

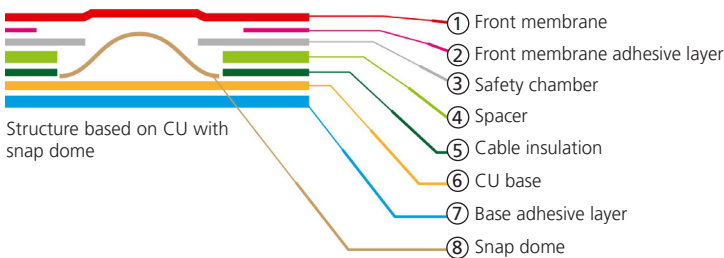
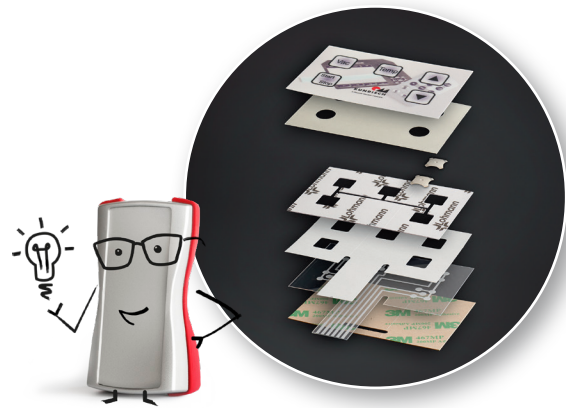
TECHNICAL INFORMATION

HMI

HUMAN MACHINE INTERFACE

DESIGN OF A MEMBRANE KEYPAD

As a rule, the outward-facing side of the transparent membrane is matt. Printing of the front membrane takes place on the back. This protects the printing against environmental influences such as dirt, moisture and scratches. Front membrane, switch membrane, distance membranes and base membrane are glued together using high-quality adhesive membranes. If required, they can then be pressed together. Pressing of the membrane keypad is not standard, and is only carried out for special requirements, e.g. for increased tightness or impermeability to alcohol.



FRONT MEMBRANE DESIGN

When designing the layout of the front membrane, maintain a minimum line thickness of 0.3 mm. Line thicknesses of less than 0.3 mm do not guarantee high print quality. Corel DRAW files including *.cdr, *.eps, *.ai, *.ps, *.DxF can be provided for the front membrane design. It is important to use vectorised data.

EXTERNAL CONTOUR

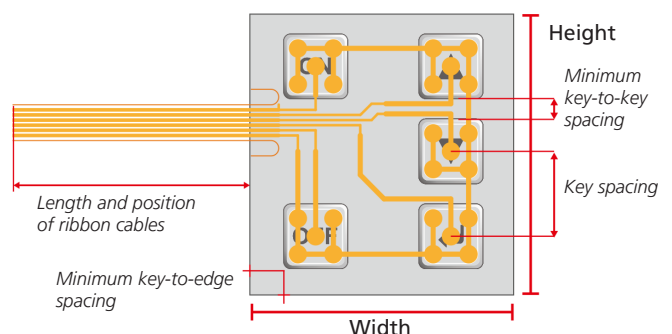
Pay attention to the degree of tolerance when planning a membrane keypad/front membrane on a supporting plate or in the enclosure. The shape can be designed as required in accordance with the requirements of the specific application. The standard tolerance for a keypad or membrane surface is ± 0.3 mm.

INSERTION POCKETS

Insertion pockets can be incorporated in the keypad for individual subsequent marking of keys or surfaces. Exchangeable insertion strips (e.g. for logos) can be fitted from the side, front or the rear. The insertion pocket is directly behind the front membrane, so the insertion strip is visible in the unprinted area.

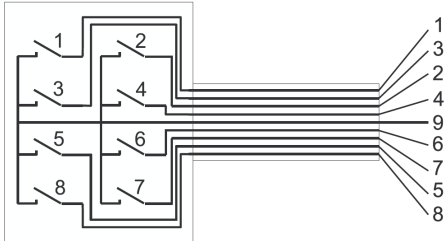
ENQUIRY DATA

- Width × height
- FFC length
- Number of keys (embossing yes/no)
- Number of LEDs
- Number of colours (clear lacquer for viewing windows classified as additional colour)
- Number
- Application (interior/exterior)



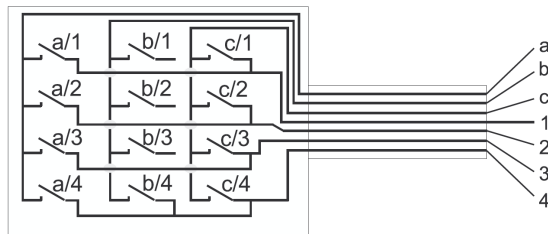
CIRCUITS

a) Common control line



Each key is connected to the common conductor and a printed conductor output. Additional decoding is not necessary. All leads are led to a highly flexible flat cable (FFC) in order to connect the entire keypad to the electronics.

b) X-Y matrix



The horizontal X output conductors and the vertical Y output conductors are connected to the contact points of the keys. This allows the connections to be reduced to just a few conductors.

SCREENING MEMBRANE

Screening can be integrated into the keypad to deal with static discharges and to prevent interference frequencies. This screening membrane is also inserted under the cover membrane. Display window with screening on request.

COLOURS

For printing front membranes, special screen printing colours, so-called push button colours, are used for plastics. Printing takes place on the rear, so the layers of paint are protected against environmental influences. Standard colours are selected and used according to RAL. Colours can also be printed according to HKS and the Pantone scale. Additives for special colours are invoiced at cost. For special colours (e.g. a company's colours), sample colour charts should be made available for the mixing procedures for the colours.

PROTECTIVE MEMBRANES

On request, a protective membrane can be drawn over the front membrane or only over the window. The membrane can be removed, without adhesive residues, after the keypad has been fitted.

SNAP DOMES

Snap or metal domes are manufactured from stainless steel. The contact side is gold-plated. The switching pressure for our standard snap domes is approx. 2.0 - 4 N.



RELEASES

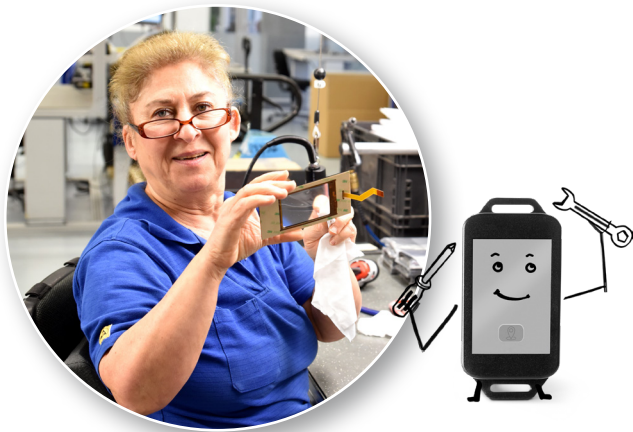
Before series manufacture starts, a file is sent by email for release. On request, release samples using the screen printing process are prepared and invoiced according to the amount of work involved. (dependent on quantity)

SURFACES

The following levels of roughness are available for the surface of the front membranes: glossy, matt or silk-matt. Matt surfaces are used in most cases.

CONNECTOR

The tail (flexible flat cable) can either be led to a FFC direct plug soldered onto the PCB, or a female connector is crimped onto the tail (grid: 2.54 mm). If female connectors are crimped on, a single-row male connector must be provided as a counter-piece from the PCB.



FLEXIBLE FLAT CABLES

The position of the exit point and the related length of the connection membrane should be specified during the design phase. The connection contacts are led out via the tail. The connecting lug is punched out of the keypad in the area of the exit so that the membrane cannot tear when bent. The standard grid is 1.0 mm. The ideal bending radius for the cable is > 4 mm. Avoid frequent bending.

LEDs

In addition, LEDs, brightness sensors, resistors or diodes can be integrated in the keypad (dependent on the height). For this purpose, the front membrane must be provided with cap embossing if necessary in the area of the LEDs.

PROTECTION CLASSES

When laminating the keypad onto a carrier, we recommend using a suitable adhesive on the cable output. If the keypad is pressed onto the carriers by means of a pressing device, the keypad is absolutely watertight (also impermeable to alcohol, depending on the design). If an enclosure, in connection with a keypad, is to achieve protection class IP65, note the following:

- The cable bushing into the enclosure must be sealed with a special adhesive.
- It may be necessary to adapt the construction of the keypad.

ASSEMBLY

BOPLA offers a complete service Processing and assembly services. The customer benefits from faster delivery times, ordering expenses and a reduced risk of rejects. In this way, the matching of the keyboard adhesive layer to the various enclosure surfaces and accuracy of fit can be guaranteed.

DISPLAY GLASS

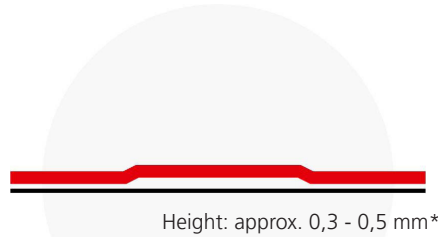
In addition to closed, crystal-clear membranes (front membrane), glass is very frequently used for a window. The following materials are available:

- Acrylic glass (e.g. Plexiglass)
- (Polycarbonate (e.g. Macrolon))
- Mineral or float glass



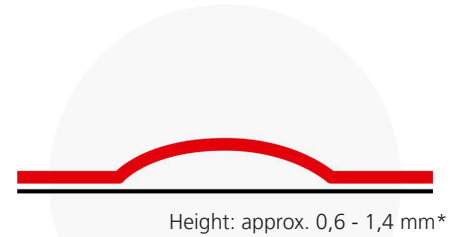
EMBOSSING

The main reason for embossing the membranes is to improve operation. Areas of the keys can be felt, and the membrane effect of the embossing improves the tactile response from the operating elements. Of course, embossing can also feature as a design element which highlights design membrane areas.



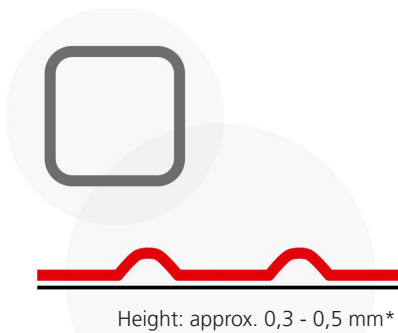
Raised embossing

Raised embossing can be executed in various forms.



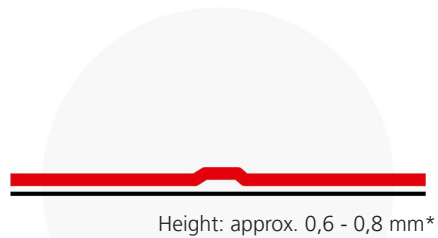
Dome embossing

Dome or bubble embossing is possible in diameters ranging from 8 to 17 mm.



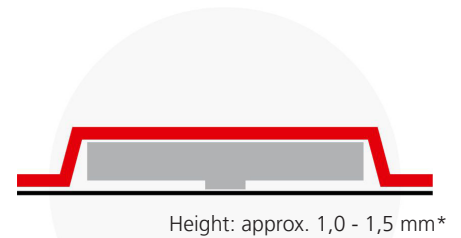
Rim embossing

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



Cap embossing

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.



Profiline embossing

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

*May diverge, depending on membrane material.



Technical data on membrane keypads with a copper base or PCB

	Copper technology with snap domes	CU/LS technology with snap domes	Keypad on PCB
Protection class to the front (dependent on design)	up to IP 67	up to IP 67	up to IP 67
Snap domes gold-plated on the contact side	from 5 mm up to 10 mm	from 5 mm up to 10 mm	from 5 mm up to 10 mm
Key area	from 5 x 5 mm	from 5 x 5 mm	from 5 x 5 mm
smallest centre clearance of the keys	between 8 mm and 13 mm	between 8 mm and 13 mm	between 8 mm and 13 mm
typical height	from approx. 0.6 mm to approx. 0.9 mm	from approx. 0.6 mm to approx. 0.9 mm	from approx. 0.7 mm to approx. 3.8 mm
Switch travel (dependent on embossing)	approx. 0.3 to 0.65 mm	approx. 0.3 to 0.65 mm	approx. 0.3 to 0.65 mm
Switching force dependent on membrane	between 3 N and 5 N	between 3 N and 5 N	between 3 N and 5 N
Operating life (dependent on snap dome used)	from 300,000 to >1 mio. test processes acc. to DIN 42115	from 300,000 to >1 mio. test processes acc. to DIN 42115	from 300,000 to >1 mio. test processes acc. to DIN 42115
Electrical data:			
Current	max. 100 mA	max. 100 mA	max. 100 mA
Voltage	max. 35 VDC	max. 35 VDC	max. 35 VDC
Maximum output	0,6 W	0,6 W	0,6 W
Conductor resistance (at 100 mm length and 1 mm width)*	<0,1 Ohm	<0,1 Ohm	<0,1 Ohm
Isolation resistance	>100 MOhm	>100 MOhm	>100 MOhm
Bouncing time (dependent on actuation)	<10msec	<10msec	<10msec
Operating temperature:			
Keypads with embossing**	-20 °C to 70 °C	-20 °C to 70 °C	-20 °C to 70 °C
Keypads without embossing	-20 °C to 70 °C	-20 °C to 70 °C	-20 °C to 70 °C
Storage temperature:			
Keypads with embossing**	-30 °C to 80 °C	-30 °C to 80 °C	-30 °C to 80 °C
Keypads without embossing	-40 °C to 80 °C	-40 °C to 80 °C	-40 °C to 80 °C

*The resistance of the conductors depends on the layout design. Conductive silver bridges can increase the conductor resistance.

**The embossing may regress slightly in the higher temperature range.

Requirements with differing data on request.

Technical data on conductive silver membrane keypads

	Conductive silver technology with snap domes	MyIardom with direct contact on conductive silver base	MyIardom with indirect contact on conductive silver base
Protection class to the front (dependent on design)	up to IP 67	up to IP 67	up to IP 67
Snap domes gold-plated on the contact side	from 7 mm up to 10 mm	ø7mm/ø8mm/ø9mm/ø10mm	ø7mm/ø8mm/ø9mm/ø10mm
Key area	from 7 x 7 mm		
smallest centre clearance of the keys	between 10 mm and 13 mm	between 10 mm and 13 mm	between 10 mm and 13 mm
typical height	from approx. 0.6 mm to approx. 0.9 mm	approx. 0.6 mm	1 mm
Switch travel (dependent on embossing)	approx. 0.3 to 0.65 mm	approx. 0.3 to 0.6 mm	approx. 0.3 to 0.65 mm
Switching force dependent on membrane	between 3 N and 4 N	between 2 N and 4 N	between 2 N and 4 N
Operating life (dependent on snap dome used)	>1 mio. test processes acc. to DIN 42115	> 300,000 test processes acc. to DIN 42115	> 500,000 test processes acc. to DIN 42115
Electrical data:			
Current	max. 100 mA	max. 100 mA	max. 100 mA
Voltage	max. 35 VDC	max. 35 VDC	max. 35 VDC
Maximum output	0,6 W	0,6 W	0,6 W
typical conductor resistance (at 100 mm length and 1 mm width)	<10 Ohm	<10 Ohm	<10 Ohm
Isolation resistance	>100 MOhm	>100 MOhm	>100 MOhm
Bouncing time (dependent on actuation)	<10msec	<10msec	<10msec
Operating temperature:			
Keypads with embossing**	-20 °C to 70 °C	0 °C to 45 °C	0 °C to 45 °C
Keypads without embossing	-20 °C to 70 °C		
Storage temperature:			
Keypads with embossing**	-30 °C to 80 °C	-30 °C to 45 °C	-30 °C to 45 °C
Keypads without embossing	-40 °C to 80 °C		

**The embossing may regress slightly in the higher temperature range. Requirements with differing data on request.

Technical data on the copper-laminated Profiline membrane keypads

	Profiline B	Profiline XE
Protection class to the front (dependent on design)	up to IP 67	up to IP 67
front membrane material used	Bayfol CR 6-2	Autotex XE
Snap domes gold-plated on the contact side	8mm und 10mm	8mm und 10mm
Key area	from 5 x 5 mm up to approx. 30 x 30 mm	from 7 x 7 mm up to approx. 30 x 30 mm
smallest centre clearance of the keys	between 16 mm and 40 mm	between 16 mm and 40 mm
Minimum clearance key edge to key edge*	between 11 mm and 24 mm	between 11 mm and 24 mm
Height	from approx. 1.4 mm to approx. 1.6 mm	from approx. 1.4 mm to approx. 1.6 mm
Embossing height	selectable: 1 mm, 1.5 mm, 2 mm	up to 1.0 mm
Switch travel (dependent on embossing)	approx. 0.3 to 0.65 mm	0.65 mm
Switching force	between 3 N and 5 N	>5N
Operating life (dependent on snap dome used)	from 300,000 to 500,000 test processes acc. to DIN 42115	>1 mio. test processes acc. to DIN 42115
Electrical data:		
Current	max. 100 mA	max. 100 mA
Voltage	max. 42 VDC	max. 42 VDC
Maximum output	0,6 W	0,6 W
Conductor resistance (at 100 mm length and 1 mm width)**	<0,1 Ohm	<0,1 Ohm
Isolation resistance		
Bouncing time (dependent on actuation)	>100 MOhm	>100 MOhm
Operating temperature	<10msec	<10msec
Storage temperature	-20 °C to 45 °C -40 °C to 80 °C	-20 °C to 70 °C -40 °C to 80 °C

*These clearances depend on the inlay size

**The resistance of the conductors depends on the layout design. Conductive silver bridges can increase the conductor resistance.
Requirements with differing data on request.

Technical data on touch panels

These data are based on the values of touch screens used in the past (resistive). Other touch types and manufacturers on request. Critical values should always be reconciled with the relevant data sheet.

Technology manufacturer	Analogue 4-wire	Analogue 5-wire
Protection classes:		
Installation on front and rear without air vent	up to IP 65	up to IP 65
Installation on front and rear with air vent	up to IP 64	up to IP 64
full-surface laminated touch*	up to IP 67	up to IP 67
Actuation force	<50g	<50g
Light transmission: installation on front and rear	>80%	>80%
Light transmission full-surface laminated	>72%	>72%
Operating life	>1 Mio.	>1 Mio.
Electrical data:		
Voltage	DC 5V	DC 5V
Isolation resistance	>10 MOhm at 25 V *	>10 MOhm at 25 V *
Current	35 mA	35 mA
Operating temperature	-10 °C to 60 °C	-10 °C to 60 °C
Storage temperature	-20 °C to 70 °C	-20 °C to 70 °C

*In the case of full-surface lamination, the minimum thickness of the touch unit material depends on the size of the sensor area. The larger this sensor area (diagonal) is, the thicker the sensor carrier glass should be (danger of breakage).

Touch panels for systems with differing specifications on request.

Characteristics and stability of the plastics used

Characteristics	Polycarbonate PC	Polyester PETP
Mechanical characteristics	Tensile strength and stretch resistance: <u>good</u> Scratch-proofing: <u>very good</u> Embossing and stamping processing: <u>very good</u> Printing: <u>very good</u>	Tensile strength and stretch resistance: <u>good</u> Scratch-proofing: <u>very good</u> Embossing and stamping processing: <u>very good</u> Printing: <u>very good</u>
Electrical characteristics	Dielectric strength: <u>ø 60 kV/mm</u> Isolation resistance: <u>10⁹ - 10¹¹ Ω</u>	Dielectric strength: <u>ø 250 kV/mm</u> Isolation resistance: <u>10⁹ - 10¹¹ Ω</u>
Thermal characteristics	Temperature range: <u>-50°C to 120°C</u> Melting point: <u>220°C</u> Flammability: <u>slow to self-extinguishing</u>	Temperature range: <u>-70°C to 150°C</u> Melting point: <u>250°C</u> Flammability: <u>slow to self-extinguishing</u>
Optical characteristics	Light transmission, well-suited for LED displays. Colour reproduction slightly damped.	Very good light transmission, resulting in good visibility for LED and LCD displays. Good colour reproduction.
Chemical characteristics	Polycarbonate is resistant to mineral acids, many organic acids, oxidation and reduction agents, and acid salt solutions, many oils, saturated aliphatic cycloaliphatic hydrocarbons and alcohols, excluding methyl alcohol.	Polyester membrane is highly insensitive to moisture and most chemicals. Polyester is resistant against detergents, water, petrol, many oils, alcohol, vinegar, aliphatic hydrocarbons, bleaching agents, 2% ferric chloride solution, iodine, ethyl acetate, food dyes, machine oil; less resistant to chlorinated hydrocarbons, ketones, aromatic hydrocarbons.

If different media are in contact with each other, the resistances may change. For this reason we cannot assume any liability for the information provided.