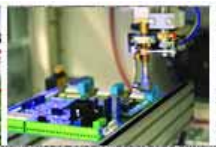
Drive Link


Serial communication from Drive Dynamics Experts in Motor Control

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Welcome to the latest edition of Drive Link for 2009.

With the onset of winter many industries are coming into their busy time conducting plant upgrades and essential maintenance. Improved efficiencies are becoming a significant focus for many companies and of course variable speed drives are a key factor in this. Our SD700 range, with the ability to operate with unscreened output cables and still meet EMC regulations, has also provided many customers with major cost savings on these projects.

Our increased stock of drives, to 450kW, has also proved valuable for many customers with urgent requirements being supplied 'off the shelf'.

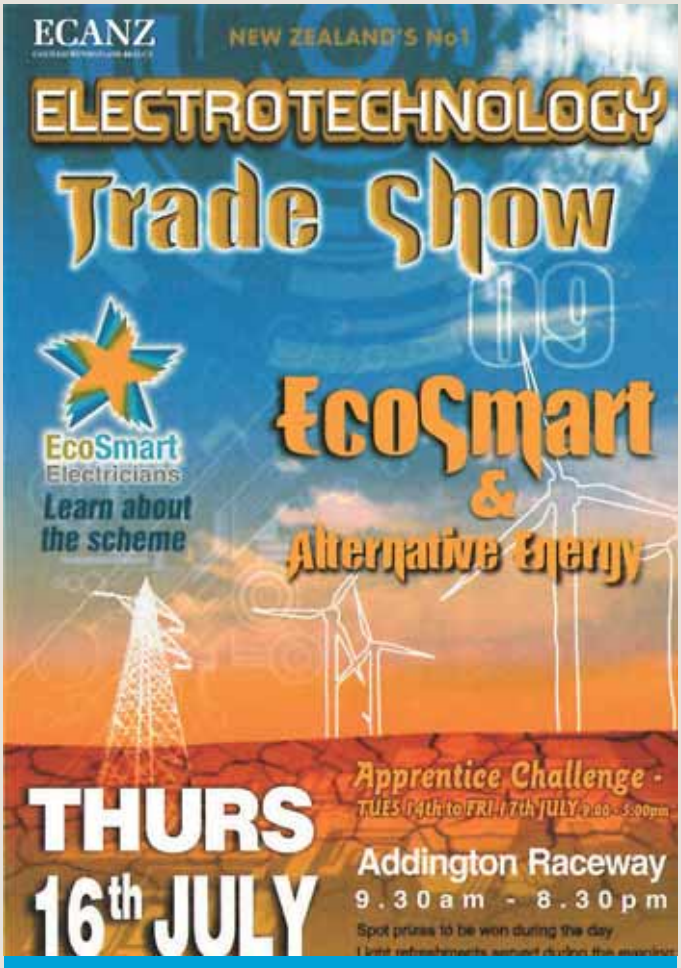
We look forward to being of service to you in the coming months.

SD700 Extension Boxes and Plinths

Frames 1 - 3 of the popular SD700 range now have termination chamber expansion boxes to give more room for terminating larger cables. Because the SD700 can handle 300m output cable runs it often becomes necessary to install oversized cables when taking voltage drop into account. These oversized cables can present a challenge when terminating on the larger current ratings of a given frame size - but not any longer. Frame one provides an additional 121mm, frame two 121mm, and frame three 151mm.

Likewise, the larger floor mounted SD700's now have additional plinth bases providing greater flexibility for terminating side entry cables, larger cables or simply elevating your SD700 to match the height of a switchboard. There are two different height plinths available. Option one adds 333mm and option two adds 533mm.

For more information give us a call or refer to the latest SD700 brochure at www.drivedynamics.co.nz



Come and visit us at Stand 107/108

Drives Key to Airport Operation

Fuel delivery systems at airports have evolved over the years and are largely the same worldwide; using a complex and energy inefficient system of fixed speed pumps and by-pass lines to re-circulate fuel as a means to control flow and pressure. This is to accommodate the wide range of fuel delivery rates, dependent on the size and type of aircraft being refueled.

The JUHI, operated by Air BP, is the company responsible for fuel supply at the Auckland Airport complex. JUHI is a company jointly owned by BP, Shell, Chevron and Exxon Mobil.

Michael Henderson manages the JUHI and he explains that nearly 3 million litres of jet fuel passes through his facility each day and is reticulated via a network of pipes below the airport apron to hydrants into which appliances connect fuel delivery hoses to enable transfer to the awaiting aircraft.

The reliability of this system is vital and aircraft must receive fuel, when they require it to achieve the shortest turn-around time.

Jet Fuel is pumped to the airport installation to three two million litre tanks via a pipeline from the nearby Wiri tank farm. The hydrant system was constructed in 1974 and since that time fuel demand has increased ten fold, as aircraft have become larger and, air travel has become the norm.

This massive growth has seen several upgrades to the original system over the years.

At the heart of the operation are four 132kW pumps. "At times of high demand, three of the four pumps can be in service at once", explains Michael. "This, coupled with an inefficient control system, encouraged Air BP to investigate ways of making the system more efficient whilst providing the highest level of flexibility and operational reliability."

Global engineering consultancy, URS New Zealand Ltd was engaged to review the original setup and recommend a solution that met their client's requirements.

Lindsay Young, Automation and Electrical Engineer for URS, proposed the use of four 132 kW Variable Speed Drives (VSDs) and a PLC system upgrade. He was working closely with colleague, David Teesdale, who was coordinating all mechanical and installation aspects of the project. URS also managed the hazardous area certification of the installation, which had to be addressed, following the installation of the SD700 variable speed drives.

There were a number of challenging aspects of the project. Firstly, the show had to go on, so there could be no interruptions to service, whilst the upgrades were undertaken. Secondly, the pumps are in a located in a zone 2 hazardous environment and are wired with Steel Wire Armoured cables .

Lindsay explains "Traditionally the addition of VSDs would have necessitated the replacement of the existing cables and specialist VSD cable installed to satisfy the NZ Radio Frequency Interference regulations. Fortunately the Drive Dynamics SD700 series of drives with their extremely high level of RFI filtering, meant that the existing cables could be retained, whilst complying with the relevant EMC standards. This was vitally important given the critical nature of radio communications in the locality and the cost benefits of being able to retain the existing cable were significant (cost being a major factor in the project viability)".

Lindsay continues; "From an interfacing perspective, the SD700 drives are currently controlled via a PLC using conventional PLC I/O. A future stage of the project is to utilise the Ethernet I/P serial communications, to enable a degree of monitoring not possible via conventional I/O. The possibility of using the communications for improved remote control has not been excluded."

The project has been extremely successful with all goals being achieved and Michael Henderson concludes "From our view point the VSD project is consistent with the Sustainability drive the JUHI shareholders are committed to".

SD700 Unscreened Cables- how do we do it?

By now you will have seen our claims and read an article about a successful installation. So how exactly do we achieve complete EMC compliance with unscreened motor cables?

In order to explain how this is achieved it is important to first understand the workings of the output stage of a VSD. Six transistors (IGBTs) are continuously switched on and off many times per second to produce a current sine wave at the required frequency for the connected motor. It is this commutation of the IGBTs that produces the electrical noise. This noise is a high frequency current signal which is coupled to the current that flows to the motor which can then be emitted by conduction or radiation.

The output voltage waveform comprises a series of on off pulses which are regulated in magnitude and length in order to create the desired base frequency and voltage being applied to the motor. Figure 1 shows a typical scope trace of the voltage output of a VSD.

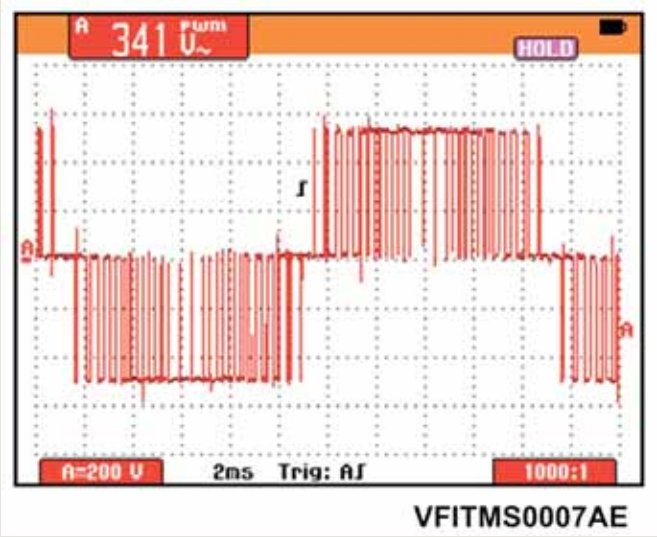


Figure 1. Typical output voltage waveform of VSD

If a single pulse is amplified it can be seen that the angle is not exactly 90 deg. It is impossible for an IGBT to be off and on at the same time - there must be a rate at which it turns on an off. This rate of change is called dV/dt.

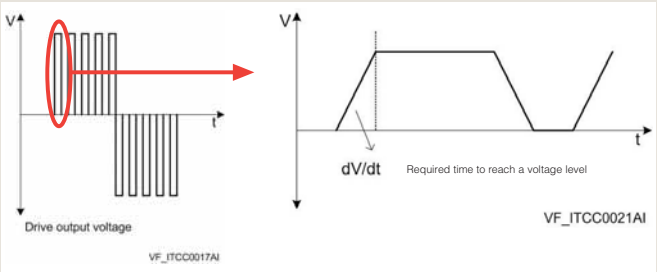


Figure 2. Drive output voltage

Figure 3. Amplified single pulse output of IGBT

The time it takes to turn on or off an IGBT results in dynamic loses. The latest generation of IGBTs reduce these losses by switching on and off more quickly i.e. the dV/dt is increased. This means there is less heat to dissipate in the drive so it can be smaller. The major disadvantage of increasing the dV/dt is the appearance of brisk over-impulses at the drive output terminals which are magnified at the motor terminals.

These over - impulses are of high magnitude and high frequency and are one of the major contributors to radio frequency interference. Remember that these over-impulses occur at every switch on and switch off point of each IGBT. A drive operating with a carrier frequency of 8kHz has 16 thousand of these over-impulses ever second! Figure 4 shows an actual output waveform of a 200A competitor drive running at full load. This represents a dV/dt of around 4000V/us.

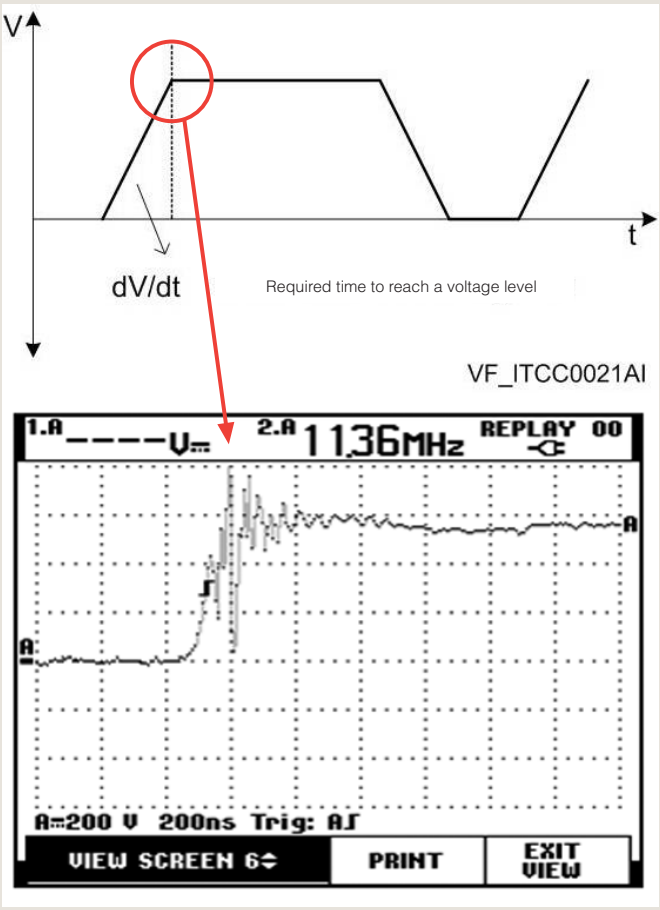


Figure 4. Actual output waveform of competitor 200A drive.

To reduce these over-impulses and thus reduce the high frequency noise caused by them, the SD700 employs unique hardware that limits dV/dt at IGBT level plus incorporates output toroids which further reduce differentially coupled noise. Figure 5 shows the actual output waveform of a 200A SD700 running at full load. There are no over-impulses. The actual dV/dt is around 500V/us.

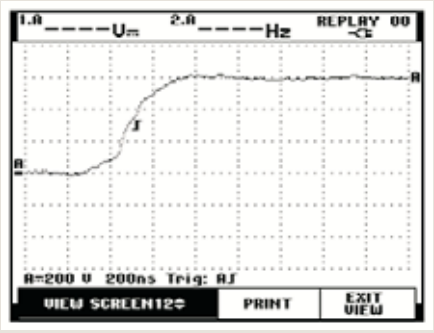


Figure 5. 200A SD700 output wave form.

In addition to the output stage design changes in the SD700 there are other features within the mechanical design that greatly assist in reducing RFI. Conventional designs utilised by most other drive manufactures result in a drive that is designed from back to front. The input rectifier stage is often at the rear of the drive with the DC bus and output inverter stage stacked on top towards the front of the drive. This design allows for the high frequency noise generated by the output stage to be coupled more easily into the input stage and thus onto the mains. Once again the SD700 moves away from conventional design by utilising a vertical architecture where the input stage is at the top of the drive and the output stage is at the bottom of the drive. This segregation makes it considerably harder for output stage noise to be coupled into the input stage. Figure 6 shows the unique vertical architecture of a frame 5 SD700.

So, is it impossible to install drives other than the SD700 with unscreened cable and still be EMC compliant? Well, no, it can be done but it is necessary to install additional hardware in the form of specialist dV/dt filters on the output of the drive. These filters typically have an interconnect to the DC bus of the drive. The drawback is that these filters are an LC design and to be absolutely sure they work need to be tuned to the output waveform of the drive. Plus, they can run very hot so need to be housed in a suitably ventilated enclosure and they can be very noisy because the high pitch switching sound normally heard in the motor is heard in the filter. To ensure compliance with IEC-61800-3 the entire package would then need to be independently tested.

The SD700 series is fully compliant with IEC-61800-3: 2004 with unscreened motor cable and has been independently tested by one of the largest EMC test labs in Europe. This same lab tests the EMC compliance of many other drive suppliers.

For more information on the EMC test results and for correct installation guidelines for the SD700 give Drive Dynamics a call on 0800 DDL VSD.

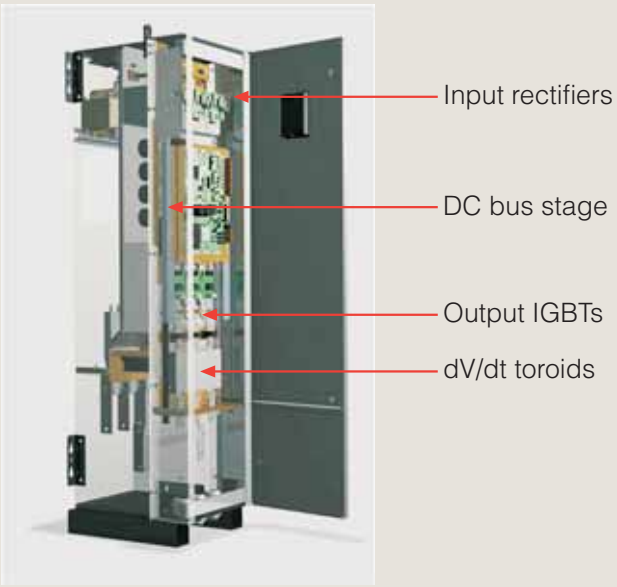


Figure 6. SD700 vertical architecture

"Drive Tips" –

Frequently Asked Questions

- Once I've finished programming my drive will the parameters be lost when I isolate the drive?

  No. On all the drive and soft starter models sold by Drive Dynamics the parameters are saved in non volatile memory. You can remove the power from the drive or s/s for as long as you like and it will retain the parameters.

- Most times when I use a drive I only want to do something simple. Do you have some simple reference guides to save me going through the whole manual?

  Yes. We have produced a number of short setup guides for each of the products. Each guide gives you a basic parameter set plus a matching control drawing. These can be downloaded from the applications page on our website. Keep an eye on this page as we do add new setup guides from time to time.

- When I program one of your drives or s/s is the program stored in the display or the main control board? Will I lose the program if I unplug the display?

  When you make changes to the setup of any of our drives or s/s these changes are stored in the main microprocessor on the control card. It is possible to upload these changes into the display of the SD700 series and SD450 series. The display on the SD250 series is actually integrated into the control board however a separate remote display can be attached and this too can upload the parameters if required. The V5 series has a display with parameters unable to be uploaded to it.

  You will not lose the program if the display is unplugged and any of the drives or s/s. In fact, you can unplug the displays while the drives or s/s are running and this will not generate a fault condition.

Drive Dynamics
Experts in Motor Control

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