Soft Servo
SYSTEMS, INC

ServoWorks S-100T Parameters Manual

Revision 1.7

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Chapter 1: Overview

Parameters are an integral part of ServoWorks S-100T. There are two kinds of parameters related to ServoWorks S-100T: *system* parameters and *program* parameters. System parameters are parameters related to the servo drive, the numerical control, and the machine tool. Program parameters are related to the ServoWorks S-100T interface, such as color parameters (related to the color of the screen) or how data is displayed (number of digits before and after the decimal point).

This reference manual is designed to guide you in setting the optimal system parameters for your ServoWorks S-100T system, to get the best performance from your lathe or turning machine. This manual does not cover program parameters – those parameters are covered in the *ServoWorks S-100T Operator's Manual*.

This manual also does not explain how to use ServoWorks S-100T to actually set the parameters. For instance, this manual does not explain how to move between text boxes, or how to save changes. Those parameters are also covered in the *ServoWorks S-100T Operator's Manual*.

Chapter 2: General Parameters

2.1 Overview

General parameters include both system parameters and program parameters. The program parameters are explained in this chapter.

The "General" screen in Configuration Mode is shown as follows:

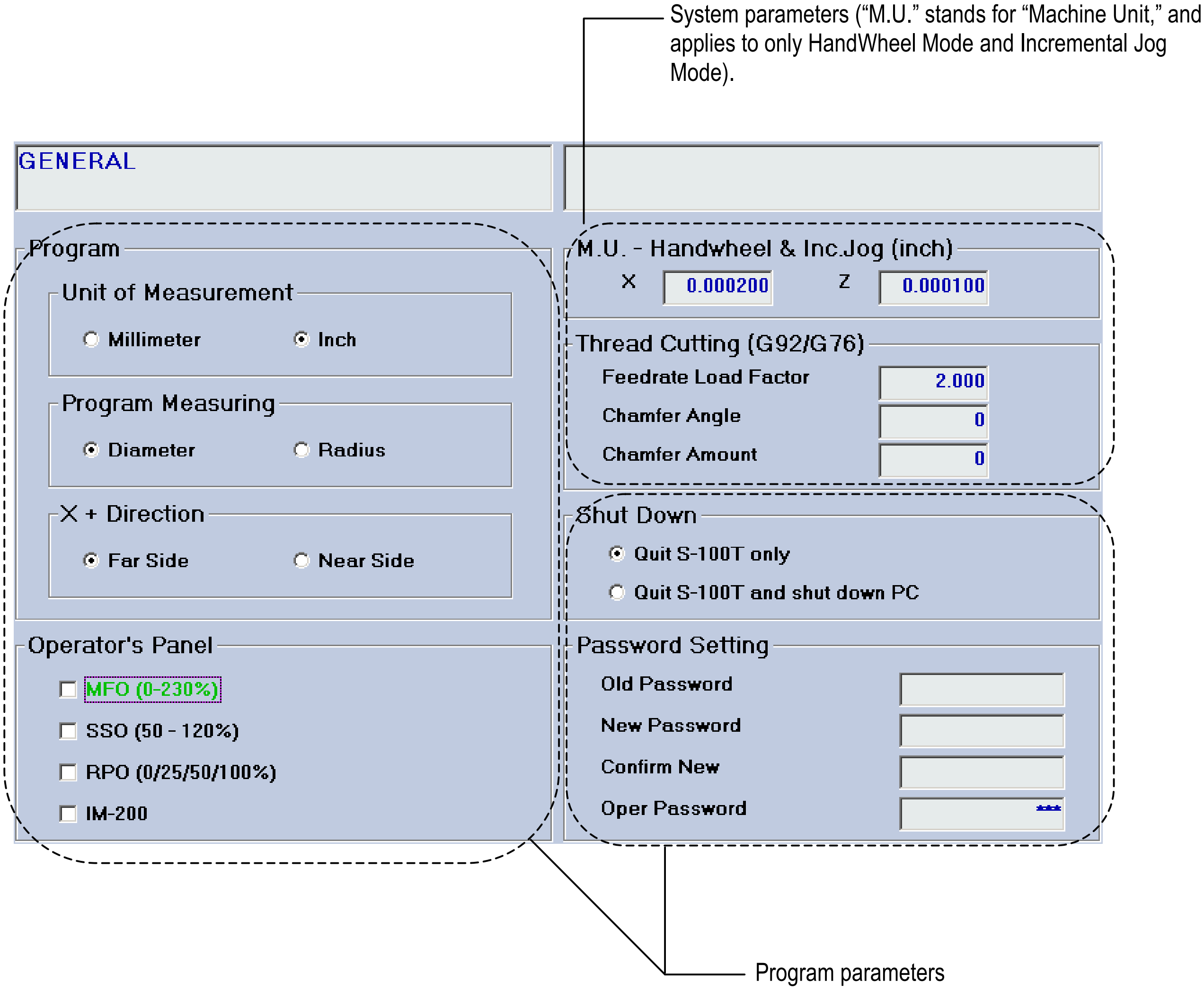


Figure 2-1: The General Parameters Display Area #1

Figure 2-2: The General Parameters Display Area #2

2.2 HandWheel and Incremental Jog Machine Unit

Description

The least input increment – the minimum unit of linear movement (distance) that the actuator (e.g. NC machine) can be commanded to move.

Measured in Units of: mm, inch

Range of Valid Values: 0 – 99,999.999

Default Values: 0.001 mm, 0.0001 inches

Usage

This parameter is mainly used for two purposes:

1) In Incremental Jog Mode, it is the unit of measurement for the "distance to go" in this manual control mode. It is the minimum distance increment value for each pulse commanded in this mode.

2) In HandWheel Mode, it determines the minimum distance increment value for each handwheel encoder pulse.

NOTE: In Auto Mode, the machine unit is pitch distance / encoder resolution.

NOTE: The X value for the handwheel and incremental jog machine unit can be based on either radius or diameter programming.

Chapter 3: Servo Control, Encoder and Motor Parameters

3.1 Overview

The parameters included in this category are mainly related to the servo control (servo loop settings, compensations and axis protection), the encoder and the motor. The value of each parameter should match the actual specification of the servomotor or the servo drive, as provided by the servomotor or drive manufacturer.

The first "Servo Control" screen in Configuration Mode is shown in the following figure:

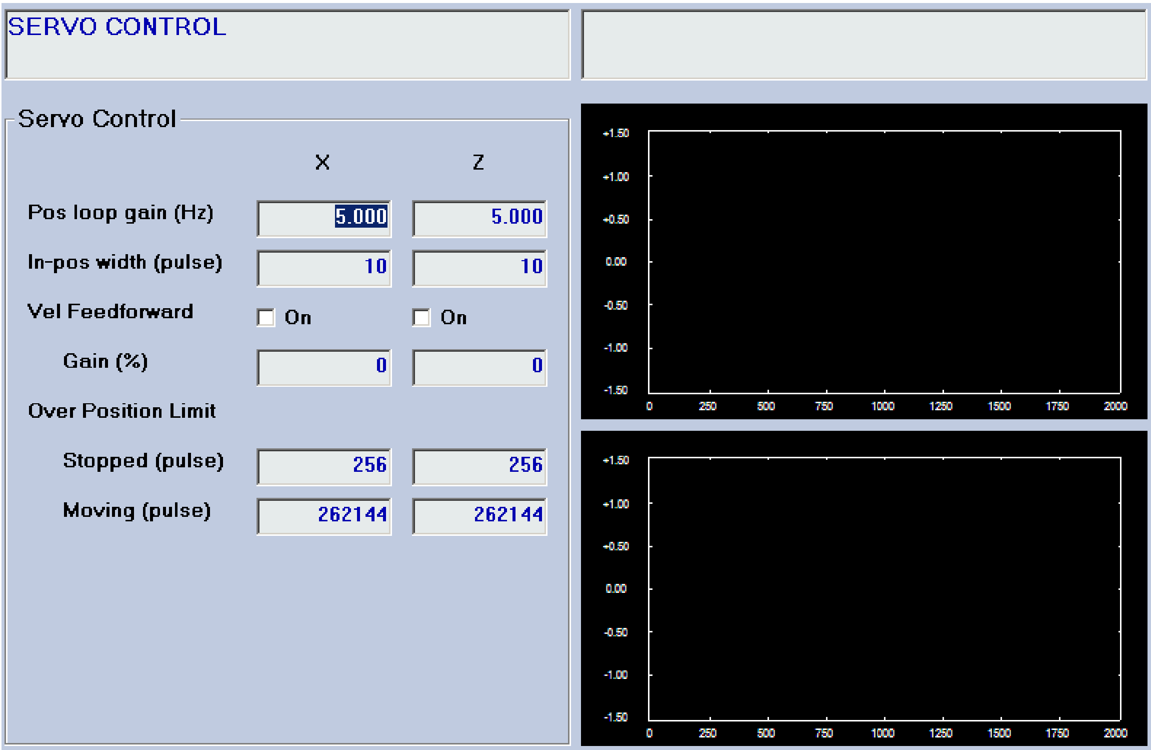


Figure 3-1: The Servo Control Parameters Display Area #1

The second "Servo Control" screen in Configuration Mode is shown in the following figure:

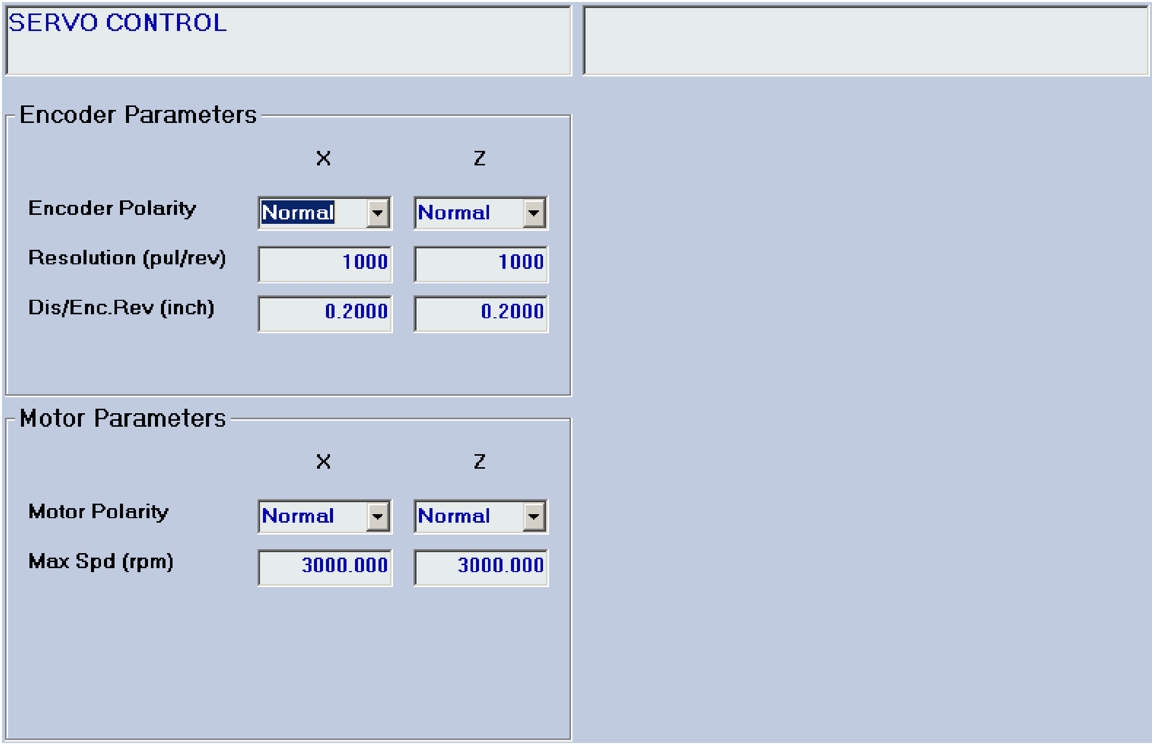


Figure 3-2: The Servo Control Parameters Display Area #2

3.2 Overall Position Loop Gain

Description

The overall position loop gain, k_{PLG}, is shown in the following diagram:

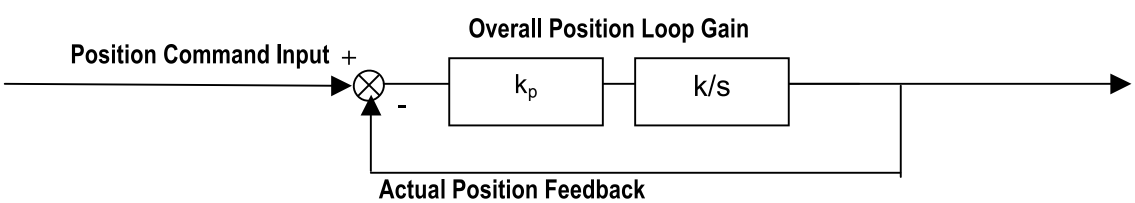


Figure 3-3: Overall Position Loop Gain

Where:

$$k_{PLG} = \text{overall position loop gain} = \frac{k_p\, k}{2\pi}$$

$$k_p = \text{proportional position loop gain}$$

$$k = k_{DAC}\, k_{ms}\, k_e$$

$$k_{DAC} = \frac{10 \text{ volts}}{2^{15} \text{ counts}}$$

$$k_{ms} = \frac{\text{rated RPM}}{10 \text{ volts}} \left(\frac{1 \text{ minute}}{60 \text{ seconds}} \right) \quad \text{[motor sensitivity]}$$

$$k_e = \frac{\text{encoder resolution}}{\text{motor revolution}}$$

Measured in Units of: Hz

Range of Valid Values: 0 – 500.0

Default Value: 5.0 Hz

Discussion

A higher value would result in stiffer (or firmer) position control, faster response and smaller servo lag, but would be more likely to cause vibration or oscillation.

Note

This parameter may also be referred to as "Position Loop Control Bandwidth."

⚠ CAUTION

For the MECHATROLINK interface system, there is a special consideration for setting the "Position Loop Gain" parameter. Please note that although the unit is "Hz", the actual value you need to set for SGDS series drives **must be 10 times the value in the unit of Hz** (because of the way the Sigma III series drives interpret the data). For example, if you'd like to set the position loop gain to 10 Hz, the value you need to set is 100 Hz. But for Sigma II series drives, the position loop gain setting should be the original value (if you'd like to set the position loop gain to 10 Hz, the value you need to set is 10 Hz).

NOTE: If you set the "Position Loop Gain" parameter without multiplying it by 10 for a Sigma III servo drive, you will get less precision position control and slower response.

3.3 In Position Width

Description

Half width of a window centered at the command position. When the actual position falls into this window, it is in position.

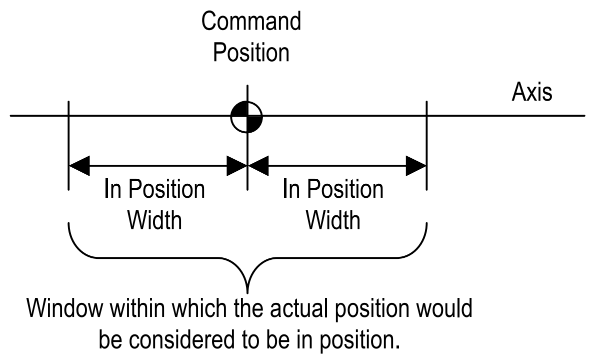


Figure 3-4: In Position Width

Measured in Units of: pulses

Range of Valid Values: 0 – 999,999

Default Value: 10 pulses

Discussion

In position check is performed at the end of rapid movement G00 in Auto Mode and MDI Mode, and also used for at home check after a homing operation is completed.

The value of the in position width is the high resolution after 4X decoding for quadrature.

3.4 Velocity Feedforward On (Off)

Description

Enabling or disabling of velocity feedforward (the process of using calculations to anticipate the likely value of axis velocity at some point in the immediate future, comparing the calculated velocity to the desired velocity, and using that information to influence the axis velocity).

Valid Values: On, Off

Meaning of Values

On – Velocity feedforward enabled
Off – Velocity feedforward disabled

Default Value: Off

Discussion

Velocity feedforward will decrease servo lag in the case when velocity command is constantly changing, e.g. in circular interpolation.

3.5 Velocity Feedforward Gain

Description

Velocity feedforward gain is the percentage of the theoretical, calculated following error or servo lag to be compensated for by changing DAC output. If velocity feedforward gain is set to 10%, then the theoretical, calculated error would be 90%.

Measured in Units of: percent

Range of Valid Values: 0 – 100

Default Value: 0

3.6 Over Position Error Protection Limit – Moving

Description

The position error limit for an axis at which the emergency stop will be triggered while that axis is moving. (When the NC machine is in moving status, the emergency stop will be triggered if the position error exceeds this value.)

[NOTE: Position error is the absolute value of the difference between the command position and the actual position.]

Measured in Units of: pulses

Range of Valid Values: 0 – 999,999

Default Value: 262,144 pulses

3.7 Over Position Error Protection Limit – Stopped

Description

The position error limit for an axis at which the emergency stop will be triggered while that axis is not moving (i.e. if the encoder feedback for that axis changes while the axis is stopped).

Measured in Units of: pulses

Range of Valid Values: 0 – 999,999

Default Value: 256 pulses

3.8 Encoder Polarity

Description

How the encoder feedback value is counted: in normal direction or in reversed (up/down) direction.

Valid Values: Normal, Reverse

Meaning of Values

Normal – Normal encoder value counting (positive)
Reverse – Reversed encoder value counting (negative)

Default Value: Normal

Discussion

Encoder polarity has to match motor polarity; otherwise the servo loop control will run away immediately.

Note

This parameter may also be referred to as "Encoder Direction Change."

3.9 Encoder Resolution

Description

Number of encoder pulses per motor shaft revolution. (1 encoder pulse = 4 encoder counts for phase encoders).

Measured in Units of: pulses per revolution

Range of Valid Values: 1 – 999,999

Default Value: 1,000 pulses per revolution

Discussion

The value of the in position width is the high resolution after 4X decoding for quadrature.

⚠ CAUTION

For the MECHATROLINK interface system, the "Encoder Resolution" setting should be ¼ the value of the motor specification. For example, if the motor specifies encoder resolution as 8192 pulses/revolution, the "Encoder Resolution" parameter setting in ServoWorks S-100T should be 8192 / 4 = 2048.

NOTE: You MUST divide the value of the motor specification by 4 when setting the "Encoder Resolution" parameter, or you will get unexpected results.

3.10 Distance Per Encoder Revolution

Description

1) The linear movement (distance) produced by the actuator's (e.g. NC machine's) final output upon one complete revolution of the encoder.

2) The linear movement (distance) produced by the actuator's (e.g. NC machine's) final output when the number of encoder pulses received is equal to encoder resolution.

Measured in Units of: mm, inch

Range of Valid Values: 0 – 99,999.999

Default Value: 10.0 mm, 0.2 inches

3.11 Motor Polarity

Description

How the analog command to the servo drive is sent: in normal polarity or reversed polarity.

Valid Values: Normal, Reverse

Meaning of Values

Normal – Normal analog command to the servo drive (positive)
Reverse – Reversed analog command to the servo drive (negative)

Default Value: Normal

Discussion

Motor polarity has to match encoder polarity; otherwise the servo loop control will fail or run away immediately.

Note

This parameter may also be referred to as "DAC Direction Change," where "DAC" refers to "Digital-to-Analog Converter."

3.12 Maximum Speed

Description

The maximum speed for motor rotation – should be less than or equal to the peak velocity specified by the motor manufacturer, or the rated velocity specified by the motor manufacturer.

Measured in Units of: RPM

Range of Valid Values: 0 – 99,999.999

Default Value: 3,000.0 RPM

Chapter 4: Safe Zone Parameters

4.1 Overview

The parameters included in this category are related to safe zones for NC protection: software safe zones, hardware limit switches, and barriers around the chuck and tailstock. The first "Safe Zone" screen in Configuration Mode is shown in the following figure:

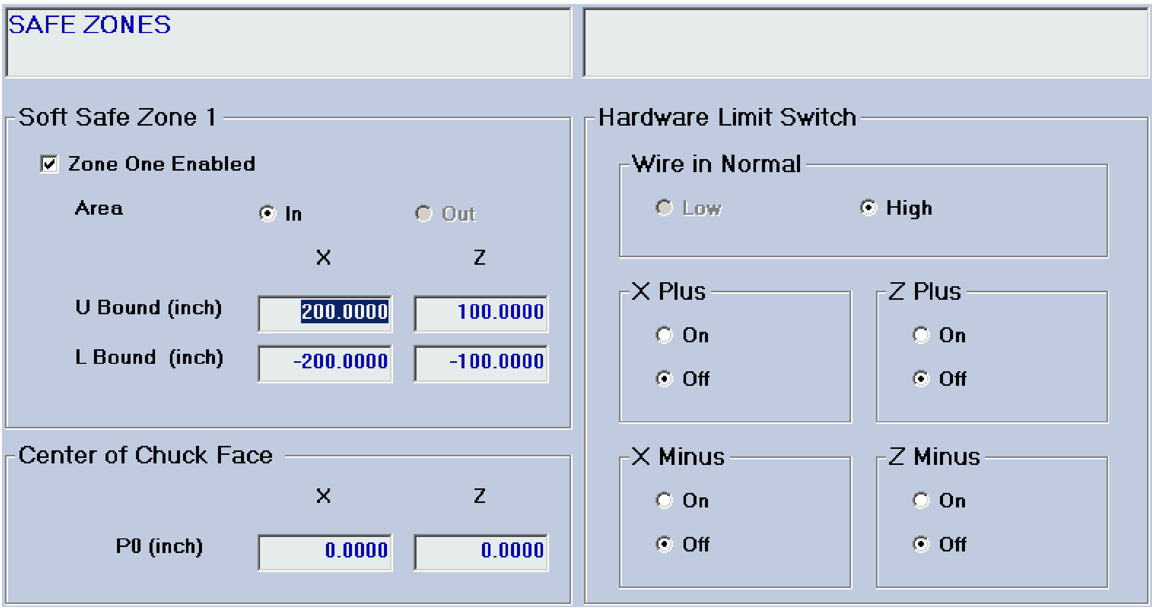


Figure 4-1: The Safe Zones Parameters Display Area #1

The second "Safe Zone" screen in Configuration Mode is shown in the following figure:

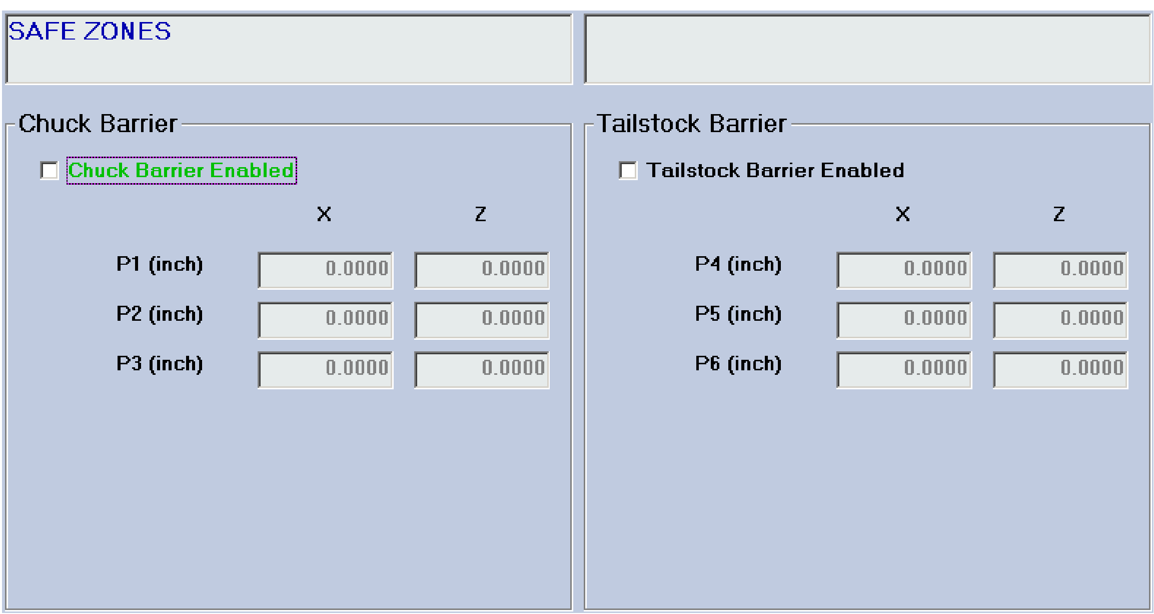


Figure 4-2: The Safe Zones Parameters Display Area #2

4.2 Software Safe Zone 1 Enable

Description

Enabling or disabling of software safe zone number 1.

Valid Values: Enabled, Disabled

Meaning of Values

Enabled – Software safe zone number one enabled – when an axis goes beyond its upper or lower bounds, feedhold is activated, an alarm code is shown, and the overtravel status is shown as red.
Disabled – Software safe zone number one disabled.

Default Value: Enabled

4.3 Area In / Area Out

Description

Whether the upper and lower limits of the software safe zone enclose a safe zone where the axes can safely move, but should not leave (inhabit in) OR the upper and lower limits of the software safe zone enclose a safe zone that is off limits, where the axes should not move (inhabit out).

Valid Values: In, Out

Meaning of Values

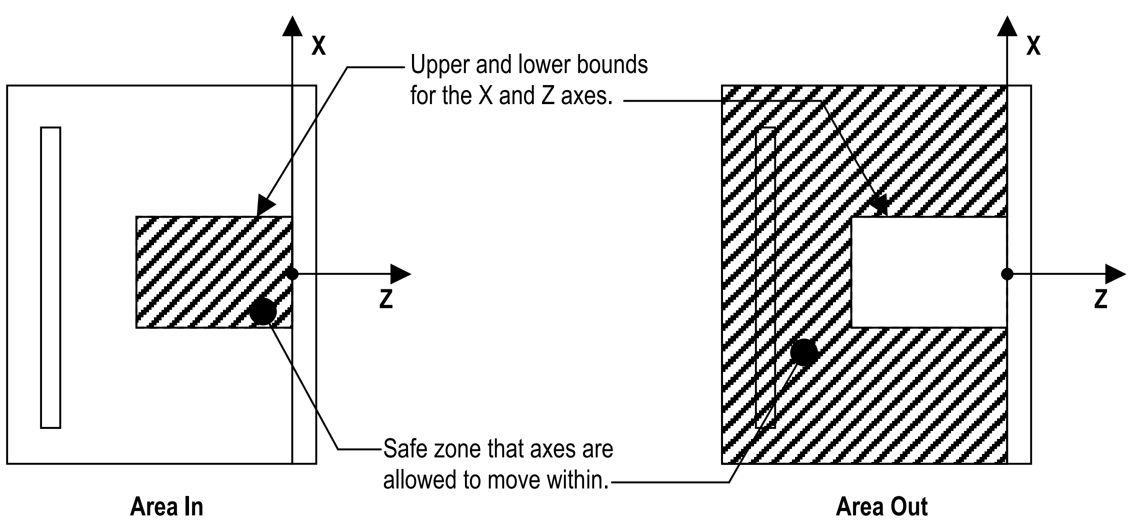


Figure 4-3: Top Views of a Turning Machine, Showing "Area In" and "Area Out"

Default Value: In

4.4 Upper Bound (U Bound) and Lower Bound (L Bound)

Description

Soft limits (software stroke limits) for positive and negative axis travel. The upper and lower bounds are effective only after a home operation has completed, because the home operation sets the machine origin from which the upper and lower bounds are measured.

Measured in Units of: mm, inches

Range of Valid Values: 0 – 99,999.999

Default Value: 1,000.0 mm, 100 inches

Note

These parameters may also be referred to as “Plus Stroke” and “Minus Stroke.”

4.5 Center of Chuck Face

Description

The center coordinates of the chuck face of a lathe or turning machine, as shown in the following figure:

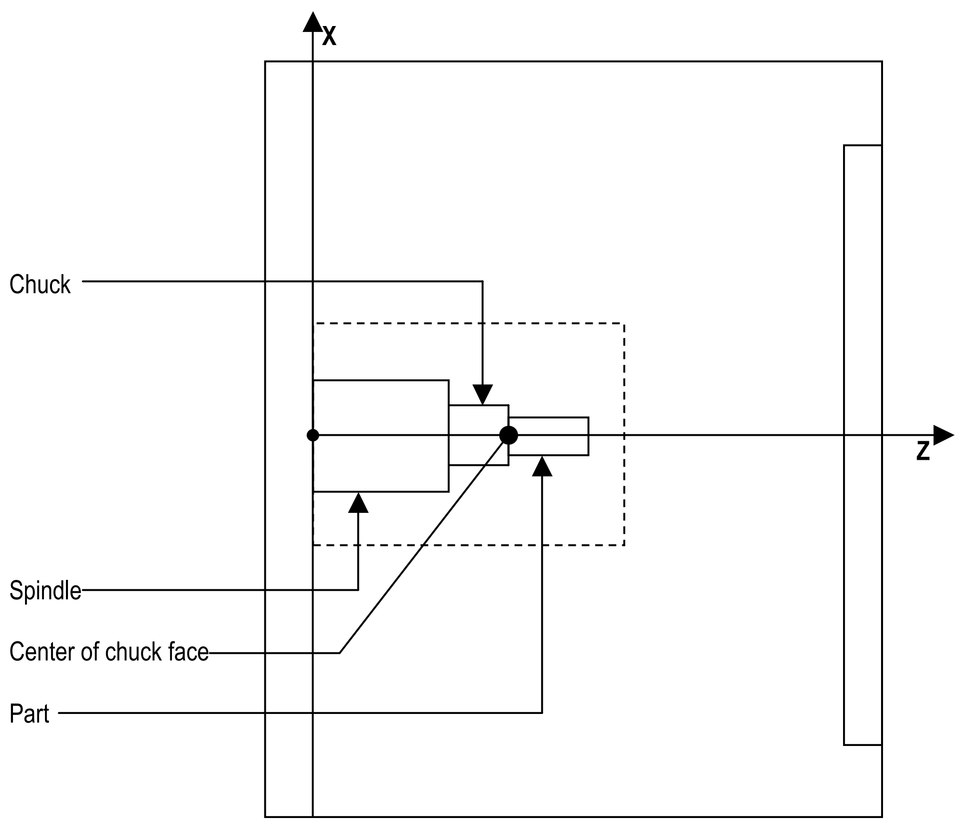


Figure 4-4: Center of Chuck Face

4.6 Hardware Limit Switch Plus/Minus On/Off

Description

This parameter setting is to tell whether or not there are hardware limit switches in your ServoWorks S-100T system.

Valid Values: On, Off

Meaning of Values

On – There are hardware limit switches in the ServoWorks S-100T system
Off – There are no hardware limit switches installed in the ServoWorks S-100T system

Default Value: Off

4.7 Chuck Barrier Enabled

Description

Enabling or disabling of a software chuck barrier.

Valid Values: Enabled, Disabled

Meaning of Values

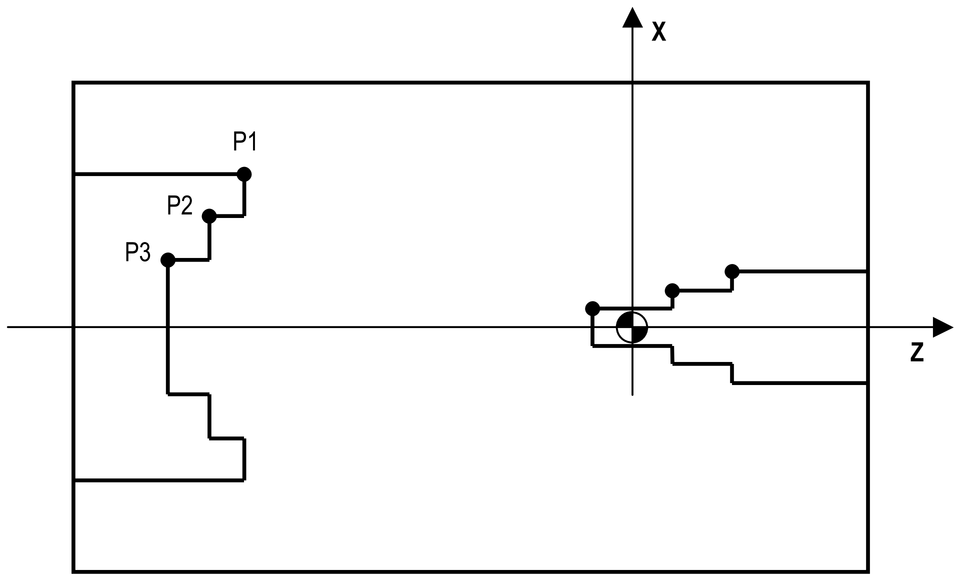
Enabled – Software chuck barrier exists and is enabled
Disabled – Software chuck barrier is disabled (does not exist)

Default Value: Enabled

4.8 Chuck Barrier Positions P1 through P3

Description

The three coordinates P1, P2 and P3 that define the chuck barrier, as shown in the following figure:



$$|X_{P1}| \geq |X_{P2}| \geq |X_{P3}|$$

Figure 4-5: Chuck Barrier Coordinates P1, P2 and P3

X is with respect to the center of the workpiece (radius or diameter programming). Z is with respect to the machine coordinate system.

4.9 Tailstock Barrier Enable

Description

Enabling or disabling of a software tailstock barrier.

Valid Values: Enabled, Disabled

Meaning of Values

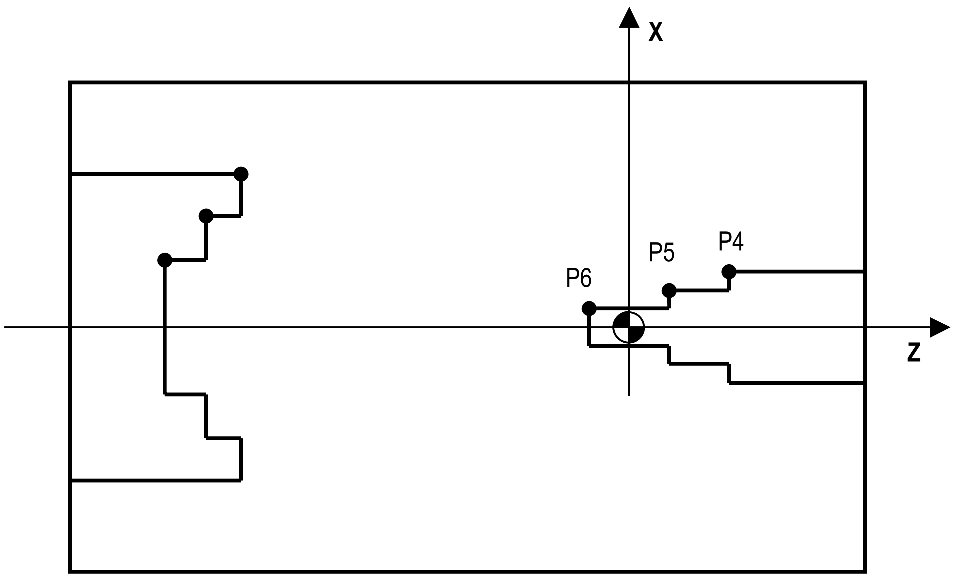
Enabled – Software tailstock barrier exists and is enabled
Disabled – Software tailstock barrier is disabled (does not exist)

Default Value: Enabled

4.10 Tailstock Barrier Positions P4 through P6

Description

The three coordinates P4, P5 and P6 that define the tailstock barrier, as shown in the following figure:



$$|X_{P4}| \geq |X_{P5}| \geq |X_{P6}|$$

Figure 4-6: Tailstock Barrier Coordinates P4, P5 and P6

X is with respect to the center of the workpiece (radius or diameter programming). Z is with respect to the machine coordinate system.

Chapter 5: Smoothing Parameters

5.1 Overview

The parameters included in this category are related to smoothing filters for position control. The smoothing function is a way of specifying a velocity profile for servo motion to follow, since response to a command to move at a certain feedrate is not instant. Velocity profiles can be specified as linear, bell shaped or exponential.

The first "Smoothing Filter" screen in Configuration Mode is shown in the following figure:

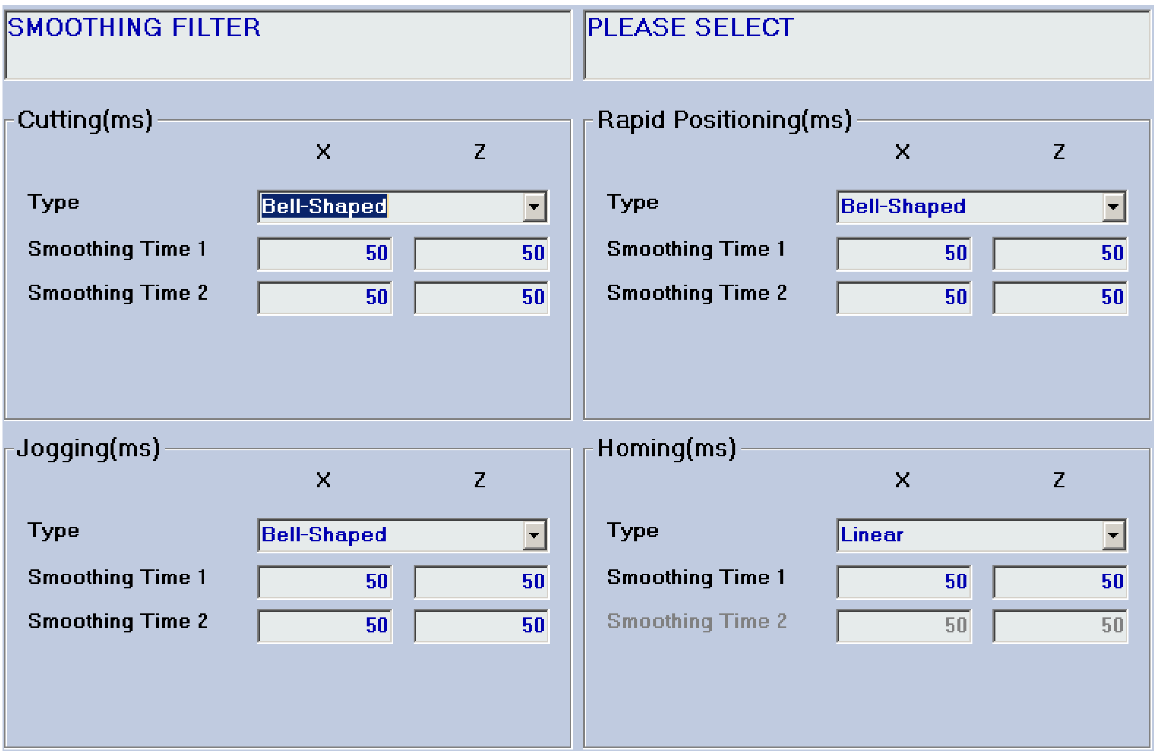


Figure 5-1: The Smoothing Filter Parameters Display Area

"Cutting" refers to linear or circular interpolation (G01, G02 or G03 codes in Auto Mode and MDI Mode). "Rapid Positioning" refers to both Rapid Mode and G00 in Auto Mode and MDI Mode. "Jog" refers to both Jog Continuous Modes and Jog Incremental Mode. "Homing" refers to the homing procedure for the axes.

5.2 Smoothing Type

Description

The setting for the velocity profile to be used to smooth motion (linear, bell shaped or exponential) – which type of smoothing profile will be used for smoothing.

Valid Values: Exponential, Linear, Bell-Shaped, None

Meaning of Values

Exponential – Exponential smoothing
Linear – Linear smoothing
Bell-Shaped – Bell-shaped smoothing
None – No smoothing

Default Value: Bell-Shaped

5.3 Smoothing Time

Description

The motion profile smoothing filter time, or filter times. For linear or exponential acceleration/deceleration, you can only specify a single smoothing filter time, as shown in Examples #1 and 3. However, for bell-shaped acceleration/deceleration, you can specify two smoothing times, T_1 and T_2.

Measured in Units of: ms

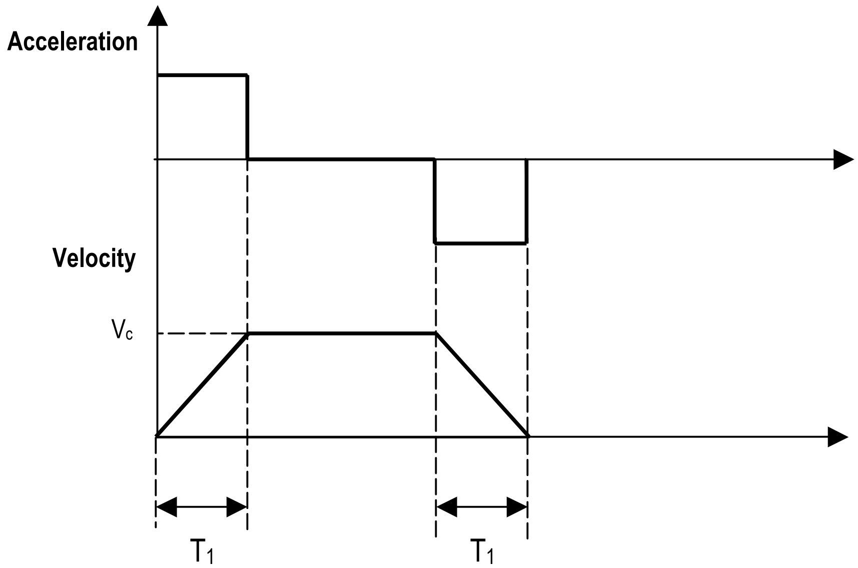
Range of Valid Values: 0 – 5,000

Default Value: 50 ms

Note

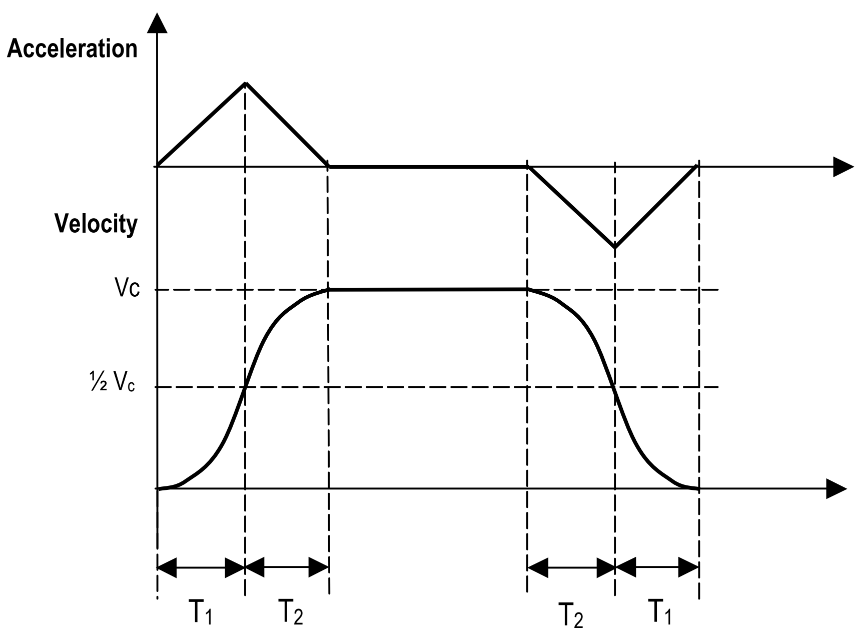
This parameter may also be referred to as "Smoothing Constant."

Examples of Smoothing Time for the Three Types of Acceleration/Deceleration Filters are shown in the following figures:



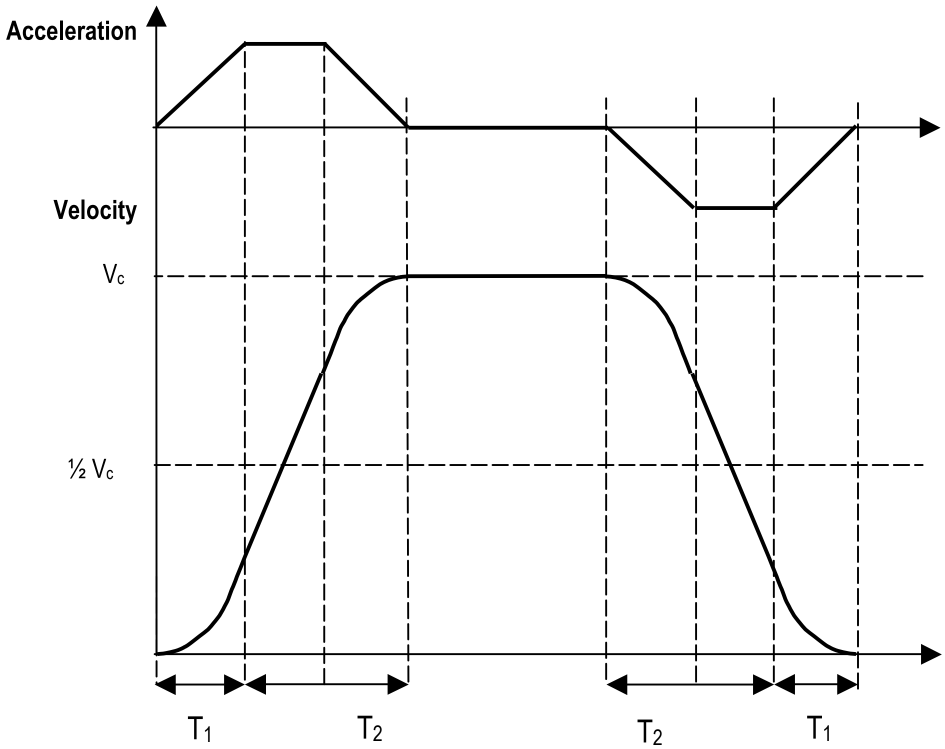
Where Vc is command velocity output and T1 is smoothing time.

Figure 5-2: Example 1: Linear Smoothing



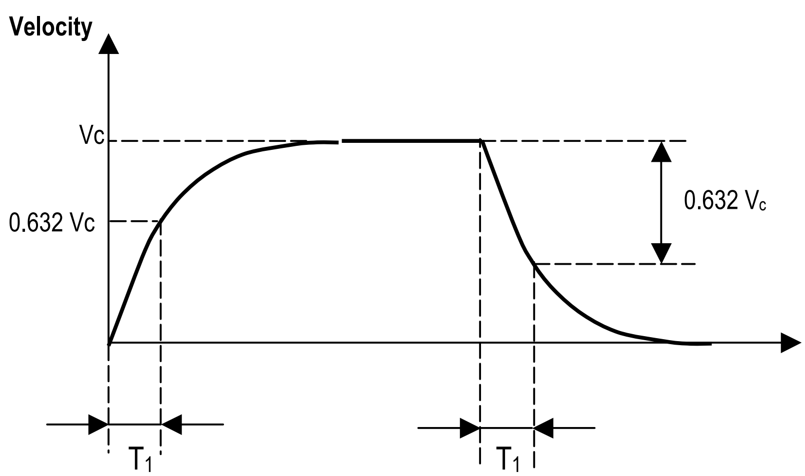
Where V_c is command velocity output and T_1 and T_2 are smoothing times.

Figure 5-3: Example 2a: Bell-Shaped Smoothing Where $T_1 = T_2$



Where V_c is command velocity output and T_1 and T_2 are smoothing times.

Figure 5-4: Example 2b: Bell-Shaped Smoothing Where $T_1 < T_2$



Where V_c is command velocity output and T_1 is smoothing time.

Figure 5-5: Example 3: Exponential Smoothing

When smoothing = "none," no acceleration or deceleration takes place on the velocity command.

Chapter 6: Machine Error Compensation Parameters

6.1 Overview

The parameters included in this category are mainly related to accuracy compensations

The "Machine Error Compensation" screen in Configuration Mode is shown in the following figure:

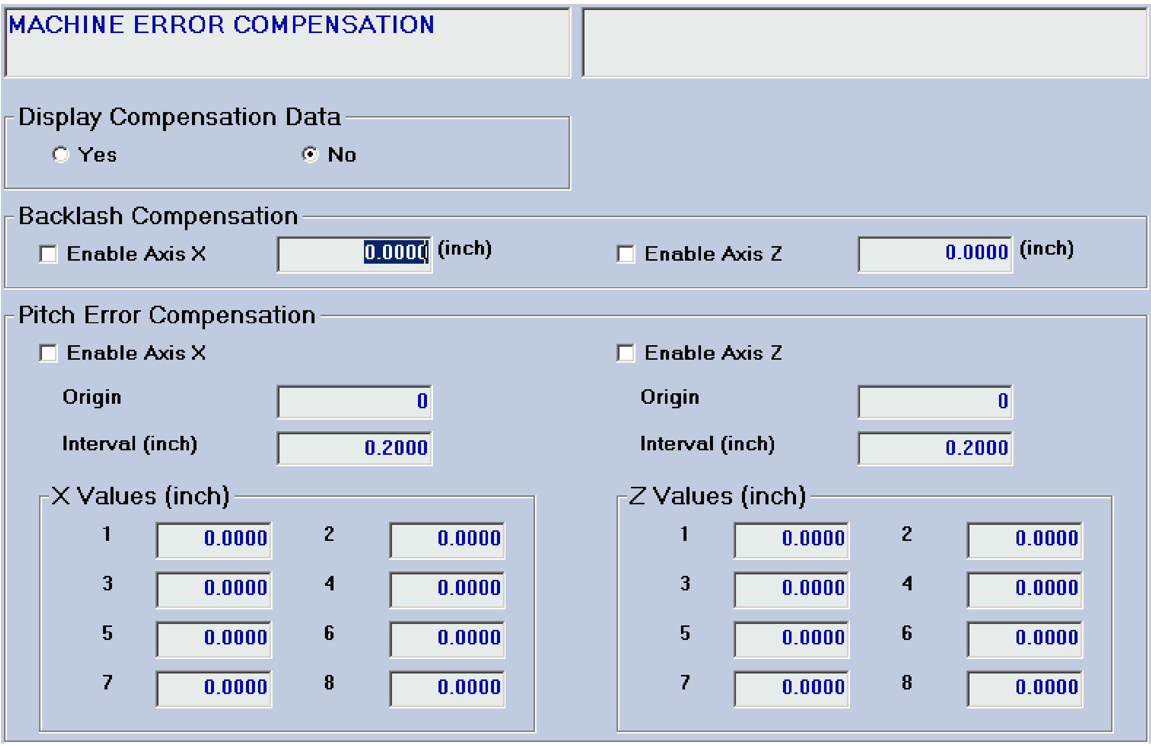


Figure 6-1: The Machine Error Compensation Parameters Display Area

6.2 Backlash Enable

Description

Enabling or disabling of leadscrew backlash compensation. Backlash is lost motion after reversing direction, due to the axial free motion between the ball nut and the ball screw (the gap between the threads of the leadscrew and the gear).

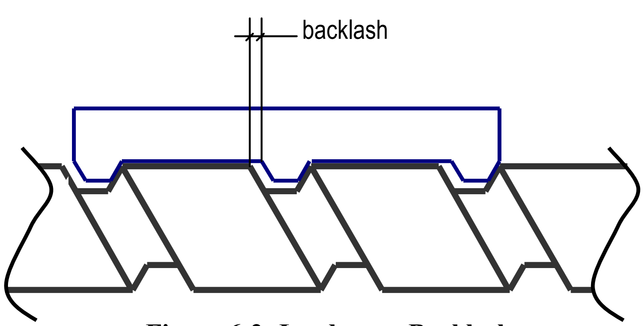


Figure 6-2: Leadscrew Backlash

The axis leadscrew backlash compensation value should be provided by the leadscrew manufacturer.

Valid Values: Enabled, Disabled

Meaning of Values

Enabled – Backlash compensation enabled
Disabled – Backlash compensation disabled

Default Value: Disabled

Discussion

Leadscrew backlash compensation is effective only after a homing operation is complete. When the linear scale is used, disable both the backlash compensation and pitch error compensation.

6.3 Backlash Value

Description

Axis leadscrew backlash compensation value.

Measured in Units of: mm, inches

Range of Valid Values: 0 – 99,999.999

Default Value: 0.0 mm, 0.0 inches

Discussion

Leadscrew backlash compensation is effective only after a homing operation is complete. When the linear scale is used, disable both the backlash compensation and pitch error compensation.

Note

Also known as "reverse error compensation."

6.4 Pitch Error Compensation Parameters and Usage

6.4.1 Overview

Pitch error compensation is calibration compensation using pitch intervals to correct for imperfections in the ballscrew of the feed motor.

In order to set up your machine to perform pitch error compensation correctly, you must understand the two parameters related to pitch error compensation, and you must set up your stored pitch error compensation in a certain file and format.

6.4.2 Pitch Error Compensation Enable

Description

Enabling or disabling of pitch error compensation.

Valid Values: Enabled, Disabled

Meaning of Values

Enabled – Pitch error compensation enabled
Disabled – Pitch error compensation disabled

Default Value: Disabled

6.4.3 Pitch Origin

Description

Index value of the machine origin (relative to the pitch error measurement starting position) among the pitch error measurement points.

$$\text{Pitch Origin} = \frac{\text{Relative Distance from Machine Origin to the Pitch Error Measurement Starting Position}}{\text{Pitch Interval}}$$

Range of Valid Values: 0 – 127

Default Value: 0

Note

This parameter may also be referred to as “Pitch Origin Index” or “Pitch Index.”

6.4.4 Pitch Interval

Description

Interval distance between the two points where the pitch error is measured.

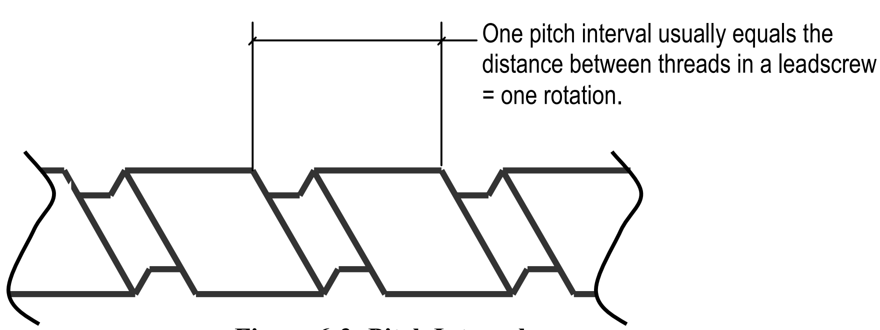


Figure 6-3: Pitch Interval

Measured in Units of: mm, inches

Range of Valid Values: 0 – 99,999.999

Default Value: 10.0 mm, 0.2 inches

Discussion

Pitch error compensation is effective only after a homing operation is complete.

Pitch error compensation occurs at any position on the axis, by linear interpolation between the pitch errors at the two nearest pitch error measurement points.

There are a maximum of 128 points of stored pitch error values, so set your pitch interval accordingly.

Note

This parameter may also be referred to as "Pitch Length."

6.4.5 Stored Pitch Error Compensation Data

6.4.5.1 Location and File Name for Stored Pitch Error Compensation Data

The pitch error compensation data must be saved in a text file with specific name, and located at specific location:

- Location: Under the ServoWorks S-100T application folder (e.g. C:\Program Files\SoftServo\S100T), there is an "ini" folder. The stored pitch error compensation data file must be located in this "ini" folder.

- File name: The store pitch error compensation data file must be named: StoredPitchErr.dat

- Example of complete file address: "C:\Program Files\SoftServo\S100T\ini\StoredPitchErr.dat"

NOTES:

1) For ServoWorks Development Kit (SDK) users, the pitch error compensation data file name and location is specified by the "sssSetPitch" API function call, and does not need to comply with the restrictions above.

2) If the pitch error compensation data file is modified while the ServoWorks S-100T application is running, the change will not be effective until the next time the ServoWorks S-100T application starts.

6.4.5.2 Required Format for Stored Pitch Error Compensation Data

Inside the stored pitch error compensation data file, the data must have the following format:

Measurement value for the starting point for Axis 1

Measurement value for the starting point for Axis 2

```
Axis_1

0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0

Axis_2

0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
0  0  0  0  0  0  0  0
```

As shown above, the data file is divided into sections by the "Axis_Number" symbol. Each section contains the pitch error compensation measurement data for each corresponding axis, specified by the axis number. The data area contains the measured pitch error value at each pitch error measurement point, and the data must be arranged in a sequence from left to right, top to bottom.

Pitch error values are measured in units of micrometers. For each axis, the maximum number of measured pitch error data is 1024.

6.4.6 Pitch Error Values

Description

A pitch error value is the absolute difference between the expected (theoretical, specified, ideal) position and the actual (measured, real) position of a pitch interval. Both values are relative to the home position. Pitch error values are machine set-up data, for an individual machine. Entering this data is equivalent to calibrating an individual machine.

Measured in Units of: mm, inches

Range of Valid Values: 0 – 99,999.999

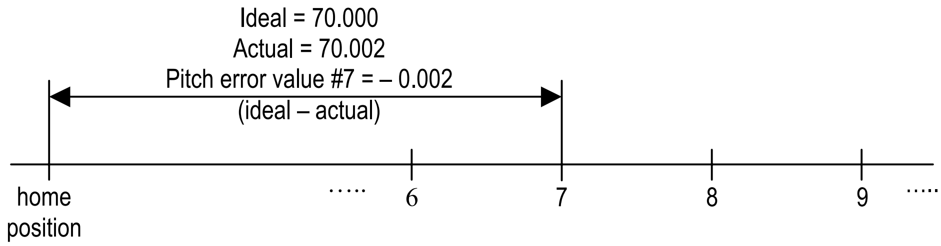
Default Value: 0 mm, 0 inches

Discussion

There are a maximum of 128 points of stored pitch error values.

Note

Pitch error is measured from the home position. Pitch error is not a relative value.



6.4.7 Example of a Pitch Error Compensation Setup

Let's assume a machine has the following parameters for the X axis:

- Soft limits: minus stroke = –1000.0 mm, and plus stroke = 1000.0 mm.
- The pitch error compensation measurement starting position is at –1000.0 mm (the minus stroke).
- The pitch interval is 10 mm.

Then, the pitch origin can be calculated as:

$$\text{Pitch Origin} = \frac{\text{Relative Distance from Machine Origin to the Pitch Error Measurement Starting Position}}{\text{Pitch Interval}} = \frac{0.0 - (-1000.0\text{ mm})}{10.0\text{ mm}} = \frac{1000.0\text{ mm}}{10.0\text{ mm}} = 100.0$$

In the stored pitch error compensation data file, in the "Axis_1" section, the first data corresponds to pitch error measurement position at –1000.0 mm (the starting point), and the data value must be 0. Then the next data value is the measured pitch error at position –990.0 mm, and the next one is measured pitch error at position –980.0 mm, and so on and so forth.

Chapter 7: Feedrate Parameters

7.1 Overview

The parameters included in this category are related to machine operation settings: preset feedrates for different manual and auto modes.

The "Feedrate" screen in Configuration Mode is shown in the following figure:

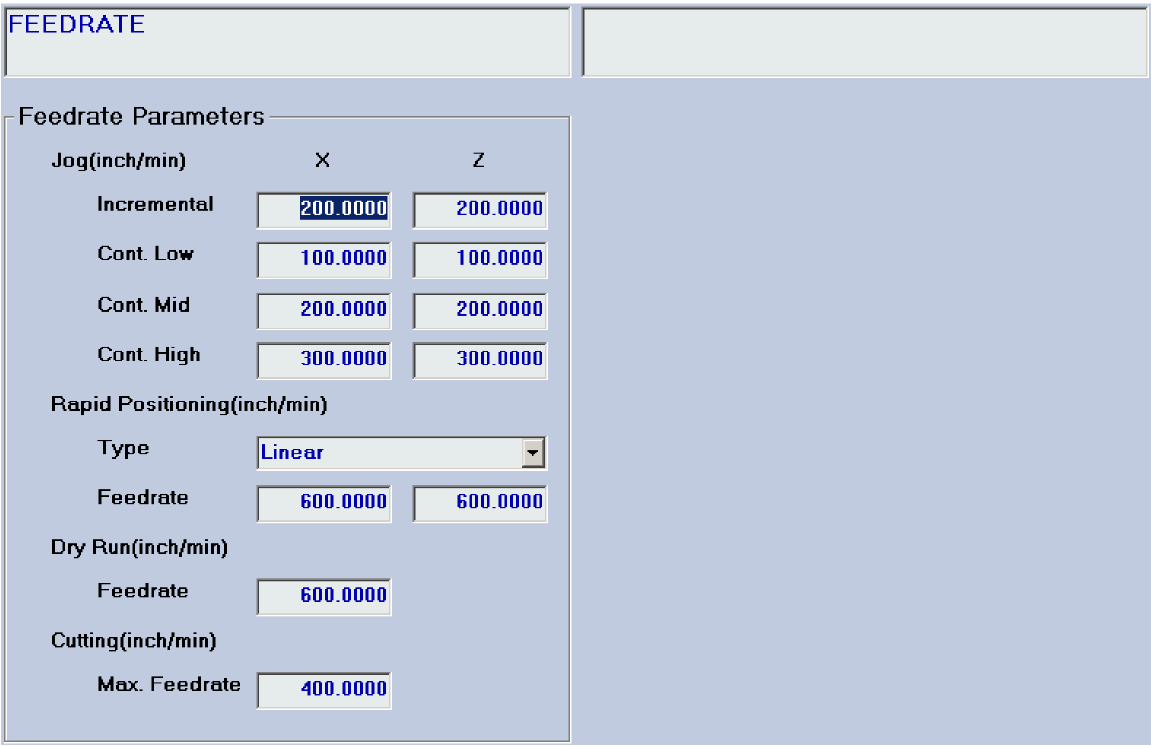


Figure 7-1: The Feedrate Parameters Display Area

"Jog" refers to both Jog Continuous Modes and Jog Incremental Mode. "Rapid Positioning refers to both Rapid Mode and G00 in Auto Mode and MDI Mode. "Dry Run" refers to Auto Mode execution with the dry run switch selected. "Cutting" refers to linear or circular interpolation (G01, G02 or G03 codes in Auto Mode and MDI Mode).

7.2 Jog Feedrate

Description

Axis feedrate to be used in Jog Incremental Mode, and for the three preset feedrate selections to be used in Jog Continuous Mode: Low Speed, Mid Speed and High Speed.

Measured in Units of: mm/min, inch/min

Range of Valid Values: 0 – Rapid Feedrate

Default Values:

Jog Continuous Mode:	**2,000.0 mm/min, 100 inches/min**
Jog Incremental Mode – Low:	**2,000.0 mm/min, 100 inches/min**
Jog Incremental Mode – Mid:	**4,000.0 mm/min, 200 inches/min**
Jog Incremental Mode – High:	**6,000.0 mm/min, 300 inches/min**

7.3 Rapid Traverse Type

Description

Which method of rapid traverse will be used for Rapid Mode and for G00 execution: Linear (a predictable straight line movement from point to point – linear interpolation – in which at least one axis moves at its rapid feedrate) and Non-Linear (in which both axes move at their rapid feedrate regardless of whether that movement is in a straight line or not).

Non-linear rapid traverse is for simultaneous motion of multiple axes in which each axis moves at its maximum velocity. In other words, each axis moves independently (individually) of the other(s), at the same or different rates (depending upon what their maximum feedrates are), and the route between two points is unlikely to be a single straight line. Non-linear rapid traverse is typically used for positioning the machine when the machine is not in contact with the part – for instance, for positioning a drill to drill a part.

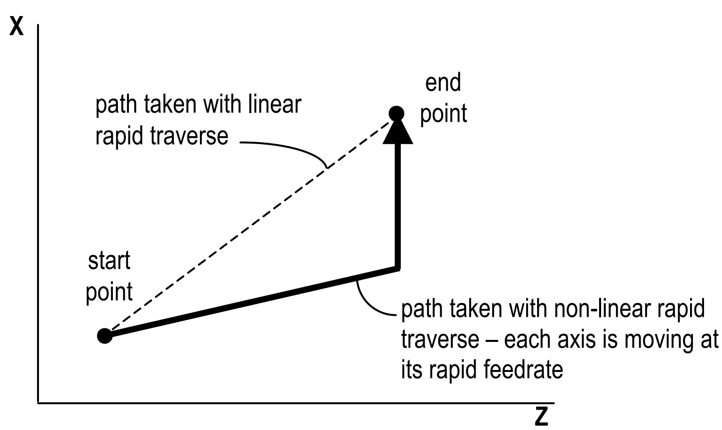


Figure 7-2: Non-Linear Rapid Traverse

Linear rapid traverse is used for moving on a straight-line path between two points, by coordinating movement along multiple axes. You can predict trajectory with linear rapid traverse, making it easy to avoid a collision. The axis with the lowest feedrate will control the coordinated feedrate in the direction of movement. Most likely, only one axis will be moving at its maximum feedrate.

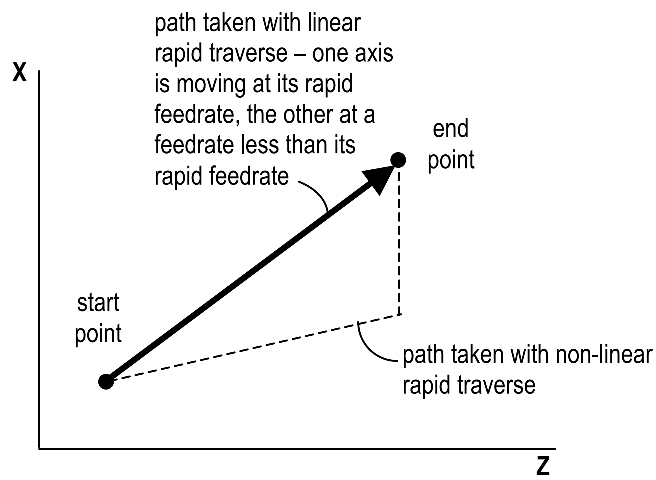


Figure 7-3: Linear Rapid Traverse

Valid Values: Linear, Non-Linear

Meaning of Values

Linear – Movement with linear interpolation of multiple axes
Non-Linear – Simultaneous movement of all axes at their respective rapid feedrates (no interpolation)

Default Value: Linear

7.4 Rapid Traverse Feedrate

Description

Maximum allowable axis feedrate on the machine. This is the speed that will be used for rapid positioning (G00).

Measured in Units of: mm/min, inches/min

Range of Valid Values: 0 – 99,999.999

Default Value: 12,000.0 mm/min, 600 inches/min

7.5 Dry Run Feedrate

Description

This is the speed that will be used when the dry run switch is activated (selected).

Measured in Units of: mm/min, inches/min

Range of Valid Values: 0 – 99,999.999

Default Value: 12,000.0 mm/min, 600 inches/min

7.6 Cutting Maximum Feedrate

Description

This is the maximum allowable feedrate that will be used for G01, G02 and G03 codes in Auto Mode and MDI Mode. This feedrate will be used in lieu of any F codes setting a higher feedrate. This parameter allows you to build some protection into your lathe or turning machine. Any cutting feedrate that is higher than this setting is ignored, and this cutting maximum feedrate is used instead.

Measured in Units of: mm/min, inches/in

Range of Valid Values: 0 – 99,999.999

Default Value: 8,000.0 mm/min, 400 inches/min

Chapter 8: Home Parameters

8.1 Overview

The parameters included in this category are hardware configurations related to the homing operation, which sets one or more axes to their home position. The homing operation guarantees that each axis will be set to a certain location, which sets the machine coordinate system.

The home position (sometimes referred to as "reference position") could be the point from which the tools start program execution and to which they return after completion of the machining sequence; a designated machine-specific position where the axes are normally located when the machine tool is not in a cycle operation; where the tool changes usually take place. The home position may be set at any convenient point inside the machine's electronic and mechanical limits, even at the machine origin.

The "Home" screen in Configuration Mode is shown in the following figure:

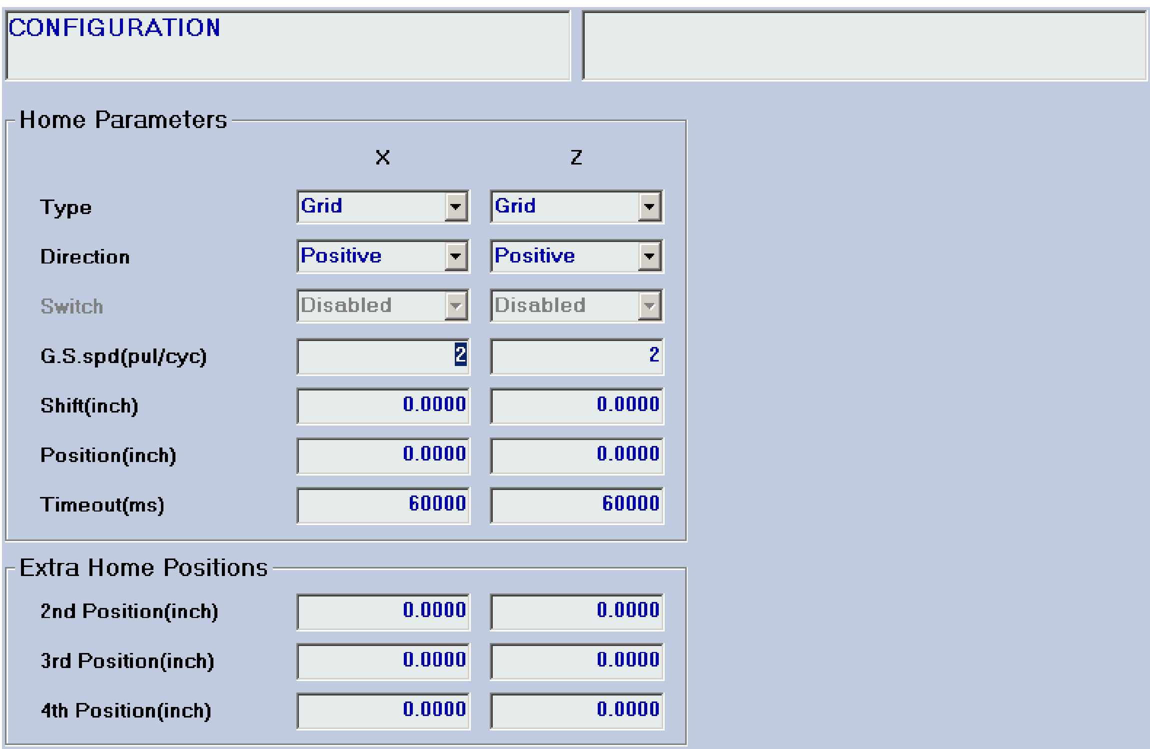


Figure 8-1: The Home Parameters Display Area

8.2 Home Type

Description

The method of finding the home position to be used for a home operation.

Valid Values: Grid, 2-Pass, 3-Pass

Meaning of Values

Grid – Find the nearest grid in the home direction.
2-Pass – Rapid positioning until reaching the home switch (i.e. the home switch is tripped), then decelerate to "grid search speed." After the home switch is untripped (is back to normal), find the nearest grid in the home direction.
3-Pass – Rapid positioning until reaching the home switch (i.e. the home switch is tripped), then decelerate to a stop, reverse direction with medium speed until the home switch is untripped (is back to normal), decelerate to stop, reverse direction again, move at "grid search speed" until the home switch is tripped again, then find the nearest grid in the home direction.

Default Value: Grid

8.3 Home Direction

Description

The direction to be used for a home operation.

Valid Values: Positive, Negative

Meaning of Values

Positive – Home to the positive direction
Negative – Home to the negative direction

Default Value: Positive

8.4 Home Switch Enable

Description

Enabling or disabling of the home switch. Without a home switch, "grid" is the only possible type of homing operation.

Valid Values: Enabled, Disabled

Meaning of Values

Enabled – Home switch enabled
Disabled – Home switch disabled

Default Value: Disabled

Discussion

For a 2-pass or a 3-pass homing operation, the home switch must be installed.

8.5 Grid Search Speed

Description

The speed at which an axis will move while that axis "looks for" the nearest grid.

Measured in Units of: pulses/cycle

Range of Valid Values: 1 – 9,999

Default Value: 2

8.6 Home Shift

Description

The distance commanded to the machine after the Z-Pulse (or grid) is found.

Measured in Units of: mm, inches

Range of Valid Values: -99,999.99 – 99,999.999

Default Value: 0.0 mm, 0.0 inches

8.7 Home Position

Description

Desired machine position when a home operation is complete, i.e. the machine is at the home position. (In other words, the machine coordinates you want to set for the physical location of the home position.) Because the home position is relative to the machine origin, setting the home position also sets the machine origin.

Measured in Units of: mm, inches

Range of Valid Values: -999,999,999.9 – 999,999,999.9

Default Value: 0.0 mm, 0.0 inches

8.8 Home Timeout

Description

Time out limit during a home operation. If this limit is reached, the home operation is aborted.

Measured in Units of: ms

Range of Valid Values: 0 – 999,999,999

Default Value: 60,000 ms

8.9 Extra Home Positions

Description

The extra home positions are up to three additional reference positions (positions #2, 3 and 4 – position #1 is the home position) that you can specify. As an example, it may be particularly useful to set a reference position where the turret of a turning machine is at a safe position before selecting a tool.

8.10 Time Charts of the Home Operation for Different Home Type, Home Direction and Home Shift Settings

Please note that the following graphs plot velocity against time, not position.

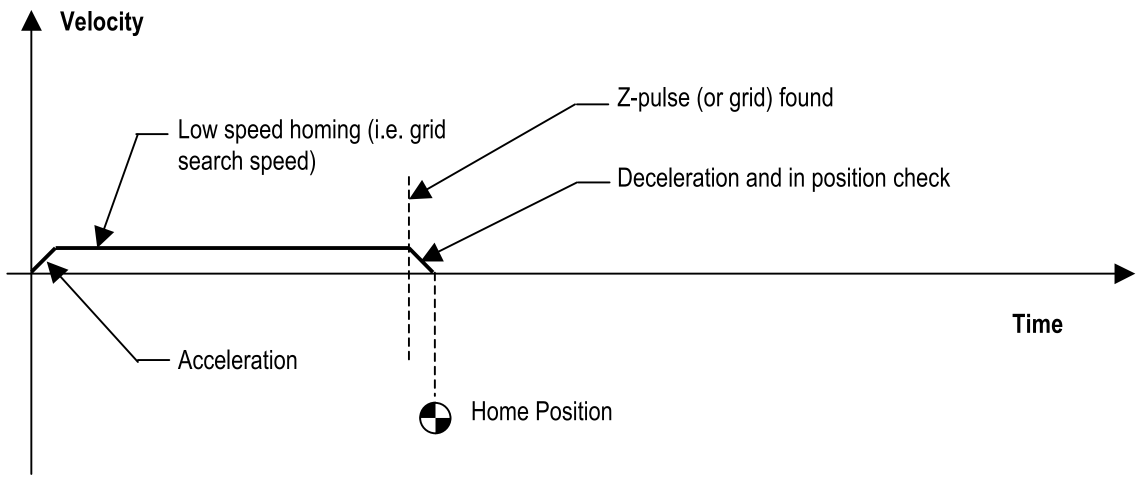


Figure 8-2: Home Type = Grid

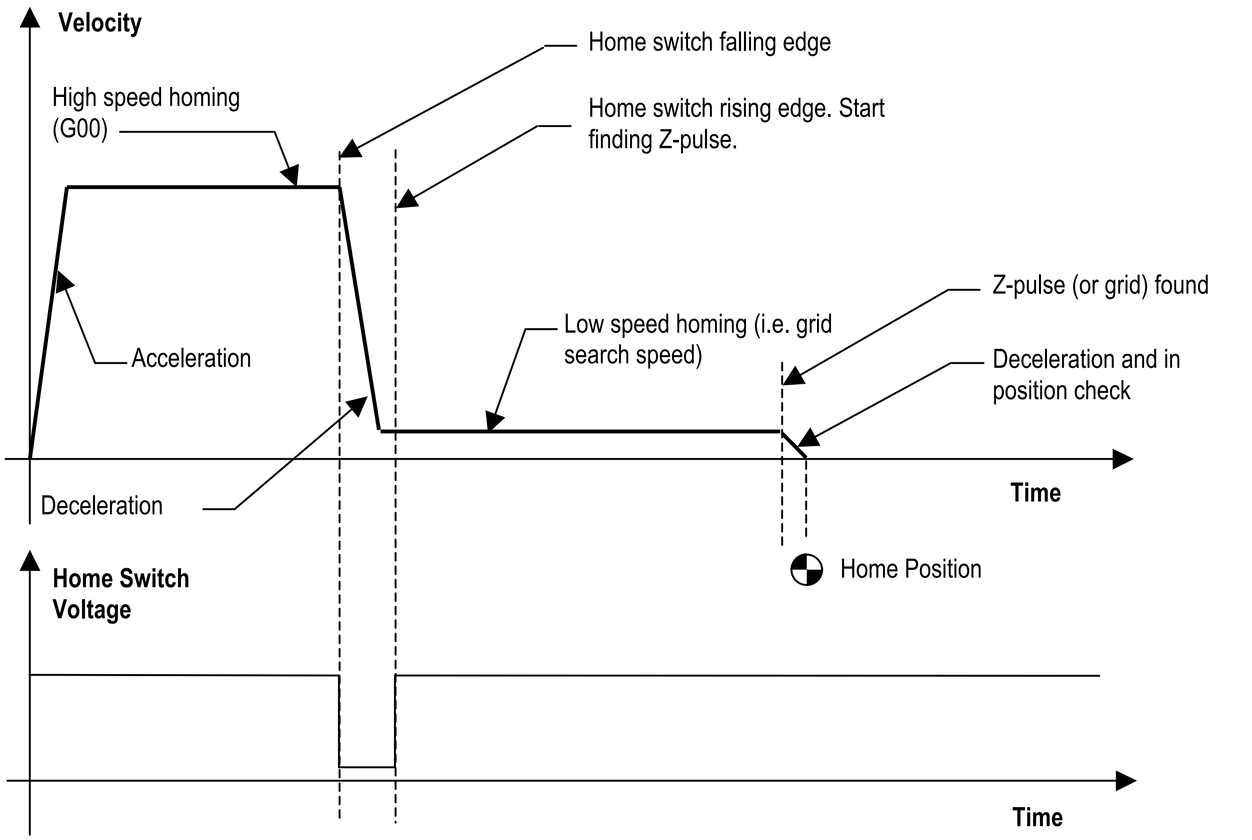


Figure 8-3: Home Type = 2-Pass

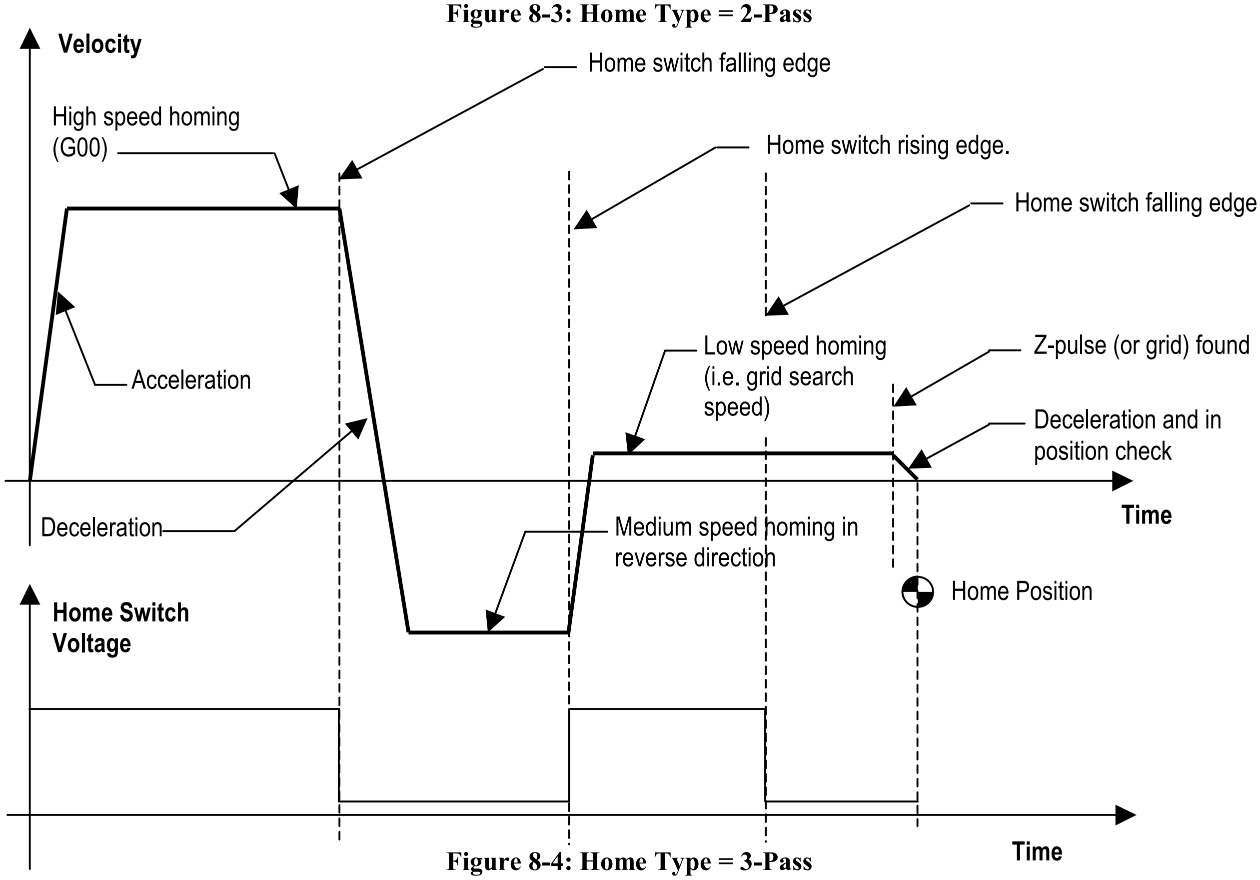


Figure 8-4: Home Type = 3-Pass

Chapter 9: HandWheel Parameters

9.1 Overview

The parameters included in this category are related to the operation of the optional handwheel (manual pulse generator).

The "HandWheel" screen in Configuration Mode is shown in the following figure:

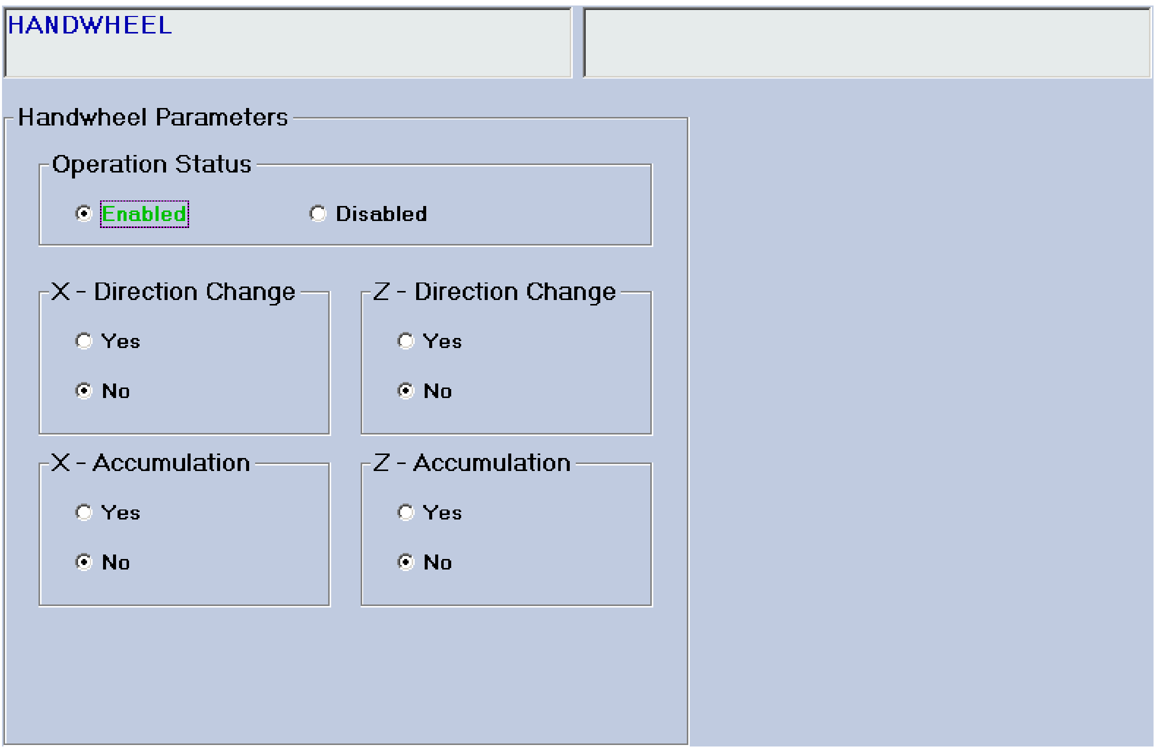


Figure 9-1: The HandWheel Parameters Display Area

9.2 HandWheel Operation Status Enable

Description

Enabling or disabling of input from an optional handwheel (manual pulse generator), to tell whether or not there is a handwheel connected.

Valid Values: Enabled, Disabled

Meaning of Values

Enabled – HandWheel enabled – ServoWorks S-100T accepts input from a handwheel (HandWheel Mode is enabled)

Disabled – HandWheel disabled – ServoWorks S-100T does not accept input from a handwheel (HandWheel Mode is disabled)

Default Value: Enabled

9.3 HandWheel Direction Change

Description

The normal positive direction for the rotation of the handwheel dial is clockwise, and the normal negative direction for the rotation of the handwheel dial is counterclockwise. However, due to the wiring of the handwheel and/or the lathe or turning machine, this may not be the case. This parameter is provided to assure that table movement can be consistent with the handwheel movement.

Valid Values: Yes, No

Meaning of Values

Yes – Change the "normal" handwheel direction
No – Keep the "normal" handwheel direction

Default Value: No

Discussion

Changing the handwheel direction is particularly useful if the normal handwheel direction is at odds with the positive and negative directions of your table. Table movement should be consistent with the handwheel rotation direction. If it is not, change this value to "Yes."

9.4 HandWheel Accumulation

Description

Whether or not to allow generator pulses to exceed the rapid traverse feedrate and accumulate.

Valid Values: Yes, No

Meaning of Values

Yes – Generator pulses exceeding the rapid traverse feedrate are accumulated in ServoWorks S-100T
No – The feedrate of the handwheel is clamped to the rapid traverse feedrate – generator pulses exceeding this rapid traverse feedrate are ignored

Default Value: No

Chapter 10: Spindle Parameters

10.1 Overview

The parameters included in this category are related to the spindle. Many of the spindle parameters are essentially the same as parameters you will set in other screens for the X and Z axes, and thus are not repeated here. Only the parameters unique to the spindle are included in this chapter.

The first "Spindle" screen in Configuration Mode is shown in the following figure:

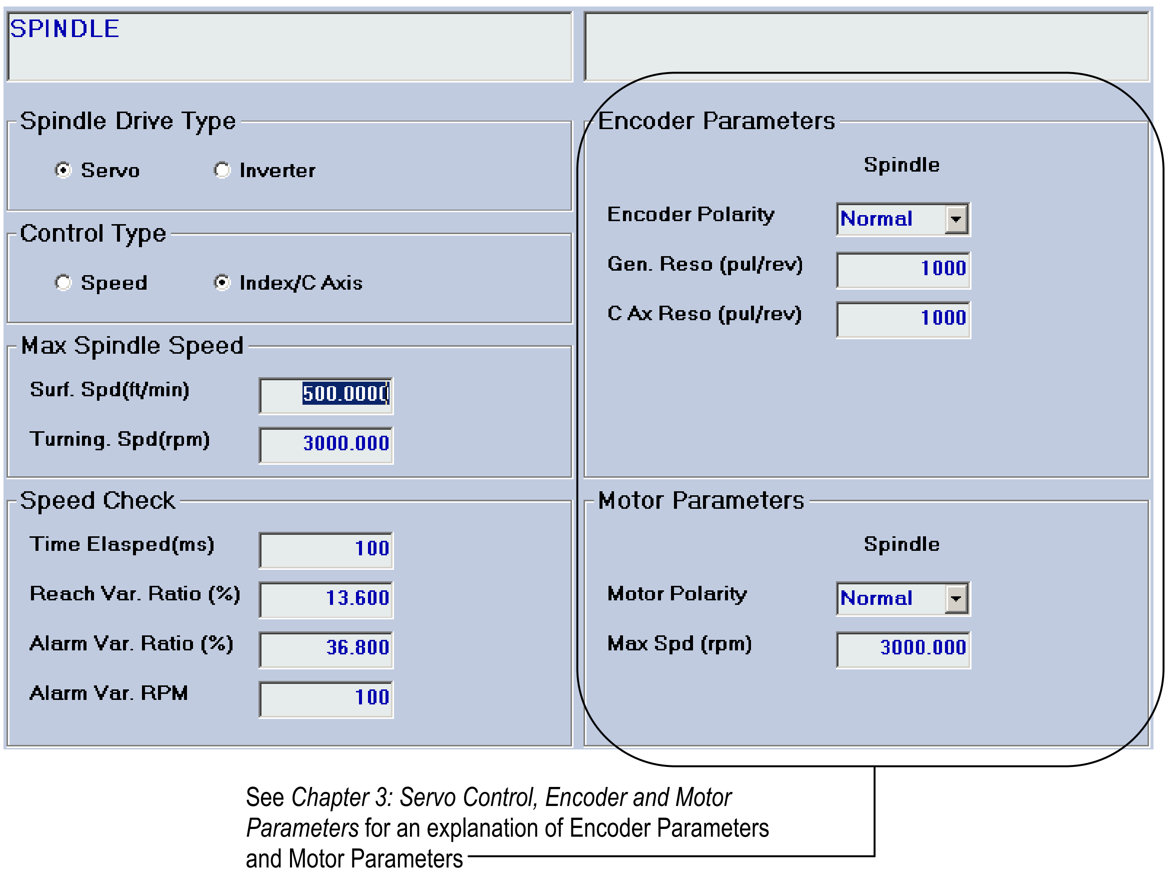


Figure 10-1: The Spindle Parameters Display Area #1

The second “Spindle” screen in Configuration Mode is shown in the following figure:

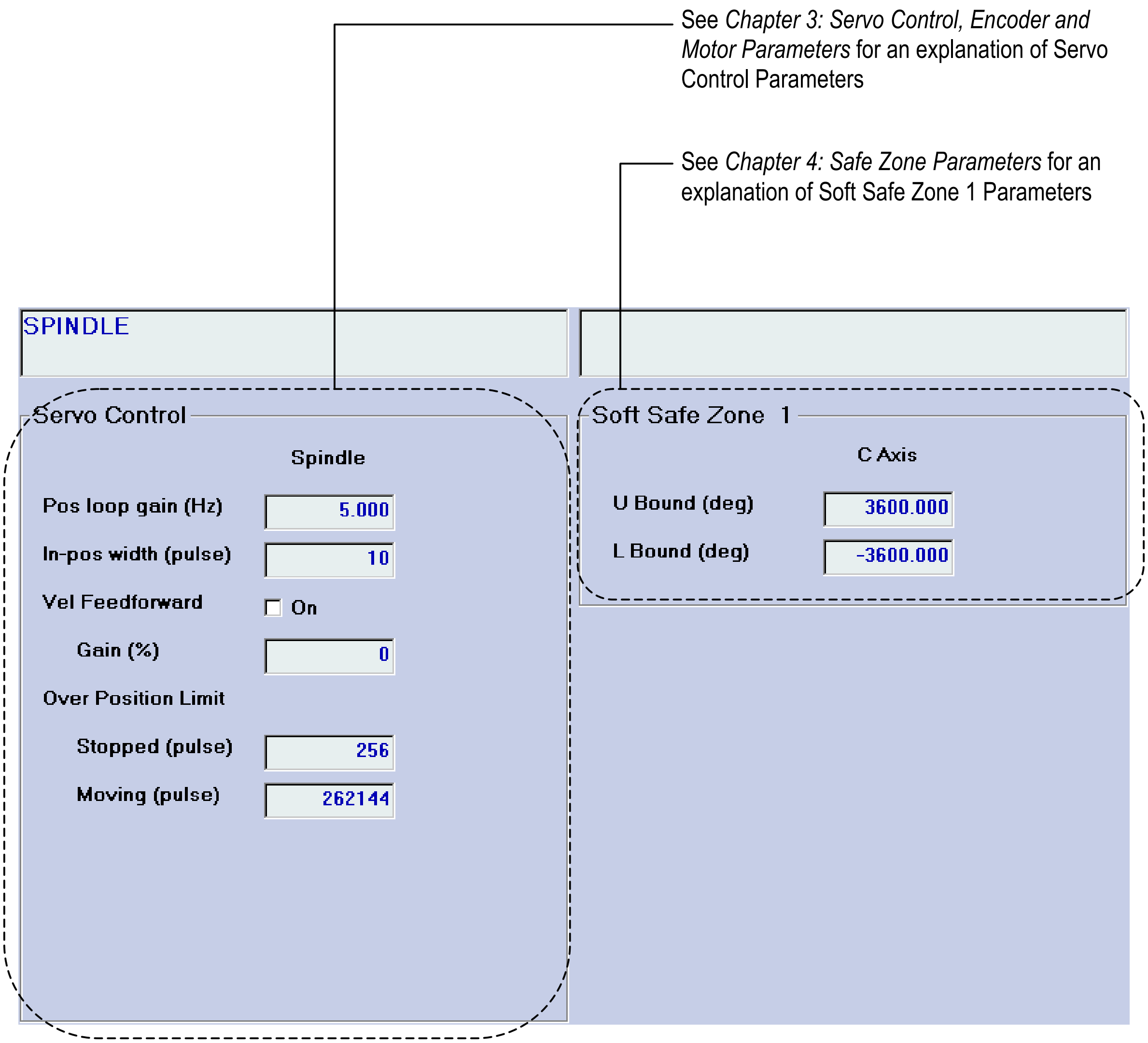


Figure 10-2: The Spindle Parameters Display Area #2

The third "Spindle" screen in Configuration Mode is shown in the following figure:

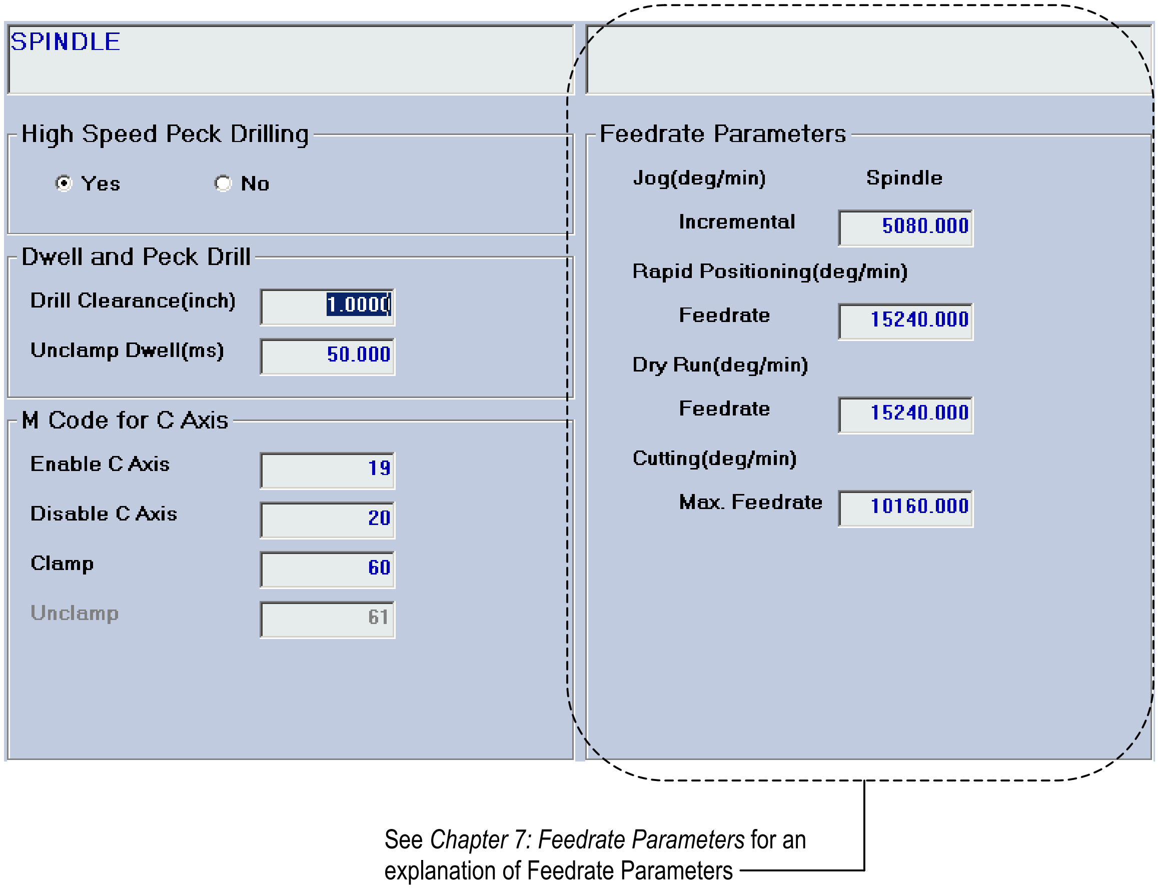


Figure 10-3: The Spindle Parameters Display Area #3

The fourth "Spindle" screen in Configuration Mode is shown in the following figure:

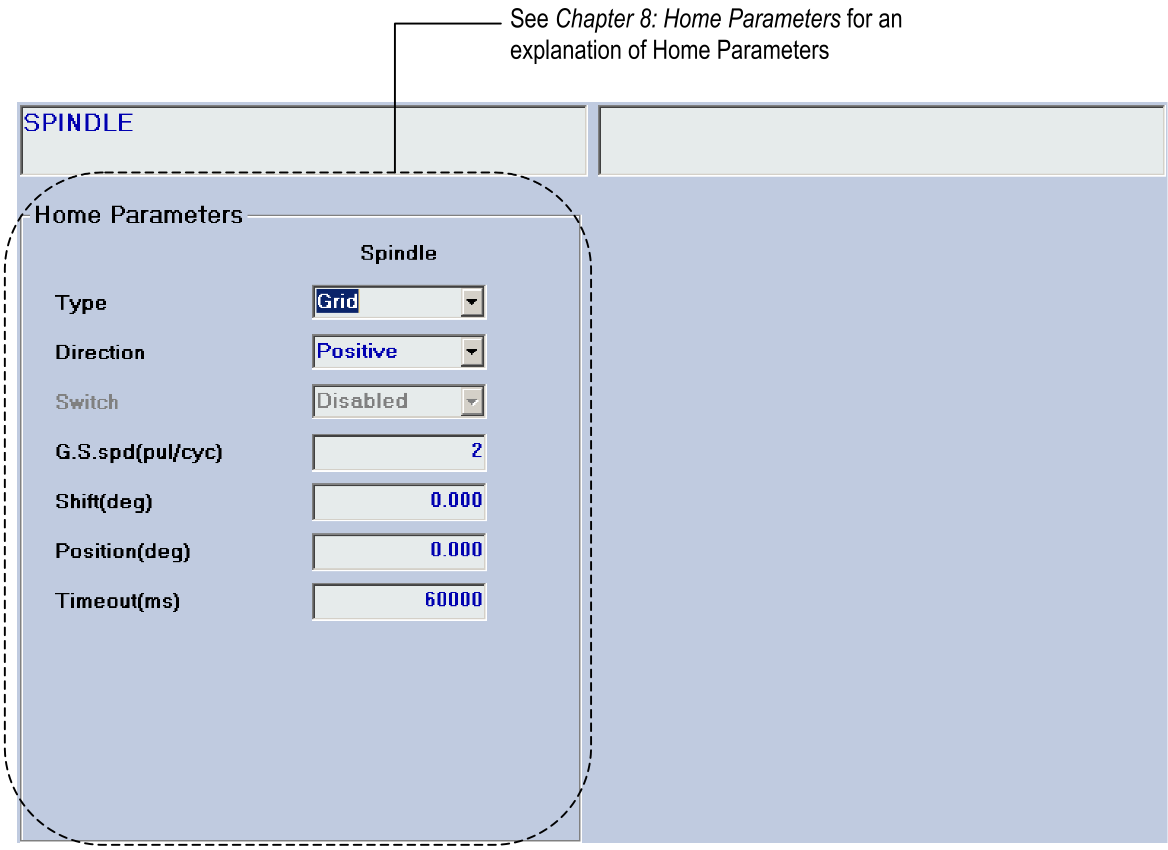


Figure 10-4: The Spindle Parameters Display Area #4

The fifth "Spindle" screen in Configuration Mode is shown in the following figure:

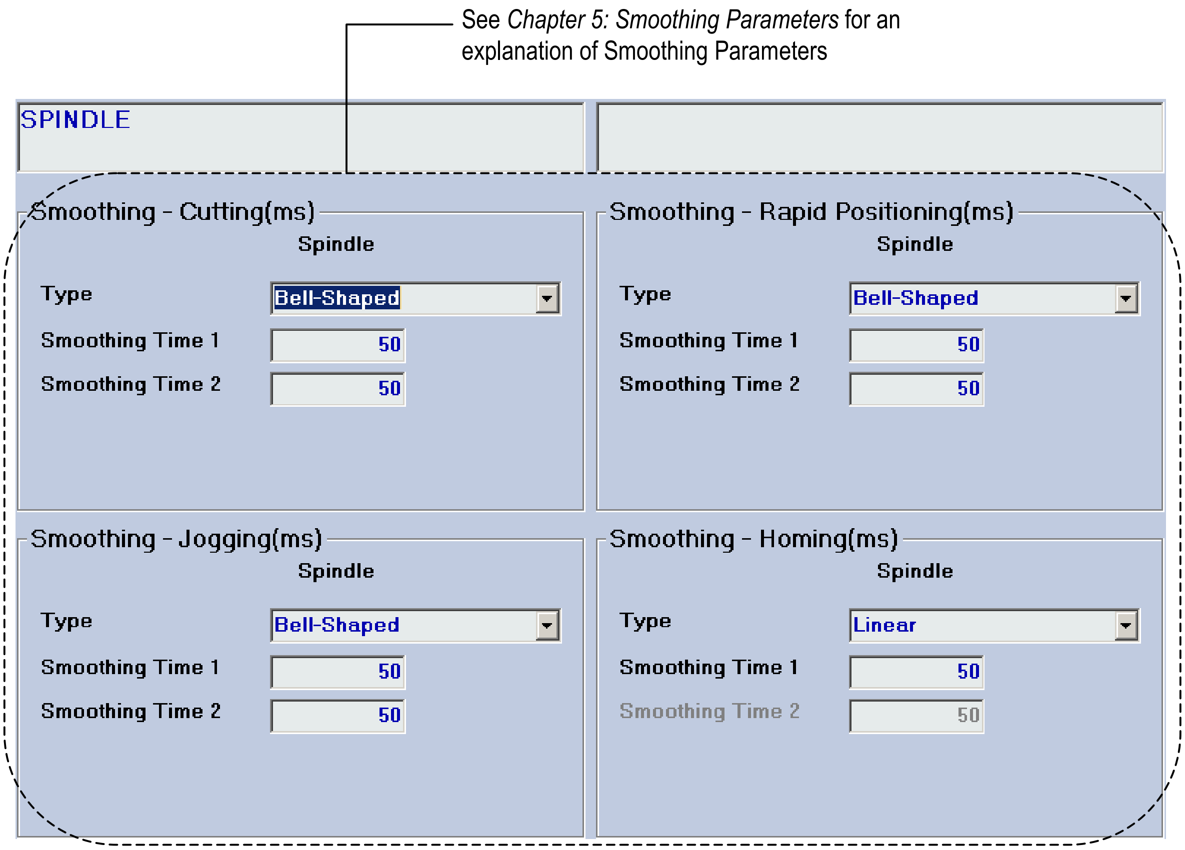


Figure 10-5: The Spindle Parameters Display Area #5

The sixth "Spindle" screen in Configuration Mode is shown in the following figure:

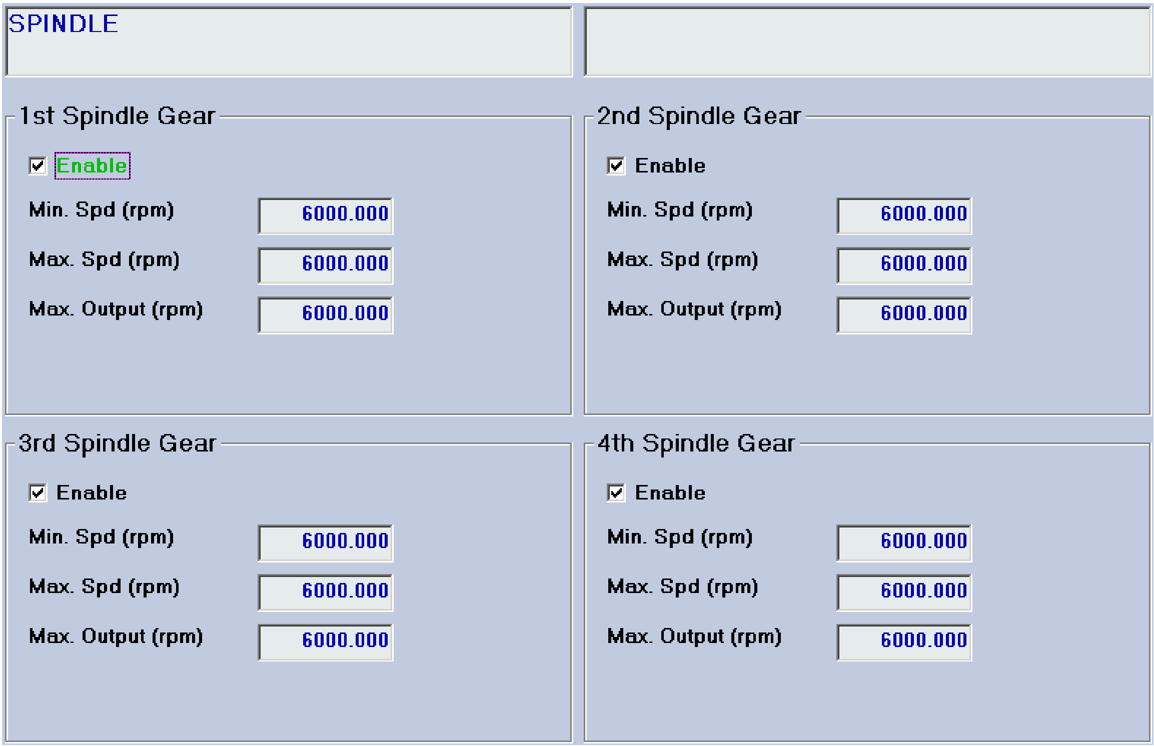


Figure 10-6: The Spindle Parameters Display Area #6

The seventh“Spindle” screen in Configuration Mode is shown in the following figure:

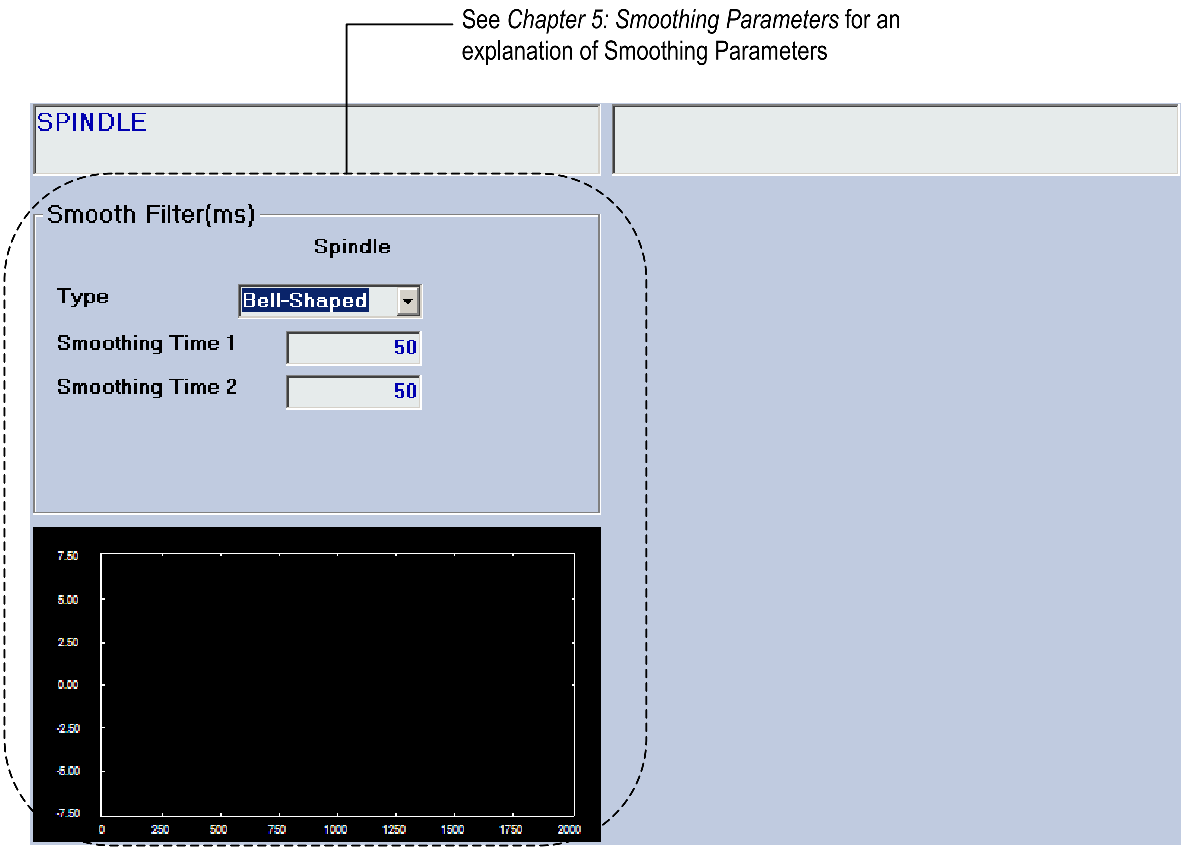


Figure 10-7: The Spindle Parameters Display Area #7

10.2 Spindle Drive Type

Description

The selection of spindle drive type in your ServoWorks S-100T system: an inverter drive or a servo drive.

An inverter drive is for velocity control only, and accepts positive voltages only – it can only be used for open loop spindle control. Its direction is controlled with PLC or a hardware port, as it can only send a unipolar (positive) signal.

A servo drive, on the other hand, is a bipolar drive that can send positive and negative voltages, and can be used for either open loop spindle control (velocity control) or closed loop spindle control (position control).

Valid Values: Servo, Inverter

Meaning of Values

Servo – Servo drive
Inverter – Inverter drive

Default Value: Inverter

10.3 Control Type

Description

This parameter only applies when the spindle drive type is set to "Servo." The control type refers to whether only the spindle speed (feedrate) will be controlled (Speed Control – for basic lathe operation), or whether the spindle position will be controlled (Index / C Axis Control – for higher order lathe operations).

For both indexing and C axis control, the spindle position is controlled with a closed feedback loop. The difference between indexing and C axis control is that indexing is for positioning of the spindle only – the spindle cannot be interpolated with other axes, while with C axis control, the C axis position (in degrees) can be interpolated with the X and Z axes.

Valid Values: Speed, Index/C Axis

Meaning of Values

Speed – Open loop feedrate control of a spindle
Index / C Axis – Closed loop indexing, or closed loop C axis control of a spindle

Default Value: Speed

10.4 Maximum Spindle Surface Speed

Description

Maximum allowable spindle surface speed that can be set with G96 (constant surface speed control) in a part program.

A surface speed is a cutting speed, which changes according to the part diameter being cut. The smaller the diameter, the more RPM is required; the bigger the diameter, the less RPM is required. The spindle rotation rate is increased or decreased in order to produce the specified constant surface speed appropriate for the spindle diameter.

Measured in Units of: m/min, ft/min

Range of Valid Values: 0 – 99,999.999

Default Value: 1,500 m/min, 5,000.0 ft/min

10.5 Maximum Spindle Turning Speed

Description

Maximum allowable spindle turning speed that can be set with G97 (constant surface speed cancel, i.e. constant turning speed) in a part program.

A turning speed is the rate at which the spindle rotates, regardless of the diameter of the part.

Measured in Units of: RPM

Range of Valid Values: 0 – 99,999.999

Default Value: 3,000 RPM

10.6 Time Elapsed for Speed Check

Description

The elapsed time after a new spindle speed command is issued before a check is performed of whether the actual spindle speed is in the range (specified by the "speed check: reach variable ratio" parameter).

Measured in Units of: ms

Range of Valid Values: 0 – 999,999

Default Value: 100 ms

Note

This is only valid when G26 (spindle speed fluctuation detection on) is in effect.

10.7 Speed Check: Reach Variable Ratio

Description

The range in which the deviation of actual spindle speed from specified spindle speed is still regarded as reaching the specified speed.

$$\frac{|\text{actual} - \text{command}|}{|\text{command}|} \times 100$$

Measured in Units of: %

Range of Valid Values: 0 – 100

Default Value: 13.6

10.8 Speed Check: Alarm Variable Ratio

Description

The range, in terms of percent, beyond which the deviation of actual spindle speed from specified spindle speed will trigger an alarm.

$$\left|\frac{\text{actual} - \text{command}}{\text{command}}\right| \times 100$$

Measured in Units of: %

Range of Valid Values: 0 – 100

Default Value: 36.8 %

10.9 Speed Check: Alarm Variable RPM

Description

The range, in terms of RPMs, beyond which the deviation of actual spindle speed from specified spindle speed will trigger an alarm.

$$\left| \text{actual} - \text{command} \right| > 0$$

Measured in Units of: RPM

Range of Valid Values: 0 – 99,999.999

Default Value: 100 RPM

10.10 Spindle Encoder Polarity

Description

How the encoder feedback value is counted: in normal direction or in reversed (up/down) direction.

Valid Values: Yes, No

Meaning of Values

Yes – Normal encoder value counting
No – Reversed encoder value counting

Default Value: Yes

Discussion

Encoder polarity has to match motor polarity; otherwise the servo loop control will fail or run away immediately.

Note

This parameter may also be referred to as “Spindle Encoder Direction Change.”

10.11 General Spindle Encoder Resolution

Description

Number of encoder pulses per motor shaft revolution for general spindle position control. (1 encoder pulse = 4 encoder counts for encoders with quadrature).

Measured in Units of: pulses per revolution

Range of Valid Values: 1 – 999,999

Default Value: 1,024 pulses per revolution

10.12 C Axis Encoder Resolution

Description

Number of encoder pulses per motor shaft revolution for C axis closed loop operation.
(1 encoder pulse = 4 encoder counts for encoders with quadrature).

Measured in Units of: pulses per revolution

Range of Valid Values: 1 – 999,999

Default Value: 1,024 pulses per revolution

10.13 High Speed Peck Drilling Enable

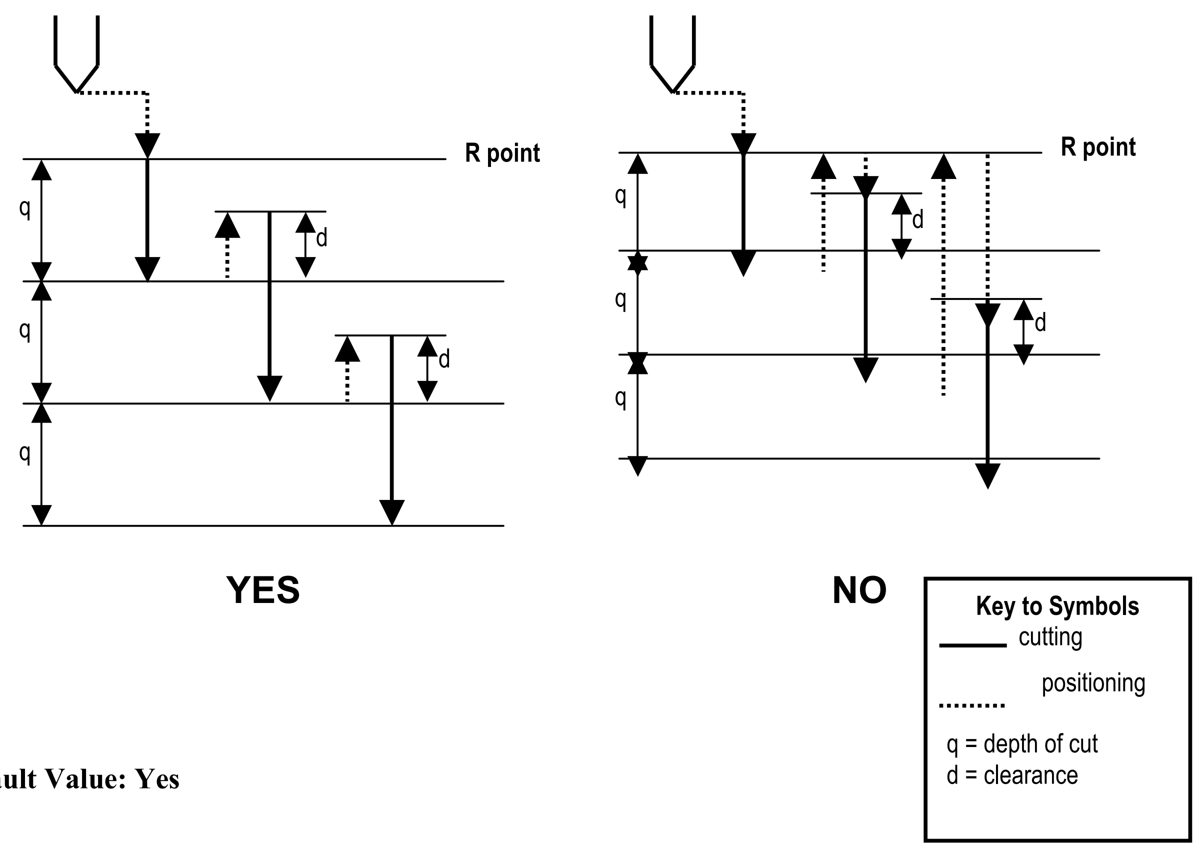
Description

Enabling or disabling of high speed peck drilling. During a high speed peck drilling cycle, the tool feeds in to the peck distance or depth of cut, then retracts a small pre-determined distance, which is the chip-breaking process, and then feeds to the next peck, which takes the tool deeper.

Valid Values: Yes, No

Meaning of Values

Yes – High speed peck drilling enabled
No – High speed peck drilling disabled (the tool always retracts to the same point)



Default Value: Yes

10.14 Drill Clearance (Dwell and Peck Drill)

Description

The drill clearance required for high speed peck drilling.

Measured in Units of: mm, inches

Range of Valid Values: 0 – 99,999.999

Default Value: 0.0 mm, 0.0 inches

10.15 Unclamped Dwell(s) (Dwell and Peck Drill)

Description

The dwell time for unclamping C-axis (if there is such a clamp device, or a brake).

Measured in Units of: ms

Range of Valid Values: 0 – 99,999.999

Default Value: 0 ms

10.16 M Codes for C Axis

Description

These parameters allow you to set M codes for specific, C Axis-related functions:

- Enable C Axis
- Disable C Axis
- Clamp
- Unclamp