

BSCiDEA Dielectric Elastomer Actuator Development Kit

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1.1	05.02.2024	Changed Wifi-connection process, adapted DEA stack strain and force	AS

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1. Terms and Safety Warning

With using BSCiDEA Development Kit, the user agrees to the following terms.

a. Intended purpose and technical design

The Product is for laboratory use, development and investigation purposes only and has no industrial or commercial purposes of any sort. Therefore, performance may differ from configuration.

The Customer shall use the Product in accordance with this user guide.

b. Limitation of liability and indemnification

The Product does not comply with applicable safety regulations, and no quality control has been applied. BSC Computer GmbH thus provides no safety guarantees and the User is fully aware of this; the User uses the prototypes at its own risk. BSC Computer GmbH does not give any assurances, neither in terms of functionality nor other characteristics. Any and all warranty is fully excluded to the fullest extent permitted by law.

The Product neither constitutes a "product" within the meaning of the Federal Act on Product Safety (PrSG) nor within the meaning of the Federal Act on Product Liability (PrHG).

Any and all liability on the part of BSC Computer GmbH for any damages or malfunction of the Product as well as for all other damages of whatever nature which may result from the use of the Product, including damages to the property of the User and damages of third parties, shall be explicitly excluded to the fullest extent permitted by law. The User shall indemnify BSC Computer GmbH against any and all third party claims.

c. Rights

The Product shall not be used for any industrial or commercial purposes and applications, including sale or (sub-)lease or other exploitation. It shall only be used for investigative purposes and for the demonstration and investigation of certain functionalities.

The Product contains rights of BSC Computer GmbH and third parties and shall not be disassembled or dismantled into individual components or parts in order to analyze, examine or determine these rights. It shall only be used by the Customer for its own use and shall not be passed on or disclosed to third parties for any reason.

With the delivery of the Product, the User does not acquire any rights, including without limitation any intellectual property rights, apart from the rights of usage in accordance with this User Guide. No licenses to the rights of BSC Computer GmbH (or any third party) are transferred to the User.

d. Safety Warnings

The Dielectric Elastomer Actuator (DEA) stacks contained in the BSCiDEA Development Kit are operated by the means of high voltage. The development kit is designed such that by using in accordance with this User Manual, touching the device or any unshielded wires is not possible. Do not operate BSCiDEA if any part is broken, wires or connectors are damaged. Do not open High Voltage Unit.



High Voltage

Danger of electrocution when coming into contact with live parts.
Danger of life.

The DEA Evaluation Board contains small parts. Keep away from children.

BSCiDEA is not a toy. Small Parts Hazard

2. Introduction

Dielectric elastomers, known for their capacity to transform electrical energy into linear motion, represent a potential game-changer in the realm of IoT actuators. Unlike conventional electric motors, these elastomers operate with minimal energy consumption and exhibit remarkable resilience to environmental factors like temperature and vibration. The BSCiDEA Development Kit is poised to provide not only the linear actuator but also an electronic control unit equipped with a web interface and IoT connectivity. Additionally, it includes a battery-free EnOcean wireless switch for effortless, "plug and play" operation. The BSCiDEA development kit allows comprehensive evaluation and quick prototyping of innovative DEA based mechatronic solutions.

3. BSCiDEA Content

BSCiDEA is provided in a plastic Demo Case, securing the items from mechanical damage. Case should be transported and stored at room temperature at normal indoor conditions. Avoid direct exposure to rain, high temperatures > 40°C and heavy humidity. Unpack and operate BSCiDEA only in indoor laboratory environment.

a. Content

- 2 x DEA stacks 10x10x20mm capable of up to 8% strain with a force of up to 12N.
Stack one: with Demokit Endplates attached and banana plugs 4mm
Stack two: standard delivery unit with wires
- DEA Evaluation Board with real-time movement display at a 5:1 scale and adjustable external force.
- Electronic Controls Unit with integrated Wi-Fi and EnOcean radio interface



- High Voltage Unit acting as power supply to DEA.
- Battery-free EnOcean radio switch for seamless actuation of the Development Kit.
- SMA Antenna 868 MHz
- Power cable Controls Unit: Micro USB to USB-A
- Connector Cable Controls- to High Voltage Unit: Micro USB to 3.5mm jack plug

b. Technical Data

DEA stack size: 10 x 10 x 20mm
Max DEA Operating Voltage: typ. 800V
DEA Features: up to 8% strain, up to 12N
Controls Unit Connectivity: EnOcean, WLAN: 802.11 b/g/n 2.4GHz
Power Supply: Micro-USB 2.0
Power Consumption: max. 2,4W at 5VDC
Environmental Conditions: 10 – 30°C, indoor

Development Kit for laboratory use only

c. Order Information

BSCiDEA Development Kit

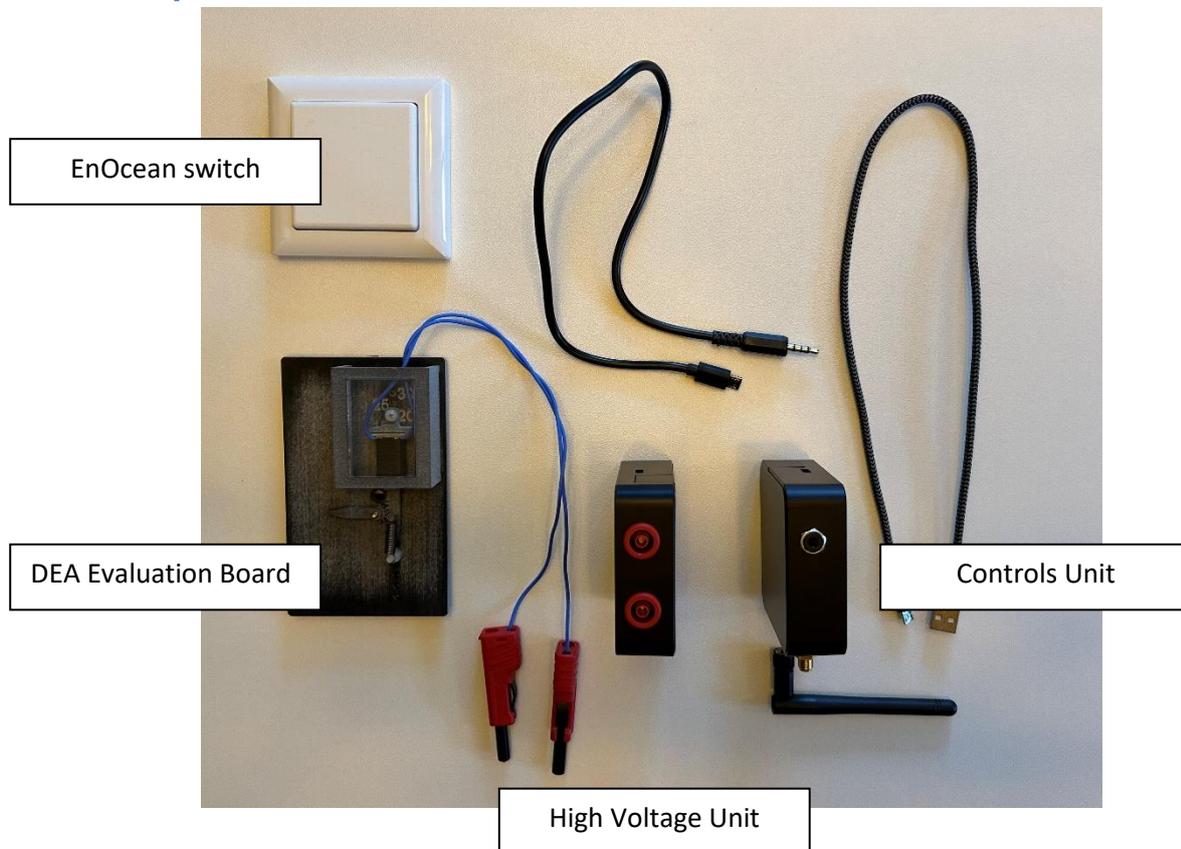
Product: BSCiDEA

Item No.: 77966

4. Getting Started

BSCiDEA is preassembled to support immediate operations.

a. Unpack and Connect



Unpack all Devices and connect in the following order:

1. Connect the DEA Evaluation Board
MAKE SURE THE DEA STACK IS PROPERLY SET INTO THE DEA EVALUATION BOARD AND HIGH VOLTAGE COVER IS IN PLACE
Plug in two red banana plugs of the DEA stack to the High Voltage Unit. The plugs are touch-proof, press the black buttons to insert plugs into the red touch-proof sockets. The plugs can be assigned to any sockets.
2. Connect the High Voltage Unit to the Controls Unit
Plug in the 3.5mm jack plug into Controls Unit. Connect the other end of the cable with the Micro USB connector of the High Voltage Unit.
3. Screw the antenna onto the antenna connector of the Controls Unit
4. Connect Controls unit to Power Supply
Plug in the Micro USB cable into the Controls unit. Connect the other end of the cable to any 5V 2.4W USB power source such as a battery bank or plug-in power supply.

Green LEDs at Controls Unit and High Voltage Unit indicate Devkit is powered and ready to Connect.

b. Connect Wifi Wireless Controls

The Controls Unit is indicating with a light green LED that it's ready to connect to a WIFI device.

Connect your own device:

- Switch on Wifi
- Choose "ESP-BSC-AP"
- Device should connect with Controls unit

Open your browser

- type "bsc-idea.local" into your browser
- You will see a safety warning, confirm by pressing button "I understand the risk"

Your device is set to control BSCiDEA.

We recommend to connect only one Wifi device at a time to avoid unintended High Voltage and operation of the DEA stack.



c. Start Demo

MAKE SURE THE DEA STACK IS PROPERLY SET INTO THE DEA EVALUATION BOARD AND HIGH VOLTAGE COVER IS IN PLACE. DO NOT TOUCH HIGH VOLTAGE CONNECTORS OR STACK DURING OPERATION

The batteryless wireless EnOcean switch is already teached into the Controls Unit.

Press EnOcean switch at any side of the rocker.

- The LED at High Voltage Unit will turn red to indicate High Voltage **on**
- The DEA stack will move into its operate end position "1".

Press EnOcean switch at any side of the rocker.

- The LED at High Voltage Unit will turn to green to indicate High Voltage off
- The DEA stack will move into its release end position "0".

DEA Evaluation Board indicates movement at a ratio of 5:1. 1mm movement of the stack results in 5mm movement of arrow indicator.

5. Remote DEA Control Options

BSCiDEA can be controlled by EnOcean wireless and Wifi DEA Application

a. DEA Controls

MAKE SURE THE DEA STACK IS PROPERLY SET INTO THE DEA EVALUATION BOARD AND HIGH VOLTAGE COVER IS IN PLACE. DO NOT TOUCH HIGH VOLTAGE CONNECTORS OR STACK DURING OPERATION

“**Off**” sets DEA in idle mode “0”. LED green

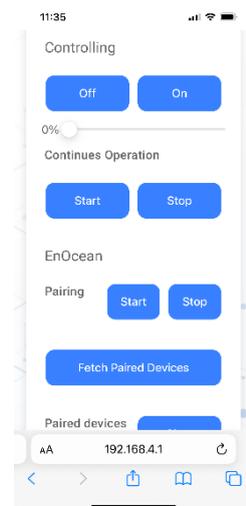
“**On**” switches on High Voltage 100%, sets DEA in operation mode “1”. LED red

The slider below “Off – On” controls High Voltage and DEA from 0 to 100%. LED changes from green 0% to red 100% with green/red at 50%

Section Continues Operation:

“**Start**” starts sinus wave from 0 to 100%

“**Stop**” ends sinus wave and switches DEA to idle mode “0”



b. EnOcean Commissioning

The batteryless wireless EnOcean switch contained in BSCiDEA is already teached into the Controls Unit and ready to operate (see 4.c)

You can teach in further EnOcean wireless switches or EnOcean gateways to remotely operate your demo. In order to avoid unintended operations, we recommend to only teach in one device at a time.

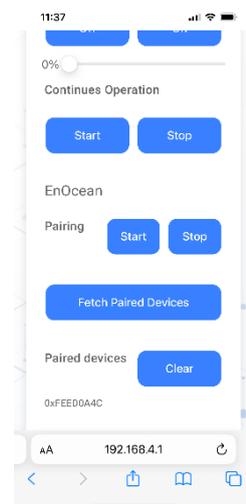
EnOcean commissioning in DEA App, Section “EnOcean Pairing”:

“**Start**” sets Controls Unit into teach in mode. Green LED is flashing

“**Stop**” ends teach in mode. Green LED is on.

“**Fetch Paired Devices**” presents all teached in EnOcean IDs under “Paired Devices”

“**Clear**” clears all teached in EnOcean devices from memory.



6. DEA Evaluation Board

a. General Description

DEA Evaluation Board is designed to support easy evaluation of DEA stack operations. We recommend to apply your own sticker-scale to evaluate position of stack end plate.

5mm movement of indicator represent 1 mm movement of DEA end plate.

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b. External force application

You can change external force acting to the DEA stack during operation to simulate your application.

Acting force is changed by putting spring holder into different positions.

In idle mode (stack in position "0"), the moving stack holder is limited in its position, no external force applies. At the moment DEA stack starts operation, the following minimal force acts on the DEA stack:

Pos 1	Pos 2	Pos 3	Pos 4	Pos 5	Pos 6
1,1N	3,8N	6,5N	9,2N	11,9N	14,6N

During operation of DEA stack, acting external force is increasing at 0,54N/mm.

c. Assembly and change of DEA stack

DEA Evaluation Board is designed to support various stack sizes from 15mm to 35mm stack length.

DEA stacks with dimensions 10x10mm are supported by the stack holders contained in BSCiDEA. Just mount the fixed stack holder In relevant position.

Other stack dimensions from 5x5mm to 15x15mm are supported by specific stack holders.

Contact BSC team to receive 3D STL data to print your own stack holders.

7. Technical Dataheet

a. DEA stack

TECHNICAL DATASHEET

EAP PORTFOLIO: CHARACTERISTICS AND MAXIMUM RATINGS

- Flexible EAP portfolio for tailored applications
- Lab-scale production established
- Automated pilot production by 2024

PHYSICAL & RELIABILITY PERFORMANCE

Surface area MY	From 5 mm x 5 mm to 15 mm x 15 mm*
Total length (± 0.2 mm)	5 – 60 mm (<5 mm upon request)
Weight (with cables)	2 – 15 g
Dielectric Layer Thickness	15 μ m
Temperature Range	-20 °C to +100 °C
Reliability at 23°C	> 70 million cycles

*Custom geometries and sizes (surface area and total length) upon request

OPERATION PERFORMANCE

Force ranges	Up to 20 N **
Contraction stroke	0 – 4 mm (Up to 8% strain) **
Actuation modes	DC + AC (up to >300 Hz)** in multiple waveforms
Actuation time	< 2 ms **
Maximum Operating Voltage	0.8 kV (1 kV upon request)

** Dependent on stack geometry and sizes.