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The Importance of Suppression Circuit Design for Electric Clutches and Brakes

By Greg Cober, Warner Electric Sales and Product Training Manager



A trend that has progressed over the past decade has been a move by machine designers to use programmable controller outputs to provide the power and switching for their electro-magnetic clutches and brakes. While manufacturers of clutches and brakes make power supplies and controls that are designed to integrate cleanly for controlling their products, in some applications the programmable controllers can do the job almost as well. It is the “almost” that is the concern.

Before proceeding, a couple of issues need to be addressed. Electromagnetic clutches and brakes work on DC power. Power supplies are used to convert AC power to DC power through a rectification circuit. They provide an on-off function, full power or no power. Commonly these are 24- or 90-volt DC power supplies. Controls also provide the AC to DC conversion but also allow for changing the output of the clutch or brake. By applying less than full voltage to an electromagnetic unit, less than full engagement force is created. For a given load, the result of the lower torque will be a longer engagement time which may be desirable in the event of a load that might tip over and spill after too abrupt of a stop.

When electric clutch/brake manufacturers build power supplies or controls, they include a suppression circuit in the design. This circuit provides two functions. First it protects the electronics in the system from spikes that are created when a coil is shut off. When a coil is shut off, a spike or back electromotive force is created which will, over time, damage electrical components. Simple suppression (Fig 1., Circuit A) protects from this.

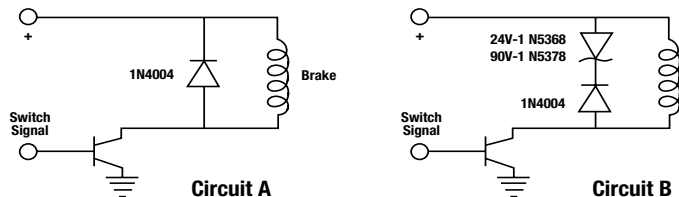


Figure 1: Simple circuit design with the proper diode designations for either 24-volt (Circuit A) or 90-volt (Circuit B) power supplies.

The second value has the impact on clutch or brake performance. The value of using a zener diode suppression circuit (Fig. 1, Circuit B) is that it will reduce the decay time needed for magnetism to leave the clutch or brake. With the lack of a proper suppression circuit, the time for magnetism to depart a unit can be significant and can lead to long release times for the unit. In cycling applications, this can result in inaccurate starts and stops as well as aggressive wear.

The solution for this is quite simple. When a clutch/brake is used with a programmable controller, a designer will include the diodes needed to provide coil suppression into their wiring harness.

The chart below shows the engagement performance for a simple spring set brake. In this unit, the time to apply the brake is directly related to the time it takes for the magnetism in the unit to dissipate.

As shown in the chart, when the dual-diode design is used, the time for the magnetism to dissipate and for the brake to engage is significantly faster when Circuit B is used rather than with Circuit A.

By using this simple circuit design, electromagnetic clutch/brake users can ensure crisp, repeatable cycling while achieving the full design life of the units.

Brake/Apply Release Time (Typical Values)

Model	Brake Release Time (Seconds)		Brake Apply Time (Seconds)			
			Suppression Circuit A		Suppression Circuit B	
	24V	90V	24V	90V	24V	90V
ERS-26	0.03	0.03	0.04	0.04	0.01	0.01
ERS-42	0.05	0.06	0.10	0.10	0.01	0.02
ERS-49	0.07	0.08	0.15	0.15	0.02	0.02
ERS-57	0.11	0.11	0.15	0.15	0.02	0.02
ERS-68	0.16	0.20	0.20	0.20	0.03	0.03

Note: Release and Apply Times are armature engagement and release only.

About Altra Industrial Motion

Altra Industrial Motion (NASDAQ:AIMC) is a leading multi-national designer, producer and marketer of a wide range of electromechanical power transmission products. The company brings together strong brands covering over 40 product lines with production facilities in nine countries.

Altra's leading brands include Boston Gear, Warner Electric, TB Wood's, Formsprag Clutch, Wichita Clutch, Industrial Clutch, Ameridrives Couplings, Kilian Manufacturing, Marland Clutch, Nuttall Gear, Bauer Gear Motor, Stieber Clutch, Twiflex Limited, Bibby Turboflex, Matrix International, Inertia Dynamics, Huco Dynatork, Lamiflex Couplings, Ameridrives Power Transmission, Delroyd Worm Gear and Warner Linear. For information on any of these technology leaders, visit www.AltraMotion.com or call 815-389-3771.



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