BALDOR MOTION PRODUCTS

Mint™ Multi-Tasking MT Application Note

AN00118-000 - Motion Profiles

Related Applications or Terminology

- ***Trapezoidal Velocity Profile***
- ***S-Ramped Velocity Profile***

Supported Controllers

*NextMove*PCI	☑
*NextMove*BX^{II}	☑
*NextMove*ST	☑
*NextMove*ES	☑
Mint*Drive*^{II}	☒
Flex+*Drive*^{II}	☒

Relevant Keywords

PROFILEMODE
SPEED
ACCEL
DECEL
ACCELJERK
DECELJERK

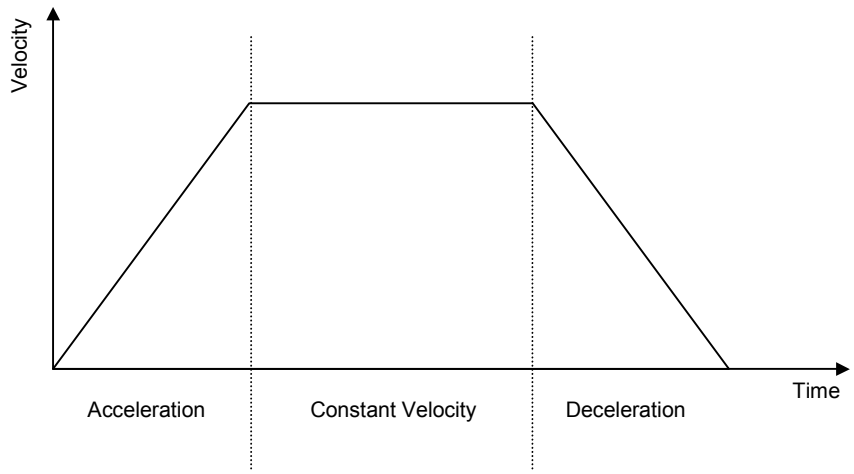
Overview

The motion of moving objects can be specified by a number of parameters, which together define the *Motion Profile*. These parameters are:

Speed:	The rate of change of position
Acceleration:	The rate of change of speed during an increase of speed.
Deceleration:	The rate of change of speed during a decrease of speed.
Jerk:	The rate of change of acceleration or deceleration.

Trapezoidal Profile

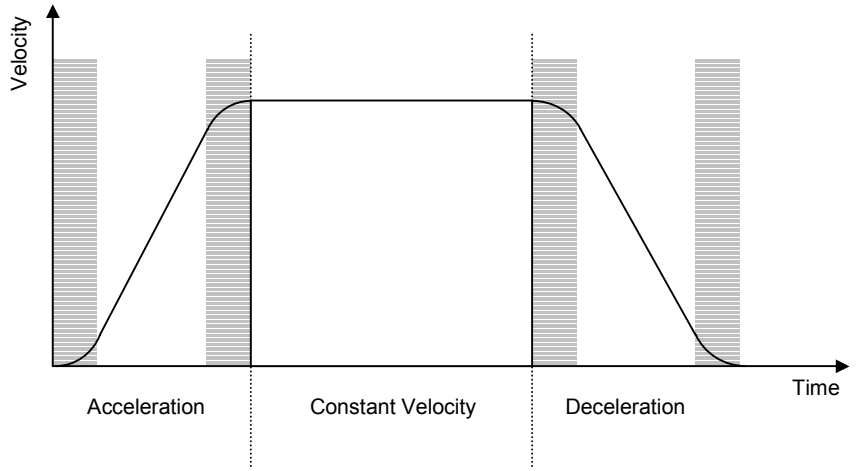
A trapezoidal profile is typically made up of three sections, an acceleration phase, a constant velocity phase and a deceleration phase.



The graph is a plot of velocity against time for a trapezoidal profile; the name reflects the shape of the profile.
For a positional move from rest, the velocity increases at the rate defined by acceleration until it reaches the slew speed. The velocity will then remain constant until the deceleration point, where the velocity will then decrease to a halt at the rate specified by deceleration.

S-Ramped Profile

An s-ramped profile can be considered as a super set of the trapezoidal profile. It typically is made up of seven sections, four jerk phases on top of the acceleration phase, constant velocity phase and deceleration phase.



The graph is a plot of velocity against time for an s-curve profile; again the name reflects the shape of the profile. The shaded areas represent jerk.
For a positional move from rest, during the jerk phase the acceleration is ramped up from zero to the specified value at the rate specified by jerk. The velocity then continues to increase at the rate specified by acceleration. The second jerk phase sees the acceleration ramped down to zero at the rate specified by jerk so that when slew speed is achieved the acceleration is zero. The velocity will then remain constant until the deceleration point, where, during the third jerk phase the deceleration is ramped from zero to the specified value at the rate specified by jerk. The velocity then continues to decrease at the rate specified by deceleration. The final jerk phase sees the deceleration ramped down to zero at the rate specified by jerk so that when zero speed is achieved the deceleration is zero.

Motion Profiles Using MintMT

MintMT can generate both trapezoidal and s-ramped velocity profiles for most move types. All motion parameters are specified on a per axis basis. The keywords for the motion parameters are:

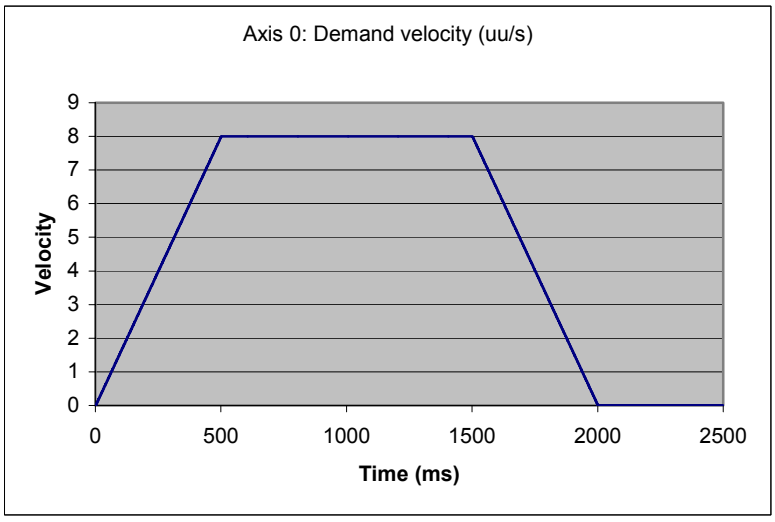
SPEED: Sets the slew speed in user units per second.
ACCEL: Sets the acceleration in user units per second per second.
DECEL: Sets the deceleration in user units per second per second.
ACCELJERK: Sets the jerk rate used on acceleration ramps in user units per second per second per second.
DECELJERK: Sets the jerk rate used on deceleration ramps in user units per second per second per second.

The type of profile generated is determined using the keyword PROFILEMODE; the default is to use trapezoidal profiles.

To perform a trapezoidal move that is 12 user units long, reaching a speed of 8 user units per second, accelerating and decelerating at a rate of 16 user units per second per second, the following MintMT code segment is required:

```
SPEED = 8
ACCEL = 16
DECEL = 16
MOVER = 12
GO
```

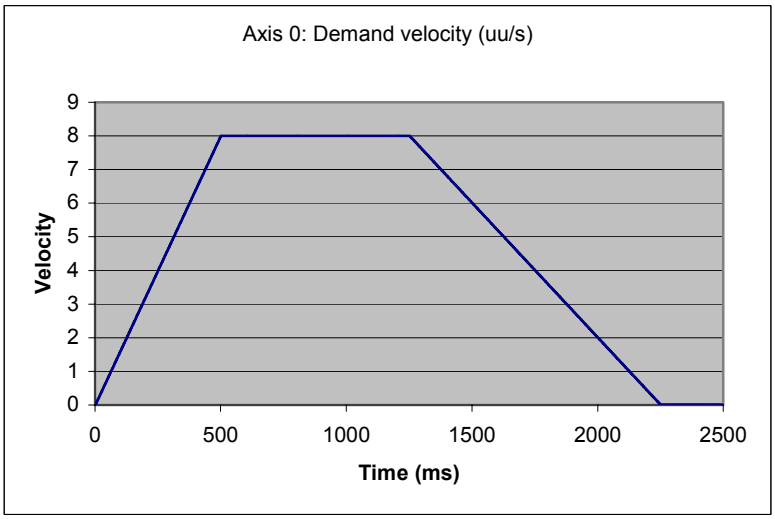
This will produce the velocity profile:



Increasing the acceleration will result in a steeper acceleration ramp decreasing the acceleration will result in a shallower acceleration ramp. The same applies to deceleration.
The acceleration and deceleration are independent values. Using a deceleration value of 8 user units per second per second:

```
SPEED = 8
ACCEL = 16
DECEL = 8
MOVER = 12
GO
```

Will produce the velocity profile:

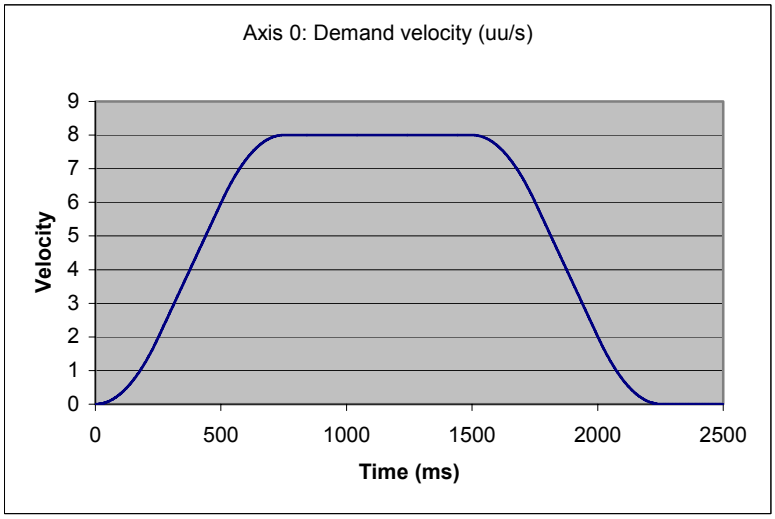


Notice the deceleration ramp is now much shallower due to the reduction of the deceleration value.

To perform a move that is 12 user units long, reaching a speed of 8 user units per second, accelerating and decelerating at a rate of 16 user units per second per second, with a jerk rate of 64 user units per second per second per second the following MintMT code segment is required:

```
PROFILEMODE = _pmS_RAMP
SPEED = 8
ACCEL = 16
DECEL = 16
ACCELJERK = 64
DECELJERK = 64
MOVER = 12
GO
```

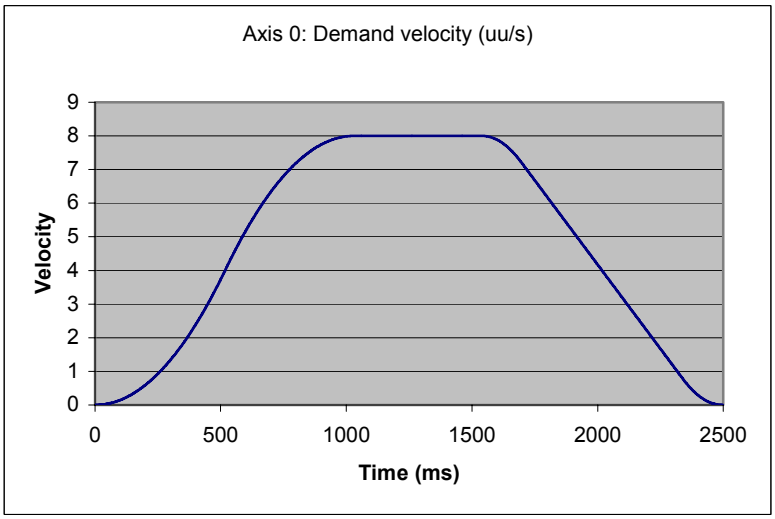
This will produce the velocity profile:



Increasing the acceleration will result in a steeper acceleration ramp decreasing the acceleration will result in a shallower acceleration ramp. The same applies to deceleration.
Increasing the acceleration jerk will reduce the s-ramp portion of the acceleration ramp as the acceleration will up ramp faster. Decreasing the acceleration jerk will increase the s-ramp portion of the acceleration ramp. Reducing the jerk value will continue to extend the s-ramp portion of the acceleration ramp so that eventually the acceleration ramp is a complete 'S' shape.
The acceleration, deceleration, acceleration jerk and deceleration jerk are independent values. Using a deceleration value of 8 user units per second per second:

```
PROFILEMODE = _pmS_RAMP
SPEED = 8
ACCEL = 16
DECEL = 8
ACCELJERK = 30
DECELJERK = 64
MOVER = 12
GO
```

Will produce the velocity profile:



Notice the acceleration ramp is now a complete 'S' due to the smaller value of acceleration jerk. The deceleration ramp is shallower due to the reduction of the deceleration value.