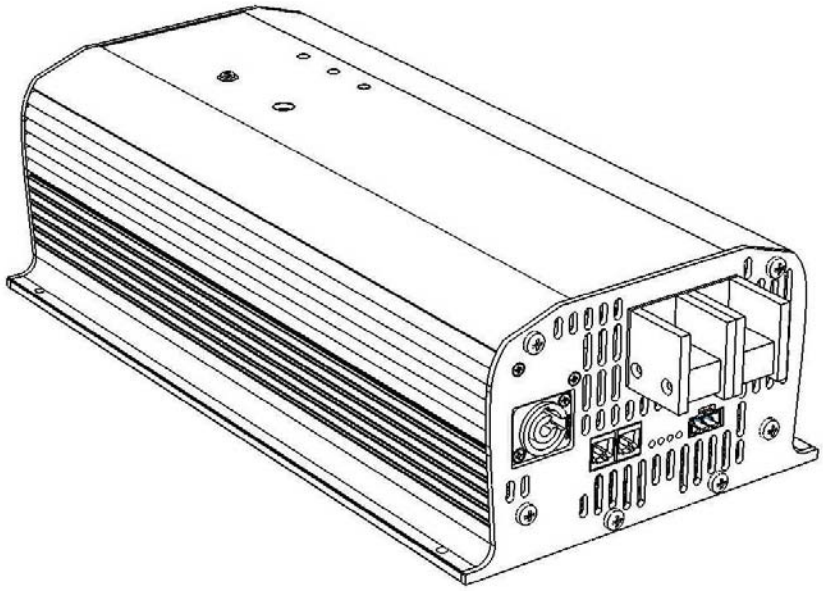
G3 COMBI

Sine Wave Inverter + Battery Charger



Type

1012- 50

1024- 30

1312- 80

1512- 80

1524- 40

2012-100

2324- 50

Version 2.0

User Manual

Clayton Power GmbH

www.claytonpower.com

IMPORTANT BASIC-INFORMATION

This User-Manual serves a guideline for safe and effective operation, for installation of equipment and for equipment maintenance. – It is therefore obligatory that all persons who work on or with the equipment are completely familiar with the content of this manual and follow the instructions contained herein.
Installation of and work on the product may only be carried out by qualified, authorized and trained staff, familiar with the locally applicable standards and taking into consideration the safety guidelines and measures.

Attention

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Content----------Page

1. FEATURES AND OPERATION-FUNCTIONS

The Combi is a combination of a sine wave inverter and a intelligent battery charger. The unit has a number of benefits thanks to its dual functionality. The Combi charges batteries, when it is connected to the fixed 230 VAC grid. When it is disconnected, the sine wave inverter part converts energy from the battery to 230 VAC. This function is particularly well-suited for emergency power (UPS). The obvious advantage is of course that it is always possible to charge and use batteries with one and same unit.

Clayton Power Combi, well-suited for emergency power (UPS)

- True Sine wave Inverter section
- Integrated UPS functions.
- Start up heavy duty loads with high peak power consumption.
- Fully automatic 3 step charge cycle control.
- Adjustable battery and charge settings
- Overload protection
- short circuit protection on output
- Over temperature shutdown
- High battery voltage shutdown
- Temperature controled fan
- Remote option
- Datacommunication
- Status indication LED in front panel
- Status LED (data, remote active) in DC input endplate
- Custom made to harsh environment with special lacquer coating and double galvanic separation.

The Combi devices can operate in three modes:

✓ **Inverter mode**

Energy is taken from the battery, inverted to 230VAC and delivered at output connector (grey socket).

✓ **Back up mode**

In case of black out of AC public grid, the device will switch over automatically to inverter function and the connected equipment will still run powered by the battery.

Important: for back up mode, the inverter section must be switched on!

✓ ***Charger mode***

The charger switch on automatically when a public grid or an AC generator (185-265VAC) is present at the AC input connector (blue socket). A relay bypasses the supplied AC voltage to the output (grey socket). At the same time some of the energy (from grid or generator) goes to recharge the battery bank.

1.1 Inverter mode:

1.1.1 Switch ON and OFF the inverter

Switch ON the inverter

- Push down ON/OFF power switch for about 2 seconds. Both blue and red LED will light.
- After 2 seconds red LED stops and the power switch can be released.
- The blue LED will flash to indicate start up sequence
- **Blue LED lights and 230VAC is present.**

Note: If the battery is discharged, then the red LED will continue to light; - recharge battery and try again!

Note: The fan is running at full speed, while the power supply is starting up for acoustic detection of the fan!

Switch OFF the inverter

- Push down the ON/OFF power switch < 0.5 second
- The blue LED stops lightning and the device shuts down

Remote ON/OFF

- Use an external switch, to switch battery Plus to remote input terminal of Combi ON or OFF.

1.1.2 Load search mode

In cases where it is preferable to leave the combi switched on and the load is periodically inactive (switched OFF), the load search mode can be activated.

In this mode the Combi is partly active and generate a short pulse every 2 second, if a load (>10W resistive) is detected, the device switches ON automatically. When a load is disconnected again the device automatically returns to search mode (low consumption) after 1 min without load. - In load search mode the battery consumption is reduced to less than 2W in order to save the battery during no load periods!

Activate load search mode

Switch OFF if the combi is activated; Push down the power switch for > 5 seconds; Release only when the **blue, green and red LED starts to light at the same time**.

Note: in load search mode the battery consumption is reduced, while no load is active! The device switch on automatically when a load is connected (> 10W resistive)

The load search mode will remain active, until deactivation or disconnection of the battery longer than 15 minutes.

Note: there will be a small delay when connecting a load and until the device starts up automatically!

Note: If load search mode is entered with a load connected, the blue LED flashes slowly only for 5 seconds (to indicate entering of load search mode), then it lights continually!

Deactivate load search mode

Push power switch > 5 seconds; Release only when **Blue, green and red LED start to flash at the same time.**

Note: The load search function will remain active if the device is switched ON/OFF by remote.

Note: Load search mode will also be deactivated, if battery is disconnected longer than 15 minutes.

1.2 Charger mode

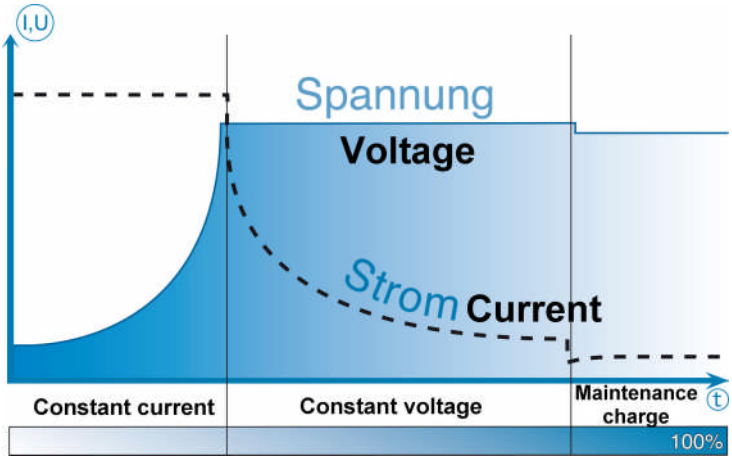
1.2.1 Charger activation

The charger will automatically switch on regardless of the ON/OFF power switch status, when 185-265VAC is connected to the AC input (blue Neutrik).

Note: If the inverter is switched OFF, the charger will operate at even lower voltage than 185VAC (down to 110VAC in this mode is accepted) but with reduced charge current!

1.2.2 Charging steps

The battery-charger is a fullautomatic three-step-charger with IUoUo-characteristic. The charging parameters can be set by the supplier before delivery, adapting the regarding batteries.



Charging with constant current (I-phase - quick blinking green LED)

In relation to actual battery charging level, charging happens with maximal charging current, to get the battery loaded as quick as possible. In case of a deep unloaded battery, the maximum current is limited during starting period, to prevent damaging the battery

After arriving the set main charging voltage (14,2 to 14,7V, depending on battery-type), the charge switches to next charging step.

Charging with constant voltage (U_1-phase - slow blinking green LED)

During this phase, the main topping charging of battery happens. The voltage is kept on a constant level of 14,4V (standard-value). In relation to approaching the full battery-capacity, the current will decrease continuously and comes down to a minimum value, which depends on the type of battery. As soon the current gets below of this minimum value, or a preset safetytime is reached, the charger switches to phase 3.

Maintenance charging with reduced voltage (U_2phase – steady green LED)

Charging voltage will be reduced to 13,5V (standard-value) to maintain full battery-capacity for a unlimited period. So the physical caused self-unloading will be equalized. Additional connected AC-consumers are than provided in parallel from AC-grid via the Combi without burden the batteries.

Charge power reduction

2300W (10A) from the AC grid should not be exceeded! The charger reduces automatically the charge current if the total power exceeds 2300W (charge power + AC output power)

Note: the regulation is slow in order to allow load peak currents, without disturbing the charging!

Important: The device has a build in fuse – see FUSING section -, do not exceed this limit!

Deactivation of charger Disconnecting from AC Grid will stop charging.

Note: If the inverter was activated (ON) there will be 230VAC at the grey output connector (discharging)

1.2.3 Charge current adjust

The charge current can be adjusted by the potentiometer on the front panel top from 0A up to maximum rated charge current (see recommended charge current table beside).

Recommended battery capacity versus charging currents (at 20°C battery temperature)

Charge current	Recommended Battery Capacity Range
15A	75-150 Ah
20A	100-200 Ah
25A	100-250 Ah
30A	150-300 Ah
40A	200-400 Ah
50A	250-500 Ah
60A	300-600 Ah
80A	400-800 Ah
120A	600 – 1200 Ah

ATTENTION

If sealed lead acid batteries are overcharged it will result in gassing and dry-out and the battery will be destroyed.

Wet batteries (open type) will loose water and need to be topping up.

If you are in doubt how your batteries shall be charged, please consult your Battery Technical Manual (data sheet), or your local battery distributor.

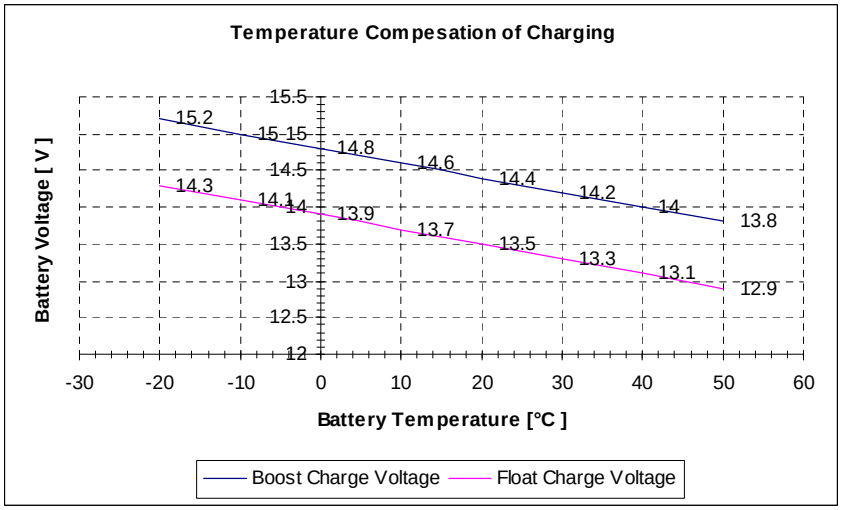
Temperatur-compensation (NTC-Sensor)

When using the external temperature sensor (NTC) the charger will reduce the charge current in respect to the max allowed battery voltage at the actual temperature!

Use the NTC temperature sensor for optimal battery performance.

Graphic shows the automatic adaptation of charging voltage in respect to the actual measured temperature.

At 20°C the boost charge max voltage is 14,4V and float charge voltage 13,5V.



1.3 Backup-Mode

In case of black out of AC public grid, the device will switch over automatically to inverter function and the connected AC-equipment will still run powered by the battery. This happens without interruption of AC-supply.

Important: for backup-mode, the inverter section always must be switched on!

Note: If inverter is switched to OFF, there only will be AC-voltage on AC-Output, when AC-voltage exists at AC-Input of inverter.

1.4 LED-indications for operation and failfunctions

Following three LEDs, located at frontside of device, indicates different status of functions and failures.

- The blue LED is for he inverter section
- The green LED is fort he charger section
- The red LED indicates the status of battery

Different conditions are identified by steady or different blinking lights by one or more LEDs.

Blue LED	Description.
ON	Inverter is running
1 Short flash every 2. second	Load search mode
1 Flash continuously	Inverter output is overloaded
2 Flash continuously	Inverter temperature is too high. (automatic cooling down and restart)
3 Flash continuously	Short circuit at inverter output
4 Flash continuously	Short circuit in power supply
5 Flash continuously	Overload in power supply while starting up

Green LED	Description.
ON	Battery fully charged – maintenance charging
Slow flashing	Charger is in absorption phase of charging (top charging)
Fast flashing	Charger is boost charging
1 Flash continuously	Mains present but too low (< 185VAC) or not clean, no good sine-wave
2 Flash continuously	Mains too high (> 265VAC)

Red LED	Description.
No light	Battery voltage okay
ON	Battery voltage too low (inverter will switch off within 1 minute, to prevent a deep downloading of battery)
Flashing	Battery voltage too high

All LED together	Description.
ON	Not used (reserved for future use)
Fast flashing	Remote control and Power button on at the same time
1 Flash continuously	NTC error (internal temperature sensor)
2 Flash continuously	Poor connections or disconnection of battery during charging
3 Flash continuously	Half bridge failure
4 Flash continuously	Full bridge failure

Red and Green LED together	Description.
4 Flash continuously	Temperature sensor (NTC) missing. Will also be shown for 20 seconds after switching on AC-supply, if no sensor is adapted.

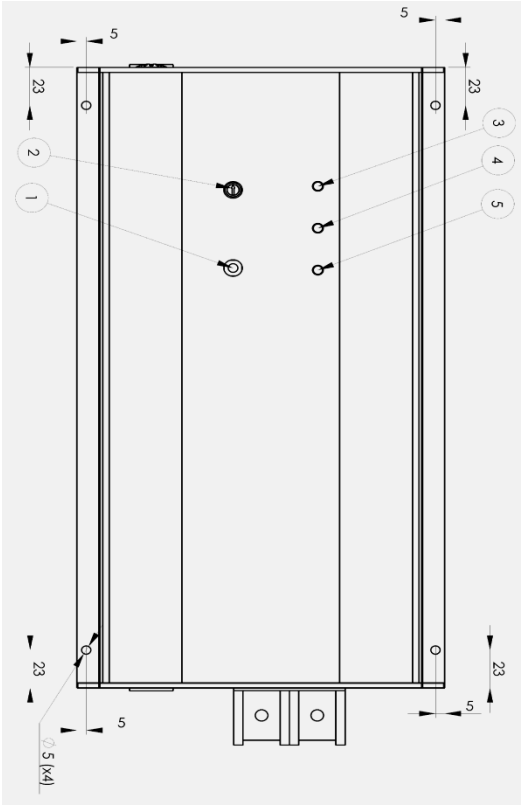
WARNING!

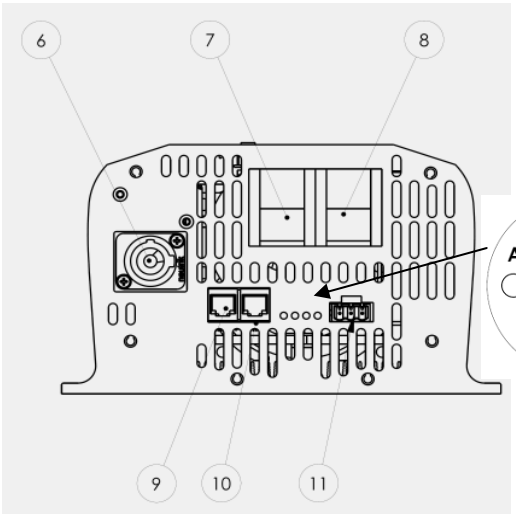
Never disconnect cables during charging (and inverting) especially near the battery bank. The battery can explode!

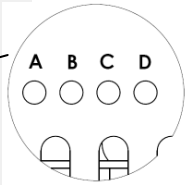
Never discharge a battery completely; it will cause permanent damage of the battery!

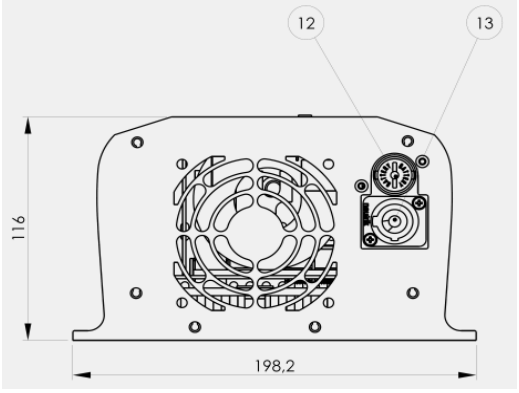
Note: batteries must be able to deliver min. 12W and min. 10,3V before charging can start!

1.5 Device layout & status indicators









1.6 Layout-description

G3 COMBI Layout	
Pos.	*Description*
1.	ON/OFF Power Switch
2.	Potentiometer – Charging current adjustment
3.	Charger LED – Green
4.	Inverter LED – Blue
5.	Battery LED – Red
6.	AC charger input connector, type NEUTRIK Blue
7.	Positive voltage DC input terminal
8.	Negative voltage DC input terminal
9.	External DATA connector RJ12 type (6p6)
10.	External DATA connector RJ12 type (6p6)
11.	External DATA connector type PHOENIX MSTBA 2,5/ 3-G-5,08
12.	Fuse holder for input mains fuse
13.	AC inverter output connector, type NEUTRIK Grey

LEDs between data-connectors

Auxiliary LED Description		
Pos.	*Color*	*Function*
A	Green	Lights when Data link is “High”
B	Yellow	Lights when Data link is “Low”
C	Orange	Lights when remote is ON
D		not used

2. SPECIFICATIONS

2.1 Electrical inverter specification

Model	1012	1312	1512	2012	1024	1524	2324	2336
POWER OUTPUT								
Continuous output power FTS (Full Temperature Scale)	1000 W	1300 W	1500 W	2000 W	1000 W	1500 W	2300 W	2300 W
Output power surge (1 sec.)	2000 W	3000 W	3000 W	4000 W	2000 W	3000 W	3000 W	4000 W
Output power surge (10 sec.)	1500 W	1800 W	2000 W	2800 W	1500 W	1800 W	3000 W	3000 W
Output power surge (15 min.)	1200 W	1500 W	1700 W	2200 W	1200 W	1700 W	2500 W	2500 W
Max. efficiency	90%							
CONSUMPTION								
No load power consumption	10 W		15 W		10 W		15 W	17 W
Load search mode consumption	< 2 W							
Sleep mode consumption	< 5mA							
THERMAL MANAGEMENT								
Max operating temperature	+50°C							
Min operating temperature	-20°C							
Max internal temperature (inverter shut down)	+80°C							
VOLTAGE OUT								
Nominal output voltage	230 VAC							
Output Voltage tolerance	-10% to +5%							
Output Voltage tolerance (at input voltage 25V to 31.5V)								-18% bis +5%
Frequency	50 Hz							
Output wave form	Sinus							
THD max.	3%							
VOLTAGE IN								
Battery input voltage (nominal)	12 VDC				24 VDC			36 VDC
Max input voltage	15 VDC				30 VDC			45 VDC
Low battery voltage cut-off (Slow reaction 3 Sec.)	10,5 VDC				21 VDC			25 VDC
Low battery voltage cut-off (Fast reaction <10mS)	9 VDC				18 VDC			23 VDC
Voltage before inverter can switch ON again (after a low battery cut-off)	12,75 VDC				25,5 VDC			38,25 VDC

2.2 Batterycharger specification

Model	1012 -50	1312 -80	1512 -80	2012 -100	102 -30	1524 -40	2324 -50
BATTERY							
Battery types	open & sealed lead acid						
Charge characteristic	I U o U o						
Battery temperature sensor (NTC)	yes (option)						
CHARGE CURRENT							
Max charge current (adjustable)	0 – 50 A	0 – 80 A	0 – 80 A	0 – 100 A	0 – 30 A	0 – 40 A	0 – 50 A
Charge current reduction (% of max current) @ 50°C	0%						
Charge current reduction (% of max current) @ 60°C	15%						
Charge current reduction (% of max current) @ 80°C	50%						
CHARGE VOLTAGE							
Boost charge voltage (factory pre-set)	14,4 VDC				28,8 VDC		
Float charge voltage (factory pre-set)	13,5 VDC				27 VDC		
INPUT MAINS							
AC Input voltage max	265 VAC						
AC input voltage min (full charge current)	185 VAC						
AC input voltage min (reduced charge current)	110 VAC						
AC Inrush current (max)	100 A						
Frequency	45 Hz bis 65 Hz						
Cos ν	0,9						
Max. efficiency							
BYPASS CURRENT							
Bypass current *AC input to AC output* (max)	90%						
Bypass current *AC input to AC output* (max)	10 A						
FUSE RATING							
Fuse rating (max)	10 A						

2.3 Mechanical specifications

Model	1012	1312	1512	2012	1024	1524	2324	2336
IP-class	IP 20							
Dimension of cabinet (L x W x H) mm	299 x 198,2 x 116		376 x 198,2 x 116		299 x 198,2 x 116		376 x 198,2 x 116	
Dimension incl. terminals (L x W x H) mm	334 x 198,2 x 116		412 x 198,2 x 116		334 x 198,2 x 116		412 x 198,2 x 116	
Weight (kg)	6		7,5		6		7,5	

3. INSTALLATION

3.1 Environment

- The Combi must be placed in a dry, well ventilated and dust free location.
- Place the unit as close as possible to the battery to keep the cables as short as possible.
- Do not place the unit in same compartment as the batteries.
- Make sure that water or dust can not enter the cabinet.
- Ensure that the air flow from fan is not obstructed.
- Avoid mounting the device next to flammable materials.

3.1.1 Mounting the device

The unit can be mounted on a wall, or flat mounted (4 x Ø5mm holes). - Optimum cooling is obtained in vertical position. During wiring use standard cable fixtures and wire ducts. Do not bent extremely the cables/wires, and avoid sharp edges to prevent the isolation of the wires/cables from cutting and abrasion.

Keep in mind that usage of too long battery cables and dirty or loose connections may produce a significant voltage drop, which would cause that the device shut down for under voltage, even if the battery is ok!

3.2 Cable Installation

ATTENTION Electric installations should only be done by skilled workers

EMC

The wiring of the cables is influencing the EMC behavior of the system, in which the inverter is a component. This is due to the fact that the cables are receiver and transmitter antennas of radio frequency and electromagnetic interference.

Good EMC properties are obtained in the following way: Place the cables in a metal rail. The metal offers resistance against interference currents. The battery cables should be placed close to each other to reduce looping area. Cables from different groups should not be twisted, but be placed parallel with each other.

3.2.1 Battery cable

The cable length (up to 3 meter) between the battery and the combi must be sized according to the table at next page. The values are given by a criterion to keep the total cable voltage drop lower than 250mV at max nominal power delivered by the combi.

Recommended cross-section of battery-cables

Wire size		Type of device						
mm^2	AWG	1012-50	1312-80	1512-80	2012-100	1024-30	1524-40	2324-50
15	5	-				1,5m		
25	3	1,5m				2,5m	1,5m	
35	2	2m	1,5m	1,5m		3m	2,5m	1,5m
50	1/0	3m	2m	2m	1,5m		3m	2m
70	2/0	-	3m	2,5m	2m			3m

Note: ***When starting up heavy load with high inrush current*** *(compressors, motors, etc) it is recommended to use cables with a even higher intersection (or shorter length) to prevent under-voltage shut-down of the device*

Mounting DC-cables

- PAY ATTENTION TO CORRECT POLARITY!
- Check that the battery voltage matches the DC input to the inverter (or Combi).
- Check the battery poles are clean.
- Prepare good electrical contact, use brass or lead battery connectors at the battery poles.
- Connect only one cable at the time.
- Start with the Black cable (-). First connect to battery pole, then to inverter (or Combi) (-) terminal (black).
- Double check that Black (-) cable are connected to the correct terminals (-).
- Secure there is no risk of short circuit!
- Connect Red cable (+). First connect to battery pole, then to inverter (or Combi) (+) terminal (red).
- When connecting the cables a spark will occur. Avoid sparks near the battery!

WARNING!

- Do not interchange the battery cables. It will result in instantaneous damage of the unit. Such damage is not covered by the guarantee.
- Do not connect inverters (or Combi) at the AC-output in parallel. It will damage the units. Such damage is not covered by the guarantee.
- Do not connect AC generator or AC mains to the units AC output connector (grey Neutrik). It will damage the unit. Such damage will not be covered by the guarantee.

3.2.2 AC cables

- **When installing the AC cables always refer to safety standards valid in the regarding country**
- **The use of a Residual Current Device (RCD) – also known as earth leakage circuit breaker is highly recommended in any installation**
- **It is also possible to build up a insulated grid and using an insulation monitoring system to achieve highest protection**

Recommended AC cable

The table below gives the minimum recommended wire sizes of the mains cable!

Device type	1012-50	1024-30	1312-80	1512-80	1524-40	2012-100	2324-50
AC cable	17 AWG	17 AWG	15 AWG	15 AWG	15 AWG	15 AWG	15 AWG

AWG 15 = 1.5mm^2 AWG 17 = 1.0mm^2

3.2.3 Fusing

AC input

The Combi unit is equipped with a fuse at AC input side. In case of overload or charger error, this fuse will blow.

Note: Only replace fuse with same type. (see electrical specification charger) Damage caused by wrong fuse replacement is not covered by the guarantee.

AC output

The inverter section is fully protected against short circuit and overload, no fuse is required at AC output side.

DC input

In addition it is recommended the fusing of the battery to prevent fire in the case of wrong wiring, cable damage, short circuit, etc.

The fuse must be located to battery as close as possible, and the screw joints must be firmly tight to prevent loose connection, resulting in joint overheating and reducing the efficiency of the fuse.

The current rating related to each model is displayed in the table beside:

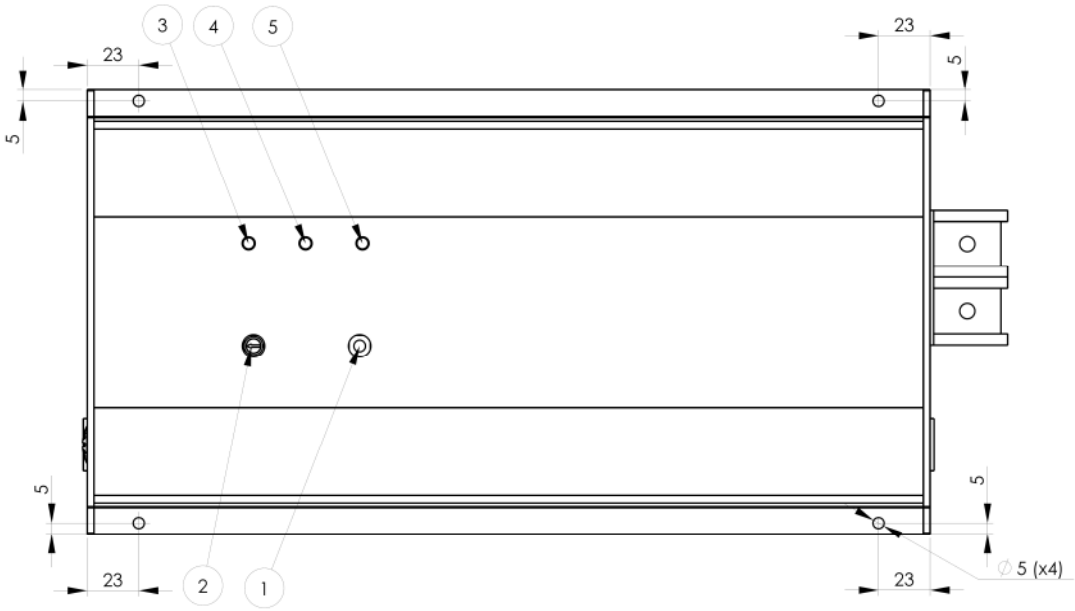
Note: The battery fuse does NOT prevent damage in case of reversed battery polarity; such damage is not covered by the guarantee!

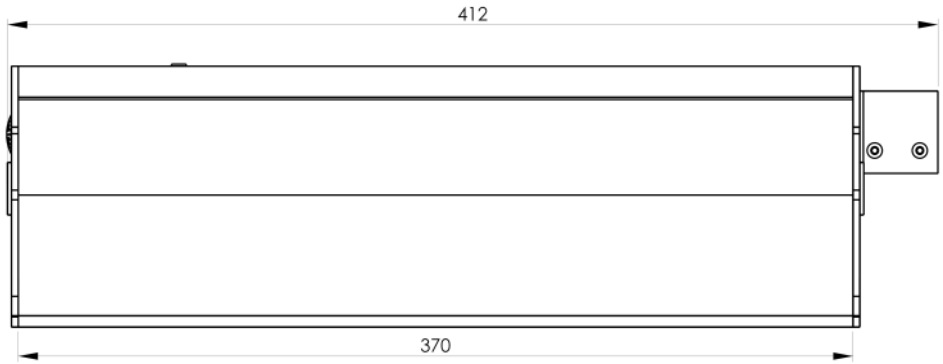
Model	Battery fuse rating
1012-50	125A slow-blow
1024-30	80A slow-blow
1312-80	175A slow-blow
1512-80	175A slow-blow
1524-40	100A slow-blow
2012-100	250A slow-blow
2324-50	150A slow-blow

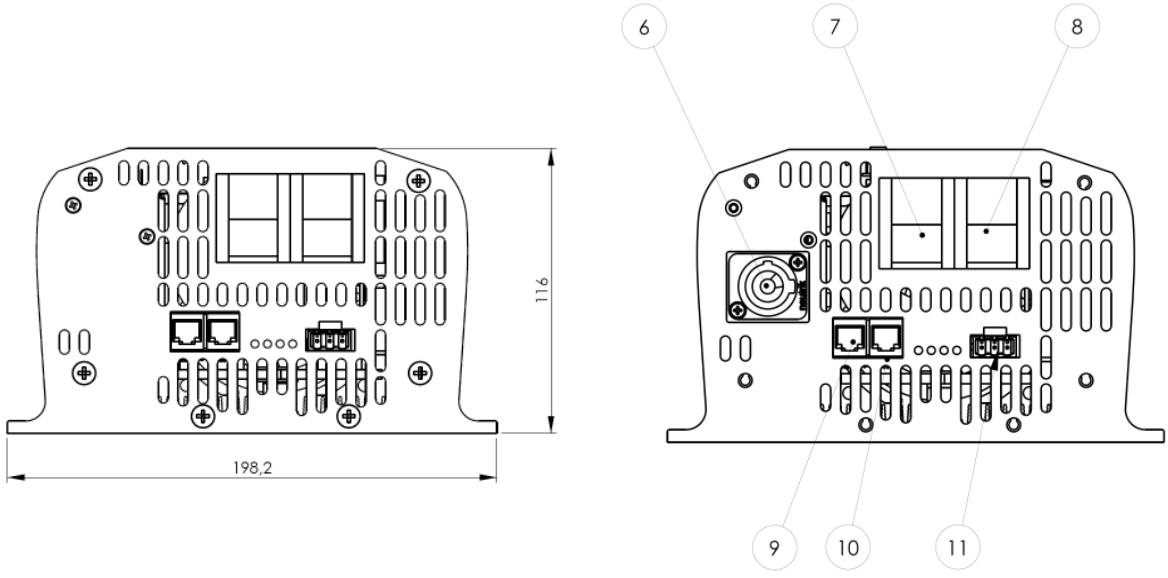
3.3 Mechanical drawings & layout description

3.3.1 Dimensions

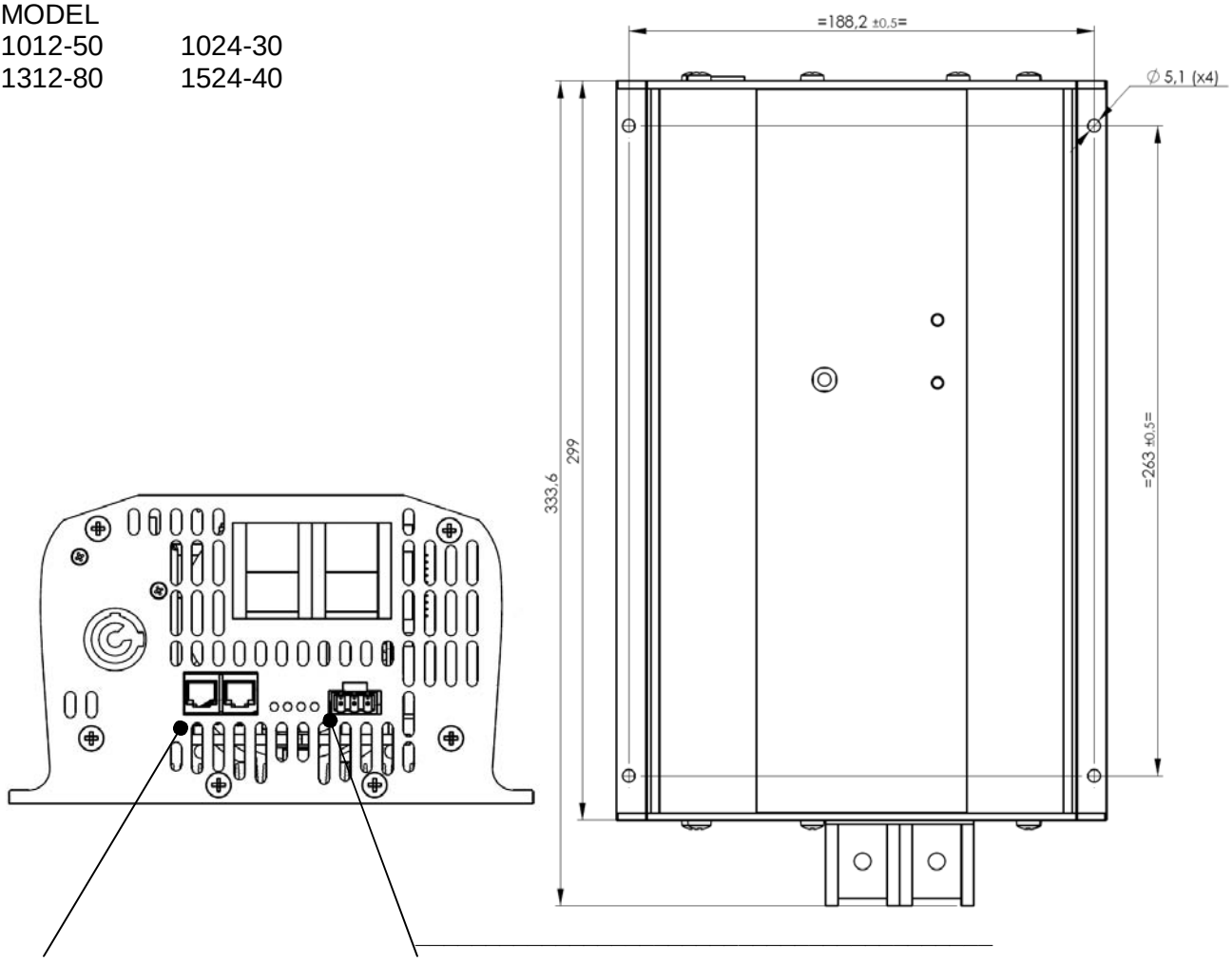
MODEL 1512-80 2012-100 2324-50







MODEL
1012-50 1024-30
1312-80 1524-40



Pin 1 RJ12-Typ[1]

Pin1 – Phoenix Combicon

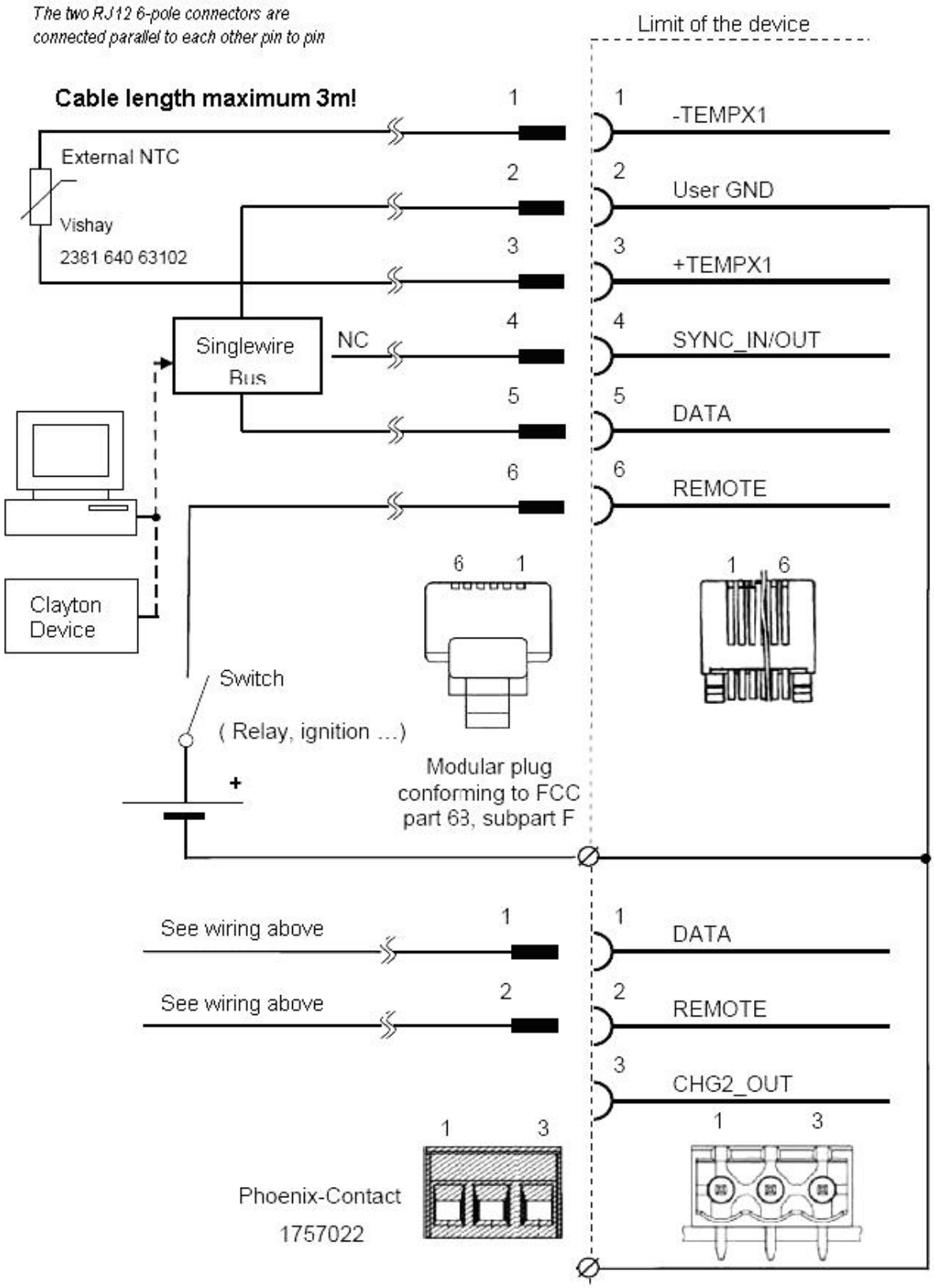
Pin#	Signal	Description
1	- TEMPX1	Temperature sensor
2		User GND (Fused)
3	+ TEMPX1	Temperature sensor
4	SYNC_IN/OUT	Used in option SYNC only
5	DATA	Single Wire Clayton Communication
6	REMOTE	Connection to plus pole of the battery switches on the combi. Not connected = no influence

Pin#	Signal	Description
1	DATA	Single Wire Clayton Communication
2	REMOTE	Connected to plus pole of the battery switches on the combi Not connected = no influence
3		not used (option)[2]

[1] The signal wires of the two connectors are connected parallel, so the pin out and the signals on the correspondending pins are identical

[2] Will be introduced and defined in future, only in the case of Combi devices

3.4 Externel wiring

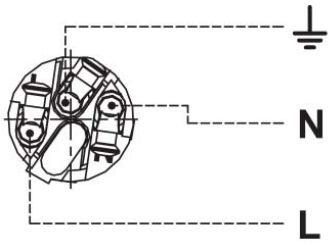


3.5 Device connection-plugs

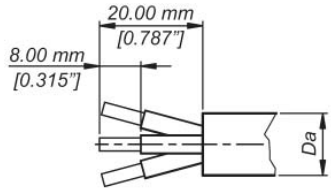
Following plugs are available for external connections

- AC-Output plug type Neutrik NAC3FCB – grey
- Phoenix data-plug, MSTB 2.5 / 3-ST-5.08 – green
- AC-Input plug, type Neutrik NAC3FCA – blue

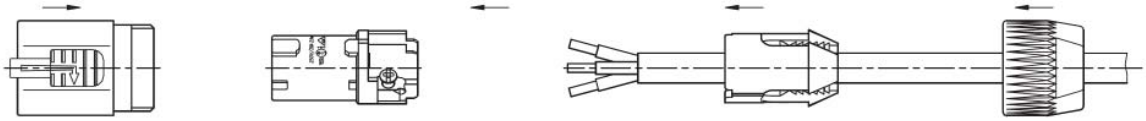
3.5.1 Assembling of Neutrik-plugs



Wire connections

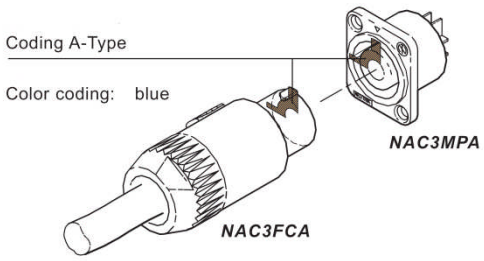


Wire preparation

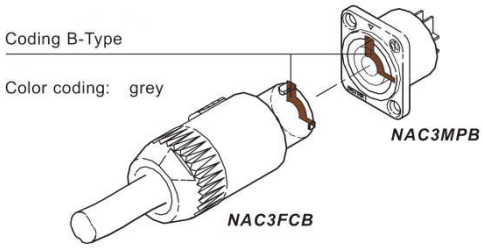


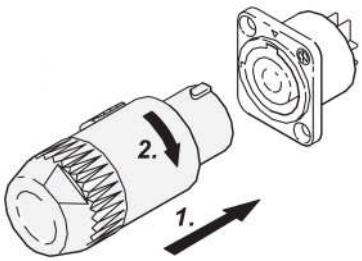
Housing **Insert** **Chuck** **Bushing**

A-Type Plug in (blue)

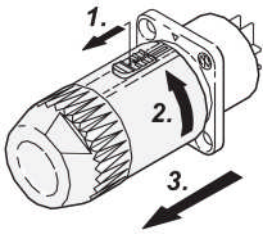


B-type plug-in (grey)





Engage



Separate

ANNEX A INFORMATION ABOUT ACID-BATTERIES

WARNING! ***Working with batteries is dangerous!***
Batteries generate explosive gasses!

Therefore it is of outmost importance that each time you serve equipment in the vicinity of the battery, to follow the battery instructions very accurate. Never smoke or allow a spark or a flame in the vicinity of a battery.

1. Choosing the best battery

Lead acid batteries are the best choice for general applications; they are easy and uncomplicated to use and their performance to price ratio is superior.

The batteries are available in many different types, sizes, ampere hours (Ah), voltages and chemistries.

Lead acid battery types

- **Starting batteries -** These batteries are designed for high discharge in very short time (1~2 min.) and only used for cranking purpose. Not recommended for inverter applications. They will not damage the inverter but the problem is, that these batteries will not last in deep cycle applications.
- **Deep-cycle batteries -** Recommended for the inverter applications. The deep-cycle batteries are designed for applications where high discharge rate is needed. They can be discharged up to 80% of rated capacity without being damaged.

1.1 Battery sizing

The batteries are the inverters energy source. The larger the batteries are, the longer the inverter can operate before recharging is necessary.

An undersized battery bank results in reduced battery life and disappointing system performance.

- **The leading cause of premature battery failure are wrong or too less battery-capacity, improper charging and poor battery maintenance.**

Note: In general do not discharge the battery more than 50% of rated capacity. Discharging of 80% is acceptable on a limited basis, such as a prolonged utility outage. Total discharge of battery will result in permanent damage and reduced battery life.

Note: Batteries discharged at a low rate will be able to deliver a higher capacity than those discharged at a high rate

Estimating battery requirements (VOLT x AMPS = WATTS):

The watt ratings of each appliance powered by inverter must be added together. Use the figures from the nameplate label on the appliance.

$$\textit{Needed battery capacity (Ah)} = \frac{\textit{Total watt consumption (W) x Running time (Hours)}}{\textit{Battery voltage (V) x 0,9 (Eff.)}}$$

Multiply the Ah with 2 to reach the recommended battery Ah size. This will also allow the battery to be cycled only 50% on a regular basis.

2. Battery-installation

Before installing the batteries, clean the contact surfaces of the lead terminal post and battery terminals with a battery brass wire brush.

Apply a thin coat of Vaseline to all contact points and connector bolts.

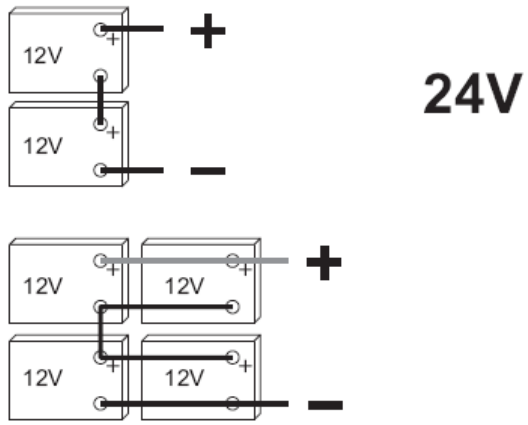
After all connections have been securely tightened; they should be gone over and tightened a second time.

When a new battery is taken into use it should be put on charging!

Batteries in serial

Connecting two batteries in series will double the voltage of the battery bank but maintain the Ah capacity.

Example: Two 12V 100Ah batteries in series will produce a battery bank of 24V – 100Ah

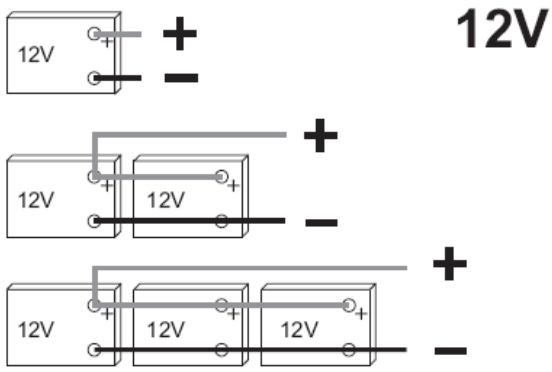


Serial connection

Batteries in parallel

Connecting 2 batteries in parallel will double the Ah rating of the battery bank, while the voltage will be the same as the individual battery blocks.

Example: Two 12 -100Ah batteries in parallel will produce a battery bank of 12V-200Ah



Parallel connection

Important:

- Only similar batteries must be connected together in a battery bank.
- Do not connect old and new batteries together.
- Do not connect flooded and sealed batteries together.
- Keep all interconnections short and in same (or higher cross section) as for the output cables.
- When paralleling batteries, connect (+) output cable to battery 1, and connect (-) output cable to battery 2 (If 3 batteries are connected, connect (-) output cable to battery 3, and so on...)

3. Battery maintenance

Performing preventive maintenance on batteries is easy and should occur at least once a month during hot weather and every three months in cold weather. A clean well kept battery will extend

the useful life of the battery. Remove dirt and dust accumulations from the top of the battery. Wash the top of the battery with clean hot water and soda solution to neutralize any acid accumulation. Baking soda used in the home is satisfactory. Rinse with clean water and dry. Ensure vent caps are in place and no soda enters the battery.

3.1 Check of electrolyte

In the case of regular or low maintenance batteries: - Check the height of the electrolyte twice a month. If necessary replace with approved water only - use of non-distilled water can cause mineral build-up in the battery cell. **NEVER** fill batteries with seawater, as **DANGEROUS CHLORINE GAS** will be liberated. Never fill the cells above the bottom of the vent (observe the regarding information of battery-manufacturer). Overfilling will cause loss of electrolyte and reduce the battery capacity. Preventive maintenance involves as a minimum to check the cell electrolyte level for correct acid volume once a month and equalizing once every six months.

3.2 Sealed batteries

In the case of sealed battery, the state of charge can be practically evaluated by measuring open cell voltage, with a digital multi-meter. This method is however not 100% reliable, because sulfating of the battery may result the increased voltage on the terminal. Than not fully charged batteries should be considered for fully charged. – Use a special testing instrument, available from a battery-dealer.

Before reading out the open cell voltage, the surface charge has to be removed. – The recommended method is to allow to rest the battery without charging or discharging for between six to twelve hours at room temperature if possible.

Summary of maintenance

- ✓ Secure the batteries always are fully charged.
- ✓ Batteries must not be left discharged for longer period without charging.
- ✓ Recharging on regular basis tends to prevent irreversible permanent sulfating
- ✓ Open / Wet batteries need topping up with distilled water frequently.
- ✓ Use protective goggles and rubber gloves, when working with batteries (acid)
- ✓ Clean battery top and poles.
- ✓ Use anti corrosion oil or Vaseline on pole bolts to preserve the surface.
- ✓ Remove any corrosion, lead oxidation, paint or rust with a battery brass wire brush
- ✓ Don't place the batteries in hot areas.
- ✓ Check min once a year the pole bolts are well tightened.
- ✓ Replace the battery if the battery case is bulging, cracked or leaking.

3.3 Battery storage

Lead-acid batteries must be stored in the open-circuit condition with the terminals insulated. Long periods of storage at even low drain rates may result in permanent damage.
Batteries should be stored in cool, dry and frost-free environments in their upright position.
Batteries that will be stored for extended periods should undergo regular open-cell voltage checks and be recharged as necessary. – This recharging will also prevent the build up of the damaging process of sulfating of the battery. Continuous float charging or periodic recharging will prevent batteries from freezing.

- **Do not store the lead acid batteries in discharged state**
- **Batteries should be kept at least 3/4 charged, especially during winter weather.**

ANNEX B WARRANTY

Installation, operation, technical support, warranty and service issues should in the first case be directed towards the outlet at which the Clayton Power devices are purchased.

CAUTION & WARNING:

DO NOT USE OR ATTEMPT TO USE THIS PRODUCT UNTIL YOU HAVE READ THIS USER'S MANUAL IN ITS ENTIRETY. IMPROPER INSTALLATION OR USAGE OF THIS DEVICE MAY BE HAZARDOUS AND MAY CAUSE DAMAGE TO OTHER ELECTRICAL EQUIPMENT AND WILL VOID WARRANTY.

Clayton Power warrants, to the original purchaser only, for a period of 24 months from the date of purchase, that the Clayton Power device will be in good working order when properly installed and operated as described in this manual.

If the inverter fails within this time period under normal use, Clayton Power will, without charge, at the place of Clayton Power's choosing, repair or replace the inverter - with new or reconditioned parts or a new or reconditioned inverter as Clayton Power deems necessary.

This warranty is void and will not be applied if:

- The inverter has been used against the recommendations of this manual.
- The inverter has been used in an application outside of general automotive, solar, industrial or marine applications without the agreement of Clayton Power.
- The inverter has been modified or repaired without written authorization of Clayton Power.
- Reverse polarity, excessive overloading, general abuse, neglect, wear & tear, ingress of liquids (water, oil, acid, or otherwise), foreign objects, lightening strikes, over or under voltage, RFI/EMI, etc.

Obtaining Warranty Service

To obtain warranty service, please contact the outlet at which the product was purchased. Do not contact Clayton Power directly. For warranty service you will require the following:

1. Proof of purchase
2. Model number
3. Serial number
4. Brief description of application and problem.

Telephone your Clayton Power dealer for an authorization number prior to dispatch (RMA-number). Do not send without authorization. Once this number has been obtained, please carefully package your inverter and send to the Clayton Power dealer.