

# Series 09

*Rugged. Modular. Reliable.*

<https://eao.com/09>



# 09 Information about the Series

## Rugged CAN Keypads

### Advantages

- Individual 4-segment and RGB halo ring illumination
- Designed for functional safety: ISO 26262 & ISO 13849
- Intelligent HMIs with CAN bus integration
- Robust, innovative, ergonomic design sealed up to IP67 protection
- Interchangeable ISO 7000 range of symbols or customised symbols

### Typical application areas

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- Roadmaking vehicles and roller compactors
- Loaders, dozers and excavators
- Cranes, dump trucks and crawler drills
- Fire-fighting and rescue vehicles
- Road sweepers, cleaning vehicles and refuse trucks
- Snow removers and groomers
- Agricultural vehicles and equipment

### HMI Functions

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- Rugged CAN Keypad
- Rugged CAN Rotary Cursor Controller

### Degree of protection

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- IP67 protection (front and rear side)
- IP67 protection (panel/screw-in)
- IP54 protection (panel/clip-in)

### Operating voltage

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8-32 VDC

### Standards

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See overview of standards at end of chapter

## Joysticks

### Advantages

- Mechanical and electrical customisation is possible
- Front protection to IP65 or IP67
- Standard joysticks available from stock
- Low back panel depth for hall effect and conductive plastic sensors

### Typical application areas

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- Commercial vehicles
- Special vehicles
- Marine, rail and electric vehicles
- Machinery
- Medical technology
- Numerous other applications

### Functions

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- Joystick
- Koordinatenschalter

### Design

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- Flush
- Raised

### Front protection

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- IP40
- IP65
- IP67

### Operating voltage

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- 5 VDC
- 8 ... 36 VDC
- 30 VDC
- 250 VAC
- 500 VAC

### Terminal

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- Screw terminal
- Soldering terminal
- Minitec plug
- Dubox plug
- Molex micro
- Cable

|  |    |
|--|----|
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- 82
- 84
- 92
- 96





# 09 Overview of Modules

## Optimal for your application.

### Series 09 variants




The Series 09 Keypads and Rotary Cursor Controllers are available in a range of different variants. They all have the flexibility of interchangeable legends, but come with a choice of different halo illumination features, communication protocols and connector types for example.

This wide choice allows designers to specify only the HMI features they actually need for their vehicle application, therefore minimising hardware costs and optimising the scope of their software development – optimal for your application.

| Variants   | Symbol backlight | Halo ring illumination             | Communication protocol | Switching element                    | IP protection                | Connector                         | Switching function/s | Functional safety standard   |
|--|------------------|------------------------------------|------------------------|--------------------------------------|------------------------------|-----------------------------------|----------------------|--|
| <b>PREMIUM</b><br> | White LED        | 4-Segment RGB                      | CANopen Safety         | Electro-mechanical switching element | IP67 frontside and rear-side | Deutsch DT04-6P                   | Pushbutton           | Functional safety<br>ISO 26262<br>ASIL B and<br>ISO 13849<br>PLD certified   |
| <b>SUPER</b><br>  | White LED        | 4-Segment RGB                      | CANopen, J1939         | Electro-mechanical switching element | IP67 frontside and rear-side | Deutsch DT04-6P                   | Pushbutton           | Design for functional safety:<br>ISO 26262<br>ASIL B and<br>ISO 13849<br>PLD |
| <b>PLUS</b><br>   | White LED        | Red LED (other colours on request) | CANopen, J1939         | Electro-mechanical switching element | IP67 frontside and rear-side | Deutsch DT04-6P                   | Pushbutton           | Fulfils ASIL QM (B) according to ISO 26262                                   |
| <b>BASIC</b><br>  | White LED        | Red LED (other colours on request) | N.A. (hardwired)       | Electro-mechanical switching element | IP67 frontside               | Würth Elektronik WR-MPC3, 16 pins | Pushbutton           | Fulfils ASIL QM (B) according to ISO 26262                                   |

\* Fully validated and certified product according to ASIL B ISO 26262 and PLD ISO 13849 with CANopen Safety available from 2022.



| Variants   | Symbol backlight | Halo ring illumination       | Communication protocol | Switching element                    | IP protection                | Connector       | Switching function/s  | Functional safety standard   |
|--|------------------|------------------------------|------------------------|--------------------------------------|------------------------------|-----------------|---|--|
| <b>PREMIUM</b><br> | White LED        | 4-Segment RGB (push-buttons) | CANopen Safety         | Electro-mechanical switching element | IP67 frontside and rear-side | Deutsch DT04-6P | Pushbuttons: push<br>RCC*: push, rotate, proportional input | Functional safety<br>ISO 26262<br>ASIL B and<br>ISO 13849<br>PLD certified*  |
| <b>SUPER</b><br>  | White LED        | 4-Segment RGB (push-buttons) | CANopen, J1939         | Electro-mechanical switching element | IP67 frontside and rear-side | Deutsch DT04-6P | Pushbuttons: push<br>RCC*: push, rotate, proportional input | Design for functional safety:<br>ISO 26262<br>ASIL B and<br>ISO 13849<br>PLD |
| <b>PLUS</b><br>   | White LED        | Red LED (push-buttons)       | CANopen, J1939         | Electro-mechanical switching element | IP67 frontside and rear-side | Deutsch DT04-6P | Pushbuttons: push<br>RCC*: push, rotate, proportional input | Fulfills ASIL QM (B) according to ISO 26262                                  |

\* Functional safety certification applies to the switching signal of the two keypad pushbuttons.

- 01
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# 09 Information about the Series

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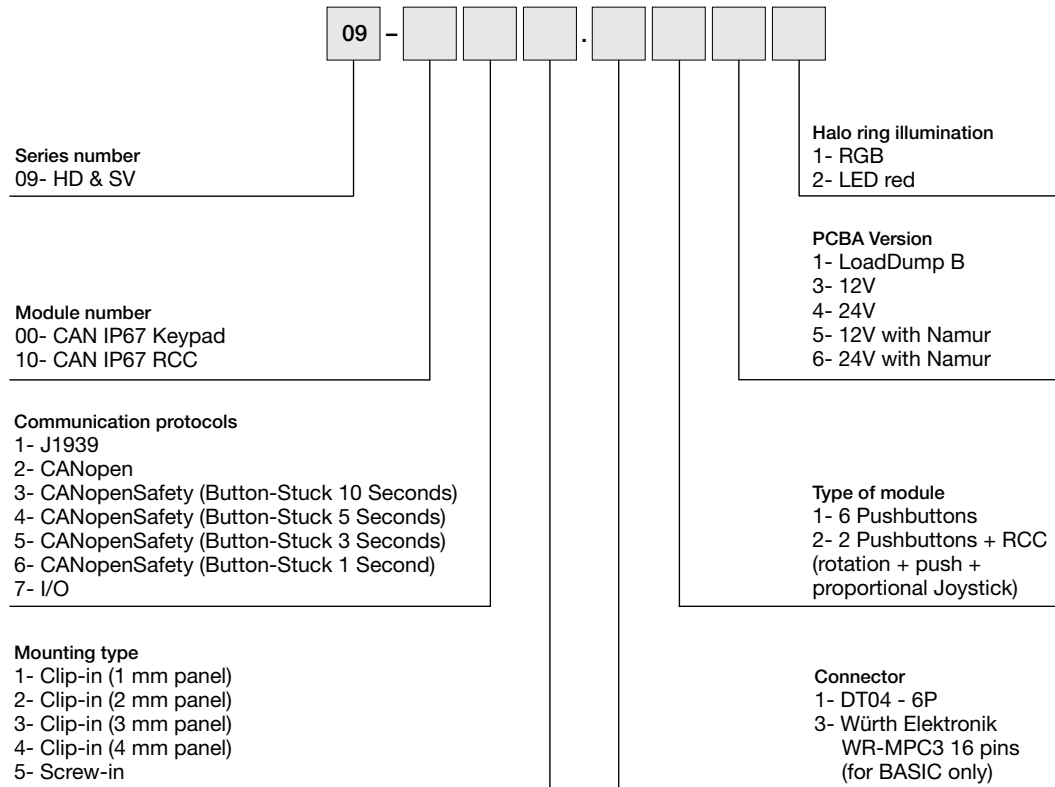
## Rugged. Modular. Reliable. *New Series 09 Rugged CAN Keypads.*

Designed for E1 applications with functional safety and CAN bus integration.

- Individual 4-segment and RGB halo ring illumination
- Designed for functional safety: ISO 26262 & ISO 13849
- Intelligent HMIs with CAN bus integration
- Robust design sealed up to IP67 protection
- Interchangeable ISO 7000 or customised symbols

## Part number structure Keypads and RCC Modules

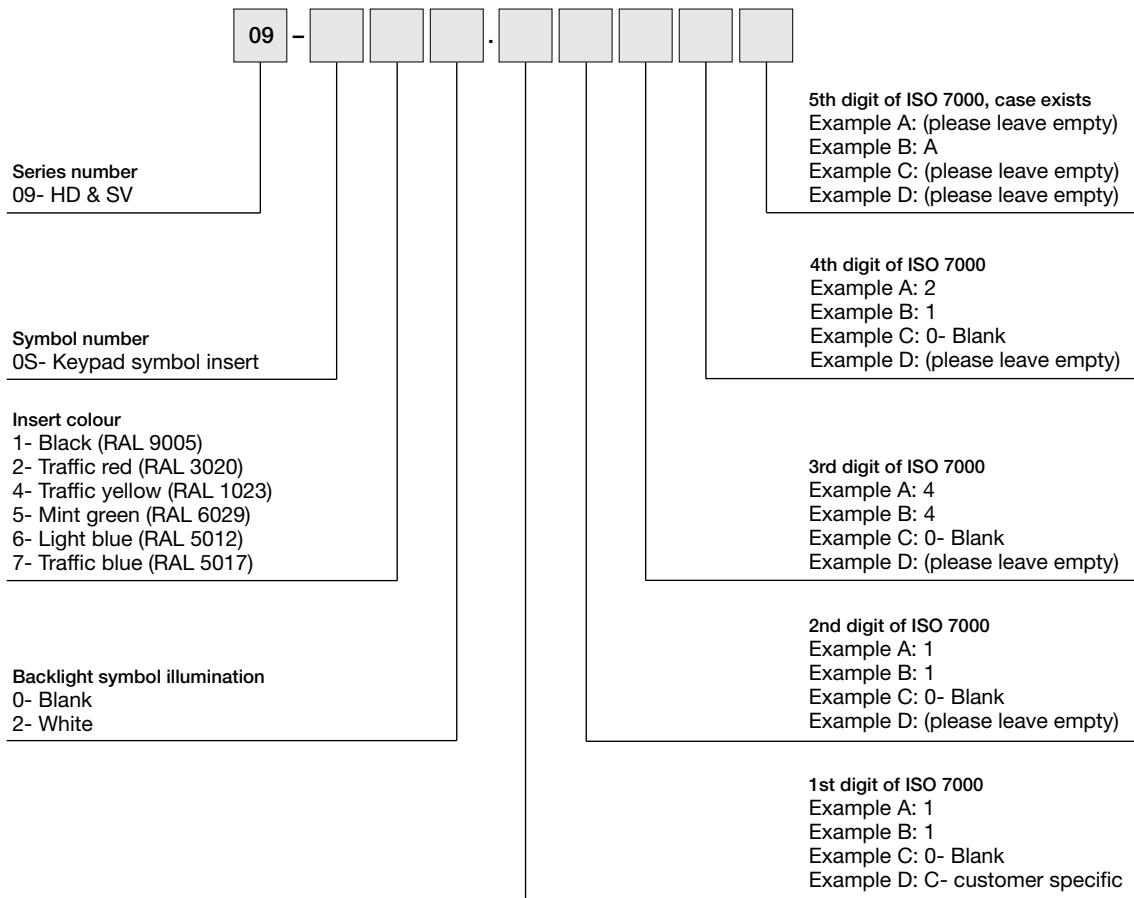
Part No. module (12 digits)



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- 70
- 71
- 82
- 84
- 92
- 96

# 09 Numbering structure

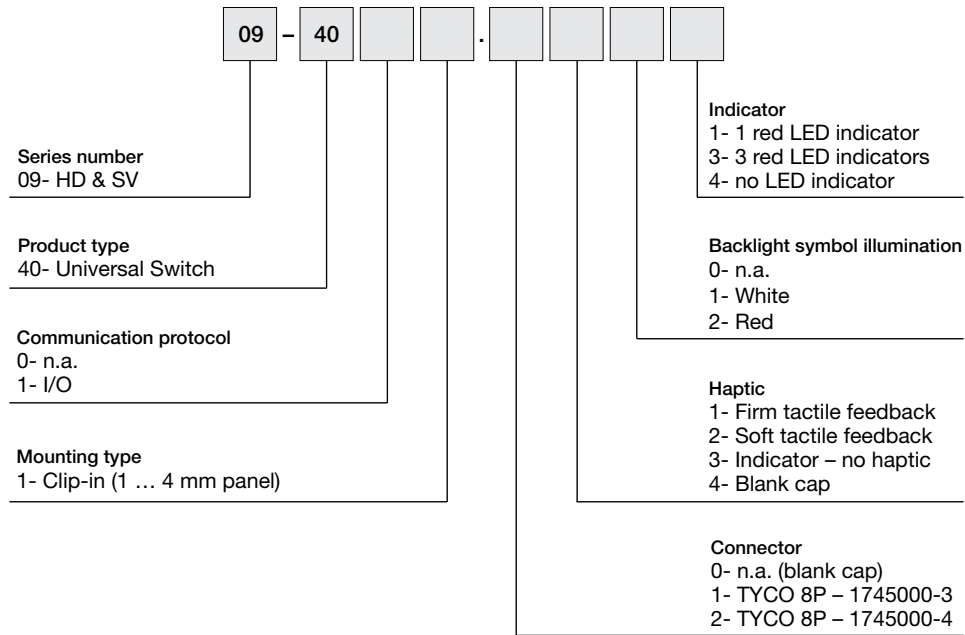
## Part No. symbols





## Part number structure Universal Switch

Part No. Universal Switch



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- 09**
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- 31
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- 45
- 51
- 56
- 57
- 61
- 70
- 71
- 82
- 84
- 92
- 96

# 09 Numbering structure

Part No. Caps



Series number  
09- HD & SV

5th digit of ISO 7000, case exists  
Example A: (please leave empty)  
Example B: A  
Example C: (please leave empty)  
Example D: (please leave empty)

Symbol number  
4S- Symbol caps

4th digit of ISO 7000  
Example A: 2  
Example B: 1  
Example C: 0- Blank  
Example D: (please leave empty)

Cap colour  
1- Black (RAL 9005)

3rd digit of ISO 7000  
Example A: 4  
Example B: 4  
Example C: 0- Blank  
Example D: (please leave empty)

Backlight symbol illumination  
0- Blank  
1- Red  
2- White

2nd digit of ISO 7000  
Example A: 1  
Example B: 1  
Example C: 0- Blank  
Example D: (please leave empty)

1st digit of ISO 7000  
Example A: 1  
Example B: 1  
Example C: 0- Blank  
Example D: C- customer specific

Symbol direction  
0- Blank  
1- 0 degrees  
2- 90 degrees  
3- 180 degrees  
4- 270 degrees

Indicators  
0- No LED indicator  
1- 1 LED Indicator  
3- 3 LED indicators

## Keypad PREMIUM\*



### Mechanical characteristics

- Actuation force: 5–13 N
- Overload: 250 N
- Mechanical lifetime up to 1 million cycles of operation

### Electrical characteristics

- Operating voltage range: 8–32 VDC

### Illumination

- Halo ring and symbol illumination can be configured independently
- LED symbol illumination
  - Colour: white
  - Luminance: max. 20 cd/m<sup>2</sup>, dimmable
- LED halo ring illumination with four segments
  - Multi-colour: RGB
  - Luminance: 1 500 cd/m<sup>2</sup>

### Symbols

- Symbols in accordance with ISO 7000
- Customer-specific symbols on request

### Connections/interfaces

- CAN interface (ISO 11898)
- CANopen Safety\* (EN 50325-5),
- Baud rate 250 kBd and 500 kBd (software configurable)
- Connector Deutsch DT04-6P

\* Fully validated and certified product according to ASIL B ISO 26262 and PLD ISO 13849 available from 2022.

### Ambient conditions

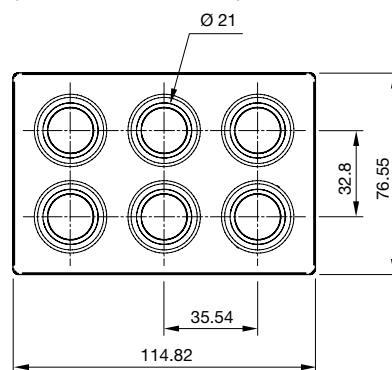
- Operating temperature: –40°C ... +85°C
- Storage temperature: –40°C ... +85°C

### Protection degree

- IP67 (front and rear side)
- IP67 (panel/screw-in)
- IP54 (panel/clip-in)

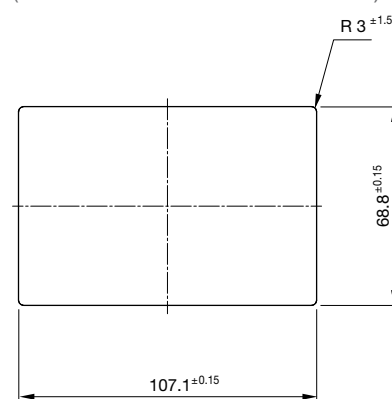
### Dimensions

(All dimensions in mm)



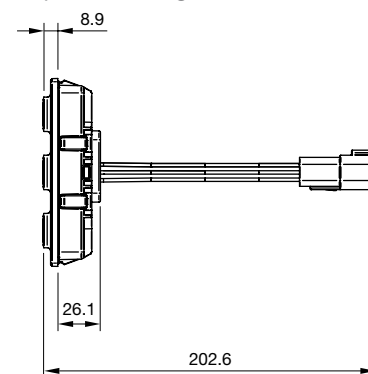
### Mounting cut-out

(Panel thickness 1.0 mm ... 4.0 mm)

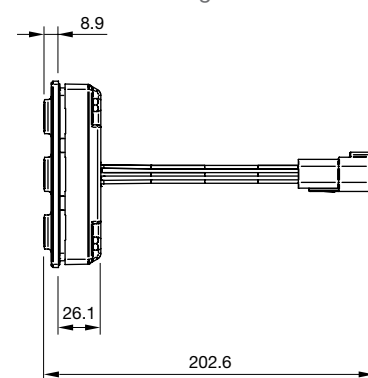


### Mounting

#### Clip-in mounting



#### Screw-in mounting



# 09 Modules

## Keypad SUPER



### Mechanical characteristics

- Actuation force: 5–13 N
- Overload: 250 N
- Mechanical lifetime up to 1 million cycles of operation

### Electrical characteristics

- Operating voltage range: 8–32 VDC

### Illumination

- Halo ring and symbol illumination can be configured independently
- LED symbol illumination
  - Colour: white
  - Luminance: max. 20 cd/m<sup>2</sup>, dimmable
- LED halo ring illumination with four segments
  - Multi-colour: RGB
  - Luminance: 1 500 cd/m<sup>2</sup>

### Symbols

- Symbols in accordance with ISO 7000
- Customer-specific symbols on request

### Connections/interfaces

- CAN interface (ISO 11898)
- CAN protocols: CANopen (CiA 401), CAN J1939
- Baud rate 250 kBd and 500 kBd (software configurable)
- Connector Deutsch DT04-6P

### Ambient conditions

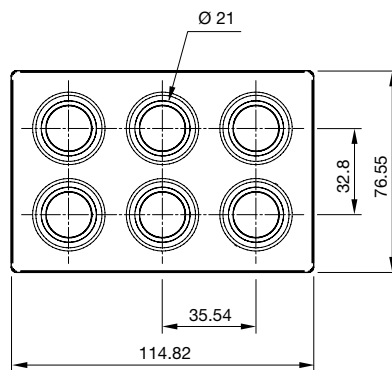
- Operating temperature: –40 °C ... +85 °C
- Storage temperature: –40 °C ... +85 °C

### Protection degree

- IP67 (front and rear side)
- IP67 (panel/screw-in)
- IP54 (panel/clip-in)

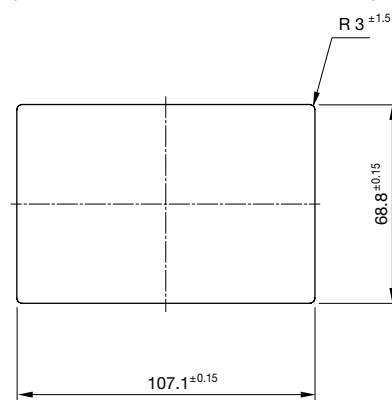
### Dimensions

(All dimensions in mm)



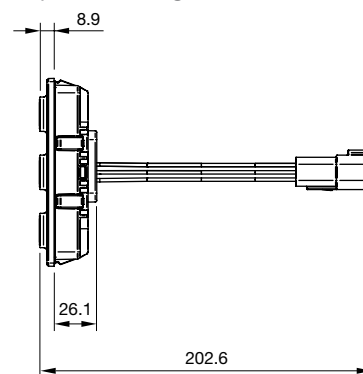
### Mounting cut-out

(Panel thickness 1.0 mm ... 4.0 mm)

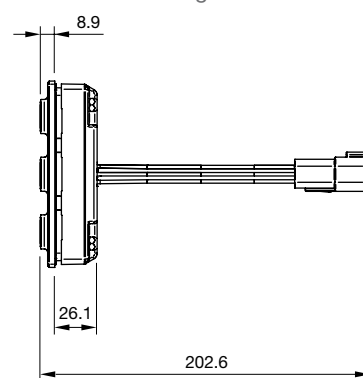


### Mounting

Clip-in mounting



Screw-in mounting



## Keypad PLUS\*



### Mechanical characteristics

- Actuation force: 5–13 N
- Overload: 250 N
- Mechanical lifetime up to 1 million cycles of operation

### Electrical characteristics

- Operating voltage range: 8–32 VDC

### Illumination

- Halo ring and symbol illumination can be configured independently
- LED symbol illumination
  - Colour: white
  - Luminance: max. 20 cd/m<sup>2</sup>, dimmable
- LED halo ring illumination
  - Colour: red
  - (other colours on request)
  - Luminance: 1 500 cd/m<sup>2</sup>

### Symbols

- Symbols in accordance with ISO 7000
- Customer-specific symbols on request

### Connections/interfaces

- CAN interface (ISO 11898)
- CAN protocols: CANopen (CiA 401), CAN J1939
- Baud rate 250 kBd and 500 kBd (software configurable)
- Connector Deutsch DT04-6P

\* Partially validated product available from end of 2020. Fully validated and certified product available from beginning of 2021.

### Ambient conditions

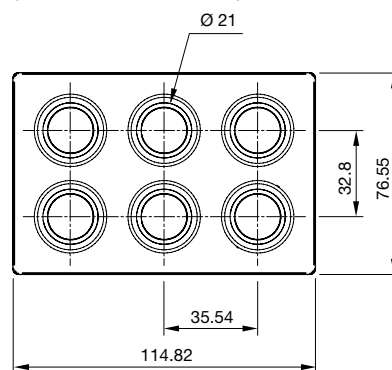
- Operating temperature: –40°C ... +85°C
- Storage temperature: –40°C ... +85°C

### Protection degree

- IP67 (front and rear side)
- IP67 (panel/screw-in)
- IP54 (panel/clip-in)

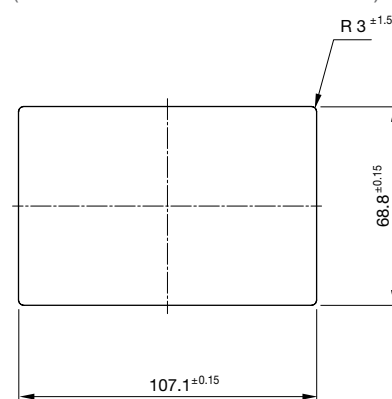
### Dimensions

(All dimensions in mm)



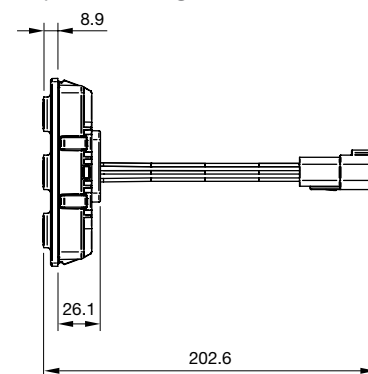
### Mounting cut-out

(Panel thickness 1.0 mm ... 4.0 mm)

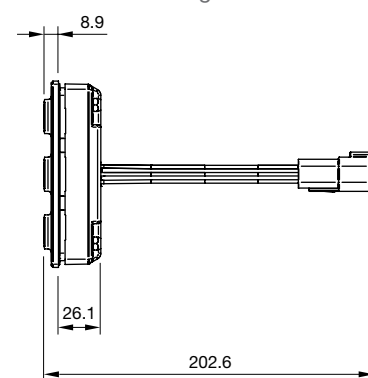


### Mounting

#### Clip-in mounting



#### Screw-in mounting



# 09 Modules

## Keypad BASIC\*



### Mechanical characteristics

- Actuation force: 5–13 N
- Overload: 250 N
- Mechanical lifetime up to 1 million cycles of operation

### Electrical characteristics

- Operating voltage range: 8–32 VDC

### Illumination

- Halo ring and symbol illumination can be configured independently
- LED symbol illumination
  - Colour: white
  - Luminance: max. 20 cd/m<sup>2</sup>, dimmable
- LED halo ring illumination
  - Colour: red
  - (other colours on request)
  - Luminance: 1 500 cd/m<sup>2</sup>

### Symbols

- Symbols in accordance with ISO 7000
- Customer-specific symbols on request

### Connections/interfaces

- Connector: Würth Elektronik WR-MPC3, 16 Pins

\* Validated product available from end of 2020. Fully validated and certified product available from beginning of 2021.

### Ambient conditions

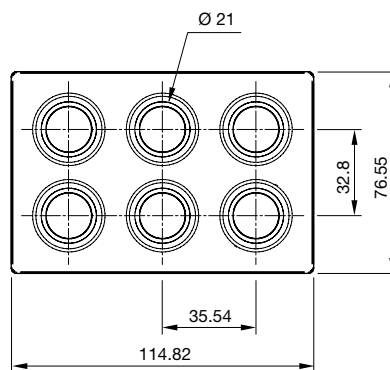
- Operating temperature: –40 °C ... +85 °C
- Storage temperature: –40 °C ... +85 °C

### Protection degree

- IP67 (front side)
- IP67 (panel/screw-in)

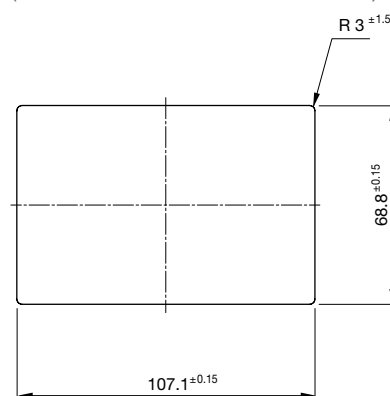
### Dimensions

(All dimensions in mm)



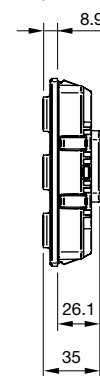
### Mounting cut-out

(Panel thickness 1.0 mm ... 4.0 mm)

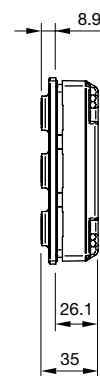


### Mounting

Clip-in mounting

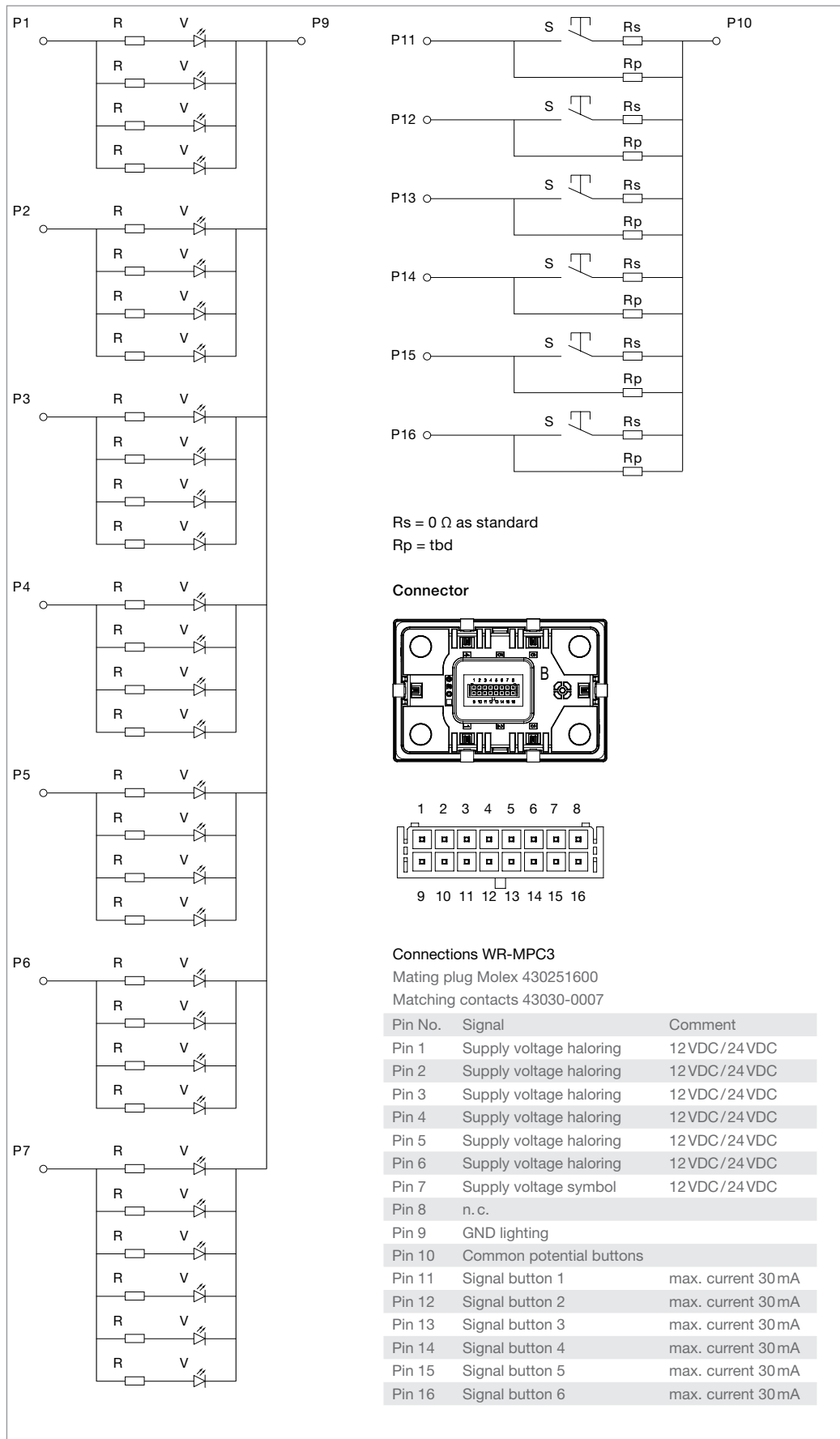


Screw-in mounting



## Wiring diagram, connector

### Wiring diagram



## Rotary Cursor Controller PREMIUM\*



## Rotary Cursor Controller Functions

- Joystick functions
  - With proportional input
  - Digital input can be configured via CAN interface
- Rotary function
  - 20 maintained positions
  - Continuous rotation with no stop position
- Push function
  - Momentary action with click-dome

## Mechanical characteristics

- Overload: 250N
- Mechanical lifetime
  - up to 10 million detents (rotation and Joystick functions Rotary Cursor Controller)
  - up to 1 million switching cycles (push of joystick rotary cursor controller and push of pushbuttons)
- Momentary action
  - Actuation force: 5-13N
- Rotary function
  - Haptic with precise detent
- Joystick function
  - Actuation angle:  $\sim 5^\circ$

## Electrical characteristics

- Operating voltage range: 8–32VDC

\* Validated product available from middle of 2021. Fully validated and certified according to ASIL B ISO 26262 and PLD ISO 13849 product available from 2022. Functional safety certification applies to the switching signal of the two keypad pushbuttons.

## Illumination

- Halo ring and symbol illumination can be configured independently
- LED symbol illumination (on pushbuttons)
  - Colour: white
  - Luminance: max. 20cd/m<sup>2</sup>, dimmable
- LED halo illumination
  - Multi-colour: RGB (buttons and RCC)
  - Luminance: 1500cd/m<sup>2</sup> (buttons)
  - Four segments on buttons

## Symbols (on pushbuttons, RCC without symbol)

- Symbols in accordance with ISO 7000
- Customer-specific symbols on request

## Connectivity

- CAN interface (ISO 11898)
- CANopen Safety\* (EN 50325-5),
- Baud rate 250 kBd and 500 kBd (software configurable)
- Connector Deutsch DT04-6P

## Ambient conditions

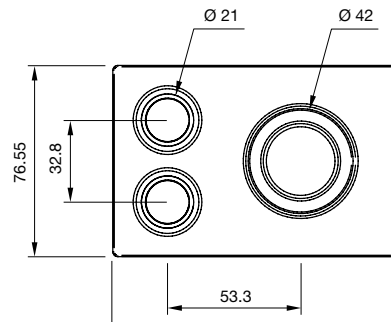
- Operating temperature:  $-40^\circ\text{C} \dots +85^\circ\text{C}$
- Storage temperature:  $-40^\circ\text{C} \dots +85^\circ\text{C}$

## Protection degree

- IP67 (front and rear side)
- IP67 (panel/screw-in)
- IP54 (panel/clip-in)

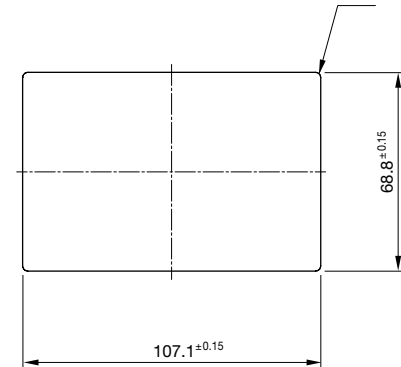
## Dimensions

(All dimensions in mm)



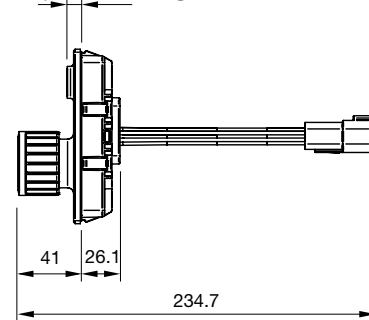
## Mounting cut-out

(Panel thickness 1.0 mm ... 4.0 mm)

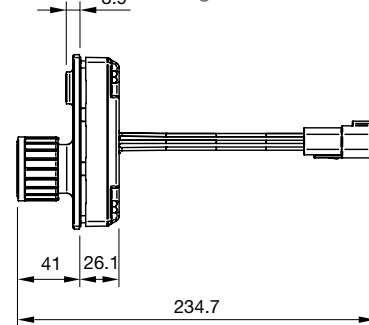


## Mounting

Clip-in mounting



Screw-in mounting





## Rotary Cursor Controller SUPER\*



### Rotary Cursor Controller Functions

- Joystick function
  - With proportional input
  - Digital input can be configured via CAN interface
- Rotary function
  - 20 maintained positions
  - Continuous rotation with no stop position
- Push function
  - Momentary action with click-dome

### Mechanical characteristics

- Overload: 250 N
- Mechanical lifetime
  - up to 10 million detents (rotation and Joystick functions Rotary Cursor Controller)
  - up to 1 million switching cycles (push of joystick rotary cursor controller and push of pushbuttons)
- Momentary action
  - Actuation force: 5-13 N
- Rotary function
  - Haptic with precise detent
- Joystick function
  - Actuation angle:  $\sim 5^\circ$

### Electrical characteristics

- Operating voltage range: 8–32 VDC

\* Validated product available from beginning of 2021. Fully validated and certified product available from middle of 2021.

### Illumination

- Halo ring and symbol illumination can be configured independently
- LED symbol illumination (on pushbuttons)
  - Colour: white
  - Luminance: max. 20 cd/m<sup>2</sup>, dimmable
- LED halo illumination
  - Multi-colour: RGB (buttons and RCC)
  - Luminance: 1 500 cd/m<sup>2</sup> (buttons)
  - Four segments on buttons

### Symbols (on pushbuttons, RCC without symbol)

- Symbols in accordance with ISO 7000
- Customer-specific symbols on request

### Connectivity

- CAN interface (ISO 11898)
- CAN protocols: CANopen (CiA 401), CAN J1939
- Baud rate 250 kBd and 500 kBd (software configurable)
- Connector Deutsch DT04-6P

### Ambient conditions

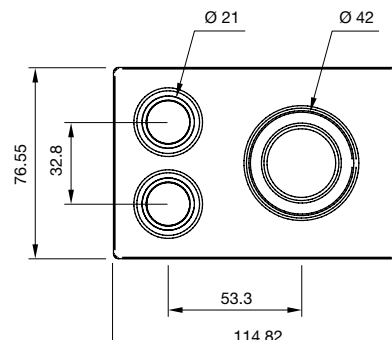
- Operating temperature:  $-40^\circ\text{C} \dots +85^\circ\text{C}$
- Storage temperature:  $-40^\circ\text{C} \dots +85^\circ\text{C}$

### Protection degree

- IP67 (front and rear side)
- IP67 (panel/screw-in)
- IP54 (panel/clip-in)

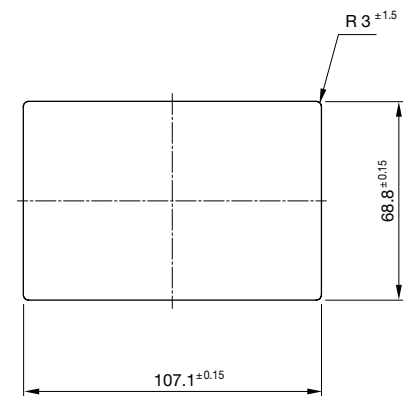
### Dimensions

(All dimensions in mm)



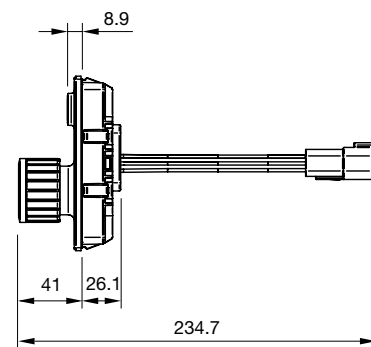
### Mounting cut-out

(Panel thickness 1.0 mm ... 4.0 mm)

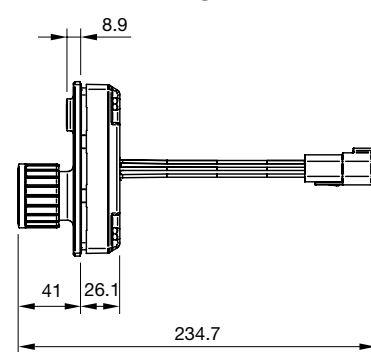


### Mounting

Clip-in mounting



Screw-in mounting



# 09 Modules

## Rotary Cursor Controller PLUS\*



### Rotary Cursor Controller Functions

- Joystick function
  - With proportional input
  - Digital input can be configured via CAN interface
- Rotary function
  - 20 maintained positions
  - Continuous rotation with no stop position
- Push function
  - Momentary action with click-dome

### Mechanical characteristics

- Overload: 250N
- Mechanical lifetime
  - up to 10 million detents (rotation and Joystick functions Rotary Cursor Controller)
  - up to 1 million switching cycles (push of joystick rotary cursor controller and push of pushbuttons)
- Momentary action
  - Actuation force: 5-13N
- Rotary function
  - Haptic with precise detent
- Joystick function
  - Actuation angle:  $\sim 5^\circ$

### Electrical characteristics

- Operating voltage range: 8–32VDC

\* Validated product available from beginning of 2021. Fully validated and certified product available from middle of 2021.

### Illumination

- Halo ring and symbol illumination can be configured independently
- LED symbol illumination (on pushbuttons)
  - Colour: white
  - Luminance: max. 20 cd/m<sup>2</sup>, dimmable
- Halo ring illumination
  - Colour: red
  - luminance: 1500 cd/m<sup>2</sup> (buttons)
  - Four segments on buttons

### Symbols (on pushbuttons, RCC without symbol)

- Symbols in accordance with ISO 7000
- Customer-specific symbols on request

### Connectivity

- CAN interface (ISO 11898)
  - CAN protocols: CANopen (CiA 401), CAN J1939
  - Baud rate 250 kBd and 500 kBd (software configurable)
  - Connector Deutsch DT04-6P

### Ambient conditions

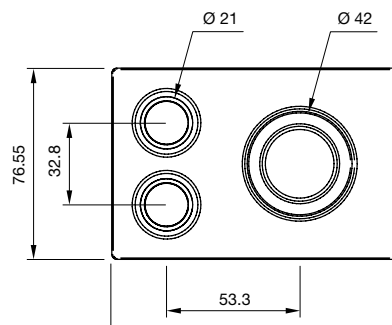
- Operating temperature:  $-40^\circ\text{C} \dots +85^\circ\text{C}$
- Storage temperature:  $-40^\circ\text{C} \dots +85^\circ\text{C}$

### Protection degree

- IP67 (front and rear side)
- IP67 (panel/screw-in)
- IP54 (panel/clip-in)

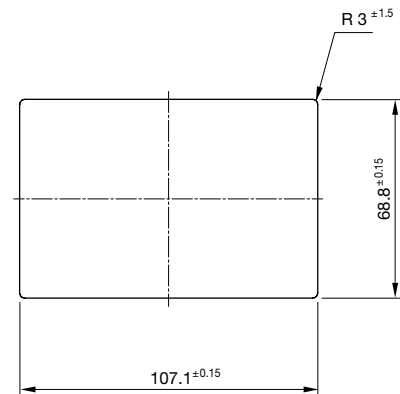
### Dimensions

(All dimensions in mm)



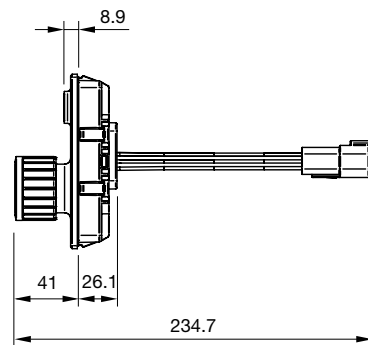
### Mounting cut-out

(Panel thickness 1.0 mm ... 4.0 mm)

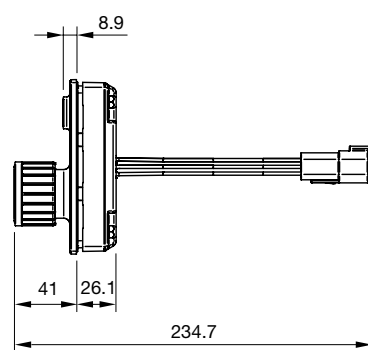


### Mounting

Clip-in mounting

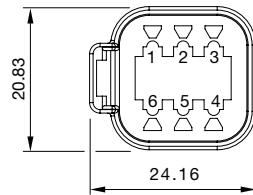
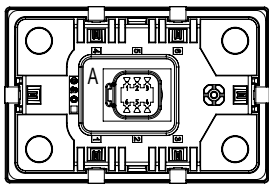
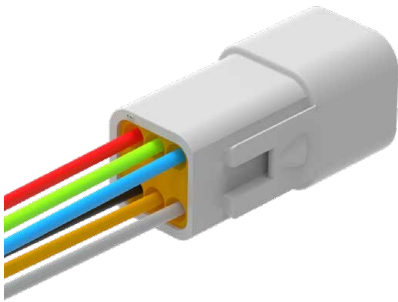


Screw-in mounting



## Accessories

### Deutsch DT Series connector (DT04-6P)



### Connector 6 – DT (DT04-6P)

Mating plug            Deutsch DT06-6S  
 Matching contacts    e.g. 1062-16-0122  
 Matching wedge      W6-S

| Pin Nr. | Signal     | Wire colour | Comment   |
|---------|------------|-------------|-----------|
| Pin 1   | GND        | Black       |           |
| Pin 2   | CAN High   | Yellow      |           |
| Pin 3   | WakeUp_Out | Grey        |           |
| Pin 4   | WakeUp_In  | Blue        |           |
| Pin 5   | CAN Low    | Green       |           |
| Pin 6   | Vcc        |             | 8 – 32VDC |

All dimensions in mm.

### Symbol inserts



### Tool for legends



The new symbol insert tool with trendy design enables user-friendly fitting and removal of symbol inserts from the keypad. The round tip layout without edges prevents from damage of the keypad and symbol inserts. The ergonomically adjusted surface with balance point in the middle offers optimal grip.

# 09 Universal Switch

## Universal Switch\*



### Typical applications

- Universal switch with white symbol illumination without status indicator
  - Menu button
  - Reset button
  - Tyre failure/malfunction
- Universal switch with white symbol illumination and red single LED status indicator
  - Lock/unlock
  - Headlights On/Off
  - Air conditioning On/Off
- Universal switch with white symbol illumination and three red LED status indicators
  - Seat heating
  - Air conditioning
  - Ventilation fan
  - Blower position
- Universal switch with red symbol illumination for use as a hazard warning light
  - Hazard warning switch
- Indicator without mechanical function with and without functional illumination
  - Driver airbag on, off or not existing
  - Passenger airbag on, off or not existing
  - ESP off
  - Parking brake

### Mechanical characteristics

- Actuation force  
5–13 N
- Overload  
250 N
- Mechanical lifetime  
250 000 cycles of operation

### Electrical characteristics

- Operating voltage range: designed for 12VDC and 24VDC vehicle electrical system
- Maximum power\*: 1 VA
- Maximum current\*: 50 mA
- Minimum current\*: 1 mA
- Contact resistance\*: <math> < 10 \Omega </math>
- Additional resistor coding customer specific version on request\*

\* Refer to S1 (see wiring diagram, page 10)

### Illumination

#### LED symbol illumination

- Colour: white with luminance:  
~20 cd/m<sup>2</sup> at 28VDC and 23 °C ± 2 °K
- Colour: red (for hazard warning light) with luminance: ~90 cd/m<sup>2</sup> at 28VDC and 23 °C ± 2 °K

#### LED status indicator

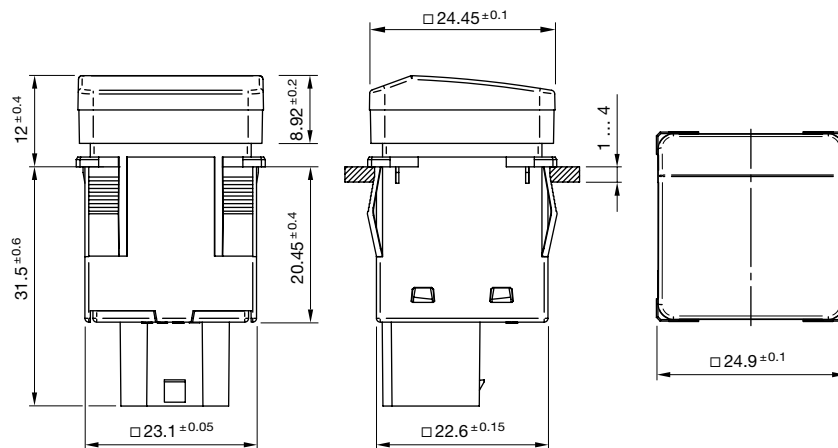
- Colour: Red
- Luminance: ~200 cd/m<sup>2</sup> at 28VDC and 23 °C ± 2 °K

### Symbols

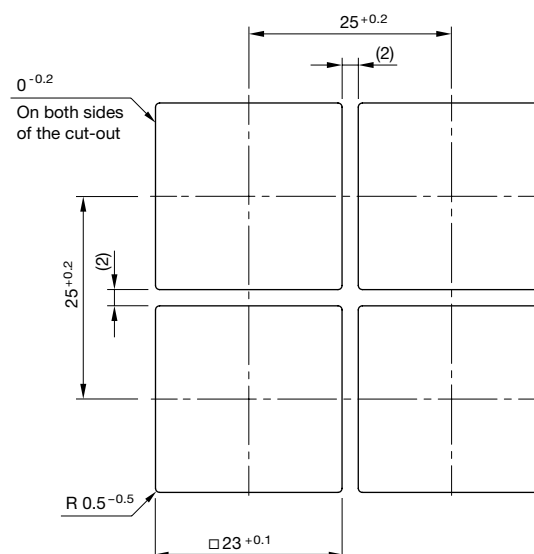
- Symbols in accordance with ISO 7000
- Customer-specific symbols on request

### Dimensions

(All dimensions in mm)



### Mounting cut-outs

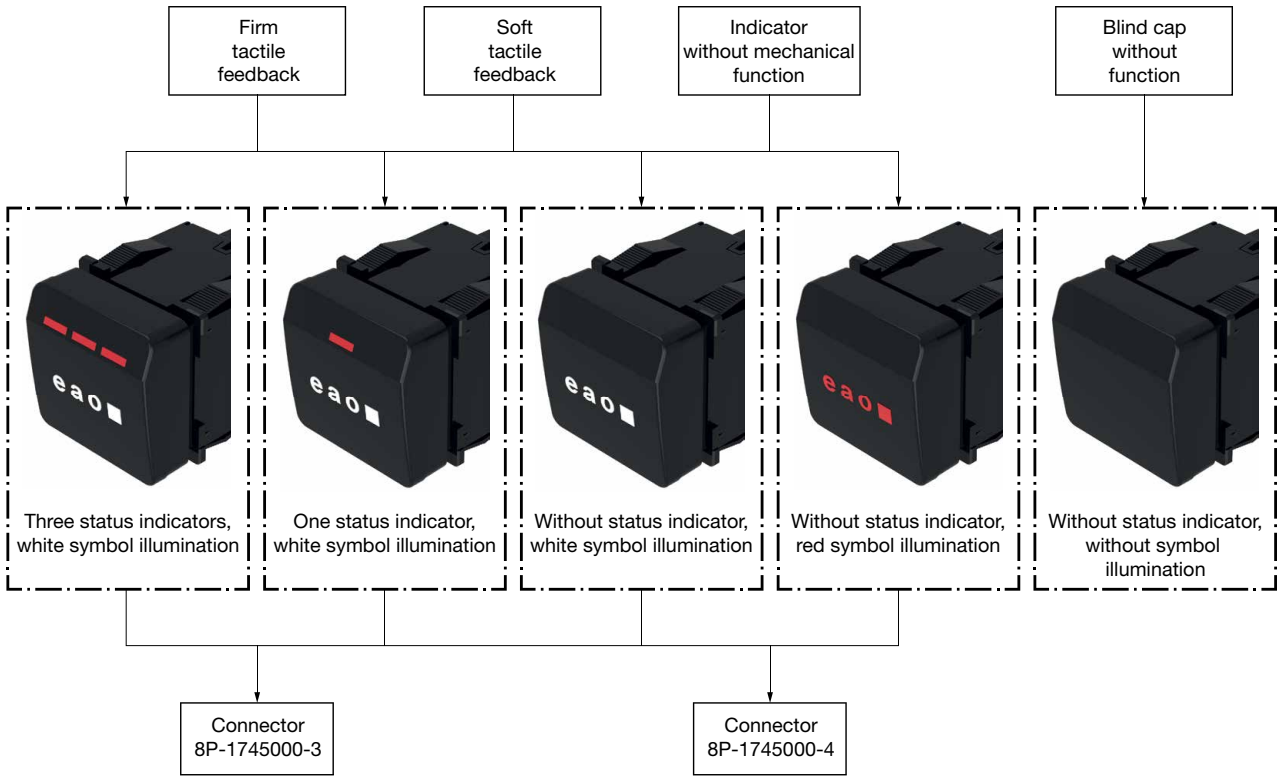


### Please note

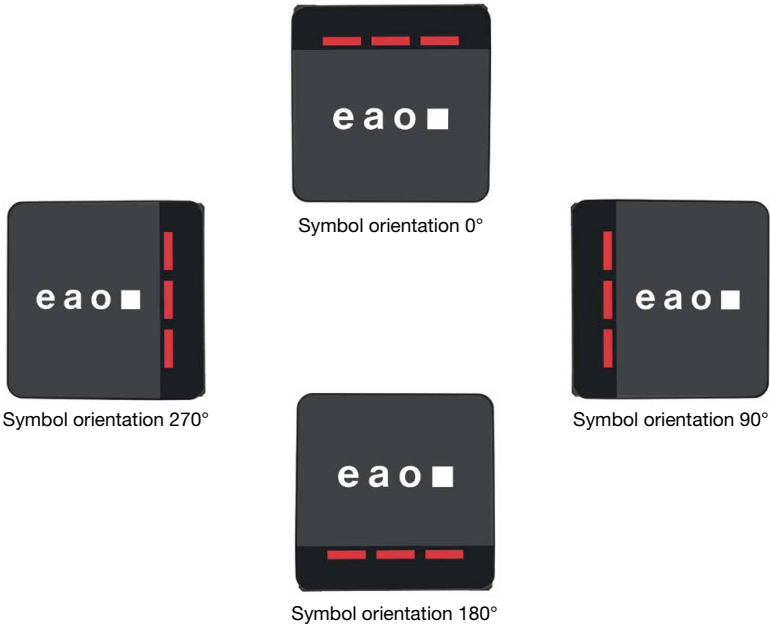
- The view shows the minimum possible distance between the cut-outs for two universal switches
- Another mounting option is using the mounting frame that fits into radio slot according to DIN ISO 7736

## Options

### Product options



### Options of the symbol orientation

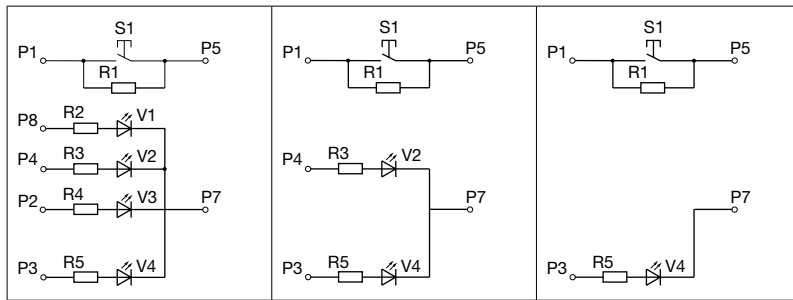


- 01
- 02
- 03
- 04
- 09**
- 14
- 17
- 18
- 19
- 22
- 31
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- 45
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- 56
- 57
- 61
- 70
- 71
- 82
- 84
- 92
- 96

# 09 Universal Switch

## Wiring diagrams

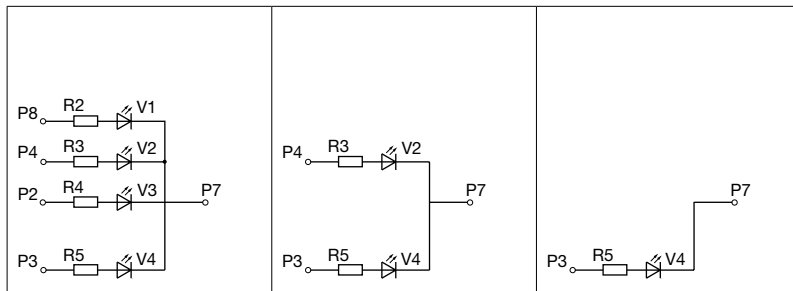
### Wiring diagrams



Three status indicators, backlight and switching element

One status indicator, backlight and switching element

Backlight and switching element



Three status indicators and backlight

One status indicator and backlight

Backlight

### Please note

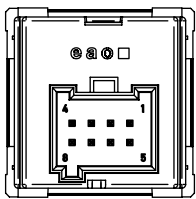
R1 not placed as standard.

### TYCO Pin connector

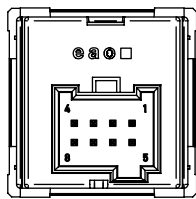
Tyco part-no. locking cover: 1745000-3, 1745000-4

Tyco part-no. housing: 965601-2

Tyco part-no. receptacle: 963715-1 (0.5 – 0.75 mm<sup>2</sup>), 928999-1 (0.25 – 0.35 mm<sup>2</sup>)

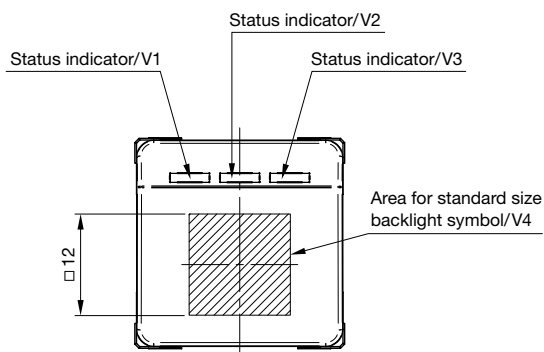


Connector  
8P-1745000-3



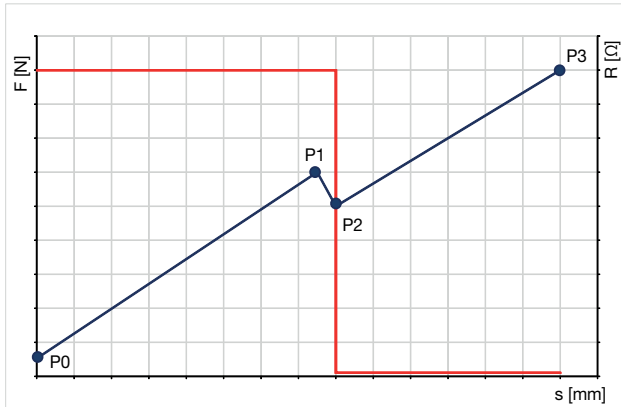
Connector  
8P-1745000-4

### Illumination specification



## Haptic specifications

### Universal switch with firm tactile feedback

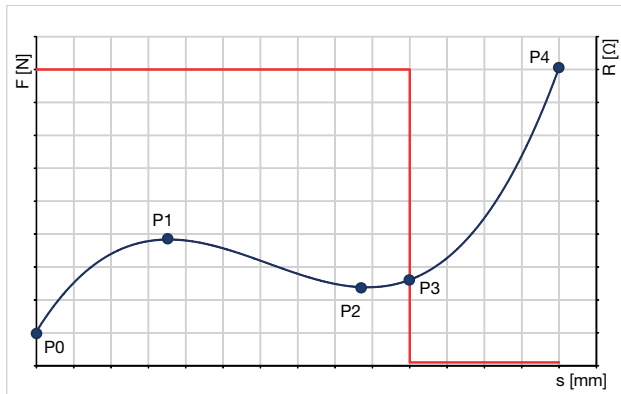


#### Parameters

|  |
|--|
| P0: $F_0 \sim 2\text{ N}$                          |
| P1: $s_1 \sim 0.65\text{ mm}/F_1 \sim 6\text{ N}$  |
| P2: $s_2 \sim 0.775\text{ mm}/F_2 \sim 4\text{ N}$ |
| P3: $s_3 \sim 1.4\text{ mm}/F_3 \sim 10\text{ N}$  |

$S_n$ : travel at point  $P_n$   
 $F_n$ : force at point  $P_n$

### Universal switch with soft tactile feedback



#### Parameters

|   |
|---|
| P0: $F_0 \sim 2\text{ N}$                           |
| P1: $s_1 \sim 0.3\text{ mm}/F_1 \sim 5\text{ N}$    |
| P2: $s_2 \sim 0.65\text{ mm}/F_2 \sim 2,5\text{ N}$ |
| P3: $s_3 \sim 0.825\text{ mm}/F_3 \sim 3\text{ N}$  |
| P4: $s_4 \sim 1.4\text{ mm}/F_4 \sim 10\text{ N}$   |

$S_n$ : travel at point  $P_n$   
 $F_n$ : force at point  $P_n$

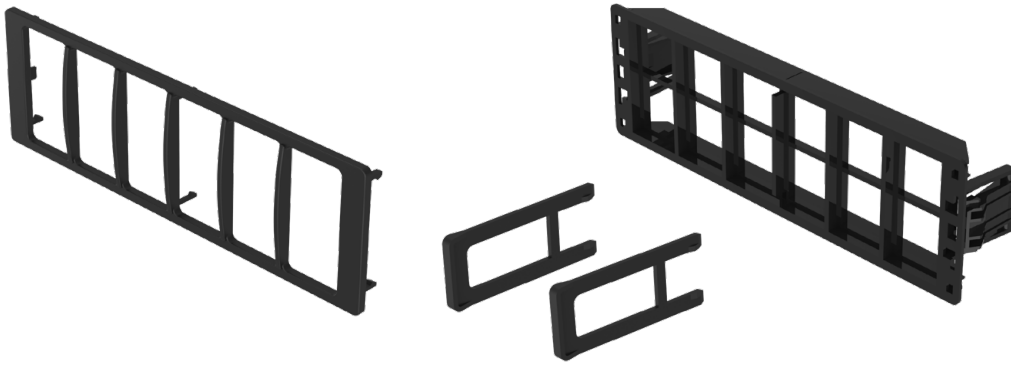
### Please note

The customer must ensure the functional and product safety compliance of the integration. The customer must perform all safety activities on the integration level and confirm that no functional safety requirements have been derived from the integration with the HMI.

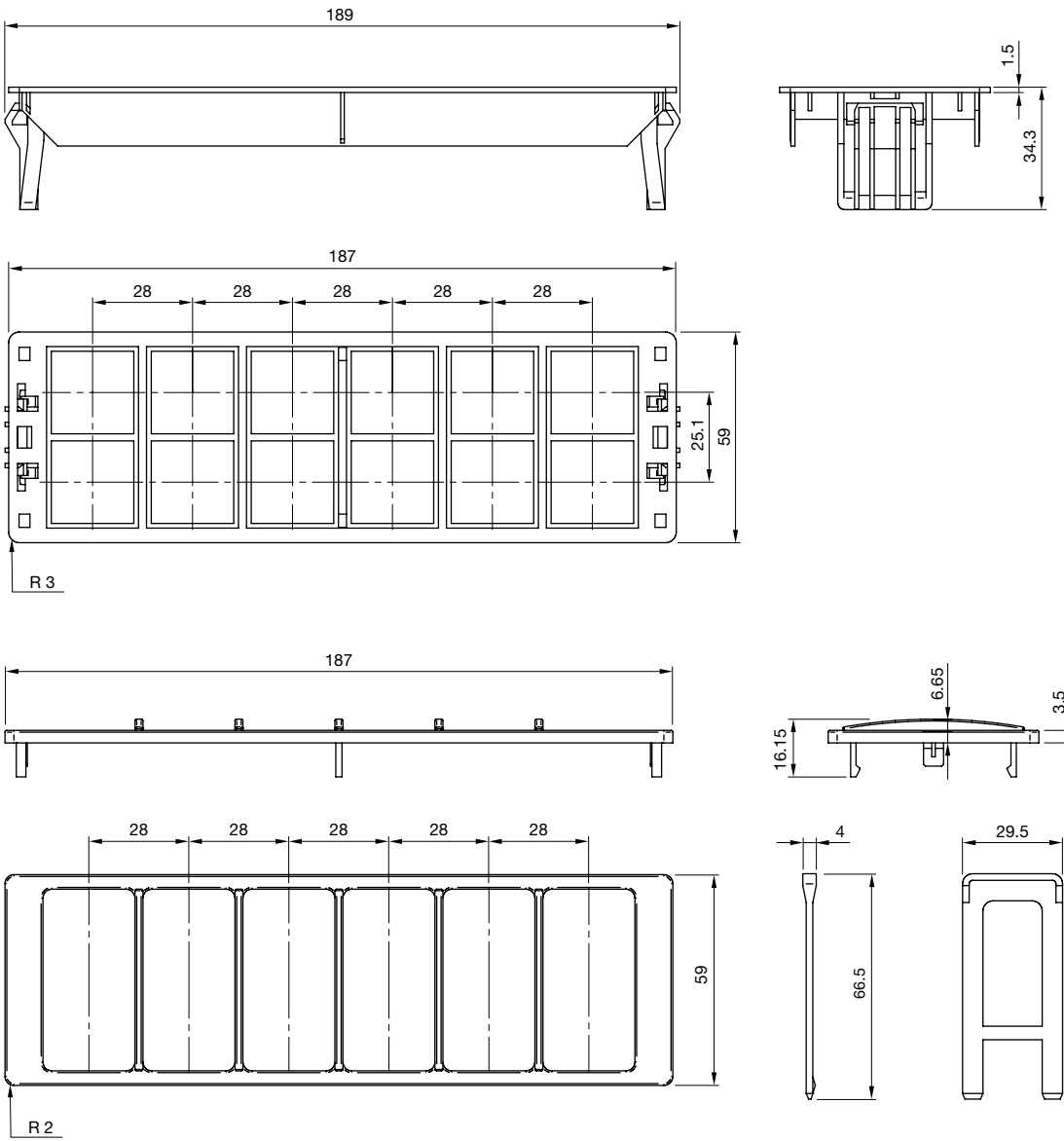
As a consequence, no functional safety requirements have been assigned to the HMI. The customer should be aware that the HMI has been developed according IATF 16949 and fulfils the ISO 26262 classification of a QM level.

# 09 Universal Switch

## Radio slot frame



### Dimensions



All dimensions in mm.

The radio slot frame is always customer specific and the above dimensions are an example only.



## LIN Switch Panel



### Mechanical characteristics

- Actuation force  
5–13 N
- Overload  
250 N
- Service life  
Up to 50 000 cycles of operation

### Electrical characteristics

- Designed for 12 VDC operating voltage

### Illumination

- LED symbol illumination
- Colour white with luminance  
~20 cd/m<sup>2</sup>
  - Colour red with luminance  
~90 cd/m<sup>2</sup>

### LED status indicator

- Colour  
Red
- Luminance  
~600 cd/m<sup>2</sup>

### Symbols

- Symbols in accordance with ISO 7000
- Customer-specific symbols on request

### Connections/interfaces

- LIN interface

### Ambient conditions

- Operating temperature  
–40 °C ... +85 °C
- Storage temperature  
–40 °C ... +85 °C

### Protection degree

- IP5K3 protection front side (mounted into panel)
- IP20 protection rear side (mounted into panel)

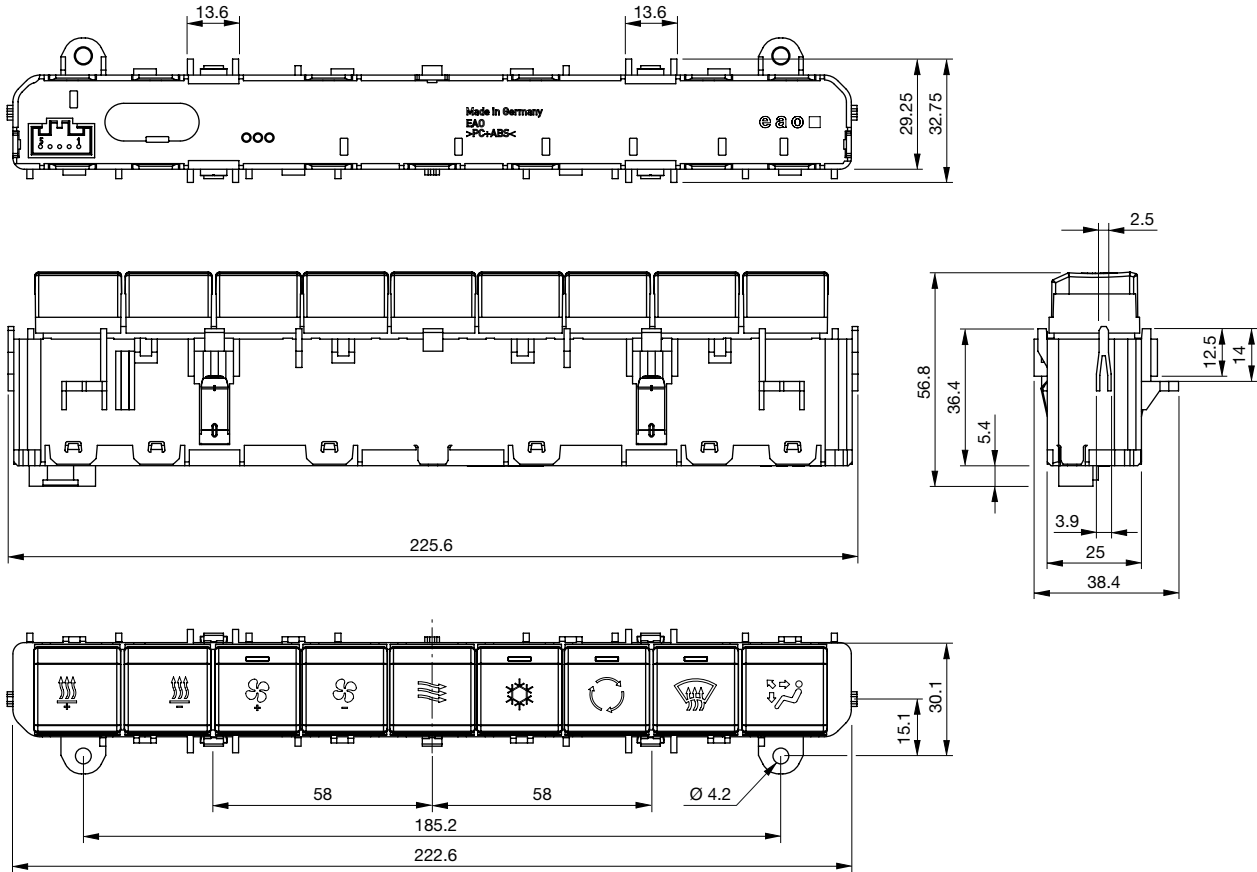
### Approvals and conformities

- E1 R10
- E1 R118
- CE

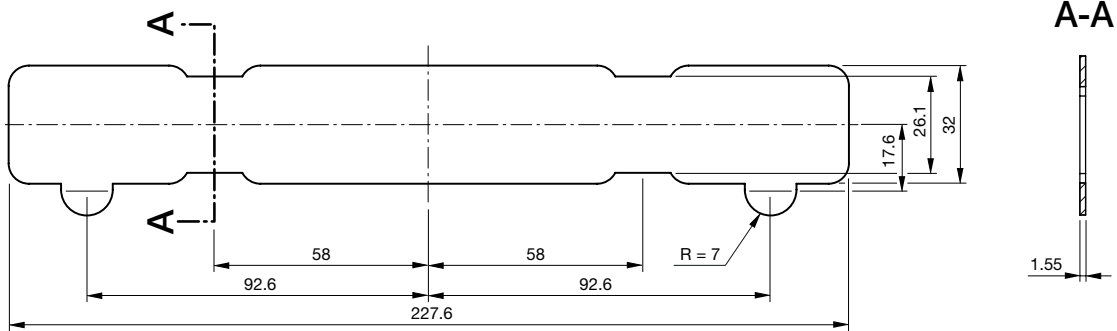
01  
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96

# 09 LIN Switch Panel

## Dimensions

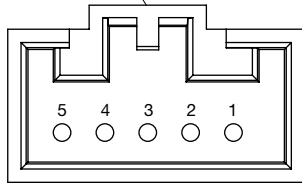
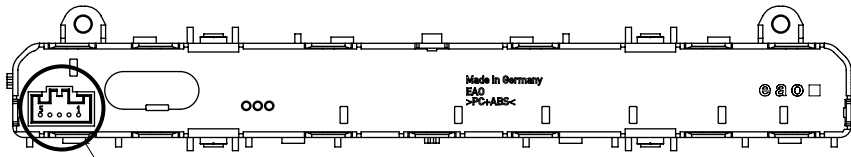


## Mounting cut-out (clip-in version)



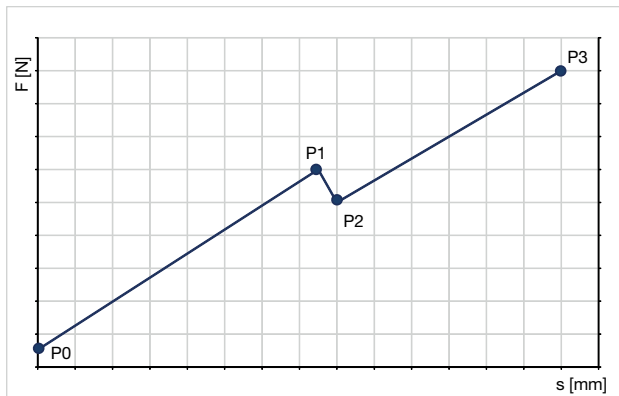
All dimensions in mm.  
Dimensional tolerance according to DIN 16472 – TGS/2768-mk.

## Electrical connections and interfaces



| LIN interface pin allocation |       |
|------------------------------|-------|
| 1                            | nc    |
| 2                            | KL 30 |
| 3                            | LIN   |
| 4                            | KL 31 |
| 5                            | nc    |

## Haptic specifications



### Parameters

P0:  $F_0 \sim 1 \text{ N}$

P1:  $s_1 \sim 0.65 \text{ mm} / F_1 \sim 5 \text{ N}$

P2:  $s_2 \sim 0.75 \text{ mm} / F_2 \sim 4 \text{ N}$

P3:  $s_3 \sim 1.35 \text{ mm} / F_3 \sim 10 \text{ N}$

$S_n$ : travel at point  $P_n$

$F_n$ : force at point  $P_n$

### Please note

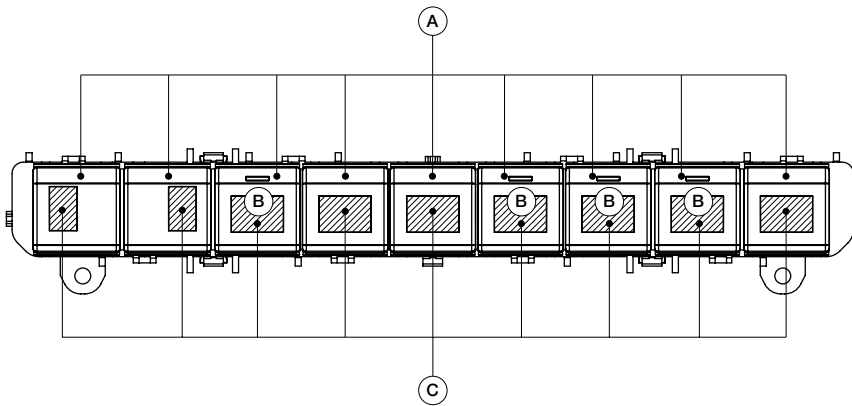
The customer must ensure the functional and product safety compliance of the integration. The customer must perform all safety activities on the integration level and confirm that no functional safety requirements have been derived from the integration with the HMI.

As a consequence, no functional safety requirements have been assigned to the HMI. The customer should be aware that the HMI has been developed according IATF 16949 and fulfils the ISO 26262 classification of a QM level.

# 09 LIN Switch Panel

## Illumination specifications

Variant with maximum number of indicators



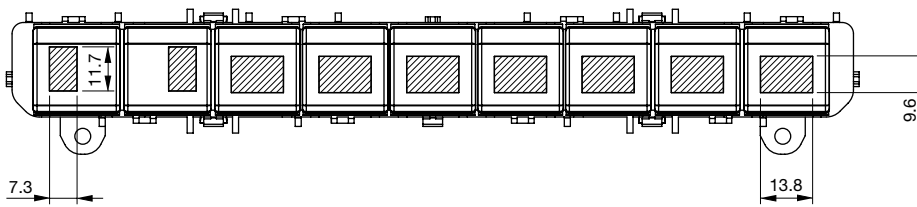
### Legend

A = Position

B = Indicator

C = Area for backlight symbol

Variant without indicators



|                                 | Pos. 1                | Pos. 2                | Pos. 3                 | Pos. 4                | Pos. 5                | Pos. 6                 | Pos. 7                 | Pos. 8                 | Pos. 9                |
|---------------------------------|-----------------------|-----------------------|------------------------|-----------------------|-----------------------|------------------------|------------------------|------------------------|-----------------------|
| Backlight colour                | white                 | white                 | white                  | white                 | red                   | white                  | white                  | white                  | white                 |
| Backlight brightness            | ~20 cd/m <sup>2</sup> | ~20 cd/m <sup>2</sup> | ~20 cd/m <sup>2</sup>  | ~20 cd/m <sup>2</sup> | ~90 cd/m <sup>2</sup> | ~20 cd/m <sup>2</sup>  | ~20 cd/m <sup>2</sup>  | ~20 cd/m <sup>2</sup>  | ~20 cd/m <sup>2</sup> |
| Indicator colour (optional)     | –                     | –                     | red                    | –                     | –                     | red                    | red                    | red                    | –                     |
| Indicator brightness (optional) | –                     | –                     | ~600 cd/m <sup>2</sup> | –                     | –                     | ~600 cd/m <sup>2</sup> | ~600 cd/m <sup>2</sup> | ~600 cd/m <sup>2</sup> | –                     |

Symbols according to ISO 7000 or customer-specific symbols on request.

## Joystick, 1 axis with square flange

**Part No.**  
09-01.18214.0107

**Mechanical characteristics**

- Mounting  
from front of panel, 4 screws  
( $\varnothing 3.5\text{mm}$ )
- 1 axis
- No cross guidance
- No gate shape
- $20^\circ$  deflection angle
- Handle "Winter"
- Resetting  
self-resetting (medium resetting force)
- Breakout torque  
Y-axis 0.18 Nm
- Operating torque  
Y-axis 0.42 Nm
- Max. allowable torque  
Y-axis 18 Nm

**Electrical characteristics**

- Operating voltage  
5VDC
- Output signal  
proportional ( $-y = 0.5\text{V}$ /  
Mid =  $2.5\text{V}$ / $+y = 4.5\text{V}$ )
- Redundancy  
yes

**Technology**

- Hall effect sensors

**Connections**

- Minitek plug (8-pole)

**Ambient conditions**

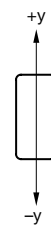
- Operating temperature  
 $-30^\circ\text{C}$  to  $+80^\circ\text{C}$
- Storage temperature  
 $-40^\circ\text{C}$  to  $+85^\circ\text{C}$

**Degree of protection**

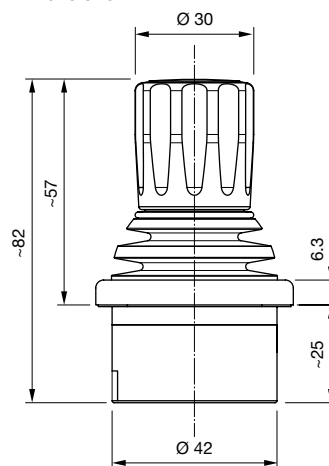
- IP65 front protection
- IP40 rear protection



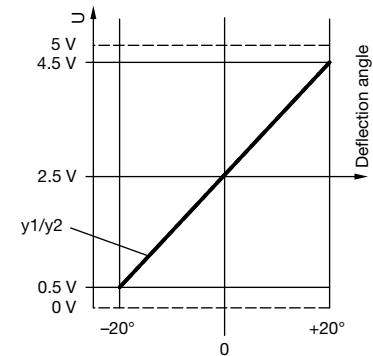
**Gate**



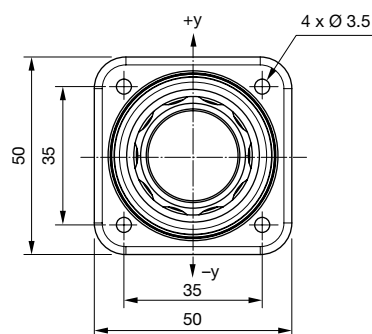
**Dimensions**



**Diagram Y-axis**



**View from above**



# 09 Joysticks

## Joystick, 3 axes with square flange.

### Part No.

09-01.32294.0109

### Mechanical characteristics

- Mounting from front of panel, four screws (Ø3.5 mm)
- 3 axes
- Soft cross guidance
- Gate shape square
- Deflection angle XY:  $\pm 20^\circ$  / Z:  $\pm 30^\circ$
- Handle "Winter twist"
- Resetting self-resetting (medium resetting force)
- Breakout torque X/Y-axis 0.18 Nm / Z-axis 0.075 Nm
- Operating torque X/Y-axis 0.42 Nm / Z-axis 0.18 Nm
- Max. allowable torque X/Y-axis 18 Nm / Z-axis 10 Nm

### Electrical characteristics

- Operating voltage 5 VDC
- Output signal proportional ( $-x/y/z = 0.5V$  / Mid =  $2.5V$  /  $+x/y/z = 4.5V$ )
- Redundancy all axes

### Technology

- Hall effect sensors

### Connections

- Minitek plug (8-pole)

### Ambient conditions

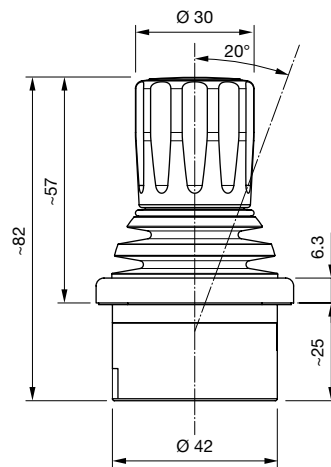
- Operating temperature  $-30^\circ\text{C}$  to  $+80^\circ\text{C}$
- Storage temperature  $-40^\circ\text{C}$  to  $+85^\circ\text{C}$

### Degree of protection

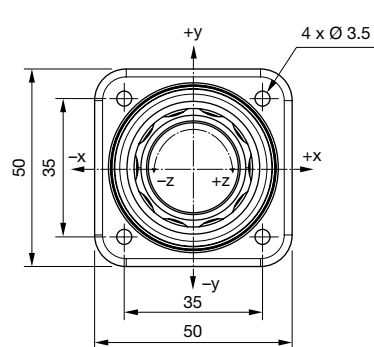
- IP65 front protection
- IP40 rear protection



Dimensions



View from above



Gate

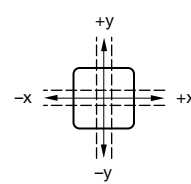


Diagram X-, Y-axis

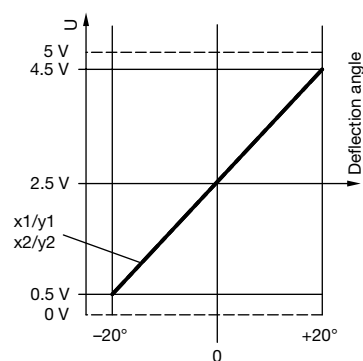
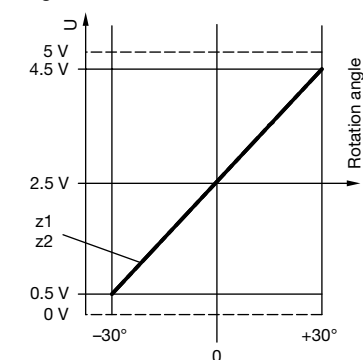


Diagram Z-axis



## Joystick, small and beautiful

### Part No.

09-01.22224.0128

### Mechanical characteristics

- Mounting  
from above, four screws ( $\varnothing$  3.5 mm)
- 2 axes
- Light cross guidance
- Gate shape square
- 20° deflection angle
- Handle "Nupsi"
- Resetting  
self-resetting (medium resetting force)
- Breakout torque  
X/Y-axis 0.18 Nm
- Operating torque  
X/Y-axis 0.42 Nm
- Max. allowable torque  
X/Y-axis 10 Nm

### Electrical characteristics

- Operating voltage  
5VDC
- Output signal  
proportional ( $-x1/y1 = 0.5V$ /average =  $2.5V$ / $+x1/y1 = 4.5V$ ) ( $-x2/y2 = 4.5V$ /average =  $2.5V$ / $+x2/y2 = 0.5V$ )
- Redundancy  
all axes

### Technology

- Hall effect sensors

### Connections

- Minitek plug (8-pole)

### Ambient conditions

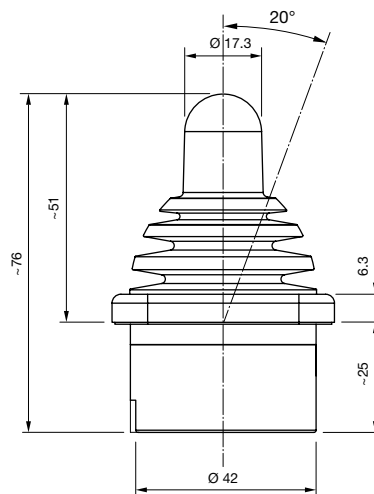
- Operating temperature  
 $-30^{\circ}\text{C}$  to  $+80^{\circ}\text{C}$
- Storage temperature  
 $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

### Degree of protection

- IP67 front protection
- IP40 rear protection



Dimensions



Gate

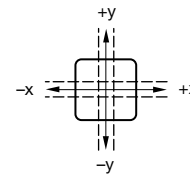
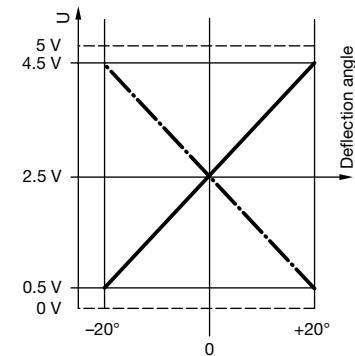
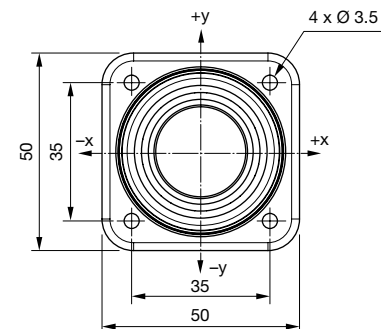


Diagram X-, Y-axis



View from above



# 09 Joysticks

## Joystick, standard with round flange

### Part No.

09-02.22244.1052

### Mechanical characteristics

- Mounting  
from rear of panel, 4 x M3 screws
- 2 axes
- Rigid cross guidance
- Gate shape square
- 20° deflection angle
- Handle "Standard"
- Resetting  
self-resetting (medium resetting force)
- Breakout torque  
X/Y-axis 0.16 Nm
- Operating torque  
X/Y-axis 0.5 Nm
- Max. allowable torque  
X/Y-axis 18 Nm

### Electrical characteristics

- Operating voltage  
max. 30VDC
- Output signal  
proportional with centre tab at  $\pm 1.75^\circ$ ,  
switch point at  $\pm 2.3^\circ$  (see diagram  
X-, Y-axis)

### Technology

- Conductive plastic with digital steps/  
control segment 1-0-1

### Connections

- Dubox plug (6- and 8-pole)

### Ambient conditions

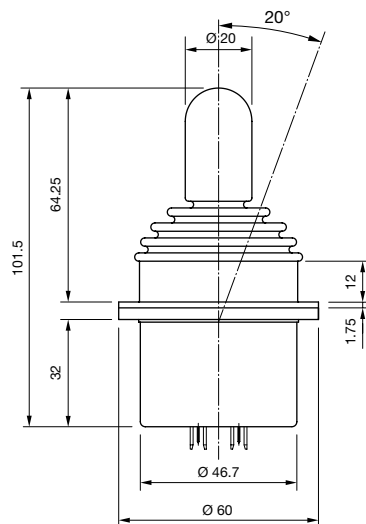
- Operating temperature  
 $-30^\circ\text{C}$  to  $+80^\circ\text{C}$
- Storage temperature  
 $-40^\circ\text{C}$  to  $+85^\circ\text{C}$

### Degree of protection

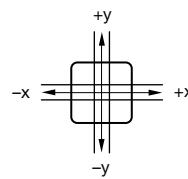
- IP67 front protection
- IP40 rear protection



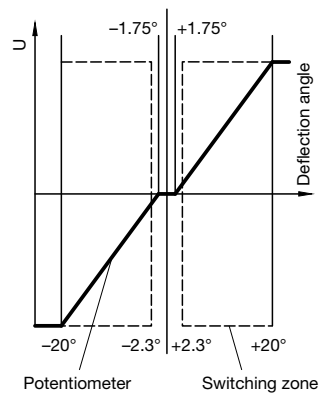
### Dimensions



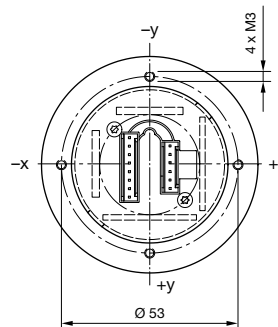
### Gate



### Diagram X-, Y-axis



### Bottom view





## Joystick, CAN with round flange

### Part No.

09-03.23362.1051 (CANopen)

09-03.23363.1051 (J1939)

### Mechanical characteristics

- Mounting  
from rear of panel, 4 x M3 screws
- 2 axes
- Soft cross guidance
- Gate shape square
- 20° deflection angle
- Handle "Sleek"  
with two integrated buttons (red)
- Resetting  
self-resetting (strong resetting force)
- Breakout torque  
X/Y-axis 0.19 Nm
- Operating torque  
X/Y-axis 0.7 Nm
- Max. allowable torque  
X/Y-axis 18 Nm

### Electrical characteristics

- Operating voltage  
8 to 36 VDC

### Technology

- Hall effect sensors

### Connections

- Dubox plug (4-pole)

### Interfaces

- CANopen/J1939 interface

### Ambient conditions

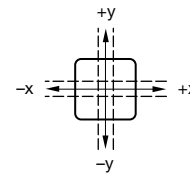
- Operating temperature  
-30 °C to +80 °C
- Storage temperature  
-40 °C to +85 °C

### Degree of protection

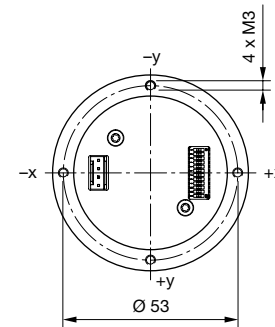
- IP65 front protection
- IP40 rear protection



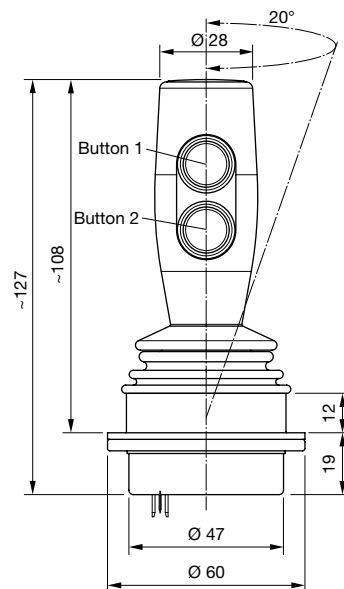
### Gate



### Bottom view



### Dimensions



# 09 Joysticks

## Joystick, CAN with 3 buttons and 1 cable

### Applications

Especially well-suited to heavy duty and special vehicles.

### Part No.

09-03.223A2.1114 (CANopen)  
09-03.223A3.1114 (J1939)

### Mechanical characteristics

- Mounting from below, 4 x M3 screws
- 2 axes
- Light cross guidance
- Gate shape square
- 15° deflection angle
- Handle "Kermit" with 3 integrated buttons (black)
- Resetting self-resetting (strong resetting force)
- Breakout torque X/Y-axis 0.63 Nm
- Operating torque X/Y-axis 1.16 Nm
- Max. allowable torque X/Y-axis 18 Nm

### Electrical characteristics

- Operating voltage 8 to 36 VDC

### Technology

- Hall effect sensors

### Connections

- PVC cable, 4 x 0.34 mm<sup>2</sup> Molex Micro-Fit (4-pole)

### Interfaces

- CANopen/ J1939 interface

### Ambient conditions

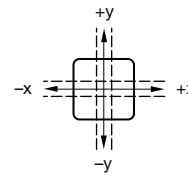
- Operating temperature -30 °C to +80 °C
- Storage temperature -40 °C to +85 °C

### Degree of protection

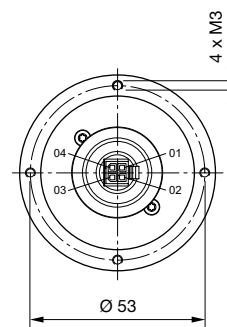
- IP65 front protection
- IP40 rear protection



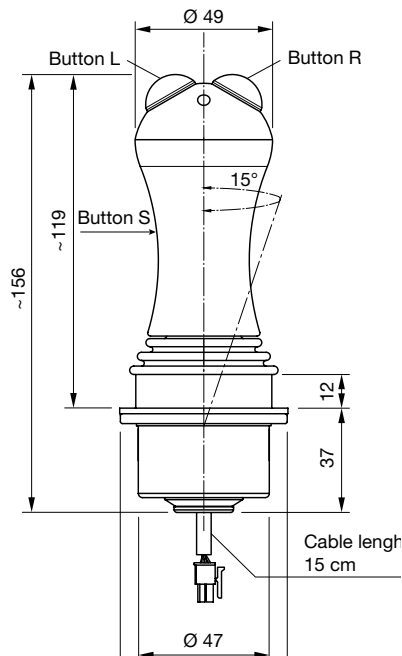
### Gate



### Bottom view



### Dimensions



## Joystick, 2 axes with 6 momentary positions each

### Applications

Especially well-suited to wireless remote control systems.

### Part No.

09-04.223E4.1112

### Mechanical characteristics

- Mounting  
from below, 4 x M3 screws
- 2 axes
- Soft cross guidance
- Gate shape square
- 20° deflection angle
- 6 momentary positions per axis
- Handle "Goblet Top" with button
- Resetting  
self-resetting (strong resetting force)
- Breakout torque  
X/Y-axis 0.19 Nm
- Operating torque  
X/Y-axis 0.7 Nm
- Max. allowable torque  
X/Y-axis 18 Nm

### Electrical characteristics

- Operating voltage  
max. 5 VDC/5 mA
- Output signal  
switching point at  $\pm 3.33^\circ$

### Technology

- Digital grid/switching segment 3-1-3

### Connections

- Dubox plug (2 and 8-pole)

### Ambient conditions

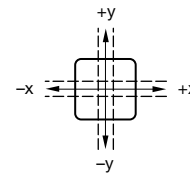
- Operating temperature  
-30 °C to +80 °C
- Storage temperature  
-40 °C to +85 °C

### Degree of protection

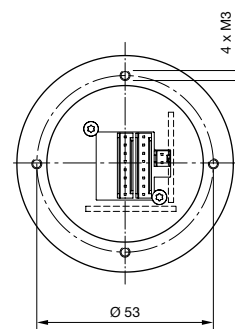
- IP65 front protection
- IP40 rear protection



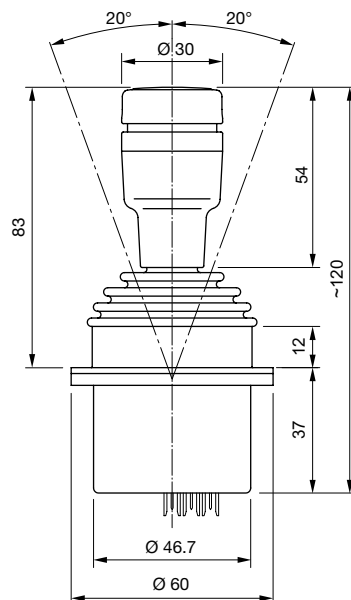
### Gate



### Bottom view



### Dimensions



# 09 Joysticks

## Joystick, drive lever with mechanical interlocking

### Part No.

09-02.174C4.1113

### Mechanical characteristics

- Mounting  
from below, 4 x M3 screws
- 1 axis
- No cross guidance
- No gate shape
- 20° deflection angle
- Handle "Central Lock"
- Resetting  
friction brake
- Unlocking force  
22 N
- Breakout torque  
0.456 Nm
- Operating torque  
0.456 Nm
- Max. allowable torque  
18 Nm

### Electrical characteristics

- Operating voltage  
max. 30VDC
- Output signal  
proportional without centre tab

### Technology

- Conductive plastic

### Connection

- Dubox plug (3-pole)

### Ambient conditions

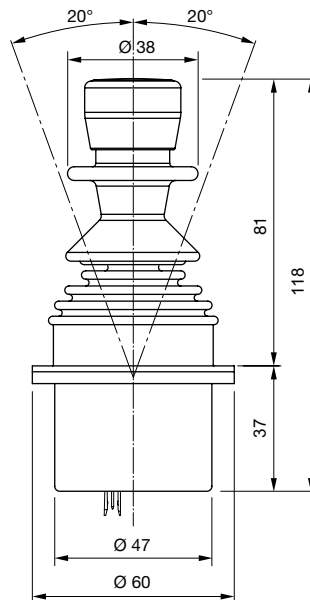
- Operating temperature  
-30 °C to +80 °C
- Storage temperature  
-40 °C to +85 °C

### Degree of protection

- IP65 front protection
- IP40 rear protection



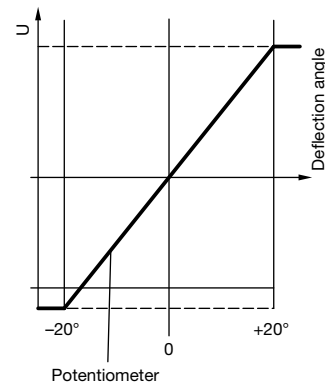
Dimensions



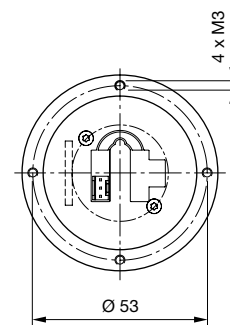
Gate



Diagram Y-axis



Bottom view



## Toggle stick, 4 directions with momentary position

### Applications

The toggle stick (4 directions with momentary position, lock-able) is suitable for various applications.

### Part No.

Please see Series 45

### Mechanical characteristics

- Mounting  
Ø 22.3 mm, raised
- 2 axes
- Rigid cross guidance
- 35° deflection angle
- Mechanical service life  
up to 250 000 switching cycles
- Connection  
screw terminal

### Electrical characteristics

- Operating voltage  
5 to 500V
- Output signal  
AC15: 6A/24V to 1.4A/500V
- Contact material  
silver

### Ambient conditions

- Operating temperature  
-25 °C to +70 °C
- Storage temperature  
-40 °C to +85 °C

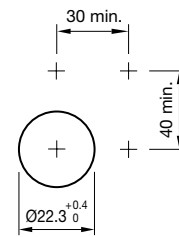
### Degree of protection

- IP65, IP67 front protection
- IP20 or IP40 rear protection

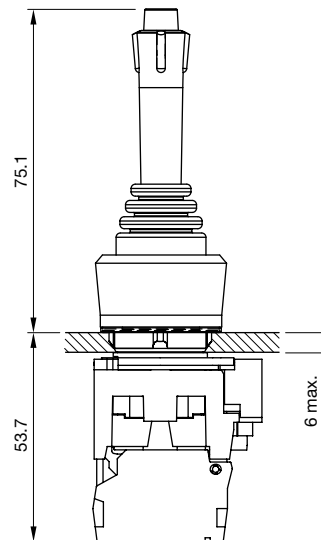
Configure your product in a few steps at [eao.com/products](http://eao.com/products).



### Mounting cut-outs



### Dimensions



# 09 Joysticks

## Lever switch, 8 positions

### Applications

The lever switch (2, 4 or 8 positions) is suitable for various applications.

### Part No.

44-800.2  
44-800.4  
44-800.8

### Mechanical characteristics

- Mounting  
Ø 22.3 mm, raised
- 2 axes
- Soft cross guidance, pulse
- 12° deflection angle
- Mechanical service life  
up to 1.2 million switching cycles
- Connection  
soldering terminal

### Electrical characteristics

- Operating voltage  
250 VAC
- Output signal  
5A/4 NC + 4 NO
- Contact material  
gold-plated silver alloy

### Ambient conditions

- Operating temperature  
-30 °C to +80 °C
- Storage temperature  
-40 °C to +85 °C

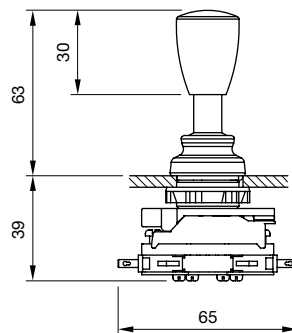
### Degree of protection

- IP65 front protection
- IP20, IP40 rear protection

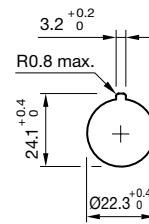
A choice of three lever switches can be found at [eao.com/products](http://eao.com/products).



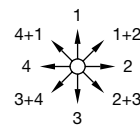
### Dimensions



### Mounting cut-outs



### Wiring diagram



## Approvals and conformities modules\*

| Test   | Standard            | Load  |
|--|---------------------|---|
| <b>Mechanical specifications</b>   |                     |   |
| <b>(acc. ISO16750-3: mounting location codes D, E, F, G, K, L, R, S)</b> |                     |   |
| Vibration  | ISO 16750-3 4.1     | Test IV and Test VII  |
| Tests for devices on doors or flaps                                      | ISO 16750-3 4.2.1   | half-sinusoidal, 300m/s <sup>2</sup> , 6 ms, 100.00 shocks  |
| Tests for devices on rigid points on the body and on the frame           | ISO 16750-3 4.2.2   | half-sinusoidal, 500m/s <sup>2</sup> , 6 ms, 10 shocks per direction                                    |
| Drop test  | ISO 16750-3 4.3     | height: 1 m, 6 directions (±x, ±y, ±z), 2 falls per DUT (±direction)                                    |
| Surface strength/scratch and abrasion resistance                         | ISO 16750-3 4.4     | ASTM F2357-10   |
| Impact resistance  | IEC 62262           | IK07, 2 Joules, free-fall hammer  |
| <b>Environmental specifications</b>                                      |                     |   |
| <b>(acc. ISO16750-4: temperature code G, climatic load code H)</b>       |                     |   |
| Low-temperature storage test   | ISO 16750-4 5.1.1.1 | -40 °C, 24 h  |
| High-temperature storage test  | ISO 16750-4 5.1.2.1 | +95 °C, 48 h  |
| Low-temperature operation test   | ISO 16750-4 5.1.1.2 | -40 °C, 24 h  |
| High-temperature operation test  | ISO 16750-4 5.1.2.2 | +85 °C, 96 h  |
| Temperature step test  | ISO 16750-4 5.2     | Tmin = -40 °C, Tmax = +85 °C  |
| Temperature cycle with specified change rate                             | ISO 16750-4 5.3.1   | Tmin = -40 °C, Tmax = +85 °C, Profile Tab. 2, 30 cycles (each 480 min)                                  |
| Rapid change of temperature with specified transition duration           | ISO 16750-4 5.3.2   | Tmin = -40 °C, Tmax = +85 °C, 100 cycles  |
| Ice water shock test - Splash water test                                 | ISO 16750-4 5.4.2   | Tmax = +85 °C, 100 cycles   |
| Ice water shock test - Submersion test                                   | ISO 16750-4 5.4.3   | Tmax = +85 °C, 10 cycles  |
| Salt spray test - Corrosion test   | ISO 16750-4 5.5.1   | T = 40 °C, 5 % sodium chloride solution, pH-Value 6.5-7.2, severity 4, 2 cycles (each 10 days)          |
| Salt spray test - Leakage and function test                              | ISO 16750-4 5.5.2   | T = 35 °C, 5 % sodium chloride solution, pH-Value 6.5-7.2, 6 cycles (each 24 h)                         |
| Composite temperature/humidity cyclic test                               | ISO 16750-4 5.6.2.3 | Tmin = -10 °C, Tmax = 65 °C, 95 % RH, 10 cycles (each 24 h)   |
| Dewing test  | ISO 16750-4 5.6.2.4 | Tmax = 80 °C, 95 % RH, 5 cycles (300 min)   |
| Damp heat, steady-state test   | ISO 16750-4 5.7     | (40 ±2) °C, (80 ±3) % RH, 21 days   |
| Corrosion test with flow of mixed gas                                    | ISO 16750-4 5.8     | IEC 60068-2-60, test Ke, method 4, 21 days  |
| Solar radiation  | ISO 16750-4 5.9     | ISO 4892-2, method A, cycle no. 1   |
| Protection against dust and water  | ISO 16750-4 7       | IP67 according ISO 20653  |
| <b>Electromagnetic specification</b>                                     |                     |   |
| Chemical resistance  | ISO 16750-5         | Chemical load codes: AD, CA, CD, CE, CF, CG, DA, DB, DC, DD, DE, DF, DG, DJ, DK, EA, EB, EC, ED, EE, EF |

## Approvals and conformities modules\*

| Test   | Standard     |           | Load   |
|--|--------------|-----------|--|
| <b>Electromagnetic compatibility tests</b>   |              |           |  |
| <b>(acc. ISO16750-2: supply voltage code min. B, max. F)</b>                                       |              |           |  |
| Electrostatic discharge (ESD)  | ISO 10605    | 8         | powered-up, up to $\pm 15$ kV, 10 pulses   |
| Electrostatic discharge (ESD)  | ISO 10605    | 9         | unpowered, up to $\pm 15$ kV, 10 pulses  |
| Electromagnetic disturbances (conducted)   | DIN EN 55025 | 6.3       |  |
| Electromagnetic disturbances (radiated emissions)  | DIN EN 55025 | 6.4       |  |
|  | ISO 11452-2  |           | 200MHz to 3.2 GHz, 100V/m, 66.7 mA to 200 mA, severity level IV  |
|  | ISO 11452-4  |           | 1 MHz to 400 MHz, 66.7 mA to 200 mA, severity level IV   |
|  | ISO 11452-5  |           | 10 kHz to 400 MHz, 200V/m, severity level IV   |
|  | ISO 11452-8  |           | 15 Hz to 30 kHz, 10 A/m to 600 A/m   |
|  | ISO 11452-9  |           | 26 MHz to 5.85 GHz, 1 W to 10 W  |
| <b>Electrical specifications</b>   |              |           |  |
| <b>(acc. ISO16750-2: supply voltage code min. B, max. F)</b>                                       |              |           |  |
| Direct current supply voltage  | ISO 16750-2  | 4.2       | 8V ... 32V   |
| Oversvoltage   | ISO 16750-2  | 4.3       | 36V, 60 min  |
| Superimposed alternating voltage   | ISO 16750-2  | 4.4       | $U_{\max} = 36V$ , $U_{PP} = 4V$ , 50 Hz - 20 kHz  |
| Slow decrease and increase of supply voltage   | ISO 16750-2  | 4.5       | $U_{\max} = 32V$ , $U_{\min} = 0V$ , 1 V/min   |
| Momentary drop in supply voltage   | ISO 16750-2  | 4.6.1     | $U_{Smin} = 8V$ , $U_{min} = 4,5V$ , $t = 100$ ms  |
| Reset behaviour at voltage drop  | ISO 16750-2  | 4.6.2     | $U_{Smin} = 8V$ , $U_{min} = 0V$ , thold_drop = 5 s  |
| Starting profile   | ISO 16750-2  | 4.6.3     | $U_N = 12V$ severity level II, $U_N = 24V$ severity level II,  |
| Load dump (Test A)   | ISO 16750-2  | 4.6.4.2.2 | 12V: $U_s = 101V$ ; $R_i = 4$ Ohm, $t_d = 400$ ms<br>24V: $U_s = 202V$ ; $R_i = 8$ Ohm, $t_d = 350$ ms |
| Load dump (Test B)   | ISO 16750-2  | 4.6.4.2.3 | 12V: $U_s = 101V$ ; $R_i = 4$ Ohm, $t_d = 400$ ms<br>24V: $U_s = 202V$ ; $R_i = 8$ Ohm, $t_d = 350$ ms |
| Reverse voltage  | ISO 16750-2  | 4.7       | -28V, 60s  |
| Ground reference and supply offset   | ISO 16750-2  | 4.8       | 28V, offset 1 V  |
| Single line interruption   | ISO 16750-2  | 4.9.1     | 28V, interruption 10s  |
| Multiple line interruption   | ISO 16750-2  | 4.9.2     | 28V, interruption 10s  |
| Short circuit protection   | ISO 16750-2  | 4.10      | 32V, $R_{i\_PSU} < 100$ mOhm, 60s  |
| Electrical transient conduction along supply lines   | ISO 7637-2   |           | Test pulses 1, 2a, 2b, 3a, 3b with severity level III  |
| Electrical transient transmission by capacitive and inductive coupling via lines other than supply | ISO 7637-3   |           | CCC test severity level IV<br>ICC test severity Level III  |

\* Available as of 2021.



## Approvals and conformities Universal Switch\*

| Test   | Standard    | Load  |
|--|-------------|---|
| <b>Mechanical specifications</b> (acc. ISO16750-3: mounting location codes D, E, F, G, K, L, R, S) |             |   |
| Vibration  | ISO 16750-3 | 4.1 Test IV, Test VII, Test VIII  |
| Tests for devices on doors or flaps  | ISO 16750-3 | 4.2.1 half-sinusoidal<br>Shock profile 1: 500m/s <sup>2</sup> , 11 ms, 13 000<br>Shock profile 2: 300m/s <sup>2</sup> , 6 ms, 100 000 |
| Tests for devices on rigid points on the body and on the frame                                     | ISO 16750-3 | 4.2.2 half-sinusoidal, 500m/s <sup>2</sup> , 6 ms, 10 shocks per direction  |
| Drop test  | ISO 16750-3 | 4.3 height: 1 m, 6 directions (±x, ±y, ±z), 2 falls per DUT (±direction)  |
| Mechanical lifetime test   |             | 250 000 cycles of operation (with temperature cycle, T <sub>min</sub> = -40 °C, T <sub>max</sub> = +80 °C)                            |
| <b>Environmental specifications</b> (acc. ISO 16750-4: temperature code F, climatic load code F)   |             |   |
| Low-temperature storage test   | ISO 16750-4 | 5.1.1.1 -40 °C, 24 h  |
| High-temperature storage test  | ISO 16750-4 | 5.1.2.1 +85 °C, 48 h  |
| Low-temperature operation test   | ISO 16750-4 | 5.1.1.2 -40 °C, 24 h  |
| High-temperature operation test  | ISO 16750-4 | 5.1.2.2 +80 °C, 96 h  |
| Temperature step test  | ISO 16750-4 | 5.2 T <sub>min</sub> = -40 °C, T <sub>max</sub> = +85 °C  |
| Temperature cycle with specified change rate   | ISO 16750-4 | 5.3.1 T <sub>min</sub> = -40 °C, T <sub>max</sub> = +85 °C, Profile Tab. 2, 30 cycles (each 480 min)                                  |
| Rapid change of temperature with specified transition duration                                     | ISO 16750-4 | 5.3.2 T <sub>min</sub> = -40 °C, T <sub>max</sub> = +85 °C, 100 cycles  |
| Ice water shock test - Splash water test   | ISO 16750-4 | 5.4.2 Tmax = +85 °C, 100 cycles   |
| Damp heat cyclic test  | ISO 16750-4 | 5.6.2.2 IEC 60068-2-30, Test Db, Variant 1, T <sub>max</sub> = 55 °C, 6 cycles  |
| Dewing test  | ISO 16750-4 | 5.6.2.4 T <sub>max</sub> = 80 °C, 95 % RH, 5 cycles (300 min)   |
| Damp heat, steady-state test   | ISO 16750-4 | 5.7 (40 ± 2) °C, (80 ± 3) % RH, 21 days   |
| Solar radiation  | ISO 16750-4 | 5.9 ISO 4892, method B  |
| Protection against dust and water  | ISO 16750-4 | 7 IP5K4 according to ISO 20653 (front)<br>IP20 according to ISO 20653 (back)  |
| Transport temperature range  |             | -40 °C ... 85 °C  |
| Humidity   |             | According to ISO 16750-4  |
| Quick temperature change   |             | According to ISO 16750-4  |
| UV-resistant   |             | ISO 4892 method B   |
| <b>Surface tests</b>   |             |   |
| Chemical resistance  | ISO 16750-5 | Chemical load codes: B, C (chemical agents: AD, CA, DA, DB, DC, DD, DF, DJ, DK, EB, EC, ED, EF)                                       |
| <b>Electromagnetic compatibility tests</b>   |             |   |
| ESD  | ISO 10605   | 9 Unpowered, up to ±15 kV, 10 pulses  |

\* Some validations are in progress.

01  
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## Approvals and conformities Universal Switch\*

| Test  | Standard    | Load |   |
|---|-------------|------|---|
| <b>Electrical performance tests</b> (acc. ISO16750-2: supply voltage code min. B, max. F) |             |      |   |
| Direct current supply voltage   | ISO 16750-2 | 4.2  | 8 V ... 32 V  |
| Overvoltage   | ISO 16750-2 | 4.3  | 36 V, 60 min  |
| Reverse voltage   | ISO 16750-2 | 4.7  | -28 V, 60 s   |
| Short circuit protection  | ISO 16750-2 | 4.10 | 32 V, Ri_PSU < 100 mOhm, 60 s   |
| Insulation resistance   | ISO 16750-2 | 4.12 | 500 V DC for 60 s between terminals and an electrode wrapped around the housing |
| <b>Approvals and Conformity</b>   |             |      |   |
| E1  | ECE R10     |      |   |
| E1  | ECE R118    |      |   |
| CE  | EMC         |      |   |

| Specifications                               | Parameters                                       |
|--|--|
| <b>Electrical specifications</b>             |  |
| Resistance opened                            | $R_{off} > 2 M\Omega$                            |
| Resistance closed sharp tactile feedback     | $R_{on} \leq 200 m\Omega$                        |
| Resistance closed soft tactile feedback      | $R_{on} \leq 10 \Omega$                          |
| Maximum switching capacity switching element | 1 VA   |
| Maximum voltage switching element            | 32 VDC   |
| Maximum switching current switching element  | 50 mA  |
| Minimal switching current switching element  | 1 mA   |
| <b>Materials</b>                             |  |
| UV-resistant                                 | According to ISO 4892-2 (06/2013) method B       |
| Chemical resistance                          | According to ISO 16750-5 (04/2010) code B and C  |
| Cap painting                                 | Paint system: laser decorative paint satin black |
| Painted surfaces                             | Paint resistance; T.B.D.                         |
| RoHS-compliant                               | RoHS directive 07/2019                           |
| REACH-compliant                              | REACH regulation 10/2019                         |
| GADSL-compliant                              | Covered with IMDS                                |
| <b>Illumination</b>                          |  |
| Colour backlight white                       | White at 28 VDC and 23 °C ± 2 K                  |
| Brightness colour backlight white            | $L_v \sim 20 \text{ cd/m}^2$                     |
| Colour indicator                             | Rot $\lambda_{dom} \sim 633 \text{ nm}$          |
| Brightness status indicator                  | $L_v \sim 200 \text{ cd/m}^2$                    |
| Colour backlight red                         | Rot $\lambda_{dom} \sim 630 \text{ nm}$          |
| Brightness colour backlight red              | $L_v \sim 90 \text{ cd/m}^2$                     |

## Radio slot frame

| Specifications  | Parameters                            |
|---|---------------------------------------|
| <b>Ambient conditions radio slot frame</b>                      |                                       |
| Service temperature   | -40 °C ... +85 °C                     |
| Storage temperature   | -40 °C ... +85 °C                     |
| Transport temperature   | -40 °C ... +85 °C                     |
| Chemical resistance   | According to ISO 16750-5 Code B and C |
| <b>Mechanical specifications radio slot frame</b>               |                                       |
| Vibration/shock in assembly with universal pushbutton and bezel | ISO 16750-3 4.1                       |
| <b>Ambient conditions bezel</b>                                 |                                       |
| Service temperature   | -40 °C ... +85 °C                     |
| Storage temperature   | -40 °C ... +85 °C                     |
| Transport temperature   | -40 °C ... +85 °C                     |
| <b>Mechanical specifications bezel</b>                          |                                       |
| Vibration/shock in assembly with universal pushbutton and bezel | ISO 16750-3 4.1                       |
| <b>Ambient conditions clamp</b>                                 |                                       |
| Service temperature   | -40 °C ... +85 °C                     |
| Storage temperature   | -40 °C ... +85 °C                     |
| Transport temperature   | -40 °C ... +85 °C                     |

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