EMERSON
Industrial Automation

Application Note CTAN #120

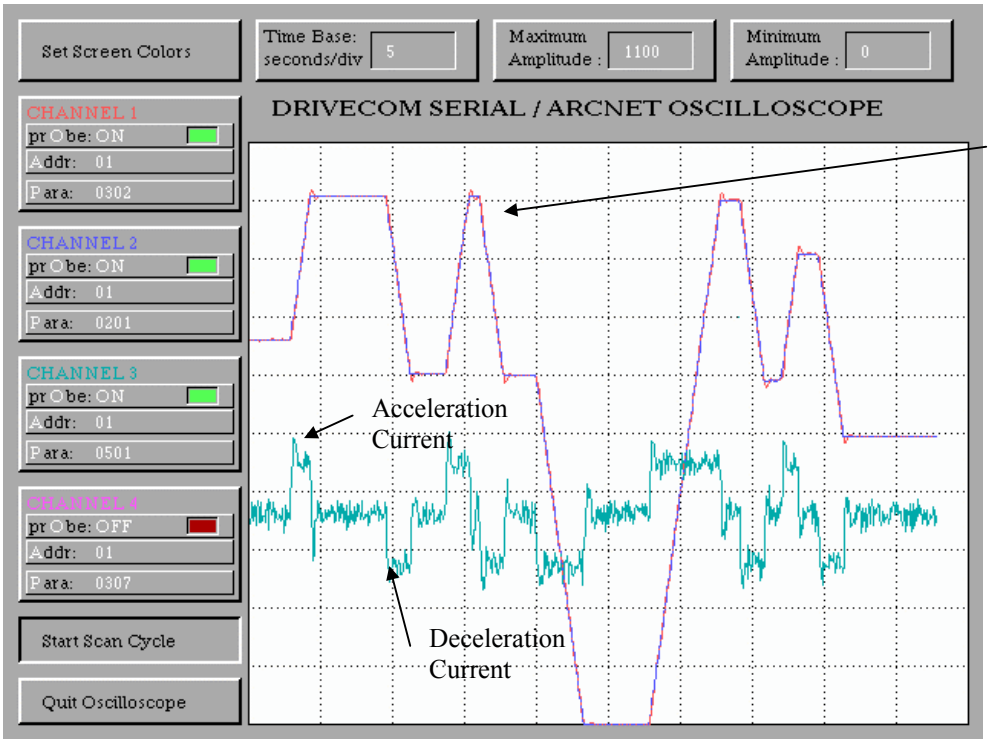
The Application Note is pertinent to the entire Control Techniques Drive range.

S-Ramp Accel/Decel Ramps

This application note attempts to illustrate the dramatic positive effects that S-Ramps can have on a drive system versus using standard linear ramps. When one looks over normal industrial applications, there are few that actually need or require the more precise linear accel/decel ramp. We know that sudden changes in speed causes stress on the mechanical drive train (chains, belts, gearbox etc) not to mention an in-rush of line current. These negative effects can be reduced significantly with the application of S-Ramps (even the more simplistic pseudo-S) as described in this article.

Effect of Motor Current without S-Ramp

The waveform shown below illustrates the application of linear accel/decel ramps and the resultant current requirement to achieve that linear ramp. Note that the resultant current demand is the derivative of the linear ramp. (The derivative of velocity is acceleration-acceleration torque requires current)

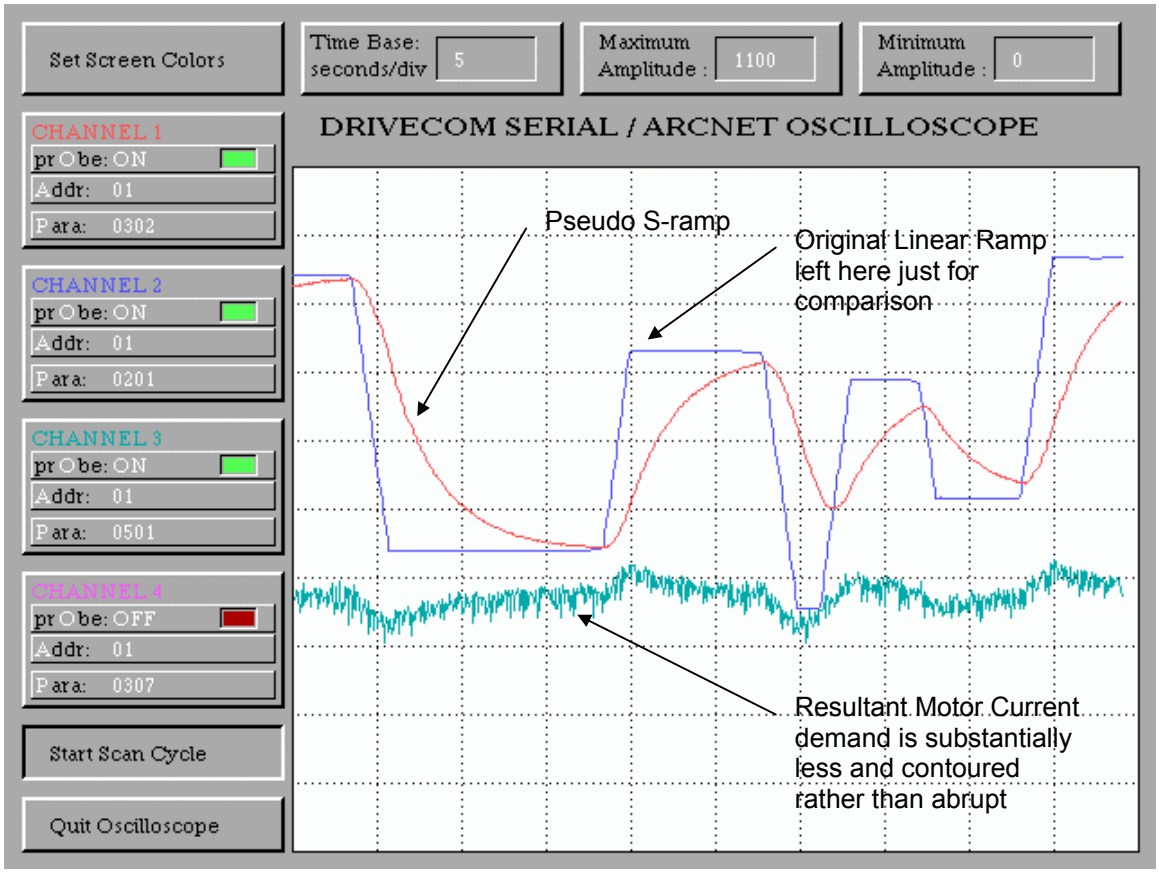


The most disturbing part of this waveform is the sudden and abrupt demand of current required from the power line/drive in order to satisfy the requested linear ramp- (which is set for 10 seconds to full speed – not all that demanding – 5 seconds would be even worse!). This sudden demand of current is what makes lights go dim, causes isolation transformers to groan and places stress on fusing etc. This sudden surge of current causes a sudden surge in motor shaft torque which results in undue mechanical strain- specifically if the load doesn't need to follow a linear accel/decel time.

SCIENCE GATE Your Automation Partner
SCIGATE AUTOMATION (S) PTE LTD
No.1 Bukit Batok Street 22 #01-01 Singapore 659592
Tel: (65) 6561 0488 Fax: (65) 6562 0588
Email: sales@scigate.com.sg Web: www.scigate.com.sg
Business Hours: Monday - Friday 8.30am - 6.15pm

Result of Motor Current with S-Ramp

The waveform below illustrates the use of a pseudo S-Ramp (not quite a pure S but good enough to achieve the desired effects). Note minimal transition disturbance as compared with the linear plot (previous plot) on the resulting current waveform. The S amount would not have to be quite so heavy and still would have had a diminishing effect on the resulting current demand.



(waveforms as captured using Drivecom for Mentor/Quantum & Unidrives)

Conclusion

One can readily see the advantage in using S-Ramp Accel/Decel for general purpose applications. It reduces current in-rush demands, mechanical stresses and may also help tame those high inertia situations as the S ramped reference will be much easier to follow than the corners of the linear reference.

The Unidrive has a pure symmetrical S-Ramp function built-in. To use it one needs only to set parameter #2.06=1. The amount of S can be adjusted with parameter #2.07.

A pseudo S-Ramp can easily be implemented with the Mentor II and Quantum III. See application note CTAN #121 for details.
http://www.emersonct.com/pdProducts/downloads/appNotesPDF/ctan121.pdf

Author: **Ray McGranor** **e-mail :** ray.mcgranor@emersonct.com
(716)-774-0093