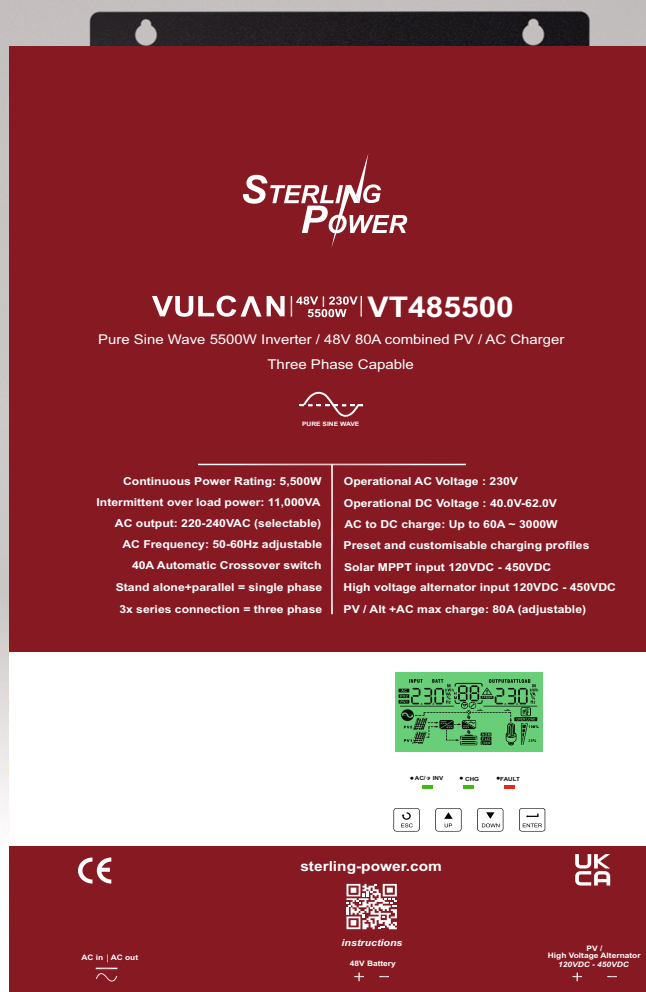




RoHS
compliant



www.sterling-power.com
www.sterling-power-usa.com
Warranty (2 years return to factory)

Sterling Power Products

Hybrid inverter / Charger | off-grid Handbook

VT485500



For latest instructions
scan this QR code

INTRODUCTION TABLE OF CONTENTS

Introduction	02	Table of Contents
	03	Legal / Safety I
	04	Legal / Safety II
Specifications	05	Dimensions
	06	Specifications
First Open and Install	07	Unpacking
	08	Understanding
	09	First install basics
	10	First install : DC
	11	First install : AC
	12	First install : PV
Screen and System	13	Screen I
	14	Screen II
	15	System setup I
	16	System setup II
	17	System setup III
	18	System setup IV
Parallel/Three-Phase	19	Parallel combining - Understanding
	20	Parallel combining - Parallel function
	21	Parallel combining - Three phase function
	22	Parallel combining - maximum configuration (9 units)
Troubleshooting	23	Fault code list
	24	Fault resolution I
	25	Fault resolution II
Manual preface		Please take your time to read and fully understand the contents of this Handbook. These guidelines are developed with your safety and the products performance in mind and failure to follow or understand these guidelines may lead to voiding the product warranty or even leading to damage or injury for you or your setup. If you are unsure of any step or guideline then please consider reaching out to Sterling via our web contact form or our phone service and we shall offer our support.
Vulcan Inverter/Charger		The Vulcan is an Inverter / Charger / Solar device designed to be used with 24V or 48V batteries. It is designed to charge up batteries, then use the stored power to run 230VAC mains appliances. Solar can be used to also add power to the batteries.
'Vulcan' clarification		Throughout this manual we will make reference to this product as the 'Vulcan'. The terms '24V' or '48V' are nominal voltage ranges, rather than specific voltages that you would see on the input or output.
Product Code		To understand the Sterling product code system better and to therefore understand your new product better, the code for the V naming system is simple. V stands for Vulcan, the first two numbers are then the input voltage, and the remaining numbers are the output power in W.
How to use this manual		This manual must be read throughout before installing this electronic device. Do not lose these instructions - keep them safe. The most up to date instructions can be found on sterling-power.com . Please refer to the latest instruction manual before contacting Sterling. At Sterling, we endeavour to include all of the product information that we can think of into the manual.
Being safe		Installation of the electronic device must be carried out by qualified and trained personnel only. The personnel must be familiar with the locally accepted guidelines and safety measures.
Safety note		Your safety is Sterling's top priority. Please follow all precautions to keep yourself safe. If you believe your unit requires repair then please contact Sterling or your distributor. Do not attempt to service the unit yourself.

SAFETY AND LEGAL LEGAL GUIDELINES

Warranty and Terms

Your 100 % satisfaction is our goal. We realise that every customer and circumstance is unique. If you have a problem, question, or comment please do not hesitate to contact us. We welcome you to contact us even after the warranty and return time has passed.

Each product manufactured by Sterling Power comes with at least a 2 year limited factory warranty. Certain Products have a warranty period of time greater than 2 years. Each product is guaranteed against defects in material or workmanship from the date of purchase. At our discretion, we will repair or replace free of charge any defects in material or workmanship that fall within the warranty period of the Sterling Power product. The following conditions do apply:

- The original receipt or proof of purchase must be submitted to claim warranty. If proof cannot be located a warranty is calculated from the date of manufacture.
- Our warranty covers manufacture and material defects. Damages caused by abuse, neglect, accident, alterations and improper use are not covered under our warranty.
- Warranty is null and void if damage occurs due to negligent repairs.
- Customer is responsible for inbound shipping costs of the product to Sterling Power either in the USA or England.
- Sterling Power will ship the repaired or warranty replacement product back to the purchaser at their cost.

If your order was damaged in transit or arrives with an error, please contact us ASAP so we may take care of the matter promptly and at no expense to you. This only applies for shipping which was undertaken by our company and does not apply for shipping organised by yourself. Please do not throw out any shipping or packaging materials. All returns for any reason will require a proof of purchase with the purchase date. The proof of purchase must be sent with the returned shipment. If you have no proof of purchase call the vendor who supplied you and acquire the appropriate documentation.

To make a claim under warranty, call our customer care check telephone numbers on www.sterling-power.com or www.sterling-power-usa.com. We will make the best effort to repair or replace the product, if found to be defective within the terms of the warranty. Sterling Power will ship the repaired or warranty replacement product back to the purchaser, if purchased from us.

Please review the documentation included with your purchase. Our warranty only covers orders purchased from Sterling Power. We cannot accept warranty claims from any other Sterling Power distributor. Purchase or other acceptance of the product shall be on the condition and agreement that Sterling Power USA LLC and Sterling Power LTD shall not be liable for incidental or consequential damages of any kind. Some states may not allow the exclusion or limitation of consequential damages, so, the above limitations may not apply to you. Additionally, Sterling Power USA and Sterling Power LTD neither assumes nor authorizes any person for any obligation or liability in connection with the sale of this product. This warranty is made in lieu of all other obligations or liabilities. This warranty provides you specific legal rights and you may also have other rights, which vary from state to state. This warranty is in lieu of all other, expressed or implied.

Copyright and Plagiarism

Copyright © 2024 Sterling Power. All rights reserved.
Reproduction, transfer, distribution or storage of part or all of the contents of this document is strictly prohibited. If you wish to use all of this document, or excerpts from it, Sterling Power must be contacted.

Liability

Sterling Power can not accept liability for:

- consequential damage due to use of this device
- possible errors in the manuals and the results thereof

Device Modification

Please do not modify the device unless you have been instructed to do so by Sterling Power directly. Product modification shall be done at Sterling when needed. Warranty shall be voided if personal attempts are made to modify the device without Sterling's approval.

Installation Laws

The installer and the user are liable for ensuring the item is properly and legally installed and suitable for use in whatever territories and conditions it is expected to operate in. Improper use of the item, improper understanding of the item, improper installation of the item etcetera do not reflect on Sterling or make Sterling liable.

SAFETY AND LEGAL SAFETY GUIDELINES

Product Guidelines

Your Sterling Power product should only be utilised for it's designated purpose. If you do not feel capable to install an AC item correctly - DO NOT. If there are any doubts about the install - get it professionally installed.

Ensure that the mains supply and battery leads are disconnected before transporting or moving the unit. No liability can be accepted for damage in transit once equipment has been unpackaged. Store the product in a dry environment, between -20°C to 60°C.

Transport and Storage

Refer to the battery manufacturer's manual for information on transportation, stowage, charge rates, recharging and battery disposal for your batteries. Sterling cannot be considered an authority on your batteries.

General Maintenance

The device must be switched off during maintenance and all cables removed from the direct feed to or from the unit. It must also be protected against unexpected switching off. Remove battery connections and ensure unit is off. If repair is required, only use original parts. Unauthorised attempts to repair Sterling units will lead to the warranty being voided. Only someone with adequate understanding of electronics and the unit itself should attempt a repair. Ensure your connections are good and clean and aim to protect your unit from humidity and water ingress. All contacts should be checked intermittently. Damage that occurs from improperly maintained contacts are at fault of the user.

Safety Precautions

Electrical appliances can be heavy. Please do not lift heavy units unassisted.
 Ensure that your product is correct for your system, voltage thresholds are crucial.
 Orientation is not critical to unit function, however may affect water ingress rating.
 Install device in a well ventilated space for cooling purposes.
 Do not expose the unit to snow, rain, water, spray, condensation, pollution etc, unless it is a waterproof unit. If it is a waterproof unit, only expose it to situations it is correctly rated for.
 Do not cover or obstruct the ventilation.
 Device connects to common negative. Common negatives must be earthed.
 In case of fire, use fire extinguisher equipment suitable for electrical fires.
 Avoid all possibilities of reverse polarity or short circuiting.
 Check cabling and connections frequently and ensure the connections are sufficient.
 Always protect DC cabling with the appropriate fusing.
 Ensure the unit is adequately and safely mounted to prevent displacement and damage.
 Always use a professional to install electrical products.
 Ensure the product is correctly set up for your battery.
 Keep out of reach of children

WARNING :

Do NOT remove the panelling to inspect the internals unless expressly told to by Sterling. This is not a product designed to be user-serviced.

WARNING :

Do NOT use the device in situations where there is danger of gas / dust / vapour explosions, or around potentially flammable produce.



A lot of modern Sterling writing tries to be candid, friendly and easy to read - with that in mind...

DO NOT ATTEMPT TO INSTALL THIS EQUIPMENT UNLESS YOU ARE COMFORTABLE AND EDUCATED WITH ALL MATTERS OF ITS INSTALL.

The V485500 and VT485500 operate in high voltage environments. 240V AC can kill. 150V-500V DC from the solar circuit can kill. VTs operating in three-phase 400VAC output can kill.

Be safe, be sensible and follow your country's legal guidelines,

Solar Warning

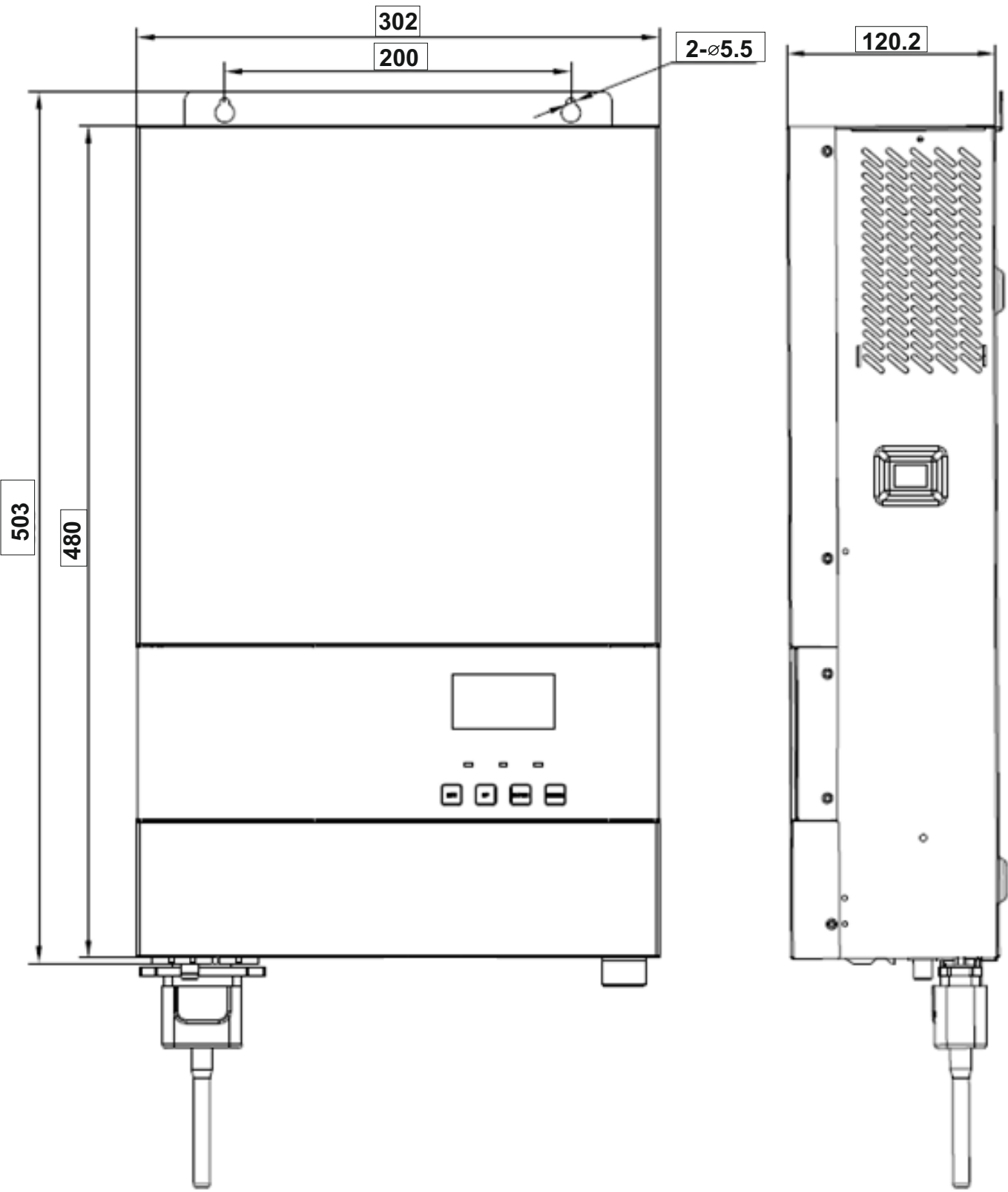
This inverter is **non-isolated**. Only three types of PV arrays are usable. Single crystalline, class A-rated polycrystalline and CIGS modules.

To avoid errors and damage, do not connect any PV arrays which may have current 'leakage'. When using CIGS modules, do not ground.

Surge protection

It's recommended to use surge protectors on the AC and PV circuits to insulate against damage.

SPECIFICATIONS **DIMENSIONS (mm)**





SPECIFICATIONS SPECS : VULCAN OVERVIEW

MODEL OVERVIEW VULCAN THREE-PHASE CAPABLE 48V 5500W, VT-485500

DC VOLTAGE 48V NOMINAL

DIMENSIONS 503 X 302 X 120 (LWH, mm)

WEIGHT 11.5kg NET, 12.5kg GROSS

NOMINAL AC VOLTAGE 240VAC SINGLE PHASE, PURE SINE WAVE (Grid or Generator-)

MAX AC INPUT VOLTAGE MAX IN - 270VAC, MINIMUM IN - 170VAC. MAX FREQ - 67Hz, MIN FREQ - 42Hz

INTEGRATED PROTECTIONS LOW VOLTAGE, HIGH VOLTAGE, OVERLOAD, OVER-TEMP, SHORT CIRCUIT, OVER-CHARGE, REVERSE POLARITY, SYSTEM ERRORS,

OPERATING TEMPERATURE 0-50 DEGC

STORAGE TEMPERATURE -15-60 DEGC

COMMUNICATION LINES USB, Rs232, Rs485, WIFI, CAN

EFFICIENCY ~92%

POWER FACTOR 1.0

Humidity 0-90%RH (Non condensing)

CHARGE SPECS CHARGER SPECS

CHARGE ALGORITHM 3 STEP CHARGE CURVE (BULK, ABSORPTION, FLOAT)

BATTERY CHARGE FROM AC UP TO 80AAT 48v

BULK VOLTAGE RANGE 48.0 - 60.0VDC

FLOAT VOLTAGE RANGE 48.0 - 60.0VDC

MAX TOTAL CHARGE (PV+AC) 100A PEAK

HIGH DC VOLTAGE ALARM 60VDC

SOLAR SPECS SOLAR SPECS

SOLAR INPUT RATING 5500W PEAK (PV)

SOLAR OPERATING RANGE 120-450VDC

SOLAR NORMAL RANGE 280-360VDC

SOLAR PEAK IN-CURRENT 20A

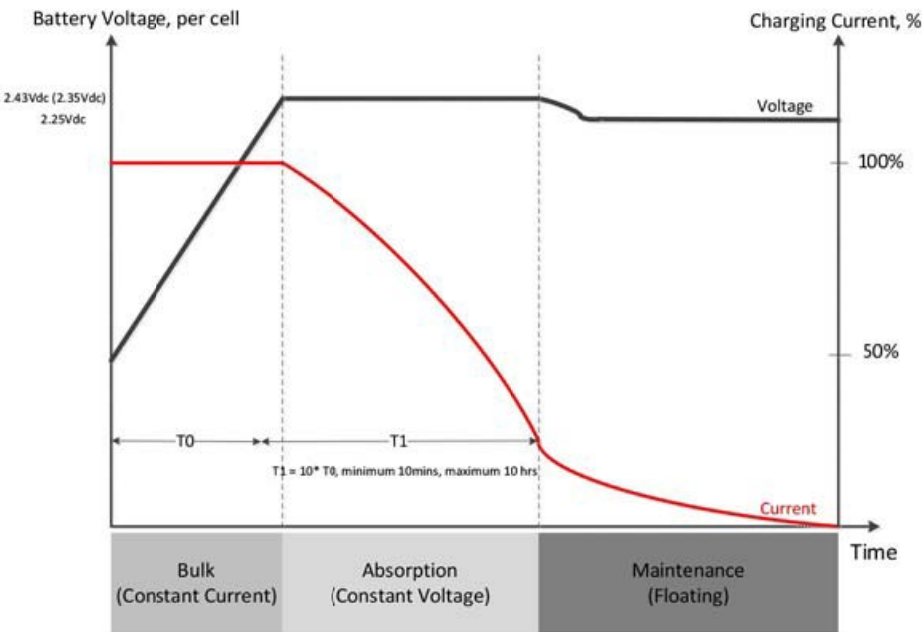
INVERTER SPECS INVERTER SPECS

RATED OUTPUT 5.5KW PURE SINE CONTINUOUS

AC OUTPUT VOLTAGE 230VAC (CONFIGURABLE - +/- 10V)

AC OUTPUT FREQUENCY 50Hz/60Hz (CONFIGURABLE)

OUTPUT CURRENT PEAK 23.9A



UNPACKING WHATS IN THE BOX

Understanding the Product

What is a Vulcan?

Before we proceed with the install it may be helpful to understand what the Vulcan is, what it can do, and what a very simplified system will look like.

The Vulcan range offer a selection of high powered inverter/chargers with photovoltaic (herein called PV) input capability built in. It was named after the Roman god of metalworking and the forge - Vulcan, as we considered that hard work and capability to be something we aim for and that which we believe the item meets and exceeds. It was (probably) not named after the aliens in that one space show.

What is 'Photovoltaic'?
(Completely unnecessary info for the manual, but some of you might find it fascinating)

PV = Photovoltaic, from the words '**Photo**' and the eponymous '**Volta**'.

Photo stems from the Greek '**Phos**'. It translates to 'Light', as in illumination.

Alessandro **Volta** is the physicist that the 'Volt' is named after - he invented the electric battery.

Finally, the 'Volt' is a unit of electrical potential and electromotive force.

So, Photo + voltaic, if we read backwards, is the process of getting electrical potential from light - in this case, the sun.

FEATURES DC/AC Inverter (1)

The Vulcan is able to provide an AC output of 220VAC-240VAC(user selectable) to support loads of up to 5500W continuously - or for as long as the DC/PV supply that powers it is sustained. The output is 'pure-sine'.

AC/DC Smart-Charger (2)

It is also able to provide a DC charge voltage to the attached battery bank (either 48V or 24V, pending model), so as to replenish a discharged battery or provide power to DC circuit loads. This power is drawn from/provided by the 240VAC input, generally from the utility/mains/grid supply.

PV Converter (PV/DC/AC) (3) / Solar Charger (3)

The solar array (150VDC-450VDC) can be used to both charge the DC circuit (your batteries, provide to DC power loads) as well as to directly power and support your AC 240V or three-phase loads. Our solar circuit can draw up to 5500W (array allowing).

Configurable Priority (4)

The AC provision (AC OUT) can be configured based on your priorities- choosing to use the battery bank, solar, or AC lines first.

Integrated Safety Monitoring (5)

The Vulcan monitors and protects against a range of 'threats'. Over-voltage, over-temp, short circuits and low DC voltage alarms are all integrated into the design of the Vulcan.

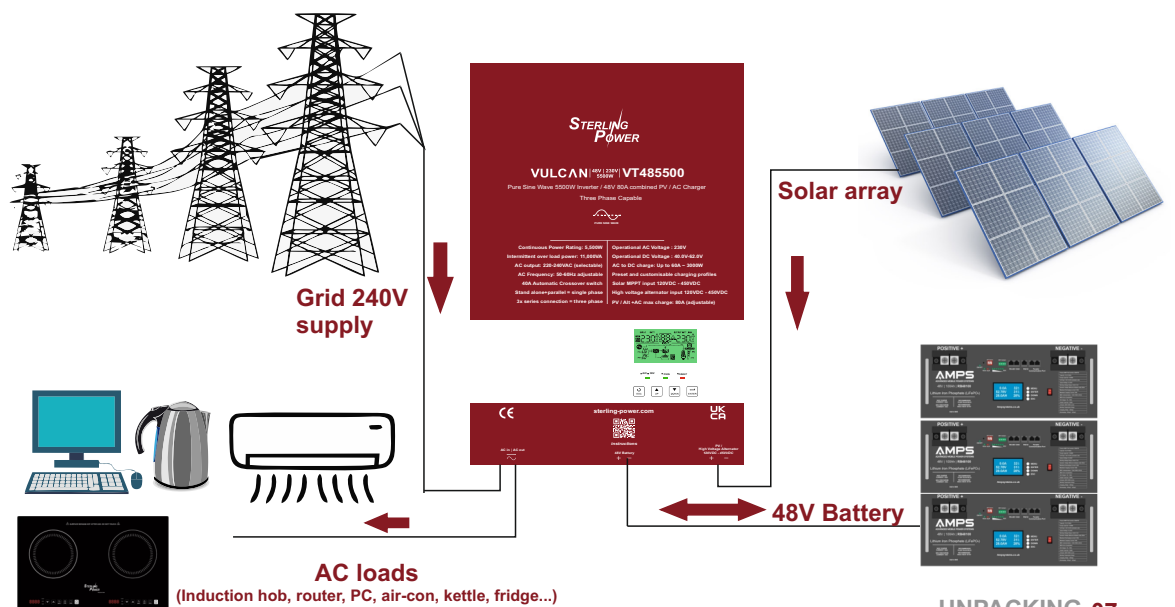
Parallel and Three Phase (6) capabilities (6)

One of the major benefits of the Vulcan (T) series item, in particular, is its ability to be combined with other identical items.

In other words- with three VT485500s you have up to 15KW of single or three phase combined output capability, at any given time. This can be expanded with up to nine total units.

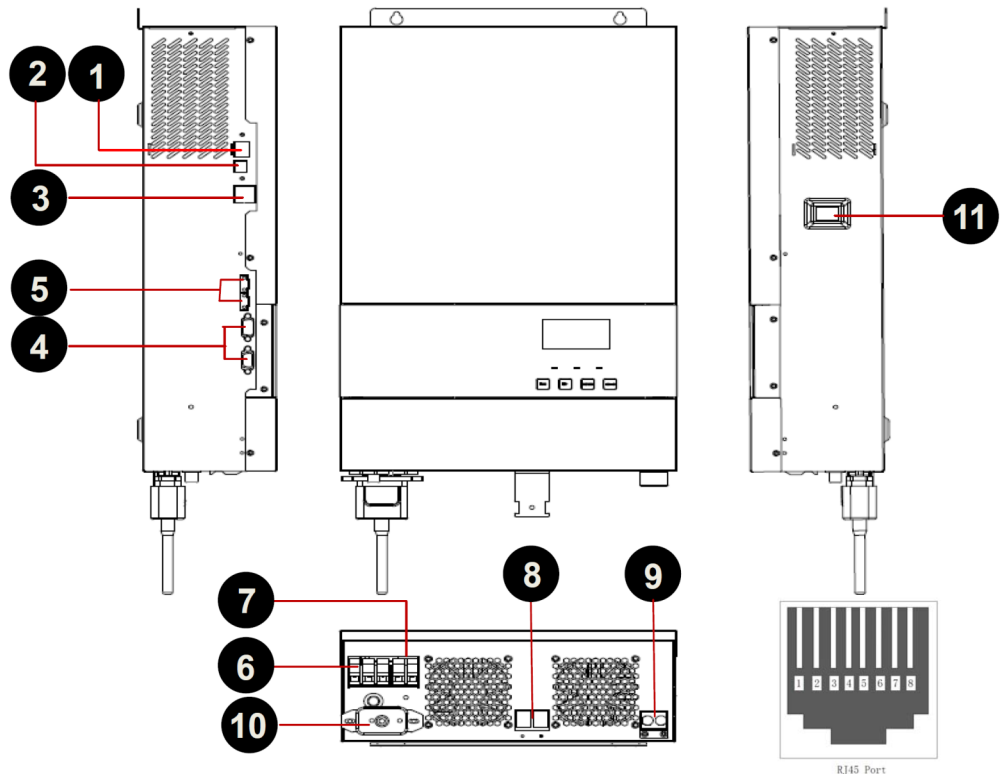
Nine V485500s in parallel offers you up to 49KW of single phase 240VAC or 415VAC Three Phase (3 Phase 240V) power to be pulled at any time... Though, you'd need a pretty hefty battery bank for that.

Basic install architecture



UNPACKING VULCAN-T BREAKDOWN

Product Breakdown



- 1) RS232/RS485/CAN Port (RJ)
- 2) USB Port (Work in progress, same project pair with 10)
- 3) Generator dry contact
- 4) Parallel ports (for multiple Vulcan-Ts)
- 5) Current Sharing Port (for multiple Vulcan-Ts)
- 6) AC IN-line (from grid or generator)
- 7) AC OUT-line (to your onboard/domestic appliances)
- 8) DC battery contact
- 9) Solar input
- 10) WiFi contact port (Work in progress)
- 11) Power ON/OFF switch

Comms port definitions :

Rs232 1:RXD, 2:TXD, 8:GND
 Rs485 6:485-B, 7:485-A,
 CAN 3:CAN-H, 5:CAN-L

Wi-Fi comms (10, 11)

WiFi monitoring is something we're aware that people are interested in. We're currently in talks regarding using open source solar monitoring platforms to pair with the Vulcans. We'll be very vocal about if it successful, so check the Vulcan Sterling page if you're curious if it's 'done yet'. It will/should be backwards-compatible with the Vulcans already 'in the field' when done.

INSTALL FIRST OPEN + INSPECTION

Unpacking the VT

When you open the VT box up - which I'm presuming you may have considering you're reading this - please inspect the box and make sure you have everything that you need and that the items do not appear damaged.

The following items should be inside the box :

- 1x VT Inverter/Charger,
- 1x User Manual,
- 1x RS232 Comms Cable,
- 1x USB Comms Cable
- 1x Parallel cable set
- 1x DC Fuse
- Mounting screws

Preparing install

The cable connection areas will be covered by securing screws. In order to access these areas for the install you may need to remove these panels. Ensure you keep-hold of any screws you remove.

It may also be sensible to start off by installing the wall-mount brackets on the VT at this stage. Hand tightening the screws into the side-mounts should suffice. You obviously will want the base of the mount to be level with the back of the inverter (IE where the wall is most likely to be...).

Mounting guidelines

There's a few basic rules that should be followed for mounting position
 Do not mount the inverter on flammable surfaces nor in ignition-prone areas.
 Do not mount the inverter on a surface that is insufficient to hold/support the inverter.
 Do not mount the inverter in a closed, tight area.

Do mount the inverter in a position where it can be accessed relatively easily- to either program the item, or to do intermittent checks on the cable security.

Do mount the inverter in a position where it has sufficient cooling/air flow.

Do ensure you have at least 50cm below the inverter for clearance, and at least 20cm either side of the inverter

The recommended installation position is 'upright', but orientation, in terms of inverter operation, is not going to affect much other than cooling capability and the drip-proofing.

Post-mounting sequence

From here we are going to be looking at actually wiring the Vulcan into your system. We will start with the DC circuit.

Cable safety

There's a few guidelines that we should follow. Some of this comes as common sense but it should be said anyway.

1) All cables should be rated for their expected use and all cables going in or out of a battery bank should be fused, ideally close to the battery terminals rather than far away. We are not liable for people using insufficient cable. Installing AC protection is also very sensible and recommended.

2) All cable contacts should be checked regularly to ensure they are secure and that there are no signs of corrosion or looseness.

3) All installs should be undertaken by qualified and confident personnel. If there are doubts about the install, please consult with someone else- either us or another professional who thinks they can comment.

4) If you are handling cable- please ensure they are not live. Installing live AC cable is dangerous- as is installing live DC cable. Connect cable to the Vulcan first and then onto the power sources where this is possible. You're not going to be hurt by 0V- but 240VAC is another story.

DC Cable recommendation

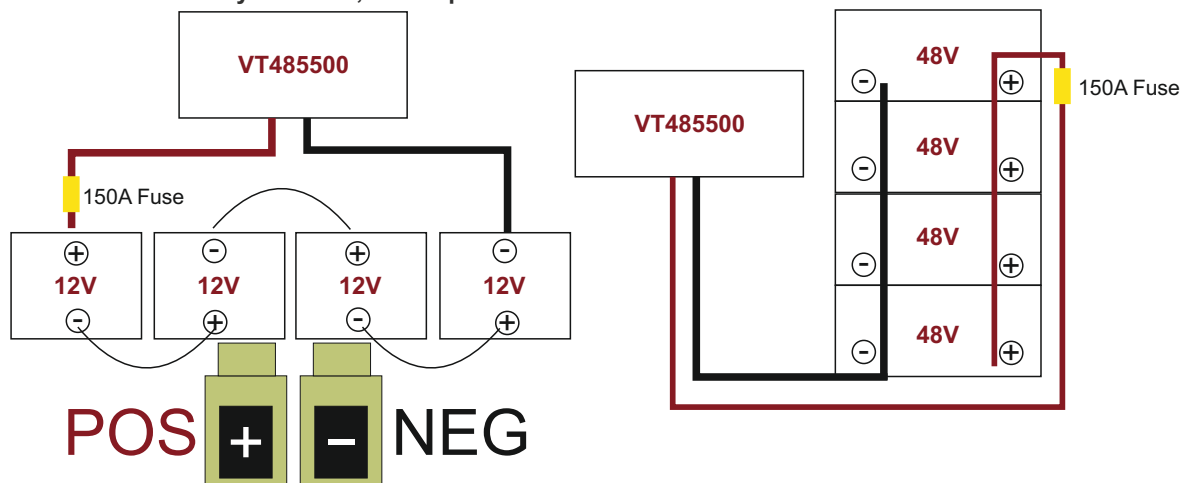
35mm²/2AWG with 150A~ fuses would be our recommendation in terms of minimum requirements for short-distance installs. 50mm²/1AWG will be superior where possible, up to about 3 meters. If you find your install necessitates cable runs of further than 3 meters- be in contact and we can try to advise.

INSTALL FIRST INSTALL - DC

Install preliminary

Install : DC
LEFT : Sample install with four
48V batteries in parallel
Right : Sample install with four
12V batteries in series.

With the guidelines of the previous page (about basic cable safety) in mind, and with the inverter already wall-mounted where you want it, we can proceed.



DC Install simplified

There are a few things you can do to make this install simple, quick and safe. Installing a 50mm² cable line to your battery bank positive that goes straight into a low-resistance DC switch that you can then isolate will give you the safest way to install the cable. You can then install the POS cables without them being live, and connect/close the switch when you are 'done'.



When installing 48V items you can expect to see some relatively large sparks if using un-isolated cable lines. If you are installing this without the isolation switch, be prepared to see a spark when you complete the circuit.

DC Install guide WITH
ISOLATION SWITCH

1)
Verify what you have

Firstly, make sure you have everything you require. The Vt485500 uses screw-compression terminals for the DC contacts. Making sure you have a suitable toolkit, access to the terminals (IE you've taken the cover plate off), and suitable cable for the install is a strong place to start.

2)
Install switch cable

If you have a DC low-loss isolation switch, now is a great time to connect your POS cable to your batteries, leading onto one side of the switch and connecting it securely. With the switch in the 'open' position, any cable you connect to the other side of that switch will be 0V, safe and easy to install, and can be made live at your leisure.

3)
Connect cable lines

With that in place, you can now connect both the null (0V) positive cable and the battery negative cable to the DC contacts of the Vulcan, securing in place until snug in the contact terminal. In most installs, while it may be 'unattractive', exposed copper is the most secure method of installing to these terminals. Copper is malleable, and the strands will deform to fill the contact space, ensuring best contact on all sides. Ferrules are neater, but can prove inefficient in these terminals, due to how hard they are and how often they are 'rounded'.

4)
Common sense- then engage.

Take a common sense check- make sure you have cables around the correct way (IE the POS cable goes into the POS terminal, the NEG goes into the NEG terminals... etc..), make sure the cables are sufficient and the contacts are all sound- then feel free to connect/close the switch.

INSTALL WITHOUT
ISOLATION SWITCH

1)
Connect cables to VT

Connect your positive and negative cables into the VT Vulcan first, securing them in place until tight and secure. Insulating against them coming loose in the future. As above, direct copper will often pose the best contact to screw-clamp terminals. Ensure you are not clamping down onto the cable sheathing.

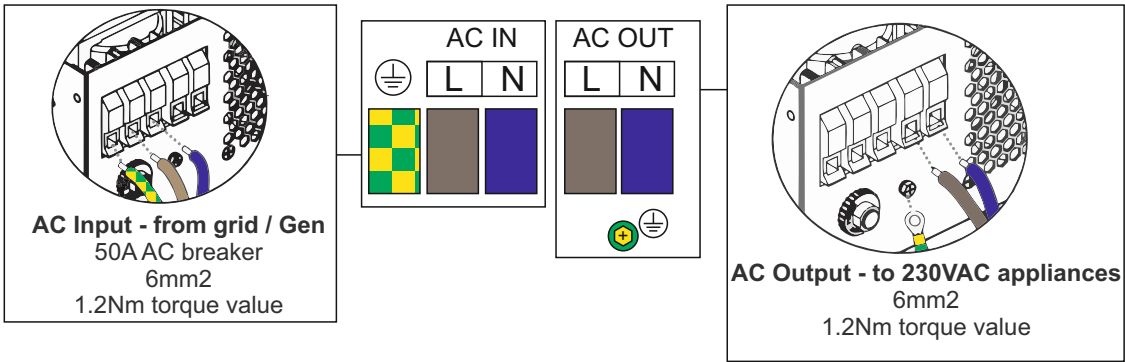
2)
Connect to battery - Neg and then pos.

You can now connect the negative cable (already installed into the Vulcan-) across to the battery negative. Tighten until secure, then repeat with the positive cable. You'll see it spark very noticeably- this is simply what's going to happen when installing 48V equipment un-isolated and is normal. Tighten and secure this line.

After completing these steps, double-check all connections and ensure everything is secure before powering on the system. DC install... **Complete.**

INSTALL FIRST INSTALL - AC

AC install precautions	We don't want to be boring - but it is very important that we re-iterate here, very clearly, that carrying out an AC install can be dangerous if you do not 'respect' it. Please read and understand the following forewarnings before going through with an AC install. Working with AC power requires careful attention to detail and adherence to safety protocols to prevent injury, equipment damage, or even fatal accidents.	
Safety: 1 - Power OFF	Ensure all power sources are turned off before beginning any AC installation work. Verify that the inverter, battery, and any connected devices are completely de-energized.	
2 - Qualified Installer	It is highly recommended that AC wiring be performed by a qualified electrician. Improper installation can lead to severe electrical hazards.	
3 - PPE	Always wear appropriate PPE, including insulated gloves, when working with electrical systems.	
4 - Proper equipment	Use only tools and equipment rated for 240V AC work. Ensure all connections are secure and compliant with local electrical codes.	
5 - Circuit protection	Please install a separate AC breaker between the inverter and the AC input power source. This will ensure the inverter can be securely disconnected/isolated during maintenance and is protected. The recommended specifications for the AC breaker is 63A for the VT.	
6 - Cable thickness	6mm2, 3 core cable is our recommendation for this degree of power, as a minimum. The torque value for the contacts is 1.4-1.6Nm.	
7 - Cable location	The AC terminal blocks are labelled IN and OUT. Please ensure that you connect your AC cable around the correct way, to save damage to the inverter.	
Cable colours and identifying	Identifying your cable layout is something that you have to verify yourselves. Different countries have different standards for how cables are coloured versus their 'assigned' polarity. For an AC install the inverter will need two sets of Live, Neutral and Earth cables, one for the AC IN and one for the AC OUT. Live should be the ONLY live (read - non zero) cables coming in to the AC contacts.	
	The following are the generally accepted colours for AC cable- but please VERIFY if you are unsure. Bold is what it should be- I only include the alternative colours in case your wiring is different, for whatever confusing reason.	
L LIVE	International Electrotechnical Commission : BROWN.	OLD UK : RED. USA : BLACK
N NEUTRAL	IEC : BLUE	OLD UK : BLACK. USA: WHITE/GREY
 EARTH	IEC : GREEN-YELLOW	OLD UK: GREEN-YELLOW. USA: GREEN
AC Cable Install	After all of that- we can now install the AC lines. Ensure that all of these cable lines that you are installing are currently unpowered/isolated. Do not even try to impress someone by installing the unit with live cables.	
Expose the copper-	Ensure that you have sufficiently stripped back the cable so as to get a good contact into the AC terminals of the Vulcan, ensuring also that you are not installing the cables with the clamp pressing down on the sheathing rather than the copper.	
Cable location	From there, simply insert the cable into the suitable slot. Live is L, Neutral is N and the Earth is a grounding symbol. For the AC OUT the grounding symbol goes to a small bolt-post rather than a screw terminal.	



INSTALL FIRST INSTALL - PV / SOLAR

Solar/PV Precautions

This solar circuit is non-isolated. Do not share multiple Vulcans to the same solar array. Please ensure the inverter and PV circuit is fused and has an installed circuit-breaker so the system can be isolated if needed.

Please ensure that all solar cable is sufficient and please ensure the array is structured so as to not exceed the Vt's maximum capabilities, particularly in terms of Voltage Open Circuit (VOC).

Cell requirements

Ensure your PV array is configured of single/mono-crystalline, class A poly-crystalline or CIGS solar modules. Also ensure that the PV array is not grounded elsewhere or you may face leakage issues.

Surge protection

Surge protection on the PV circuit/junctions would also be advisable, in order to protect against lightning strike damage.

Solar VOC Limit Solar Operating Voltages

VOLTAGE OPEN CIRCUIT LIMIT : 450VDC
PV ARRAY OPERATING RANGE : 120VDC - 450VDC

PV Install

Please follow these steps for implementing the PV contacts- ensuring the cable line is isolated via your in-line PV circuit breaker first.

- 1) If your solar cable is still insulated/sheathed to the end, remove the insulation sleeve ~15mm on both the POS and NEG cable lines. If your solar cable is not still insulated and you have direct metal contacts (inside of a MC-4 connector, for example or a bootlace ferrule), that should suffice.
- 2) With these metal contacts exposed, install the cable into the allocated 400VDC PV input area, tightening the clamp with up to ~1.5Nm of torque.

Solar array examples

	SOLARINPUT	Qty of panels	Total input power
	Based on voltage, the minimum array requires 5 panels in series, and maximum is 11 in series.		
Example panel Solar Panel Spec.250Wp Vmp:30.1Vdc Imp:8.3A Voc:37.7Vdc Isc:8.4A	5 panels in Series, Sets of 1 in 'Parallel'	5 pcs	1250W
	8S 1P	8 pcs	2000W
	10S 1P	10pcs	2500W
	9S 2P	18pcs	4500W
	5S 4P	20pcs	5000W
	11S 2P	22pcs	5500W

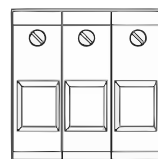
Final assembly

With all our connections now made (DC, AC IN, AC OUT, PV IN...) you can reconnect the covers to the unit with the screws.

Please remember to check contacts occasionally to make sure that nothing has changed and to maximise safety.. But other than that, the hard part is done.

GENERATOR/DRY CONTACT SIGNAL

If you have a generator that can take a 'low battery signal' from an inverter/charger, the side of the Vt485500 has a dry contact signal section, rated to 3A at 250VAC. If you want to install this line, do so now. You'll find it to the side of the Vulcan.



NC C NO

UNIT OFF
UNIT ON, BATTERY > 51V
UNIT ON, BATTERY < 45V

NC & C = OPEN, C & NO = CLOSE
NC & C = OPEN, C & NO = CLOSE
NC & C = CLOSE, C & NO = OPEN

INSTALL SCREEN AND SETUP

Post install celebration

We're there. You've done it, the Vulcan is now installed (hopefully) without any damage. Cables are secure, contacts are tight, all is well in the world. Now let's get to understanding and actually using the Vt485500

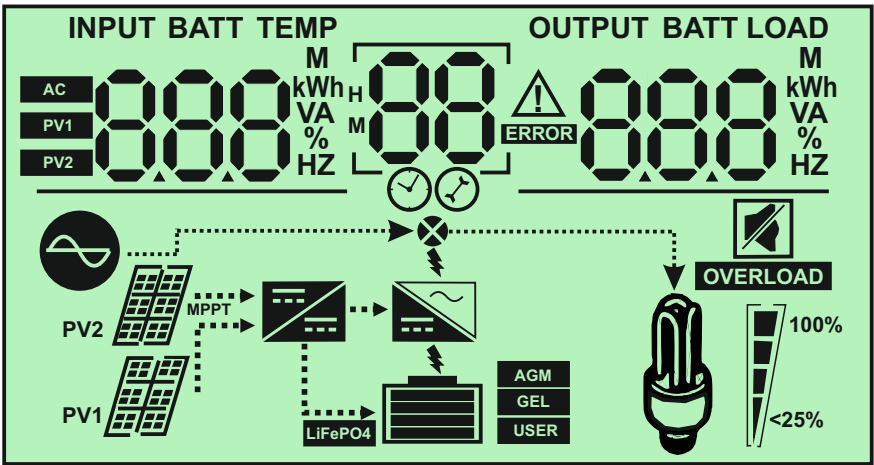
Power ON/OFF

Once the install is complete, you'll find the ON/OFF toggle switch on the right hand side of the Vt485500.

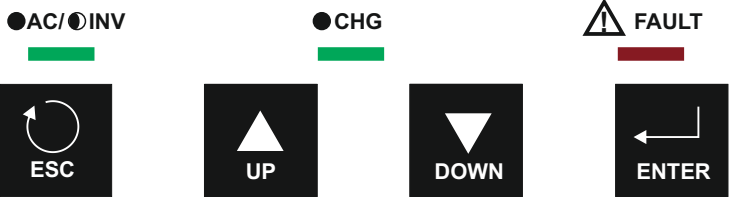
Operations display

The operations display is the main control and visual display for the Vt485500, and is where you'll make much of the actual decisions about how things operate. Let's break down what it shows and how we can use it.

Display (drawn)



LEDs



Operating/Function buttons

LED Explanations

LED BEHAVIOUR			DESCRIPTION
●AC/●INV	GREEN	SOLID ON	AC OUTPUT POWERED BY GRID (PASS-THROUGH)
		FLASHING	AC OUTPUT POWERED BY INVERTER (BATT/PV)
●CHG	GREEN	SOLID ON	CHARGE COMPLETE, CHARGER IN FLOAT
		FLASHING	BATTERY STILL CHARGING
⚠ FAULT	RED	SOLID ON	FAULT FOUND
		FLASHING	WARNING EVENT FOUND

Buttons and their purpose

ESC	EXIT CURRENT MENU/SETTING - 'GO BACK'
UP	GO 'UP' IN THE SEQUENCE OF MENUS
DOWN	GO 'DOWN' IN THE SEQUENCE OF MENUS
ENTER	CONFIRM ON-SCREEN SELECTION (DECIDING SETTINGS)

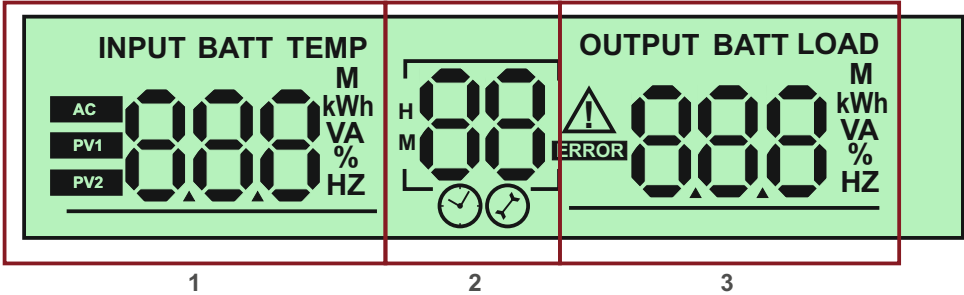
On-screen understanding

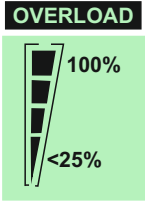
AC	WHEN LIT, UNIT IS DISPLAYING INFORMATION REGARDING THE AC INPUT
PV1	UNIT IS DISPLAYING INFORMATION REGARDING THE PV/HVDC INPUT
PV2	UNUSED

INSTALL SCREEN AND SETUP

Display understanding,
continued

- 1) Input related information (Voltage, power, provision)
- 2) Used for choosing and deciding on settings (covered later), displaying errors codes, or number of units in parallel.
- 3) Output related information (Voltage, load, current)



	BATTERY SOC (25% INCREMENTS), CHARGE STATUS
	LOAD DISPLAY - IE PERCENTAGE OF PEAK OUTPUT CAPABILITY OVERLOAD ALARM DISPLAYS IF >100% OUTPUT
	INDICATES CONNECTION TO AC MAINS OR GENERATOR
	INDICATES CONNECTION TO PV ARRAY
	CHARGING FROM DC/PV SOURCE
	CHARGING FROM AC SOURCE
	ALARM DISABLED- PRESS AND HOLD 'ESC' FOR 3 SECONDS TO TOGGLE
M H	MASTER OR FOLLOWER DISPLAY. M = MASTER, H = FOLLOWER.
LiFePO4 AGM GEL USER	CURRENT CHARGE PROFILE CHOSEN

Understanding the display

When everything is displayed (as above) at the same time, it can be confusing. When in operation, much of the display can be interpreted by understanding what is occurring in your system at any given time.

When you are choosing settings, much of the display will go blank bar the central set. You will only be displayed information when it is relevant for you to see.

While it is poor for a manual to say that some things can be inferred, rather than to explicitly guide, this is likely to be the best case here.

As, if the ERROR symbol is displaying we may infer that the numbers display an error code. If we are choosing settings, the screen displays our current selection.

INSTALL SETTINGS LIST AND PARAMETERS

LCD settings

To access the settings, integral to the control and configuration of the Vulcan, press and hold the ENTER button for 5 seconds. You will be able to move UP or DOWN through the setting parameters list by using the UP or DOWN buttons.

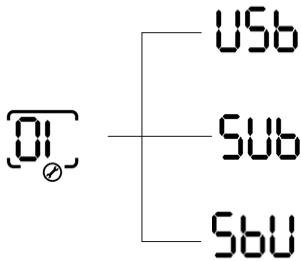
When you land at the setting you wish to configure, press the ENTER button and adjust the settings with the UP and DOWN buttons once more. ENTER will confirm the setting, ESC will go back to the prior menu.

EXIT SETTINGS : 00

ESC

Confirming here will exit the 'SETTINGS' area of the VT system.

PRIMARY AC SOURCE : 01



Dictates what the Vulcan will pull from as the primary, secondary and tertiary choice when powering your loads.

'UTILITY, SOLAR, BATTERY' (Default)

Your AC source will be the primary supplier to your AC loads when it is available. If the AC source is insufficient or disappears, solar and then battery source will be used.

'SOLAR, UTILITY, BATTERY'

Similar to above, but using the PV supply as the primary provider, followed by grid and then finally to battery, on order of what is available.

'SOLAR, BATTERY, UTILITY'

For those who want to avoid pulling from the grid/AC source- this setting will focus on the solar and battery provision first- until the battery voltage falls low (Configurable - 12)

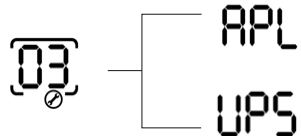
MAX CHARGE CURRENT: 02



This parameter dictates the total charge current the Vulcan may provide (PV + AC)

60A (default) will be the first setting from the factory. This can be adjusted up and down in 10A increments, from 10A to 100A. Future variants may offer up to 120A peak.

AC INPUT RANGE : 03

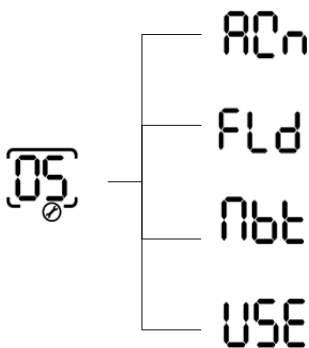


The acceptable AC INPUT range is dictated by this setting.

APPLIANCES (Default) : Acceptable AC input range : 90-280VAC

UPS : Acceptable AC input range : 170-280VAC

CHARGE PROFILE : 05



Selectable here is the charge profile for your DC batteries. Please check with the battery specification sheet regarding what the manufacturer recommends. Our labels are only guidelines and are not going to be universal. In fact, Sterling would recommend you to use the USE profile, and set up parameters for your bank specifically.

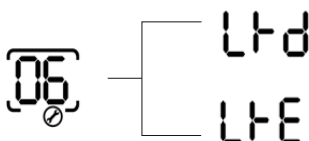
AGM (Default)

FLOODED

NO BATTERY (If using Vulcan exclusively as a PV supply, you must use NBT)

USER DEFINED : Battery charge voltage and low DC disconnect voltage can be configured on settings 26, 27 and 29.

OVERLOAD RESTART : 06



This dictates how the Vulcan performs after a 'Overload' shutdown.

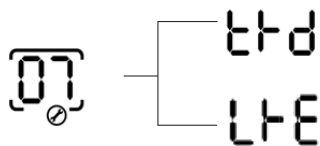
AUTO RESTART DISABLED (Default) - Vulcan must be manually recovered from an overload state.

AUTO RESTART ENABLED - Vulcan will self-recover. If the fault is not resolved it may repeat.



INSTALL SETTINGS LIST AND PARAMETERS

OVER-TEMP RESTART : 07



Similar to (06), this dictates how the Vulcan recovers from an 'Over-Temperature' event.

AUTO RESTART DISABLED (Default) - Vulcan must be manually recovered from an over-temp state.

AUTO RESTART ENABLED - Vulcan will self-recover. If the fault is not resolved it may repeat.

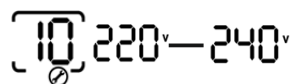
AC OUTPUT FREQUENCY : 09



Configure the AC output frequency - according to what your appliances require

50Hz is the default. 60Hz is available if you choose

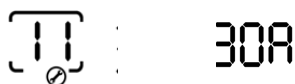
AC OUTPUT VOLTAGE : 10



Configure the AC output voltage - according to what your appliances require

230VAC is the factory default. 220VAC and 240VAC can be chosen

PEAK CHARGE FROM AC : 11



Configure and set the maximum charge current we can draw from the AC supply. Please note that setting (02) takes priority. A 'MAX CHARGE' overall of 50A will not be overridden by a 60A 'AC PEAK'.

Charge limit can be set to any value from 10A to 80A, in 10A increments.
30A is factory default.

LOW BATTERY V-SET : 12



Sets the limit in (SBU) mode at which point the Vulcan will stop drawing from the battery, and will move to draw from the AC source.

46V default, configurable from 44V to 51V. Each press of the UP/DOWN button will adjust values by 1V.

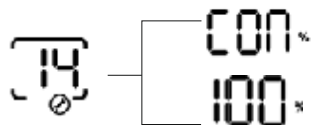
RETURN TO BATT V-SET : 13



Sets the threshold in (SBU) mode at which point the Vulcan will begin using the battery as primary supply again

Configurable in increments of 1V from 48V to 58V. Default is 54V.

BATT CHARGE LIMIT : 14



Set the limit at which the battery charge procedure halts.

May require battery comms

Charge continuously (Note :: This does not equal 'overcharging', it just charges to the limits that you set)

Charge halts when the set value is reached (Default, 100%). Configurable from 50% to 100% in increments of 1%

BATT DISCHARGE LIMIT : 15

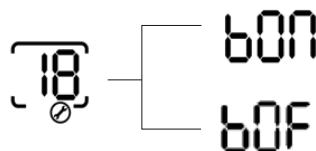


Set the limit at which the battery discharge procedure halts.

May require battery comms

Default : 10%. Configurable from 5% to 50% in increments of 1%.

ALARM CONTROL : 18

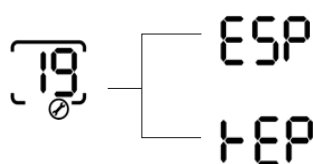


Choose between the alarm operating or not.

Alarm ON (default)

Alarm OFF

SCREEN RESET Y/N : 19



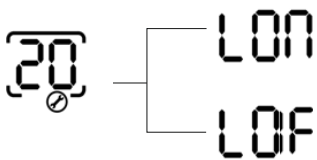
Set the logic behind the Vulcan resetting the display screen after 1 minute, or staying on the screen as set.

Returns to main-display after 1 minute (default)

Retains display as last set / Stay on current screen until changed

INSTALL SETTINGS LIST AND PARAMETERS

BACKLIGHT CONTROL : 20

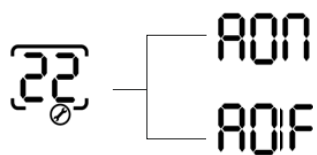


Decides the behaviour of the Vulcan screen's backlight.

Light ON (default)

Light OFF

AC ABSENCE ALARM : 22

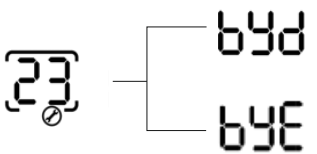


Decides if the Vulcan should alarm/beep if the AC IN line is interrupted

ALARM ON : Vulcan will alarm if the AC in-line suddenly disappears (default)

ALARM OFF : Vulcan will not alarm

BATT OVERLOAD BYPASS : 23

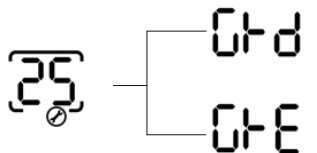


This setting dictates whether the Vulcan returns to AC priority in the event that a battery overload occurs. This setting will require battery comms.

Bypass disabled (Will not turn to AC as a backup) (default)

Bypass enabled (Will turn to AC as a backup)

GRID CONNECTION : 25



These parameters dictate if the Vulcan connects to the grid supply or not. When running off of a generator or running in parallel this may be good to disable.

Grid connection DISABLED (default)

Grid connection ENABLED

CHARGE BULK VOLTAGE : 26



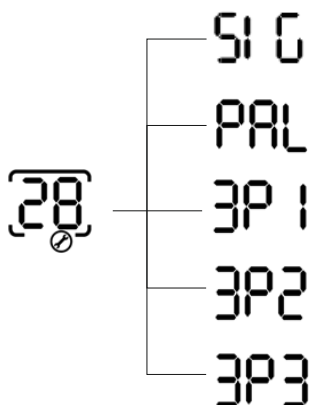
Default : 56.4V
Range : 48.0V to 60.0V in 0.1V increments.

CHARGE FLOAT VOLTAGE : 27



Default : 54.0V
Range : 48.0V to 60.0V in 0.1V increments

PARALLEL SETTINGS : 28



These settings are crucial for ensuring your inverters work in the parallel configuration that you want. If you intend to connect these items in parallel or in three-phase configuration, I advise you to read the manual fully. Later in this manual we cover the parallel and three-phase configuration.

Single configuration (default)

Parallel configuration

Three phase (Phase 1)

Three phase (Phase 2)

Three phase (Phase 3)

INSTALL SETTINGS LIST AND PARAMETERS

LOW DC VOLTAGE : 29

 **BATT**
42.0 v

If this voltage threshold is exceeded, one of two events will follow. If battery power is the only source available the inverter will shut down. If PV is available the Vulcan will focus on charging the batteries rather than providing AC to your domestic circuit. This setting is only available if using USER CUSTOM in setting (5)

Default : 42.0V
Range : 40.0V to 48.0V in 0.1V increments

BATTERY DESULPHATION : 30

  EEN
EdS

Enable or disable intermittent 'desulphation' cycles on your batteries. Only available for the Flooded or User Custom battery types set in (5).

Enabled

Disabled (default)

DESULPHATION VOLTAGE : 31

 58.4 v

Set the voltage that the desulphation process operates at

Default : 58.4V
Range : 48.0V to 61.0V in 0.1V increments

DESULPHATION TIME : 33

 60

Set the period of time the Vulcan remains in the desulphation cycle

Default : 60 minutes
Range : 5 minutes to 900 minutes, in 5 minute increments

DESULPHATION TIMEOUT : 34

 120

Set the period at which the Vulcan will exit the desulphation cycle if it is exceeded

Default : 120 minutes
Range : 5 minutes to 900 minutes, in 5 minute increments

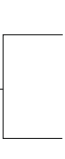
DESULPH. FREQUENCY : 35

 30d

Set the frequency at which the Vulcan will repeat the desulphation cycle

Default : 30 days
Range : 0 days to 90 days, in one day increments

FORCE DESULPHATION : 36

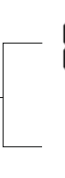
  AEN
AdS

Forces the desulphation cycle to occur immediately

Forces the desulphation cycle to occur immediately

Disables/cancels the desulphation process.

DISCHARGE LIMIT (A) : 40

  OFF
10

Set the limit at which the Vulcan will draw from your batteries.

Discharge current limit is not enabled, nor set. The Vulcan will draw as your loads dictate. (Default)

Setting range : 10A - 200A in increments of 5A.

If in SBU priority, when the loads are greater than this setting the inverter will automatically change to using the Utility supply to power the loads.

PARALLEL/THREE PHASE

COMBINING MULTIPLE VULCANS

VT Parallel and Three-Phase

The VT-485500 has the somewhat unique feature of being able to combine their capabilities to meet and overcome otherwise impossible to meet conditions. By utilising the communication lines on the VT you can combine their output power in either parallel single phase or three phase configurations.

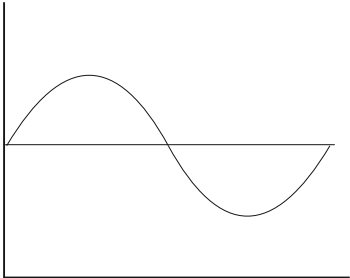
It's important we understand what this means, as well as why the communication lines are integral to this function.

Parallel and Three-Phase

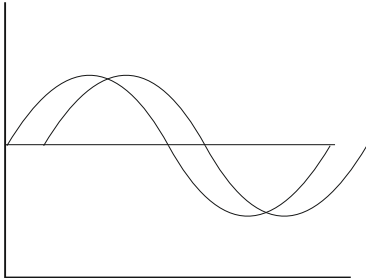
The idea of operating in parallel is simple to understand. In simple terms, they share their capabilities while remaining at the same operating voltage, like how batteries do. Two 240V VT-485500s correctly installed in parallel will provide 11kW at 240V to your domestic loads. This is expandable up to nine VT-485500s, to 49.5kW.

Three-phase can be considered distantly, then, like series - albeit far more complicated. Much like how a 24V battery bank cannot provide to 48V loads and will likely destroy a 12V circuit, a three-phase 400VAC supply will not be suitable for your normal 240VAC appliances - but some circuits are designed entirely around this three-phase requirement. Three VT-485500s operating in a three-phase configuration will provide 16.5kW at ~400V three phase. This can only be done in multiples of three.

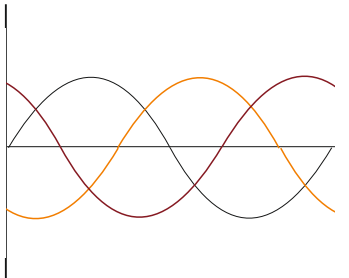
Importance of synchronicity



Single phase AC, alone, looks similar to this...and, when in synchronicity, will look the same, irregardless of how many inverters are added.



Multiple AC inverters on the same circuit, not in synchronicity, run the very real risk of destroying one another- current flowing into the other.



Three-phase requires an even more specific balance.

Parallel functionality requires the communication cables between inverters to be installed, and it necessitates the use of a battery pack. This cannot be done without a DC battery provided. They must share the same battery pack, and they must all utilise the same parameters. You may not use the same solar array on inverters in parallel. The solar array must only feed into one inverter at a time, of one system at a time.

We'll cover the specific cabling and the specific setup required for multiple items on the following pages-

PARALLEL/THREE PHASE COMBINING MULTIPLE VULCANS

Parallel process and instructions
Notes:

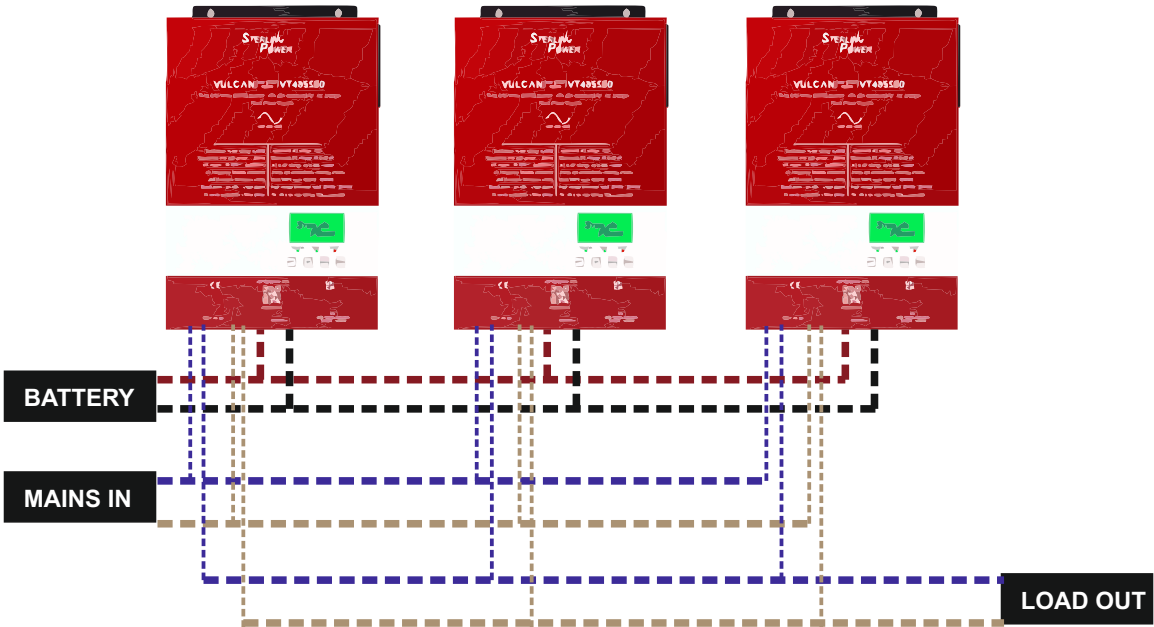
The cabling for the VT-485500s, in a demonstration set of three (so the remaining configurations can be inferred) is as follows.

All inverters must be set-up with identical output parameters before being ran and configured in parallel. IE, in sequence, turn an inverter on, set up the parameters to what you need them to be, turn them off.

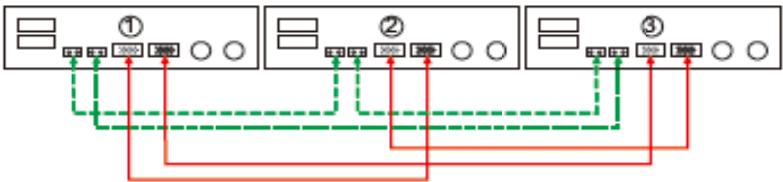
Once all parameters are set- turn all inverters off, before turning them on again and choosing the Parallel function in the settings.

Do not put the inverters into parallel or three-phase until correctly configured and wired.

Parallel configuration



Communication Connection:



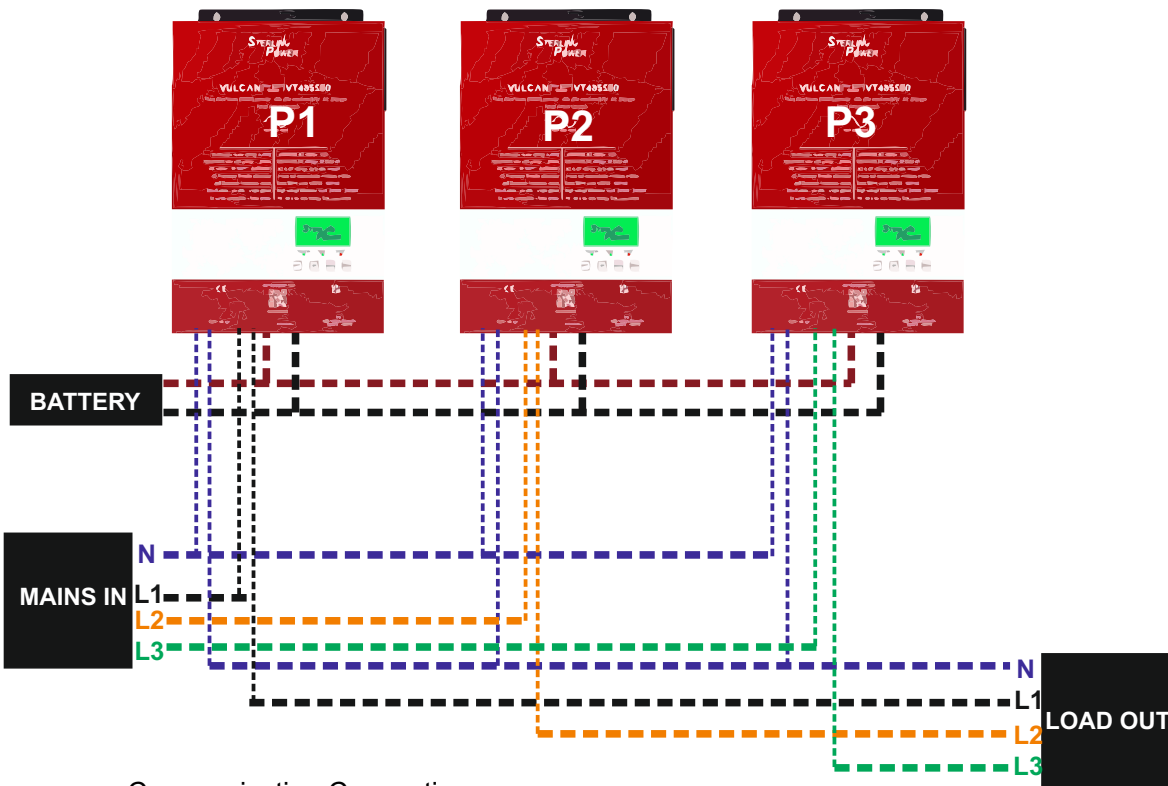
PARALLEL/THREE PHASE COMBINING MULTIPLE VULCANS

Three phase configuration
notes

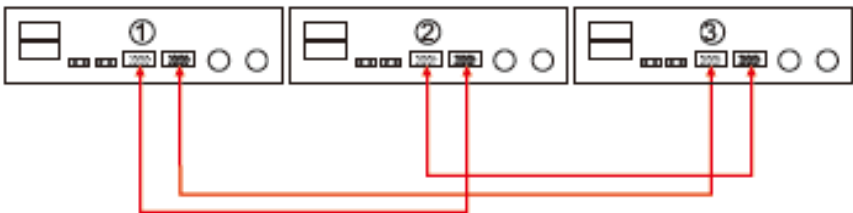
As before - Solar arrays cannot go to any more than a single Vulcan in the set. All Vulcans must share the same battery bank. All parameters must be shared. Do not connect the current sharing cable.

When setting the system up in three-phase, set each inverter up independently, one at a time. Setting Phase One, then turning the inverter off. Moving to the second inverter for Phase Two, turning the inverter off, then moving to the third inverter for Phase Three, and turning it off. Ensure that all settings (apart from the setting phase) are identical between the three inverters.

Turn them back on in order of One, Two and Three.



Communication Connection:

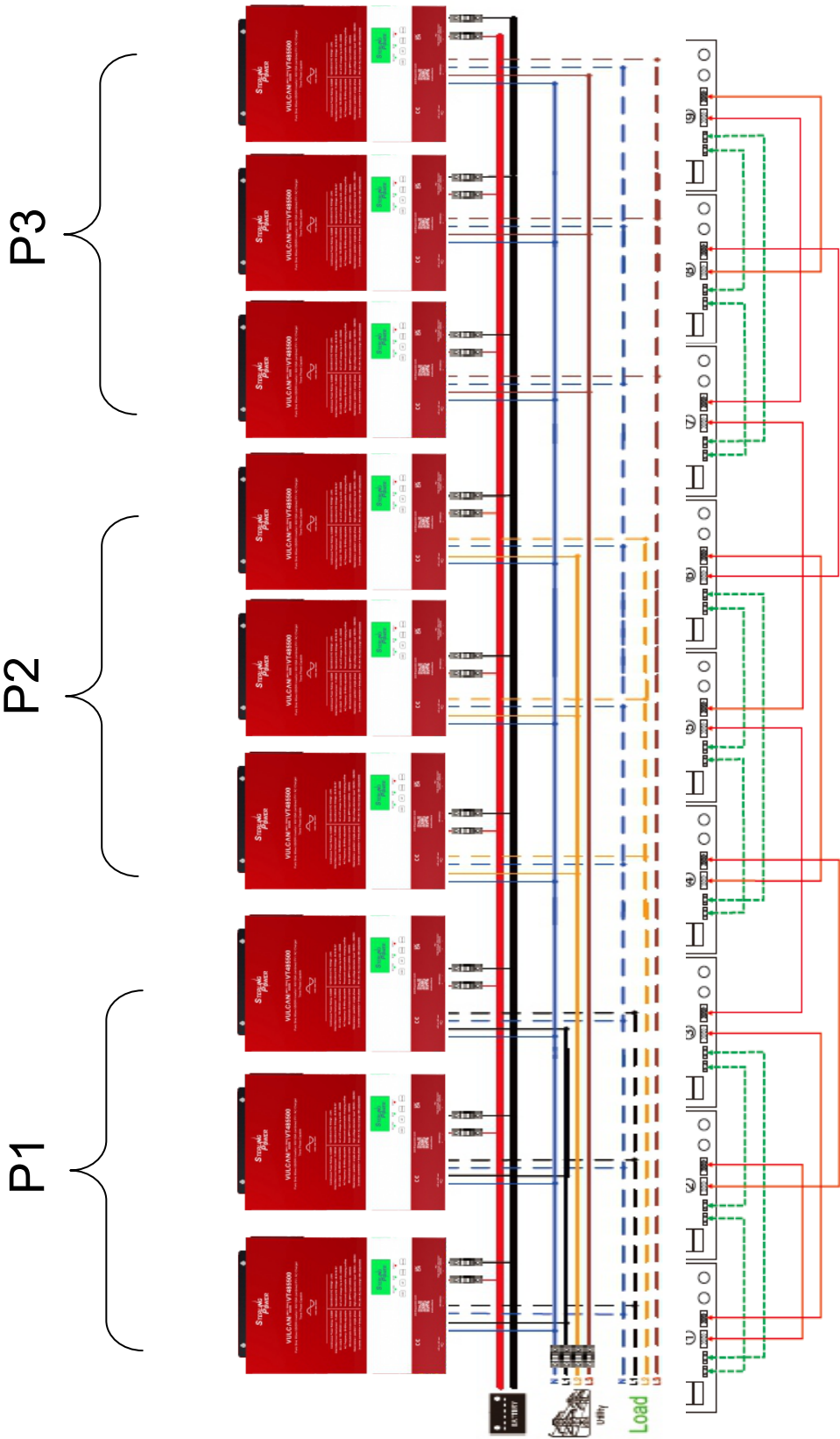


PARALLEL/THREE PHASE COMBINING MULTIPLE VULCANS

Three phase configuration
notes

For systems larger than 3- you expand the array repeatedly.

I print, below, a system incorporating the maximum (nine) number of Vts running in three phase, so it may help you understand the modularity a bit further. It's visually complex- but the previous page will show you more.





STERLING
POWER

TROUBLESHOOTING FAULT INDEX

Fault code

01	Fan failure	54	Self test error
02	Over-temperature or NTC failure	55	Inverter DC voltage too high
03	High DC Batt Voltage	56	Battery disconnection error
04	Low DC Batt Voltage	57	Current sense failure
05	Output short circuit	58	Inverter voltage LOW
06	High output voltage	60	Inverter power supply failure
07	Overload timeout	70	Logic fault
08	High common voltage	71	Parallel version error
09	Soft-start failure	72	Output voltage error
10	Charge fault	80	CAN comms error
11	Battery NTC over-temperature	81	Main parallel line lost
12	High DC Batt Voltage	82	Secondary parallel line lost
13	Phase 1 Lost	83	Parallel battery voltages not in sync
14	Phase 2 Lost	84	Parallel lines not in sync
15	Phase 3 Lost	85	Parallel current imbalance
16	Phase IN voltages/Hz are different	86	Parallel output voltage error
17	Phase OUT voltages/Hz are different	WARNING INDICATOR	
18	Power feedback protection	01	Fan failure during operation
19	Firmware differences	02	Over-temperature
20	Current sharing fault	03	Battery over-voltage/overcharge
23	Over-current on solar feed	04	Low battery
24	Solar over-temperature	07	Overload error
25	Solar overload	10	Output power sagging
26	Solar boost error	21	Solar voltage low
51	Inverter over-current	22	Solar voltage high
52	Bus voltage low		
53	Inverter soft-start failure		

TROUBLESHOOTING FAULT INDEX

NATURE OF ISSUE	AUDIOVISUAL ALARMS	PROBABLE CAUSE/ISSUE	ROUTE TO RESOLUTION
Vulcan shuts down automatically during start-up	Screen/alarm may engage at startup and then immediately turn off.	Low battery/DC voltage	Verify with voltmeter. Recharge if necessary. Replace if necessary.
No response at all following toggling the power switch	None/unresponsive	Low battery voltage, fuses between battery and VT have tripped, VT fuse tripped.	Check DC terminal voltage (VT). If zero, check batteries for charge and check fuses.
Mains IN is connected but the VT is not charging/is only pulling from batteries	Input voltage registered as 0 on LCD, and green LED is flashing	Input AC protection has tripped, or AC not connected (IE cabling/RCD issue)	Check AC breaker is healthy and in the closed position. Check AC wiring + Voltage
	Fault LED flashing	Input AC insufficient (Low AC voltage, incorrect frequency or sine-wave)	Check AC wires (too long, too thin, degraded contacts). Verify 240VAC source.
After turning on, internal relay is chattering ON/OFF repeatedly	LCD and LED displays flashing	DC/Battery voltage .. If going from 0V->~48V repeatedly, a DC breaker may be faulty or the battery BMS may be chattering back and forth.	Isolate where the variable DC voltage stems from (BMS, breaker etc) and either replace, or resolve the issue there.
Audible alarm and red FAULT LED is lit Screen displaying fault code	WARNING code : 01	Fan failure/fault	Check fan for obstruction. If fan is not obstructed the fan may need replacing.
	WARNING code : 02	Internal temperature is exceeding 85°C	Allow unit to cool and look to improving ventilation capability
	WARNING code : 03	High DC voltage - Either the batteries are naturally too high voltage, or are being overcharged.	Check DC voltage at batteries. If high because of Vulcan overcharging - unit will need to be serviced. Otherwise, find the source of the high voltage and isolate.
	WARNING code : 10	Over-current disconnect (DISCHARGE)	Triggered by exceeding setting 40. Either amend the setting to a higher value, or ensure your loads are within the rating of your settings.
	FAULT code : 82	Parallel error	Ensure parallel cables between inverters are correct and sufficient (IE not loose). Verify the settings are all 'common' with one another.
	FAULT code : 05	Short circuit / reverse polarity error.	Isolate power to the inverter and check all wiring on the output AC line. It may be worth disconnecting loads and reconnecting one at a time to see if it is an appliance caused fault.

TROUBLESHOOTING FAULT INDEX

NATURE OF ISSUE		AUDIOVISUAL ALARMS	PROBABLE CAUSE/ISSUE	ROUTE TO RESOLUTION
Audible alarm and red FAULT LED is lit Screen displaying fault code		FAULT code : 07	Inverter overload error - 100% capacity has been exceeded for too long.	Reduce your overall load- turn off some equipment or turn down their settings.
		WARNING code : 59	PV/Solar voltage exceeding Vulcan specified limits	Reduce your PV array voltage, most likely by re-arranging the array (less items in series)
		FAULT code : 06/58	AC OUTPUT ERROR - Voltage either too high (>260) or too low (<180)	Reduce the output load or contact Sterling regarding return/repair.
		FAULT code : 51	PV overload (over-current)	Resolve abnormal load, or check the PV input rating
		FAULT code : 08 FAULT code : 52	Internal voltage too high Internal voltage too low	Restart unit- if the error persists then it will require repair
		FAULT code : 11	Internal temperature is exceeding 85°C	Allow unit to cool and look to improving ventilation capability
		FAULT code : 84	Three phase error- Phase loss/sync error	Verify the three phase install cables and settings are all correct.
		FAULT code : 86	Parallel inverter settings are different to one another	Check all connected inverters and ensure that the output voltage and frequency are all identical - and that settings have been input correctly RE: parallel/three phase function.
		FAULT code : 71	Firmware error / incompatible	Ensure all inverters are running on the same firmware. They may require an update if errors persist.
		FAULT code : 85	Output current error (IE each item has a different output limit)	Check sharing cables are installed correctly, and verify all settings are common with the other inverters.

If errors are persisting or not covered here, please call us or contact us for support.

CONTACT:

Use our contact form at sterling-power.com

Or email us at info@sterling-power.com

Or call us at 01905 771771

NOTES

NOTES

--	--

NOTES

NOTES



UK
CA



RoHS
compliant



www.sterling-power.com
www.sterling-power-usa.com
Warranty (2 years return to factory)