

MEMBRANE SWITCHES



TESLA JIHLAVA, a.s.

Welcome to TESLA Jihlava



COMPANY PROFILE

TESLA Jihlava, a.s. - a joint-stock company - is one of the largest Czech manufacturers of electromechanical components specialized in connector- and switch- business since 1958. The company is certified in compliance with ISO 9001 standard and VDA 6.1 directive for automotive industry, authorized to apply the UL Mark for DIN 41 612 connector series and KEMA approval for switching components.

TESLA Jihlava provides customers with comprehensive service including subcontracting of all primary production operations.

Electromechanical Components Product Range:

Connectors

- two-piece rectangular (PCB mount) DIN 41 612 - F, C, H, F+H
- HYPCON (with hyperbolic geometry)
- insulation displacement connectors (IDC) for .050" flat ribbon cables
- coaxial

Switches

- membrane switches
- push-button switches

Customer Designed Products

- connectors
- switches
- assemblies

Services:

- special tools, metal stamping tools, injection moulds design and manufacture
- jigs & single-purpose machines development and manufacture
- tailor-made operations in subcontracting range of:
 - tool-making workshop
 - moulding workshop
 - metal stamping workshop
 - plating plant
 - precision machining workshop
 - automation
- specialized assembly operations

Membrane switches

Membrane switches are cheap, reliable solution of a human / machine interface. They are easily accessible even for unique and/or low volume applications.

Field of applications spreads from industrial machines through automation and robotics, measurement devices to health and fitness devices, household appliances and consumer electronics, but also security systems and military industry.

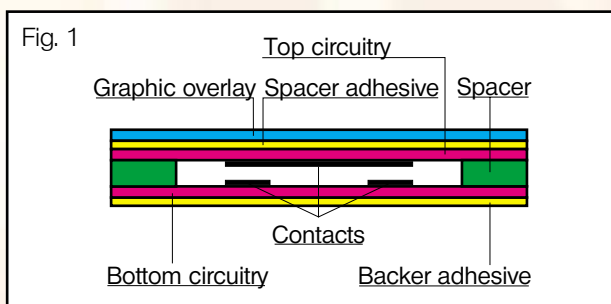
Features of membrane switches:

- quick and easy application
- short delivery times
- resistance to harsh environment (humidity, water jets, dust etc.)

There is a broad variety of membrane switch designs.

Most of switches are tailor-made to meet specific customer requirements, such as:

- dimensions and shape of a membrane switch contour (square, oblong, circle etc.)
- artwork (colour style, lettering, marks, symbols, company logos)
- style of keys (flat, embossed, with embedded metal dome)
- shape and dimensions of embosses (rims, pillows - squares, arrows and other symbols, e.g. blind blocking)
- type of switch encoding (X-Y matrix, common bus, or other)
- embedded SMD components (LED lamps, resistors and other elements)
- arrangement and length of flex-tails, flex-tail termination
- connector termination pitch (2.54 mm, 1.27 mm and 1.00 mm)
- pockets for in-key or off-key legends



Self-adhesive faceplates

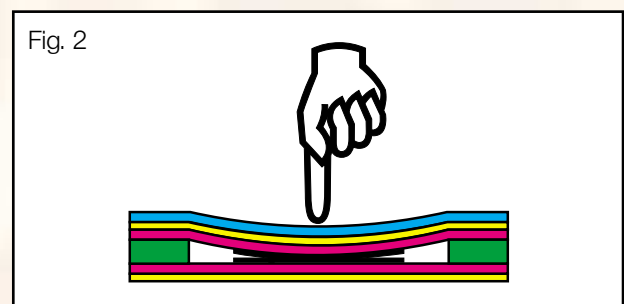
The faceplates are custom-made graphic overlays that are to be laminated on machine and device panels, thus finalizing the graphic design. Faceplates do not include any contacts. The graphics of the faceplate can be printed either on the reverse side of the film (to secure abrasion-resistance), or on the front side. The faceplate can be embossed and/or fitted with pockets for exchangeable legends.



Function and design of membrane switches

The membrane switch is a multilayered film sandwich consisting of static bottom circuitry, top circuitry with graphic overlay and spacers laminated by means of adhesive (see Fig. 1).

To make circuitry and contacts, silver loaded conductive ink is screened on top and bottom circuitry films. These films are separated by a spacer with holes that separate the contact points from each other or may contain metal domes for a tactile application. Figure 2 illustrates electrical connection after pushing the graphic overlay down.



A tail is a flexible extension of one or more circuit layers providing the means for electrical interconnection with the electronics. The tail can carry multiple circuit traces with a width and pitch determined by the application.

The flat flex-tail can either exit from the side of the membrane switch or from the back. Such membrane switch is "splash" proof (see Fig. 3).

To ensure abrasion resistance of the membrane switch the graphics are made on the reverse side of the graphic overlay. Outer side can only be coated with UV textures or clear inks.

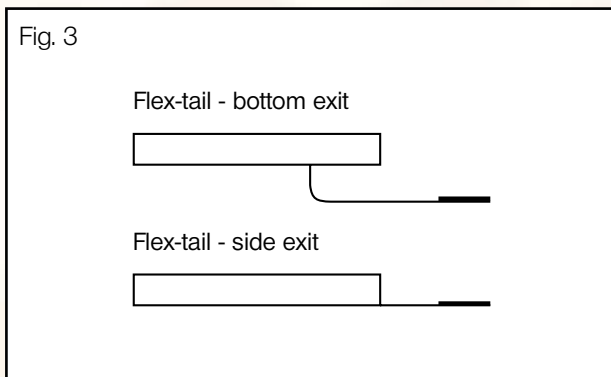
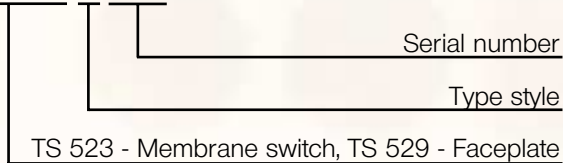
In general, the membrane switches can be divided into two groups - switches with a tactile response (click feel) and without tactile response (non-tactile). A characteristic feature of non-tactile switches is linear course of the actuation force, while switches with a tactile response have typical nonlinear response with a sudden drop of the actuation force (see Fig. 4).

Tactile response is created either by dome embossing of the graphic overlay (polydome tactile) or by a metal dome that is embedded in a switch (metal dome tactile).

Tesla Jihlava manufactures 5 basic styles of membrane switches (see Tab.1 - Membrane Switch Characteristics on page 6).

Ordering nomenclature:

TS 52x x xxx



Materials used for membrane switches and faceplates

To assure high quality of our switches and faceplates we use strictly tested high-quality materials. The customer can choose graphic overlay material according to the switch graphic design and environmental conditions.

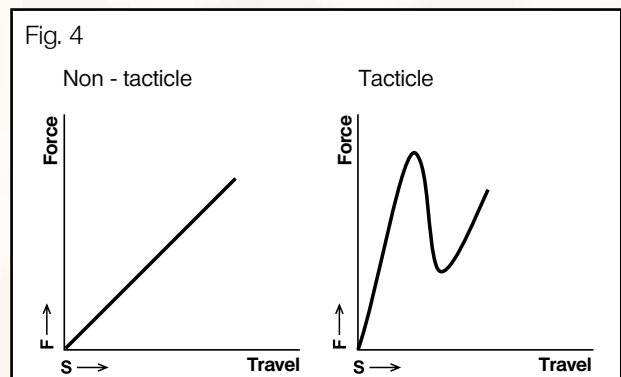
Materials for membrane switches:

- a) polyester:
 - 1) transparent
 - 2) anti-reflexive
 - 3) matted
 - 4) textured
- b) polycarbonate:
 - 1) transparent
 - 2) fine-textured
 - 3) coarse-textured

Polycarbonate films are not suitable for polydome tactiles.

Materials used for faceplates:

- a) for reverse-side printing:
 - materials are identical to membrane switches materials
- b) for front-side printing:
 - PVC film - transparent
 - PVC film - coloured
 - aluminium silver-coloured film



Membrane switch type styles:

A) Non-tactile switches

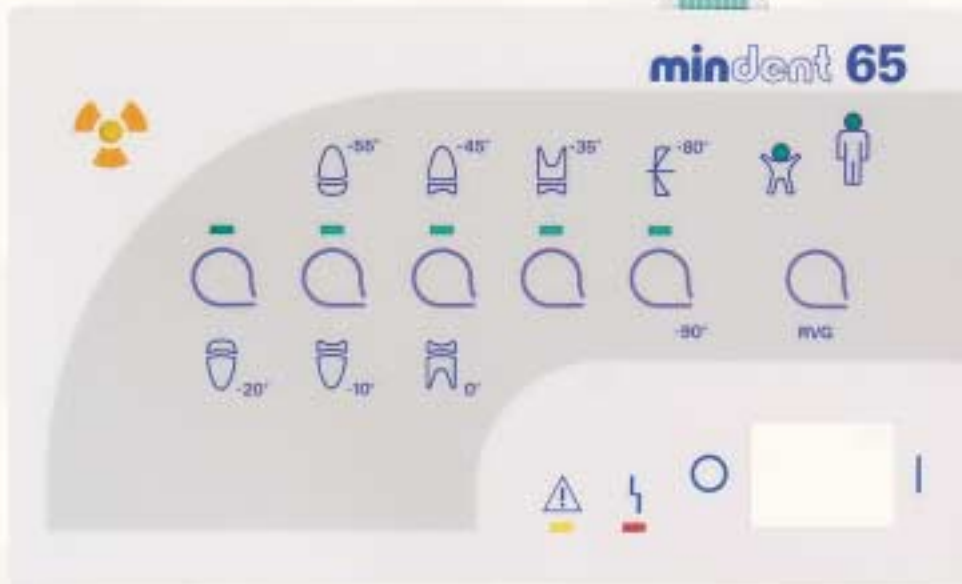
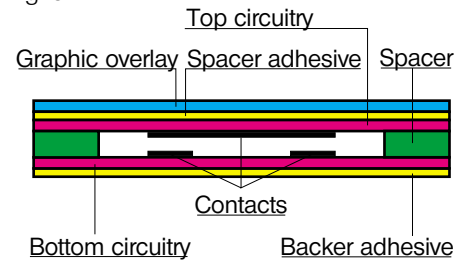
Type style TS 523 0 xxx (see Fig. 5)

Graphic overlay can be embossed to your wish:

- rim emboss (a circle, square)
- pillow emboss (a circle, square)



Fig. 5



B) Switches with tactile response

1 - polydome tactile

Type style TS 523 3 xxx and

TS 523 4 xxx (see Fig. 6)

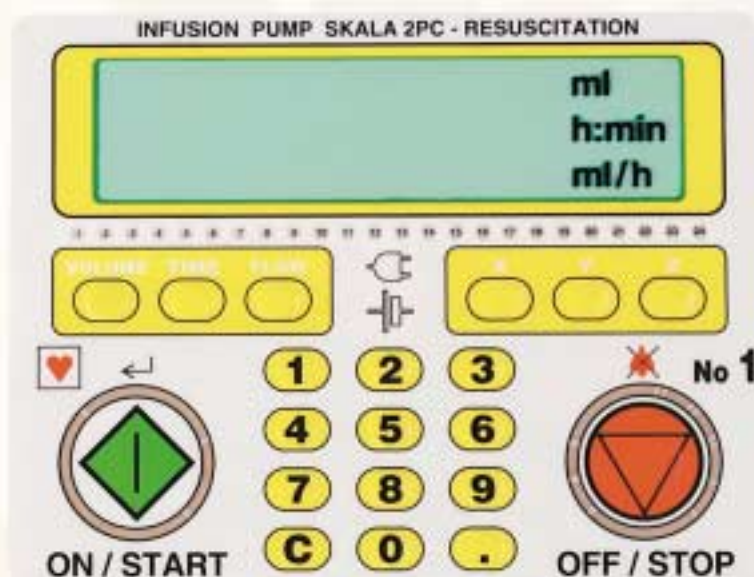
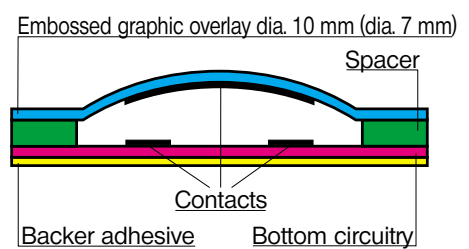
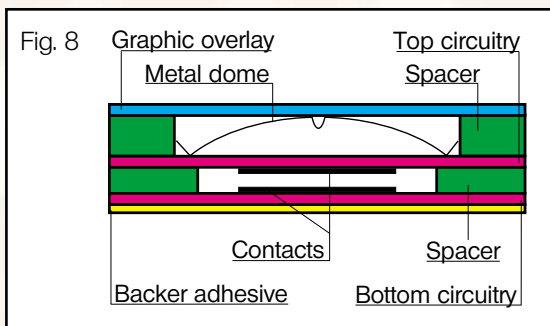
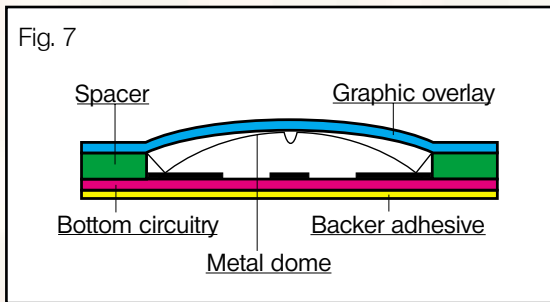


Fig. 6

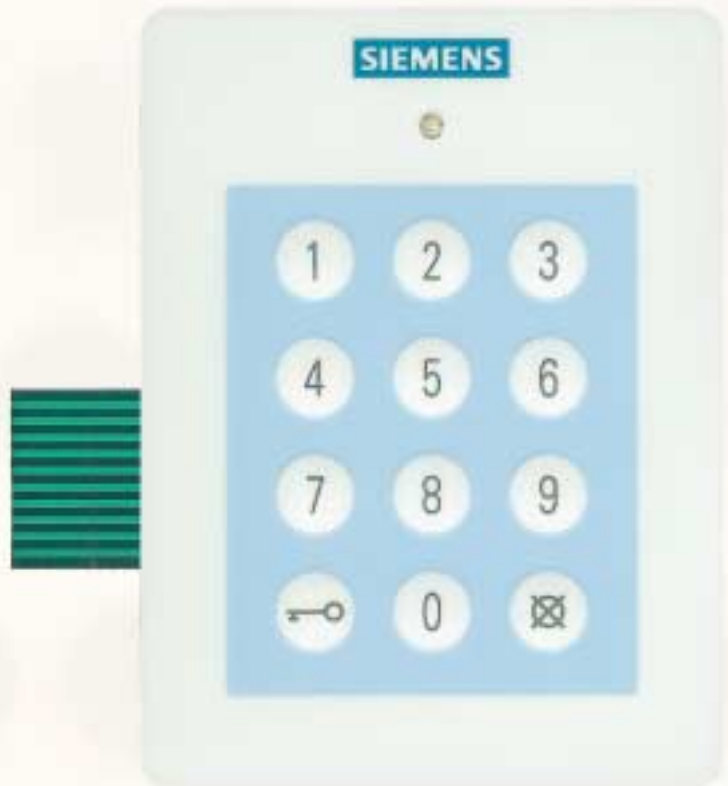
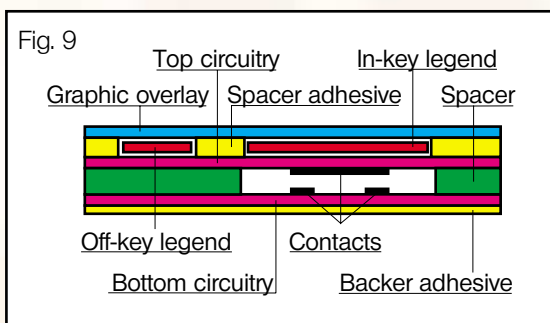


2 - metal dome tactile

Type style TS 523 2 xxx and TS 523 6 xxx (see Fig. 7 and 8). Any emboss can be provided to your wish (a circle, square of minimum size 10 mm). The design according to Fig. 8 is preferred for high-density switches with matrix switch encoding.



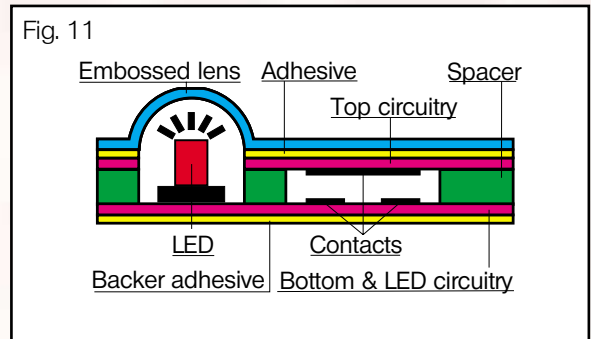
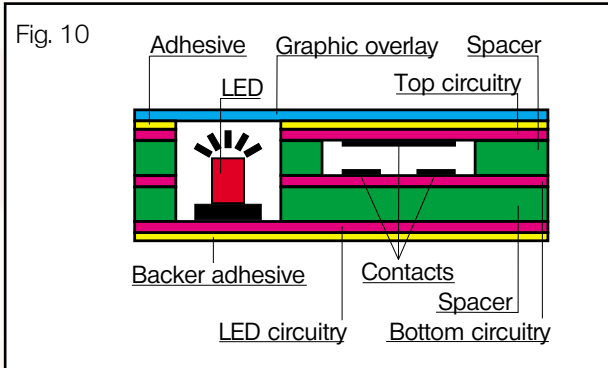
For on the spot customization, a legend pocket can be included to allow either user exchangeable labeling or build time only labeling (see Fig. 9). Off-key legends can be included in all membrane switch types, in-key legends are applicable only at TS 523 0 xxx, TS 523 2 xxx and TS 523 6 xxx types (see Tab.1 - Membrane Switch Characteristics on page 6). For the legend material, we recommend plastic film or card of approx. 0.1 mm thickness. Side legends are to be slide into the membrane switch through a slot in one of the outside edges of the switch, rear legends through a slot in the rear.



Underneath the membrane switch or faceplate, either LED, LCD or LED display can be installed. Therefore, there are display windows in the graphic overlay, while there are openings in all layers beneath the window. When matted and / or textured material is used for graphic overlay, UV clear ink is applied on display windows to maximize clarity over displays. When using transparent materials for graphic overlay, selectively texturing is applied. This process leaves display windows without texture. On customer demand, display windows can be coloured on the reverse side with transparent ink (red, green, blue and others).

Membrane switches with embedded LED's

The SMD technology enables LED lamps to be embedded in the membrane switch. The LED's are adhered either to their own film with a flex-tail (see Fig.10), or directly on the bottom circuitry - in such case there must be embossed lenses on graphic overlay over the LED's (see Fig. 11). Standard colours of LED's are red, green, yellow and bicolour.



Membrane switch and faceplate assembly

Membrane switches and faceplates are coated on bottom side with pressure sensitive adhesive protected by a paper or foil. Customer can install the switch / faceplate on the spot or order the switch / faceplate mounted on a support panel provided by the customer or by the switch manufacturer.





Support panels are usually made of metal (aluminium alloys) or rigid plastics. Switch / faceplate manufacturer can supply the panel with clinch studs, nuts and stand-offs. The studs, nuts and standoffs are self-clinched in the panel having sufficient push-out and torque-out forces.

Standard membrane switches



Standard membrane switches are versatile standardized switches designed for a broad range of standardized control panels. They are especially suitable for low volume applications, such as new product development. They are easily available in a very short time for reasonable prices. A wide variety of standard switches are produced in optional colour styles with full scale of flex-tail terminations.

Tab. 2 on page 17 shows survey of technical characteristics of standard membrane switches. Detailed technical specifications are on pages 8 to 16.

Tab. 1 - Membrane Switch Characteristics

	Membrane Switches TS 523 x xxx				
	0 xxx	3 xxx	4 xxx	2 xxx	6 xxx
Electrical characteristics					
Max. operating voltage	25 V DC				
Max. operating current	25 mA DC				
Contact resistance	Approx. 1 Ω/cm of trace				
Insulation resistance	10 ⁷ Ω min.				
Mechanical characteristics					
Life cycle	> 10 ⁶	> 5 x 10 ⁵	> 5 x 10 ⁵	> 10 ⁶	> 10 ⁶
Actuation force	1.6 ÷ 2 N	1.5 ÷ 2.5 N	1.5 ÷ 2.5 N	3 ÷ 4 N	3 ÷ 4 N
Standard key pitch	14 mm	9 ÷ 12 mm	16 mm	13 mm	12.5 mm
Tactile response	NONE				
Min. key size	9 x 9 mm	∅ 7 mm	∅ 10 mm	∅ 12 mm; 10 x 10 mm	
Storage temperature (°C)	-40 / +80	-40 / +65	-40 / +65	-40 / +80	-40 / +80
Operating temperature (°C)	-25 / +80	-25 / +65	-25 / +65	-25 / +80	-25 / +80
Degree of protection	IP 65				
Tolerances	up to 200 mm: +/- 0.2 mm; over 200mm: +/- 0.3 mm				
Options available					
Off-key pocket	YES	YES	YES	YES	YES
In-key pocket	YES	NO	NO	YES	YES
ESD/EMI shielding	YES	YES	YES	YES	YES
Embedded LED's	YES	YES	YES	YES	YES

Note: Technical characteristics above can be modified on request.

Legend:  - metal dome  - polydome

Switch encoding

Switch encoding can be designed using X-Y matrix, one common bus or combinatorial matrix. Switching positions of the individual switches are connected via bottom circuitry traces and a flat flex-tail with a terminal.

Options of the flex-tail termination:

- 1) pads for ZIF / LIF connectors
- 2) crimped male contacts (pitch 2.54 mm)
- 3) crimped female contacts with housing (pitch 2.54 mm)

Circuit traces on the flex-tail are insulated either by insulation ink or by dielectric protective film that covers the flex-tail up to the point of termination. On request, the flex-tail can be stiffened. Minimal bend radius is 4 mm.

Procedure recommended when ordering customer membrane switches and faceplates

When ordering, the customer should provide complete circuit, graphic and dimensional specifications. Information can be transferred on printed documents or in electronic files.

Colour specification should be done using PRÖLL, RAL or PANTONE palettes (Pantone Matching System).

Electronic data:

- compatible data formats: CorelDraw (5 -9), AutoCad LT (*.dxf, *.wmf)
- send files (in order of preference): via e-mail or on CD ROM or 3.5" diskette
- remember to include a dimension drawing including tolerances (if any)
- it is necessary to convert texts into curves or send font styles as well

Printed data:

- drawings must clearly dimension / mark:
 - outer dimensions and corner radius
 - display and LED windows location and size
 - location and shape of through-cut holes
 - location, size and shape of switch positions
 - width of lines and borders
 - location and size of graphics: symbols, logotypes and characters
 - location and length of flex-tails, bottom or side exit, style of termination

- pinout
- location, size and connection of LED's
- location and size of pockets for exchangeable legends
- other important dimensions
- logotypes and special symbols can be submitted opaque black in colour, scaled up, on opaque paper or directly on a film

Before ordering customer membrane switches and faceplates we recommend technical consultation with our specialists.

To order membrane switches or faceplates you can use Membrane Switch & Faceplate Specification form which is available on TESLA Jihlava's web sites in Company Products / Membrane Switches part.

Pricing of membrane switches and faceplates

System of pricing of customer membrane switches and faceplates including start-up costs and prices of standard membrane switches is described in a Price List of Membrane Switches.

Contact address:

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výroba fóliových klávesnic
Havlíčková 30
586 26 JIHLAVA
CZECH REPUBLIC

Tel./Fax: +420 - 66 - 721 00 47

Tel.: +420 - 66 - 721 16 46

E-mail:

Technical concerns: zak@teslaji.cz

Commercial concerns: svoboda@teslaji.cz

Web sites:

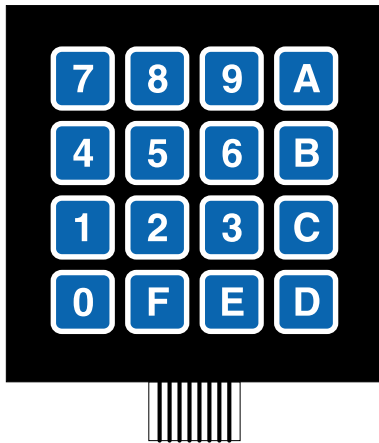
www.teslaji.cz

STANDARD MEMBRANE SWITCHES

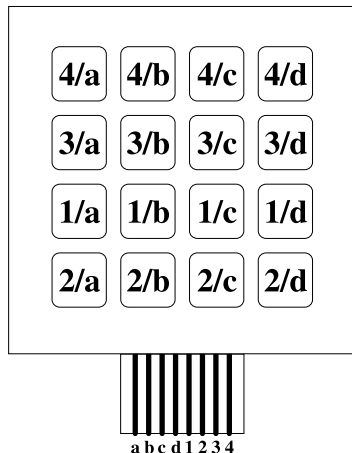
TESLA JIHLAVA, a.s.

TS 523 0003

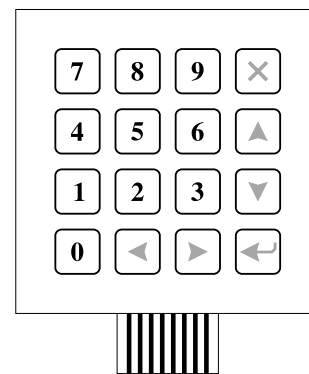
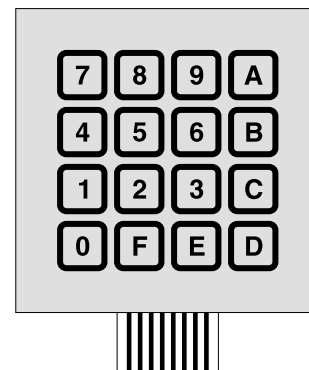
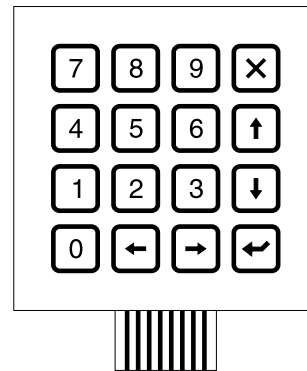
Membrane switch:



Switch encoding:



Options:



Specification:

Number of switch positions	16
Key pitch	19 mm
Embossing	none
Overall dimensions	96 x 96 mm
Flex-tail length	75 mm
Number of flex-tail traces	8
Flex-tail termination	pins (standard)
Number of colours	3

Mechanical characteristics:

Tactile response	none
Actuation force	1.6 - 2 N
Life cycle	> 10 ⁶ cycles
Storage temperature	-40 / +80 °C
Operating temperature	-25 / +80 °C
Degree of protection	IP 65

Electrical characteristics:

Max. operating voltage	25 V DC
Max. operating current	25 mA DC
Contact resistance	approx. 1 Ω/cm of trace
Insulation resistance	10 ⁷ Ω min.

Options of termination: pins (standard)
female contacts

Colours: black (ground)
blue (keys)
white (characters, rims)

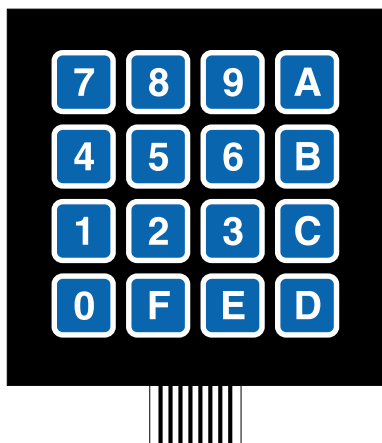
Note: Characters, colours, flex-tail length and termination can be modified for extra charge.

STANDARD MEMBRANE SWITCHES

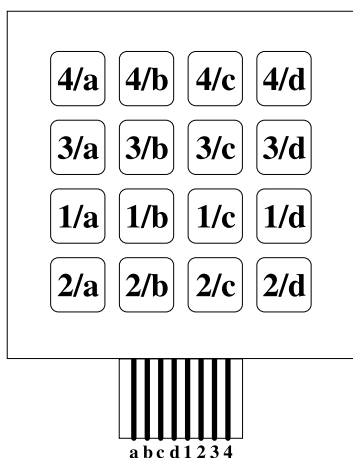
TESLA JIHLAVA, a.s.

TS 523 2000

Membrane switch:



Switch encoding:



Specification:

Number of switch positions	16
Key pitch	19 mm
Embossing	Ø 12 mm
Overall dimensions	96 x 96 mm
Flex-tail length	75 mm
Number of flex-tail traces	8
Flex-tail termination	pins (standard)
Number of colours	3

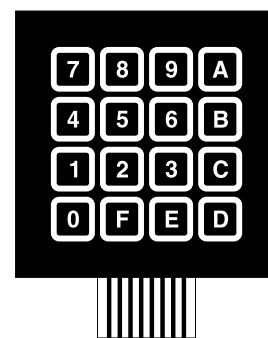
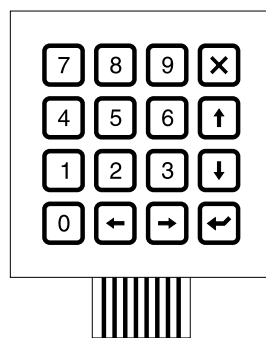
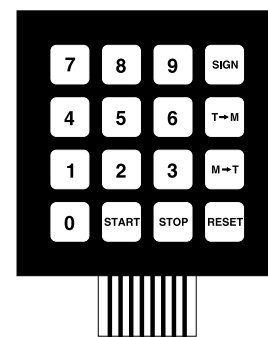
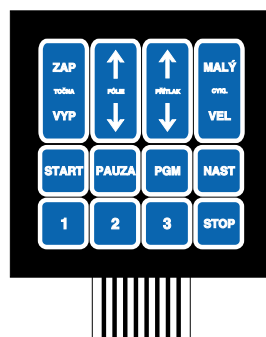
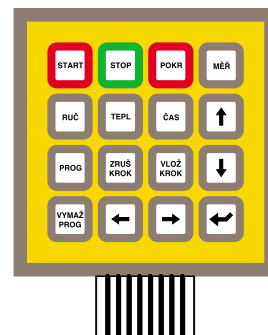
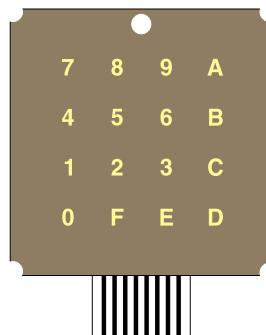
Mechanical characteristics:

Tactile response	metal dome
Actuation force	3 - 4 N
Life cycle	> 10 ⁶ cycles
Storage temperature	-40 / +80 °C
Operating temperature	-25 / +80 °C
Degree of protection	IP 65

Electrical characteristics:

Max. operating voltage	25 V DC
Max. operating current	25 mA DC
Contact resistance	approx. 1 Ω/cm of trace
Insulation resistance	10 ⁷ Ω min.

Options:



Options of termination: pins (standard)
female contacts

Colours: black (ground)
blue (keys)
white (characters, rims)

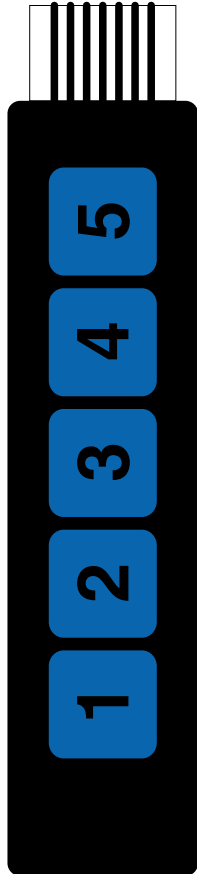
Note: Characters, colours, flex-tail length and termination can be modified for extra charge.

STANDARD MEMBRANE SWITCHES

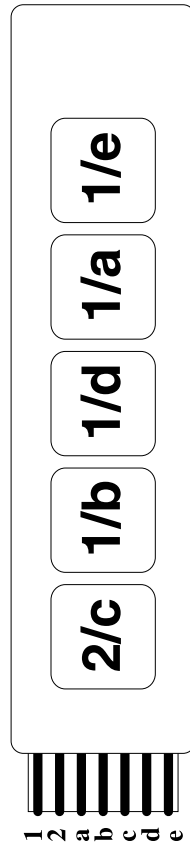
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TS 523 2041

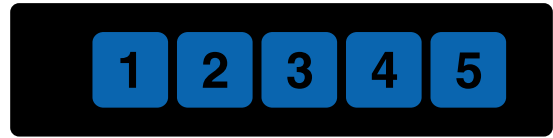
Membrane switch:



Switch encoding:



Options:



Specification:

Number of switch positions	5
Key pitch	19 mm
Embossing	Ø 12 mm
Overall dimensions	122 x 30 mm (r2)
Flex-tail length	40 mm
Number of flex-tail traces	7
Flex-tail termination	pins (standard)
Number of colours	2

Mechanical characteristics:

Tactile response	metal dome
Actuation force	3 - 4 N
Life cycle	> 10 ⁶ cycles
Storage temperature	-40 / +80 °C
Operating temperature	-25 / +80 °C
Degree of protection	IP 65

Electrical characteristics:

Max. operating voltage	25 V DC
Max. operating current	25 mA DC
Contact resistance	approx. 1 Ω/cm of trace
Insulation resistance	10 ⁷ Ω min.

Options of termination: pins (standard)
female contacts

Colours: black (ground, characters)
blue (keys)

Note:

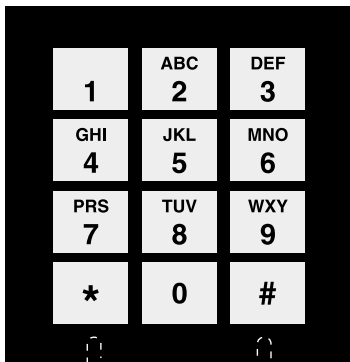
Characters, colours, flex-tail length and termination can be modified for extra charge.

STANDARD MEMBRANE SWITCHES

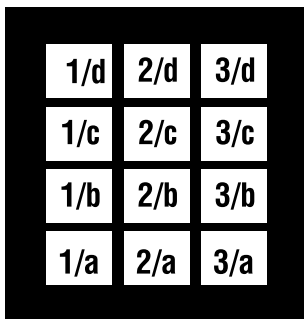
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TS 523 3042

Membrane switch:



Switch encoding:



Specification:

Number of switch positions	12
Key pitch h/v	13/10.5 mm
Embossing	Ø 7 mm
Overall dimensions	51 x 52.8 mm
Flex-tail length	91 mm
Number of flex-tail traces	7
Flex-tail termination	pins (standard)
Number of colours	2

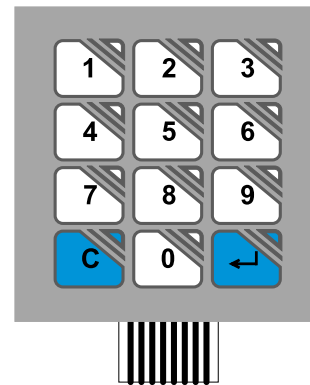
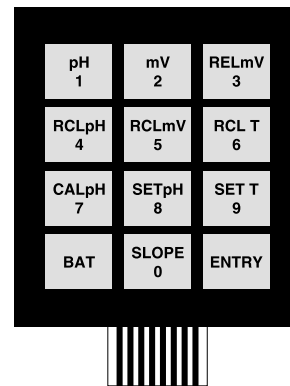
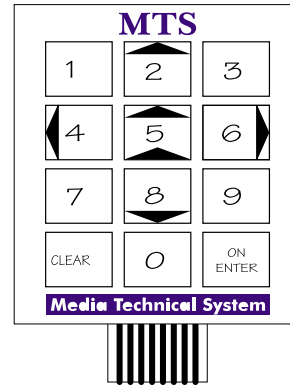
Mechanical characteristics:

Tactile response	polydome
Actuation force	1.5 - 2 N
Life cycle	> 5 x 10 ⁵ cycles
Storage temperature	-40 / +65 °C
Operating temperature	-25 / +65 °C
Degree of protection	IP 65

Electrical characteristics:

Max. operating voltage	25 V DC
Max. operating current	25 mA DC
Contact resistance	approx. 1 Ω/cm of trace
Insulation resistance	10 ⁷ Ω min.

Options:



Options of termination: pins (standard)
female contacts

Colours: light grey (keys)
black (characters, ground)

Note:

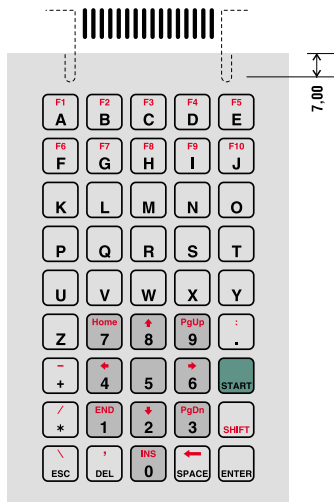
Characters, colours, flex-tail length and termination can be modified for extra charge.

STANDARD MEMBRANE SWITCHES

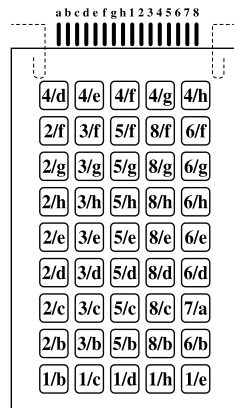
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TS 523 2196

Membrane switch:

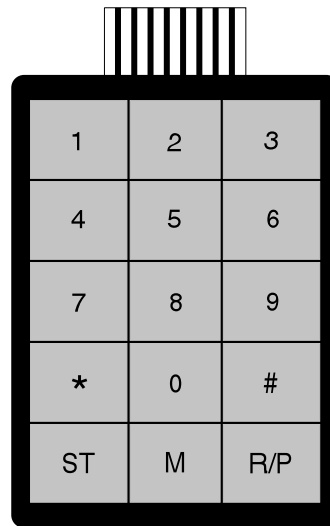


Switch encoding:

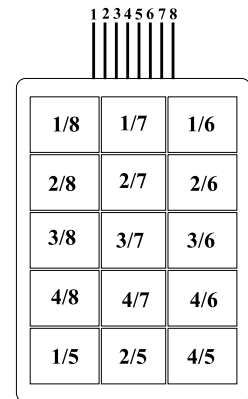


TS 523 3015

Membrane switch:



Switch encoding:



Specification:

Number of switch positions	45
Key pitch	13.2 mm
Embossing	rim embossing
Overall dimensions	84.5 x 135.4 mm
Flex-tail length	100 mm
Number of flex-tail traces	16
Flex-tail termination	pins (standard)
Number of colours	5

Mechanical characteristics:

Tactile response	metal dome
Actuation force	3 - 4 N
Life cycle	> 10 ⁶ cycles
Storage temperature	-40 / +80 °C
Operating temperature	-25 / +80 °C
Degree of protection	IP 65

Electrical characteristics:

Max. operating voltage	25 V DC
Max. operating current	25 mA DC
Contact resistance	approx. 1 Ω/cm of trace
Insulation resistance	10 ⁷ Ω min.

Options of termination:	pins (standard) female contacts
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Colours:	light grey (ground, keys) dark grey (numeric keys) green (START key) red (SHIFT, upper-case characters) black (lower-case characters, rims)
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Note:

Characters, colours, flex-tail length and termination can be modified for extra charge.

Specification:

Number of switch positions	15
Key pitch h/v	15/12 mm
Embossing	Ø 7 mm
Overall dimensions	51 x 70.5 mm
Flex-tail length	45 mm
Number of flex-tail traces	8
Flex-tail termination	pins (standard)
Number of colours	2

Mechanical characteristics:

Tactile response	polydome
Actuation force	1.5 - 2 N
Life cycle	> 5 x 10 ⁵ cycles
Storage temperature	-40 / +65 °C
Operating temperature	-25 / +65 °C
Degree of protection	side exit of flex-tail - IP 64 is not guaranteed

Electrical characteristics:

Max. operating voltage	25 V DC
Max. operating current	25 mA DC
Contact resistance	approx. 1 Ω/cm of trace
Insulation resistance	10 ⁷ Ω min.

Options of termination:	pins (standard) female contacts ZIF/LIF connectors (pitch: 2.54, 1.27, 1.00 mm)
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Colours:	silvery (ground) black (characters, rims)
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Note:

Characters, colours, flex-tail length and termination can be modified for extra charge.

STANDARD MEMBRANE SWITCHES

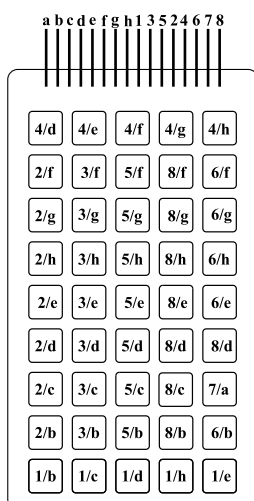
TESLA JIHLAVA, a.s.

TS 523 3020

Membrane switch:



Switch encoding:

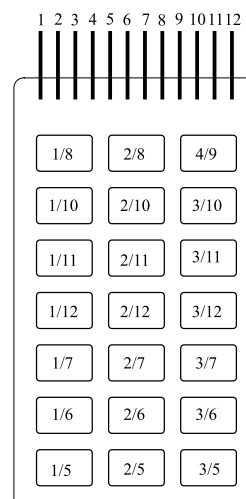


TS 523 6061

Membrane switch:



Switch encoding:



Specification:

Number of switch positions	45
Key pitch	13 mm
Embossing	Ø 7 mm
Overall dimensions	74.8 x 131.4 mm (r3)
Flex-tail length	123 mm
Number of flex-tail traces	16
Flex-tail termination	pins (standard)
Number of colours	5

Mechanical characteristics:

Tactile response	polydome
Actuation force	1.5 - 2 N
Life cycle	> 5 x 10 ⁵ cycles
Storage temperature	-40 / +65 °C
Operating temperature	-25 / +65 °C
Degree of protection	IP 65

Electrical characteristics:

Max. operating voltage	25 V DC
Max. operating current	25 mA DC
Contact resistance	approx. 1 Ω/cm of trace
Insulation resistance	10 ⁷ Ω min.

Options of termination: pins (standard)
female contacts

Colours: light grey (ground, keys)
dark grey (numeric keys)
green (START key)
red (SHIFT, upper-case characters)
black (lower-case characters, rims)

Note:

Characters, colours, flex-tail length and termination can be modified for extra charge.

Specification:

Number of switch positions	21
Key pitch h/v	22/16 mm
Embossing	rim embossing
Overall dimensions	74.8 x 131.4 mm (r3)
Flex-tail length	110 mm
Number of flex-tail traces	12
Flex-tail termination	pins (standard)
Number of colours	5

Mechanical characteristics:

Tactile response	metal dome
Actuation force	3 - 4 N
Life cycle	> 10 ⁶ cycles
Storage temperature	-40 / +80 °C
Operating temperature	-25 / +80 °C
Degree of protection	IP 65

Electrical characteristics:

Max. operating voltage	25 V DC
Max. operating current	25 mA DC
Contact resistance	approx. 1 Ω/cm of trace
Insulation resistance	10 ⁷ Ω min.

Options of termination: pins (standard)
female contacts
ZIF/LIF connectors
(pitch: 2.54, 1.27, 1.00 mm)

Colours: light grey (ground, keys)
dark grey (numeric keys)
green (START key)
red (SHIFT, upper-case characters)
black (lower-case characters, rims)

Note:

Characters, colours, flex-tail length and termination can be modified for extra charge.

STANDARD MEMBRANE SWITCHES

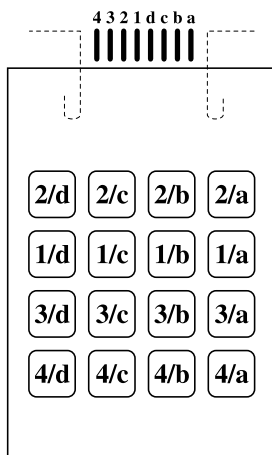
TESLA JIHLAVA, a.s.

TS 523 6154

Membrane switch:



Switch encoding:

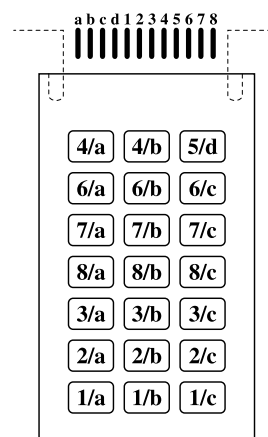
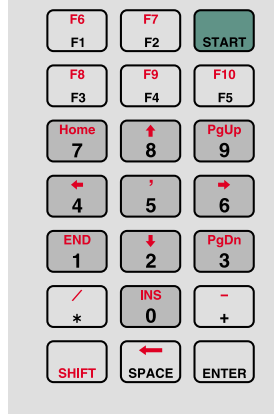


TS 523 6155

Membrane switch:



Switch encoding:



Specification:

Number of switch positions	16
Key pitch	15.5 mm
Embossing	rim embossing
Overall dimensions	69.5 x 101.9 mm
Flex-tail length	100 mm
Number of flex-tail traces	8
Flex-tail termination	pins (standard)
Number of colours	4

Mechanical characteristics:

Tactile response	metal dome
Actuation force	3 - 4 N
Life cycle	> 10 ⁶ cycles
Storage temperature	-40 / +80 °C
Operating temperature	-25 / +80 °C
Degree of protection	IP 65

Electrical characteristics:

Max. operating voltage	25 V DC
Max. operating current	25 mA DC
Contact resistance	approx. 1 Ω/cm of trace
Insulation resistance	10 ⁷ Ω min.

Options of termination:

pins (standard)
female contacts
ZIF/LIF connectors
(pitch: 2.54, 1.27, 1.00 mm)

Colours: light grey (ground, keys)
dark grey (numeric keys)
red (SHIFT, upper-case characters)
black (lower-case characters, rims)

Note:

Characters, colours, flex-tail length and termination can be modified for extra charge.

Specification:

Number of switch positions	21
Key pitch h/v	18/13.5 mm
Embossing	rim embossing
Overall dimensions	69.5 x 119.4 mm
Flex-tail length	100 mm
Number of flex-tail traces	12
Flex-tail termination	pins (standard)
Number of colours	5

Mechanical characteristics:

Tactile response	metal dome
Actuation force	3 - 4 N
Life cycle	> 10 ⁶ cycles
Storage temperature	-40 / +80 °C
Operating temperature	-25 / +80 °C
Degree of protection	IP 65

Electrical characteristics:

Max. operating voltage	25 V DC
Max. operating current	25 mA DC
Contact resistance	approx. 1 Ω/cm of trace
Insulation resistance	10 ⁷ Ω min.

Options of termination:

pins (standard)
female contacts
ZIF/LIF connectors
(pitch: 2.54, 1.27, 1.00 mm)

Colours: light grey (ground, keys)
dark grey (numeric keys)
green (START key)
red (SHIFT, upper-case characters)
black (lower-case characters, rims)

Note:

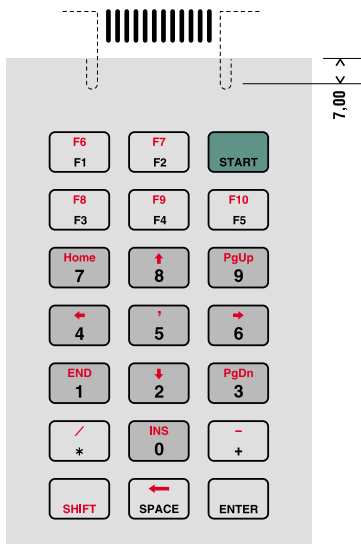
Characters, colours, flex-tail length and termination can be modified for extra charge.

STANDARD MEMBRANE SWITCHES

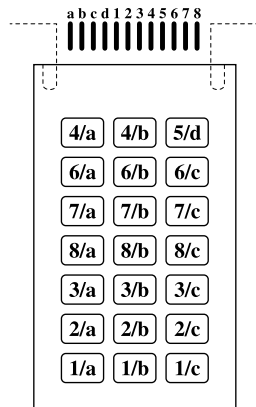
TESLA JIHLAVA, a.s.

TS 523 6156

Membrane switch:

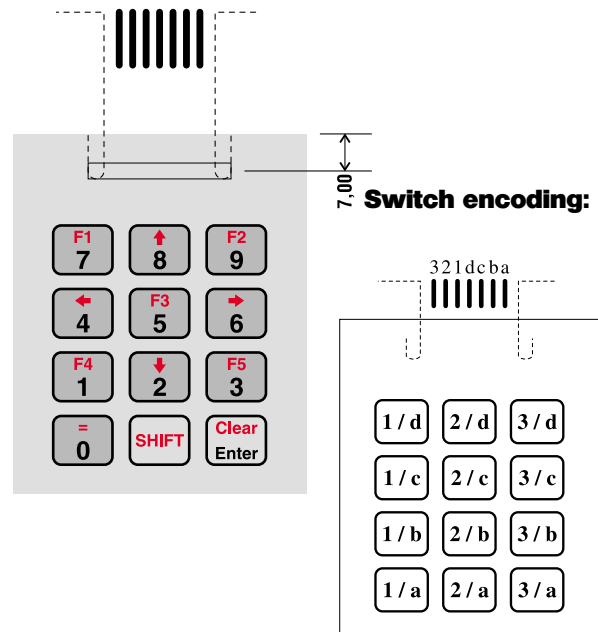


Switch encoding:

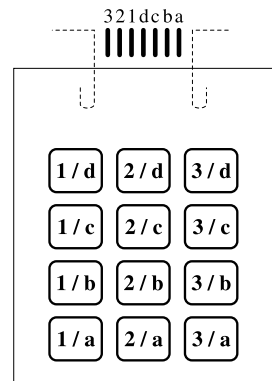


TS 523 6157

Membrane switch:



Switch encoding:



Specification:

Number of switch positions	21
Key pitch h/v	22/16 mm
Embossing	rim embossing
Overall dimensions	84.5 x 135.4 mm
Flex-tail length	100 mm
Number of flex-tail traces	12
Flex-tail termination	pins (standard)
Number of colours	5

Mechanical characteristics:

Tactile response	metal dome
Actuation force	3 - 4 N
Life cycle	> 10 ⁶ cycles
Storage temperature	-40 / +80 °C
Operating temperature	-25 / +80 °C
Degree of protection	IP 65

Electrical characteristics:

Max. operating voltage	25 V DC
Max. operating current	25 mA DC
Contact resistance	approx. 1 Ω/cm of trace
Insulation resistance	10 ⁷ Ω min.

Options of termination:

pins (standard)
female contacts
ZIF/LIF connectors
(pitch: 2.54, 1.27, 1.00 mm)

Colours: light grey (ground, keys)
dark grey (numeric keys)
green (START key)
red (SHIFT, upper-case characters)
black (lower-case characters, rims)

Note:

Characters, colours, flex-tail length and termination can be modified for extra charge.

Specification:

Number of switch positions	12
Key pitch h/v	14.5/12 mm
Embossing	rim embossing
Overall dimensions	55.5 x 68 mm
Flex-tail length	100 mm
Number of flex-tail traces	7
Flex-tail termination	pins (standard)
Number of colours	4

Mechanical characteristics:

Tactile response	metal dome
Actuation force	3 - 4 N
Life cycle	> 10 ⁶ cycles
Storage temperature	-40 / +80 °C
Operating temperature	-25 / +80 °C
Degree of protection	IP 65

Electrical characteristics:

Max. operating voltage	25 V DC
Max. operating current	25 mA DC
Contact resistance	approx. 1 Ω/cm of trace
Insulation resistance	10 ⁷ Ω min.

Options of termination:

pins (standard)
female contacts
ZIF/LIF connectors
(pitch: 2.54, 1.27, 1.00 mm)

Colours: light grey (ground, ENTER and SHIFT keys)
dark grey (keys)
red (SHIFT, upper-case characters)
black (lower-case characters, rims)

Note:

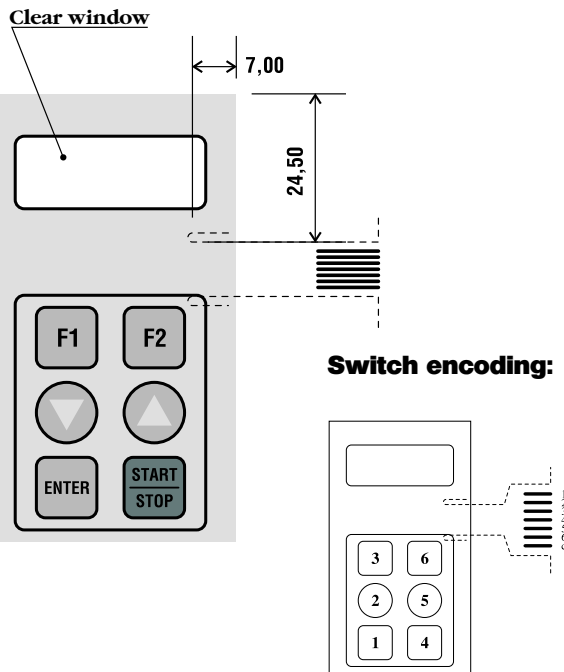
Characters, colours, flex-tail length and termination can be modified for extra charge.

STANDARD MEMBRANE SWITCHES

TESLA JIHLAVA, a.s.

TS 523 6158

Membrane switch:



Specification:

Number of switch positions	6
Key pitch h/v	14.5/12.4 mm
Embossing	rim embossing
Overall dimensions	41.6 x 74 mm
Flex-tail length	100 mm
Number of flex-tail traces	7
Flex-tail termination	pins (standard)
Number of colours	5

Mechanical characteristics:

Tactile response	metal dome
Actuation force	3 - 4 N
Life cycle	> 10 ⁶ cycles
Storage temperature	-40 / +80 °C
Operating temperature	-25 / +80 °C
Degree of protection	IP 65

Electrical characteristics:

Max. operating voltage	25 V DC
Max. operating current	25 mA DC
Contact resistance	approx. 1 Ω/cm of trace
Insulation resistance	10 ⁷ Ω min.

Options of termination:	pins (standard) female contacts ZIF/LIF connectors (pitch: 2.54, 1.27, 1.00 mm)
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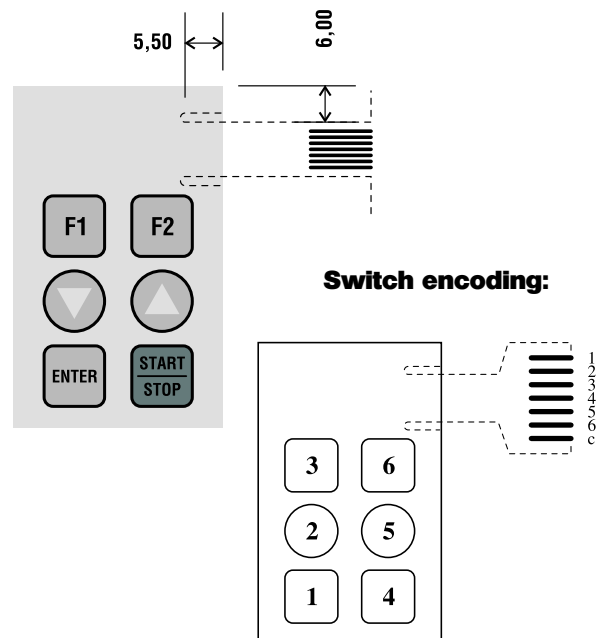
Colours:	light grey (ground, arrows) dark grey (keys) green (START/STOP key) black (characters, rims) clear ink (window)
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Note:

Characters, colours, flex-tail length and termination can be modified for extra charge.

TS 523 6159

Membrane switch:



Specification:

Number of switch positions	6
Key pitch h/v	14.5/12.4 mm
Embossing	rim embossing
Overall dimensions	34.6 x 56.5 mm
Flex-tail length	100 mm
Number of flex-tail traces	7
Flex-tail termination	pins (standard)
Number of colours	4

Mechanical characteristics:

Tactile response	metal dome
Actuation force	3 - 4 N
Life cycle	> 10 ⁶ cycles
Storage temperature	-40 / +80 °C
Operating temperature	-25 / +80 °C
Degree of protection	IP 65

Electrical characteristics:

Max. operating voltage	25 V DC
Max. operating current	25 mA DC
Contact resistance	approx. 1 Ω/cm of trace
Insulation resistance	10 ⁷ Ω min.

Options of termination:	pins (standard) female contacts ZIF/LIF connectors (pitch: 2.54, 1.27, 1.00 mm)
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Colours:	light grey (ground, arrows) dark grey (keys) green (START/STOP key) black (characters, rims)
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Note:

Characters, colours, flex-tail length and termination can be modified for extra charge.

Tab. 2 - Characteristics of Standard Membrane Switches

	TS 523 0003	TS 523 2000	TS 523 2041	TS 523 2196	TS 523 3015	TS 523 3020	TS 523 3042	TS 523 6061	TS 523 6154	TS 523 6155	TS 523 6156	TS 523 6157	TS 523 6158	TS 523 6159
Number of switch positions	16	16	5	45	15	45	12	21	16	21	21	12	6	6
Key pitch h/v (mm)	19	19	19	13.2	15/12	13	13/10.5	22/16	15.5	18/13.5	22/16	14.5/12	14.5/12.4	14.5/12.4
Embossing (mm)	NONE	Ø 12	Ø 12	□	Ø 7	Ø 7	Ø 7	□	□	□	□	□	□	□
Overall dimensions (mm)	96x96	96x96	122x30	84.5x135.4	51x70.5	74.8x131.4	51x52.8	74.8x131.4	69.5x101.9	69.5x119.4	84.5x135.4	55.5x68	41.6x74	34.6x56.5
Flex-tail length (mm)	75	75	40	100	45	123	91	110	100	100	100	100	100	100
Number of flex-tail traces	8	8	7	16	8	16	7	12	8	12	12	7	7	7
Flex-tail termination														
Number of colours	3	3	2	5	2	5	2	5	4	5	5	4	5	4
Mechanical characteristics														
Tactile response	NONE	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒
Actuation force (N)	1.6±2		3+4			1.5±2					3+4			
Life cycle		>10 ⁶				>5x10 ⁵					>10 ⁶			
Storage temperature (°C)		-40/+80				-40/+65					-40/+80			
Operating temperature (°C)		-25/+80				-25/+65					-25/+80			
Degree of protection		IP 65	*		*						IP 65			
Electrical characteristics														
Max. operating voltage	25 V DC													
Max. operating current	25 mA DC													
Contact resistance	Approx. 1 Ω/cm of trace													
Insulation resistance	10 ⁷ Ω min.													

- Legend:
- h - horizontal
 - v - vertical
 - - rim embossing
 - ☒ - metal dome
 - ☒ - polydome
 - * - side exit of flex-tail - IP 64 is not guaranteed



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