

## Press Release

# Medical technology cannot any longer be imagined without sensor-and resistor products in thick film technology

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The demand on medical equipment relating to reliability, ease of operating, precision, long life cycle as well as a balanced cost-performance ratio has over the last few years increased tremendously and will continue to do so. This consequently has far reaching implications in the fields of medical electronics, controls and especially for the sensor systems. The demand for high quality sensor- and resistor products within the medical technology has had significant growth which also reflected within the field of thick film technology. Fields of applications extend from clinical diagnostics (x-ray systems), computer tomography (CAT) or magnetic resonance tomography (MRT) to infusion (syringe pumps) and dialysis up to the fields of laboratories (cell manipulation, mass spectrometer).

### High voltage resistors in thick film technologies

High voltage resistors manufactured in thick film technology are essential parts of x-ray systems, CAT and MRT. These resistors and also high voltage dividers are used to measure the high voltage in a.m. systems, to ensure a precise control of x-rays necessary for an exact x-ray image and therefore a reliable diagnosis. Precision of the resistors or dividers is achieved through laser trimming. Accuracy of up to 0,1% of the high voltage to be measured (up to 160 KV, with a temperature stability up to 10ppm/°C) is possible with this technology.



Photo 1: Metallux High voltage resistors in computer tomography (photo GE)

An advantage of the high voltage divider is furthermore the fact that the actual high voltage part and the low end- or measuring resistor are positioned on a substrate, and therefore a very good tracking (consistent thermal drift) and high measuring accuracy can be achieved.

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These products are normally housed in a high tension generator filled with insulating oil. Special designed and selected resists protect the resistor and contribute to high long life stability.

In the same application so called damping resistors are used to protect the electronic systems from spark-over in case of malfunction of the x-ray tube.

### Joysticks for the medical technology

Ergonomic formed joysticks available as 1-, 2-, or 3-axial versions and also with push button function in the handle to manipulate operating tables are assembled into the control panels of X-Ray-, CAT-, and MRT-Systems.

The sensor elements used in the joysticks to generate analog and/or digital control signals are manufactured in the polymer thick film technology. Here a polymer-paste is printed onto a pc-board. A wiper slides over a virtual wear-free potentiometergenerating, depending on position an analog output signal controlling direction of travel as well as speed of movement of the operating table. Thereby an intuitive, precise positioning of the patient is possible.



Photo 2: Metallux-Joystick 3-D

Hermetically sealed sensor elements working on the same principle as a potentiometer are deployed if environmental conditions demand this. Cleaning chemicals or their vapors could be a reason for that. A potentiometer track is applied onto a FR4 carrier. A collector foil is kept at a distance, with a separation foil (spacer), of 200 $\mu$  and a plastic wiper is being pressed onto the resistor track, thereby receiving an analog, linear output signal, dependent on a position.

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### Linear- and rotary sensors in service

Linear and rotary sensors in polymer thick film technology are used in infusion- and injection syringes, also in radiation equipment used for cancer treatment. A high measure of precision is required in the dosage of medicine and infusions. The position of the syringe is detected via a linear sensor system in conductive plastic technology, another description for polymer thick film technology.

The sensor consists of a precise potentiometer element. Laser or high speed milling ensures the high linearity requirement. Placed in a precision housing were a stainless steelwiper, mounted on a carrier, guarantees a safe position recording and dosage regulation. The hermetically sealed membran sensors MetaPot and the magnetic, contactless version MMP are used in similar applications for position recording, if environmental conditions, as described above, necessitate this.

Similar linear and rotary sensor systems were developed to precisely determine the position of moveable lead plates in radiation equipment, to exactly localize the area of the body to be radiated.

### Ceramic pressure sensors

Ceramic pressure sensors in thick film technology are increasingly used in dialyses systems, to measure the pump pressure of the blood pump. In this instance flush mounted sensors are used. An incorporated foil separates the media. A Wheatstone's bridge in thick film technology is printed onto the sensor membrane. Via through connection with the resistor circuit, calibration of TC and off-set is done.

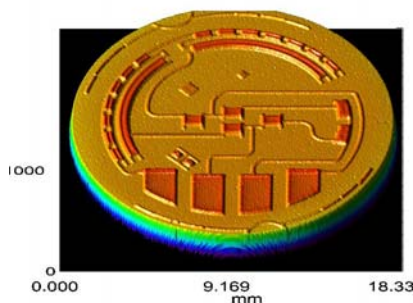


Photo 3: Pressure Sensor, film thickness gauge

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The sensors work within a pressure range of -600 up to 2000 mbar and offer due to their cost structure and extreme long term stability an alternative to capacitive systems.

### Application in Laboratories

New markets for sensors and resistors have also opened in laboratories of the medical technology. High tensile high voltage resistors are used in mass spectrometers. These are used to analyze specimens like tissues, blood and urine but also in the food industry. The high voltage resistor measures and controls, similar as in the x-ray, CAT- and MRT-Systems, high voltage, generated and required by the mass spectrometers.

Another application is micro manipulators used for artificial insemination, like impregnating egg cells with sperm. The pipette handling system is controlled with a precision joystick. Important here is a precise and sensitive mechanic together with a precision sensor system which transfers the deflection of the control handle to an exact analog output signal. The deployed sensoric in our joysticks is a precision conductive plastic element in thick film technology.

### Thick film technology – the procedure

For many years now Metallux AG in Korb near Stuttgart, designs, develops and manufactures products for the medical engineering sector in thick film technology. For decades, thick film technology has proven itself as a reliable and competent technology. It is based on the application of conductive and resistive layers during a complex screen printing process. Special ovens are used to burn in the applied layers. Continuous further developments of substrate- and paste materials as well as manufacturing processes result in producing precise sensors and resistors.

Depending on the product as well as the required specifications one can differentiate between two thick film technologies:

The **Cermet-thick film technology** is based on a ceramic paste system, the **Polymer thick film technology** consists of carbon, resin, epoxy, meaning "synthetic" based paste materials. Both technologies are similar, differentiating only in the burn-in process and temperature; approximately 240°C with the polymer technology compared to 850°C with the Cermet thick film technology.

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Fundamental in the development and production of high precision sensors is the "know-how" of the various manufacturing methods. This specialist knowledge allows for a wide variety of products and applications. Sensors and resistors in thick film technology are by now an established part of the medical technology.

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**About Metallux:**

Metallux AG is a high performance manufacturer of electronic components produced in thick film technology.

The German company boasts a vast variety of services and offers next to their standard program of pressure, linear and rotative as well as membrane sensors, high voltage and brake resistors, also customspecific solutions including customised potentiometers and joysticks.

A strong customer orientation coupled with ideas and solutions makes for satisfied customers. Innovative products, a multitude of granted patents, long standing experience - numerous customers in the automotive industry, electrostatic-, medical- and industrial-electronic industries depend already for 25 years on the Swabian company Metallux, a pioneer in its field.

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