

T E C H N I C A L N O T E

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Version: 1.2
Subject: Servo Loop Parameters for Piezo Motor Control

Overview:

Additional loop control parameters have been added to the servo loop in system software version 1.63 and later. These control parameters are designed for control of piezo motors although they can be used for the control of other motors as well. For a list of the Motion Coordinators that currently support this system software version, please see the Trio Motion Technology website at www.triomotion.com.

The loop parameters allow an offset to be applied to the output DAC signal in both a positive and negative direction. They also allow a deadband to be applied within which the output DAC signal will be clamped to zero.

Offset to output DAC signal:

Two keywords allow an offset to be applied to the output DAC signal from the servo loop. The offset is applied *after* the DAC_SCALE function.

- An offset of 327 will represent an offset of 0.1 volts when using a Motion Coordinator product with a 16 bit DAC; for example the P201 or MC206X.
- An offset of 20 will represent an offset of 0.1 volts when using a servo daughter board with a 12 bit DAC.

It is suggested that the offset is 65% to 70% of the value required to make the stage move in an open loop situation. *The negative offset must be a negative value.*

```
POS_OFFSET=300  
NEG_OFFSET=-270
```

Servo Deadband:

The servo loop DAC output can be clamped to zero when a move has been completed within a tolerance band. This "dead zone" is set using two axis parameters:

```
D_ZONE_MIN=3  
D_ZONE_MAX=10
```

The servo loop will clamp the output to zero when the demand movement is complete and magnitude of the following error is less than the D_ZONE_MIN value. The servo loop will be reactivated if either the following error rises above the D_ZONE_MAX value, or a fresh movement is started. The Dead Zone values are specified in user units for the axis.

Example:

A linear stage is driven by piezo motor and has a feedback of one count per micrometer. (1000 counts per mm) The manual for the motor suggests dead zone range of minimum=3 and maximum=10. It is also found that 140 mV is required to make the stage move in the positive direction and that the command voltage must reach -124 mV before the stage moves in the negative direction.

A PCI208 Motion Coordinator PC card is to be used with the P184 DAC output expansion board fitted. This has a 16 bit D to A converter for the analogue output.

- Calculation for POS_OFFSET:
65% of 140 mV is given by $0.14 * 0.65 = 0.091$
In 16 bit DAC terms this is $0.091 * 32768 / 10 = 298.2$
POS_OFFSET = 298
- Calculation for NEG_OFFSET:
65% of 124 mV is given by $0.124 * 0.65 = 0.0806$
In 16 bit DAC terms this is $0.0806 * 32768 / 10 = 264.1$
NEG_OFFSET = -264

It is required to program the axis in mm, so UNITS is set to allow this:

- **UNITS = 1000**

It is necessary to set the dead zone values in user units therefore the following values must be set:

- **D_ZONE_MIN = 0.003**
D_ZONE_MAX = 0.010