

HAPTIC-FORCE Evolution KIT

User Guide

evolution HAPTIC EVALUATION KIT



Abstract

This guide provides step-by-step instructions for setting up, operating, and evaluating the HAPTIC-FORCE Evolution KIT. It is intended for engineers, developers, and technical professionals who wish to:

- Explore piezo-based HAPTIC-FORCE technology
- Test and configure different haptic waveforms
- Use the kit as a reference design for integrating HAPTIC-FORCE ACTUATOR into their own applications.

Note: This guide applies exclusively to the NEXT SYSTEM HAPTIC-FORCE TOUCH™ with HAPTIC-FORCE ACTUATOR M1.



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1 Overview

The HAPTIC-FORCE Evolution KIT is designed to help engineers and technical professionals quickly explore and evaluate piezo-based HAPTIC-FORCE technology. The kit includes everything needed to get started:

- **4x HAPTIC-FORCE ACTUATOR M1** – pre-mounted on the breakout board
- **HAPTIC-FORCE CONTROLLER** – driver and control electronics
- **Piezo Cable** – connects breakout board to *Haptic Controller*
- **USB cable (type A)** – PC connection
- **12 V Power Supply** – powers the *Haptic Controller*
- **Cover Glass** – for safe and consistent user interaction
- **Quick Start Guide** – this document



Important: This evaluation kit is intended for use in a laboratory setting only. It operates at voltages up to 120 V DC and must be handled only by qualified personnel following appropriate safety standards.

1.1 HAPTIC-FORCE Breakout Board

The breakout board is equipped with four HAPTIC-FORCE ACTUATOR M1 and serves as a reference platform for up to 7-inch display applications.





- **Scalability:** For larger or smaller display sizes, the breakout board can be divided. The piezo modules and carrier board can be repositioned as needed under the display. When reconfiguring, connect the modules to the connector board using pads X1, X2, X3, and X4.
- **Rigid Mounting:** For best haptic performance, fix carrier board using the two diagonally arranged mounting holes.

1.1.1 Connector Pinning

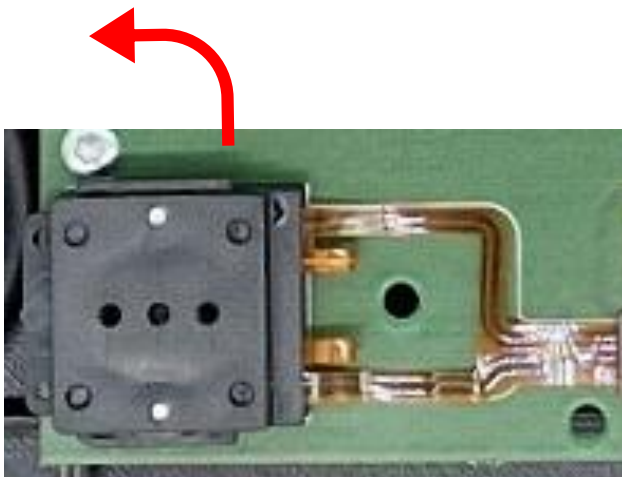
Pin 1 of each connector (X1-X4) is marked with a dot for easy identification.

1	HV-
2	GND
3	CAPSENSE
4	HV+

1.1.2 Mounting Brackets

The four piezo modules are held in place with mounting brackets. These ensure that all actuator surfaces remain parallel during liquid bonding. After bonding, the mounting brackets must be removed.

1. Grip the mounting bracket at one of the holes or use tweezers to grasp the end.
2. Pull in the direction indicated by the red arrow until the hook disengages
3. Remove the hook from the opposite side



1.2 HAPTIC-FORCE CONTROLLER Gen5

The HAPTIC-FORCE CONTROLLER Gen5 drives the four HAPTIC-FORCE ACTUATOR M1 connected to the breakout board.

- **Parallel Connection:** All four piezo modules are connected in parallel. Independent control of each module is not supported
- **Reference Documentation:** For detailed electrical specifications and integration, refer to the "Datasheet HAPTIC-FORCE CONTROLLER Gen5 Vx.x" supplied separately.



1.3 Cabling and Power

- **USB Cable:** connects the HAPTIC-FORCE CONTROLLER Gen5 to a PC.
Uses a USB Type-A cable.
- **Power Supply:**
 - 12 V DC, minimum 1 A recommended.
 - Connect only with the provided power supply or an equivalent certified supply.
 - Ensure proper polarity and secure connection before powering on.

1.4 Cover Glass

The kit includes a magnetic glass plate intended as the user interaction surface during evaluation.

Purpose:

- Provides a consistent surface for touch and pressure tests
- Helps to spread load across multiple piezo modules for realistic feedback

Mounting and removal:

- The glass is magnetically attached to the four HAPTIC-FORCE ACTUATOR M1 to reduce the risk of breakage and to simplify handling.
- To remove the glass, stabilize the enclosure with one hand, then lift the glass straight up using the opposite hand.

Safety tip: Always use the supplied glass during operation. Do not operate the kit with the glass removed unless performing controlled laboratory measurements with appropriate safeguards.



2 Operation

2.1 Safety & ESD Precautions

	ESD Risk Components are sensitive to electrostatic discharge. Use grounded wrist strap, ESD mat, and grounded workbench when handling boards.
	Electrical Hazard The kit can generate up to 120 V DC. Avoid touching exposed contacts during operation. Use the enclosed <i>Cover Glass</i> .
	Mechanical Safety Remove the mounting brackets as instructed. Operating the kit with the clips installed may impair haptic performance.

2.2 Preparation

Before operating the kit, ensure the following are ready:

- The HAPTIC-FORCE Evolution KIT is in its original enclosure or on a flat, non-conductive surface.
- The breakout board with HAPTIC-FORCE ACTUATOR M1 connected to the *HAPTIC-FORCE CONTROLLER Gen5*
- The *Cover Glass* is available for safe operation
- The 12 V power supply and USB cable are accessible
- A PC with the HAPTIC-FORCE Test Tool installed is ready for use.

2.3 Step-by-step Operation

1. **Connect Power:** Attach the 12 V power supply to the *HAPTIC-FORCE CONTROLLER Gen5* board.
2. **Connect USB:** Plug the USB cable between the *HAPTIC-FORCE CONTROLLER Gen5* and the PC
3. **Remove Mounting brackets** (if not yet removed after bonding)
4. **Install Cover Glass:** Place the magnetic glass plate on the breakout board.
5. **Launch Software:** Launch the HAPTIC-FORCE Test Tool on your PC.
6. **Test HAPTIC-FORCE TOUCH™:** Use the Try Me button in the software or simply hover the mouse cursor above it and then press gently on the glass to trigger haptic pulses

2.4 Shutdown Procedure

1. Power off and unplug the 12 V power supply
2. Disconnect the USB cable
3. Re-install mounting brackets if shipping or storing the kit.
4. Place the glass plate in its designated packaging slot.
5. Secure all cables with Velcro ties and close the enclosure.



3 Software

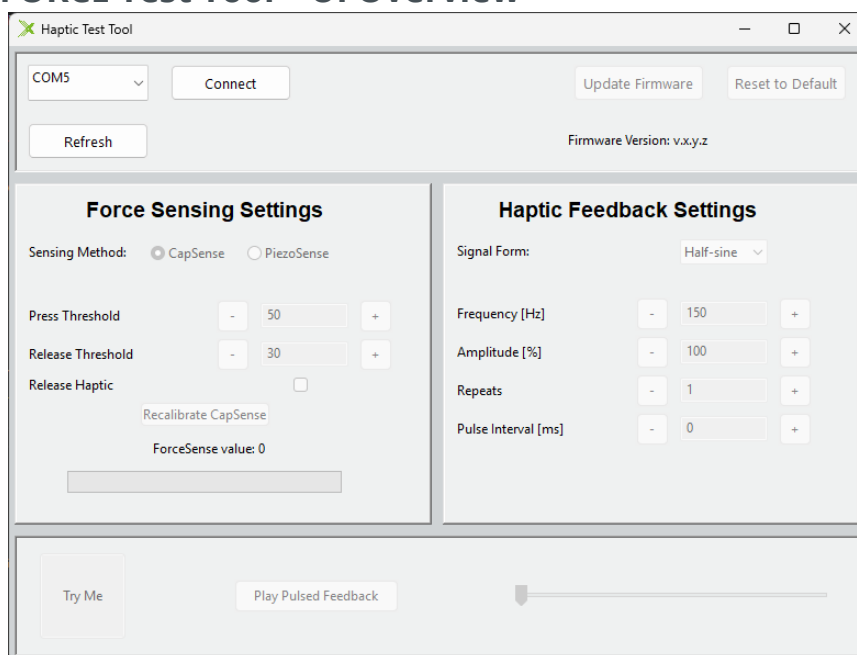
The kit includes a PC application called the HAPTIC-FORCE Test Tool for configuring, testing and updating the *HAPTIC-FORCE CONTROLLER Gen5*. The HAPTIC-FORCE Test Tool can be requested from Next System at the Haptics page: www.nextsystem.at/haptics

3.1 Connecting the Controller

When the *HAPTIC-FORCE CONTROLLER Gen5* is connected to a PC, a COM port is installed; this port appears in the Device Manager. The Haptic Test Tool will auto-detect available ports and select the appropriate port upon connection.

If multiple *HAPTIC-FORCE CONTROLLER Gen5* are connected simultaneously, use the drop-down menu to select the desired device/COM port before clicking **Connect**. The selected *HAPTIC-FORCE CONTROLLER Gen5* will be shown in the application, and its firmware version will be displayed after a successful connection.

3.2 HAPTIC-FORCE Test Tool – UI Overview



The application is organized in four main panels:

1. Control Panel – Manages device connection, shows firmware version as well as the update method, and a button to reset all changed values to default.
2. Force Sensing Panel – Displays and allows selection of sensing mode (PiezoSense or CapSense) and displays real-time sensor values,
3. Haptic Feedback Panel – Configures haptic profile parameters.
4. Testing Panel – Provides interactive elements to test the current haptic profile.



3.2.1 Force Sensing Settings

The kit supports two sensing methods — PiezoSense and CapSense — each with different configuration options:

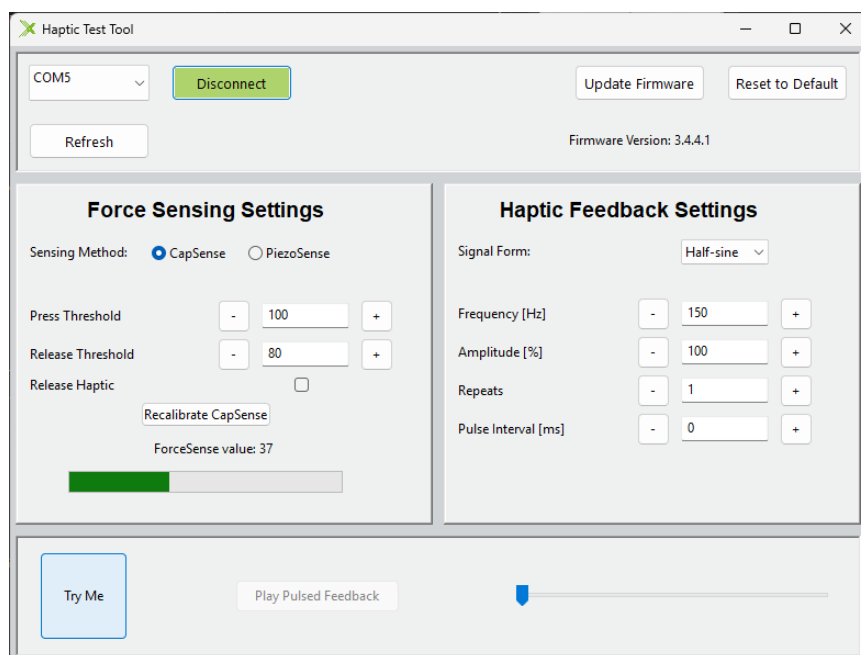
PiezoSense

- › Detects rapid force changes (dynamic presses).
- › Only a Press Threshold parameter can be adjusted.

CapSense

- › Detects both press and release events based on capacitance change.
- › Allows adjustment of both Press Threshold and Release Threshold.
- › Select the Enable Release checkbox to generate feedback on release as well as press. Clear the checkbox to generate press feedback only

Note: Any parameter changes are immediately sent to the *Haptic Controller* and applied without additional user action.



3.2.2 Haptics Feedback Panel

The haptic profile is defined by any combination of values within range of the following parameters:

- › **Signal form** defines the used signal form for haptic pulse; the signal form has impact on haptic impression but also influences the generated audible sound.
 - › Half sine
 - › Trapeze
 - › Sawtooth
- › **Frequency:** number in range of 20 to 300 (Hz)
- › **Amplitude:** number in range of 0 to 100 (where 100 means 120V output)
- › **Repeats:** number of repeated pulses (1 = single pulse)
- › **Pulse Interval** defines the interval at which to automatically trigger another haptic pulse



3.2.3 Testing Panel

Try me button:

- Click to instantly trigger haptic feedback.
- **Hover + Press:** Hover the cursor over the button, then press on the *Cover Glass* until the applied force exceeds the press threshold to trigger feedback.
- **Double-click Mode:** Double-click the button to enable continuous test mode. Double-click again to disable it.

The screenshot shows the 'Haptic Test Tool' window. At the top, there is a dropdown menu set to 'COM5', a green 'Disconnect' button, and buttons for 'Update Firmware' and 'Reset to Default'. A 'Refresh' button is on the left, and the 'Firmware Version: 3.4.4.1' is displayed on the right. The main area is divided into two panels: 'Force Sensing Settings' and 'Haptic Feedback Settings'. In the 'Force Sensing Settings' panel, 'Sensing Method' is set to 'CapSense' (selected with a blue dot), 'PiezoSense' is unselected. 'Press Threshold' is 100, 'Release Threshold' is 80, and 'Release Haptic' is unchecked. A 'Recalibrate CapSense' button is present, and the 'ForceSense value: -7' is shown with a corresponding progress bar. The 'Haptic Feedback Settings' panel shows 'Signal Form' as 'Half-sine', 'Frequency [Hz]' as 150, 'Amplitude [%]' as 100, 'Repeats' as 1, and 'Pulse Interval [ms]' as 0. At the bottom, there is a green 'Press Anywhere' button, a 'Play Pulsed Feedback' button, and a blue slider control.

This screenshot shows the same 'Haptic Test Tool' window, but the 'ForceSense value' has been updated to 50, which is reflected in the green progress bar in the 'Force Sensing Settings' panel. All other settings and the layout remain identical to the previous screenshot.



Play/Stop Pulsed Feedback

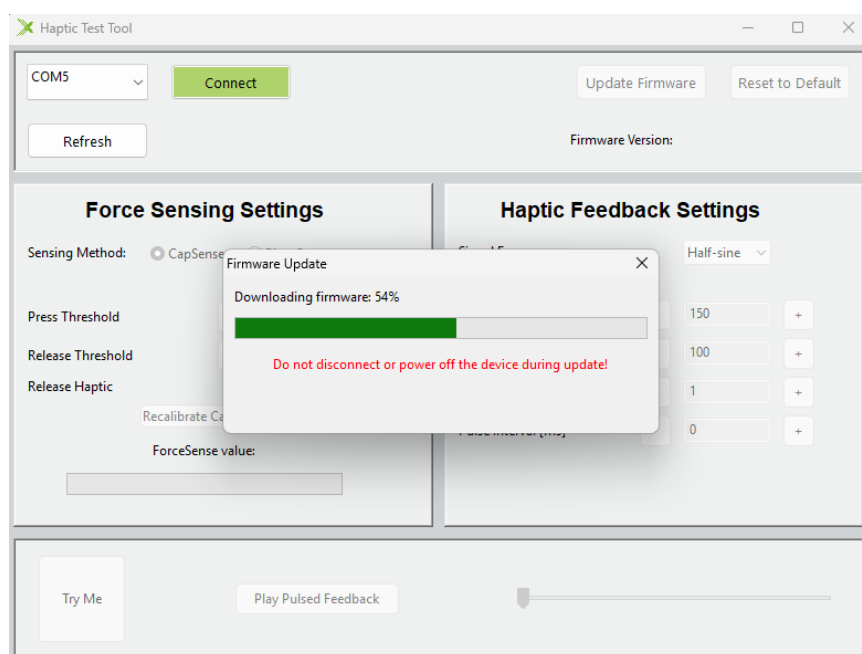
- Enables when Pulse Interval is not set to 0.
- Click to start repeated pulses; click Stop to end.

Slider

- Drag the slider to trigger a haptic pulse at each step.

3.3 Firmware Update

To update the firmware, click *Update Firmware*, select the firmware binary from the file browser, and follow the on-screen progress dialog. The application will reconnect automatically once the update is completed.



3.4 HAPTIC-FORCE API

A *HAPTIC-FORCE API* is available for integrating haptic control into custom applications. See the separate document “Documentation API HAPTIC-FORCE CONTROLLER Vx.x” for detailed API calls, message formats, and example code.

4 Best practice

- Start with the provided demo application to get an initial impression of performance.
- Experiment with frequency and amplitude to find the desired sensation. Small frequency changes can have a large perceptual effect.
- Half Sine waveform generally yields a pleasant acoustic signature and is a good default.
- Use CapSense for static press detection; use PiezoSense for dynamic detection.



Revision History

Document version	Date of release	Description of changes
0.1	2022-08-10	Documentation created
0.2	2023-11-06	Document supplemented
0.3	2024-04-19	Document supplemented
1.0	2025-09-08	Changed to new design
1.1	2026-03-23	Changed to new wording (HAPTIC-FORCE)

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