knitter-switch

Input Systems

knitter-switch Overview

knitter-switch is one of Europe's leading manufacturers of switches. Since its foundation in 1966, **knitter-switch** has remained at the forefront of switch technology and now provides an unrivalled range of switching solutions from basic toggle types to tact switches and membrane and rubber keypads for today's most complex and demanding control applications.

knitter-switch continues to design new switching solutions, employing the latest technologies and materials while ensuring compliance to continuously evolving legislation. We offer the most complete range of switches available to design engineers and bring the added benefits of a local design service, fast turn around on quotations and production quality prototypes together with Far East pricing.

knitter-switch has its headquarters near Munich, Germany and has subsidiary companies in the UK, France and Asia and strategic alliances with a number of leading global distributors.

Membrane Keypads, Rubber Keypads and complete units with Touch Screens

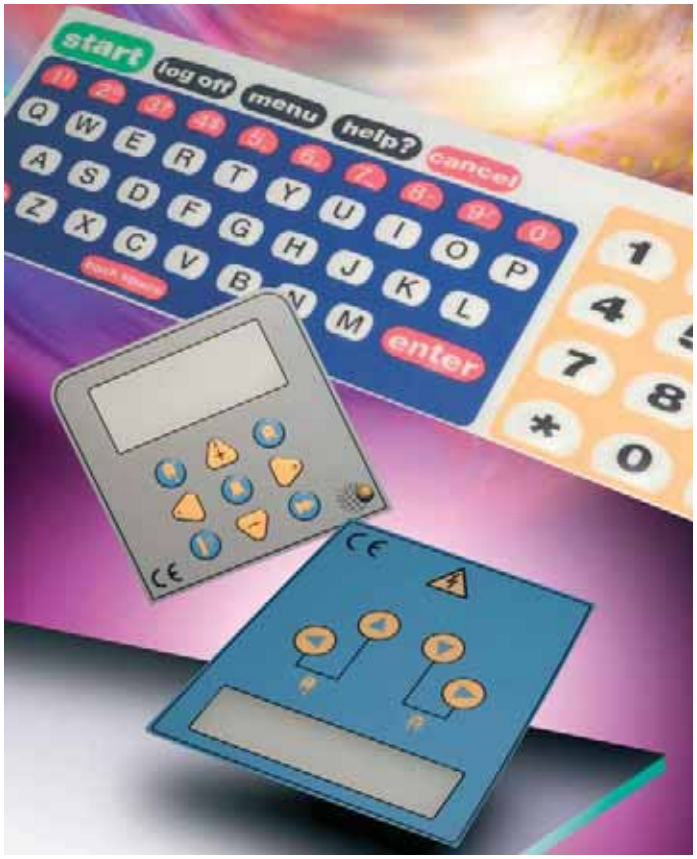
Membrane keypads offer a unique combination of features to enable fast and simple supply of customer-specific keypads. High quality products, designed in Germany and manufactured in Asia to ensure competitive prices, are backed up by local design and sales support to ensure fast and accurate communications and rapid delivery of each customer's requirements.

Switches are available in flat, poly-domed and metal-domed types, giving a variety of levels of tactile feedback, and life expectancy in excess upto one million operations. All **knitter-switch** membrane keypad designs are tested for resistance to surface scratching, thermal shock, electrical ratings and operating lifetime.

Silicone rubber keypads are manufactured from elastic, non-toxic silicone rubber compounds. Silicone keypads are processed from compression or injection molding. The result is an economic and reliable keypad for small, medium and large production runs. Silicone keypads can be integrated with printed circuit boards or flexible circuits and have excellent resistance to temperature and aging.

Touch screens are available with resistive or capacitive principles as complete customized functional units integrated in modules such as front panels.

Input Systems



Membrane Keypads

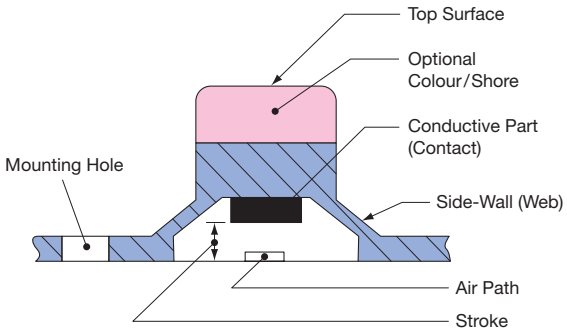
- Graphic overlay only or full switching membrane
- Metal, polydome or pushgate contacts
- Tactile or non-tactile feel
- Integrated touch screens, encoder, LEDs and other components
- LCD windows
- ESD/RFI shielding
- Insertable legend options

Rubber Keypads

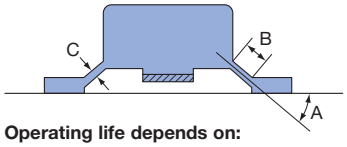
- Backlighting options
- Various coatings eg epoxy, polyurethane
- Harder rubber options to give ‘plastic’ feel
- Various travel/operating force options
- Combination with tactile switches
- Wide variation of colours and designs
- Plastic key tops available

Rubber Keypad Design

Basic Construction Illustration

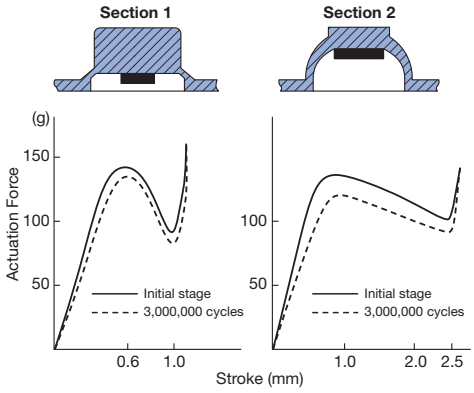


Life Test



Operating life depends on:

- **Soft Material** ... 50 Shore is preferred.
- **Low Stroke** ... less than 1 mm.
- **Angle** (as part A illustrated above) ... 40-degree is recommended.
- **Length of side-wall** (as part B illustrated above)
- **Thickness of side-wall** (as part C illustrated above) ... determined by key structure. The thicker the web, the higher the operating force.



Tolerance Requirement of Silicone Rubber Key

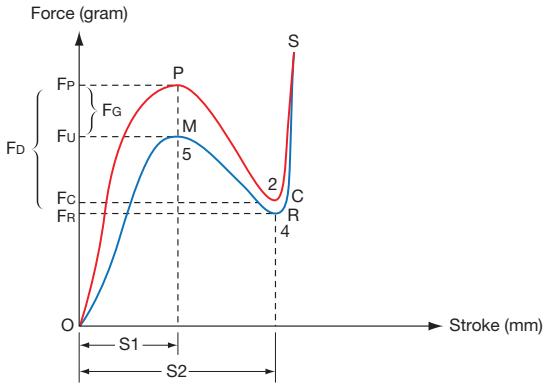
Dimensions:		Actuation Force:	
0 ~ 10 mm	± 0.10 mm	50 ~ 60 grams	± 15 grams
10 ~ 20 mm	± 0.15 mm	61 ~ 80 grams	± 20 grams
20 ~ 30 mm	± 0.20 mm	81 ~ 100 grams	± 25 grams
30 ~ 40 mm	± 0.25 mm	101 ~ 120 grams	± 30 grams
40 ~ 50 mm	± 0.30 mm	121 ~ 150 grams	± 35 grams
50 ~ 60 mm	± 0.35 mm	151 ~ 200 grams	± 40 grams
60 and above	± 0.6%	201 and above	± 25%

Mechanical and Electrical Properties of Silicone Rubber

	Non-Conductive Silicone
Temperature for use	-55°C ~ +250°C
Specific Gravity	1.15
Tensile Strength	90 kg/cm^2
Tear Strength	13 Kgf/cm
Compression Set	10% (180°C x 22 hrs.)
Elongation at Break	350%
Volume Resistivity	8 x 10^{14} ohm cm
Contact Resistance	–
Contact Rating (DC)	–
Contact Bounce	–
Chattering	–
Insulation Breakdown	24 Kv/mm
Colour	Colouring possible
Dielectric Constant	4.2 (50 Hz)
Dielectric Tangent	13% (50 Hz)

Depending on the size of contacts and keyboard layout.

Force-Stroke Curve of Rubber Keypad



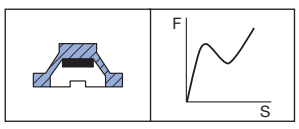
Force	
FP	Peak Force (FMAX)
FU	Max. Return Force
FC	Contact Force
FR	Min. Return Force (FMIN)
FM	Max. Return Force
FD	Drop Force (FD = FP – FC)
FG	Gap Force (FG = FP – FM)

Stroke	
S1	Peak Stroke
S2	Contact Stroke

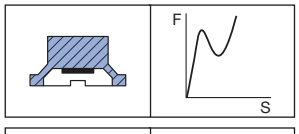
Location	
O	Original Point
P	Peak Point
C	Contact Point
R	Return Point
M	Max. Return Point

Travel	
O-P	Peak Force (FMAX)
P-C	Contact Force
C-S	Min. Return Force (FMIN)
S-R-M-O	Gap Force (FG = FP – FM)

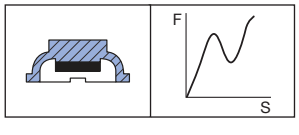
Typical Key Sections and Characteristics



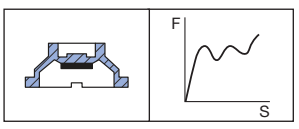
Force Range	30 ~ 350 grams
Stroke Range	0.5 ~ 3.0 mm
Cycle Life (x10^3)	500 ~ 2000
Typical uses	Telephone, Remote Control, Automotive, Radio, Toys, Calculator, etc.



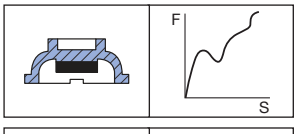
Force Range	30 ~ 250 grams
Stroke Range	0.7 ~ 2.5 mm
Cycle Life (x10^3)	500 ~ 2000
Typical uses	Telephone, Remote Control, Toys, Games, Calculator, etc.



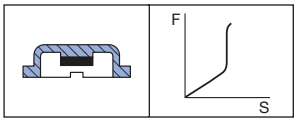
Force Range	30 ~ 150 grams
Stroke Range	0.5 ~ 3.0 mm
Cycle Life (x10^3)	1000 ~ 3000
Typical uses	Telephone, Remote Control, Toys, Measuring Instruments, Office Machine



Force Range	30 ~ 80 grams
Stroke Range	2.0 ~ 4.0 mm
Cycle Life (x10^3)	5000 ~ 20000
Typical uses	Computer, Typewriter etc.



Force Range	30 ~ 200 grams
Stroke Range	1.0 ~ 2.5 mm
Cycle Life (x10^3)	500 ~ 3000
Typical uses	Telephone, Typewriter, Test Instruments, etc.



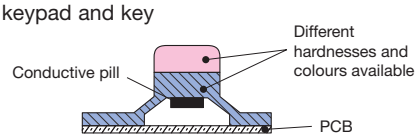
Force Range	20 ~ 80 grams
Stroke Range	0.2 ~ 1.0 mm
Cycle Life (x10^3)	500 ~ 10000
Typical uses	Typewriter, Household Appliances, Computer, etc.

The above information and specifications are for reference only.

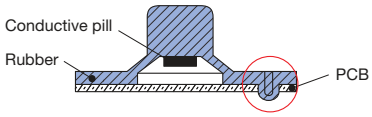
Rubber Keypad Design

Some Special Design Illustrations

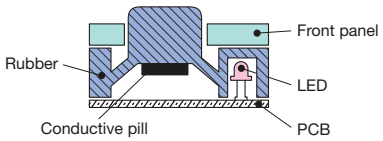
1. Different shorehardnesses in the basic keypad and key



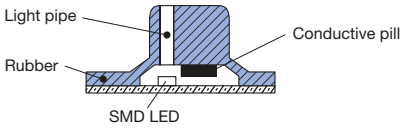
2. Push or pull thru to anchor keypad to PCB



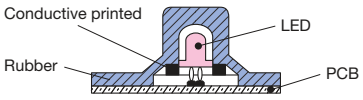
3. Back lighting – option 1



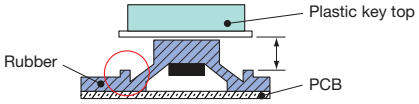
4. Squared key top design with LED light pipe



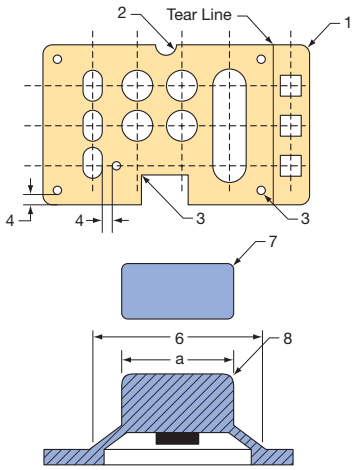
5. Back lighting – option 2



6. Control of travel distance

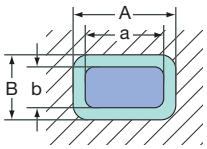


Special Design for Construction Ideas



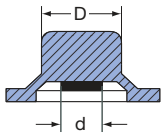
1. Typical outside radius is 1.0 to 1.5 mm.
2. Minimum radius is 0.3 mm.
3. Minimum inside radius is 0.2 mm.
4. Spacing between the edges of a rubber dome and a guide hole is 1.0 mm or more.
5. Guide holes are min. 1.0 mm in diameter.
6. The width of a rubber dome base is typically 2.0 mm more than a.
7. The minimum radius for the side edges of key top is 0.25 mm.
8. The minimum radius for the top edges of key top is 0.2 mm.

Guideline for Assembly Design

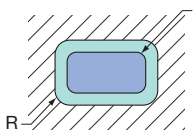


A & B : dimensions of plastic
a & b : dimension rubber

A-a ≥ 0.5 mm, B-b > 0.5 mm

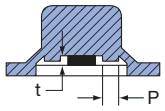


D-d = 1.5 ~ 2.0 mm

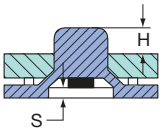


R : the corner radius of plastic
r : the corner radius of rubber

1mm ≤ R ≤ 1.25 mm, 0.75 mm ≤ r ≤ 1 mm is better

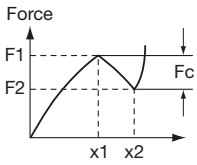


P : diameter of post
t : the gap between post & conductive pill
P = 1.0 mm is better
t = 0.1 - 0.15 mm is better



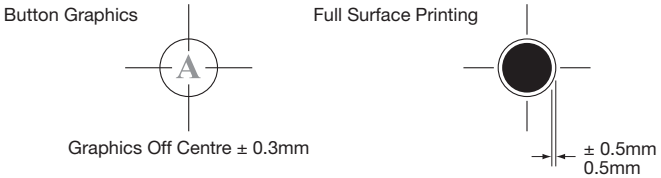
H : the dimension of key tops & plastic
S : the stroke of key pad

H-S ≥ 1.5 mm

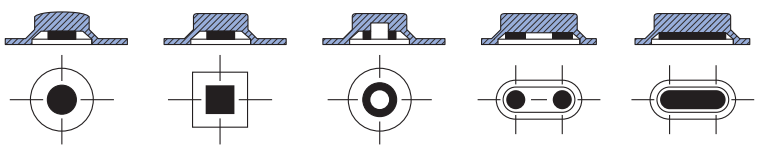


Fc : click force
Fc : F1-F2 > 25 g is better

Guideline for Printing Artwork Design



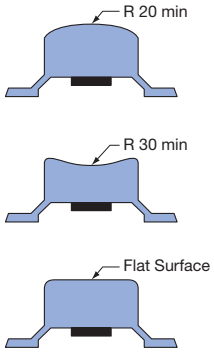
Patterns of Conductive Designs



Items	Standard Sizes of Conductive Pill
Circle	Ø1.5, Ø2, Ø2.5, Ø3, Ø3.5, Ø4, Ø4.5, Ø5, Ø6, Ø7, Ø8, Ø9, Ø10
Square/ Ellipse	Recommended size of conductive ink printing contact is flexible.

Conductive Pill Resistance	Less than 150 ohms, with 125 grams loading
Life	10 million (min.)
Print Type Resistance	Less than 500 ohms, with 125 grams loading
Life	1 x 10^6 max.

Colour / Printing

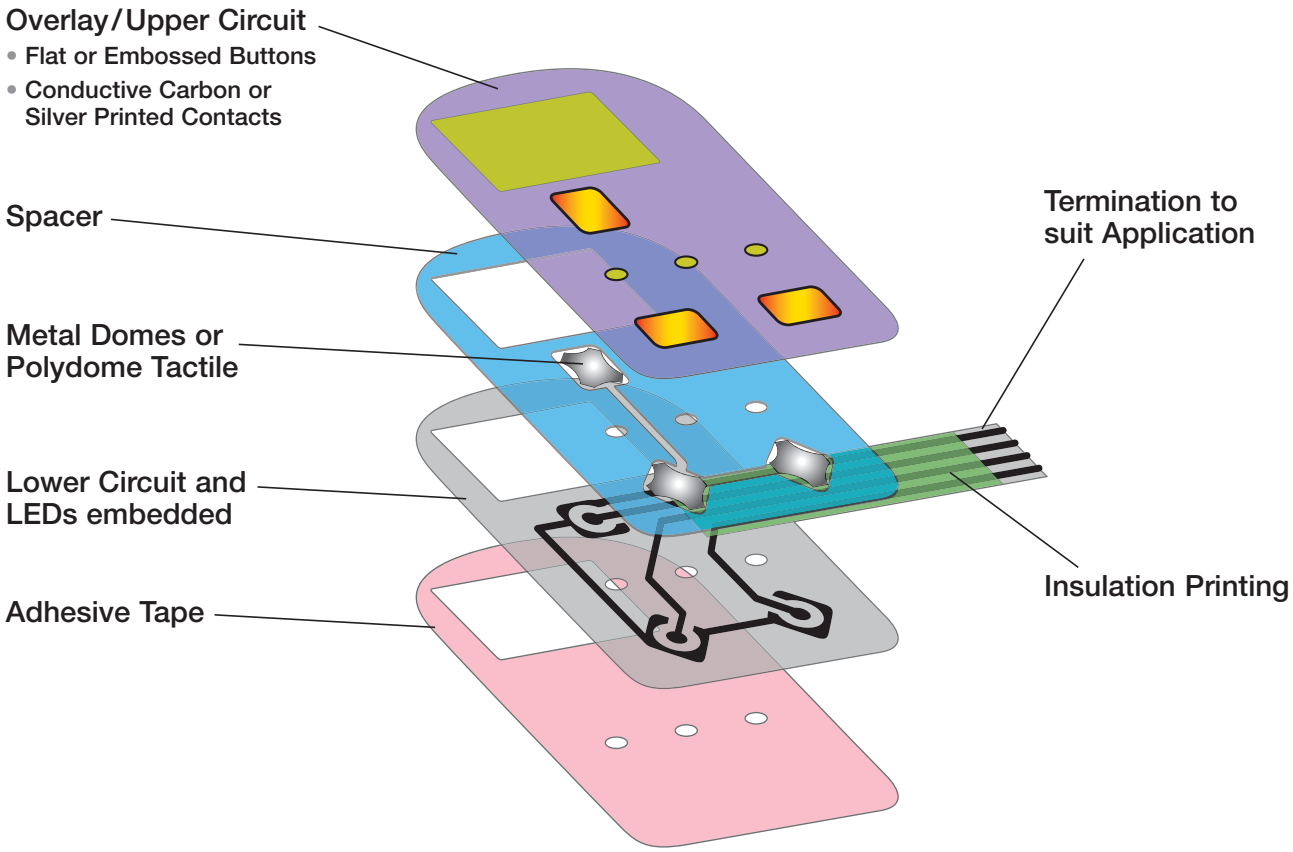


Suitable Key Surface for Legend Printing:

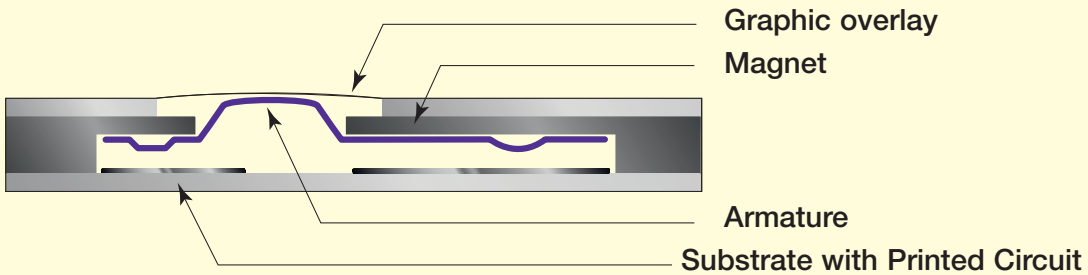
The commonly used colour for the underlay is medium-grey. Customers should provide us with the Pantone code or a colour specimen for both the key button and the legend.

The above information and specifications are for reference only.

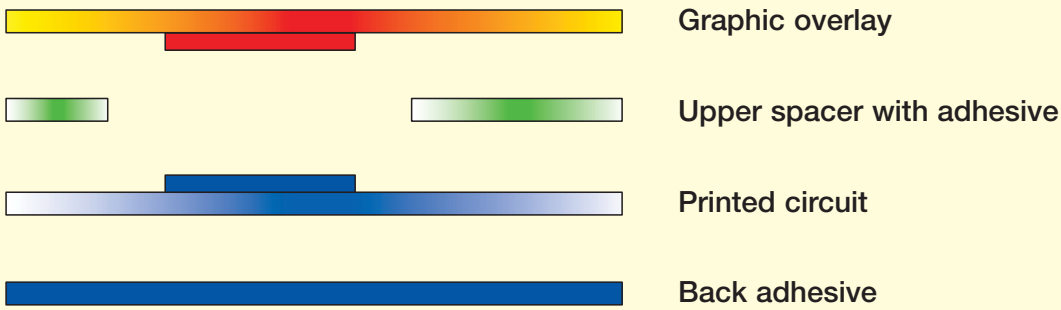
Membrane Keypad Structure



PushGate



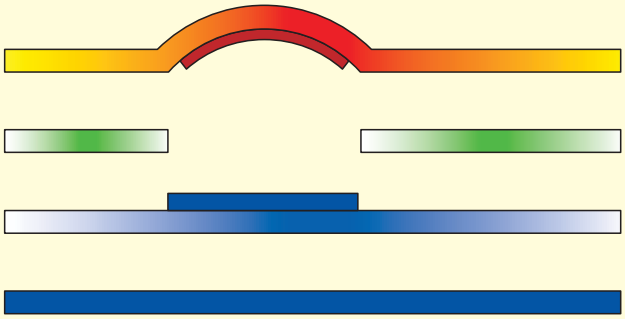
Flat Type (POLYDOME, Non-Tactile)



Membrane Switch Structure

Tactile Type

POLYDOME



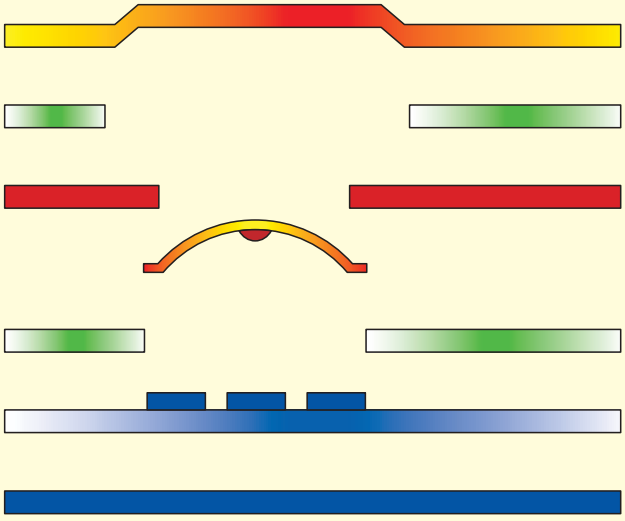
Embossed graphic overlay with upper circuit

Spacer with adhesive

Lower circuit

Back adhesive

METAL DOME



Embossed graphic overlay

Mounting spacer with adhesive

Mounting spacer

Metal dome

Lower spacer with adhesive

Lower circuit

Back adhesive

Typical Specification	POLYDOME	METAL DOME	PushGate
Operating voltage	min. 100 mV AC/DC max. 25 VAC / 42 VDC	min. 100 mV AC/DC max. 25 VAC / 42 VDC	min. 3 V AC/DC max. 50 V AC/DC
Breaking current	100 mA	100 mA	50 mA
Max. initial contact resistance	500 Ω	500 Ω	2 Ω
Min. isolation resistance	100 MΩ	100 MΩ	45 MΩ
Operating temperature	–5 °C…+50 °C	–10 °C…+80 °C	–40 °C…+85 °C
Endurance	500 000 operations	200 000 operations	1 000 000 operations
Actuation force	0.3 N…5 N	0.3 N…5 N	2.2 N, 2.8 N
Typ. Travel	0.3 mm...0.6 mm	0.25 mm...0.4 mm	0.3 mm
Typ. Bounce	3 ms	5 ms	1 ms

Capacitive keypads

Capacitive keypads are wear-free input systems with no moving parts, which are operated by touch (sensor) without pressure.

An inexpensive alternative to the touch screen, they consist of an actual keypad with sensor surfaces arranged in fixed positions and a controller IC.

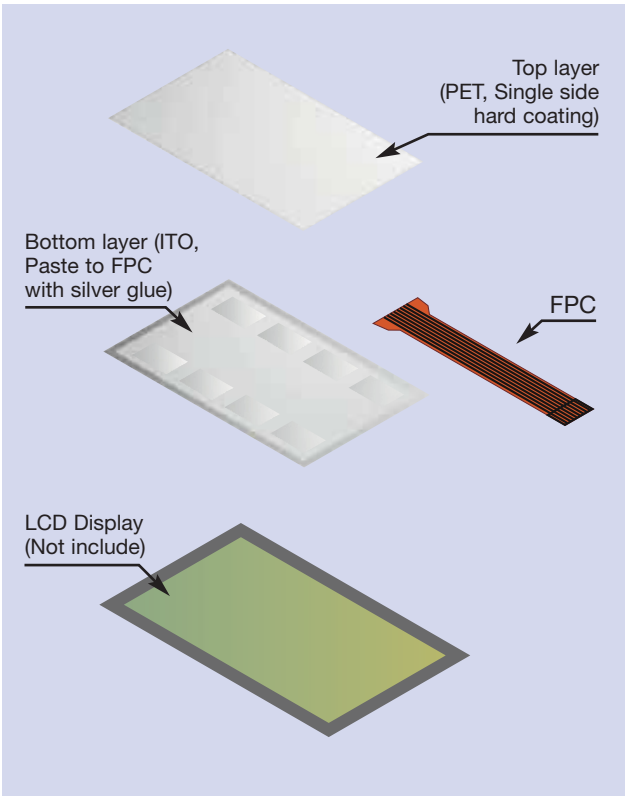
Spatially, the controller can be both assigned to the keyboard or located on the PCB at the equipment end.

The design in terms of shape and colour scheme is essentially restricted only by the type of surface material used (insulators such as glass, plastic, wood etc.), so it is also easy to produce multidimensionally curved shapes.

Appropriate arrangement of the sensor surfaces makes it possible for keys, sliders, rotary potentiometers etc. to be reproduced easily.

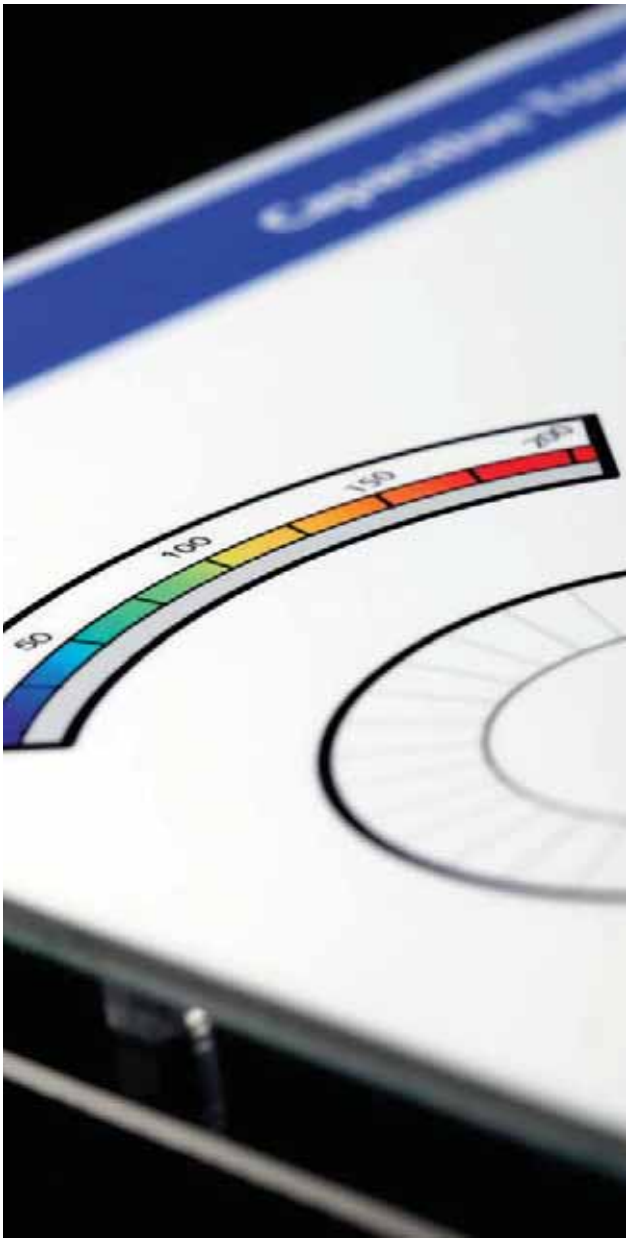
In addition to applications where ease of cleaning is important (medical technology, food industry, household appliances), this process is particularly suitable for designer (lifestyle, multimedia, home automation) equipment.

Structure



Technical Data for the Controller

Operation voltage	2.7…5.5 V
Power consumption	80 µA typ.
Inputs/Outputs	8 sensor surfaces / 8x digital (L or H active)
Operating temperature	–20°C ~ +70°C



Functional units with touch screens

Touch screens operating according to resistive or capacitive principles are an obvious choice for applications in which, as in a monitor display, a variety of input fields (differing in terms of number, size, arrangement) are designed to be active and a robust, closed surface is required.

knitter-switch supplies complete customized functional units in which touch screens, optionally in combination with film keypads, are integrated in modules such as front panels.

Resistive touch screens

These consist of a carrier layer (glass, film) and a surface layer (film), the facing surfaces of which are coated with a transparent conductive material and are held in position in close proximity to one another.

When the film is pressed onto the carrier at a particular point, a conductive connection is created there, the position of which can be determined by means of voltage measurements along the X and Y axes.

Its simple design with a movable surface layer means that the system is inexpensive, but not wear-free.

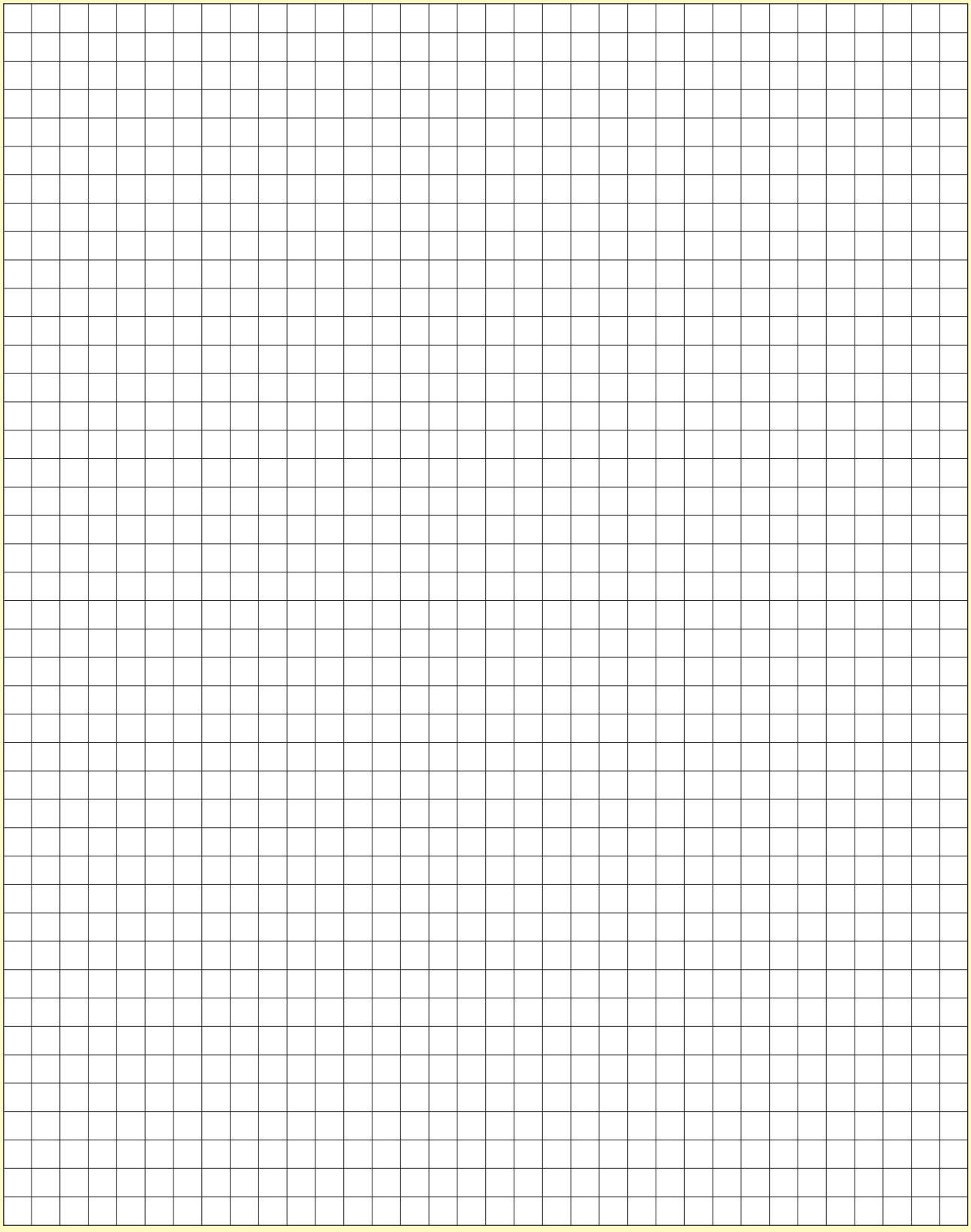
Since such input systems can also be used with styluses, prostheses etc, they are the technology of choice where accessibility is important.

Capacitive touch screens

These consist of a transparent substrate which is coated with a conductive layer and has an AC voltage source arranged on each of its four corners. When you touch this with your finger, four different currents are produced, and the position can be calculated from the relationship of these currents to one another.

Specifications (based on the resistive touch screen as an example)	
Dimensions	customized
Operation voltage	5 VDC
Insulation resistance	> 20 MΩ
Operating temperature	–20°C ~ +70°C
Service life	>1x10^6 (pen hitting) or >1x10^5 (pen sliding)
Linearity deviation	< 1.5 %
Transparency	> 80 %
Surface hardness	3 H (pencil test)

Layout Inquiry



Please sketch out your keypad layout and return to us

(See back page for address details)

Keypads Inquiry Form

Company

Department

Attention

Address

Postcode

Phone

Fax

Email

Web

Membrane Requirements

Graphic Layer

Overall size

What finish is required (matt, gloss or selective texture)

Are windows required

Size

Position

Do they need to be tinted

Is embossing required

Pillow or rim

Number of colours

Switches

Number

Tactile or non-tactile

If tactile: polydome or metal dome

Metal means higher unit cost, lower tool cost.
Polydome means lower unit cost, higher tool cost.

Electrical schematic: ”x-y-matrix” or ”common return”?

LEDs

Are embedded LEDs required

Number and colour

Will a separate tail be required

Tail position and length

Position of tail – exit from side and rear

Type of connector (if required)

If ZIF connector being used, get type for ref.

Any special features required

Insert legends

Luminescent inks

Other

Estimated project volume

Please complete this questionnaire and return to us with your sketch overleaf

(See back page for address details)

Input Systems

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knitter-switch