IPEC ENGINEERING holds substantial expertise and experience in the design of high quality Electronic Controllers to provide control, drive and monitoring of Permanent Magnet (PM) Actuators to drive Medium Voltage VCBs. IPEC ENGINEERING is one of only a few companies in the world who can combine actuator design, electronic drives and advanced microcontroller technology to provide ‘holistic’ solutions for the new generation of PM Actuator VCBs.

Technology

IPEC ENGINEERING MAGACT® controllers utilise robust and reliable, military specification Field Programmable Gate Array (FPGA) technology with all intelligent control logic and strategy software programmed. Sophisticated multi-layer PCBs are utilised alongside complete opto-isolation for a compact system with outstanding EMC immunity. The output current pulse timing from the controller can be easily hardware programmed according to the control requirements of the VCB offering an extremely flexible solution to the customer.

Introduction
IPEC ENGINEERING MAGACT®
PM Actuator Electronic Controller Features:

- All Controller inputs and outputs are opto-isolated to provide excellent EMC immunity and reliability.
- Military-Specification FPGA (Field Programmable Gate Array) technology is at the core of the controller which ensures reliability of operation in harsh environments and a wide frequency range.
- Universal voltage supply range from 12 to 300 Vac or dc depending on the customer’s or the installation requirements.
- Variable Close Pulse, Trip Pulse and Trip Pulse Delay timing which is fully hardware programmable and suitable for all single-coil PM Actuator designs.
- Intelligent 'closed loop' control and switching of the coil current minimises energy consumption and ensures reliable O-CO operation – refer to Figures 1 and 2.
- Coil current is precisely controlled using high quality MOSFETS ensuring a controller working life of a minimum of 500,000 operations.

Technical Discussion:
Figure 1 shows the operation of a PM actuator using IPEC ENGINEERING’s Intelligent MAGACT® Electronic Controller with 'Closed Loop' Control. In this case the controller is programmed to emit the coil current pulse until a positive signal is received back from the microswitch position indicators (in this case the contacts ‘closed’ indicator). This ensures successful operation of the actuator in situations such as rapid reclose operations whilst maintaining maximum efficiency. This provides the opportunity for a smaller, more cost effective electrolytic capacitor bank.

Figure 2 shows the operation of the same PM actuator using a standard electronic controller. This shows that any current flowing after the end of actuator operation is wasted energy. If the current pulse duration is reduced with such a controller (to try to save energy) reliable sequential operation over the life of the VCB cannot be ensured. This is particularly true when contact wear in the VI and mechanical wear of the mechanical drive results in changes in the operating time of the VCB after extended
Typical Configuration of a MAGACT Actuator Capacitive Drive

**External Connections**
- Capacitor(s)
- AC / DC input
- DC / DC and / or AC / DC converter connections
- Actuator Coil
- Indicators & Counter Outputs (Open, Close, Alarm & Voltage Level LEDs)
- Auxiliary Contacts (options of 1, 3 or 5)
- Position Sensors (for contact status and ‘closed loop’ control)
- Remote (Protection Relay) Inputs
- Local (Manual) Operation inputs

**Environmental**
- **Temperature** Operating: -40°C to 70°C
- **Humidity** 10 to 90% RH, non-condensing at 40°C
- **Power** Universal supply: 12 to 300 Vac or dc depending on customer requirements. Utilising AC/DC or DC/DC converters.

**Applications**
PM Actuator Controller for VCBs and Autoreclosers

**Standards**

**EMC tests passed by MAGACT® Electronic Controller**

**EMC - Immunity Tests**
- EN 61000-4-2: Electrostatic discharge
- EN 61000-4-3: radio frequency disturbance
- EN 61000-4-4: Fast transient burst
- EN 61000-4-6: electrical pulse surge
- EN 50155: Variations and interruptions of voltage supply

**EMC - Emissions Tests**
- EN 55022 Class A: Electric field radiated emissions
- EN 50121-3-2:2000: Power line conducted emissions

**Environmental**
- IEC 68-2-30-1980
- IEC 529-1989

**RFI and Interference Tests**
- ANSI / IEEE C37.60.6.12 - 1981
- ANSI / IEEE C37.60.6.13 - 1981
- ANSI / IEEE C37.60.6.14 -1981
- ANSI / IEEE C37.90.1 - 1989
- ANSI / IEEE C37.90.2 - 1987

**Impulse Tests**
- ANSI / IEEE C37.60.6.2 - 1981
- IEC 255-5 - 1977

**Vibration and Shock Tests**
- IEC 255-21-1-1988
- IEC 255-21-2 - 1988
- IEC 255-21-3 - 1988

**ESD Test**
- IEC 255-22-2-1996

**Burn - in**
Twenty temperature cycles from ambient to 75°C over 48 hours

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