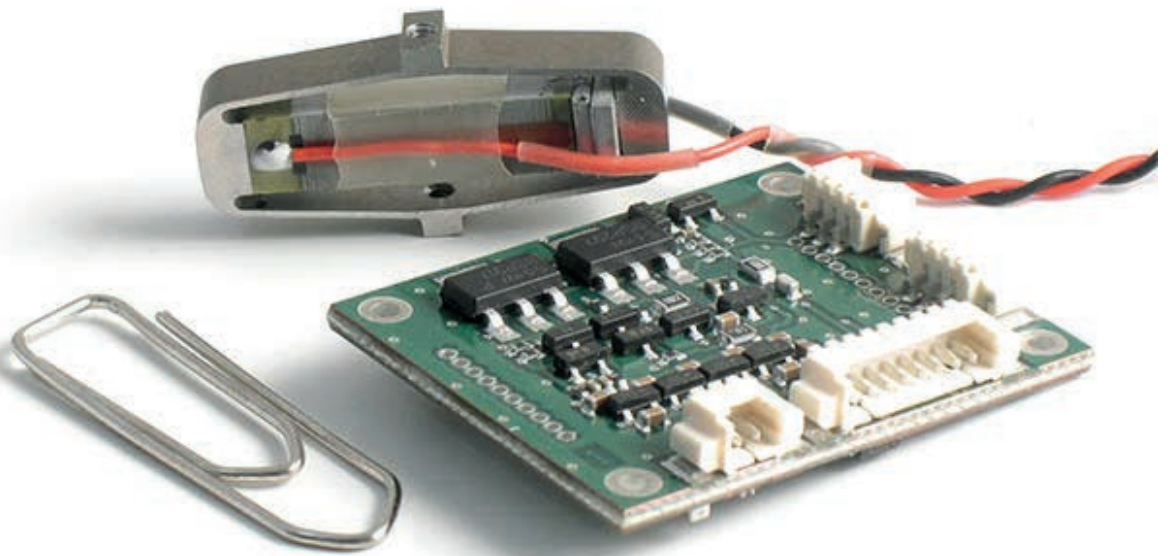


# MECHATRONIC PLUG AND PLAY SOLUTIONS

COMPACT - DYNAMIC - PRECISE



## MECHATRONIC SOLUTIONS

CEDRAT TECHNOLOGIES (CTEC) proposes different types of complete mechatronic solutions:

- Evaluation and development kits
- Turnkey mechatronic modules

The mechatronic kits can be seen as first plug and play solutions to discover and to practice different aspects of piezo mechatronic for different purposes. For instance, are presented in the following paragraphs:

- The Evaluation [Pack EP120S](#): for low cost access and practice of piezo actuator & driver.
- The Active Control of Vibration [ACV educational kit](#): a set up for educational purpose.
- The Linear Stepping Piezo Actuator [LSPA30uXS development kit](#) to experience miniaturised SPA motor with various integration levels combined with its associated Stepping Piezo Controller SPC45.
- Multi-Layer Actuators [MLA series](#).
- Vibration Educational Device

## 1. EVALUATION PACK EP120S

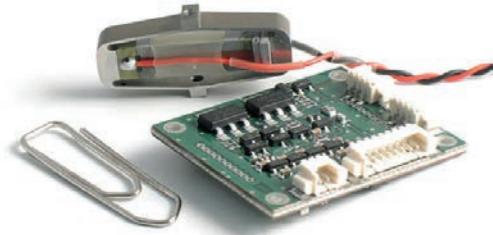


Fig. 1 : Evaluation Pack EP120S: APA120S actuator & CAu10 amplifier

The Evaluation Pack provides with an easy evaluation of CEDRAT TECHNOLOGIES's (CTEC) piezo offer in quasi static conditions. It includes:

- An Amplified Piezoelectric Actuator APA120S
- A linear amplifier CAu10
- Related cables

The APA120S can bear load up to 0.5 kg over 140  $\mu\text{m}$ , in a compact size.

The CAu10 can deliver a voltage up to 150 V and has 2 channels.

Please refer to the datasheet of APA120S actuator and CAu10 amplifier for technical specifications and drawings.

The typical diagram stroke/frequency of the EP120S is presented in Fig. 10.b:

The main features enlightened by the evaluation pack are:

- A high stiffness of the actuator
- A nanometer resolution
- A good repeatability
- An excellent reliability
- An easy implementation
- A low cost of ownership

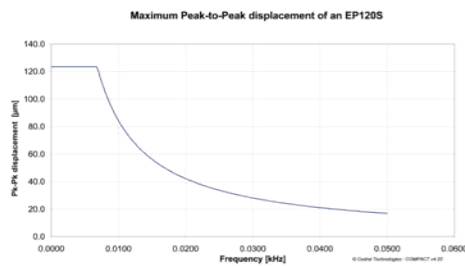


Fig. 2 : Stroke / frequency of the EP120S

## 2. EDUCATIONAL KIT ACV

A real opportunity for students to discover mechatronics, control and piezoelectricity.

The education kit ACV (Active Control of Vibration) includes:

- A beam equipped with an accelerometre at the tip
- A Compact Amplifier CA45 with an implemented controller to adjust the different parametres
- A magnetic exciter able to move the beam on a large bandwidth
- Related cables

In the actual industry, a growing number of enquiries deals with mechatronics and particularly Active Control of Vibrations. Stabilisation of wafers during lithography process, noise reduction of helicopter blades, elimination of motion blur in optical devices, damping of machine tool vibrations... are few examples of industrial applications.

The kit contains an original and innovative APA®, patented technology from CTEC attached to a mechanical beam. When the beam is excited by the magnetic shaker, the vibrations are measured with an accelerometer. The control is realised with an industrial driver & controller from CTEC using variable PID parameters and output filters. The controller drives the piezo actuator in order to cancel the vibrations of the beam. The result is very visual and impressive!

Developed with CETIM, a centre of excellence in mechanics, SUPMECA and Polytech Annecy-Chambéry, two recognised engineering schools, it fits the curricula of many engineering courses, especially the ones in the forefront of mechanics, mechatronics, control systems and industrial data processing. Control parameters are directly available to students.

Several practical works from 4 to 8 hours developed by teachers are available for download on [cedrat-tec.com/products/evaluation-kits/educational-kit-acv](http://cedrat-tec.com/products/evaluation-kits/educational-kit-acv). It is easy and fast to set up. The treated topics are required know how for engineers: system analysis, PID control, signal post treatment, modal analysis...

Similarly to the whole range of products of CTEC, the kit is extremely robust. It is well protected against mishandlings which relieves students and teachers when using the material.

The educational kit received the first price in the University Challenge 2011 organised by Bruel&Kjaer for the project relative to "Study and control of the vibration behaviour of a ski".



Fig. 3 : Educational kit ACV

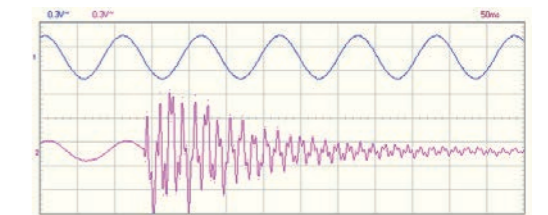


Fig. 4 : Vibration damping with ACV kit



Fig. 5 : Components of the LSPA30uXS developer kit

### 3. PIEZO MOTOR DEVELOPER KIT

The LSPA30uXS (Linear Stepping Piezo Actuator) developer kit offers the possibility to discover the potential of the LSPA30uXS, the smallest existing LSPA, in stepping mode. The developer kit is a plug and play solution. It allows to learn quickly how to use the LSPA motor.

With the included small driver [Stepping Piezo Controller SPC45](#) and a high resolution magnetic sensor, the developer kit is a fully closed-loop

The LSPA30uXS developer kit is made of the following items (Fig. 5):

- LSPA30uXS on platform: LSPA30uXS mounted on 30×25 mm platform and coupled with a 2 μm resolution position sensor
- SPC45 driver
- SPC45 power supply
- Cables
- USB cable for GUI control on PC

LSPA30uXS performances when coupled with SPC45 are presented in Table a. The [LSPA30uXS](#) motor can be extracted from the holding platform and integrated directly onto the user's test bench.

PARAMETER	UNIT	LSPA30UXS
<b>&gt; Stepping mode</b>		
Travel range	mm	3.4
Nominal Speed <sup>(a.1) (a.2)</sup>	mm/s	20
Typical step size <sup>(a.1) (a.2)</sup>	μm	5 ... 30
Stiffness	N/μm	0.09
<b>&gt; Forces</b>		
Holding force without consumption	N	0.8
Nominal driving force <sup>(a.1) (a.2)</sup>	N	0.2
<b>&gt; Driver</b>		
Nominal driver		SPC45

Table a : Characteristics of piezo motor developer kit coupled with SPC45

a.1 Unloaded  
a.2 With nominal driver

### 4. MULTI-LAYER ACTUATORS MLA SERIES

The Multi Layer Actuators MLA are non pre-stressed low voltage piezo ceramics. As a consequence, **they are not suited to high level dynamic operations.**

- Strain Gauges SG can be added on MLA upon request.
- Wired connections are secured through a tube shrink.
- MLA can be driven by CEDRAT TECHNOLOGIES (CTEC) linear amplifiers.

Expertise of on MLA results from several space evaluation programs performed for CNES and ESA on different types of MLA.

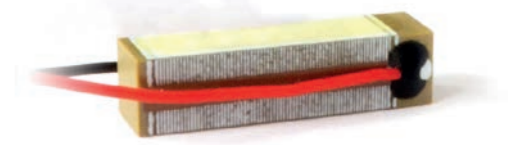


Fig. 6 : MLA 5×5×20

PARAMETER	UNIT	2×5×10	5×5×10	5×5×20	10×10×20	14×14×20
Nominal stroke	μm	10			20	
Blocked force	N	400		1 100	4 700	9 300
Stiffness	N/μm	40	110	55	235	465
Resolution <sup>(1.1)</sup>	nm	0.56			1.1	
Free - Free resonance frequency	Hz	130 000			60 000	120 000
Thermomechanical behaviour	μm/K	1.0			2.0	
Voltage range	V	-20 ...150				
Capacitance	μF	0.22	0.55	1.2	4.4	8.7
Height	mm	2.0	5.0		10.0	14.0
Width (incl. Wedges, wires)	mm	9.0			16.0	20.0
Mass (excl. Wires)	g	0.8	1.9	3.8	15.0	30.0
Available options <sup>(1)</sup>		SG VAC				

Table b : Characteristics of MLA series

b.1 With amplifier SNR of 85 dB

CEDRAT TECHNOLOGIES (CTEC) offers off-the-shelf mechatronics products including piezoelectric & magnetic actuators, motors, mechanisms, transducers and sensors with corresponding drivers & controllers. These mechatronics products are used for scientific and industrial applications requiring functions such as: micro and nano positioning, generation of vibrations, micro-scanning, fast & precise motion control, active control of vibrations, and energy harvesting

Most of the products are available in OEM versions for low cost and high volume industrial applications. CTEC also offers services including, design, R&D under contract and training

You can request our e-catalogue on [cedrat-technologies.com/miscellaneous/catalogue](http://cedrat-technologies.com/miscellaneous/catalogue)

CTEC is a SME located in Meylan, Inovallée, the French Innovation Valley near Grenoble. CTEC is recognised as a highly innovative company and has received several awards

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