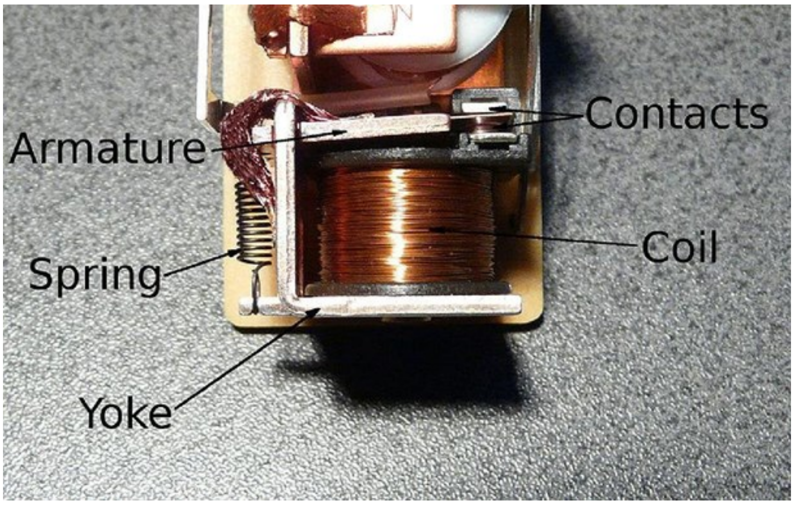
Technical Note 133

Relays and Pumps

Introduction

Throughout the industry there are increasing reports of relays failing in dosing controllers similar to the CRONOS® and CRIUS®4.0 from Pi. Why is this and what can we do about it?

Relays



A relay is an electromechanical device normally consisting of two arms, a solenoid (coil) and a spring.

The two contacts are connected to a circuit and if they come together they close the circuit and current can flow. The contacts are drawn together by a small current flowing through the solenoid. The contacts are held apart by the spring.

Relays are used to turn things on and off. Typically these can be lights or alarms, or in a control situation; a pump. This often means switching 110VAC or 220VAC. The bigger the relay the more current it can switch. This is analogous to a fuse, the higher the rating of the fuse (the thicker the wire), the more current it can carry. It is important therefore that the current used by the pump isn't higher than the current rating of the relay. Unfortunately it isn't as simple as just checking the rating on the relay and the current draw of the pump.

Pumps

Pumps come in all shapes and sizes, costs and qualities. They draw a known current and this is normally quoted on literature and in manuals. A small dosing pump used in the pool industry could draw for example 0.5 Amps. If the relays in a controller are rated to 4 Amps this should be fine, HOWEVER, even if the current draw of the pump is less than the rating of the relay, problems can still occur.

What's the problem?

When a pump first starts and stops it draws significantly more current than when it is continuously running. This current is called the "inrush current" and it only lasts a very short time, often only milliseconds. Expensive pumps contain electronics that manage and reduce that surge of current, by spreading it out over a longer time so that it never gets very high. Unfortunately that inrush current protection costs money and in the ultra competitive world of pump manufacturing, sometimes it is taken out.

So what happens?

When a pump without this inrush current protection is turned on a surge of current flows through the relay as it opens and closes (it sparks) and if the current is high enough it will put too much energy into the relay contacts, melting the surface and welding the contacts together.

As an example, Pi recently borrowed a well known pump, from a well known supplier. The literature that came with the pump gave it's current draw as 0.54 Amps but didn't specify the inrush current; when asked, the supplier didn't know what the inrush current was. Pi then measured the inrush current and it spiked up to 60 Amps for 3 microseconds as the relay closed and up to 20 Amps for 3 microseconds when the relay opened.

The current flow of up to 60 Amps, over a number of cycles can destroy a relay rated to 10 Amps (as they are in the CRONOS®, CRIUS®4.0 and other controllers on the market).

What can we do about it?

There are a number of things a user can do to ensure that the current flowing through a relay doesn't damage the relay.

1. Pay more for a better protected pump. (At least demand to know the inrush current from your pump supplier).
2. Use a bigger rated relay. (A 60 Amp rated relay is a significant size and won't fit in a standard controller. It is possible to fit a secondary external relay that will protect the relay in the controller. This uses the smaller relay to switch the larger relay which carries the current. See Fig.2.).
3. Use a pump with a volt free switching function. In this configuration there is no inrush current and therefore no problem.

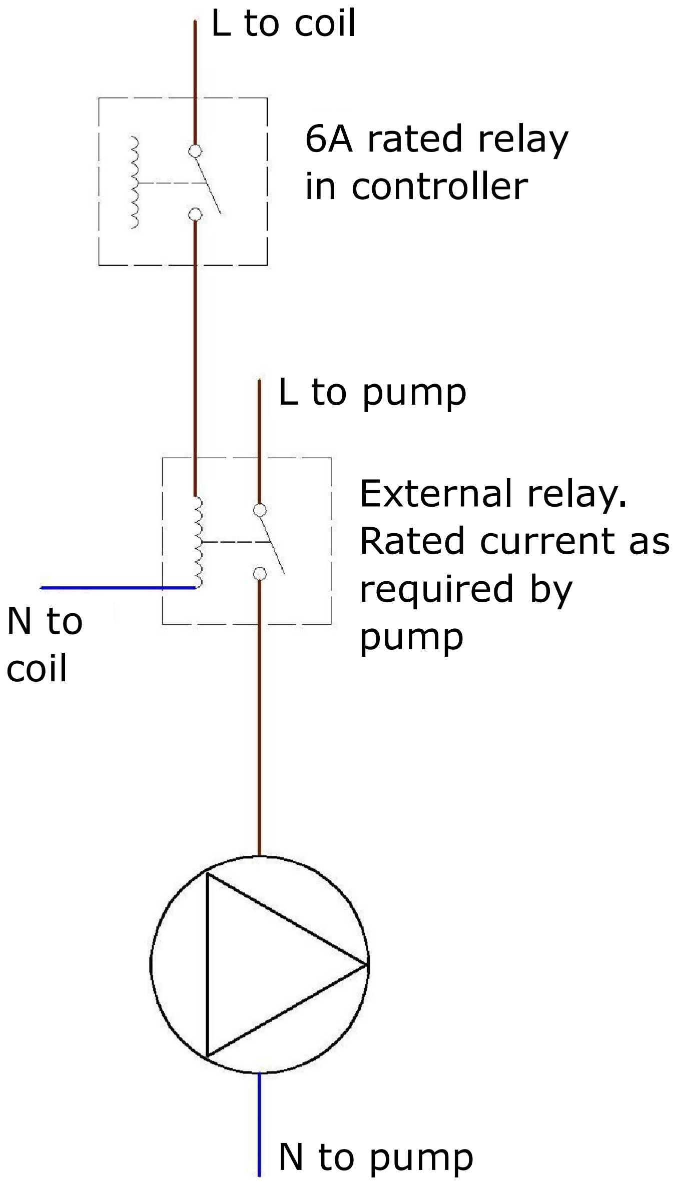


Fig.2 Diagram showing where a secondary external relay would be fitted.

If you are worried about your pump in use with a Pi CRONOS® or CRIUS®4.0 controller, please discuss with your Pi equipment supplier or contact sales@processinstruments.co.uk.