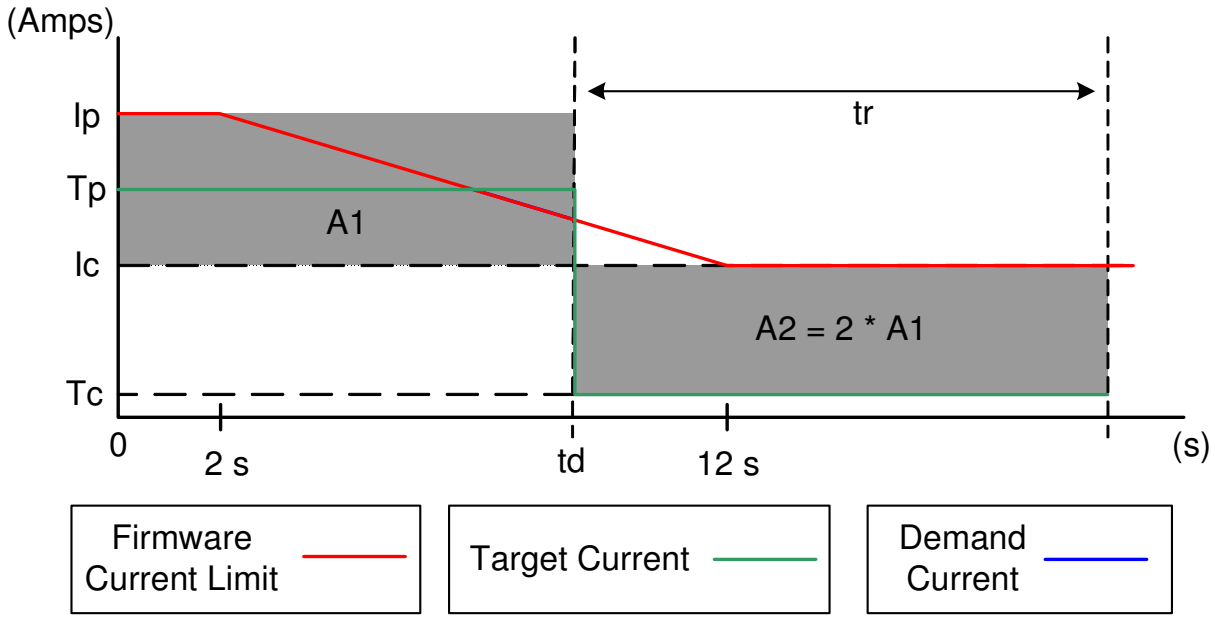
AMC Digiflex Drive Peak Current Recovery

Introduction

All AMC Digiflex servo amplifiers employ a current limiting feature that limits the amount of current available from the drive. The feature is designed to protect the amplifier from damage and prevent excessive current from reaching the motor. The user is allowed to adjust (using AMC's DriveWare or DriveSuite) the amount of peak and continuous current anywhere below the hardware current limit envelope (red line in Figure 1)

The hardware current limit envelope allows peak current for 2 seconds and then a maximum fold back time of 10 seconds (assuming the amplifier's rated peak current is used for the full 2 seconds). It is possible to set a fold back time via software longer than 10 seconds as long as the entire foldback shape does not intersect the hardware envelope anywhere (red line in fig 1).

Digiflex Current Foldback Envelope



ADVANCED MOTION CONTROLS

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As a basis for this description, Figure 1 is assumed to have current limits set to max values. For all AMC amplifiers, max current limit values correspond to the following:

1. Peak current limit is set to the amplifier rated peak current. Rated peak current time is never allowed for more than 2 seconds.1
2. Continuous current limit is set to the amplifier rated continuous current. Fold back to rated continuous current is no longer than 10 seconds if rated peak current is used for 2 seconds.1

The peak and continuous currents of AMC Digiflex amplifiers may be set below the corresponding rated values, but never above the hardware limits (Figure 1, Red Line)
For simplicity, this paper uses a square wave target current command.
In Fig 1, Target current is arbitrarily held constant at Tp for some time (td) less than 12 seconds. As the Target current resides above Ic (continuous current line), a counter increments up until the target drops below Ic (to Tc in fig 1). While the counter increments, area 'A1' is calculated (shown in the gray area of Fig 1) based on the difference between Ip and Ic. As soon as the target drops below the Ic line, the counter begins to decrement in order to recover the area spent while target was above Ic. The counter decrements half as fast as it increments, therefore twice the area spent is what must really be recovered.
The following equations may be used to determine how long before the full peak current may be applied again. This is assuming a square wave pattern on the target Current command where the target is held constant above the Ic line and then drops instantly to a constant below the Ic line.

Equation 1: $A1 = (Ip - Ic) \cdot td \quad 2 < td < 12$

Equation 2: $tr = \frac{2 \cdot A1}{(Ic - Tc)} \quad Tc < Ic$

Variable description:

Ip = Drive Peak Current Rating
Tc = Continuous Target
Ic = Continuous Current Setting

td = Time when target drops below continuous current setting

tr = Recovery Time

Example 1:

Ip = 12 Amps
Ic = 6Amps
td = 8 Amp command for 9 s. (This is equivalent to 2 seconds of peak current and 7 seconds of fold back)
Tc = 1.2 Amps; from a value of 8 amps.
(12-6)*9 = 54
(2*54)/(6-1.2) = 22.5 Seconds

tr = **22.5 seconds**

This means it will be 22.5 seconds before the amplifier will allow the user to send a peak current command for 2 seconds with the 7 seconds of foldback again.

The amplifer would give 12 amps again with less than 22.5 seconds recovery time, but then the full 2 second peak period may not be available.

[1] Projects that require extending the hardware envelope may be considered if sufficient quantity is met. Contact AMC at http://www.a-m-c.com/download/form/form_salesengineering.html for more details.