inverters recommends using the correct wire size to connect your generator to your Oasis, sizes listed below.

7.2.2 Installing a Source

1. Power down the Oasis by completing the instructions in 'Powering down the Oasis' on page 18.
2. If a generator or utility is connected, double check that it is OFF and any 'Automatic starting' circuitry that could cause the generator to start is disabled.
3. Referring to Figure 4, bring a 10mm² for the 5kVA model, and 16mm² for the 8kVA and 10kVA models cables from the generator or utility into the 'Generator' terminals of the Oasis, taking care to connect the Live wire to the 'L' terminal and the Neutral wire to the 'N' terminal. While every attempt has been made to insure the safety and reliability of the Oasis, there is a chance that connecting the generator incorrectly could cause damage to the unit.
4. Make sure to ground the generators chassis to the same Earth connection as the Oasis.
5. Once all the internal electrical connections have been made, check that they are secure as a loose connection could get hot enough to cause a fire.
6. Follow the instructions in 'Powering up the Oasis' on page 18 to re-start your machine.
7. (Optional) If the source is a generator with an automatic start, wire up the relay and set the relay function as required.

8. Configuration Switches



The DIP Switches are located underneath the removable terminal cover.

The switches can be turned on or off by moving the pin up towards the ON position for on or moving it to the OFF position away from the on text.

The default position of all the switches are shown above and table below.

8.1 DIP Switch Table

Switch	Function	Default	ON	OFF
1	Battery Charge Rate	OFF	High	Low
2	Battery Type Selection	OFF	Flooded	Sealed
3	Float Charge Enable	ON	Enabled	Disabled
4	Audible Beep Cautions	ON	HMI configurable	Disabled
5	Audible Beep Warnings	ON	HMI configurable	Disabled
6	Large source	OFF	Enabled	Disabled
7	Battery cycle mode enable	OFF	HMI configurable	Disabled
8	Load sense mode enable	OFF	HMI configurable	Disabled
9	Battery Setup enable	OFF	HMI configurable	Disabled
10, 11	Reserved			
12	CAN Termination	OFF	CAN terminated	CAN un-terminated

8.1.1 Description of DIP functionality

8.1.1.1 Battery Charge Rate

Adjust the battery capacity selection switch to alter the maximum battery charging current.

Model	ON	OFF
Oasis 5H48	40 A	20 A
Oasis 8H48	50 A	25 A
Oasis 10H48	80 A	40 A

Note: If the grid ADMD limit is configured, the maximum charging current may be reduced.

8.1.1.2 Battery Type Selection

Adjust the battery type selection to best fit your battery type, be it AGM, Sealed or Flooded Cell type.

Typically flooded cell type batteries float and charge at higher voltages than sealed and AGM type of batteries. Note: These values only apply if DIP switch 9 is OFF, otherwise the values on the Battery Setup screen are used.

	Flooded (ON)	Sealed/AGM (OFF)
Battery Float Voltage	2.20 VPC	2.20 VPC
Battery Bulk Voltage	2.45 VPC	2.35 VPC

8.1.1.3 Float Charge Enable Selection

Note: This only applies to Lead-Acid batteries.

The float charge enable switch enables or disables the fourth charge stage. If this is disabled, the charger will perform the bulk and absorption charge stages and then stop charging the batteries. Charging will only resume if the battery voltage falls below the recharge voltage. If the float charge is enabled, then the charger will perform the bulk and absorption charge stages as normal and will then maintain the batteries at the float voltage indefinitely.

The float charge is desirable when the inverter is used as a backup supply and it is critical that the batteries always be fully charged and ready. This does however use power from the AC source to keep the batteries at the float voltage.

8.1.1.4 Audible Beep Cautions

If enabled, this allows the user to enable an audible beeping sound when a Caution event occurs. This can be enabled or disabled via the HMI interface. If this is enabled, but the option on the HMI is disabled, this will be disabled.

8.1.1.5 Audible Beep Warnings

If enabled, this allows the user to enable an audible beeping sound when a Warning event occurs. This can be enabled or disabled via the HMI interface. If this is enabled, but the option on the HMI is disabled, this will be disabled.

8.1.1.6 Large Source

This DIP switch allows up to 40A (for 5kVA) or 60A (for 8 and 10kVA Oases) to be drawn from the source. This implies that a load larger than the inverter current rating can be connected to the load output if the source is online. However, if the source is offline, and the inverter is running from batteries, the load must be reduced to the inverters rated current.

If the load is higher than inverter rated current and a source failure occurs, the inverter will overload, causing a loss of power. Turn off the extra load and reset the inverter to restore power.

8.1.1.7 Battery Cycle Mode Enable

If this is turned ON, then the HMI battery cycling option is enabled on the dashboard.

8.1.1.8 Load Sense Mode

If this is turned ON, then the HMI load sense option is enabled on the dashboard. OFF will disable load sensing and the inverter will always be on, irrespective of load size.

8.1.1.9 Battery Setup enable

Flicking this to ON enable the Battery Setup menu. Turning it OFF resets the custom battery settings to default and disables custom battery profiles.

8.1.1.10 CAN Termination

If the Oasis is at one end of the CAN bus (when using CAN communication) then the termination should be enabled.

9. Grid-tied Inverters on Output

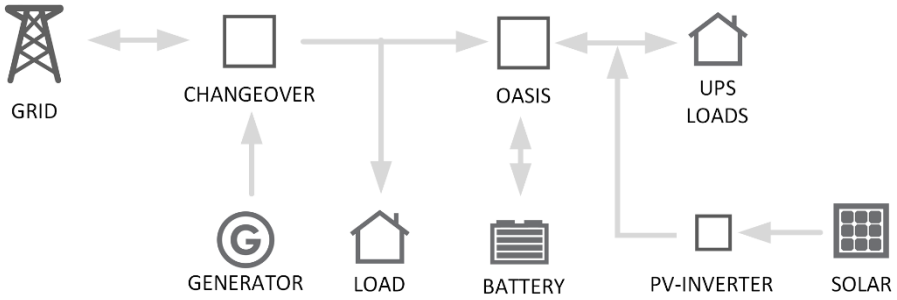
9.1 General

Grid tied inverters can be connected to the output of the Oasis with the following restrictions:

1. The total PV power should not exceed the Oasis inverter's continuous power rating[1].
2. The PV-inverter should support frequency-based output throttling.

The Oasis inverter will increase the output frequency when the battery is getting close to full and it detects reverse power, if not grid connected at the time, in order for the PV inverter to decrease it's power output. If the PV inverter does not support frequency based throttling, it will eventually disconnect at a high frequency and reconnect once the battery voltage falls within limits although using PV inverters that do not support frequency based throttling is not recommended, especially with Lithium batteries, because Lithium batteries are not tolerant to higher than normal charging voltages.

If you are unable to export to the source, it is recommended to select the Export Limit option. See section 5.4 Control Panel for more information.



[1] Please note this is the continuous power rating, not the half-hour (H) power rating.

10. About Batteries

10.1 General

A number of batteries can be used together with the Oasis inverter. There are two types of batteries that can be used, Lithium and Lead-Acid.

10.1.1 Sealed Lead-Acid Batteries

Standard, Gel, Sealed or *Low Maintenance* battery. This type of battery is designed to provide a large current for a very short period of time. They are not designed to be regularly discharged by more than 25% of their capacity. This battery is suitable for backup applications.

10.1.2 Deep Cycle Lead-Acid Batteries

Deep cycle lead acid batteries are designed to be repeatedly discharged to at least 50% of their capacity, which makes them suitable for homes using solar power or off-grid power use.
Thus if in your application you are repeatedly charging and discharging your batteries you should be using deep cycle batteries. If, however, you are using your system as a UPS, low maintenance batteries may be sufficient. Standard batteries can be flooded batteries which require regular maintenance or sealed which are maintenance free. Deep cycle batteries are available only in the flooded variety. If standard batteries are suitable, maintenance free type should be selected as they do not require topping up of their electrolyte during their life.

10.1.3 Lithium Batteries

Lithium based batteries are currently manufactured using various technologies and chemistries. The most commonly available Lithium batteries are lithium polymer batteries (LiPo) and Lithium Iron Phosphate ($LiFePO_4$). Some Lithium batteries can be used with the Oasis inverter please contact MLT Inverters for details of recommended Lithium packs.

10.2 Battery Bank Location

When selecting a suitable location for your battery bank, take the following into consideration:

- Some batteries packs must be installed in a well-ventilated environment.
- Install batteries away from direct sunlight.
- Ensure that the battery leads are as short as possible for maximum efficiency.
- Appropriate protection ***must always*** be installed!

10.3 Maintenance

The battery maintenance required will be detailed in the documentation supplied with the battery. Flooded batteries generally includes checking of the electrolyte levels on a regular basis and topping up with distilled water when necessary.

Providing the site is maintained correctly, a good quality battery bank should last for the full number of rated cycles before needing replacement.

10.4 Replacing a Battery

Always replace a battery with a battery of the same type and capacity. Never replace a flooded lead-acid battery with a maintenance free battery or vice-versa.

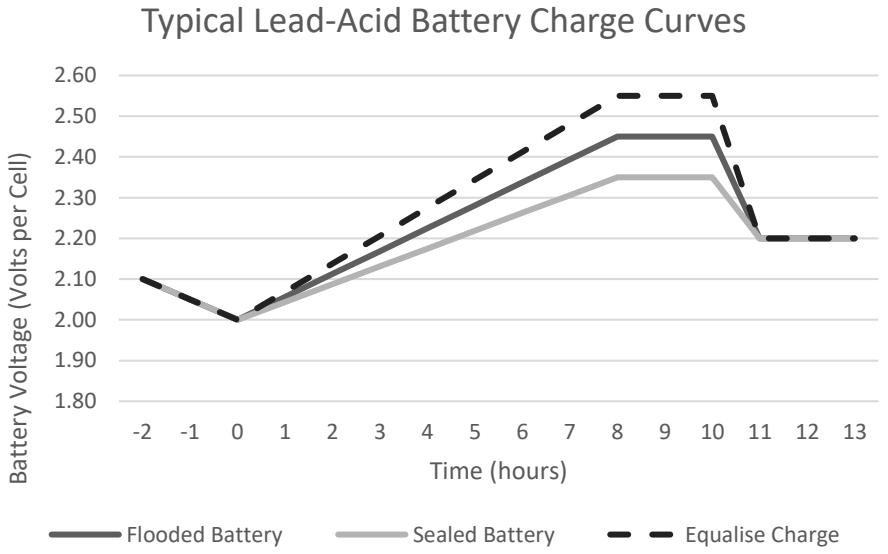
If you are not sure about the type and capacity of the batteries installed, please contact your installer. Always following the instructions of the battery manufacturer.

ELECTRICAL SHOCK: To prevent short circuits it is recommended that you always use an insulated spanner when connecting or disconnecting individual batteries or battery banks.

All electrical connections must be made a qualified person.

10.5 Lead-Acid Battery Charging

10.5.1 Charging Stages



The Oasis includes a four stage battery charger. Please configure the inverter for use with your batteries as per your battery manufacturers' specifications.

Above is a typical battery charge curve for a lead acid battery. It consists of four stages, a bulk constant current stage, absorption stage, taper-to-float stage and last the float stage.

The total charging period is approximately 10 hours in this example, but can be much shorter depending on depth of discharge, charging current and load.

10.5.1.1 Stage 1: Bulk Constant Current Charge Period (Hours 0-8)

This is the first stage of charge using a constant current until the bulk voltage is reached. At the end of this stage, the battery is around 80% full. This charge period will typically last up to 8 hours.

10.5.1.2 Stage 2: Absorption Charge Period (Hours 8-10)

This stage maintains the cells, and hence the batteries, at a constant voltage. This will complete the battery charge. This charge period is 2 hours or until the charge current is reduced to zero amps.

This is sometimes referred to as a boost or bulk charge.

10.5.1.3 Stage 3: Taper-to-Float Period (End of Bulk)

The voltage will be lowered to the float voltage by reducing the current into the battery, this typically should only last a few minutes.

10.5.1.4 Stage 4: Float Charge (Hours 10+)

The battery voltage is kept constant at the float voltage level. If an auto-start generator was used, it will turn off when this stage is reached.

10.5.2 Battery charger settings

It is important to select the correct charging current and voltage for your batteries during the installation of your Oasis. If you increase or decrease your battery capacity or replace the battery bank with a different type of battery it may be necessary to change the battery charger settings.

The maximum battery charging current can be set by changing the appropriate settings. Note that the actual charging current will also depend on external chargers from Solar or Wind sources.

As a general rule of thumb, a flooded cell type battery bank should be charged over a period of 7 hours, and a sealed cell bank should be charged over a 10 hour period.

This means that the charge current can easily be calculated by using this formula:

$$\frac{battery\ capacity\ (Ah)}{charge\ time\ (h)} = \frac{Ah}{h} = charge\ current\ (A)$$

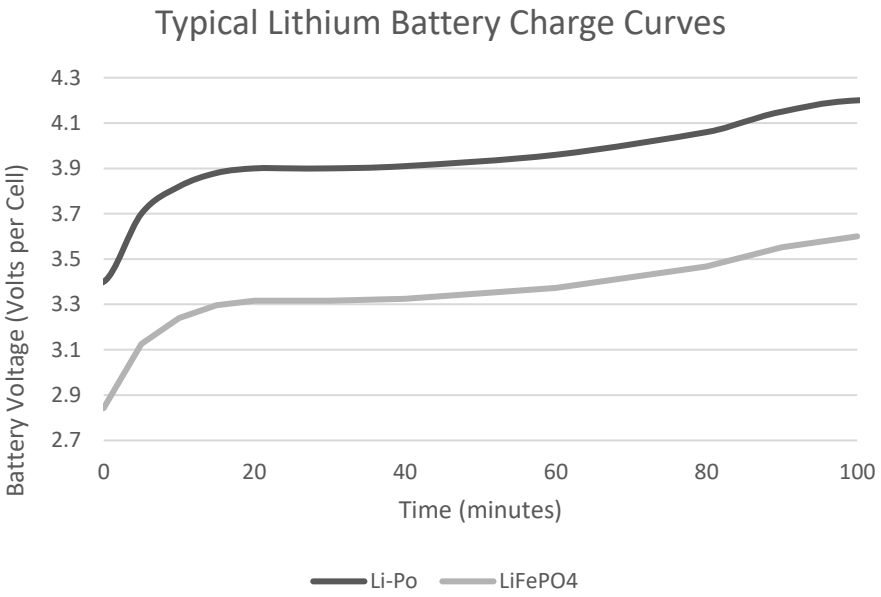
So for example with a battery bank of 205Ah for a sealed battery:

$$\frac{205\ Ah}{10\ h} = 20.5A$$

This is the maximum current that the sealed battery bank should be charged with.

Please note: Always configure battery charging currents according to manufacturer limits. These limits may differ from the above formula.

10.6 Lithium Battery Charging



The Oasis can charge certain Lithium-based battery banks. Lithium batteries are typically charged much faster than Lead-Acid based batteries, and at higher currents. Please see the MLT Inverters website for full information regarding compatible battery banks.

10.6.1 Battery charger settings

It is important to select the correct charging current and voltage for your batteries during the installation of your Oasis.

If you increase or decrease your battery capacity or replace the battery bank with a different type of battery it may be necessary to change the battery charger settings.

Please note: Always configure battery charging currents according to manufacturer limits.

11. About Solar Panels

11.1 Introduction

The term solar panel refers to a panel comprising a number of Photovoltaic (PV) cells which convert sunlight into electricity.

Solar panels are a source of renewable energy which is becoming increasingly accessible.

As with most renewable systems solar panels are unable to provide energy at all times as there may be insufficient sunlight available. To fill the gaps, electricity can be supplied from storage batteries or generators in stand-alone systems or from the electrical grid in grid connected systems.

11.2 Using a Solar System with the Oasis

If you are considering adding a solar system to your installation, contact your local installer for more information on the Nomad Charge Controller.

CAUTION: **DO NOT** connect solar panels directly to the batteries, a solar regulator must be used, otherwise damage to the batteries and/or Oasis could result.

11.3 Battery charger settings

The table below lists some typical settings for batteries. Always use the battery manufacturer's recommended settings.

	Flooded	Sealed/AGM
Battery Float Voltage	2.20 VPC	2.20 VPC
Battery Bulk Voltage	2.45 VPC	2.35 VPC
Battery Equalise	2.55 VPC	N/A

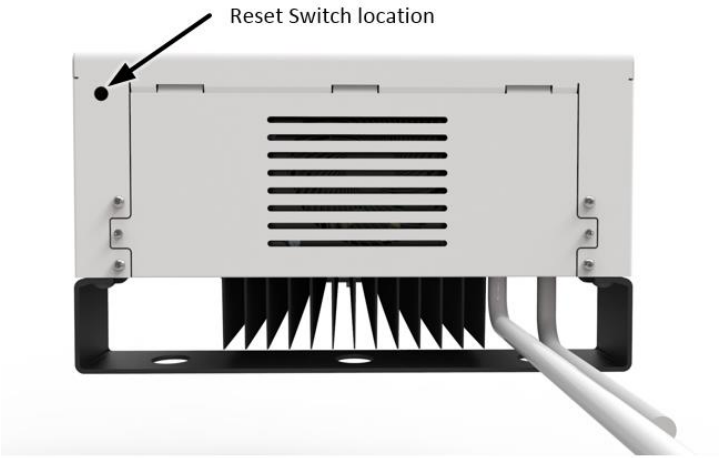
12. Trouble Shooting

12.1 Faults

If there is a fault with the Oasis inverter, the HMI will indicate which fault has occurred, and an audible alarm, if enabled via the DIP switches and the HMI control panel, will sound. If you have a fault that is not addressed in this manual then you should contact the person who installed your Oasis or, alternatively, MLT Inverters product support. See 'Contacting MLT Inverters' on Page 7.

12.2 Typical Problems

12.2.1 My Oasis' screen fails to respond or does not appear to be working



You can attempt to do a hard reset on the inverter by using a pen or similar non-conductive object to push the reset button located at the bottom of the inverter.

12.2.2 Why does the Oasis not connect to a running generator?

Check that any circuit breaker on the generator is in the up position, and the Oasis is not in battery-cycling mode.

If the generator voltage is very low or high, the Source LED will be red. If this happens, check the generator output to ensure that it is operating correctly. If the generator is operating normally, check the wiring between the generator and the Oasis for a fault. The allowable input voltage range can be found in the specifications.

12.2.3 Why does the generator connect and then immediately drop out?

This could be caused by overloading of the generator. Check that the generators rated capacity is large enough to supply the load that is connected to the Oasis. Turn off some loads if necessary.

12.2.4 Why didn't I get the usual capacity from my storage batteries?

Were the batteries fully charged to start with? To ensure a consistent performance from the batteries it is important that they are charged correctly. Each battery type (flooded deep cycle, sealed, gel etc.) has different charging requirements. Incorrect adjustment of battery settings is the most common cause of reduced backup time from your batteries.

For Flooded Lead Acid Batteries it is important to check the battery electrolyte level periodically. Never leave the battery cells with the electrolyte below the required level.

One or more of the cells in the battery bank could be faulty. Check the batteries in accordance with the manufacturer's documentation and replace as necessary.

Flooded lead-acid batteries can be checked with a hydrometer. All batteries should measure the same specific gravity ±10%.

Sealed batteries can be tested with a multi-meter. All batteries should measure close to the same voltage.

12.2.5 Why doesn't my Oasis 'wake up' when I switch on a load?

Is the load large enough? The load sensing feature of the *Load Sense* mode requires a minimum load of 20W to be connected before the Oasis will start. A single cell-phone charger or LED light, for example, is not large enough. Try switching on a light bulb or TV to increase the load, or turning off the load sense mode. A typical compact fluorescent or 'Energy saver' light bulb uses between 8W and 14W.

13. Glossary

AC	Alternating current. The utility, generators, and inverters can supply AC. The AC voltage to homes in South Africa is described as 230V AC 50Hz meaning 230V RMS that is alternating between a positive voltage and a negative voltage 50 times a second.
DC	Direct current. Batteries, solar panels (PV) and some wind turbines provide DC. The Oasis can take DC from batteries and output 230V AC to supply homes and businesses.
Generator	This is a machine that usually runs off diesel or petrol to provide AC power. Generators are usually only run when needed. Generators need to be run periodically to keep their moving parts functional. Generators usually provide most power per litre when they are electrically loaded to 80% of their rating.
Grid/Utility	This is an AC power source that is usually will be present most of the time. The utility is often provided by some power producing company and is not always reliable due to lack of capacity.
PV	Photo voltaic cell. Also known as solar panels. PV cells generate DC electricity when sunlight strikes them.
SRC or SOURCE	A source (abbreviated as SRC) is the general definition for an AC supply such as the Grid or a Generator.
Wind Turbine	This is a modern form of wind mill. Wind turbines generate electricity when their blades are rotated by the wind. Wind turbines usually generate DC.

Appendix A: Single Line Wiring Diagram