



# STACKSHOT CONFIGURATION SETTINGS & PROGRAM MODES

## Understanding the Configuration Settings

Configuration Parameter	Definition	Value Range & Default Setting	My preferred Settings	Notes
<b># Pics</b>	Number of shutter activation pulses generated after each movement of camera	1 - 1,000 - 1	1 for live view and mirrorless 2 for DSLR	Select 2 if using Mup mode with DSLR to minimize vibration
<b>Tsettle</b>	The amount of time following movement of rail before first shutter actuation	100ms - 24hrs - 2 seconds	2-5 seconds	Use longer pause for heavy rail load or high center of gravity
<b>Toff</b>	The amount of time between shutter activation pulses when taking multiple images per step	100 $\mu$ s - 24hrs - 500ms	At least 2 seconds for DSLR in Mup mode, otherwise 500ms	Only relevant when “# Pics” is set to a value greater than 1
<b>Load/Save</b>	Create new saved configurations or load previously saved configurations	10 configuration sets available	Configure settings for all commonly used equipment configurations	Optional, but useful tool for increasing efficiency and consistency
<b>Auto Return</b>	Instruction to return rail to starting position after stack completed	Yes - No - Yes	Yes	Especially useful when using precision specimen mount, as start position will be consistent
<b>Speed</b>	Motor speed	99 $\mu$ m/sec - 4.96mm/sec - 4.96mm/sec	1mm/sec	Increasing speed causes a decrease in torque. With heavy loads keep speed low
<b>Tlapse</b>	Amount of time between individual stacks in time-lapse mode	Off - 24hrs - Off	Keep setting to Off unless shooting a time-lapse series	If any value other than Off is entered in settings, time-lapse will be active

<b>Tpulse</b>	Duration of shutter activation pulse sent to camera	100 $\mu$ s - 24hrs - 500ms	500ms	Use shortest pulse duration that does not cause missed-actuations
<b>Tramp</b>	Time motor takes to reach speed (as selected in "Speed", above)	10ms - 10sec - 1sec	1 second	Higher acceleration significantly increases vibrations, especially with high center of gravity loads
<b>Units</b>	Distance units	Imperial/mils, Metric/mm, or Steps - Metric/mm	Metric/mm	Use whatever units you are comfortable with
<b>Torque</b>	Rotational force produced by the stepper motor (usually expressed as Newton/meters)	1 - 10 - 5	5	Increasing torque consumes more energy but may be required to move very heavy camera loads
<b>Hi Precision</b>	Optional micro-stepping operation allowing for steps as short as 1 $\mu$ m	On - Off - Off	Off unless using very high magnification with need for 1 $\mu$ m steps	Inefficient, noisy, and prone to non-uniform stepping errors when activated
<b>Backlight</b>	Brightness of LCD screen	1 - 10 - 10	10	Backlight is not bright, even at maximum setting
<b>Dist/Rev*</b>	Distance of linear rail travel per revolution of motor <sup>1</sup>	1 $\mu$ m – 999.9mm - 1.59mm	1.59mm <sup>2</sup>	This value will change as backlash compensation is adjusted
<b>Backlash*</b>	Backlash compensation during initial step in sequence	0 $\mu$ m – 1001.4mm <sup>3</sup> - 224 $\mu$ m	140 $\mu$ m <sup>4</sup>	All linear actuators of this type have some degree of laxity in the lead screw/nut coupling which is apparent when the direction of movement is reversed. Use this setting to adjust amount of compensation up or down

\* These parameters can be accessed from the shooting menu by depressing the “Config” button for 3 seconds.

<sup>1</sup> This parameter is confusing – the shaft rotation of the motor is mechanically coupled to the nut of the linear actuator. Once stable operation is established (after backlash is taken up), the relationship between rotational and linear travel becomes fixed. However, changing this value also changes the “Backlash” value, suggesting that the variable “Dist/Rev” is only relevant to the initial step of the rail and is, in fact, an alternative expression of backlash compensation. The parameter might be more appropriately named “Dist/Rev-initial”.

<sup>2</sup> This value is tied to the value entered for backlash compensation. I recommend leaving it at the default setting and using the backlash compensation parameter to adjust the amount of compensation applied.

<sup>3</sup> Value varies in proportion to “Dist/Rev” setting.

<sup>4</sup> My particular rail has considerably less backlash than is allowed for by the default backlash compensation setting (224 $\mu$ m). Reducing my compensation to 140 $\mu$ m results in an initial step length that is equal to subsequent step lengths, avoiding focus gaps at the beginning of a stack.

## Understanding the Program Modes

Program Mode*	Inputs Required	Use Cases	Application Notes
<b>“Manual Dist” or Manual Distance Mode</b>	1) Step Length <sup>1</sup> 2) Start and End Positions <sup>2</sup>	Use when you have selected an appropriate step length and know where you wish to start and stop the stack, but want to retain control over when the rail moves to its next position and takes next shot(s)	A useful mode for timing your shots around variability in light conditions (e.g. moving clouds)
<b>“Auto-Step” or Automatic Step Mode</b>	1) Number of Steps 2) Start and End Positions	This mode is only useful if you measure the total travel distance and calculate the resulting step length, without which you will not know if your number of steps is adequate to avoid focus banding	This mode has little practical application unless step length is calculated. Better results can be achieved directly, using the Auto Distance Mode
<b>“Auto-Dist” or Automatic Distance Mode</b>	1) Step Length 2) Start and End Positions	This is the best mode in virtually all circumstances. The optimal step length, based on lens/magnification, can be selected, and the depth of the stack is selected by direct observation	No values need to be guessed when using this mode. It is the most reliable approach to automated focus stacking of small subjects
<b>“Total Dist” or Total Travel Distance Mode</b>	1) Number of Steps 2) Travel Distance	Similar to the Auto-Step Mode, but even less useful. The start position is set by positioning the camera, but the end position is not verified by direct observation, risking over/under estimation of the required travel distance. The step length must be calculated to ensure adequate coverage	This mode may have some application in settings where the start and end points of the stack are not critical (photographing textures), but the step length still must be calculated to ensure it is adequate for chosen magnification ratio

<p><b>“Dist/Step” or Distance per Step Mode</b></p>	<p>1) Number of Steps 2) Step Length</p>	<p>A useful mode for subjects where a defined start and end position are not important, and the total distance of travel is irrelevant (though it can easily be calculated)</p>	<p>A useful tool for closeup photography of surface textures of larger objects, where any representative area of the subject will suffice</p>
<p><b>“Manual” or Manual Mode</b></p>	<p>1) Step Length</p>	<p>Similar to the Manual Distance Mode, but without defined start and end points. Provides full control over the timing of shots and the total distance of travel</p>	<p>A very handy tool for situations in which maximum control over timing and the total depth of image is critical. This is a fully manual mode, requiring a push of the “Up” or “Down” buttons<sup>3</sup> for each consecutive shot</p>
<p><b>“Continuous” or Continuous Mode</b></p>	<p>1) Travel Distance</p>	<p>This is a strange mode with little or no application in my macro photography. The travel distance is set and when the stack is initiated the rail moves continuously, forward or backward, until the set distance has been traveled. Shutter pulses are sent to the camera at intervals defined by the sum of the Toff and Tpulse times defined in the configuration settings</p>	<p>I do not know of a practical use for this mode, especially at high magnification ratios. Natural light would require longer exposures, and even using flash at very low power may not provide a fast-enough exposure to overcome the inevitable vibration and motion blur</p>

\* Each of these modes are examined as they pertain to photographing small subjects at a magnification ratio of 1:2 or greater. A focusing rail is not the correct tool to use when photographing larger subjects (landscapes, product images, etc.) due to perspective shifting.

<sup>1</sup> Step length is critical to any focus stacking operation in macro photography. Modes that allow entry of step length are intrinsically more accurate.

<sup>2</sup> Start and end positions are determined by direct observation of the subject as the camera is moved from closest to furthest points of interest. It does not require direct measurement of total travel distance but ensures that all points between the start and end positions will be in focus, providing that correct step length was selected.

<sup>3</sup> This is one of several modes in which the motion of rail can be set by the button chosen (“Up” for forward, and “Down” for backwards). The other modes in which this is possible include Total Travel Distance Mode, Distance per Step Mode, Manual Distance Mode, and Continuous Mode.