HMI
HUMAN MACHINE INTERFACE

BOPLA
A Phoenix Mecano Company
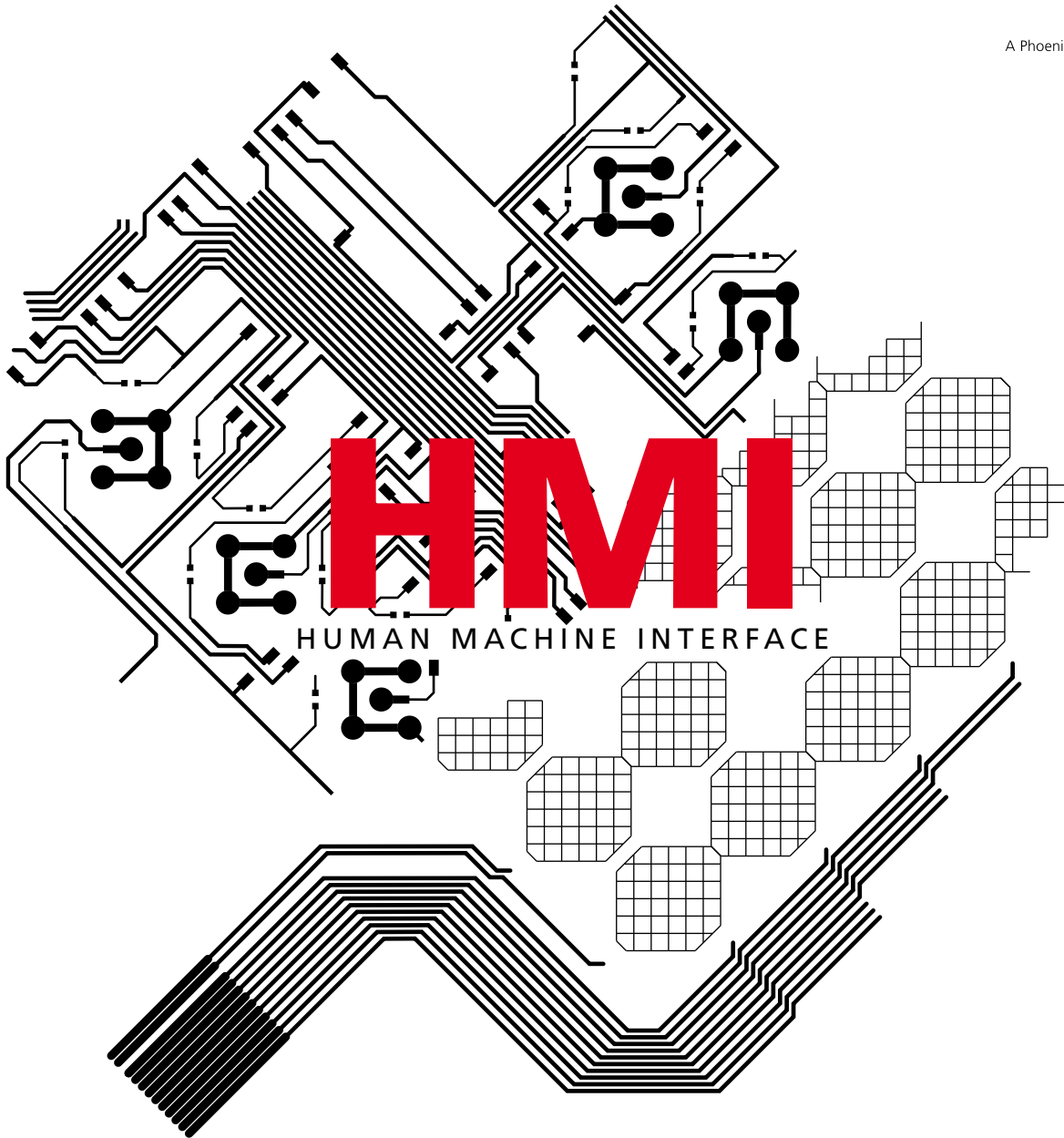
CONTENTS

FRONT-MEMBRANES

The front membrane is the visual and tactile interface between your membrane keypad and the user.

It can be labelled and surface-finished using a number of different printing and embossing methods.

The visual impression made is also of decisive importance for the appeal of your device! Various materials, including polyester and polycarbonate, combined with geometrical flexibility, colour and design, permit ergonomically rational flat membrane keypads for electronically controlled devices.

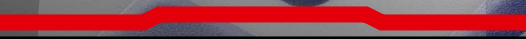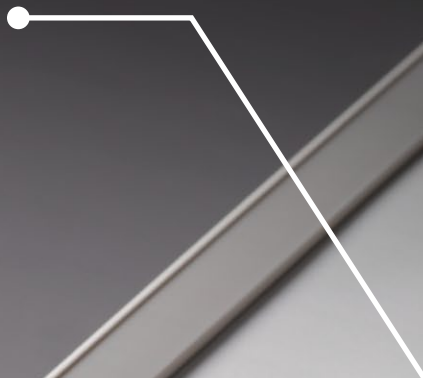Our high-quality front membranes conform to high tightness and robustness standards.

There are virtually no limits on design. The front membranes can be supplied with or without self-adhesive layers, depending on the customer's requirements. In addition, we can also offer key embossing and display windows, depending on your needs.

You determine your design, in cooperation with ourselves.

We will be pleased to advise you!

FOR TACTILE KEY DELINEATION.

CAP EMBOSSING

Height: 0.6 - 0.8 mm*

Cap embossing is a cap-shaped projection. This form of embossing is used for installation of LEDs, enabling levelling out of component height and intensification of the illumination effect.

RAISED EMBOSSING

Height: 0.3 - 0.5 mm*

Raised embossing can be executed in various forms.

EMBOSSING

Membranes are embossed primarily to improve ease of use. Series of keys are made "feelable", while the membrane effect of the embossing improves tactile feedback from the actuating elements. Embossing can, of course, also be used as a design element for emphasis of design membrane sectors.

Height: 0.3 - 0.5 mm*

RIM EMBOSSING

Rim embossing is applied as a guide for the fingers. The surface level of the front membrane and key surface remain the same.

Height: 0.6 - 1.4 mm*

DOME EMBOSSING

Dome embossing is possible in diameters ranging from 8 to 17 mm.
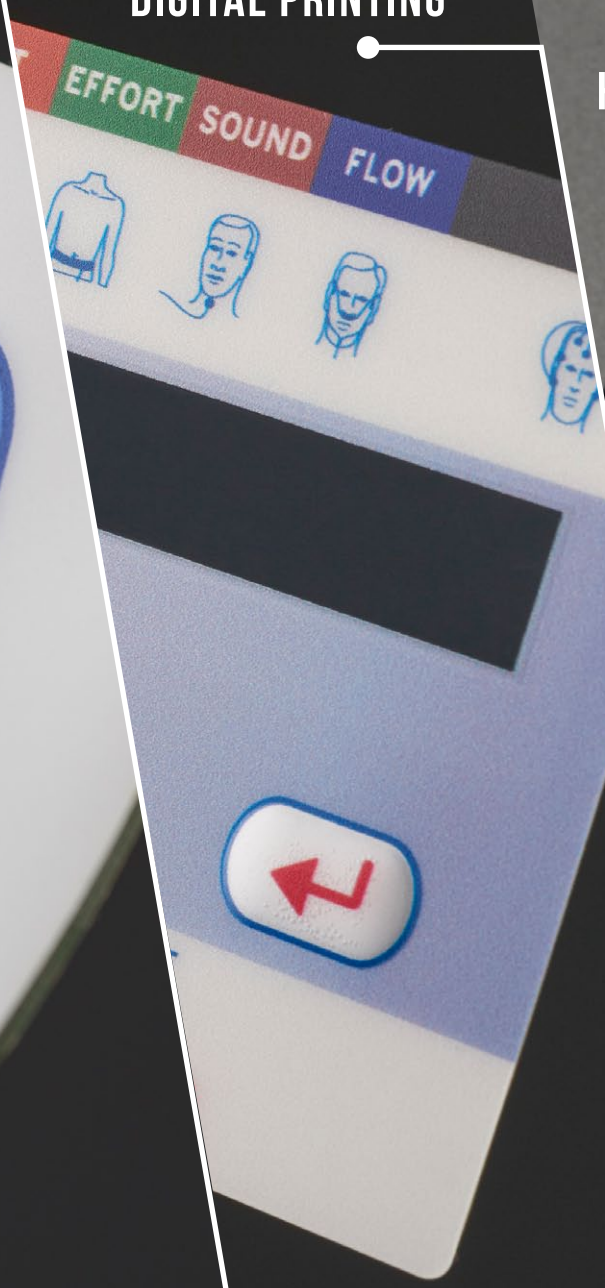
Height: 1.0 - 1.5 mm*

PROFILINE EMBOSSING

This especially high embossing is the basis of our Profiline keypads.

* May diverge, depending on membrane material.

SCREEN PRINTING

DIGITAL PRINTING

HIGH-GLOSS TECHNOLOGY

out
arm
in

EFFORT SOUND FLOW

1
2 ABC
3 DEF
4 GHI
5 JKL
6 MNO
8 TUV
9 WXYZ

PRINTING METHODS

Industrial screen printing forms the basis for the production of all types of membrane keypads.

Previously unachieved flexibility in front membrane design.

Our high-gloss technology is a special surface design treatment.

SCREEN PRINTING

We work under cleanroom conditions using the latest, highly specialised equipment in the form of multiple production lines which print your design motifs onto the membrane flexibly and with no sacrifices in quality.

A high level of scratch-proofing is assured, since the membranes are printed on the rear side.

Mounting, tensioning, coating, preparation for printing: We perform all of these operations ourselves – "in-house" – and are able to act and react flexibly and assure shorter processing times.

DIGITAL PRINTING

Digital-printing technology is especially suitable for prototypes, short production series and for individual, customer-specific motifs.

- *High-quality photos and graphics*
- *Various colour gradients and graphics possible*
- *Fast and flexible*
- *For short runs and individual printing*
- *Prototypes, e.g. exhibition and trade fair samples*

HIGH-GLOSS TECHNOLOGY

Here, a high-gloss membrane is partially printed using a special textured lacquer and is delustered in the process. This produces a luxurious and high-quality design. High-gloss technology is a rational-cost alternative to doming.

Thanks to their positive-function structure, our membrane keypads are suitable for a broad range of applications, from simple hand-held devices, up to and including sophisticated high-quality medical and industrial equipment.

MEMBRANE KEYPADS

Membrane keypads assuring maximum quality and durability – ideal for medical, metrological and mechanical-engineering applications.

1

3

8

4

5

6

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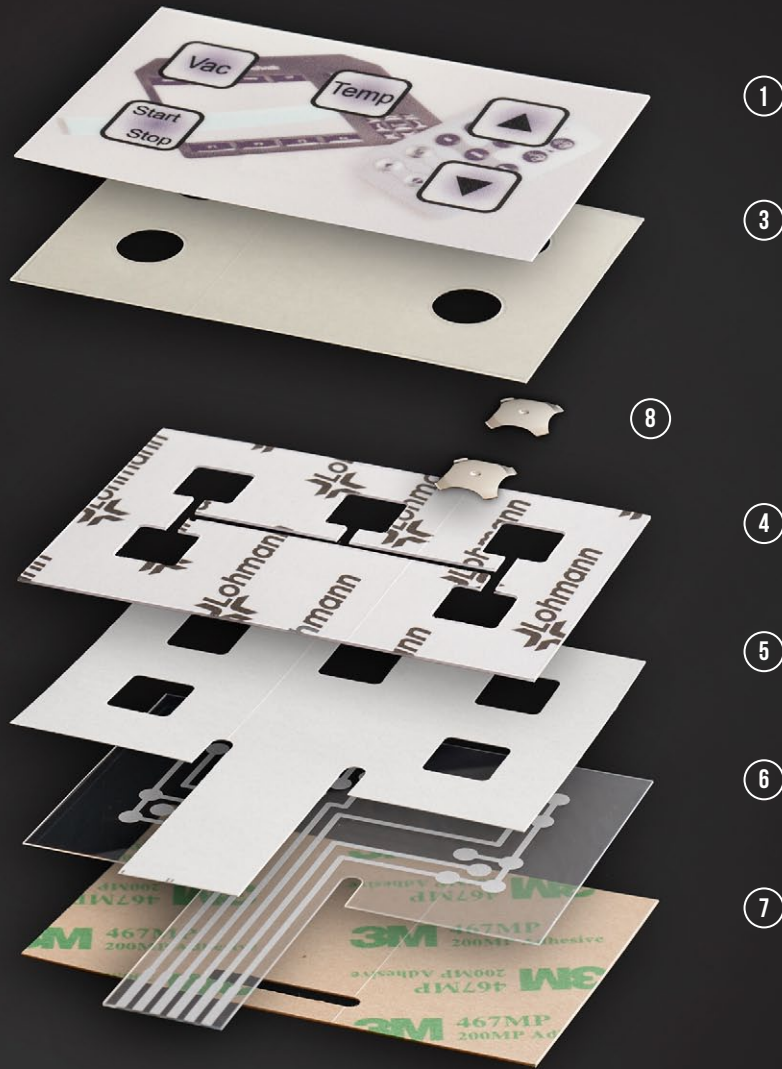
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STRUCTURE OF A MEMBRANE KEYPAD

Structure based on CU with snap dome

1. **FRONT MEMBRANE**
2. **FRONT MEMBRANE ADHESIVE LAYER**
3. **SAFETY CHAMBER**
4. **SPACER**
5. **CABLE INSULATION**
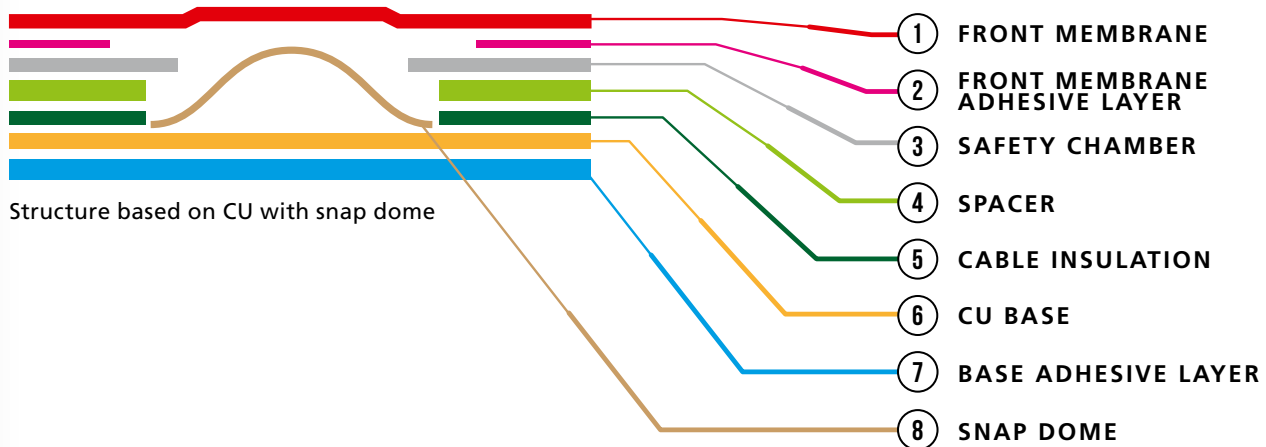6. **CU BASE**
7. **BASE ADHESIVE LAYER**
8. **SNAP DOME**

ENQUIRY DATA:

Height

Minimum key-to-key spacing

Key spacing

Length and position of ribbon cables

Minimum key-to-edge spacing

Width

- *Width × height*
- *Length of ribbon cables*
- *Number of keys (embossing yes / no)*
- *Number of LEDs*
- *Number of colours (clear lacquer for viewing windows classified as additional colour)*
- *Quantity*
- *Application (interior / exterior)*

ANYONE CAN DO SILVER, COPPER IS GOLD!

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MEMBRANE KEYPADS WITH COPPER CONDUCTORS

For demanding applications, we create exclusive high-quality membrane keypads that incorporate the outstanding properties of surface-treated copper conductors.
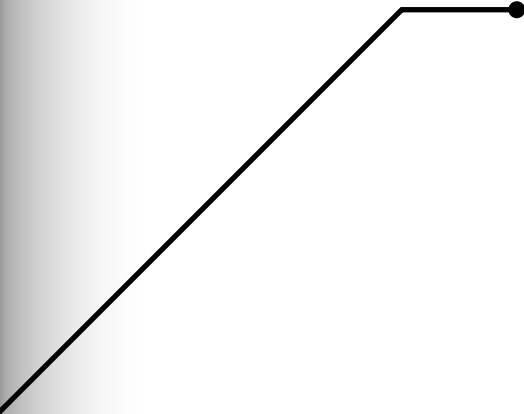
High-quality copper-laminated membranes form the basis for a membrane keypad.

These are silver- or, for extreme applications, gold-plated. The technology of copper-laminated switch wafers permits reliable SMD equipping with electronic components, followed by soldering.

Silver migration can be greatly reduced or, in the case of gold-plated conductors, eliminated entirely. The Cu conductors assure low loop impedances and minimised danger of conductor breakage.

CONDUCTIVE SILVER-PASTE CONDUCTORS

Conductive silver-paste technology is used, in particular, where the following aspects are of decisive importance:

/ *Economic factors*

/ *Ease of manufacture*

L1

L2

L3

L5

PROFILINE MEMBRANE KEYPADS

This technology succeeds in providing outstanding data-entry operation for a large range of industrial requirements.

Customised design for every keypad!
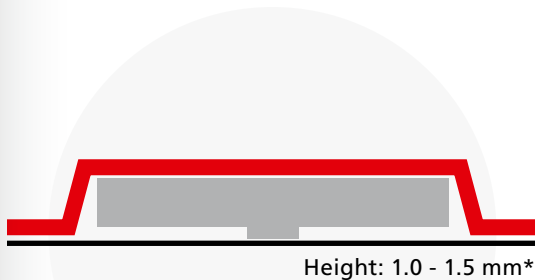
Our premium keypads are equipped with Profiline technology.

Excellent tactile feedback with "short-stroke feeling" and outstandingly good switching performance are the characteristics of our Profiline technology. It is also linked to many degrees of freedom in key geometry, key size and design.

This is all assured by means of an inlay consisting of a special plastic and positioned above the switching elements. Even exceptionally forceful or high punctiform pressure loads cannot harm the switching mechanism.

Inlays of tailored geometries perform the fibre-optics function for key illumination. Groups of keys, symbols and/or illuminated fields are thus homogeneously back lit.

Height: 1.0 - 1.5 mm*

PROFILINE EMBOSSING

Profiline embossing combined with an inlay generates the so-called "short-stroke feeling" to assure unequivocal tactile feedback.

Profiline embossing can be executed in a range of different forms.

Improved user-friendliness thanks to:

- *Unequivocal tactile feedback*

- *Exceptionally good key feel*

- *Freedom of design for key geometry*

- *Here, the membrane keypad with clearly designed key shaping can also be implemented as a rocker switch and/or oversize key.*

* May diverge, depending on membrane material.

Terminal ECO

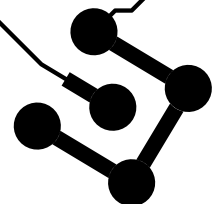| Ein/Aus | Hauptzylinder ausfahren | |
| Scheinwerfer | Hauptzylinder einfahren | Liftachse heben |
| | | Hakenverr. öffnen |

F1   F3

F2   F4

Krampe
QUALITÄT AUF RÄDERN

www.krampe.de

ILLUMINATED MEMBRANE KEYPADS

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Assists error-free operation in low-light conditions.

Our illuminated membrane keypads make operation easier in low-light situations and thus assure reduction of user errors.

LEDs are predominantly used for illumination of the display, and of operating and design elements.

The lowest-cost configuration for signal generation is implemented using LEDs and LED windows. These can be executed with or without embossing.

Integration of fibre-optics and scatter elements, combined with the matching keypad structure, permits optimum illumination results. To assure this in a large range of applications, all the necessary parameters are harmonised with one another during the development phase.

A vanish effect can usually be implemented, depending on the particular application.

PROFILINE BACKLIT

The use of special LEDs and special treatment of the inlay provides homogenous illumination, with long service life naturally assured. The light from the LED passes through the aperture in the snap dome and into the integrated acrylic inlay, where it is correspondingly scattered.

Tip: The back-lit Profiline keypad can be used in numerous demanding applications.

Suitable for the BoPad
BOP 700 enclosure.

USB
KEYPAD

Plug & Play – the membrane keypad for immediate operation using the USB port.

We use printed electronics to integrate configurable keypad controllers into the membrane keypad.

The ribbon cables needed can thus be narrower and can be connected directly to USB A sockets.

Additional customer hardware for operation of conventional membrane keypads is thus no longer needed.

Plug & Play operation is on the basis of HID 1.1 standard with no need for additional drivers.

An easy-to-use PC tool can be utilised to configure up to 64 keys at any time. Password protection can also be implemented.

The scope of functionality is expanded by means of three switchable control levels to up to 188 function keys. In addition, macros make it possible to assign keys with key sequences, simultaneous actuation and text entries in a manner similar to that for the familiar standard T9 keypad, and also mouse functions.

USB membrane keypads can thus be integrated into your embedded system, saving money, space and time.

/ *Cost, space and time-savings*

/ *Optimum for connection to PC or embedded system*

/ *188 functions thanks to three control levels (FN keys)*

/ *19 macros, mouse function, multimedia keys*
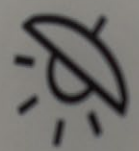
TOUCH / DISPLAY INTEGRATION

Convince yourself of the advantages of this versatile technology and benefit from an all-in single-source system solution.

Touch the future!

Printed silver conductors can also be implemented, depending on specific requirements.

COVER GLASS

SENSOR

FPC

CONTROLLER COF

INTERFACE

DISPLAY

ENCLOSURE

CAPACITIVE TOUCH SCREEN

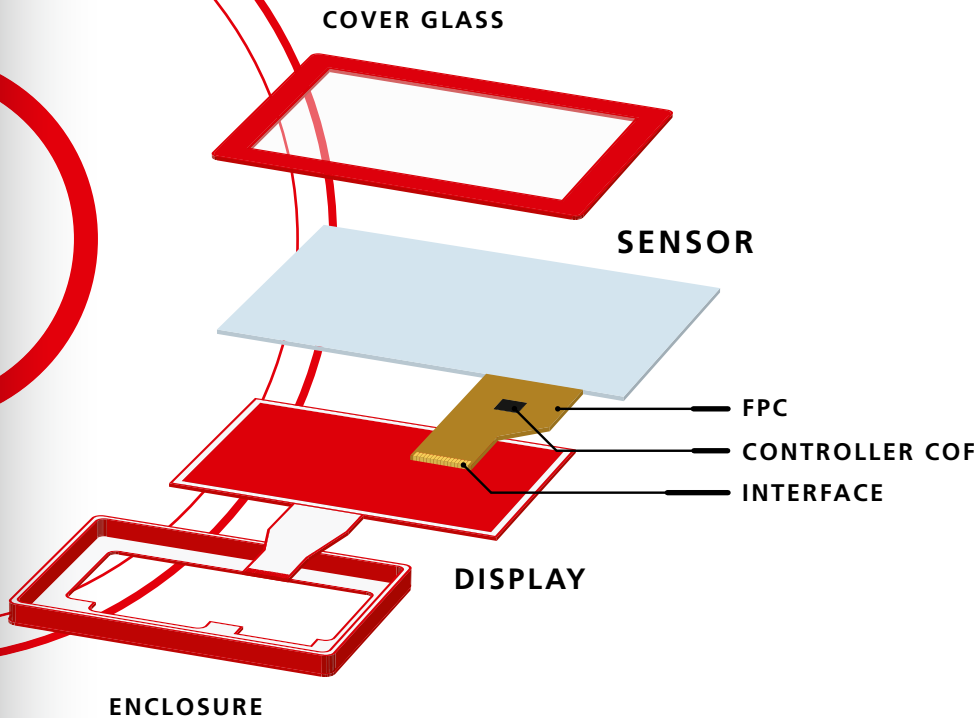Until recently, membrane keypads and conventional resistive touch screen solutions have been used in the industrial environment, but capacitive touch screen technology is now increasingly taking over. Future-orientated capacitive technology, definitively shaped by the consumer market, now meets the high demands made in all sectors of industry. This technology is noted for its exceptionally high reliability, intuitive operation and unique functionality.

For these reasons, more and more user systems / human machine interfaces (HMI) in use in industrial applications are now being converted to capacitive input systems.

Our engineering capabilities provide the solution optimally tailored to your needs. Ranging from the printed front glass featuring a laminated or bonded touch sensor and the matching evaluation function, up to and including an all-in system solution complete with display, supporting plate or enclosure.

And also in the form of a complete embedded processor-board solution if desired.

**Further PCAP benefits (Projected Capacitive) solutions:**

- *Vandal-proof*
- *Easy cleaning*
- *Can be operated wearing gloves*
- *Temperature resistance*
- *UV resistance*
- *Operation in wet environments no problem*
- *Extremely high service-life*

RESISTIVE TOUCH SCREEN

Our flexible and rationally-priced touch screen solution for your product!

Contact

ITO-PET

SPACER   SPACER DOTS

ITO GLASS

Selection of the optimum technology is of decisive importance, especially in the field of touch screen systems. We supply resistive and capacitive touch / display solutions, with their differing technical requirements, in numerous standard formats, or developed specifically to meet your individual needs. This is why detailed analysis of the operating requirements, covering all mechanical components, is a vital necessity at the very start of device development. We are at the side of our customers' technical departments to provide support on all of these items.

We analyse your needs together with you during the design phase to determine the implementation routes that we will use for your product.
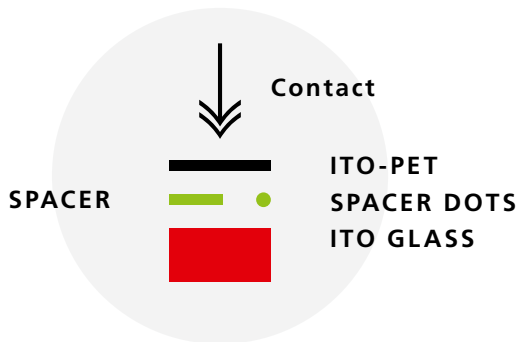
Selection of our possible implementation routes:

Full-surface lamination on a decorative foil

Viewing windows cut out in the decorative foil

Partial lamination on the decorative foil

Rear installation in the enclosure

Combination of touch screen with membrane keypad

All the methods listed above are performed under clean-room / ISO-classified controlled area conditions in our production department for your products – to assure the optimum result for you.
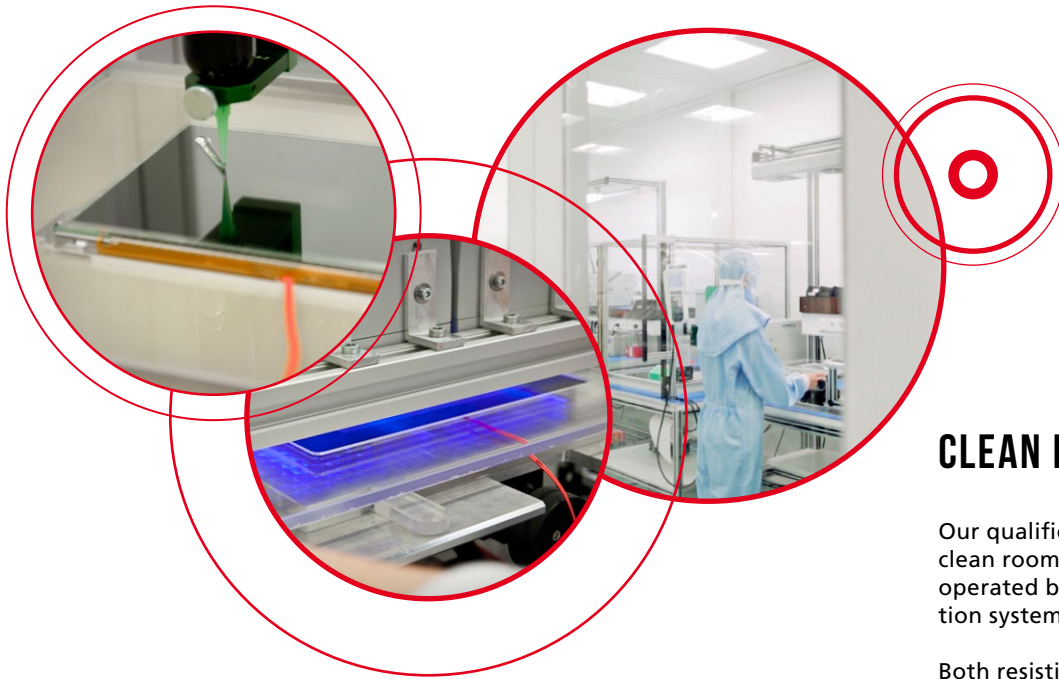
TOUCH / DISPLAY SOLUTIONS

Individual enclosures, optimised for the installation of capacitive and resistive touch screens

In addition to the integration of commercially-available displays, our enclosures also make possible the installation of resistive and capacitive touch screens. BOPLA has developed a special grouting compound technology for the mounting of the components, which often do not even have mounting points.

In both cases, the integration of the touch screen can be achieved in many ways. For applications which do not permit dirt-collecting edges (medical technology or the foodstuffs sector), BOPLA also has solutions with a continuous front membrane – laminated over the entire area, or with spacer dots on the back.

Individual solutions for all types of enclosures

Enclosure, enclosure front / front membrane: project-specific printing

Special grouting compound technology for optimal protection against harsh environment, shock and vibration

Project-specific display retaining plate made of aluminium ensures perfect connection between display and electronics

* The following are required for preparation work: sample, CAD data or a datasheet for the touch/display combination.

OPTICAL BONDING

Optical bonding signifies for us full-surface transparent bonding of touch sensors to a cover glass and display to make a complete unit.

You can select between various types of glass, customised printing and the PCAP sensors that are right for your project.

The available variants of optical bonding are LOCA, OCA and air-gap bonding.

LOCA and OCA bonding prevents parallax between the front glass, the sensor and the display and improves device structure in terms of functionality, stability and optics.

Together with you, we decide which of these processes is the most suitable for your application.

Benefits:

- *Reduction of the danger of splintering in case of glass breakage*
- *High resistance to vibration and shock*
- *Improved legibility*
- *Special contents*

CLEAN ROOM

Our qualified cleanroom in acc. with clean room class 6 / ISO 14644, part 1 is operated by means of a special ventilation system.

Both resistive and capacitive touch screens are full-surface laminated in the cleanroom.

ISO-CLASSIFIED CONTROLLED AREA

In the ISO-classified controlled area, our employees install the full-surface laminated touch screens into enclosures, or onto supporting plates or monitor front assemblies. These can be optionally moulded and then submitted to 100 percent testing. Moulding is accomplished either fully automatically on a metering system developed specially for BOPLA or with manual metering using pneumatic dispensers.

Our air-conditioned ISO-classified controlled area is operated by means of a special ventilation system.

In addition, front membrane keypads and displays can also be installed in standard and customised enclosures.

ISO-CLASSIFIED CONTROLLED AREA / CLEAN ROOM PRODUCTION

TOUCH SCREEN LAMINATION

Full-surface touch screen lamination is performed only in the cleanroom (ISO clean room class 6).

The pre-assembled and pre-cleaned touch screens are fed into the clean-room via a materials airlock for further processing, i.e. lamination.

On the laminators, lamination can be performed using a roller with either a hard or soft rubber surface, depending on the touch screen type (capacitive/ resistive and equipped with snap domes).

The laminating jigs are made in our own special department and consist of various conductive and non-conductive plastics.

LAMINATION PROCESS

Prior to the first process operation, a mounting specific to the touch screen is designed and constructed here at BOPLA. The touch screen is then positioned in this jig, in order to then correctly position the cut-to-size high-transparency OCA self-adhesive layer on it. The two elements are then permanently joined to one another with the exclusion of dust particles by means of the laminator and its heat-able rollers.

The next operation is the lamination of the back-printed front membrane under the same conditions. Not only our cleanroom and our high-quality assembly equipment, but also our employees' many years of experience in design and assembly, are the essential guarantors of visually perfect completion of this complex process.

The laminated touch screen is then inspected for inclusions and forwarded for further functional testing using test and documentation tools.
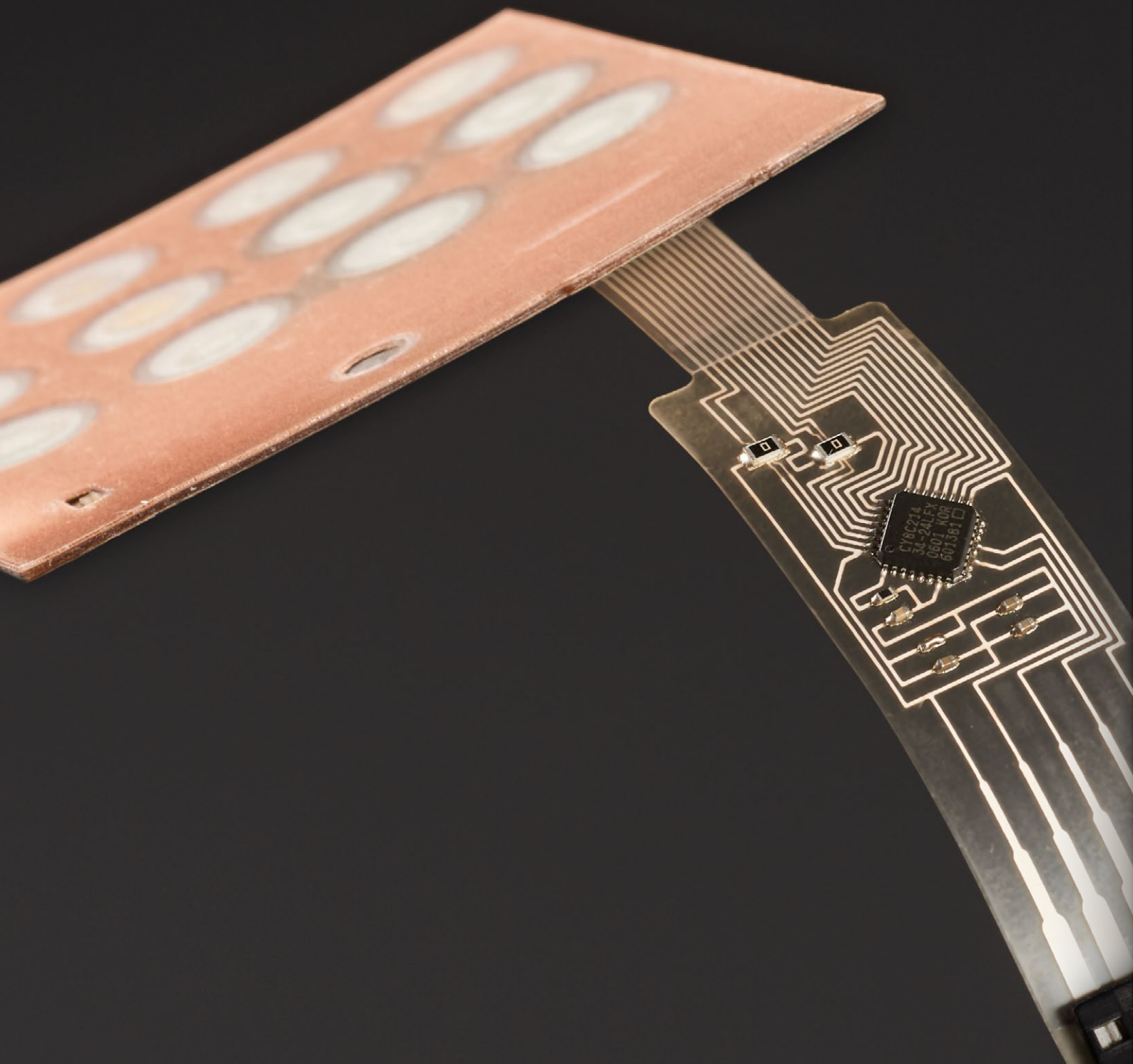
PRINTED ELECTRONICS

Traditional electronics inevitably runs up against its limitations when flexibility is needed. Our technical potentials now enable us to print customised flexible electronics.

Available free surfaces can be equipped with sensors and electrical functions. The low, flexible structure can be directly implemented with the design print and the printed electronics.
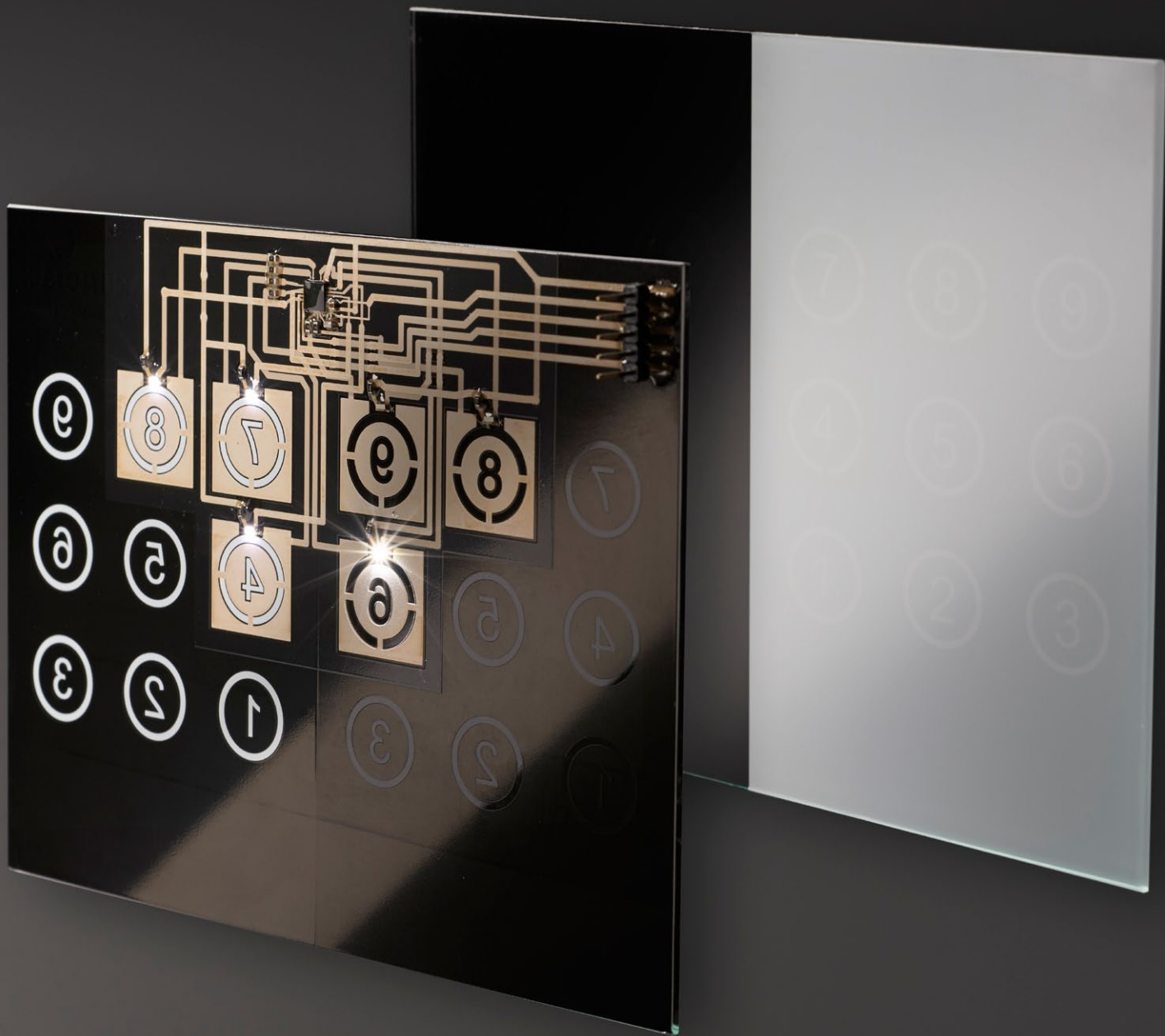
CAPACITIVE KEYPADS [35]

Touch sensor membranes make your non-conductive surfaces into a capacitive keypad.

Touch-sensor systems can be printed in the form of singles buttons, sliders or matrices, using direct printing onto flexible substrates, such as membranes, glass plates or alternative surfaces, such as enclosures, for example.

A touch-sensor membrane can, for instance, be bonded behind non-conductive surfaces in order to convert these surfaces into a membrane keypad.

Direct printing of enclosure parts with touch sensor systems makes it possible to efficiently combine production operations, save resources and reduce consumption of materials. This cuts materials costs and lowers the risk concerning the long term stability of adhesively bonded joints.

To assure reliable signal evaluation, our sensor electronics are supplied with a customised flat connector for immediate connection to the existing system.

The necessary signal evaluation can also be optionally implemented directly on the membrane. Correct functioning is then assured even in the presence of droplets of water or fouling on the surface.

Benefits:

- *Cost-savings thanks to combination with graphical printing*
- *Plug & Play sensor-surface and controller solution*
- *Reduced risk of failure*
- *Direct printing of alternative surfaces*
- *Good optical transparency*
- *No mechanical wear*
- *Easy cleaning thanks to sealed surfaces*

PRINTED ANTENNAS

We design the antenna geometry needed for your application.

Antennas of various geometries are needed for RFID products, depending on the particular application.

The geometry of the antenna is optimised for its electrical data and is not restricted to RFID.

We design the antenna geometry needed for your application and can print it using our tried-and-proven copper technology.

Copper technology provides greater range, faster read potentials and higher data-transmission rates compared to conductive silver.

In addition, we use NFC and RFID chips to integrate a passive digital identification feature into the membrane for you.

NFC technology can also act as an interface with the machine, making it possible to transmit condition scans or measured data, for instance. It is not necessary to pierce the enclosure for this purpose, with the result that a high IP ingress protection rating can be achieved.

A large range of digital products for the most diverse applications, such as anti-tamper seals, moisture sensors, process-monitoring cards and input systems using an NFC interface, for example, can thus be implemented.

- *Range up to 7 cm thanks to copper technology*
- *Direct integration into front membranes and membrane keypads*
- *Password-protected memory contents*
- *Many diverse potential applications*
- *Easy and cost-efficient integration into existing systems, even in small production runs*

ALSO OPTIONALLY AVAILABLE

PRESSURE SENSOR SYSTEMS

- *Low-profile and lightweight*
- *Combinations with other sensors also possible*
- *Sensor electronics can be integrated to achieve better scalability*
- *Customers' designs can be integrated straight into the sensor*

PRINTED HEATERS

- *Low-profile, lightweight and flexible*
- *Can be integrated into membrane keypads, glass and touch systems*
- *Self-regulating or with integrated measuring electronics*
- *Up to 200°C in continuous operation (depending on overall system)*

SYSTEM INTEGRATION
YOUR SINGLE-SOURCE SPECIALIST
AND ALL-ROUND EXPERT.
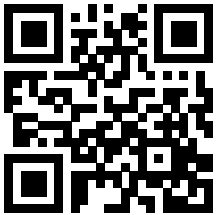
Video tip:
System integration

Modern HMI solutions need to be tailored to ever greater demands in terms of integratability, technology, geometry and design.

For this reason, our customers more and more frequently need all-in units that can be integrated as "Plug & Play" modules into their devices or systems.

The term "system integration" is used where individual components, such as a membrane keypad, electronics, touch screen and enclosure are combined to form a single unit.

An operating unit may consist of the following components:

- *Front membrane*
- *Membrane keypad*
- *Supporting plate*
- *PCB*
- *Enclosure*
- *Display*
- *Resistive touch screen*
- *Capacitive touch screen*
- *Front glass*
- *Embedded solution*