



INSTALLATION MANUAL

Version 7

**FOR CONNECTION TO FRONIUS IG15, SMA WB1700 & SMA
WB1100 GRID CONNECT INVERTERS WITHOUT BATTERIES.**

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INTRODUCTION

This manual provides technical descriptions, specifications and installation procedures for the SOMA wind generators.

WIND GENERATOR USAGE

This SOMA Wind Generator is designed to operate with a Fronius IG15 inverter or Windy Boy WB1700 inverter (Soma 1000) or WB1100 (Soma 400). The Fronius inverter must be set to operate at a fixed input voltage of 170V (Soma 1000) or 200V (Soma 400). If set lower than this, the wind generator will overheat and over time the winding will be damaged. The WB (or SB) inverter must be programmed with specific parameters. Please consult Soma Power for these parameters and do not connect the inverter until it has been programmed accordingly.

The dump load inside the Soma controller is set to operate at 300V. This will prevent the output of the Soma from rising any higher while the inverter is attempting to synchronise with the grid. Once synchronised, the inverter will pull the Soma voltage back down and the dump load will turn off. During a grid failure, the dump load will similarly protect the inverter from overvoltage and the Soma from over-speeding on no load. Also during a grid failure, a mains failure relay will short all 3 phases of the Soma together, causing a braking effect on the turbine and preventing the dump load from continuously dissipating heat during an extended blackout.

SIMPLE INSTALLATION

It should take two people no more than two days to complete the installation of the SOMA 1000. Recommendations put forward in this manual should be adhered to as closely as possible. An improper site selection or poor installation can seriously affect the performance of the system.

PLEASE READ THIS MANUAL CAREFULLY BEFORE BEGINNING INSTALLATION.

LIST OF COMPONENTS

Upon receiving your SOMA you will have the following components that must be assembled together.

1. blade
2. tail pipe (strapped to blade)
3. tail fin
4. power head
5. propellor bolts
6. nose cone (SOMA 1000 only)
7. controller

THE BLADE

The rotor blades are constructed using a hollow moulded fibre glass technique that is unique to Soma. High tensile anilinear glass fibres combined with marine grade resins create a modulus for a blade that is both strong and light. Polypropylene tape provides long term erosion protection for the leading edges of the blades.

The blade is in one piece which is pre-balanced and fits into location over the boss of the rotor hub. Four bolts are used to secure the blade to the rotor hub.

BLADE CHARACTERISTICS

	<u>SOMA 1000</u>	<u>SOMA 400</u>
Rotor diameter	2.7 metre	2 metre
Chord length: base	125mm	125mm
tip	50mm	65mm
Pitch at tip	2 degrees	5 degrees
Twist	7 degrees	7 degrees
Tip speed ratio	10:1	8:1

ALTERNATOR

The SOMA alternator, which is the main component of the power head is a brushless, directly-driven, alternating current generator which utilizes a rotating permanent magnet field.

The alternator is designed to produce a power curve that is optimally suited to the two bladed rotor. The copper windings are impregnated with resin to protect them from corrosion. The rotor shaft is stainless steel with sealed ball bearings (bearing number 6205). The rotor hub is galvanised steel.

The rotor hub of the alternator contains the powerful permanent magnets which rotate around the 14 pole stator. The alternator produces 3 phase alternating current (AC) which is converted to direct current (DC) by the Soma Controller.

SWIVEL ASSEMBLY

The swivel assembly rotates and allows the wind generator to face the wind. It also provides the mechanism by which the rotor can tilt back out of the wind to prevent overspeeding. Housed within the swivel assembly are the brushes and slip rings which carry the power to the cable leading to the controller. It is made of galvanised steel.

The swivel assembly fits over the top of a 65mm NB galvanised pipe tower and is secured with 2 bolts. Sealed ball bearings enable free rotation. (Bearing numbers 6206 and 6007). The tail pipe is secured inside the stator boss and the tail vane is bolted to the pipe.

THE SOMA CONTROLLER

The controller is located near the inverter which can be located up to 740 metres away from the wind generator. The controller is a voltage regulator which protects the inverter from over-voltage from the wind generator. It contains a passive over-voltage limiting circuit to protect the inverter. The controller also contains the rectifier which converts the 3 phase A.C. voltage generated by the SOMA into D.C. voltage suitable for the inverter. Thirdly, the controller contains a mains failure relay, which shorts the a.c. output of the turbine, preventing heat dissipation during an extended blackout. This will also electrically brake the turbine causing it to slow down to very low RPM.

FEATHERING MECHANISM

The SOMA 1000 utilizes the proven "tilt-up" feathering method to limit rotor speeds in winds in excess of 15ms (metres per second), or 54 kph. It is necessary to limit rotor speed in strong winds to reduce the loads on the wind generator and the tower and to prevent blade wear from overspeeding.

The centre of effort of the rotor is above the pivot point of the stator, and wind pressure causes the whole assembly to tilt up. This has the effect of reducing the rotor area presented to the wind, and results in a limitation of the power and rotational speeds achieved by the rotor. The stronger the wind, the further back the rotor tilts. As the wind decreases, gravitational effect pulls the rotor back into normal operating position. A stainless steel hydraulic dampener governs the speed at which the feathering action takes place. This reduces undesirable gyrational action.

TOWER

Soma Power manufacture 13m and 19.5m guyed tilt towers. Other towers can be used, but Soma Power recommend that the tower should be able to tilt down to the ground so that installation and maintenance of the turbine is easy.

GALVANISED PIPE WINCH-TILT TOWER

These towers, available from Soma Power, come in 2 heights: 13m and 19.5m.

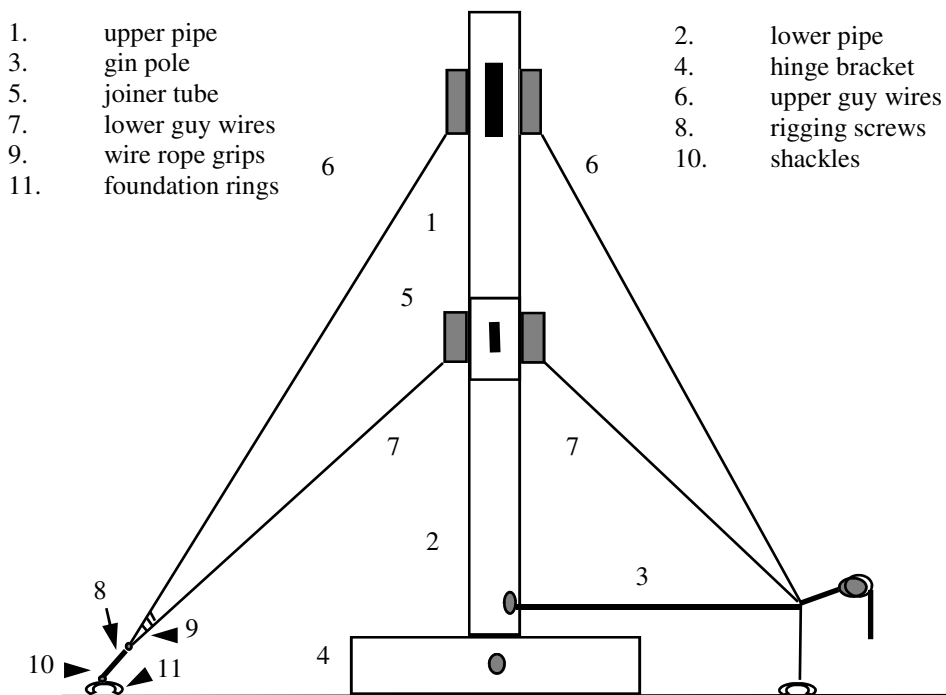
The tower consists of 6.5 metre lengths of galvanised pipe supported by guy wires. Generally 2 lengths of pipe are used to provide a 13 metre tower. The tower requires concrete foundations and it pivots at the base to enable it to be raised and lowered for ease of installation and maintenance of the wind generator. A jockey pole or gin pole is used for leverage to raise the tower and a winch is secured to one of the guy wire foundations to winch the tower up and down.

Tower kits are available from your SOMA agent which include all of the components necessary, except for the lengths of galvanised pipe and the concrete.

The galvanised pipe can also be supplied by Soma Power, but high shipping costs usually mean it is easier and more cost effective for a local steel supplier to supply and pre-drill the poles for you.

Drilling details for the poles are supplied in the tower manual to assist local supply.

COMPONENTS FOR 13 METRE TOWER



WINCH TOWERS

**SAFE
&
EASY**

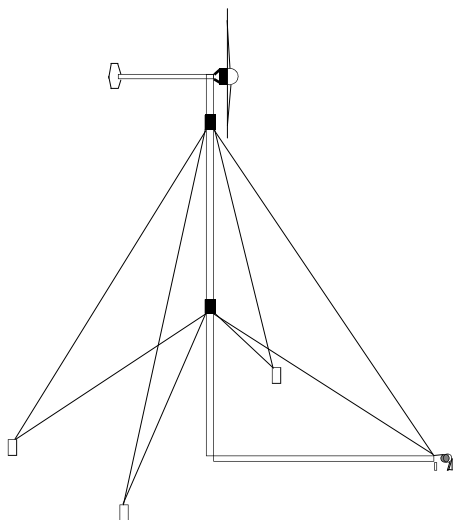
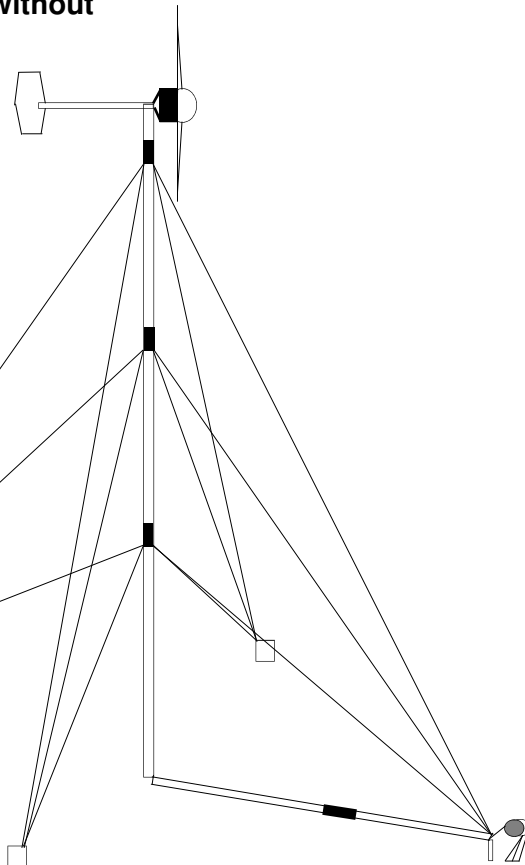
features

- tower tilts down to the ground
- bi-directional brake winch
- hot dip galvanised
- supplied in kit form with or without

19.5m TOWER	
<i>Specifications</i>	
Height	19.5metres
Base Dimensions	13.8m x 13.8m
Outside Foundations	0.7 x 0.7 x 0.7m
Centre Foundation	1 x 1 x 0.25m deep

benefits

- no climbing
- no towing
- safe
- anti corrosion
- simplifies installation &



13m TOWER	
<i>Specifications</i>	
Height	13 metres
Base Dimensions	9.2 x 9.2m
Outside Foundations	0.6 x 0.6 x 0.6m
Centre Foundation	1 x 1 x 0.25m deep

SOMA POWER
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INSTALLATION & OPERATION

FOUNDATION

A comprehensive installation manual is provided with each tower kit. Follow these instructions for laying out the footings. For the 19.5m tower, 17m³/₄ of concrete is required, while for the 13m tower, use at least 1.2m³. While the concrete is wet, the foundation brackets are placed in position. Allow at least 48 hours for the concrete to strengthen before raising the tower.

ASSEMBLY

Lay out the pipes and guy ropes on the ground in position. Feed the cable up through the centre of the mast, then join the mast sections together using the sleeves provided. Bolt the mast and gin pole to the base plate and shackle all the guy ropes to the mast and base loops. Use the rope grips to set the approximate length of the guy ropes. Raise the tower using the winch and set the guy lengths as required. Adjust the turnbuckles to tighten the guys and make the tower vertical and straight.

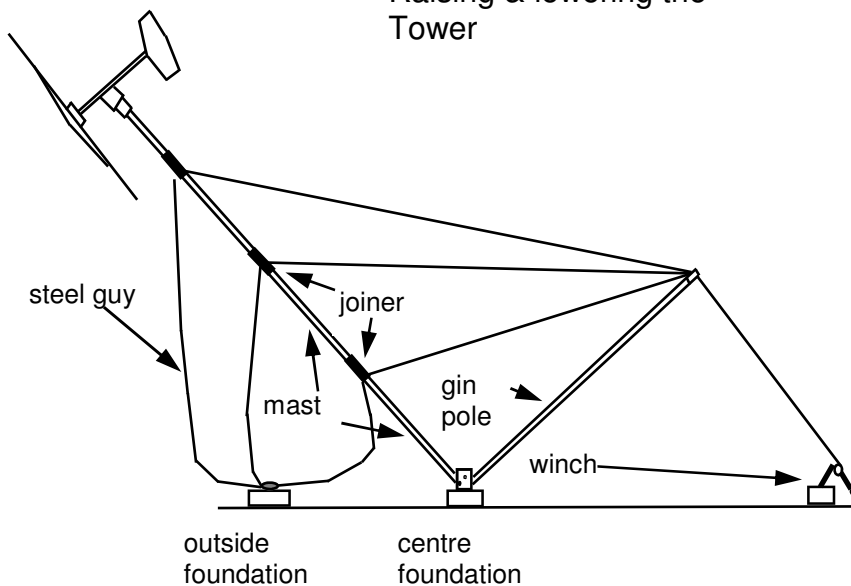
WIND GENERATOR

Once the tower has been raised and lowered a few times, attach the wind generator and raise it for operation.

MAINTENANCE

Wind generator maintenance now becomes a simple, safe half hour operation.

Raising & lowering the Tower



SHIPPING INFORMATION

Tower kits include everything required except for the poles and concrete. Poles can be supplied by Soma Power, but due to shipping costs, these are normally supplied by your local agent. Specifications for the poles are in the tower kit manual.

	BOX DIMENSIONS	WEIGHT
19.5m kit	700x450x450mm	90kg
19.5m poles	6500x220x220mm	233kg
13m kit	700x450x450mm	43kg
13m poles	6500x160x160mm	120kg

SITE SELECTION

The performance of your wind generator depends on four factors:

- 1) The amount of air turbulence at the site.
- 2) The average wind speeds at the site.
- 3) The distance from the tower to the inverter.
- 4) The height of the tower.

TURBULENCE

The most likely cause of air turbulence is local obstructions such as trees, buildings and hills. When a smooth airstream encounters a nearby obstruction, it is broken up into gusts of variable strength and direction. As these gusts hit the wind generator it will be continually accelerating, decelerating and turning, causing variations in the stresses on different parts of the blade, shafts, bearings and tower.

To avoid these destructive effects, it is essential to erect the wind generator at least 5-10 metres above any obstruction that is within a radius of 100 metres.

AVERAGE WINDSPEEDS

The average windspeed will determine the amount of power the wind generator supplies to the inverter. The power available in the wind depends on one very important characteristic.

POWER GOES UP BY THE CUBE OF THE WIND SPEED. This means that a 10 m/s wind has 8 times more power than a 5 m/s wind. Or a site with an average windspeed of 6 m/s has 73% more power than a marginal 5 m/s site.

IT IS ESSENTIAL TO SELECT A SITE WITH AS MUCH WIND AS POSSIBLE.

SOMA wind generators have been designed to extract as much power as possible from light and moderate windspeeds. However, it is generally accepted that where the average annual windspeed is under 4 to 5 metres per second, harnessing the power is not viable.

HEIGHT

The wind speed nearly always increases with height. The amount that the wind increases above the ground depends on the surface roughness, whether grass plains, tall crops and hedges, or bush, forest and woodlands. The windspeed at 10 metres above head high scrub and bushes would be at least 1.5 times the wind speed at 3 metres above the scrub. Considering the cubic relationship between windspeed and wind power, the power at 10 metres is 3.5 times the power at 3 metres.

Considerable gains in energy output can be obtained from a wind generator by siting it in the best possible location. Often the extra costs involved, such as the price of an extra tall tower or the cost of extra copper cable to reach a nearby hilltop are more than compensated for by the increased output.

DISTANCE TO INVERTER

Consideration must be given to the length of cable running from the wind generator to the inverter. At higher amperages in higher windspeeds there will be more losses due to the resistance of the copper wire. The factors affecting these losses are:

1. length of transmission line
2. size of wire used
3. amperage output of wind generator

The greater the distance to the inverter the larger the size of copper cable required.

The following table gives maximum transmission length for different cable sizes.

cable mm²	S1000 170V										
2.5	185m										
4	296m										
6	444m										
10	740m										
16											
25											
35											
50											

It is usually better to select a site that is further away, if that site has more wind. The copper losses are very minimal at low to medium power output levels and the increased outputs in higher winds will usually outweigh the losses.

INSTALL THE WIND GENERATOR

The SOMA 1000 wind generator is transported to you in 7 separate pieces as previously detailed.

INSTALLATION PROCEDURE

1. Fasten electrical cable. (galv pipe tower)

Lower the top of the tilt tower to the ground once you are happy that the tower is correctly installed.

The same electrical cable that runs from the tower to the controller is fed up the inside the mast of the galv pipe tower to the top. (It may be necessary to use a lighter feeder wire to pull the cable through). The cable has to be 3 wires, for the 3 phase output of the Soma. A neutral is not required. The tower is earthed at the base of the tower. The Soma is bolted to the top of the earthed tower, which provides the earth for the Soma. Tie a loop in the cable 75mm from the end so that when the wind generator is in place on top of the tower, a 10mm bolt can pass through the tower and loop. This will support the weight of the cable so that strain is not placed on the terminals of the wind generator.

Connect the cable to the connector strip terminals that protude out of the swivel assembly. Phasing doesn't matter, so any cable can connect to any of the 3 terminals. Place the swivel assembly and alternator over the top of the tower and fasten the 2 locking bolts, using Loctite.

2. Bolt the tail vane to the tail pipe using the 6mm bolts provided. Use LOCTITE on the nuts. This can be done at ground level.
3. The tail pipe should be inserted into the back of the alternator. The securing bolt should be tightened so that the housing clamps tightly around the tail pipe. The housing is split to allow the clamping action to work. Once tightened, there should be no movement of the tail pipe inside the housing at all. A possible consequence of movement is wear of the 10mm bolt. USE LOCTITE on the nut. Smear silicon rubber on the outside of the tailpipe where it inserts into the back of the alternator if it appears to be a loose fit.
4. **Bolt the blade to the alternator.** Use 4 stainless steel 10mm x 45mm bolts with the washers provided. USE LOCTITE.
5. **Fasten the nose cone** (SOMA1000 only). There are 4 screws provided to fasten the nose cone to the blade. USE LOCTITE.
The wind generator is now ready for operation. But before raising the tower and allowing it to turn, the controller must be installed.

INSTALL THE CONTROLLER

A detailed description of the operation of the controller follows later in this manual.

DANGER: FIRE RISK : READ THIS SECTION BEFORE PROCEEDING.

The controller should be located in an accessible, dry location within 5 metres of the Inverter. The dump load inside the controller can dissipate upto 1500W and the top of the box may get hot to touch. The Soma Controller should be located at least 1.5m below any horizontal surface such as a ceiling or cabinet top. Sideways clearance of 500mm should be observed for any objects to the left or right of the Soma Controller. It should not be fastened to a flammable surface such as wood. (Use fire proof board between the controller and a flammable wall). The enclosure should be adequately ventilated to allow the heat from the dump load to escape. If more than 1 controller is installed in the same location, the clearances and ventilation will need to be increased adequately to allow for the extra heat dissipation.

MAKING THE CONNECTIONS

It is very important that the wind generator is not allowed to spin before the wiring is complete, otherwise it will have no load and could overspeed causing mechanical damage.

See wiring drawing on following page for detailed wiring instructions.

The wire from the controller to the inverter should be flexible and should be colour coded **RED (positive)** and **BLACK (negative)** to avoid confusion.

DO NOT REVERSE THE POLARITY - THE INVERTER WILL BE DAMAGED!!

The wind generator is now ready for operation. But, before you allow it to start generating, please read the remainder of this manual to familiarise yourself with the operation of the controller and other aspects of the system.

CONTROLLER FUNCTION AND OPERATION

The purpose of the Controller is to prevent the wind generator from damaging the inverter by regulating it's output voltage. The controller will dump power through the dump load if the output of the controller rises above 300VDC.

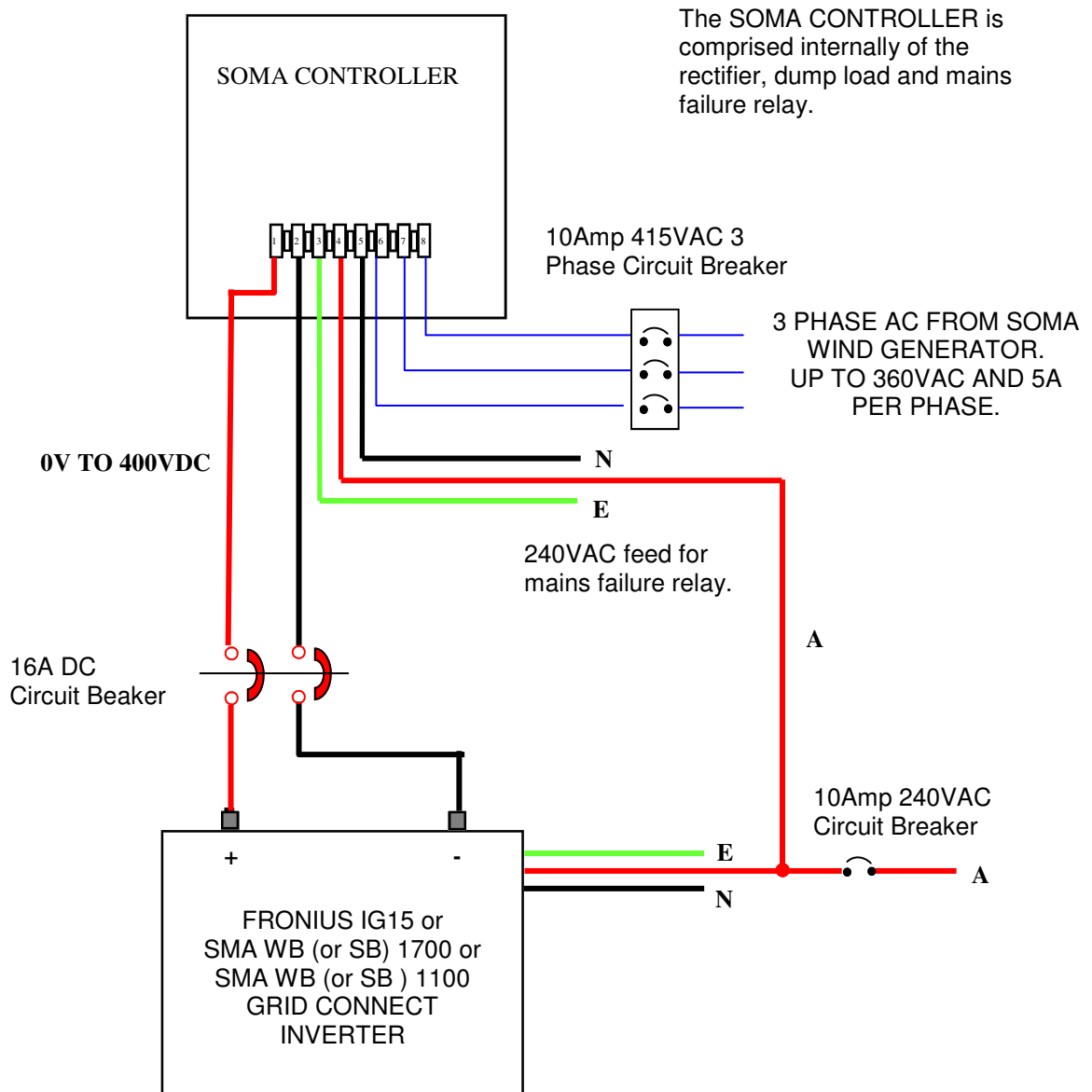
The controller also has a rectifier for converting the 3 phase AC output of the Soma to DC.

INVERTER VOLTAGE

The Fronius IG15 inverter must be set to operate at a fixed input voltage of 170V. If set lower than this it could damage the Soma due to overheating.

The SMA Windy Boy (or Sunny Boy) 1700 inverter must be programmed with parameters specified by Soma Power P/L.

SOMA WIRING



EARTHING

The body of the Soma Wind Turbine must be earthed to help protect it from lightning damage. This can be done by earthing the metal tower at it's base using a 1200mm earth stake and 16mm² earth wire. The controller must also be earthed as shown above.

ELECTRICAL BRAKE

It is possible to stop the wind generator from turning in the wind with electrical braking by cutting power to the mains failure relay. This should preferably be done in light wind speeds to stop the wind generator for servicing, etc.

EARTHING

The body of the wind turbine must be earthed for lightning protection. This can be done by earthing the base of a metal tower to a nearby earthstake. Use 16mm² cable between the two. If a wooden tower is used, the short metal stub at the top of the tower which is used for mounting the turbine must be connected to an earth wire which is connected to an earth stake at the bottom of the tower. The controller must also be earthed.

COMMISSIONING THE WIND GENERATOR

When the wiring has been completed, the wind generator can be commissioned.

With the electrical brake on, winch up the tower and wind generator into its working position. When the tower is secured in its upright position, release the electrical brake, by connecting 240VAC power through to the Soma Controller. If there is enough wind the rotor should start spinning and after a couple of minutes the inverter will synchronise to the grid and feed power to it.

The rotor should spin freely and should not shake or vibrate. If any abnormalities are observed, the brake should be re-applied and the unit lowered so that the problem can be analyzed and fixed. Under normal circumstances, the SOMA Wind Generator can now be left unattended to generate power.

MAINTENANCE

The SOMA Wing Generator has been designed to be very rugged and durable. As such, the maintenance required is minimal. Along with several visual checks, the only maintenance required is to grease the tilt back bushing and the hydraulic dampener bolts once a year.

MAINTENANCE PROCEDURE

1. Engage electrical brake on a light wind day and lower tower.
2. Physically inspect all bolts on the tower and wind generator to ensure that they are secure.
3. Check that the wind generator turns freely and tilts back freely.
4. Check that the blade is in good condition and that it has not been hit or damaged by flying objects. Replace the protective leading edge tape if necessary.
5. If stiff, the 20mm dia. tilt back bolt will need to be removed and re-coated with DuPont Teflon White Lithium Grease in the spray can. Available from Repco in Australia.
6. Grease the hydraulic dampener bolts.
7. The hydraulic dampener should be topped up with 20/50 engine oil if it has lost oil. Be sure that it is not overfilled. The dampener may need to be removed from the machine to do this, as the dampener needs to be filled while in a vertical position. This depends on whether your tower tilts down horizontally. Fill through the top bushing screw hole and fully depress the plunger after filling to squeeze out the excess. Allow the plunger to return to its normal position, then replace the screw. Use loctite on the mounting bolts when replacing the dampener.
8. Observe operation of wind generator.
9. Ensure that the guy wires and rigging screws are securely tightened. Grease the wire ropes to protect against corrosion if close to a coastal or salty environment.

DOS AND DON'TS

Please observe the following rules for the operation of your wind generator. They are very important and to disregard them may result in the failure of the wind generator.

1. **DO** ensure that the site you have selected is free from obstacles that cause turbulent air.
2. **DO** use copper cable of sufficient diameter for the distance to the inverter.
3. **DO** ensure that the controller is situated close to the inverter and is in a dry place.
4. **DO NOT** climb or lower tower without engaging the electric brake.
5. **DO NOT** allow the wind generator to operate while it is disconnected from the controller.
6. **DO** grease the tilt back bolt once a year using Du Pont Teflon White Lithium Grease in the spray can. Available at Repco in Australia.

CONGRATULATIONS! YOU HAVE PURCHASED ONE OF THE FINEST AND MOST RELIABLE WIND GENERATORS AVAILABLE.

WARRANTY CONDITIONS

Soma Power warrants your Soma1000 / Soma400 to be free of defects in materials and workmanship under normal use and service, for a period of two (2) years.

This warranty is available from the date of original purchase. All parts will be replaced or repaired free of charge within this period. Freight charges and the cost of any repairs resulting from damages occurring during this freighting will be borne by the owner.

The provision of this warranty shall not apply if the unit has been subject to misuse, poor installation, neglect, acts of Nature, accidental damage or has been used for a purpose for which it is not designed. The warranty does cover the machine in winds up to 50 metres per second, but does not cover the machine from the effects of flying debris or birds.

Any alterations or repairs by unauthorised parties will void your warranty.

To ensure fast handling of any warranty claims, please complete the warranty form below and return it within 30 days from date of purchase.



WARRANTY COUPON	
Name of Purchaser:.....	
Address of Purchaser:.....	
Location of Wind Generator (if not at above address)	
Date of Purchase:.....	
Point of Purchase:.....	
Soma Model & Serial Number:.....	