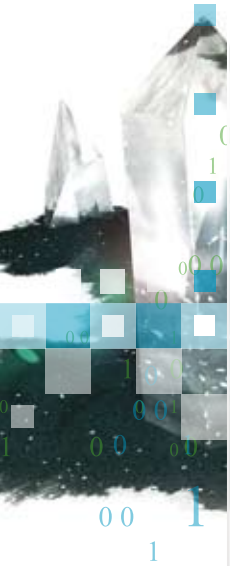
Piezo - the exclusive touch

ALGRA Dynasim and Dynapic



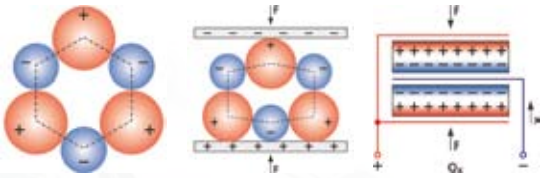
An ingenious phenomenon ...

... is based on the piezo element: the release of voltage through pressure. The crystalline elements are predestined for use in keyboards. Their sensitivity is so extreme, that the switching cycle can even be produced through 4 mm thick panels, which can be made from many different materials.

We have perfected piezo technology. In the past, ceramic elements have been incorported in the technical parts of a keyboard, but we have developed a technology to apply piezo-electric lacquer on the surface. This unique method, developed and patented by ALGRA, guarantees the same precise switching characteristics as conventional piezo elements.

Piezo electricity

In 1880, the French physicists Pierre and Jacques Curie discovered that mechanical pressure on the surface of certain crystals (e.g. PZT, lead-zirconate-titanate) generates electrical charges. They called this phenomenon the piezo effect. «Piezo» originates from the Greek and means both «pressure» or «press». An electrical charge can be measured on two crystal surfaces while the pressure changes (bending, stretching, pressing) which is proportional to the force expended. The stretching is extremely minimal – ultimately a crystal cannot be pressed together like a sponge.



The illustrations provide a greatly simplified presentation of the functions of the piezo effect. The first image shows a rendering of a six-sided crystal structure cell. All charges are mutually equalized so that the cell has a neutral electrical effect from the outside in. The pressure on this structural cell (image in centre) causes a shift of the centres of gravity of the positive and negative charges against each other. The resulting difference in the charge is evaluated as voltage or a charge (right image).

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Known applications

Lighter
Here a small hammer is pre-stressed which then strikes the piezo-electrical crystal. A spark can be generated by the resulting voltage which ignites the gas.

Alarm clocks
Most electronic alarm clocks use the piezo effect. Acoustic pressure is formed through the creation of alternating voltage which wakes up even the deepest of sleepers.

Pick-ups for musical instruments
Piezo-electrical pick-ups are attached, for example, on the bridge of a guitar under the strings. They pick up the vibrations created by the strings. These vibrations are converted into electrical signals. A solution which has had a sustained influence on rock and pop music.

Alarm systems
Sensors, e.g. on the panes of display windows, pick up the impact sounds and convert them to electrical signals. Sounds and vibration which are caused by instruments used for a break-in result in the alarm being triggered just as the break-in attempt begins.

Buzzers
Conversely, the electrical vibration can be transferred to a crystal using the inverse piezo effect. The air is made to vibrate and thereby becomes audible.

Piezo-electrical switches

Piezo-electrical switches only need a stroke from 1 to 10µm in order to generate a usable turn-own voltage or charge. It is rather the application of force as motion which creates an output signal in the switch element. The switch processes are triggered even trough several millimetres of thick plates.

Because the required movement is negligibly small for the activation of a piezo-electrical switch element, the designers can use practically any material for every overlaying; polyester, polycarbonate, anodized aluminium, steel or other metals, plexiglass and glass, wood or even stone. The keyboard can even be bent depending on the materials. This makes environmental and aesthetic compromises no longer necessary in the man-machine interface.

It also means that every window in the overlay (e.g. for LC displays) should be made thick enough to guarantee the most reliable protection even in the roughest environments. When overlay materials are selected, requirements such as moisture, chemicals or even resistance to rays can be taken into account. These keyboards can resist any type of vandalism.

ALGRA offers its own ASIC which intensifies and digitalizes the piezo- electrical signals. These CMOS signals are available as serial, parallel and as a matrix for further processing. Standardized interfaces are also available; the switch sensitivity is also set electronically through the adjustment of the switch point on the IC. This setting can be made when the switch is manufactured, at our internal electronics laboratory or is offered to the user as an option.

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ALGRA Dynapic

ALGRA Dynapic consists of various laminated layers. In the key area are ceramic elements, the piezo pills. The force applied by the user's finger generates a charge/voltage in the piezo pills that is interpreted as a switching signal. The overlay only undergoes a very slight elastic deformation. As a result, the ALGRA Dynapic keyboard is extremely robust and durable. Resistance to vandalism, precise switching cycles and a high degree of operator comfort are amongst the most important properties of this unique flat keyboard, which is based upon piezo technology. Zero-travel operation allows a simple and solid construction with minimum insertion depth. Also, the overlay can be chosen individually from a wide range of materials.

Technical data *(guideline values)*

Electrical values

Voltage typically:	1 V/N (burden 10MOhm)
Impulse width typically:	70 ms (burden 10MOhm)

Mechanical values

Mechanical loading:	up to 200 N/cm2
Operating force:	from 0.1 to 100 N
Required operation speed:	approx. 10 N/s
Maximum cycles per second:	> 1000 Hz
Storage temperature:	-60°C to +110 °C
Operating temperature:	-40°C to +85°C
No. of press cycles:	> 10 millions

ALGRA Dynasim

The ALGRA Dynasim keyboard is also based on the piezo-electrical effect and combines these advantages with the costs of a conventional keyboard. The lacquer developed and manufactured by ALGRA with piezo-electrical properties is behind this innovation. This is made into a technical «multi-layer package» through a serigraphic process with electrical conductors and insulations. A unique control panel is created which is a combination of the desired surface material made of aluminium, various plastics, glass or stainless steels which can hardly be surpassed in terms of originality – or how would a keyboard made of wood look? The key size is (almost) completely customizable and arched keyboards are no problem. This allows completely new design ideas to be implemented.

Technical data *(guideline values)*

Electrical values

Charge from a 4x4 matix (½ key):	1 nC/N
Charge from one key:	2 nC/N
Capacity 4x ½ keys:	10 nF
Capacity of one key:	5 nF

Mechanical values

Mechanical loading:	up to 200 N/cm2
Operating force:	from 0.5 to 100 N
Required operation speed:	approx. 10 N/s
Maximum cycles per second:	> 1000 Hz
Storage temperature:	-40°C to +100 °C
Operating temperature:	-40°C to +85°C
No. of press cycles:	> 10 millions

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