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Quarterly Technical Newsletter of Australia's leading supplier of low-voltage motor control and switchgear.

IN THIS ISSUE

The thinking contactor

By Bill Mairs

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Technical Manager

Electronics has invaded many products over the past 20 years. As the cost decreases and the performance increases the applications that can incorporate electronic enhancements seem to be unlimited.

The first contactor fitted with electronic coil control appeared on the market several years ago and is proving itself to be reliable as well as providing a step increase in performance. While the modern contactor is the result of many years of refinement of basically the same principle the incorporation of electronics has allowed designers the opportunity to re-think some of the basics.

New intelligent modern contactor

The first contactor fitted with electronic coil control appeared on the market several years ago and is proving itself to be reliable as well as providing a step increase in performance.

Conventional contactors

Conventional contactors are driven by simple magnet systems, the coil of which is directly activated by the AC or DC control supply. Although simple from a design perspective, there has been an enormous amount of know-how involved

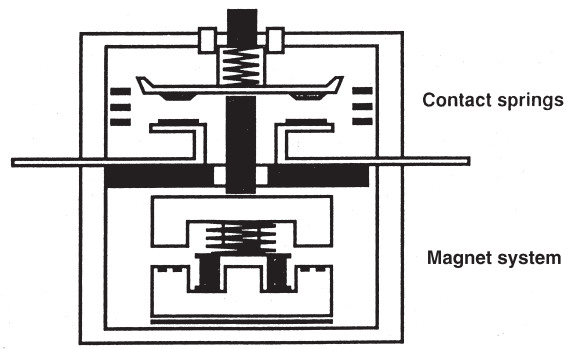
Conventional contactors
(continued from page 1)

in achieving the features already available in the modern contactor, such as wide operating parameters, low noise operation, high mechanical endurance, compactness and low cost. The force provided by conventional AC or DC magnet systems is far from optimum and designers have had to work around the inherent characteristics.

The magnet system must provide sufficient force to the contacts to ensure low electrical resistance and to prevent the contacts from lifting during periods of normal overcurrent, such as motor starting. This force must be available during all operating conditions and especially so, at the lower end of the control voltage range. This leads to increased coil consumption at normal and high control voltage conditions.

The speed of closing varies with control voltage and point-on-wave of activation.

In the case of an AC coil zero force is developed at the zero crossing point of the coil current. To overcome this, shading rings are used which produce a current out of phase with the coil current. This arrangement provides a minimum force during the zero cross over but it is this force that is required to provide the contact force requirements. This means that for the rest of the cycle excess force is produced.

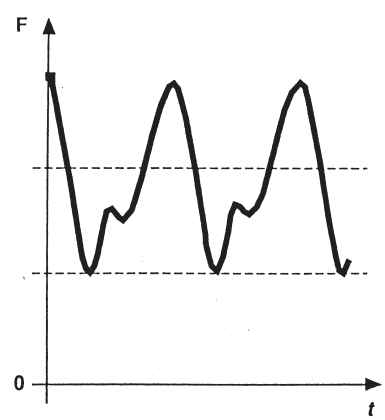


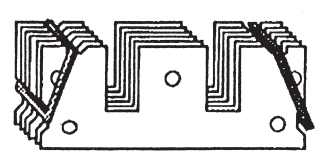
Principle design of a contactor

The AC coil does have the advantage of providing sufficient closing force in the open position due to the high initial current. The current reduces, as the air gap in the magnet system decreases, and acceptable power levels are achieved in the closed position. The speed of closing varies with control voltage and point-on-wave of activation. High closing speeds cause contact bounce and the subsequent arcing is detrimental to long contact life.

The DC magnet system has the advantage of constant force in the closed position but to achieve the required pull-in force the system is overpowered in the closed position. It is common to provide some means of reducing the power in the closed position by inserting a resistor in series with the coil, or, to switch to a different number of turns on the coil. Quiet operation is assured with the DC coil but closing speed of the contacts is still influenced by the magnitude of the control voltage.

If the control voltage is too low to allow correct closing the coil should not be energised.





AC magnet force oscillation

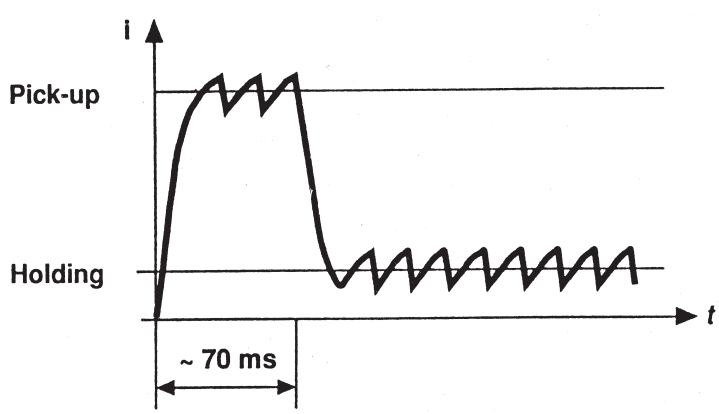
The electronic solution

To optimise the closing operation the magnet system requires a controlled electrical supply which provides high initial current to close the magnet which then drops to a level which meets the holding requirements. If the control voltage is too low to allow correct closing the coil should not be energised. The power applied to the coil should not vary with control voltage variation and the system should not be sensitive to brief supply voltage dips.

With the use of modern electronics these features can be achieved at a reasonable cost. The use of application, specific integrated circuits, allows the size of the electronic module to be reduced so that it will fit in the case of the contactor without a significant increase in the overall size.

The coil is supplied with DC voltage and by the use of current and voltage monitoring, the operation is precisely controlled. The use of electronics makes it a simple matter to provide for the contactor to be controlled directly by the low power relays provided in the PLC output modules.

The ability of the contactor to virtually think before it closes, think about and control the power during closing, hold in and to prevent coil burnout even when the contactor operation is jammed…makes the electronically controlled contactor the smart "kid" on the shelf.



Pick-up and hold-in current with electronic control

The ability of the contactor to virtually think before it closes, think about and control the power during closing, hold in and to prevent coil burnout even when the contactor operation is jammed (such as occurs with mechanical interlock operation) makes the electronically controlled contactor the smart "kid" on the shelf.

The future

While the conventional contactor provides excellent performance in most applications electronic coil control provides a significant performance step.

A contactor fitted with electronic coil control can solve some of the common problems experienced in the field.

The success of the system over the last few years has encouraged continued development and further enhancements are likely. A wider range of manufactures can be expected to offer the system as users begin to understand the performance benefits and start to specify electronic control.

Applications

A contactor fitted with electronic coil control can solve some of the common problems experienced in the field. The high current inrush

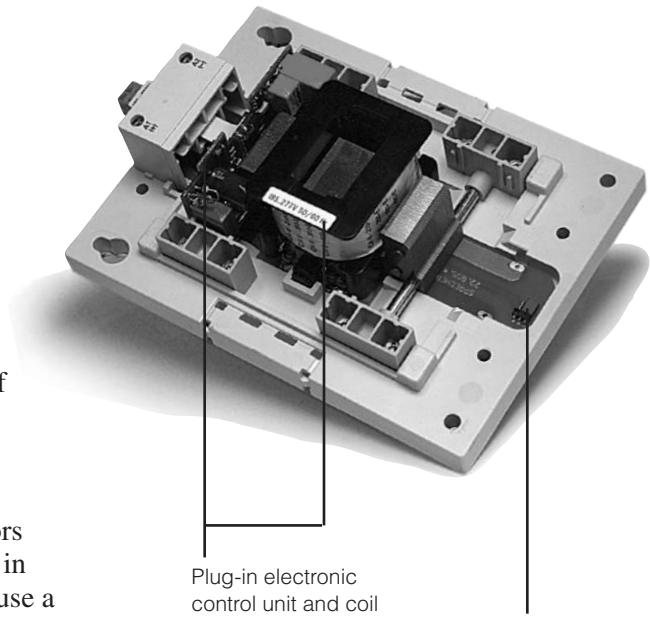
4

Application
(continued from page 3)

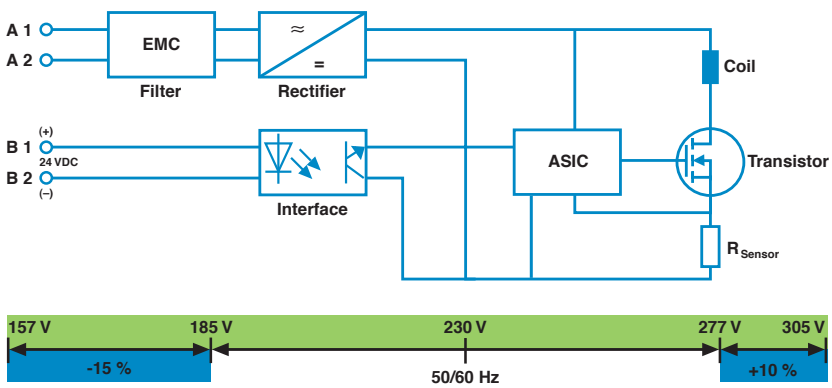
in many large contactor magnet systems can be greatly reduced. This high inrush requires higher rated control circuits and / or higher rated coil control switches. The problem becomes worse if the contactor operation is synchronised with other units.

The starting of large motors can cause significant dips in the voltage which may cause a conventional contactor to fail to close properly, or even drop out. This can cause burn out of the contactor coils and damage to the main contacts. The precise pull-in and drop-out of the electronic control can prevent erratic operation.

The life of the contactor is more predictable in high use applications as the influence of control voltage variation is greatly reduced.



This view shows the electronic coil control system of the CA6 contactor designed by Sprecher + Schuh.



The electronic circuit of the Sprecher + Schuh CA6 contactors allows a very wide operating voltage with precise opening and closing levels. The design includes EMC filters and a built-in PLC interface.

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