# PicoMite Stepper Motor Control Reference

## 1. Overview

The STEPPER command provides a comprehensive system for controlling up to 3 stepper motor axes (X, Y, Z) with support for G-code execution, acceleration planning, and hardware limit switches. It uses a dedicated 100kHz interrupt timer for smooth pulse generation.

## 2. Initialization & Configuration

### 2.1 Initialization

```
STEPPER INIT [arc_tolerance] [,buffer_size]
```

Initializes the stepper subsystem. Must be called before any other STEPPER commands.
- arc_tolerance: (Optional) Tolerance for arc segmentation in mm (default: 0.05).
- buffer_size: (Optional) Size of the G-code lookahead buffer (default: 16, max: 256).

### 2.2 Axis Configuration

```
STEPPER AXIS axis, step_pin, dir_pin [, enable_pin] [, dir_invert] [, steps_per_mm] [, max_vel] [, max_accel]
```

Configures a specific axis (X, Y, or Z).
- axis: X, Y, or Z.
- step_pin/dir_pin: GPIO pins for Step and Direction signals.
- enable_pin: (Optional) GPIO pin for Enable signal (active low).
- dir_invert: (Optional) 1 to invert direction, 0 otherwise.
- steps_per_mm: (Optional) Steps required to move 1mm.
- max_vel: (Optional) Maximum velocity in mm/min.
- max_accel: (Optional) Maximum acceleration in mm/s^2.

### 2.3 Limits & Safety

```
STEPPER HWLIMITS x_min, y_min, z_min [,x_max] [,y_max] [,z_max]
```

Configures hardware limit switch pins (active low).

```
STEPPER LIMITS axis, min_mm, max_mm
```

Sets soft limits for an axis in mm.

```
STEPPER ESTOP
```

Emergency stop: halts motion immediately, clears buffer, disables drivers, and turns spindle off.

## 3. Motion Control

### 3.1 G-Code Execution

```
STEPPER GC <gcode> [words...]
```

Executes a standard G-code command string.
Supported codes: G0, G1, G2, G3, G4, G28, G90, G91, G92, M3, M5.
M3/M5 and G4 are buffered and executed in-order with motion blocks.
Example: STEPPER GC G1 X10 Y5 F500

```
STEPPER GCODE G0|G1|G2|G3|G4|G28|G90|G91|G92|M3|M5 [, X, x] [, Y, y] [, Z, z] [, F, feed] [, I, i] [, J, j] [, K, k] [, R, r] [, P, ms]
```

Alternative syntax for adding motion commands to the buffer. All parameters must be comma separated.
G4 uses P in milliseconds (for example: STEPPER GCODE G4, P, 500).
Example: STEPPER GCODE G1, X, 10, Y, 5, F, 500

### 3.2 Manual Positioning

```
STEPPER POSITION HOME
```

Sets all axes to position 0 and clears G92 offsets.

```
STEPPER POSITION axis, position
```

Sets the current position of an axis to the specified value (mm).

## 4. Advanced Features

```
STEPPER SCURVE 0|1
```

Enables (1) or disables (0) S-curve acceleration profiling for smoother motion.

```
STEPPER JERK value
```

Sets the jerk limit in mm/s^3 for S-curve planning.

```
STEPPER SPINDLE pin [,invert]
```

Configures a spindle control pin used by buffered M3/M5 commands.

## 5. System Management

```
STEPPER RUN
```

Arms the system and begins executing buffered commands.

```
STEPPER CLEAR
```

Clears the G-code buffer (only when motion is idle).

```
STEPPER STATUS
```

Displays detailed system status, including axis positions, buffer state, and configuration.

```
STEPPER CLOSE
```

Shuts down the stepper subsystem, releases resources, and deconfigures stepper-owned GPIO pins.

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```
PEEK(STEPPER X)
PEEK(STEPPER Y)
PEEK(STEPPER Z)
PEEK(STEPPER ACTIVE)
```

Returns current workspace axis position in mm (X/Y/Z) or active state (ACTIVE returns 1 when stepper is actively processing queued work, otherwise 0).