

User Manual

Version 1.1
2025/05/01



Bio-Touch

Bio-Touch Graphical User Interface User Manual



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User Manual

Bio-Touch Software
Version 1.1



1. Document History

Ver.	Chapter	Description / Changes	Date
1.0		Initial release	2025.01.17
1.1		Force Trajectory Update	2025.05.01



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2. Document Coverage

This document provides the user with a basic and detailed explanation of how to use ADMOTEK Bio-Touch. It is expected that the user has a basic understanding of motion systems and motion control concepts.

This user manual focuses only on concepts that might not be self-explanatory. It does not cover interface elements that are simple enough for the user to understand. This manual only covers the user interface of Bio-Touch. For instructions related to the device itself, please refer to the corresponding device manual.



3. Prerequisites

This chapter provides an overview of the Bio-Touch software prerequisites and the recommended minimum specifications.

3.1. Operating System

This software requires the following operating system to perform best:

- Windows 7, 32/64 bit or later.

Note that Windows 10, 32/64 bit is recommended.

3.2. Screen Resolution

A minimum display resolution of 1024x600 is required for the Bio-Touch software.

3.3. Additional Software

Although the Bio-Touch software is standalone, it is recommended to install Microsoft Excel to help with the post-processing of the logged data.

3.4. Installation

The Bio-Touch software does not require an installation process and is provided as a portable single-package executable file.

4. Introduction

This chapter provides an introduction to the Bio-Touch software, its structure, and the main sections.

4.1. Structure

This software comprises several sections as listed below and shown in Figs. 1 and 2.

- 1- Dark Mode Button
- 2- Test Tab
- 3- Test Configuration Tab

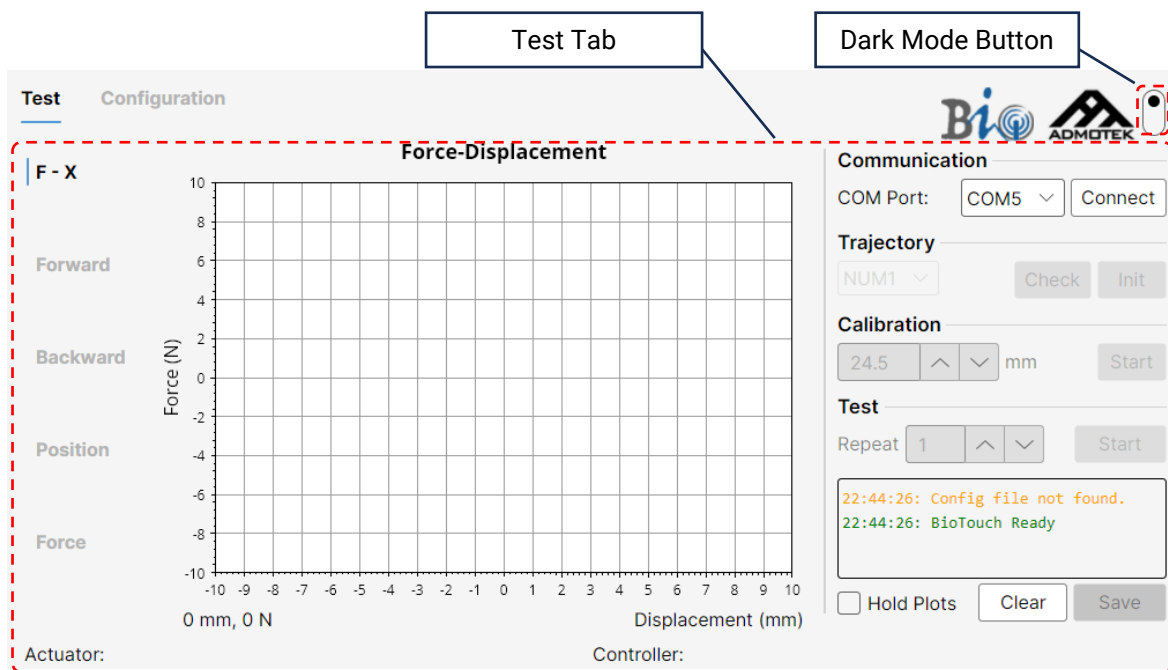


Fig. 1. Bio-Touch Software Structure: Test Tab.

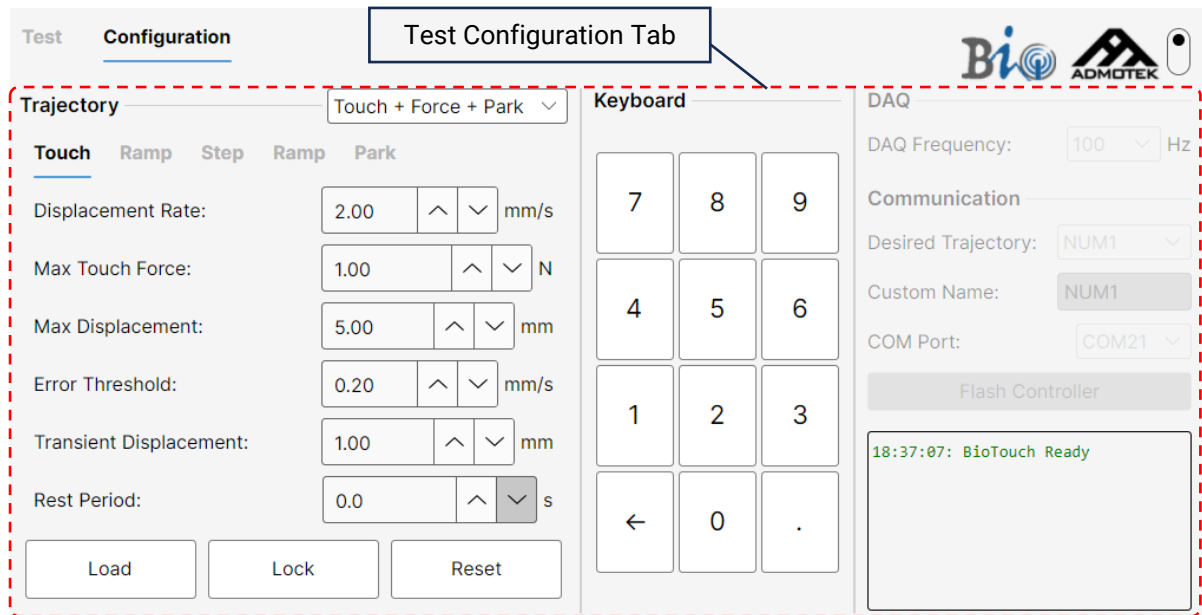


Fig. 2. Bio-Touch Software Structure: Test Configuration Tab.

4.2. Test Tab

This section can be used to perform tests and comprises the following sub-sections:

1- F - X Plot:

This plot contains the curve known as the hysteresis curve of the tissue (The tissue press force vs its displacement) for both pressing and releasing trajectories. This means that the plotted data starts at the touch position and ends at the release point. It does not include the data before the first touch and the parking trajectory data.

To view this plot, click or touch the "F - X" text on the left side of the interface (if using the touchscreen LCD provided with the device).

2- Forward Force – Position Plot:

This plot contains the force vs displacement data for the pressing trajectory. This means that the plotted data starts at the touch position and ends at the bottom of the tissue. It does not include the releasing trajectory data and the data before the first touch.

To view this plot, click or touch the "Forward" text on the left side of the interface (if using the touchscreen LCD provided with the device).

3- Backward Force – Position Plot:

This plot contains the force vs displacement data for the releasing trajectory. This means that the plotted data starts at the bottom of the tissue and ends at the release point. It does not include the touch data, the pressing data, and the parking trajectory data.

Note that if the test does not contain a release trajectory, this plot will be left empty.

To view this plot, click or touch the "Backward" text on the left side of the interface (if using the touchscreen LCD provided with the device).

4- Position Plot:

This plot contains the position vs time curve for the whole test.

To view this plot, click or touch the "Position" text on the left side of the interface (if using the touchscreen LCD provided with the device).

5- Force Plot:

This plot contains the force vs time curve for the whole test. Note that the reported force is true only if the rotor is moving with a constant velocity. This means that any acceleration in the rotor motion results in errors in the estimated force.

To view this plot, click or touch the "Force" text on the left side of the interface (if using the touchscreen LCD provided with the device).

6- Test Control Panel:

This panel contains the controls required for testing. It consists of the following parts:

- Communication
- Trajectory
- Calibration
- Test Panel
- Test Log Console
- Plot Controls

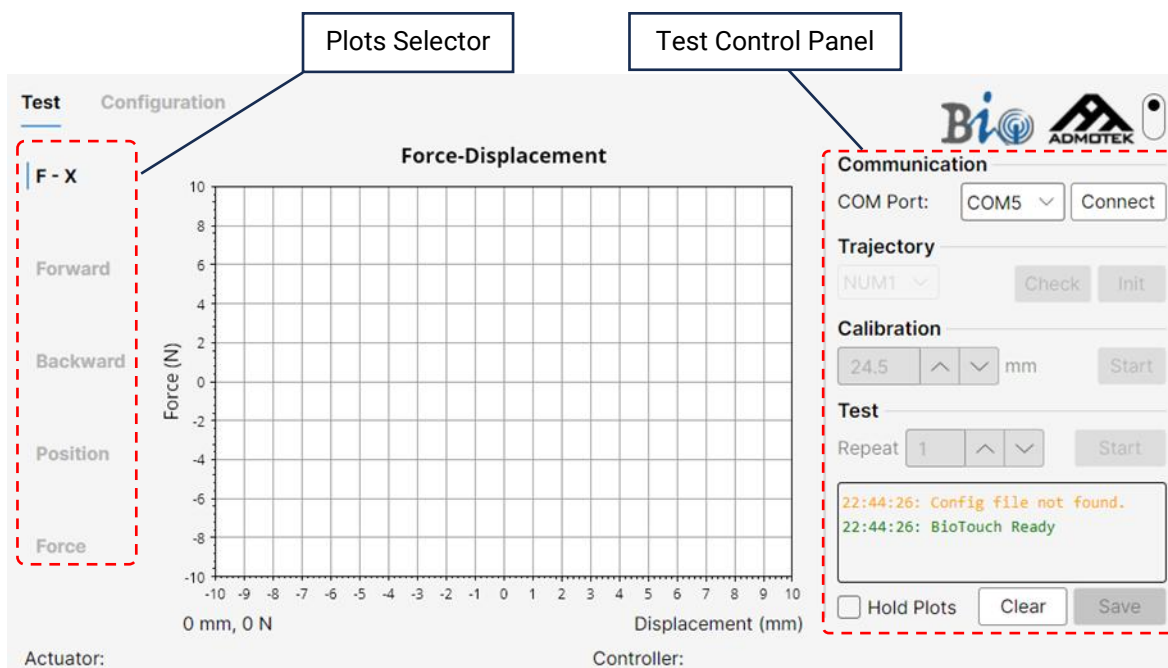


Fig. 3. Test Tab.

4.3. Configuration Tab

Test configuration tab is made up of three main sections:

1- Trajectory

The trajectory section includes multiple sub-sections representing different available tissue testing trajectories.

2- On-Screen Numpad

The on-screen numpad allows users to input numbers in various sections using the touchscreen LCD.

3- Controller Panel

This panel can be used to change the controller configuration and send the trajectory and configuration data to the controller.

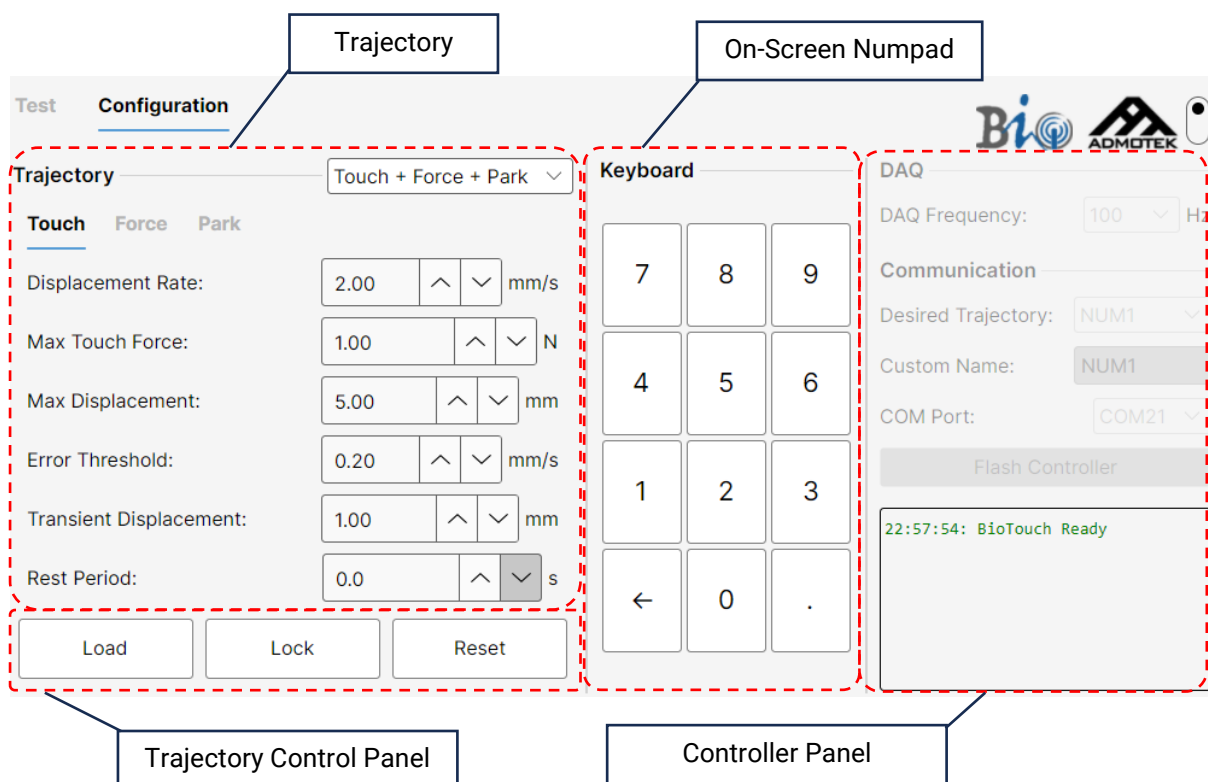


Fig. 4. Test Configuration Tab.

5. Configuration Tab

This chapter focuses on the configuration tab, especially the approach for defining a new trajectory and changing the controller configuration.

5.1. Trajectory Design

To define a new trajectory, the user must start by selecting the test type from the pop-up list as shown in Fig. 5.

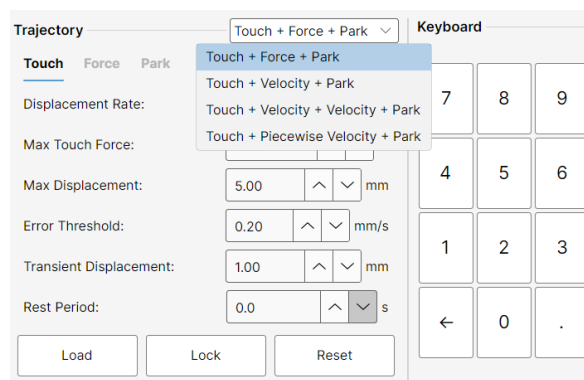


Fig. 5. Trajectories List.

By selecting the desired trajectory, related sub-sections will show up, as shown in Fig. 6.

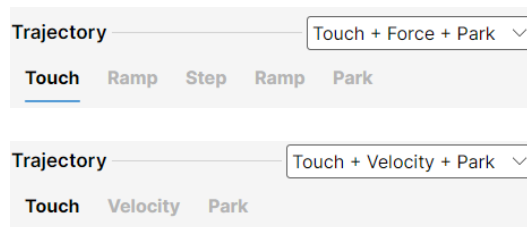


Fig. 6. Trajectory Sub-Sections.

1- Touch (First Touch Detection):

As the first part of the trajectory, the user can define the Soft-Touch algorithm parameters to detect the body surface. With this algorithm, the rotor moves with a constant and usually slow velocity to detect the surface of the body. The parameters of this part are:

Velocity: The velocity of the rotor (in millimeters per second). This value should be set according to the required accuracy of the surface detection. For better accuracy, use lower velocities.

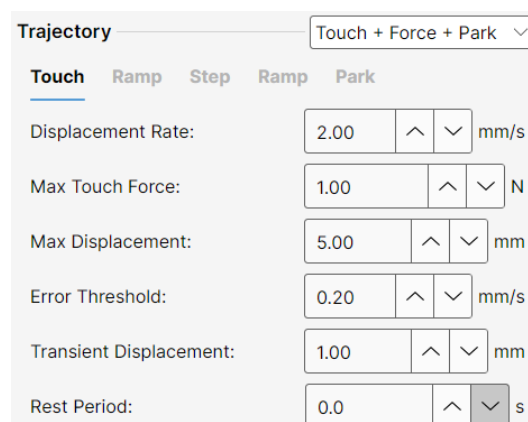
Max. Displacement: The maximum allowable displacement for this part (in millimeters). The touch detection finishes if the rotor moves as much as this value, regardless of a successful detection.

Max. Touch Force: The maximum allowable external force of the rotor (in Newtons). The rotor's external force will be limited to this value after it passes the transient displacement. Set this value as high as possible for the best repeatability. Using values less than 0.4 N can result in wrong detections and require frequent calibrations.

Transient Displacement: The displacement in which the rotor force is not limited (in millimeters). When the rotor starts a constant velocity trajectory (like this one), the velocity controller needs to tune the velocity to the desired value and needs to exert high forces to the rotor. These parameters define the displacement required for the velocity controller to achieve a steady-state. Set this value as high as possible for the best repeatability. Using values less than 0.5 mm can result in wrong detections.

Error Threshold: Threshold of the velocity control error that triggers a touch detection (in millimeters per second). When the rotor touches a surface, the path impedance increases, increasing the velocity control error. The controller tries to compensate this error by increasing the force, but it's limited by the Max. Touch Force parameter. This results in aggregation of error, eventually triggering the error threshold. Using values less than 0.05 mm/s can result in wrong detections.

Rest Period: The amount of time during which the rotor is held in position and data continues to be logged before the next command is performed.



The screenshot shows a software interface for controlling a trajectory. At the top, there is a dropdown menu labeled 'Trajectory' with the selected option 'Touch + Force + Park'. Below this, there are five tabs: 'Touch', 'Ramp', 'Step', 'Ramp', and 'Park'. The 'Touch' tab is currently selected. Underneath the tabs, there are six rows of parameters, each with a label, a numerical input field, and a unit. Each input field has up and down arrow buttons for adjustment. The parameters and their values are: Displacement Rate (2.00 mm/s), Max Touch Force (1.00 N), Max Displacement (5.00 mm), Error Threshold (0.20 mm/s), Transient Displacement (1.00 mm), and Rest Period (0.0 s).

Parameter	Value	Unit
Displacement Rate	2.00	mm/s
Max Touch Force	1.00	N
Max Displacement	5.00	mm
Error Threshold	0.20	mm/s
Transient Displacement	1.00	mm
Rest Period	0.0	s

Fig. 7. Touch Detection.

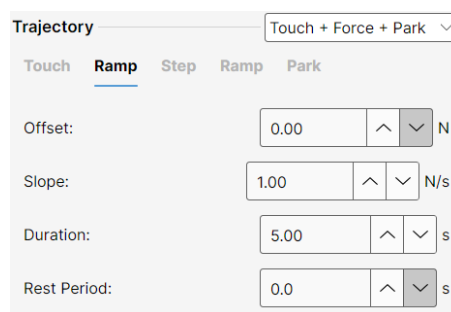
2- Force Ramp:

Offset: The initial force value from which the ramp begins.

Slope: The rate at which the force increases over time.

Duration: The total time over which the force ramp is applied.

Rest Period: The amount of time during which the rotor is held in the final position and data continues to be logged before the next command is performed.



The screenshot shows the 'Trajectory' software interface with the 'Touch + Force + Park' dropdown menu selected. The 'Ramp' tab is active, and the following parameters are visible:

Parameter	Value	Unit
Offset:	0.00	N
Slope:	1.00	N/s
Duration:	5.00	s
Rest Period:	0.0	s

Fig. 8. Force Ramp.

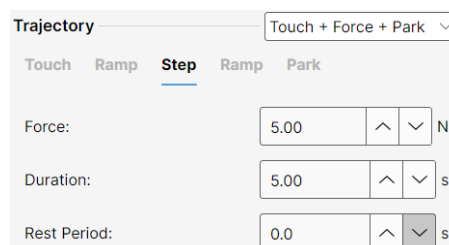
3- Force Step:

This section allows the user to perform tissue relaxation tests. After finding the body surface using the soft-touch algorithm, the actuator will press the tissue with the desired force for a specified time. The parameters of this part are:

Force: The amount of force applied to the tissue.

Duration: The length of time the force is maintained.

Rest Period: The amount of time during which the rotor is held in position and data continues to be logged before the next command is performed.



The screenshot shows the 'Trajectory' software interface with the 'Touch + Force + Park' dropdown menu selected. The 'Step' tab is active, and the following parameters are visible:

Parameter	Value	Unit
Force:	5.00	N
Duration:	5.00	s
Rest Period:	0.0	s

Fig. 9. Force Step.

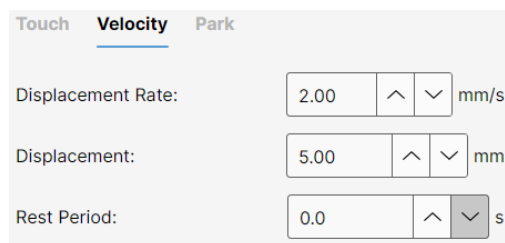
4- Velocity:

The user can define a constant velocity trajectory in this part. The parameters of this part are:

Velocity: The velocity of the rotor (in millimeters per second). This value should be set according to the required standard or test. For better accuracy, use lower velocities.

Displacement: The total distance that rotor moves during this section (in millimeters).

Rest Period: The amount of time during which the rotor is held in the final position and data continues to be logged before the next command is performed.



The screenshot shows a control panel with three tabs: 'Touch', 'Velocity', and 'Park'. The 'Velocity' tab is selected and underlined. Below the tabs are three input fields, each with a numerical value, up and down arrows, and a unit label. The first field is 'Displacement Rate' with a value of 2.00 and unit mm/s. The second field is 'Displacement' with a value of 5.00 and unit mm. The third field is 'Rest Period' with a value of 0.0 and unit s.

Fig. 10. Velocity.

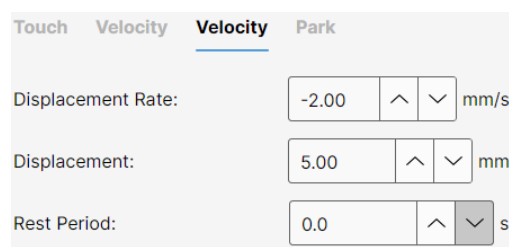
5- Velocity (Second):

The user can define another constant velocity trajectory in this part, but with a negative velocity to release the tissue. The parameters of this part are:

Velocity: The velocity of the rotor (in millimeters per second). This value should be set according to the required standard or test. For better accuracy, use lower velocities.

Displacement: The total distance that rotor moves during this section (in millimeters).

Rest Period: The amount of time during which the rotor is held in final position and data continues to be logged before the next command is performed.



The screenshot shows a control panel with three tabs: 'Touch', 'Velocity', and 'Park'. The 'Velocity' tab is selected and underlined. Below the tabs are three input fields, each with a numerical value, up and down arrows, and a unit label. The first field is 'Displacement Rate' with a value of -2.00 and unit mm/s. The second field is 'Displacement' with a value of 5.00 and unit mm. The third field is 'Rest Period' with a value of 0.0 and unit s.

Fig. 11. Velocity (Second).

6- Piecewise Velocity:

In this section, up to eight different velocity steps can be defined. For each step, the user must enter the velocity, displacement, and rest period. Each step allows the rotor to move at a specified velocity for a set distance or time before transitioning to the next step. This enables more complex motion profiles tailored to specific testing requirements.

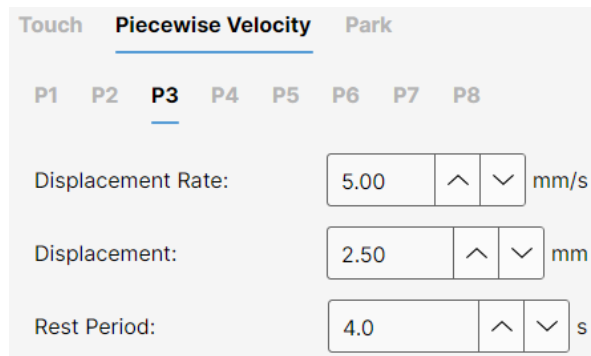


Fig. 12. Piecewise Velocity.

7- Park:

As the end of the trajectory, this part parks the rotor at home position. The user can define the acceleration for this part:

Acceleration: The acceleration of the rotor (in millimeters per square second). The rotor moves with a negative acceleration for the half of the time, and a positive acceleration for the other half.

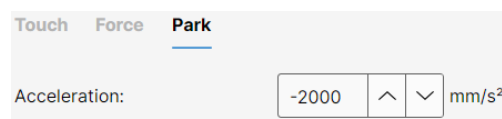


Fig. 13. Park.

Trajectory Control Panel:

To continue defining a new trajectory, the control panel (shown in Fig. 4) is used. Three buttons are available:

Load: This loads the latest trajectory that was saved to the software.

Lock: This locks the defined trajectory and enables the controller panel. Note that the defined trajectory is also reported in the console if the user wishes to configure the controller using other methods. If any additional changes are needed after locking the trajectory, user can unlock it using the unlock button.

Reset: This resets the trajectory inputs to the default values.

5.2. Controller Panel

After designing and locking a trajectory, the controller panel is accessible. As shown in Fig. 4, the available options in the controller side panel are as follows:

DAQ Frequency: The controller records data at 25 kHz, which is too high for online data transmission. The user can select the data acquisition frequency from the pop-up menu according to their requirements.

Desired Trajectory: This list contains the nine available trajectories that can be saved on the controller's flash memory. Select the one you wish to save the designed trajectory.

Custom Trajectory Name: This option can save a custom name for the designed trajectory. Note that this name is not saved on the controller and is only available inside the Bio-Touch's software.

COM Port: This list contains the list of available COM ports of the computer. Select the controller's COM port.

Flash Controller: This button sends the trajectory and configuration data to the controller. The result of the process is printed in the console.

6. Test Tab Control Panel

This chapter focuses on the test tab and goes through the process of calibrating the actuator, and performing tests.

To start, the user must connect to the controller using the Communication section (shown in Fig. 13). A COM Port list is available in that section where the user can choose the controller's COM port.

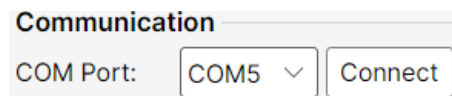


Fig. 14. Communication Section.

By successfully connecting to a controller, the communication section's status updates and shows the actuator and controller serial numbers and temperatures, as shown in Fig. 14. Note that while the software is connected to the controller, Configuration tab is disabled.

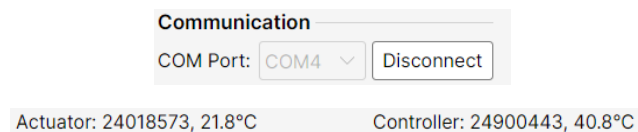


Fig. 15. Communication Section After a Successful Connection.

After connecting to a controller, the user must choose a trajectory. The trajectory list contains all the possible trajectories that can be saved on the controller. If a trajectory has a custom name saved on the software, the custom name is shown instead of the default name. By choosing the desired trajectory and clicking on the Check button, the software communicates with the controller and retrieves the selected trajectory. Then it compares the retrieved trajectory with the one saved on the software's database. If the trajectories match, the other panels get enabled but if the trajectories do not match, a warning is printed to the console.

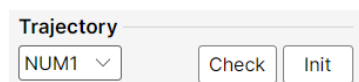


Fig. 16. Trajectory Selection Section.

Each time the controller is restarted or the actuator is disconnected from the controller, the actuator's encoder needs to be initialized. The Init button is responsible for this initialization. If the encoder is already initialized, the Start button will be enabled; otherwise, the user will have to click on the Init button. Note that the encoder initialization process includes moving

the rotor for several millimeters. Refer to CTRL1-48-5-G4 user manual for further information.

After verifying a trajectory and initializing the actuator, three sections are available to the user:

6.1. Calibration

Fig. 16 shows the Calibration section. The user can use this section to calibrate the actuator. Without a calibration, the actuator won't be able to perform Soft-Touch correctly and the force data are not reliable. The calibration needs a range. The user can change this range according to the setup. Note that while calibrating, the rotor must move freely in the given range.

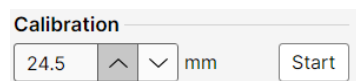


Fig. 17. Calibration Section.

6.2. Test

Fig. 17 shows the Test tab.

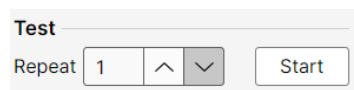


Fig. 18. Test Perform Section.

After a successful encoder initialization, the test can be started by pressing the Start button. The user can also perform repetitive tests by adjusting the number of repeats in the corresponding text box. During the test, the other buttons get disabled and only the Start button and the Disconnect buttons are available. In the case of an emergency or need, the user might click on each of these buttons to stop the test. The tests can also be stopped using the physical response button handed to the patient.

While the tests are being performed, Position and Force curves are plotted in real time. If the cycle finishes successfully, all other curves are plotted as well. Otherwise, the error code along with the description is printed into the console. After the test is finished, all the data can be saved into a zip file using the Save button.

