Sine-wave and Triangle-wave performance of our ARC12532 and Compact 506 scanners

(Two separate reports are contained within this document.)

Sine-wave and Triangle-wave performance of ARC12532 with our standard 30mm mirror set

The ARC12532 scanner is presently the largest scanner we make, and the 30mm mirror set has almost 10 times the inertia as the 20mm mirror set driven by the Compact 506 and discussed below.

For the purposes of this report, the performance limit was determined by heat dissipated by the scanner. The scanner was driven such that the internal coil temperature reached 70C with a 30C body temperature (a 40C rise in temperature inside the scanner). For triangle-wave scanning, this coincided with an electrical power requirement of 48 watts, and for sine-wave scanning this coincided with an electrical power requirement of 67 watts. Note that these figures are for a single axis running.

If the body temperature of the scanner will be greater than 50C, then the frequency will need to be decreased somewhat to limit the internal temperature of the scanner.

Summary for ARC12532 with mirror set capable of projecting a 30-mm beam through a 40-degree-optical angle:

ARC12532 with 30mm mirror set driven with a sine-wave:

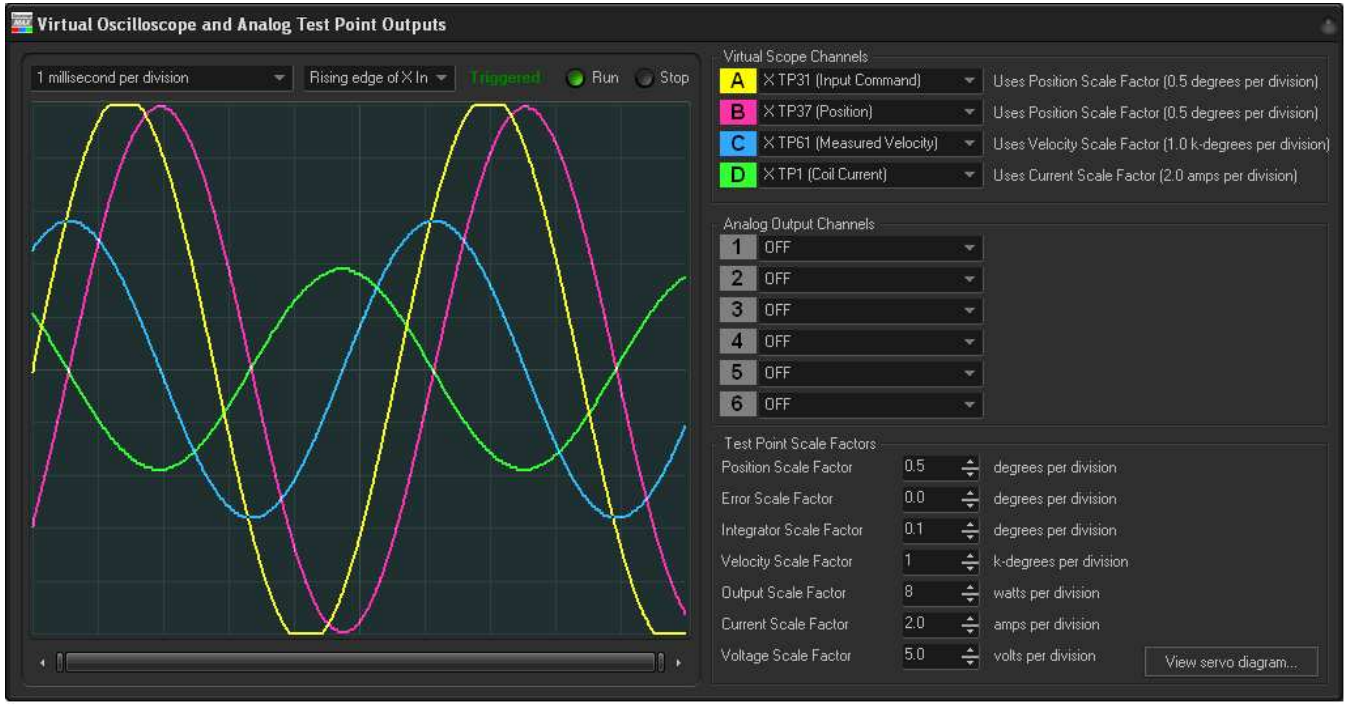
- 90Hz at 40-degrees optical peak to peak
- 125Hz at 20-degrees optical peak to peak
- 180Hz at 10-degrees optical peak to peak
- 360Hz at 2.5-degrees optical peak to peak

ARC12532 with 30mm mirror set driven with a rounded triangle-wave:

- 80Hz at 40-degrees optical peak to peak
- 110Hz at 20-degrees optical peak to peak
- 160Hz at 10-degrees optical peak to peak

It is evident that, for a given amount of electrical power consumption and heat generated by the scanner, if the scanning amplitude is reduced by a factor of 4, then scanning frequency can be increased by a factor of 2. It is also evident that, for this particular scanner and mirror configuration, sine-wave scanning can be performed at roughly 1.4x the frequency of triangle-wave scanning.

ARC12532 driven by a sine-wave



Sine-wave performance

90Hz at 40 degrees optical peak to peak

125Hz at 20 degrees optical peak to peak

180Hz at 10 degrees optical peak to peak

360Hz at 2.5 degrees optical peak to peak

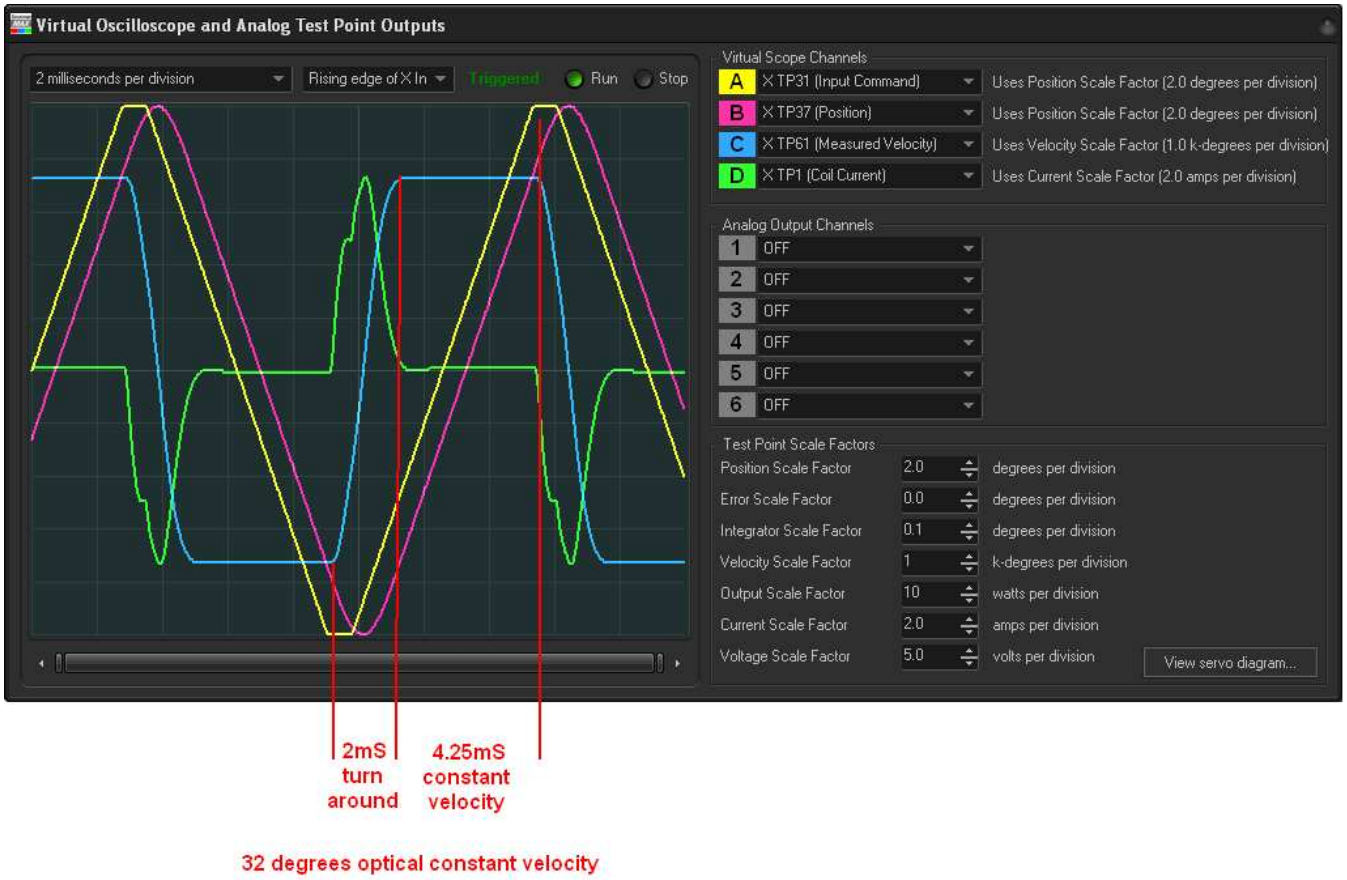
+/-24V at 1.4 amps per rail (67 watts electrical power)

16 watts of heat generated by the scanner

40 watts of heat dissipated by servo driver

(All of these figures are for a single axis)

ARC12532 achieving 80Hz, 40-degree, rounded triangle-wave scanning



80Hz Triangle Wave

40 degrees optical peak to peak scanning

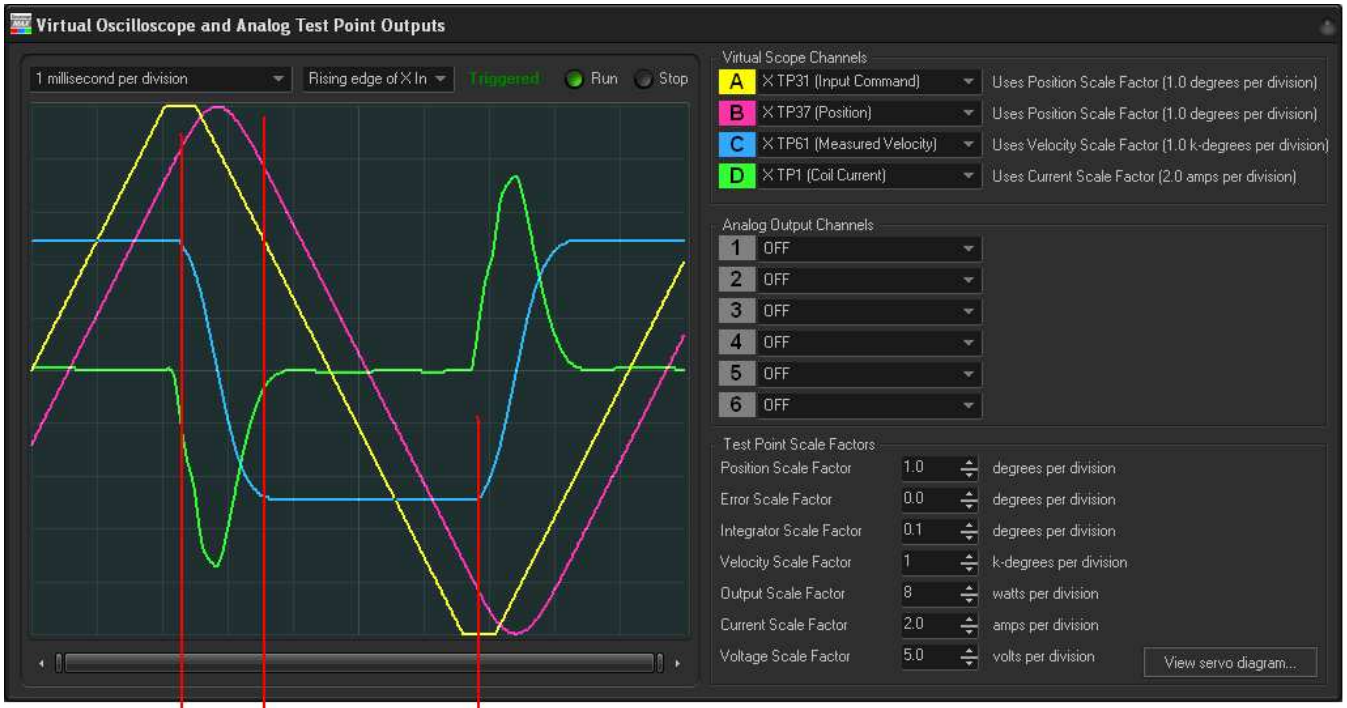
+/-24V at 1 amp per rail (48 watts electrical power)

18 watts of heat generated by the scanner

16 watts of heat dissipated by the servo driver

(All of these figures are for a single axis)

ARC12532 achieving 110Hz, 20-degree, rounded triangle-wave scanning



1.3mS turn around

3.25mS constant velocity

16 degrees optical constant velocity

110Hz Triangle Wave

20 degrees optical peak to peak scanning

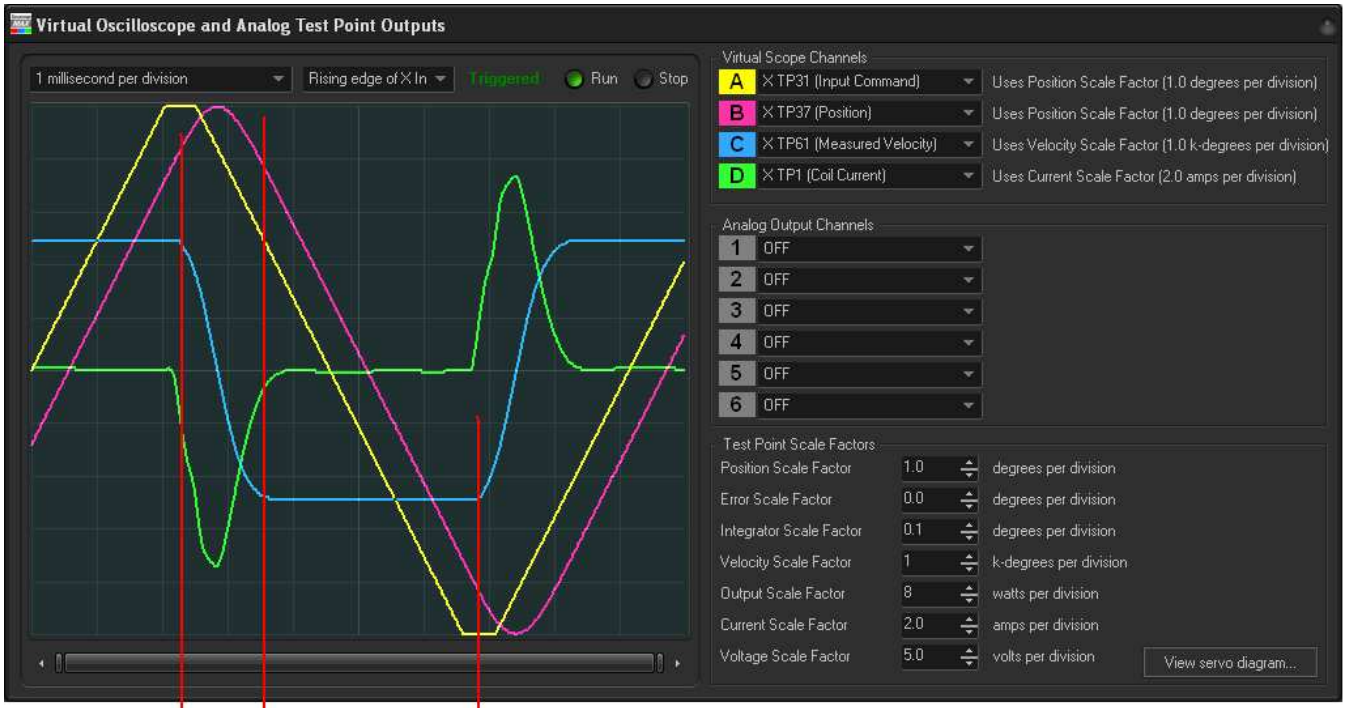
+/-24V at 1 amp per rail (48 watts electrical power)

16 watts of heat generated by the scanner

14 watts of heat dissipated by servo driver

(All of these figures are for a single axis)

ARC12532 achieving 160Hz, 10-degree, rounded triangle-wave scanning



1.3mS turn around

3.25mS constant velocity

16 degrees optical constant velocity

110Hz Triangle Wave

20 degrees optical peak to peak scanning

+/-24V at 1 amp per rail (48 watts electrical power)

16 watts of heat generated by the scanner

14 watts of heat dissipated by servo driver

(All of these figures are for a single axis)

Sine-wave and Triangle-wave performance of Compact 506 with our standard 20mm mirror set

The Compact 506 is presently the smallest scanner that we make. The whole scanner is the size of the tip of your finger. A 20mm mirror normally could not be used on a scanner this small, but the Compact 506 has a very short and very stiff rotor, and we use a special mirror mount to attach the 20mm mirror to its shaft. This is certainly the smallest and most cost effective way to move a 20mm mirror.

As was the case for the ARC12532 above, the performance limit for the Compact 506 was determined by heat dissipated by the scanner. The scanner was driven such that the internal coil temperature reached 70C with a 30C body temperature (a 40C rise in temperature inside the scanner). For triangle-wave scanning, this coincided with an electrical power requirement of 28.8 watts, and for sine-wave scanning this coincided with an electrical power requirement of 42 watts. Note that these figures are for a single axis running.

If the body temperature of the scanner will be greater than 50C, then the frequency will need to be decreased somewhat to limit the internal temperature of the scanner.

Summary for Compact 506 with mirror set capable of projecting a 20-mm beam through a 40-degree-optical angle:

Compact 506 with 20mm mirror set driven with a sine-wave:

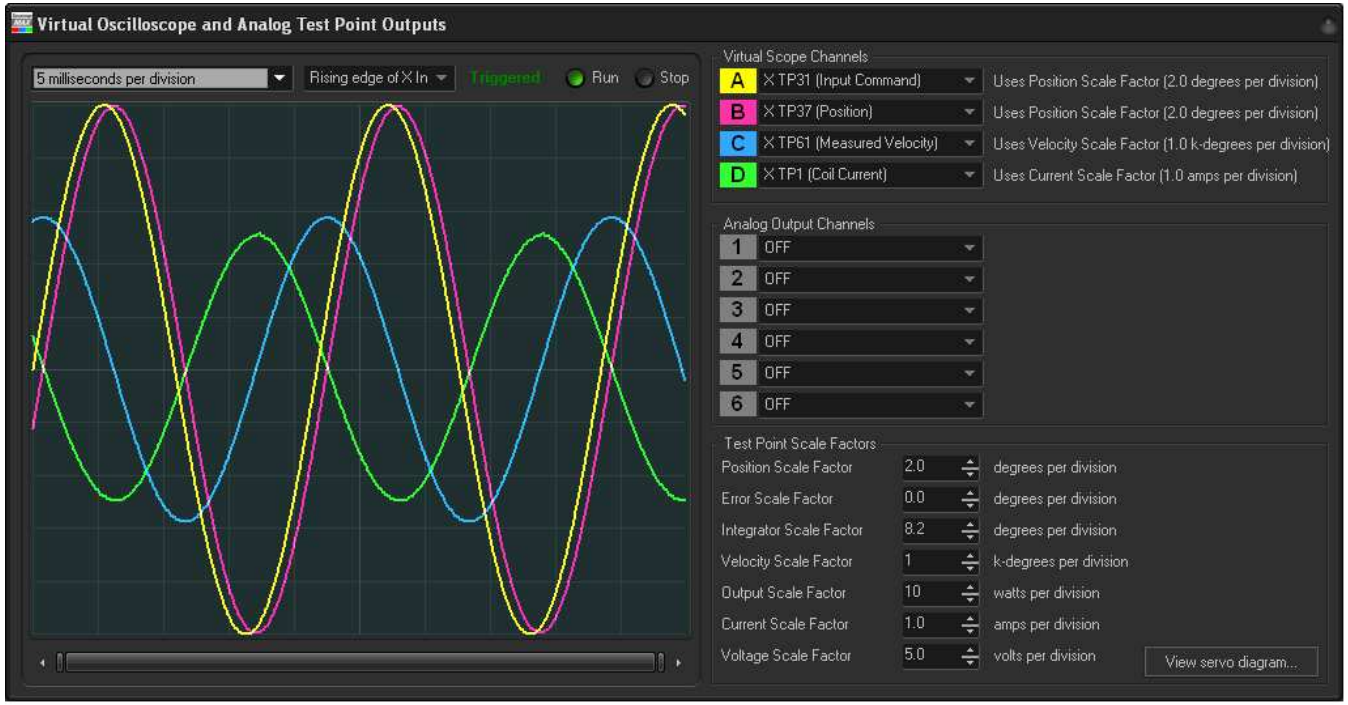
- 46Hz at 40-degrees optical peak to peak
- 65Hz at 20-degrees optical peak to peak
- 92Hz at 10-degrees optical peak to peak
- 184Hz at 2.5-degrees optical peak to peak

Compact 506 with 20mm mirror set driven with a rounded triangle-wave:

- 36Hz at 40-degrees optical peak to peak
- 50Hz at 20-degrees optical peak to peak
- 72Hz at 10-degrees optical peak to peak

It is evident that, for a given amount of electrical power consumption and heat generated by the scanner, if the scanning amplitude is reduced by a factor of 4, then scanning frequency can be increased by a factor of 2. It is also evident that, for this particular scanner and mirror configuration, sine-wave scanning can be performed at roughly 1.3x the frequency of triangle-wave scanning.

Compact 506 driven by a sine-wave



Sine-wave performance

46Hz at 40 degrees optical peak to peak

65Hz at 20 degrees optical peak to peak

92Hz at 10 degrees optical peak to peak

184Hz at 2.5 degrees optical peak to peak

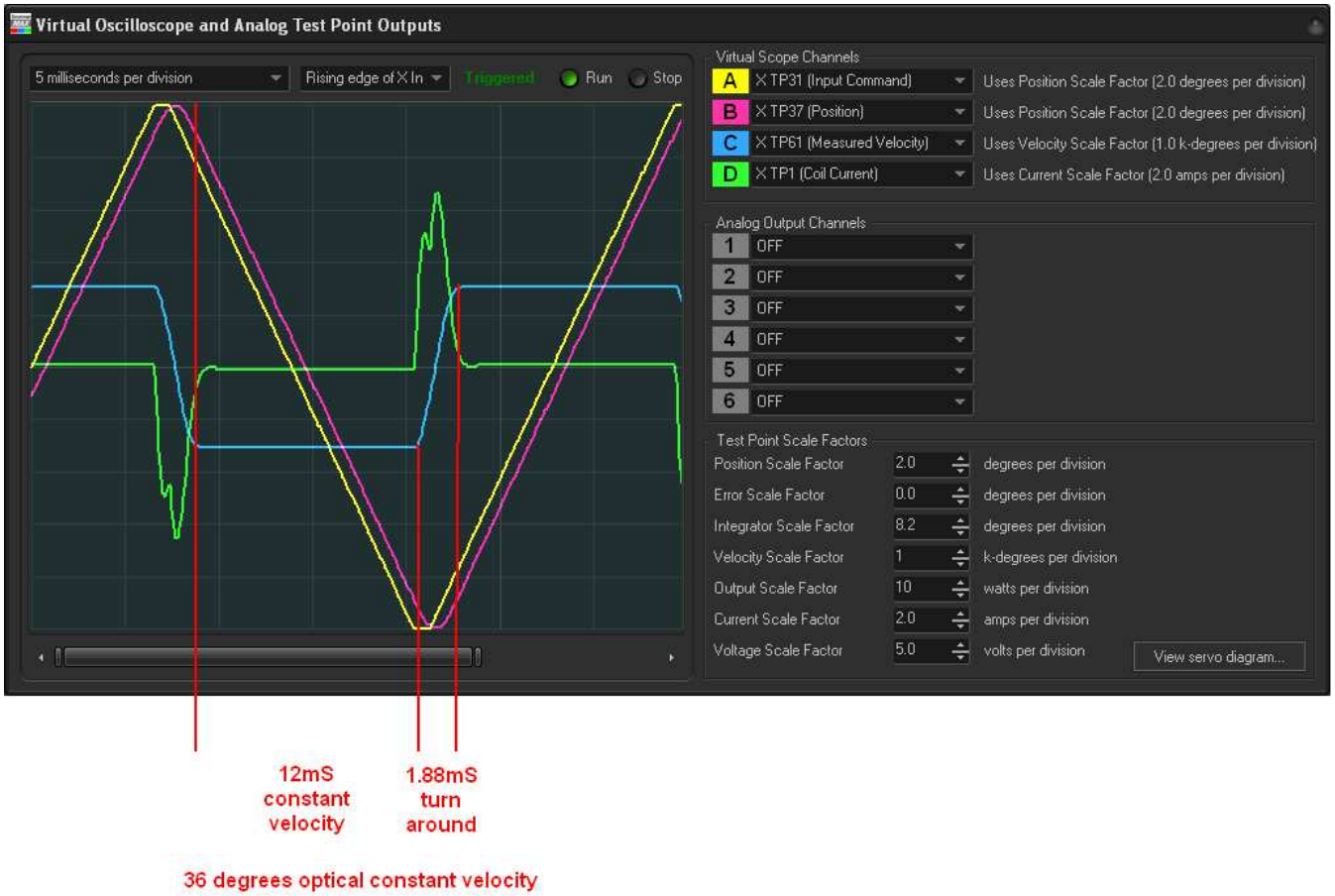
+/-24V at 0.88 amps per rail (42 watts electrical power)

16 watts of heat generated by the scanner

40 watts of heat dissipated by servo driver

(All of these figures are for a single axis)

Compact 506 achieving 36Hz, 40-degree, rounded triangle-wave scanning



12mS constant velocity

1.88mS turn around

36 degrees optical constant velocity

36Hz Triangle Wave

40 degrees optical peak to peak scanning

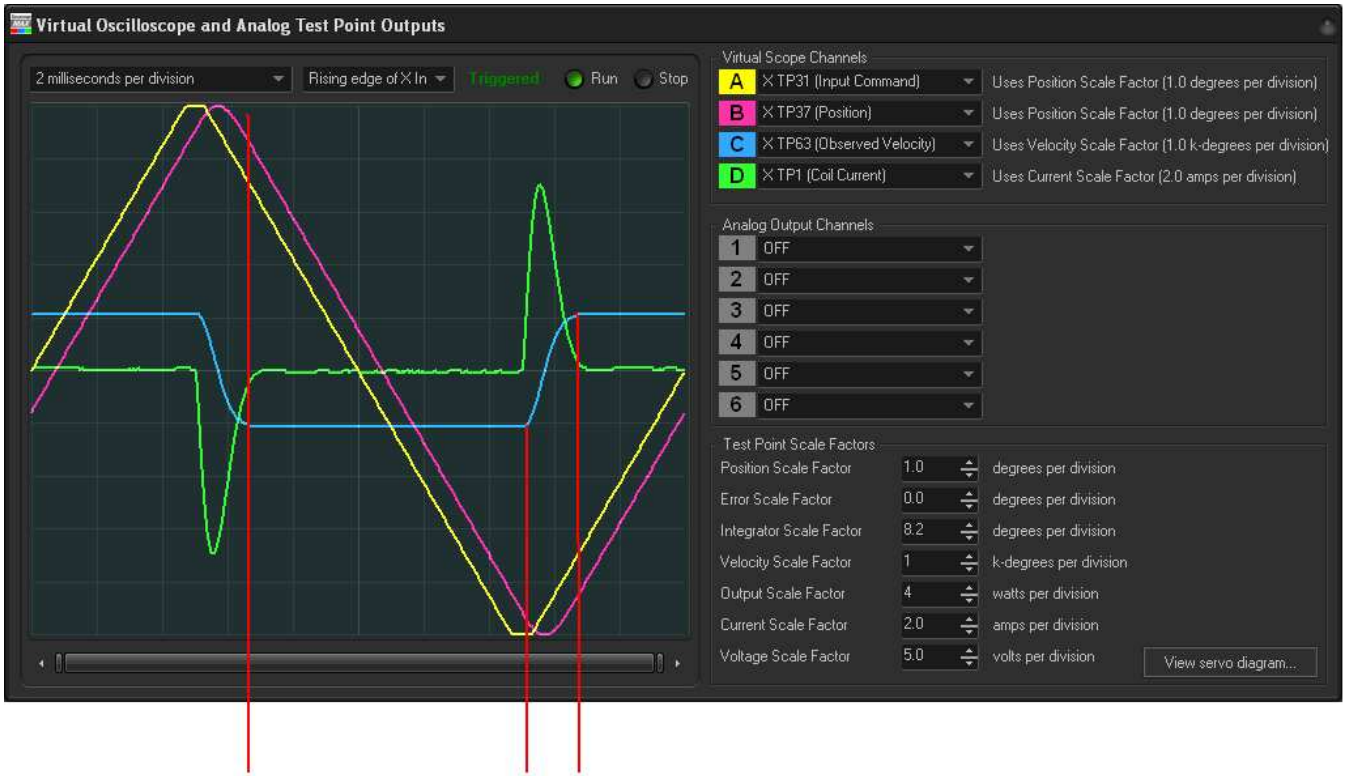
+/-24V at 0.6 amps per rail (28.8 watts electrical)

7 watts of heat generated by the scanner

10 watts of heat dissipated by the servo driver

(All of these figures are for a single axis)

Compact 506 achieving 50Hz, 20-degree, rounded triangle-wave scanning



8.4mS constant velocity

1.6mS turn around

18 degrees optical constant velocity

50Hz Triangle Wave

20 degrees optical peak to peak scanning

+/-24V at 0.6 amps per rail (28.8 watts electrical)

7 watts of heat generated by the scanner

10 watts of heat dissipated by the servo driver

(All of these figures are for a single axis)

Compact 506 achieving 72Hz, 10-degree, rounded triangle-wave scanning

72Hz Triangle Wave

10 degrees optical peak to peak scanning

+/-24V at 0.6 amps per rail (28.8 watts electrical)

7 watts of heat generated by the scanner

10 watts of heat dissipated by the servo driver

(All of these figures are for a single axis)