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POWER ELECTRONICS POWER NEWS

SUMMARY

Welcome

to the first edition of Power News for 2017.

2017 is going to be an exciting year for the Power Electronics team. We have a number of new products, both AC motor control and power quality, for release during the year. Keep your eyes peeled on our newsletters or our new look website www.power-electronics.co.nz

Our team is back to full strength after the holiday season, refreshed, raring, and ready to go, so don't hesitate to give us a call if you would like to catch up and discuss that VSD or power quality application.

All the best for the coming year!

REVOLUTIONARY NEW OUTDOOR MEDIUM VOLTAGE VSD DESIGN

On the back of the release of the hugely successful XMV660 range of medium voltage variable speed drives Power Electronics have released the revolutionary new XMV8 outdoor medium voltage VSD range.

The XMV8 is a fully self-contained medium voltage VSD solution. It can be shipped directly to site and installed on a concrete pad outdoors – no need to extend or build specialist and expensive switch rooms or plant rooms. All the protection equipment and disconnects are built inside. Simply connect your HV feed and control cables and you are ready to roll. Constructed in stainless steel to IP55/NEMA3R and then coated in a specialist C5M coating the XMV8 is designed to withstand any environment. It is designed to operate in temperatures up to 50 degC. An innovative new filter-less cooling system provides clean air for the XMV8. No external liquid cooling or air conditioning systems are required.

The XMV8 is currently operating in all extremes as far away as the deserts of the Middle East and in the snow and ice of South America with great success.

Ask your local Power Electronics sales engineer to show you our promotional video.

XMV8 OUTDOOR
MEDIUM VOLTAGE VSD

IP55/NEMA3R
50ºC OPERATION
STAINLESS STEEL
SANDSTORM PROOF

SD500SP AND SD700SP – PUMPING USING ENERGY FROM THE SUN

It is a natural fit – with expertise in both AC Motor Control and Utility Scale Solar Inverters it seems the perfect solution to tie both technologies together – enter the SD500SP and SD700SP solar pumping systems.

Everyday the sun beams down huge amounts of energy just waiting for us to capture. For many pumping applications this energy can be collected and put to use – either as "standalone" or "island" application where the only energy used is solar, or alternatively, the solar can be the primary energy source and topped up by the mains or generator connection, or vica versa. This is referred to as a "hybrid" system.

The SD500SP is great for low power "standalone" systems where there is no connection to the grid. A suitably sized PV array is connected to the VSD. An onboard Solar Pumping MPPT PLC manages the operation of the control system and ensures that the system is pumping at optimum for the given solar conditions. The PLC will turn the pump on and off automatically. Perfect for those little stock water pumps in the middle of nowhere with no electrical supply close by. It can also be used as a 'hybrid' system by connecting both PV panels and AC mains.

The SD700SP can be operated in both a "standalone" mode or in "hybrid" mode. The SD700SP uses a modified version of the standard SD700 hardware which has expanded to accommodate higher voltages and currents in the DC bus. The solar management software is written into the SD700SP firmware and is accessible thru the SD700SP display. "Standalone" operation is as per the SD500. "Hybrid" allows parallel energy sources to the VSD – one from the PV field, the second from the mains or a generator. This makes it ideal for systems where continuous controlled pumping is required but the expense of kWh purchased from the grid or diesel generator can be reduced by the addition of the solar energy. If using a generator, the generating equipment can be started and stopped via the SD700SP controls.

Don't be fooled into thinking that designing a solar pump system is just banging a couple of solar panels directly into the DC bus connection of your VSD. Solar pumping in its simplest configuration is far more complex than that. Provision must be given to sizing of the PV solar array, the appropriate string voltage, the appropriate power rating, and operating conditions in all thermal environments. It is very easy to inadvertently end up with a system that has insufficient voltage to run reliably – remembering peak generation is only for a very short period each day – or to provision for the fact that the PV panels will generate high voltage in cold sunny conditions which can lead to a voltage high enough to damage the VSD DC bus capacitors. This can be a very common occurrence in places with cold, sunny winters, like Central Otago. A good system design will take all these factors into consideration.

For more details contact your local Power Electronics sales office.

POWER ELECTRONICS

POWER FACTOR CORRECTION – DISTORTION OR DISPLACEMENT

In today's modern electrical environment power factor correction is not quite as easy to design as in years gone by. With the advent of non-linear electrical loads, like LED lighting, UPSs, High Frequency welding machines, and the associated harmonic currents, throwing a few power correction capacitors and a power factor controller in as a solution no longer cuts the mustard. This article is aimed at demystifying the types of power factor and how "Power Factor" as a term has changed.

Displacement or Fundamental Power Factor (50Hz only)

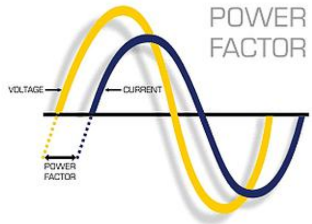
Up until the early 1980's electrical loads were very simple and normally fell into one of three categories from a power factor perspective. They were:

- Resistive – These are loads that displayed resistive characteristics only. There was no inductance or capacitance to impact on power factor. On these resistive loads the voltage and the current are in phase so no power factor correction was required. Examples of these type loads are incandescent light bulbs and heating elements.
- Inductive – These are loads that display both resistive and inductive characteristics. The inductive component of the load causes the current to lag behind the voltage, hence the term lagging power factor. These inductive loads are very common in industry and examples are AC motors, light fitting ballasts, and induction furnaces.
- Capacitive – These are loads that display both resistive and capacitive characteristics. The capacitive component of the load causes the current to lead the voltage, hence the term leading power factor. These capacitive loads are uncommon but an example is an over excited synchronous motor or capacitor.

The power factor of these leading or lagging loads was always just an expression of the magnitude that the current was out of phase with the voltage, hence the term displacement power factor. By applying the same magnitude of corrective power factor (in the case of lagging power factor, a leading power factor device needs to be connected and vica versa) the original poor power factor is cancelled out and the overall power factor improves. On most sites a practical target factor is between 0.95 and 0.99 at 50Hz.

As the vast majority of power factor correction systems are to correct lagging power factor (inductive). The fix has been to connect additional leading power factor devices such as capacitors, Static Var Generators, or an over excited synchronous motor.

During this period significant non-linear loads, such as DC drives or thyristor fired temperature controllers or motor controllers, did exist but as a total percentage of the load connected to a network were insignificant. The harmonics that they created caused little or no problem as their installation concentration was so low. So their impact on power factor was generally ignored.



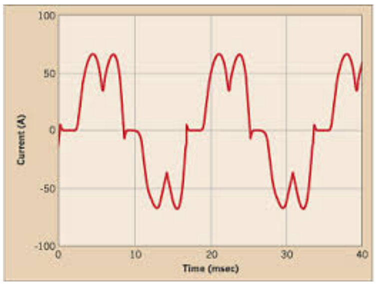
A graphical representation of a lagging power factor where current lags voltage

Distortion Power Factor

Have you ever been on site where you have continued to add capacitors to the power factor correction system but no matter how many more capacitors you add the power factor does not improve? There is a strong chance you are dealing with a site that has a high harmonic or non-linear loading.

Many modern installations contain electrical loads that have a high percentage of harmonic producing devices. Just think about a new office building. It probably has inverter heat pumps, LED lighting, countless computer power supplies, UPSs, maybe even VSDs for the air conditioning. The current drawn from the supply is quite different from a sinusoidal waveform. It can be full of peaks and troughs as per the example below. The distortion power factor is the distortion component associated with the harmonic voltages and currents present in the system. These harmonic currents are at multiples of 50Hz and add to the overall RMS current.

POWER FACTOR CORRECTION – DISTORTION OR DISPLACEMENT CONT.



A graphical representation of a typical current waveform effected by harmonics. This is the cause of distortion power factor

No amount of capacitors will fix this type of power factor. Capacitors in a power factor system are 50Hz only devices. Distortion power factor can only be improved by removing the harmonics from the system.

True Power Factor

In today's electrical environment we should be referring to and correcting the True Power Factor. The True Power Factor is simply the combination of both the displacement and distortion power factor. It is no longer adequate to take 30% of the site supply rating in KVAR, bang in a power factor controller, some contactors and capacitors and expect it to work or even last. For new installations you should undertake some modelling on the types and quantity of loads that will be connected. Strong consideration must be given to the anticipated percentage of displacement and distortion correction required. For existing sites a power quality audit should be undertaken to determine the magnitude of displacement and distortion required. Only then can a suitable solution be investigated. Power Electronics can assist with this if required.

Technology has also changed significantly. In the past displacement and distortion power factor have been corrected with individual devices - power factor correction capacitors and harmonic filters.

Now there is finally a device on the market that can correct both. The Advanced Static Var Generator (ASVG) from Sinexcel is capable of correcting leading or lagging power factor whilst at the same time correcting the 3rd, 5th, 7th, and 11th harmonics. With a modular and compact design the system is easy to expand for future requirements and the "two in one" minimises that expensive switchboard room real estate and minimises installation cost. For further details please contact your local Power Electronics office or visit www.power-electronics.co.nz and ask about the ASVG.

STOP PRESS...

The first Power Electronics XMV660 3.3KV VSD to be installed in NZ has just been commissioned at GBC Winstone.

- 50°C operation
- Multi-level, pulse-width modulation with phase shift transformer
- High efficiency and power factor at partial loads
- Low harmonics - IEE 519 compliance
- Low DV/DT - no motor derating or motor cable length restriction
- Suitable for retro fitting to existing motors
- Output voltage boost transformer tap adjustment
- Redundancy
- Rugged and maintenance friendly design

GBC Winstone's cement plant is situated at Portland, some 12km south of Whangarei and is New Zealand's largest and only fully integrated cement manufacturer.

An energy efficiency project identified significant energy savings to be had at the Portland plant by replacing inefficient damper control on the main Cooler Vent Fan with a Variable Speed Drive.

The Power Electronics XMV660 Variable Speed Drive is controlling a 235kW 3.3KV motor.

The commissioning team; Jason Curtis (Power Electronics NZ), Jacobus Vermeulen (GBC Electrical Projects Engineer) and Ramón Arnau (Power Electronics Spain)

FREQUENTLY ASKED QUESTIONS

What is the advantage of having an internal bypass contactor in my V2 or V5 soft starter?

The internal bypass contactor in the V2 and V5 is closed after the soft starter has brought the motor up to speed. The algorithm of the soft starter determines when the motor is up to speed and at that time closes the bypass contactor. The advantage of an internal bypass contactor is the SCRs in the soft starter do not need to conduct current after the start is completed. This allows the soft starter to minimise heat losses which means the unit can be installed in an enclosure with no ventilation or in an environment where heat emission is not desirable.

I see that you can supply a StaticVar generator for power factor control and an Active Harmonic Filter for harmonic mitigation. My site needs both forms of correction is there one device that can do this.

Most definitely - The Sinexcel ASVG product can be configured to perform power factor correction whilst using up to 50% of its rating for harmonic mitigation. Harmonic mitigation is limited to the 3rd, 5th, 7th, and 11th harmonics only. On most sites these are the predominant harmonics. The ASVG comes in exactly the same form factor as the SVG.

If harmonic mitigation is required for frequencies above the 11th harmonic, then an AHF can be configured to perform power factor as well as harmonic mitigation. However this can be an expensive solution.

Contact your local Power Electronics office to discuss what works best for your application.

I have just replaced an old motor with a new high efficiency motor and now we have starting issues. What is going on?

Unfortunately – This is a question we have been asked all too often of recent times. The characteristics of high efficiency motors are quite different from those of their older counterparts and this has presented customers with some significant issues, particularly when retro-fitting into existing installations.

A combination of less copper in the windings, changes in the steel type and design of the core, lowering resistance in the rotor, and improvements to windage and bearing losses are common areas where these energy efficiencies have been achieved. However, this has had an impact on the electrical characteristics of the motor.

It is not uncommon to see starting inrush currents of 12 to 15 x FLC, a major increase from the 6 to 8 x FLC we are used to seeing. This higher current has caused failures of starting contactors not rated to cope with this additional current.

In some motors the lower resistance rotors have also lead to reduced starting torques. Meaning that a load that used to break away on the old motor cannot on the new more energy efficient motor.

These problems can often be overcome with the installation of a correctly applied Power Electronics VSD.

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