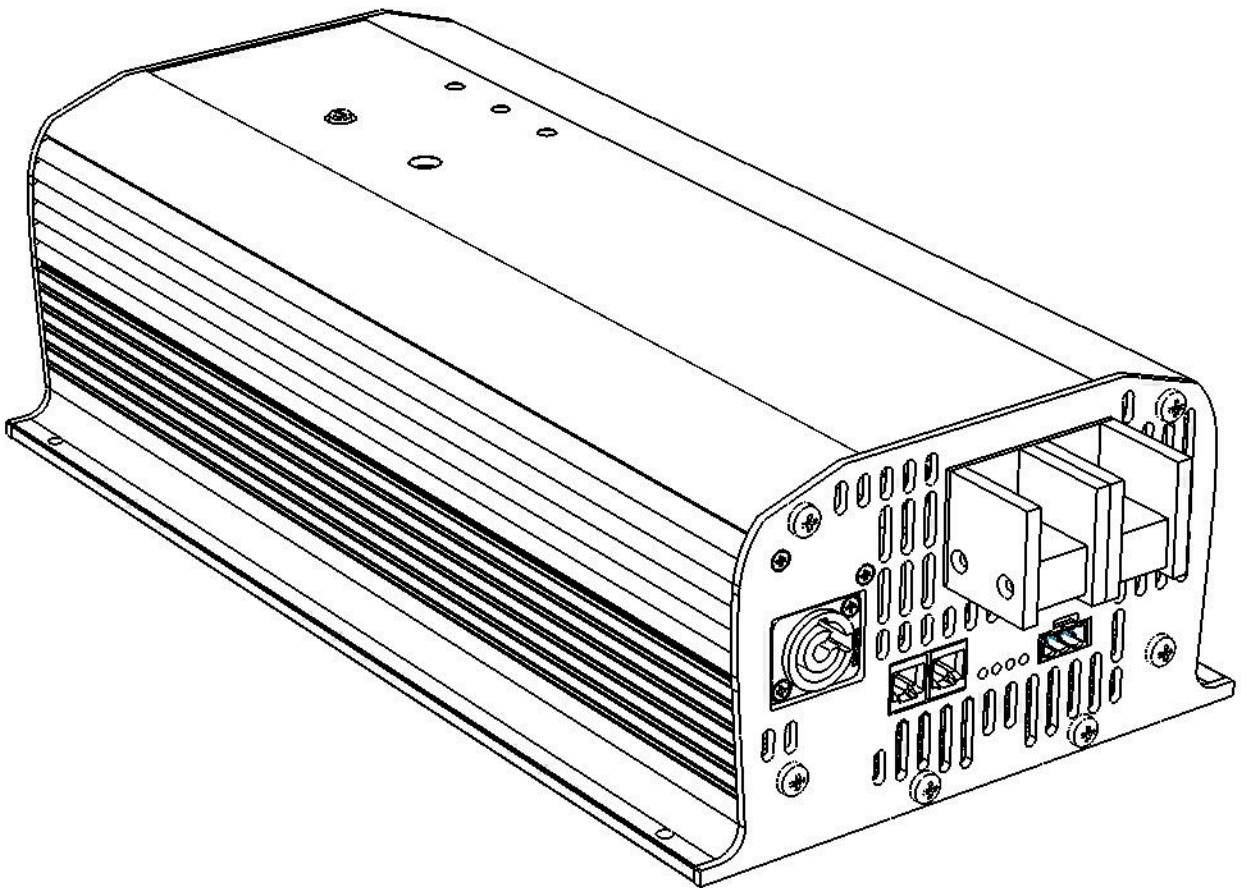


G3 COMBI

MODEL:

1012-50, 1024-30, 1312-80, 1512-80, 1524-40, 2012-100, 2324-50

VERSION: 2.0



USER'S MANUAL

Clayton Power
Website: www.claytonpower.com

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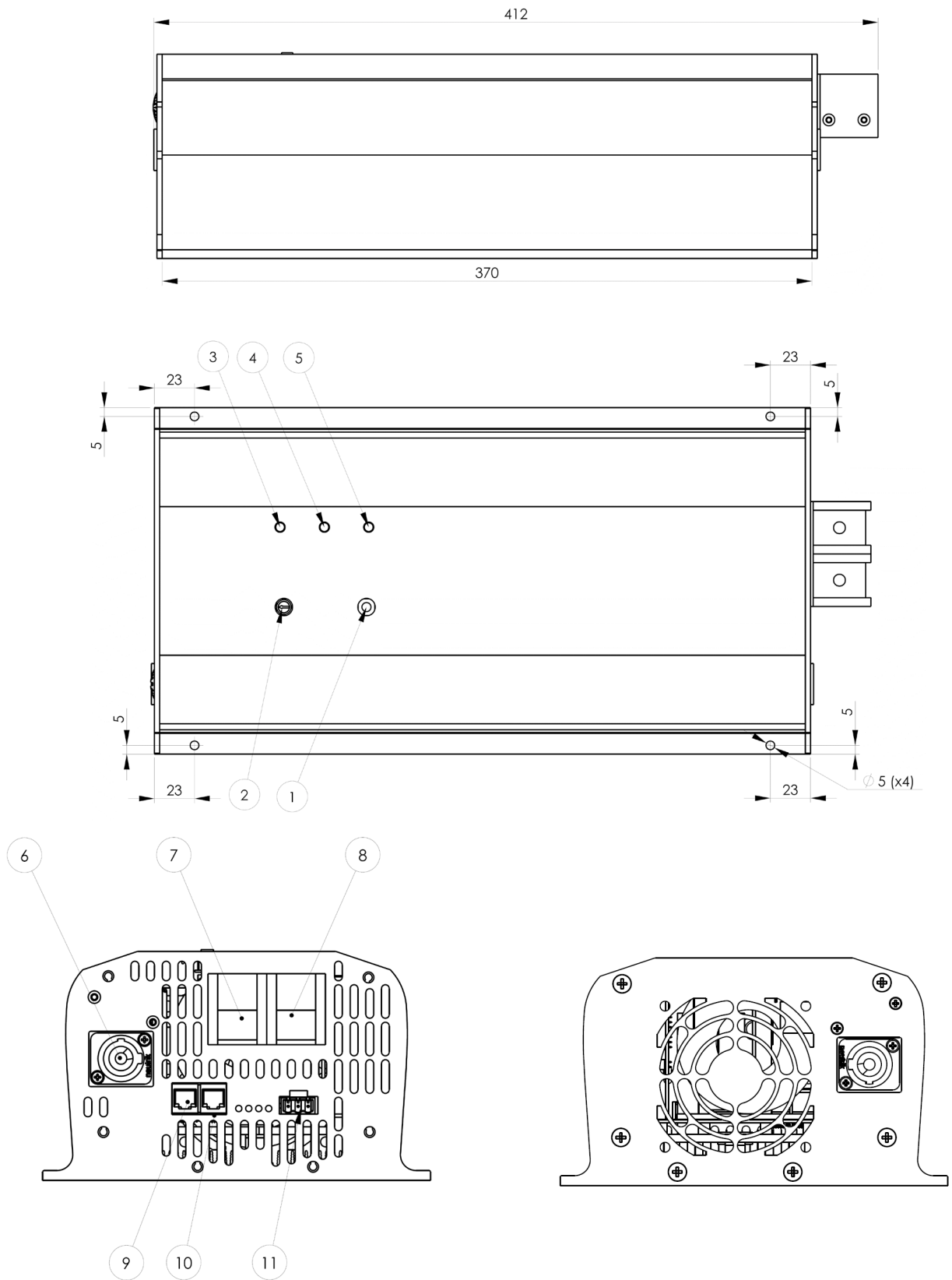
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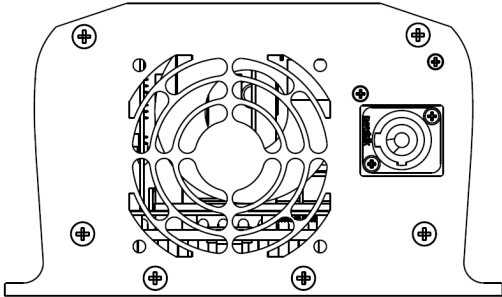
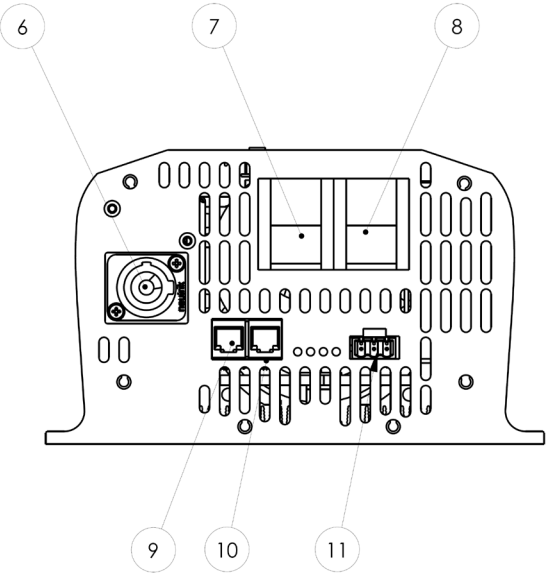
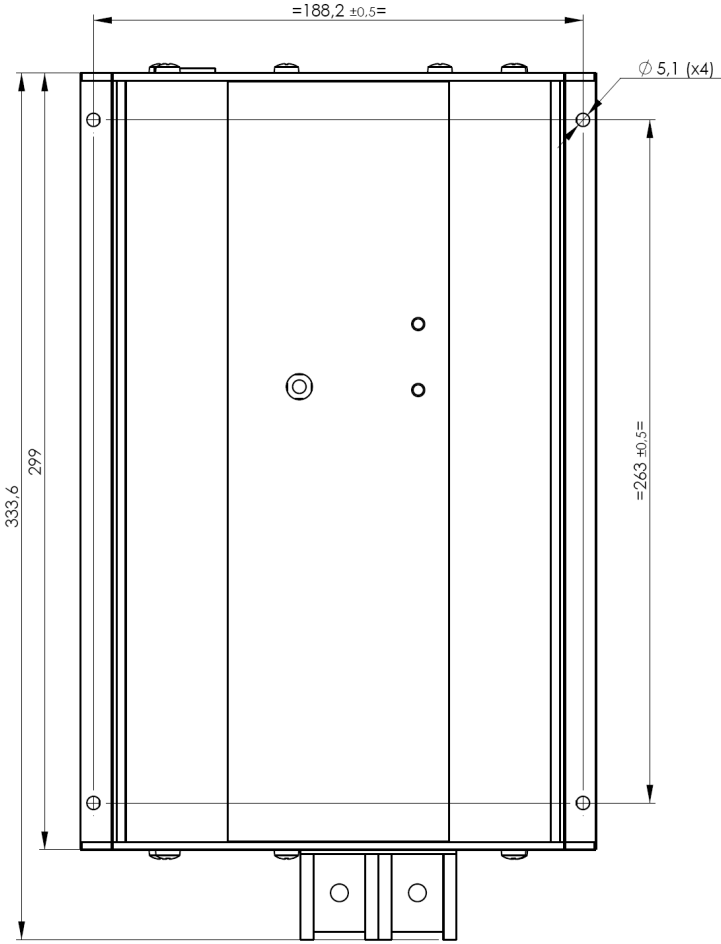
1.1 Mechanical Dimensions

Model: 1512-80 2012-100 2324-50



1.2 Mechanical Dimensions

Model: 1012-50 1024-30 1312-80 1524-40



2.0 Installation

Environment

- The inverter (or combi) must be placed in a dry, well ventilated and dust free location.
- Place the unit as close as possible to the battery in order to keep the battery 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.

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.
 - Make sure that each wire used in the installation has at least the same intersection and correct length, as given in this manual!
 - 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!**

2.1 DC cables

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 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.

Recommended cable

- The table bellow is given by a criterion to keep the total cable voltage drop lower than 250mV at max nominal power delivered by the combi.

*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*

- The cable length (up to 3 meter) between the battery and the combi must be sized according to the table below:

Note: Avoid cables longer than 3 meters between battery and combi!

Note: Cable length are defined per each cable (or as the distance between battery and combi)

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	1.5	-	3m	2.5m	1.5m
50	1/0	3m	2m	2m	1.5m	-	3m	2m
70	2/0	-	3m	2.5m	2m	-	-	3m

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 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) in parallel. It will damage the unit (s). Such damage is not covered by the guarantee.
- Do not connect AC generator or AC mains to the unit's AC output connector (grey Neutrik). It will damage the unit. Such damage will not be covered by the guarantee.

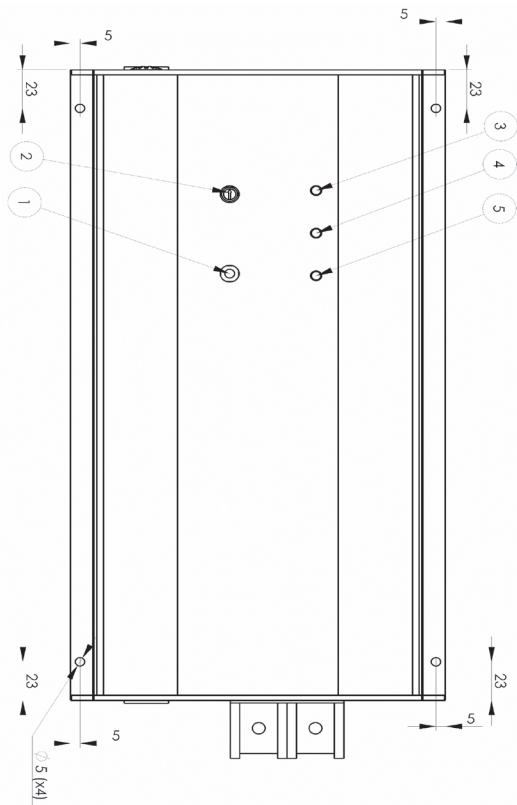
2.2 AC Mains cables

- When installing the AC cables always refer to safety standards valid in your country!
- The use of RCD devices – also known as FI fail current protection is highly recommended in any installation!

Recommended AC cable

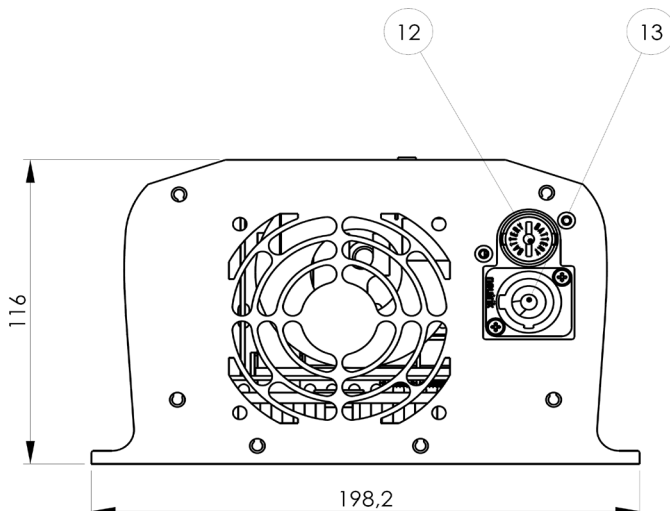
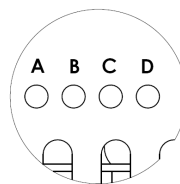
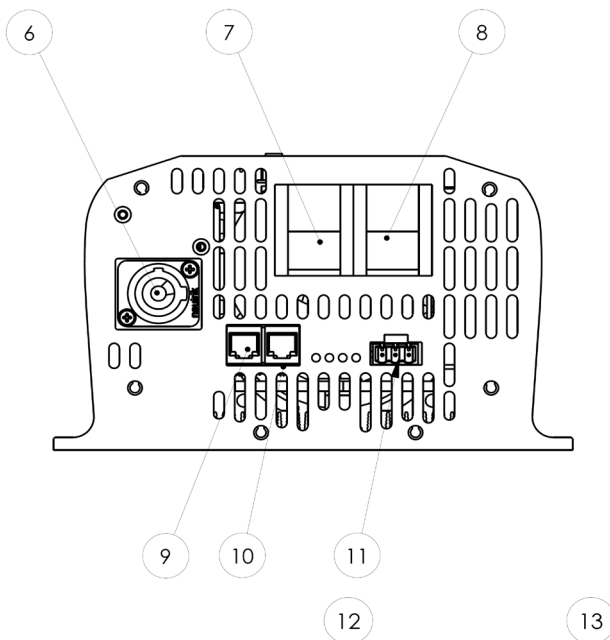
- The table below gives the minimum recommended wire sizes of the mains cables!
- AWG 15 = 1.5mm² AWG 17 = 1.0mm²
- The assembly of the mains connector is described in section 3.3 Neutrik connector's assembly

	1012-50	1024-30	1312-80	1512-80	1524-40	2012-100	2324-50
Mains Cable	17 AWG	17 AWG	15 AWG	15 AWG	15 AWG	15 AWG	15 AWG



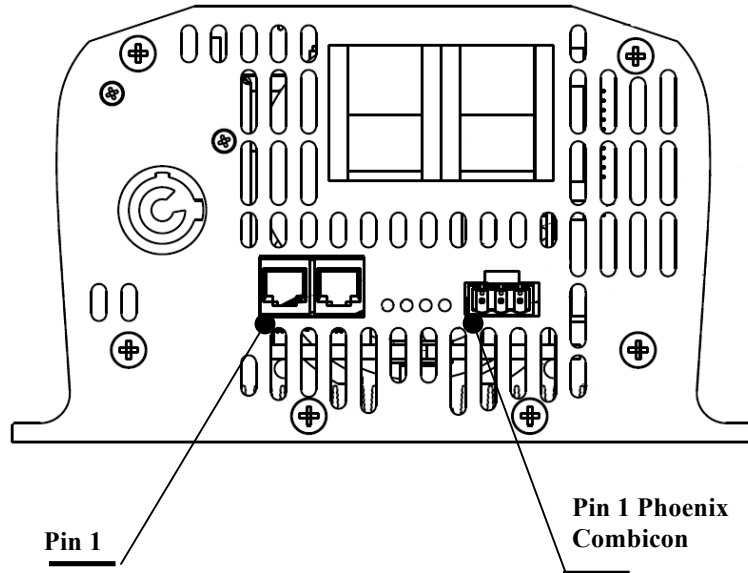
3.0 Device layout

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)



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	Green	Optional charger output 2

3.1 External connections



RJ12 type 6p6 connector: ¹

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

Phoenix Combicon MSTB 2.5 / 3-ST-5.08:

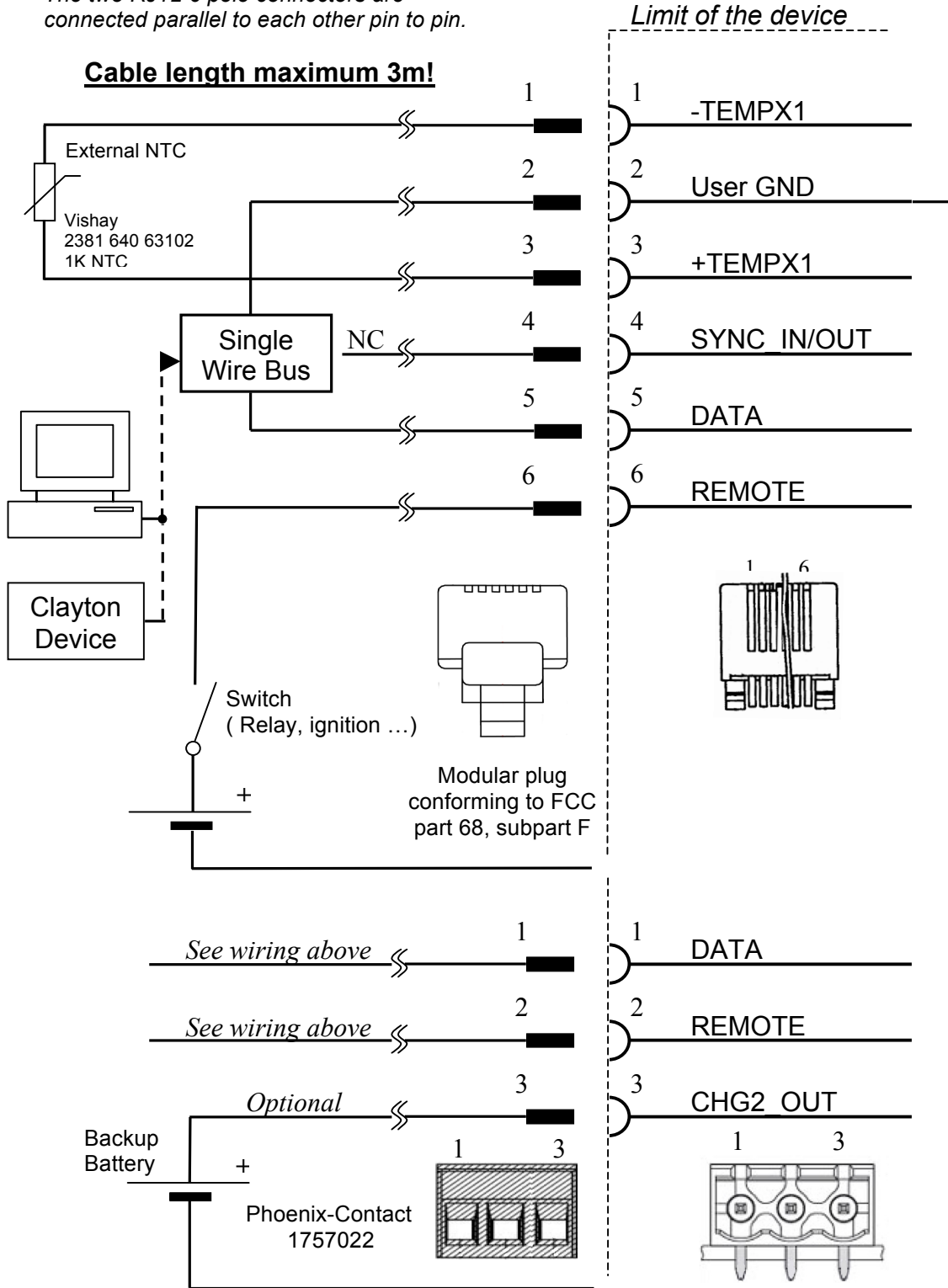
Pin#	Signal	Description
1	DATA	Single Wire Clayton Communication
2	REMOTE	Connected to plus pole of the battery switches on the combi Not connected = no influence
3	CHG2_OUT	Extra charger output (option) ²

¹ The signal wires of the two connectors are connected parallel so the pin out and the signals on the corresponding pins are identical

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

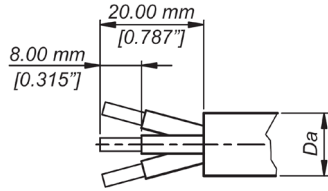
3.2 External Wiring

The two RJ12 6 pole connectors are connected parallel to each other pin to pin.

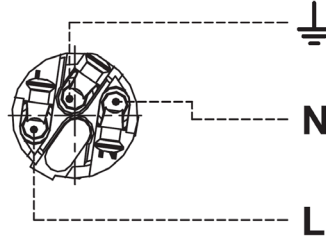


3.3 Neutrik connectors assembly

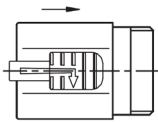
Cable Preparation



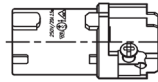
Wiring



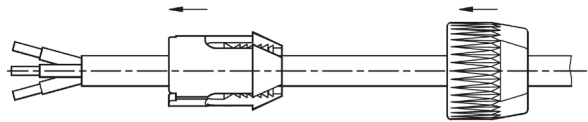
Assembling



Housing



Insert



Chuck

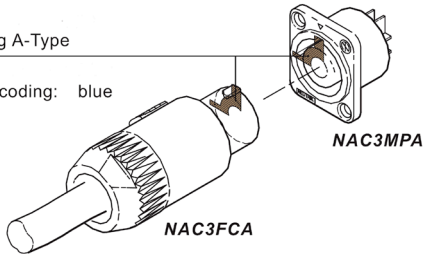
Bushing

BLUE

Combination for AC Power IN (only combi models)

Coding A-Type

Color coding: blue

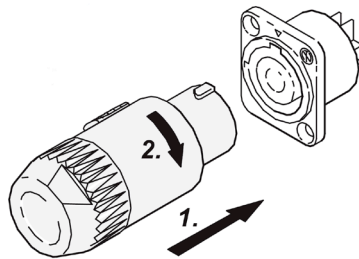
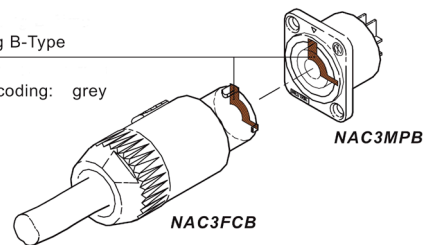


GREY

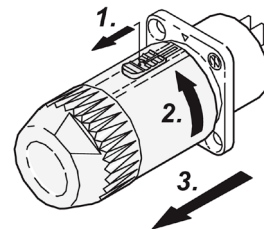
Combination for AC Power OUT

Coding B-Type

Color coding: grey



Engagement



Separation

4.0 Accessories

COMBI Accessories List	
No.	Description
a.	AC output connector, type Neutrik NAC3FCB (Grey)
b.	Phoenix DATA connector: MSTB 2.5 / 3-ST-5.08 - Green
c.	AC input connector , type Neutrik NAC3FCA (Blue)

5.0 Operating the device

•The aim of this section is to give a brief overview necessary to operate the device and give some proposal how to solve most normal problems occurring during operation of the device.

Information for all LED error codes can be found in section 6.0 LED Code description.

Combi devices can operate in 3 modes:

Inverter mode

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

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 Neutrik), a relay bypass the supplied AC voltage to the output (grey Neutrik). At the same time some of the energy (from grid or generator) goes to recharge the battery bank.

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: the inverter section must be switched on!**

Inverter section:

Switch ON the inverter

- Push down ON/OFF power switch for approximately. 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!

Charger section:

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 in section 5.2 *Charge Current Setting* for correct adjustment.

Charge characteristic setup

- Future option!

Activate the charger

- The charger section 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 is in this mode is accepted** But with reduced charge current!*

Note: If AC was connected and then removed (short charge time), the inverter can be restarted even if the battery is still empty!

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 + load 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!

Boost charging

- Fast flashing green LED, the charger delivers full charge current to the battery

Top charging

- Slow flashing green LED, the charge current is reduced in order not to exceed max battery voltage allowed.

Fully charged battery

- Continuously light green LED

Deactivate the charger

- Remove AC, charging will stop.

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

Errors charger:

AC input voltage to low <185VAC (with inverter switched ON)

- 1 flash by green LED

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

AC input voltage to high >265VAC

- 2 flash by green LED (rear situation!)

AC input distortion

- The charger can not begin charging if the input voltage is a non sine wave, or heavily distorted!
- 1 flash by green LED

No NTC temperature sensor connected

- 4 flash by green + red LED together

Note: "No NTC connected" status is indicated every time the charger is connected to AC voltage (110VAC-265VAC)

Note: "No NTC connected" flash code is only present for 20 seconds, and then the green LED will indicate the actual charge status.

Note: If no NTC is used, the charger will charge the battery without temperature compensation!

Poor connections (or disconnection of battery during charging)

- 2 flash all LED together

Note: Always make sure that all connections joints are in a good quality: tighten all screws, wiring size must be correct dimensioned, no corrosion at terminals etc.

WARNING!

Never disconnect cables during charging (and inverting) especially near the battery bank.

The battery can explode!

Defect battery

- The battery must be able to deliver min. 12W and min. 10,3V before charging can start!

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

- No LED code for this error

5.1 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 switch 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 3W in order to save the battery during no load periods!

Activate load search mode

- Switch OFF if the combi (if 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 (the mode will be active > 15min after disconnecting the battery)

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!

Note: When a load has been connected and afterwards disconnected the device stays fully ON for 1 min then it returns again to search mode (low battery consumption).

Deactivate load search mode

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

Remote used with load search function

- The load search function will remain active if the device is switched ON and OFF by remote.
- Only deactivation (or disconnection of battery >15 min) will clear load search mode

5.2 Charge Current Setting

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

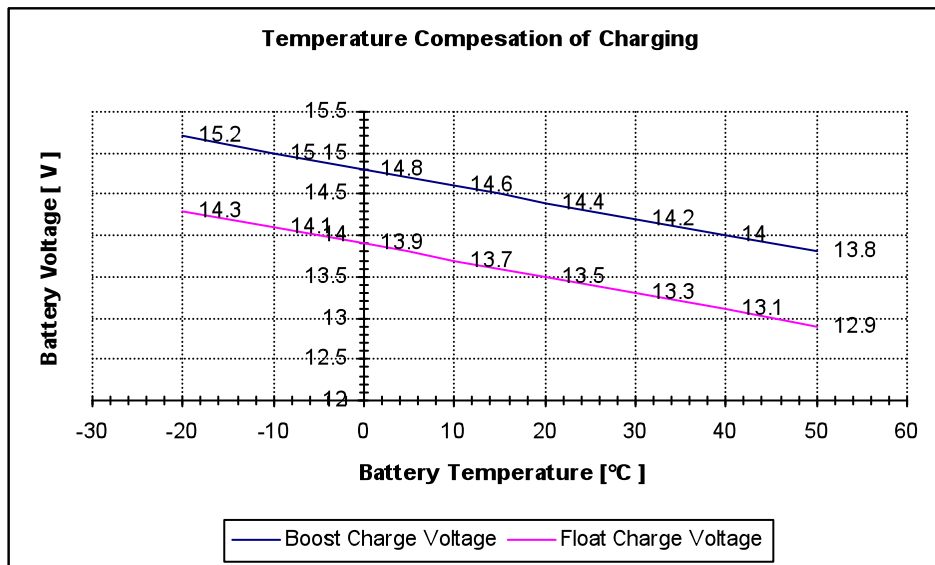
Charge Current	Recommended Battery Capacity Range
15 A	75 – 150 Ah
20 A	100 – 200 Ah
25 A	100 – 250 Ah
30 A	150 – 300 Ah
40 A	200 – 400 Ah
50 A	250 – 500 Ah
60 A	300 – 600 Ah
80 A	400 – 800 Ah
120 A	600 – 1200 Ah

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 battery / batteries shall be charged please consult your Battery Technical Manual (data sheet), or your local battery distributor.

Temperature compensation (NTC sensor)

- When using the external temperature sensor (NTC) the charger will reduce the charge current with respect the max allowed battery voltage at the actual temperature!
- Refer to scheme: at 20°C the boost charge max voltage is 14,4V and float charge voltage 13,5V
- Use the NTC temperature sensor for optimal battery performance.



5.3 Charging Stages

- The charger is a fully automatic 3-stage charger with IUoUo characteristic.

Boost charge - Fast flashing green LED

- The charger will start in boost charge mode with max pre-set voltage and max charging current.

Top charging - Slow flashing green LED

- The battery has reached the maximum pre-set charging voltage and will automatically reduce the charge current until the charger measure 1Amp

Battery Full (Float charge) - Continuously light green LED

- The battery was detected fully charged.

Maintenance current (Float charge) - Continuously light green LED

- The charger keeps a pre-set float charge voltage, and adjusts the charge current automatically to compensate for battery discharging.
- The charger can deliver up to 50% (of max adjusted charger current) at float charge voltage.
- If the battery voltage drops below float charge voltage level, the charger switch over to boost charge mode.

6.0 LED codes description

- The Blue LED is for the Inverter section.
- Green LED is for the charger section.
- Red LED indicating the status of the battery.
- Two or all LED can also flash together; see description of the error / status!

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

Green LED	Description.
ON	Battery fully charged – float charging
Slow flashing	Charger is in absorption phase of charging (top charging)
Fast flashing	Charger is boost charging
1 Flash	Mains present but too low
2 Flash	Mains too high

Red LED	Description.
No light	Battery okay
ON	Battery voltage too low
Flashing	Battery voltage too high

All LED Together	Description.
ON	Not used (reserved for future use)
Fast flashing	Remote on and Power button on at the same time
1 Flash	NTC error (internal temperature sensor)
2 Flash	Over Voltage of internal high voltage DC link
3 Flash	Half bridge failure
4 Flash	Full bridge failure

Red and Green LED Together	Description.
4 Flash	Temperature sensor (NTC) missing

7.0 Batteries

WARNING!

Working with batteries is dangerous!

Batteries generate explosive gasses!

• *Therefore it is of out most 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.*

Lead acid batteries

- 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.

Battery sizing

- The batteries are the inverters (combi) 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 is 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.

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

- **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.

7.1 Maintenance batteries

- 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. In the case of lead acid batteries the maintenance should include check the electrolyte level for non-sealed wet batteries and the State of Charge (SOC) with hydroscope measurement of specific gravity of the electrolyte and recharging the battery if necessary.

- 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.

- 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 well (approximately 1 inch or 25mm) below the top of the vent opening). Over filling 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.

- 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 and not fully charged battery should be considered for fully charged. Before reading out the open cell voltage, the surface charge has to be removed – the recommended method is to allow to sit (or rest) the battery without charging or discharging for between six to twelve hours at room temperature if possible.

- As a part of the maintenance always tight loose hold-down clamps to prevent excessive vibration, battery lugs, terminals and connectors.
Clean the battery top to eliminate conductive paths created by dried or wet electrolyte and prevent corrosion.

- **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.**

7.2 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, 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.

8.0 Warranty

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

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, lightning strikes, over or under voltage, RFI/EMI, etc.

Obtaining Warranty Service

• To obtain warranty service, please contact the outlet at which you purchased your product. 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 - do not send without authorization. Once this number has been obtained, please carefully package your inverter and send (freight paid) to the Clayton Power dealer.

