

## How do you determine the power sizing of the PropSava and equipment you wish to protect?

When determining the total power rating for the solution you require, do not forget to allow for possible future expansion of the load you wish to protect over the medium to long term. The normal margin is 20% unused load against supply. This is needed for two reasons, to ensure that there is additional load capacity for possible future expansion of the property/site, and to protect the Voltage Optimiser from damage that may be caused by unexpected large loads. You will need to check the rating of the equipment to be protected. Such ratings are normally quoted in Amps, Watts or KVA. You will also need to determine the nominal voltage line to neutral and line to line if three phase, plus the frequency and power factor.

Such information is usually shown on the rating plate attached to the equipment, otherwise you will need to consult the manufacturers of the equipment or take measurements. It is always recommended that you measure the loads true RMS (root mean square) value.

The performance of the Power Optimisation System relies on the relationship between input and output voltage and the existing Power Factor. Input and Output Voltage define the performance of the system to save power through voltage regulation. The existing Power Factor determines the power efficiency of the site and has an effect on the safety margin for peak loads.

If the total measured load of the site is 60KVA and the Power Factor is 0.8 the total power requirement would be 20% more due to low Power Factor and would therefore increase PropSava sizing to 72KVA, plus 20% safety margin for future expansion and/or extreme loads; so  $72 \times 1.2 = 86.4$ , or 90KVA. Clearly, you have the option here to install Power Factor Correction System to increase the Power Factor closer to Unity (1.0) and would then need a lower KVA size of PropSava. The decision as always will be based upon cost and return on investment.

Please ask a qualified Electrical Engineer to carry out this assessment of KVA needs for your site/property.

## Quick Check Method: We would always advise you to use a Qualified Electrical Engineer to carry out this calculation.

Check all the equipment in the property and calculate the total KVA. The result of this calculation should produce a starting point for sizing the KVA value of the PropSava Power Optimiser. We then need to compensate for the difference in existing Power Factor if less than unity (1.0) and an additional 20% for future expansion and/or peak load safety margin of the PropSava. This KVA value should be at least 20% more than the total equipment loading – and usually equal to the KVA rating of the main breaker switch.

### Breaker Box Loading:

It is always a good idea to check that the Power Breaker Amp rating is sufficient for the current load of the site, plus 20%. To calculate the Power Breaker Amp rating on a 3 Phase System you should add the total value of all three fuses. This total value in Amps should then be changed to KVA using the formula given below. The total Power Breaker rating, expressed as KVA, should be equal to the size of the PropSava. If not, we suggest that you consider upgrading the Power Breaker to this size – although not required for the installation of the PropSava it is considered good practise. Please consult a qualified Electrical Engineer for this assessment.

## Example Calculations of PropSava Sizing:

To calculate the size in KVA of the PropSava, you need to know the outgoing main voltage (the voltage you want the Power Optimiser to be set at), times by the 1.732 (this is the square root value of 3) divided by 1,000 to produce a KVA rating. Then divide the KVA rating by the Power Factor and add 20%.

**Example 1:** Total load of all electrical equipment in property is 200 Amps.

E.g. Breaker Amps = (3 single fuses of 100 Amps) 300 Amps, outgoing main voltage = 380 (single phase equal to 220 volts per phase), existing Power Factor of 0.8:

$300 \text{ Amps} \times 380 \text{ Volts} \times 1.732 / 1,000 = 197.45 \text{ KVA} = \text{Main Power Breaker Size.}$

$200 \text{ Amps} \times 380 \text{ Volts} \times 1.732 / 1,000 = 131.63 \text{ KVA} = \text{Property/Site Load}$

Now calculate the KVA load with the existing Power Factor:

$131.63 / 0.8 = 164.54 \text{ KVA}$

Now to finalise the sizing of the PropSava we must add 20% to ensure future system expansion and the peak load safety margin.

$164.54 \times 1.2 = 197.45 \text{ KVA}$

## Difference between Main Power Breaker and Property/Site Load:

$197.45 - 197.45 = 0$

Power Breaker Switch and PropSava size are equal and therefore acceptable.

197.45 KVA is not a standard size so round up to 200 KVA – **Order 200 KVA Voltage Optimiser.**

**Example 2:** Total load of all electrical equipment in property/site is 230 Amps.

E.g. Breaker Amps = (3 single fuses of 100 Amps) 300 Amps, outgoing main voltage = 380 (single phase equal to 220 volts per phase), existing Power Factor 0.72:

$300 \text{ Amps} \times 380 \text{ Volts} \times 1.732 / 1,000 = 197.45 \text{ KVA} = \text{Main Power Breaker}$

$230 \text{ Amps} \times 380 \text{ Volts} \times 1.732 / 1,000 = 151.38 \text{ KVA} = \text{Property/Site Load}$

Now calculate the effect of the KVA load with the existing Power Factor:

$151.38 / 0.72 = 210.25 \text{ KVA}$

Now to finalise the sizing of the PropSava we must add 20% to ensure future system expansion and the peak load safety margin.

$210.25 \times 1.2 = 252.30 \text{ KVA}$

252.30 KVA is not a standard size so round up to 260 KVA – **Order 260 KVA Voltage Optimiser.**

## Difference between Main Power Breaker and Property/Site Load:

$197.45 - 252.30 = -54.85 \text{ KVA}$

Power Breaker Switch and PropSava size are not equal and you should consider upgrading the Breaker Switch to a higher value; but seek advice from a qualified Electrical Engineer.

## What is the best PropSava solution for you?

If you have a good idea as to the mains problems you are experiencing and the power requirements of the equipment you wish to protect you are in a very strong position to identify clearly the best and most cost efficient solution. If you are experiencing all of the Power Quality issues identified above an online UPS (Uninterruptible Power Supply) will often be viewed as the obvious choice. But be warned, these are usually expensive to buy and have high ongoing maintenance and support costs. In many less developed countries the high technology skill sets required to maintain such systems are not readily and inexpensively available.

For most applications where the loss of mains is not really a critical issue, or can be accommodated by the use of a standby generator, the deployment of an Automatic Voltage Optimiser will be a far more cost efficient solution both in terms of initial outlay, ongoing maintenance, support costs and the required local skill sets required to install, maintain and support the solution. Be Warned - Over engineering a solution due to a lack of understanding on the power quality issues being experienced is an all too common mistake that can deeply impact your wallet!

## Why is determining the input voltage variation you are experiencing and output voltage accuracy required important?

Choosing a Voltage Optimiser with the right input variation capability is important because if its input voltage range is exceeded, then its output will increase or decrease by the same amount by which it has gone "out of limit".

In situations where there is a good mains supply, a Voltage Optimiser offering an input variation swing of  $\pm 15\%$  will usually be more than acceptable, but in more remote locations, or countries where the national supply infrastructure is less developed, variations of  $\pm 20\%$  or greater may be needed to be accommodated by the Voltage Optimiser.

As a general rule the greater the input voltage swing the Voltage Optimiser needs to correct the greater the price. An output voltage to within  $\pm 1.5\%$  /  $\pm 2.5\%$  of the preset output voltage is the norm when specifying a Voltage Optimiser. However if a lower output voltage accuracy can be accommodated by the load equipment, then the input voltage range can be extended proportionally. As the cost of the Voltage Optimiser is linked to the input voltage range it has to handle, accepting lower output accuracy may prove to be a more economical solution.

## Is Supply Frequency Important?

With most supplies operating on 50 or 60 Hz, your normal mains supply frequency is unlikely to vary more than  $\pm 2\%$ , and this is well within the capability of our Voltage Optimiser. But if the supply is from a local generator it is possible that the frequency could deviate beyond this range and suitable protection should be considered to protect both the load and the power protection system.