User manual

The Evaluation kit

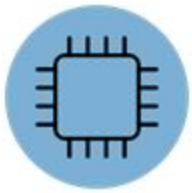
Table of Content

1. Introduction

Welcome to the world of HD haptics. The evaluation board will allow you to explore, create and test new ways of interaction using haptics. Actronika develops a whole value chain to deliver the high end haptics to their clients.

What are the key ingredients of HD haptics?

Our library is based on many years of research in the haptic domain including fields like vibrotactile feedback, neuroscience and tribology. It provides a collection of HD haptic effects available on the Tactronik module. It can be easily upgraded with new effect based on your needs.



The electronic driver is easy to integrate and delivers reliable performance. The driver is able to control two actuators independently. 32-bit ARM Cortex™ M4f CPU on board along with UART, SPI, PDM and I2C communication protocols provide more than enough computing power and integration flexibility in an extremely small package.

The actuator had been designed specially for haptics. The most important parameter is its large bandwidth allowing to produce complex effects. It has been optimized and packaged in a small volume which provides the best volume to power delivered ratio on the market.

Thank you for choosing Actronika.

2. Inside the box

What will you find in the Evaluation kit box?

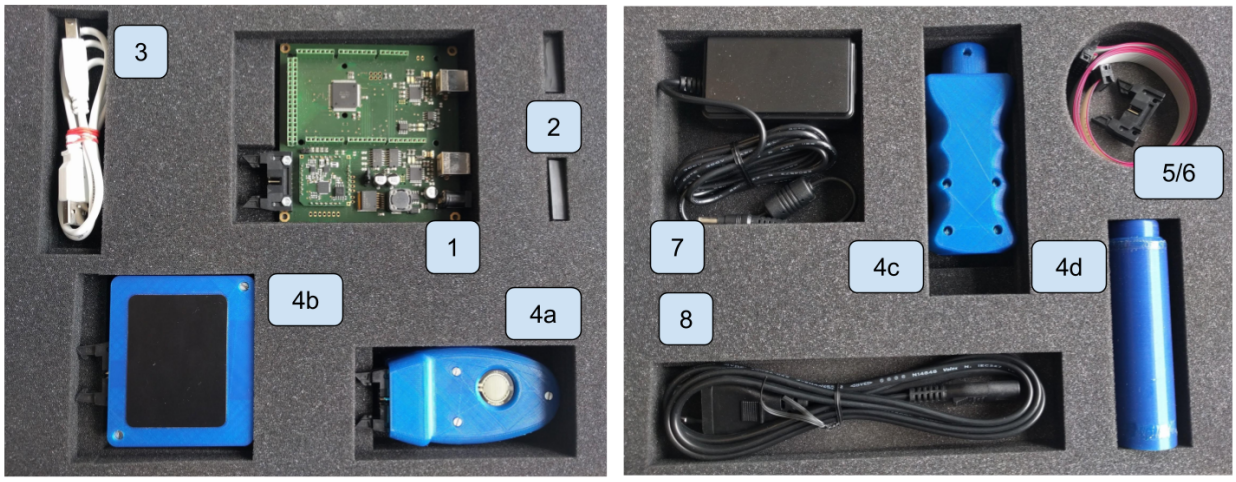


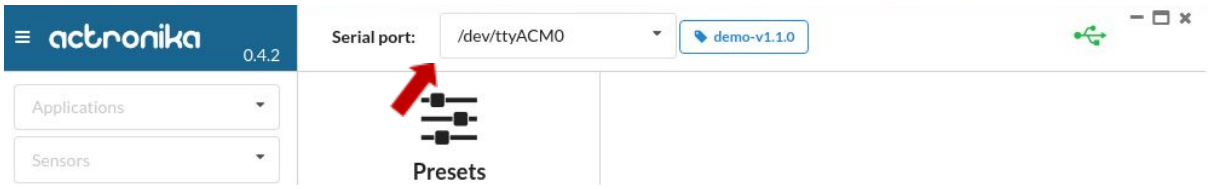
Figure 1. Top level (on the left) and bottom level (on the right)

1. The Evaluation kit motherboard with the Tactronik module.
2. 2 spare HFPA9532 actuators developed by Actronika.
3. USB cable to connect the main board to a PC.
4. End modules:
    a. force sensor - FSR402short - http://www.interlinkelectronics.com/FSR402.php.
    b. trackpad - Azoteq ProxSense TPS65 module.
    c. a handle with a build-in accelerometer (https://www.invensense.com/products/motion-tracking/6-axis/mpu-6050/).
    d. an add-on for the handle module.
5. IDC connector for spare actuators.
6. IDC ribbon cable to connect end modules to the main board.
7. 9V Power supply.
8. Power supply cable.

3. Quick start (Evaluation Mode)

Once you open the box you have to simply:

1. Download our Tactronik Desktop Application file (Tactronik demo kit Setup 0.4.2.exe) from here: http://dev.actronika.com/ on the resources page.
2. Install the application on your PC (Windows, Linux).
3. Connect the Evaluation kit motherboard [1] (USB2 connector) to your PC using an USB cable [3].
4. Connect the power supply (DC 9-12V) [7],[8] to the motherboard [1].
5. Launch the application.
6. Choose a serial communication port from the header of the application.



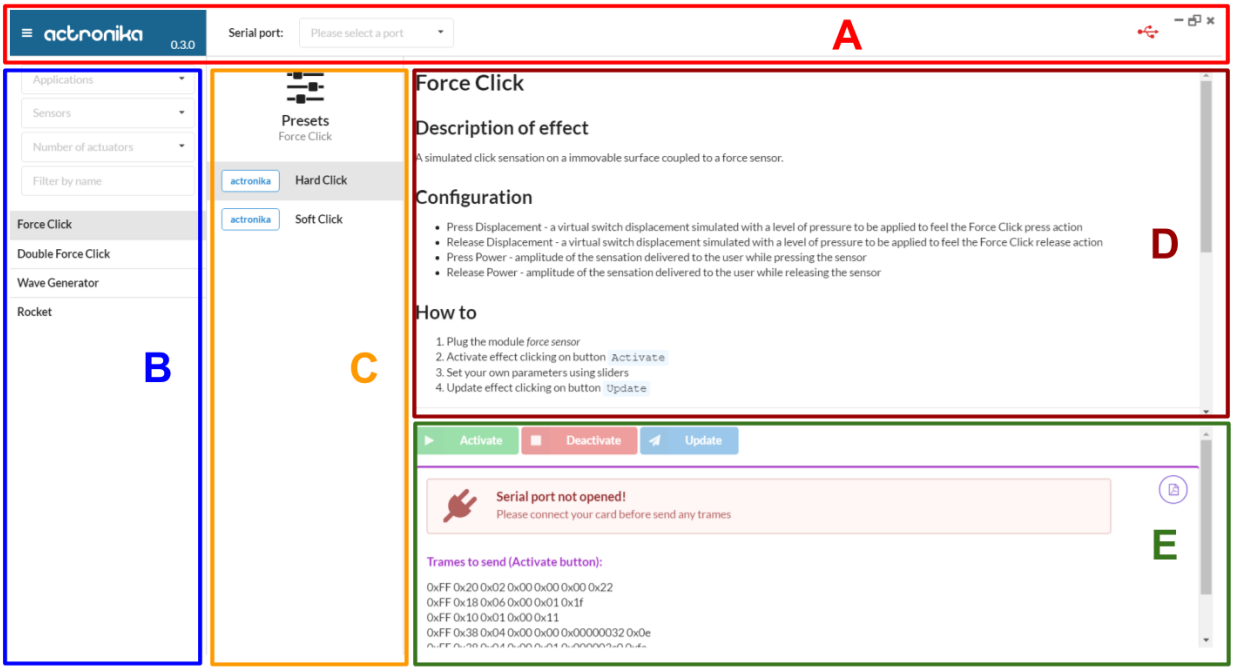
7. Choose a haptic effect to be activated.
8. Choose a preset.
9. Connect a corresponding module that works with the effect.
10. Click a button Activate  and play with it.

Tips:

- You can deactivate the effect at any time by pressing Deactivate button. 
- At any time you can modify the effect by changing parameters and clicking Upload button. 
- To make sure that the USB communication has been established properly verify that the USB icon in the right upper corner is “green”. 

4. The Interface Application

The interface application can be downloaded here http://dev.actronika.com. Once installed and launched it will appear on your screen as shown below. This section will explain you how to use it and what features it provides.



4.1. Interface explanation

A. **Header** (starting from the left-hand side):
   a. **Logo** Actronika
   b. **Software version** – a version number
   c. **Serial port** – a name of a serial port connected to the evaluation board
   d. **Firmware version** – the firmware version flashed on the chip which is displayed when the connection between the card and a PC is established
   e. **USB connection icon** – an indicator of a connection state between the evaluation board and a PC; connected (green) / disconnected (red)

B. **Library column**
   a. **Filters** – a set of words allowing to find the best matching effects. Filter selection criteria:
      i. **Application**
      ii. **Sensors**
      iii. **Number of actuators**
      iv. **Filter by name**
   b. **Library of effects** – a list of effect available on the Tactronik platform (version

C. **Presets column** – a suggested combination of parameters. Each preset has a one of two possible tags: ”actronika” tag - when a preset was set by us and ”user” tag when a preset is saved by the customer.
D. **Effect zone**
    a. **Effect description**
    b. **Configuration**
    c. **Parameters** - a set of parameters available to control the specific haptic effects. It changes based on the effect.

Tips:

- Every time you change a default or preset parameters you have to click the Upload button to be able to experience it.

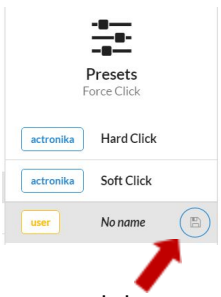
E. **API zone**
    a. **Activate button** activates communication between the Tactronik module and the end module
    b. **Deactivate button** deactivates communication between the Tactronik module and the end module
    c. **Update button** updates parameters of the current active effect
    d. **API frame generator**
    e. **API documentation button**, once pressed, provides an access to the API documentation

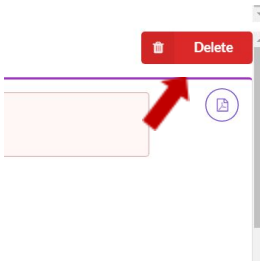
Tips:

- When you move a mouse cursor over the specific line in the API frame generator a comment will appear to indicate what information it provides to the Tactronik module

4.2. How to save/delete a haptic effect with a new user preset?

The application will automatically suggest to save a new set of parameters under a new name every time a parameter of already existing preset is modified. This way, once you tune the effect the way you like, it will not get lost. It is enough to click the icon and give it a proper name.





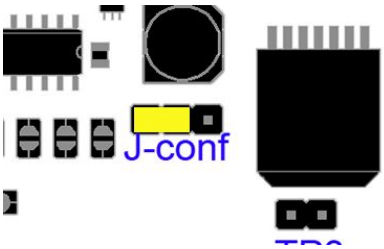
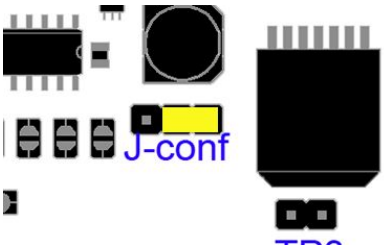
Whenever you want to delete a user defined effect, just click a delete button in the API zone.

5. Evaluation mode vs Development mode

The are two mode with different functionalities in which the board can be used:

1. The Evaluation kit mode
2. The Development kit mode

To change between modes a J-conf jumper has to be properly positioned and a corresponding USB connector have to be used.

	Evaluation mode	Development mode
TP4 / J-conf jumper		
USB connector	Connected to USB2	Connected to USB1

5.1. Evaluation mode

Provides a direct link to the Tactronik module through a USB serial converter. It need the Tactronik interface application.

In this mode you can:

- Experiment with haptic effects and their parameters
- Build new modules using provided module PCB

5.2. Development mode

An Arduino Mega 2560 is integrated to be used with the Tactronik module. ICSP plug is used to program Arduino Mega chip by using a dedicated programmer (USBtiny).

In this mode you can :

- Test API
- Use Arduino / Arduino shields to integrate external sensors
- Test your algorithms with active haptic feedback

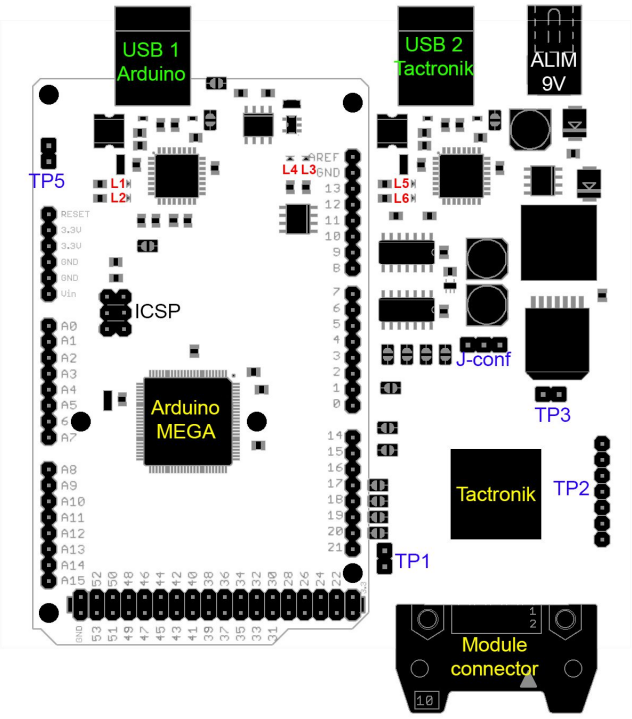


Figure . Top view and pinout of the Evaluation board

5.3. Board configuration

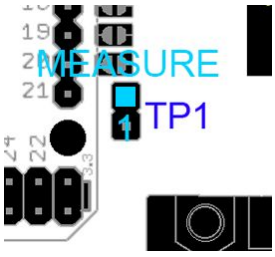
The board can be configured using:

Test pads (TPXX) in blue, USB plugs (USBX) in green and LEDs (LX) in red It is equipped with the Tactronik module, an Arduino Mega 2560, a power supply connector and a module connector to connect end modules (see chapter 6. End modules).

5.3.1. Test pads

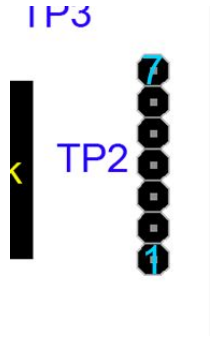
There are 5 test pads on board:

- **TP1** permits to measure current.



To measure the current flowing through an actuator connect a multimeter between a pad 1 (GND) and a pad MEASURE of TP1. The current can be computed by using a formula: I = V * 5.

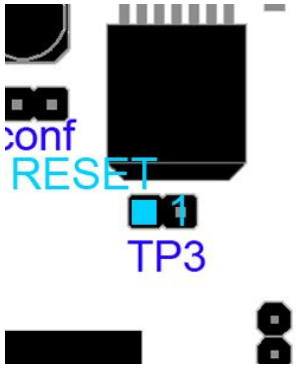
- **TP2** - sniffer port allows to analyse the Tactronik communication.



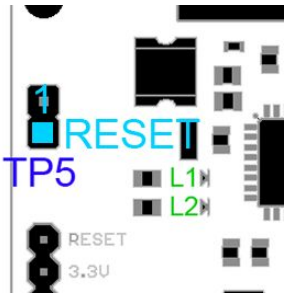
The sniffer port is configured as follows:

Pin	Description	Function
1	GROUND	Ground
2	NRF_CONFIG_2	Reserved
3	NRF_CONFIG_1	Reserved
4	NRF_COM_4	Reserved
5	NRF_COM_3	Reserved
6	NRF_COM_2	NRF TX
7	NRF_COM_1	NRF RX

- **TP3** allows to reset Tactronik.



- **TP4 / J-conf** jumper connects the Tactronik to either a PC or an integrated arduino mega.
- **TP5** resets integrated Arduino Mega chip.



5.3.2. LEDs

- **L1** indicates if USB-serial converter of arduino received data.
- **L2** indicates if USB-serial converter of arduino transmit data.
- **L3** is LED 13 of arduino.
- **L4** indicates if board is powered supply.
- **L5** indicates if USB-serial converter of Tactronik received data.
- **L6** indicates if USB-serial converter of Tactronik transmit data.

5.3.3. USB connectors

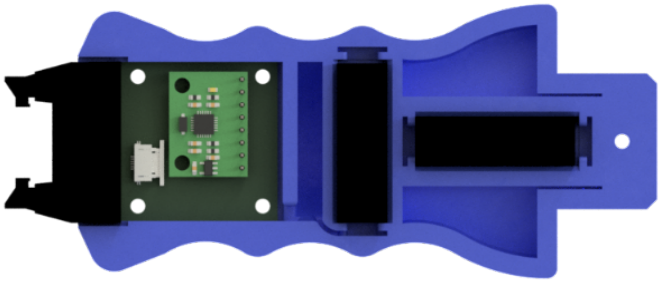
- **USB1** - connects the integrated Arduino Mega to a PC.
- **USB2** - connects the Tactronik module to a PC.

6. End modules

In the Evaluation mode, three modules are provided in order to discover and understand haptic effects associated with several sensors : an acceleration sensor, a tactile sensor and a force sensor. It can be connected through a module connector (see chapter 5.3 Board configuration).

6.1. An accelerometer module

Composition

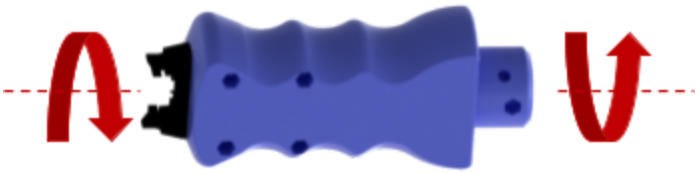


The acceleration handle consists of :

- Frame
- Two actuators oriented orthogonally
- Accelerometer
- Control card
- Connector

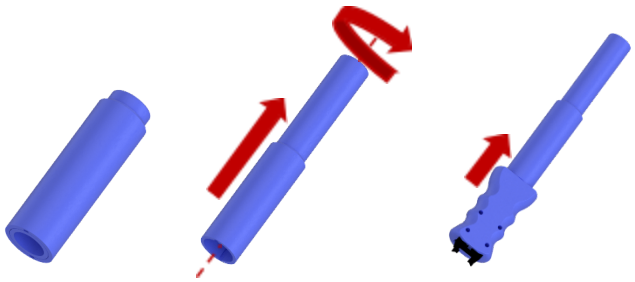
The module must be connected at the Evaluation kit motherboard with IDC ribbon cable N°6.

Use

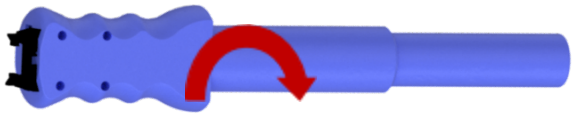


Once you implement the desired effect through the Actronika software, the module can be used correctly.

- Jerky Impulses : rotate the handle around the axis of it from front to back in order to feel the effect.



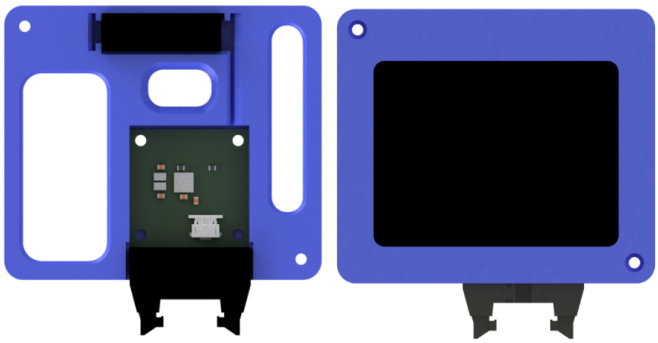
- **Stick effect (not available yet) :** as part of this effect, it is recommended to add the **telescopic tube** .



Tilt the module downwards, then return to the horizontal position in order to feel the effect.

6.2. A trackpad / touchpad module

Composition

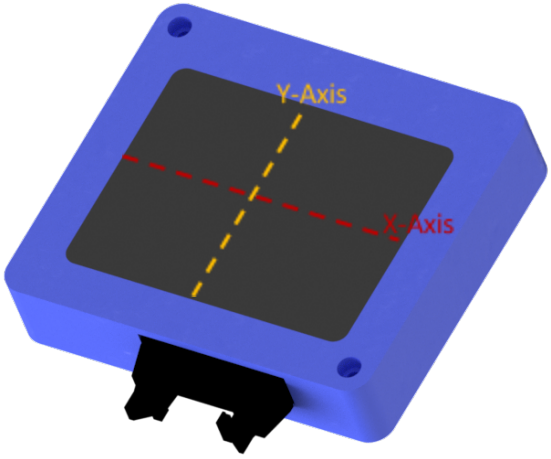


The trackpad / touchpad module consists of :

- Frame
- One actuator
- Touch surface
- Control card
- Connector

The module must be connected at the Evaluation kit motherboard with IDC ribbon cable N°6.

Use



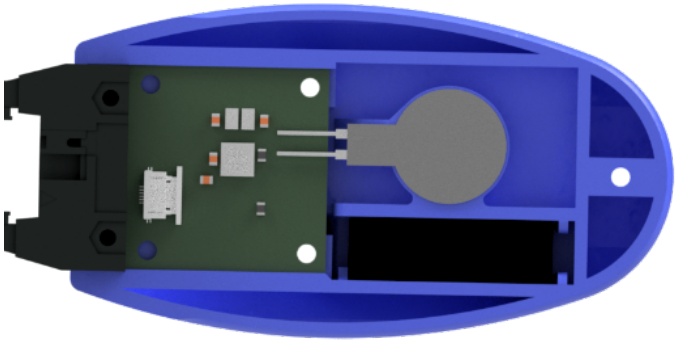
Once you implement the desired effect through the Actronika software, the module can be used correctly.

- **Generic Texture (X-Axis) :** Slide your finger from left to right and vice versa in order to feel the effect.

- **Scroll (Y-Axis) :** Slide your finger from bottom to top and vice versa in order to feel the effect.

6.3. A force sensor module

Composition

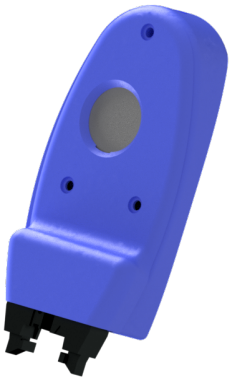


The force sensor module consists of :

- Frame
- One actuator
- Force sensor
- Control card
- Connector

The module must be connected at the Evaluation kit motherboard with IDC ribbon cable N°6.

Use



Once you implement the desired effect through the Actronika software, the module can be used correctly.

- **Force Click :** Grab the module so that your thumb is face to the force sensor. Then press down it in order to feel the effect.

- **Double Force Click :** Same procedure as **Force Click**.

7. Actuator - Characteristics

The evaluation kit is equipped with 2 spare actuators. They can be used with the Evaluation kit in both modes: the evaluation mode and the development mode. To control them it is enough to connect it to the motherboard through the IDC connector for spare actuators [see chapter 2].

To connect an actuator to the motherboard it is necessary to respect the pinout of the end module IDC connector below:

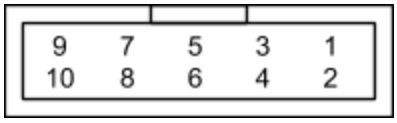


Figure. Pinout of the IDC connector to be used with 2 spare actuator

The actuator 1 must be connected between A1-1 and A1-2 and the actuator 2 must be connected between A2-1 and A2-2.

Pin	Description	Function
1	A1-1	Actuator 1 - pin 1
2	A1-2	Actuator 1 - pin 2
3	A2-2	Actuator 2 - pin 2
4	A2-1	Actuator 2 - pin 1
5		Reserved
6		Reserved
7		Reserved
8		Reserved
9		Reserved
10		Reserved

Table. IDC pinout description

7.1. Technical characteristics

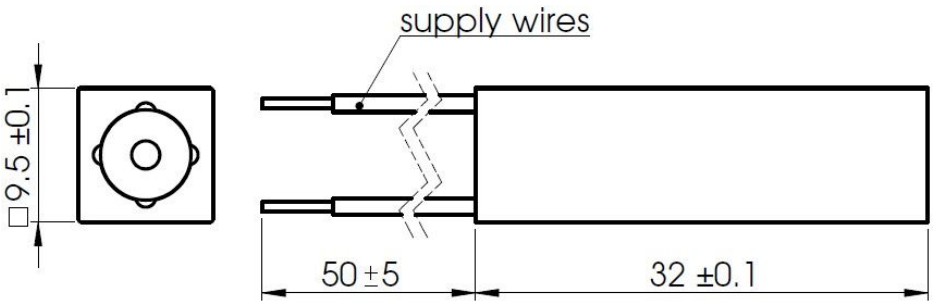


Figure. Technical dimensions

Actuator performance	
Resonant Frequency	65 Hz (±10%)
Bandwidth	10 Hz to 7 kHz[1]
Acceleration peak-to-peak[2]	4 g
Consumption RMS[2]	40 mA

[1] 98% of the haptic bandwidth and most of the audio bandwidth

[2] At the resonant frequency, a test load of 100 g and an operating voltage RMS of 0,71 V

Actuator Characteristics	
Dimensions	9.5 x 9.5 x 32 ± 0,1 mm
Total Mass	8,2 ± 0,1 gr
Moving Mass	4,5 ± 0,1 gr
Resistance	4,7 Ω
Inductance	120 µH
Thermal Resistance	30,7 °C/W
Max. Instant Power	5 W

Max. Continuous Power	2 W
Max. Operating voltage	12 Vpp

7.2. Performance characteristics

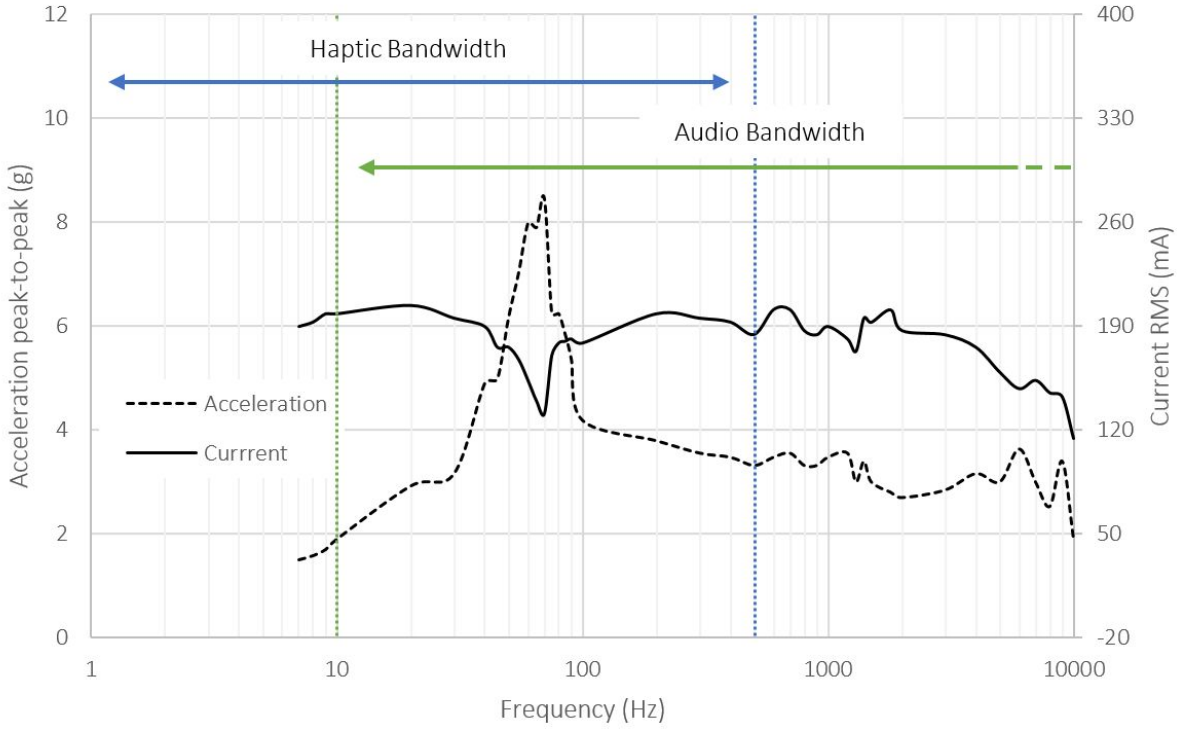


Figure. HFBA9532 Bandwidth, 5 Vpp sinus command

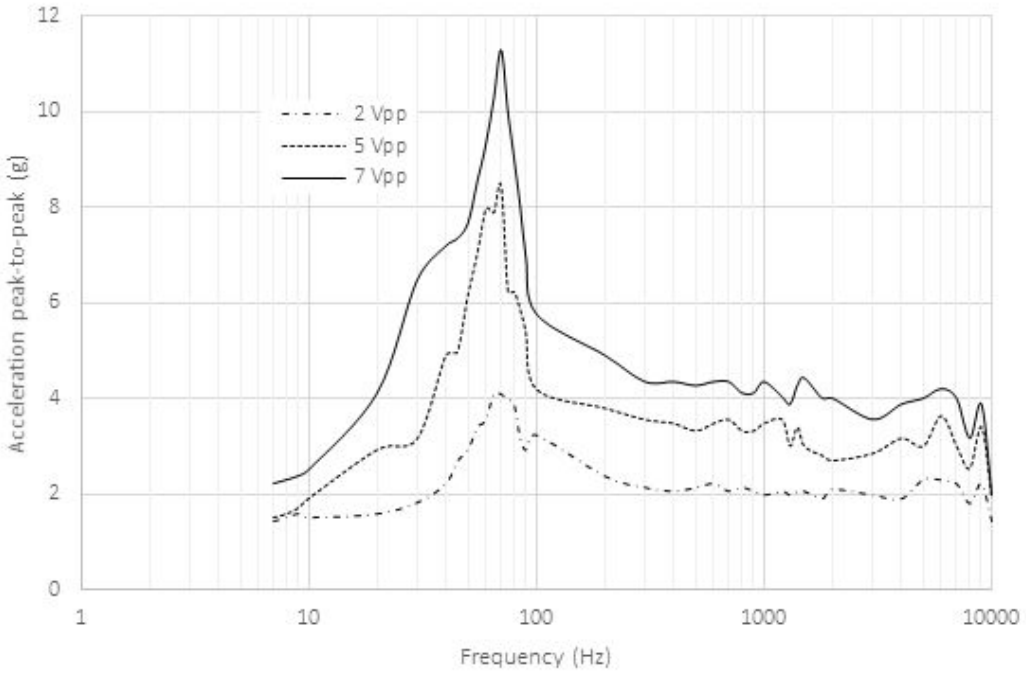


Figure. HFBA9532 Bandwidth for various amplitude command

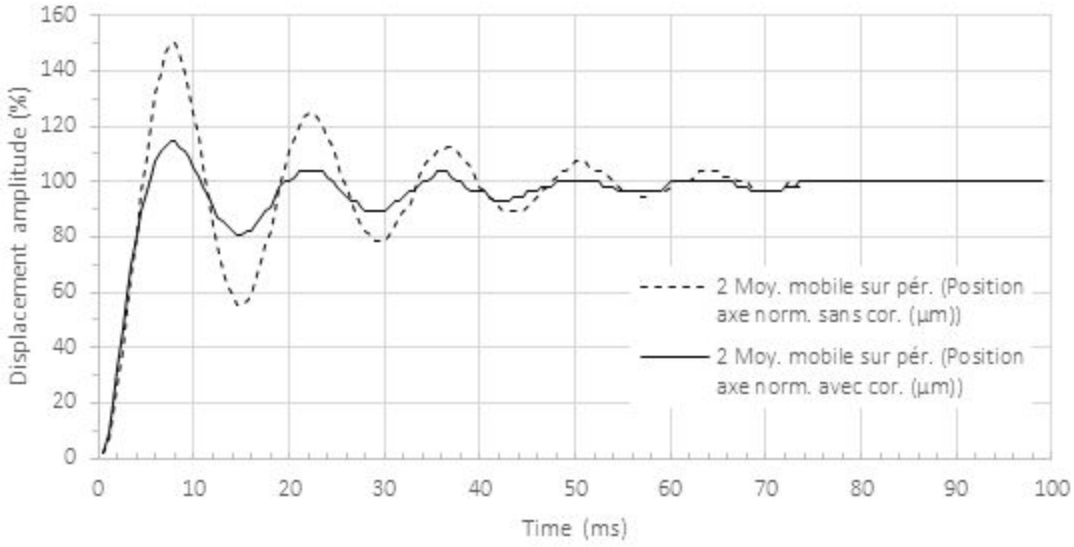
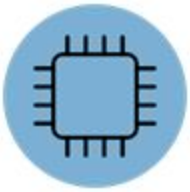


Figure. Response time of the HFBA9532, for a half stroke maximum command

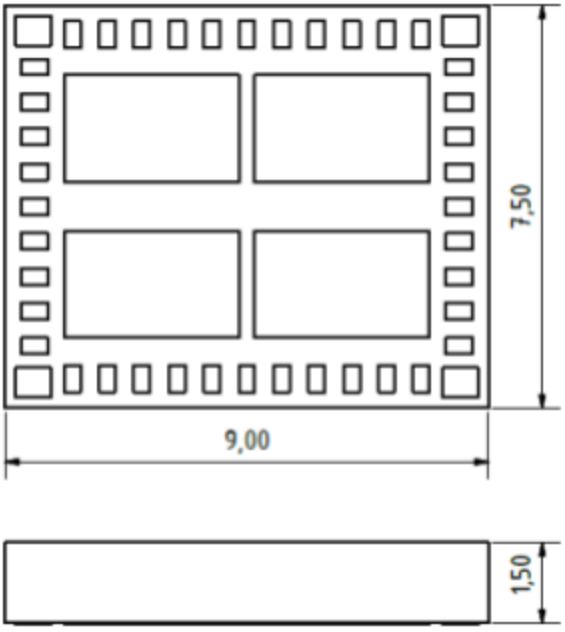
8. Tactronik module



The Tactronik LGA module (TAK 2-330210-01-1) is under development. It miniaturized size (7.5 x 9 x 1.5 mm) allows seamless integration of HD haptics in the products of our customers. Tactronik enabled devices provide users with highly realistic haptic renderings.

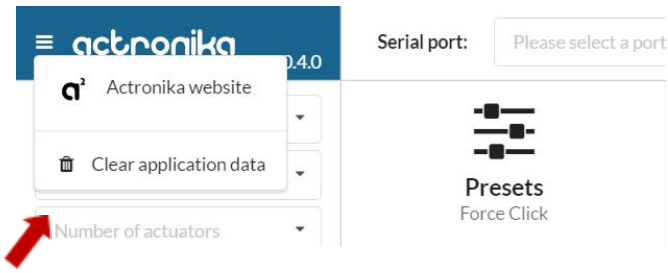
8.1. Mechanical Dimensions

Dimensional drawing of a 9 x 7.5 x 1.46 mm, 48-Pad LGA Package



9. Troubleshooting

1. Problem: I have installed a new version of the Tactronik interface application but the library is missing some haptic effects. Proposed solution: Clear application data -



2. Problem: I want to remove all presets previously saved in the application? Solution : see solution 1.

10. License and Terms of Use

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5.6. Licensee acknowledges that disclosure of Confidential Information would cause substantial harm to Actronika that could not be remedied by the payment of damages alone, and therefore that upon any such disclosure by Licensee, Actronika shall be entitled to seek appropriate equitable relief. Licensee will return all Confidential Information to Actronika upon termination or expiration of this TEA and, if requested by Actronika at any later time, certify to such return in writing.

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7.2. NOTWITHSTANDING ANY OTHER PROVISION OF THIS TEA, ACTRONIKA'S ENTIRE LIABILITY TO LICENSEE UNDER THIS AGREEMENT SHALL NOT EXCEED THE PRICE OF THE EVALUATION PRODUCTS.

7.3. The Parties agree that the limitations specified in this section will survive and apply even if any limited remedy specified in this TEA is found to have failed of its essential purpose.

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8.3. This TEA may be executed in two or more identical counterparts (including facsimile and other electronically transmitted copies), each of which shall be deemed to be an original and all of which taken together shall be deemed to constitute the agreement when a duly authorized representative of each Party has signed the counterpart.

8.4. All notices, requests and other communications under this TEA shall be deemed to have been duly given on the third day after mailing of the notice, postpaid, to the Party entitled to such notice at the address set forth below.Any notice to be given under or in connection with this TEA shall be made in writing, by registered letter, and sent to the following address: If to Actronika: Actronika - 68, Boulevard de Courcelles - 75017 Paris - France; If to the Licensee: _____

8.5. Neither Party may assign this TEA without the other Party's prior written consent, and any assignment in violation of this TEA shall be void. This TEA shall benefit and be binding upon the Parties to this TEA and their respective successors and permitted assigns.

8.6. Wherever possible, each provision of this TEA shall be interpreted in such manner as to be effective and valid under applicable law, but if any provision of this TEA shall be prohibited by or invalid under applicable law, such provision shall be deemed modified to the extent necessary to make it enforceable under applicable law. If any such provision is not enforceable as set forth in the preceding sentence, the unenforceability of such provision shall not affect the other provisions of this TEA, but this TEA shall be construed as if such unenforceable provision had never been contained herein.

8.7. This TEA including the annexes, exhibits and attachments hereto (if applicable) sets forth the entire understanding and agreement between the Parties with respect to the subject matter hereof, and supersedes any prior oral or written agreements, and all contemporaneous oral communications. All additions or modifications to this TEA must be made in writing and must be signed by the Parties. Any failure to enforce a provision of this TEA shall not constitute a waiver thereof or of any other provision.

8.8. THIS TEA SHALL BE GOVERNED BY THE LAWS OF FRANCE, WITHOUT REFERENCE TO CONFLICT OF LAWS PRINCIPLES. THE EXCLUSIVE VENUE FOR ANY DISPUTE SHALL BE IN PARIS, FRANCE. ALL DISPUTES BETWEEN THE PARTIES IN CONNECTION WITH OR ARISING OUT OF THE EXISTENCE, VALIDITY, CONSTRUCTION, PERFORMANCE AND TERMINATION OF THIS TEA (OR ANY TERMS THEREOF), WHICH THE PARTIES ARE UNABLE TO RESOLVE BETWEEN THEMSELVES AMICABLY, SHALL BE FINALLY SETTLED BY THE COMPETENT COURTS OF PARIS, FRANCE.

11. Revision History