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TUNING GUIDE

For all controller types excluding integrated

Xeryon devices use a very versatile control system to enable their movement. This level of control enables our products to operate in a wide range of applications. However, knowing how to tune the stage for each specific use case can be challenging. For this reason, the following document has been made to help describe the most common faults and their resolutions. Ensure to follow all of the instructions in this document to tune your device to the best of its ability.

KEY REQUIREMENTS

Xeryon Stage or Actuator	Any stage or actuator excluding devices with an integrated controller.
Xeryon Controller	The relevant controller for the selected device
Windows Computer	Any computer that can run the Windows Interface provided
Xeryon USB	This USB contains the Xeryon Windows Interface and the “settings_default.txt” files

SAFETY & HANDLING INSTRUCTIONS

Instruction	Reasoning
Do not touch the ceramic strip	Oils from skin reduce friction dramatically and can lead to poor performance, slipping, and oscillation. Handle the strip only with gloves or lint-free wipes when cleaning.
Never Lubricate the Ceramic Strip or Guide Mechanism	Lubricants disrupt the friction-based drive mechanism and will severely reduce performance. Only IPA should be used for cleaning.
Avoid Applying Side Loads	The actuator is designed for axial motion only. Lateral forces from misalignment, over-tightened guides, or uneven mounting surfaces can cause noise, reduced force, or other unpredictable behaviour.
Operate Within Specified Limits	Do not exceed the maximum load, speed, or duty cycle specified for the stage model. Prolonged high-speed scanning without breaks can lead to overheating. XLA-10 actuators especially need to observe a maximum of 50% operational time in a 120s period.
Use Only Approved Cables	Vacuum-rated stages require vacuum-compatible cables to operate correctly in both directions. A proper vacuum feedthrough should be used in combination with airside cables.

Keep Electrical Connections Secure	Ensure the power supply is appropriate for the controller and properly connected. Do not connect or disconnect any cables while the controller is powered. Ensure that controllers with exposed PCBs are not placed onto conductive surfaces.
Stop the Motor After Operation	Do not let the motor remain on for a prolonged period of time in one specific position. This may cause damage to the ceramic strip and reduce the functionality of the device.

BEFORE YOU START

1. **Verify Mechanical Setup**
   Ensure the stage can move freely over its full stroke without any mechanical interference.
   Confirm the stage is mounted on a flat, rigid surface to avoid twisting or deformation.
   Inspect cable routing to ensure there is no drag or resistance, especially near stroke limits.
   For vacuum stages: verify that vacuum-rated cables are used with straight-through vacuum flanges.
2. **Prepare your tools**
   A Windows computer with all of the relevant files included on your Xeryon USB stick.
   Power supply connected to the controller with basic lights illuminating to confirm operation.
   USB Serial connection to the controller confirmed and stable.
3. **Perform a functionality check**
   Home the stage if applicable by pressing the button “Find Index”.
   Execute a short series of steps and scans in both directions to verify basic operation and movement.
   If the stage moves only in one direction, does not move at all, or the actual position box fails to update, stop immediately and confirm the cables are correct and there are no loose connections.

HOW TO PERFORM TUNING

Tuning can be performed using multiple methods. The most clear and recommended method is to make changes in the relevant “Settings_default.txt” file while working with the Windows Interface. Each time a change is made to one of the parameters, be sure to save the file and press “Reset” in the Windows interface.

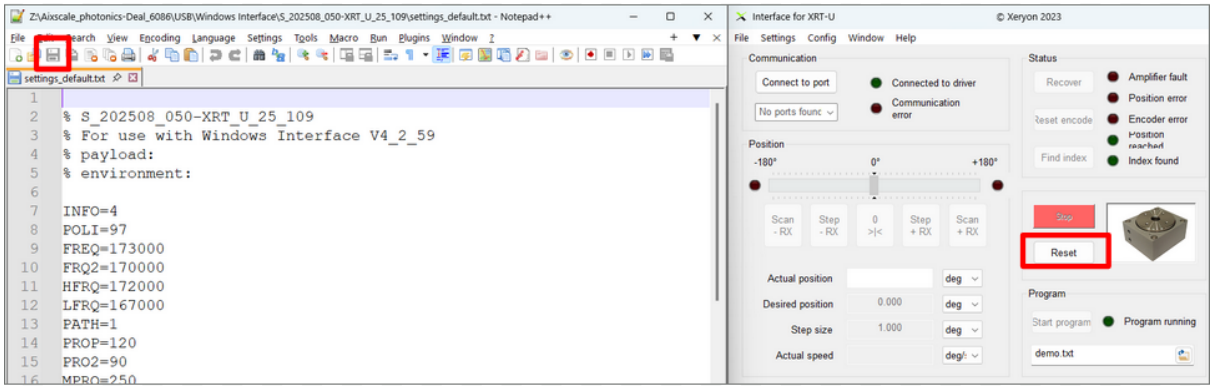

Figure 1: Visual guide on how to adjust settings and reset the Windows Interface

COMMONLY ENCOUNTERED PROBLEMS

1.	Excessive Noise During Motion
Symptoms	• Clicking, buzzing, or a high-pitched noise when the actuator moves.
Typical Causes	• Drive frequencies (FRQ2, FREQ) are not optimised. • Motion parameters are too aggressive (high speed or acceleration). • Mechanical friction due to contamination on the strip or rail.
Resolution	• Increase the values of FRQ2 and FREQ in steps of 500, keeping FRQ2 below FREQ and both below the value of HFRQ. • Reduce speed (SSPD) and acceleration (ACCE). • Clean the ceramic strip with IPA and run the device for 60 seconds to ensure the IPA has been evenly spread and dries correctly.
2.	**The stage cannot reach the desired position**
Symptoms	• Reaching a location close to the desired position, but unable to reach the desired position.
Typical Causes	• FREQ is unable to provide enough force for Zone 1 movement.
Resolution	• Decrease the value of FREQ in steps of 500, keeping the value greater than FRQ2.
3.	**The stage oscillates at the landing position**
Symptoms	• The stage keeps oscillating around the desired position but does not stop or land correctly.
Typical Causes	• FREQ provides too much force for Zone 1 movement, leading to overshoot and underdamping.
Resolution	• Increase the value of FREQ in steps of 500, ensuring that the value stays below HFRQ. If this is not sufficient, increasing the value of FRQ2 can also provide a benefit. Ensure that the value of FRQ2 remains smaller than the value of FREQ. • Additionally, the value of PTOL and PTO2 can be increased to make landing easier.
4.	**Insufficient working force**
Symptoms	• The stage struggles to move the desired payload.
Typical Causes	• The value of FRQ2 is unable to provide enough force to the actuator. • The MASS parameter is set too low for the current load.
Resolution	• Decrease the value of the FRQ2 parameter in steps of 500, ensuring that it remains greater than LFRQ. Increasing the value of the MASS parameter in steps of 100 can also provide great benefit. This value should vaguely represent the mass of the payload in grams.
5.	**Rough or Jerky Motion**
Symptoms	• Motion is not smooth; the actuator vibrates or moves unpredictably during travel.

Typical Causes	• MASS parameter set too low, leading to movement oscillations. • FRQ2 is not providing the correct force to maintain consistent movement.
Resolution	• Increase the value of the MASS parameter in steps of 100, to approximately match the mass of the payload in grams. • Adjust FRQ2 in steps of 500 until smooth motion is achieved. • Increase the value of FRQ2 to provide less force and reduce speed oscillation. • Decrease the value of FRQ2 to gain more consistent speed and increase force.
6.	**Stage Not Reaching Desired Speed**
Symptoms	• The stage moves more slowly than expected, cannot achieve the set speed (SSPD), or the speed varies during motion.
Typical Causes	• FRQ2 is not set to a value that can provide sufficient force. • SSPD is set higher than what the actuator can achieve with the current load or tuning.
Resolution	• Decrease the value of FRQ2 in steps of 500 to increase the force. Ensure to keep the value above LFRQ. • Reduce SSPD to a value suitable for the current load and application.
7.	**Low or inconsistent holding force**
Symptoms	• The stage cannot maintain its position when stationary, slips under load, or shows variation in holding torque depending on where it is on the strip.
Typical Causes	• Contamination on the ceramic strip reducing friction.
Resolution	• Clean the ceramic strip with IPA and run the device for 60 seconds to ensure the IPA has been evenly spread and dries correctly. This will restore proper friction levels.

PARAMETERS OF INTEREST

Parameter	Description	Range
SSPD	Defines the speed the controller attempts to reach during closed-loop movements. • Lower SSPD gives more control and smoother motion. • Higher SSPD increases travel speed but may exceed available force if FRQ2 is too high. If increasing the value of SSPD, ensure that the value of MSPD is greater than the new desired speed.	0 to 250 mm/s
ACCE	Controls how quickly the stage accelerates toward the target speed.	0 to 65500 mm/s^2

	• Reduce ACCE to prevent jerky starts or unstable movement. • Increase ACCE for faster motion when stability is already good.	
DECE	Controls how quickly the stage slows down as it approaches the target position. • Increase DECE to prevent oscillations near the landing point. • Reduce DECE if overshoot occurs due to aggressive braking.	0 to 255 mm/s^2 XD-C 0 to 65500 mm/s^2 All other controllers
FRQ2	This is the main frequency used during scanning or bulk movement. A lower frequency allows for more force, whereas a higher frequency can provide smoother motion. • If the stage struggles to reach the set speed, → Decrease FRQ2 (more force). • If movements are noisy or unstable → Increase FRQ2 (smoother behaviour). • Must always stay above LFRQ and below FREQ.	LFRQ to (FREQ - 500) Hz The value of LFRQ is defined in the "settings_default.txt" file This value should never be lower than 85,000 Hz for XLA-10 devices
FREQ	Frequency used during final positioning. Controls landing accuracy and overshoot. A higher frequency allows for more control, whereas a lower frequency provides more force. • Stage stops early → Decrease FREQ. • Stage oscillates or overshoots → Increase FREQ. • Must always stay above FRQ2 and below HFRQ.	(FRQ2 + 500) to HFRQ The value of HFRQ is defined in the "settings_default.txt" file
MASS	Compensates the controller response for the payload mass. • Increase MASS (in steps of 100) when carrying heavier loads to reduce oscillations. • Decrease MASS if motion feels sluggish or slow to respond.	0 to 1000 (Approximately equal to the mass of the payload in grams)
PRO2	Closed-loop gain is used during scanning and bulk motion. • Lower PRO2 if movement feels noisy or unstable. • Increase PRO2 for improved speed regulation.	0 - 250 The value of PRO2 must always be lower than the value of PROP
PROP	Closed-loop gain used during final positioning. • Increase PROP for faster settling and reduced position error. • Reduce PROP if oscillations occur during landing.	0 to 250 The value of PROP must always be higher than the value of PRO2
PTOL	Defines how close the stage must be to the target before the controller declares "Position Reached." • Increase PTOL for difficult landings or noisy environments. • Keep PTOL small for high-precision applications.	0 - 255 Encoder counts

PTO2	A backup tolerance window is used if the stage cannot settle within PTOL before the timeout (TOUT). • Increase PTO2 when the device struggles to land using PTOL alone. • Use in combination with TOUT to prevent endless oscillation attempts.	0 - 255 Encoder counts

MY ISSUE IS NOT HERE

Contact support using the following link: https://xeryon.com/support/