Application Note AN0106: Power supply for electric actuator

Introduction

The power supply is an important component in an actuator application. Many parameters must be considered when choosing a power supply for actuators; however, some of the important – yet ignored aspects – are “inductive load capabilities” and “back EMF capabilities”. The inductive load capabilities are relevant when the actuator starts and back emf comes into play when the actuator stops. Other parameters, which should not be neglected are nominal current consumption and “stall current” when the actuator meets a hard stop.

Starting an actuator

At the peak moment when an actuator is started, the armature in the DC-motor is stationary and there is no counter EMF (E_{CEMF}) being generated. The only component to limit starting current (I_a) generated by E_t is the armature resistance (R_a), which, in most DC-motors, is a very low value (approximately one Ohm or less), as shown in the equation…

$$I_a = \frac{E_t - E_{CEMF}}{R_a}$$

For a standard Concens actuator the starting current is the same as the DC-motors stall current:

- con35-12V: 9.4 A
- con35-24V: 5.2 A
- con50-12V: 43.7 A
- con50-24V: 31.2 A
- con60-24V: 83.7 A

The inrush current depends on load being applied for around 200 ms, i.e., the power supply must be able to handle this high current for a minimum of 200 ms. This can be achieved if the power supply that is used, is able to supply the full current or if it is built for high inductive loads, i.e. a boost function or a blanking window.

Using a controller

One way to reduce the effects of the inductive load is to use a controller between the power supply and the DC-motor. When using a controller, the possibility of slowly increasing the voltage and thereby also the current flowing to the actuator is available. This will reduce the need for current from the power supply significantly – to 1/3 or 2/3 – but it is still important that the power supply can handle inductive loads.

Stopping an actuator

When stopping an actuator by removing the power from the DC-motor, the actuator will start to act as a generator. This generation of power is called EMF (electric motoric force) and it sends power back to the power supply. The power supply will – in most cases – see this as a too high

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current or short circuit and shut down.
In many cases, this can also be avoided by using a controller, but sometimes it is necessary to use other means if the power supply is not able to handle it. This could be an active break load controller or similar.

How to choose the correct power supply?

It is recommended always to use an actuator with integrated controller or to install an external controller in the application and in addition to this always use a power supply, which is designed for use with inductive loads.

All Concens controllers (integrated or external) have parameters, which allow adaption to the specific application. These parameters are referred to as “Max current delay”, “I-trip delay” or similar. Correct adjustment of these settings avoids an over sensitive system, which stops on small current fluctuations. Standard values for these parameters are 100ms to 500ms, which define that the current is allowed to exceed the limit for a given period. The limit is normally referred to as “Over current level” or “I-trip level” and the recommended values for Concens actuators are as follows:

- con35-12V: 4,5 A
- con35-24V: 2,5 A
- con50-12V: 20 A
- con50-24V: 9,5 A
- con60-24V: 15 A

Rule of thumb

As a rule of thumb, it is recommended to use a power supply, which has 50% more capacity than the actual need or with at least 50% power boost. Below is shown a good example of a power supply for icon60 or con60 with external controller.

POWER SUPPLY

- AC 100-240V Wide-range Input
- Width only 82mm
- Efficiency up to 93.9%
- ATEX and IECEx Approved (-A1 Version)
- -C1 Version with Conformal Coated PC-board
- 150% (720W) Peak Load Capability
- Safe Hiccup^{PLUS} Overload Mode
- Easy Fuse Tripping due to High Overload Current
- Active Power Factor Correction (PFC)
- Negligible low Inrush Current Surge
- Short-term Operation down to 60Vac and up to 300Vac
- Full Power Between -25°C and +60°C
- DC-OK Relay Contact
- Quick-connect Spring-clamp Terminals
- 3 Year Warranty

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Please note the “150% Peak Load Capacity”, which support the 50% power boost mentioned above. Furthermore, the documentation states the following, i.e., it is designed to handle both EMF and inductive load.

22.2. Peak Current Capability

Solenoids, contactors and pneumatic modules often have a steady state coil and a pick-up coil. The inrush current demand of the pick-up coil is several times higher than the steady-state current and usually exceeds the nominal output current (including the PowerBoost). The same situation applies when starting a capacitive load.

22.3. Back-feeding Loads

Loads such as decelerating motors and inductors can feed voltage back to the power supply. This feature is also called return voltage immunity or resistance against Back- E.M.F. (Electro Magnetic Force).

22.10. Inductive and Capacitive Loads

The unit is designed to supply any kind of loads, including unlimited capacitive and inductive loads.

Summary

In summary, it is important to take the following aspects into consideration when choosing a power supply for an actuator application:

- Power supply must be able to handle 150% of required current or have 50% boost
- Power supply must be designed to handle inductive load
- Power supply must be designed to handle back EMF

Please contact support@concens.com for further information.

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29.12.2023 – MTS/RL

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