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

- 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

- Rugged CAN Keypad
- Rugged CAN Rotary Cursor Controller

Degree of protection

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

Operating voltage

8-32 VDC

Standards

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

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

Functions

- Joystick
- Koordinatenschalter

Design

- Flush
- Raised

Front protection

- IP40
- IP65
- IP67

Operating voltage

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

Terminal

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

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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
PREMIUM 	White LED	4-Segment RGB	CANopen Safety	Electro-mechanical switching element	IP67 frontside and rear-side	Deutsch DT04-6P	Pushbutton	Functional safety ISO 26262 ASIL B and ISO 13849 PLD certified
SUPER 	White LED	4-Segment RGB	CANopen, J1939	Electro-mechanical switching element	IP67 frontside and rear-side	Deutsch DT04-6P	Pushbutton	Design for functional safety: ISO 26262 ASIL B and ISO 13849 PLD
PLUS 	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
BASIC 	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
PREMIUM 	White LED	4-Segment RGB (push-buttons)	CANopen Safety	Electro-mechanical switching element	IP67 frontside and rear-side	Deutsch DT04-6P	Pushbuttons: push RCC*: push, rotate, proportional input	Functional safety ISO 26262 ASIL B and ISO 13849 PLD certified*
SUPER 	White LED	4-Segment RGB (push-buttons)	CANopen, J1939	Electro-mechanical switching element	IP67 frontside and rear-side	Deutsch DT04-6P	Pushbuttons: push RCC*: push, rotate, proportional input	Design for functional safety: ISO 26262 ASIL B and ISO 13849 PLD
PLUS 	White LED	Red LED (push-buttons)	CANopen, J1939	Electro-mechanical switching element	IP67 frontside and rear-side	Deutsch DT04-6P	Pushbuttons: push RCC*: push, rotate, proportional input	Fulfils ASIL QM (B) according to ISO 26262

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



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

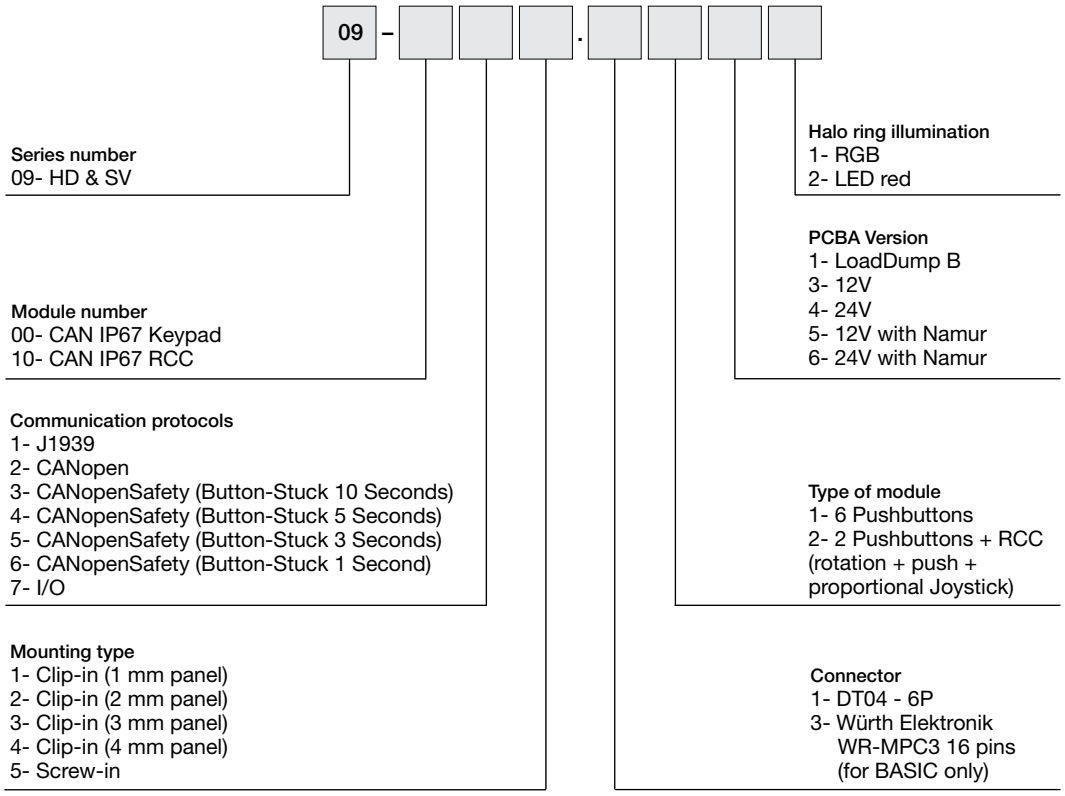
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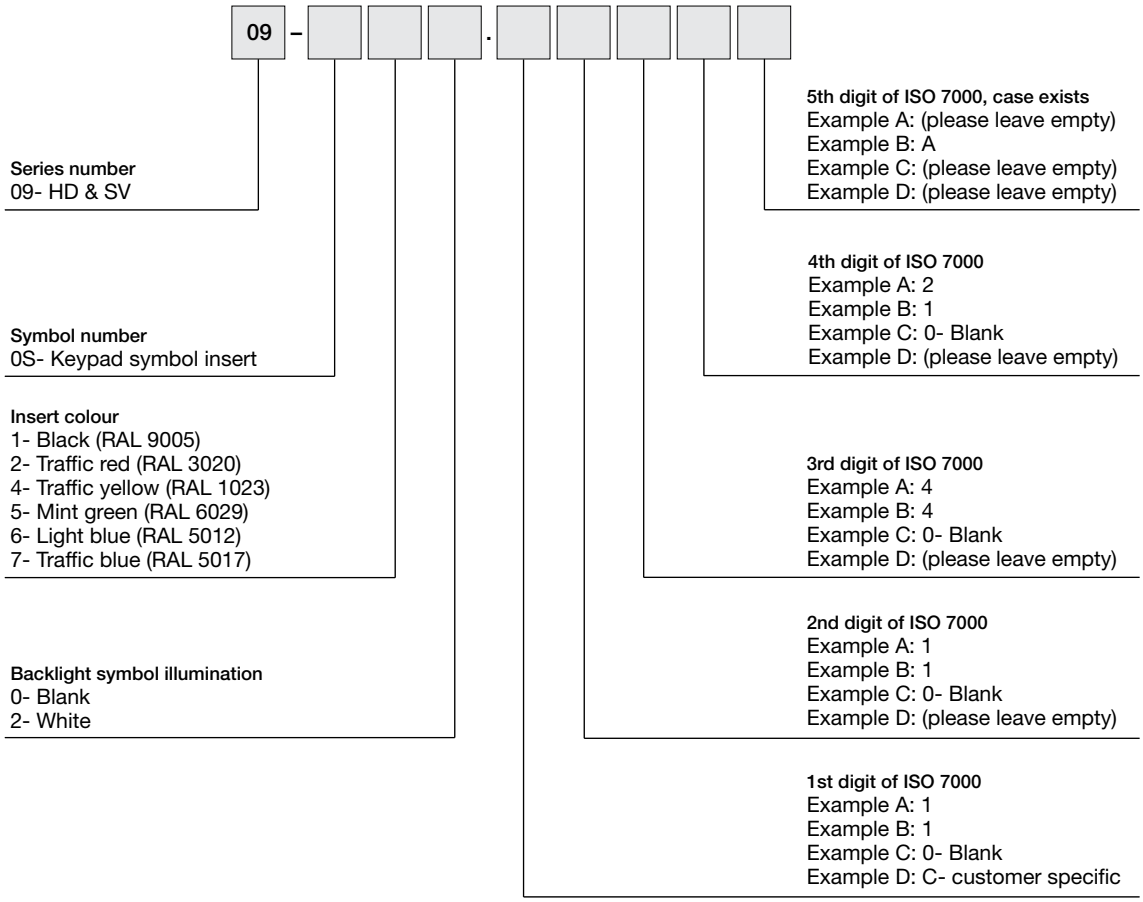
Part number structure Keypads and RCC Modules

Part No. module (12 digits)



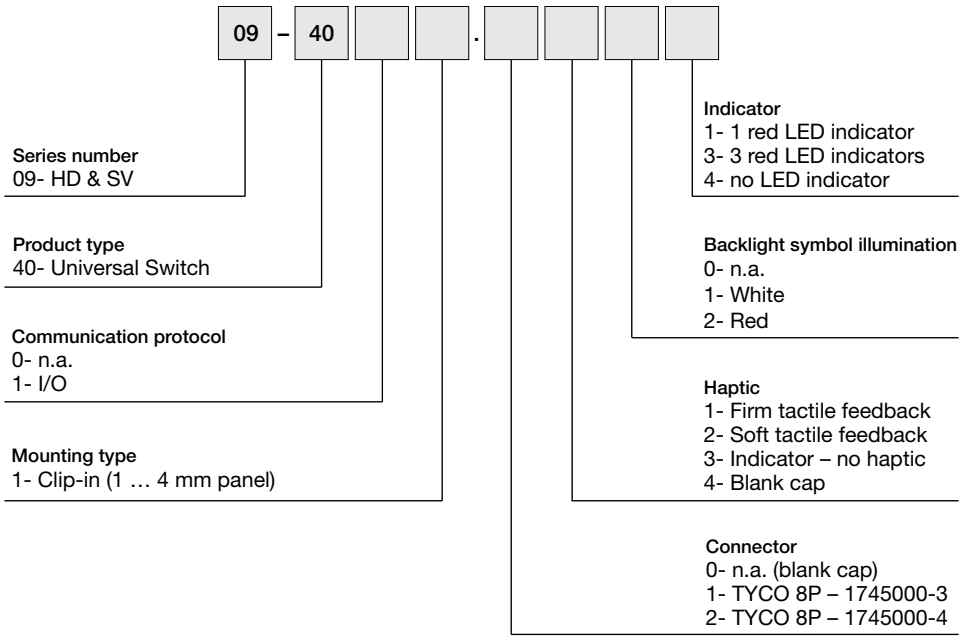
09 Numbering structure

Part No. symbols



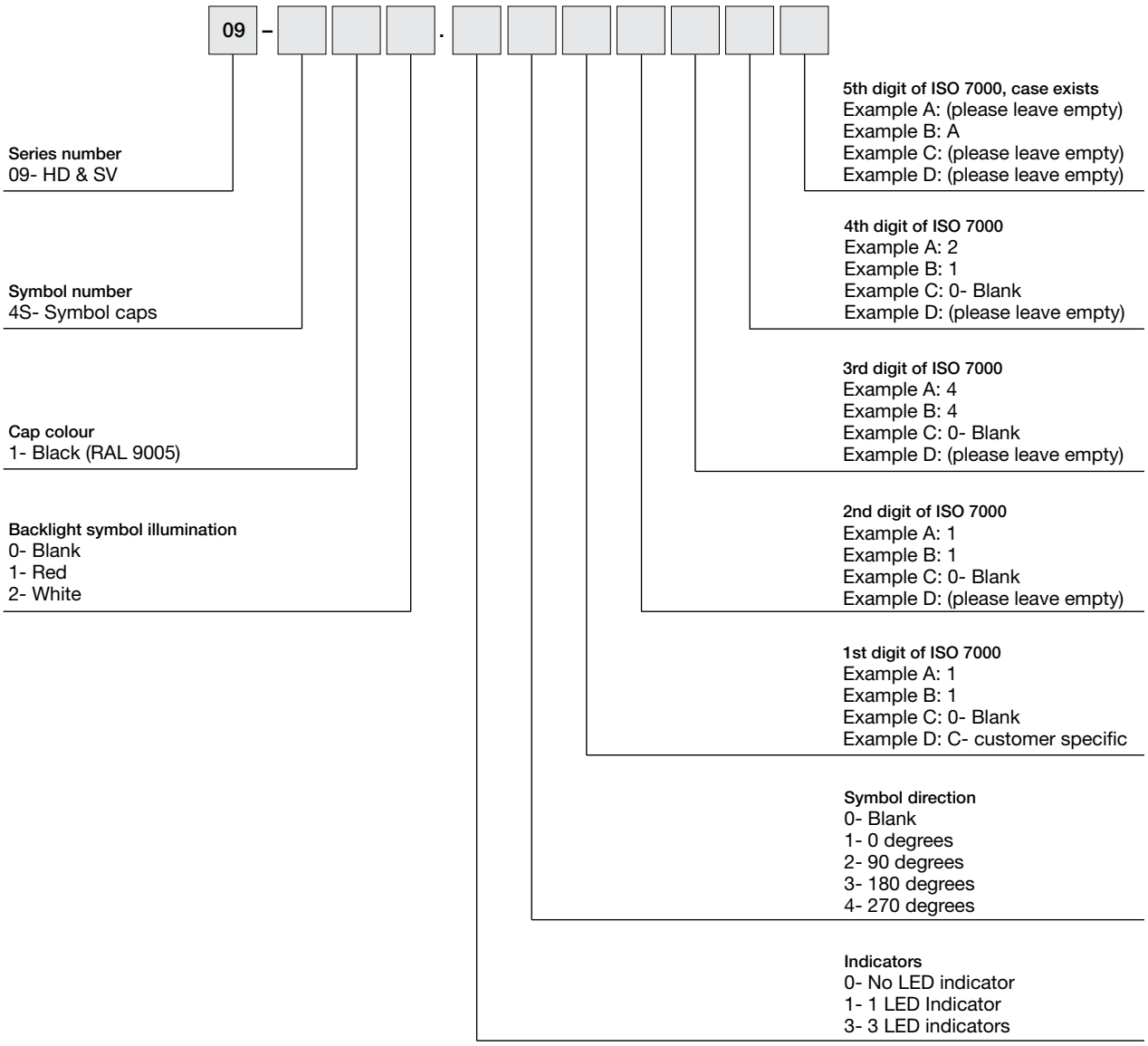
Part number structure Universal Switch

Part No. Universal Switch



09 Numbering structure

Part No. Caps



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/m², dimmable
- LED halo ring illumination with four segments
  – Multi-colour: RGB
  – Luminance: 1 500 cd/m²

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

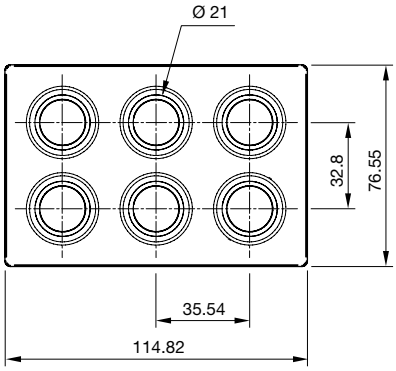
Connections/interfaces
- CAN interface (ISO 11898)
- CANopen Safety* (EN 50325-5),
- Baud rate 250 kBd and 500 kBd (software configurable)
- Connector Deutsch DT04-6P

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

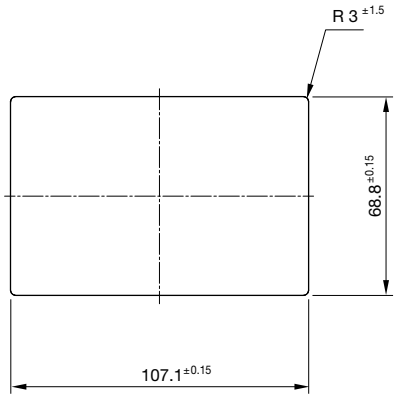
Ambient conditions
- Operating temperature: –40 °C … +85 °C
- Storage temperature: –40 °C … +85 °C

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

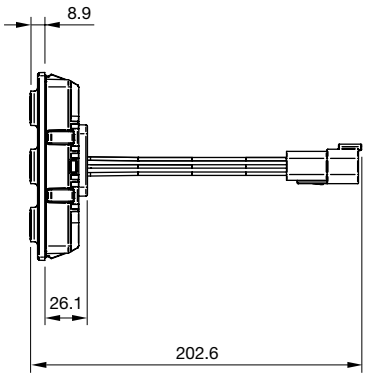
Dimensions
(All dimensions in mm)



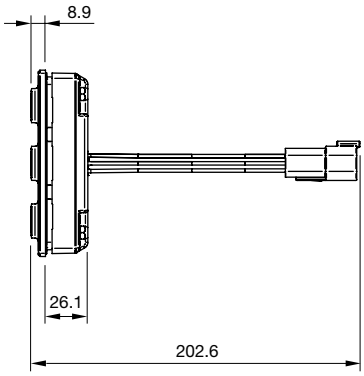
Mounting cut-out
(Panel thickness 1.0 mm … 4.0 mm)



Mounting
Clip-in mounting



Screw-in mounting



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/m², dimmable
- LED halo ring illumination with four segments
  – Multi-colour: RGB
  – Luminance: 1 500 cd/m²

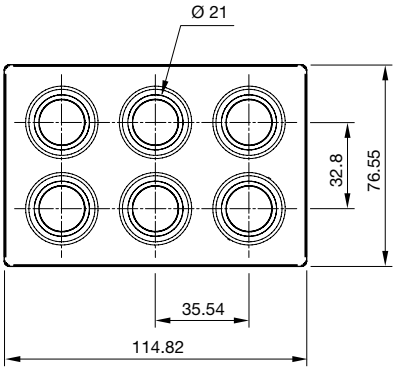
Symbols
- Symbols in accordance with ISO 7000
- Customer-specific symbols on request

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

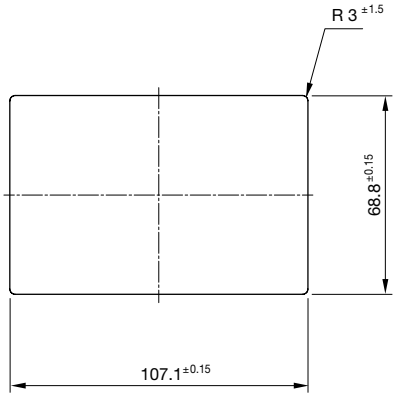
Ambient conditions
- Operating temperature: –40 °C … +85 °C
- Storage temperature: –40 °C … +85 °C

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

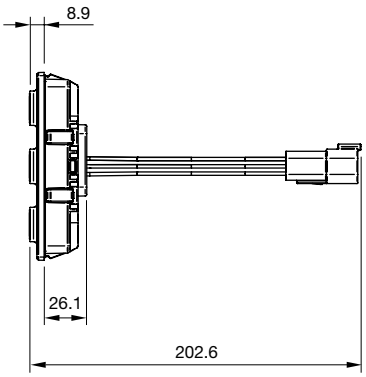
Dimensions
(All dimensions in mm)



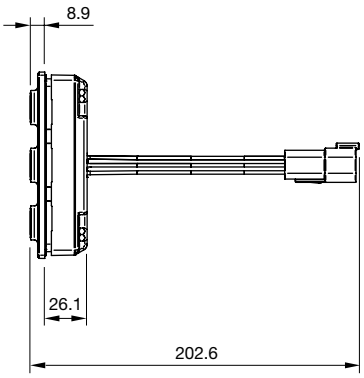
Mounting cut-out
(Panel thickness 1.0 mm … 4.0 mm)



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/m², dimmable
- LED halo ring illumination
  – Colour: red (other colours on request)
  – Luminance: 1 500 cd/m²

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

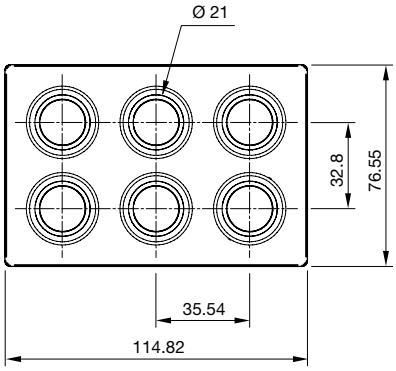
Connections/interfaces
- CAN interface (ISO 11898)
- CAN protocols: CANopen (CiA 401), CAN J1939
- Baud rate 250 kBd and 500 kBd (software configurable)
- Connector Deutsch DT04-6P

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

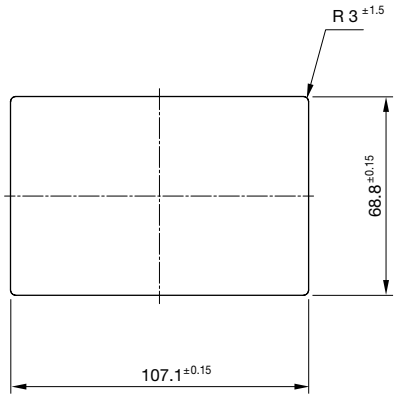
Ambient conditions
- Operating temperature: –40 °C … +85 °C
- Storage temperature: –40 °C … +85 °C

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

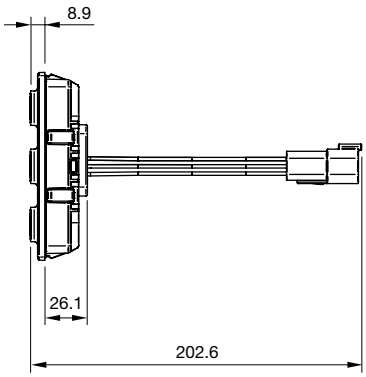
Dimensions
(All dimensions in mm)



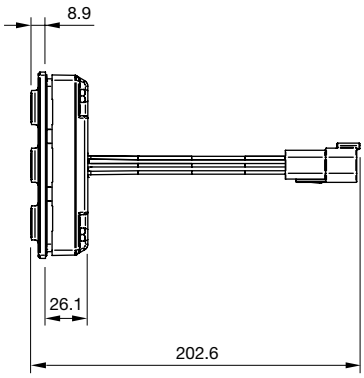
Mounting cut-out
(Panel thickness 1.0 mm … 4.0 mm)



Mounting
Clip-in mounting



Screw-in mounting



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/m², dimmable
- LED halo ring illumination
  – Colour: red (other colours on request)
  – Luminance: 1 500 cd/m²

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

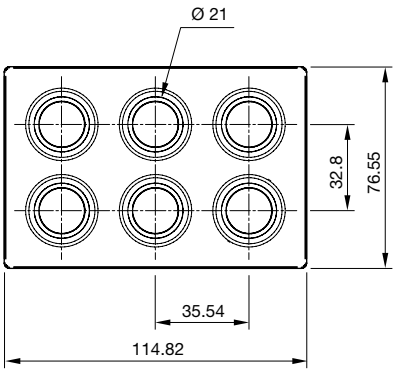
Connections/interfaces
- Connector: Würth Elektronik WR-MPC3, 16 Pins

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

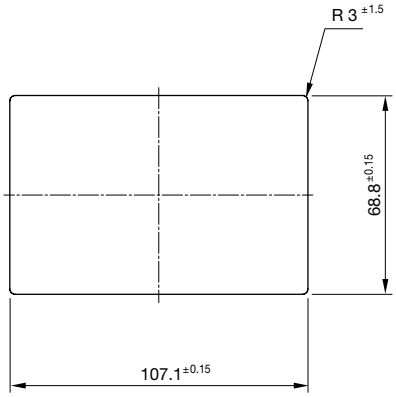
Ambient conditions
- Operating temperature: –40 °C … +85 °C
- Storage temperature: –40 °C … +85 °C

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

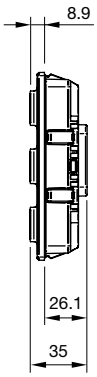
Dimensions
(All dimensions in mm)



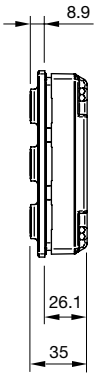
Mounting cut-out
(Panel thickness 1.0 mm … 4.0 mm)



Mounting
Clip-in mounting

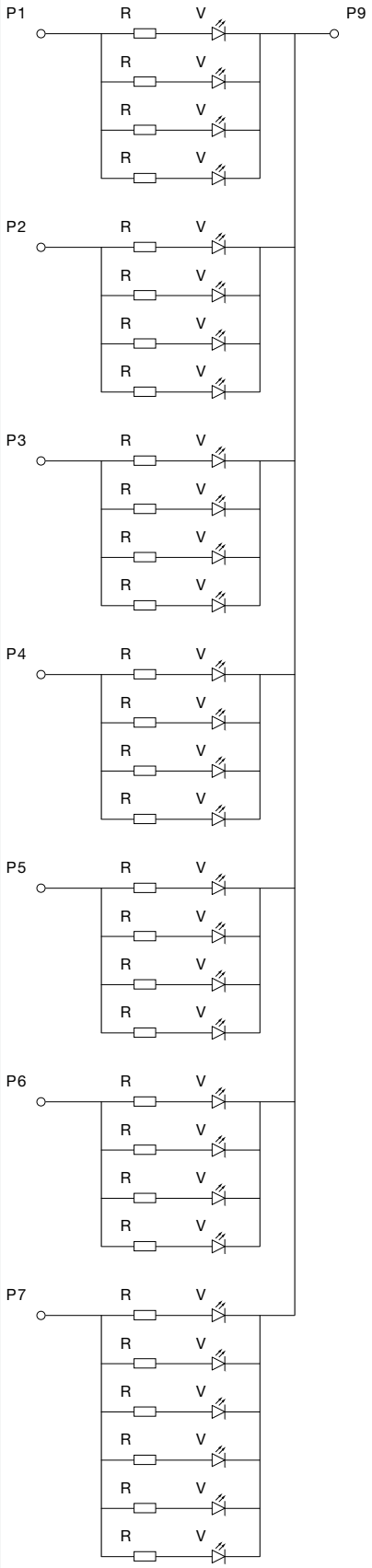


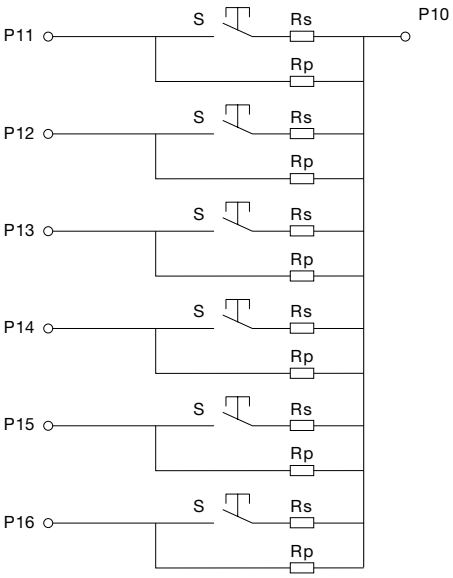
Screw-in mounting



Wiring diagram, connector

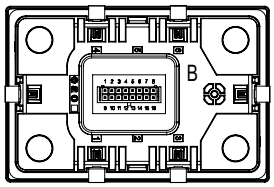
Wiring diagram

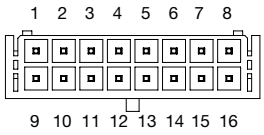




Rs = 0 Ω as standard
Rp = tbd

Connector





Connections WR-MPC3
Mating plug Molex 430251600
Matching contacts 43030-0007

Pin No.	Signal	Comment
Pin 1	Supply voltage haloring	12 VDC / 24 VDC
Pin 2	Supply voltage haloring	12 VDC / 24 VDC
Pin 3	Supply voltage haloring	12 VDC / 24 VDC
Pin 4	Supply voltage haloring	12 VDC / 24 VDC
Pin 5	Supply voltage haloring	12 VDC / 24 VDC
Pin 6	Supply voltage haloring	12 VDC / 24 VDC
Pin 7	Supply voltage symbol	12 VDC / 24 VDC
Pin 8	n. c.	
Pin 9	GND lighting	
Pin 10	Common potential buttons	
Pin 11	Signal button 1	max. current 30 mA
Pin 12	Signal button 2	max. current 30 mA
Pin 13	Signal button 3	max. current 30 mA
Pin 14	Signal button 4	max. current 30 mA
Pin 15	Signal button 5	max. current 30 mA
Pin 16	Signal button 6	max. current 30 mA

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: 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: ~5°

Electrical characteristics
- Operating voltage range: 8–32 VDC

* 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. 20 cd/m², dimmable
- LED halo illumination
  – Multi-colour: RGB (buttons and RCC)
  – Luminance: 1 500 cd/m² (buttons)
  – Four segments on buttons

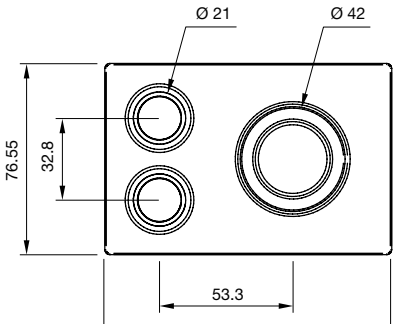
Symbols (on pushbuttons, RCC without symbol)
- Symbols in accordance with ISO 7000
- Customer-specific symbols on request

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

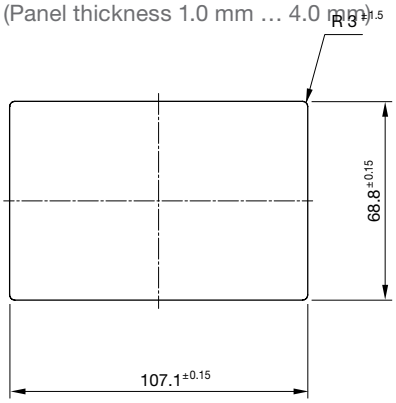
Ambient conditions
- Operating temperature: –40 °C … +85 °C
- Storage temperature: –40 °C … +85 °C

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

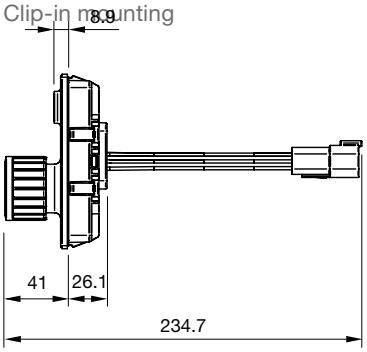
Dimensions
(All dimensions in mm)



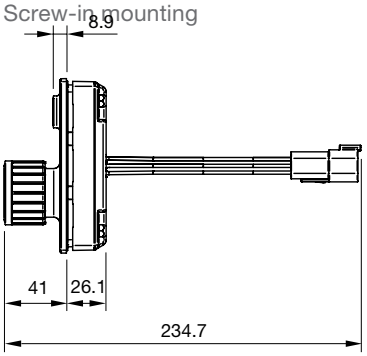
Mounting cut-out
(Panel thickness 1.0 mm … 4.0 mm)



Mounting
Clip-in mounting



Screw-in mounting



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: ~ 5°

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/m², dimmable
- LED halo illumination
  - Multi-colour: RGB (buttons and RCC)
  - Luminance: 1 500 cd/m² (buttons)
  - Four segments on buttons

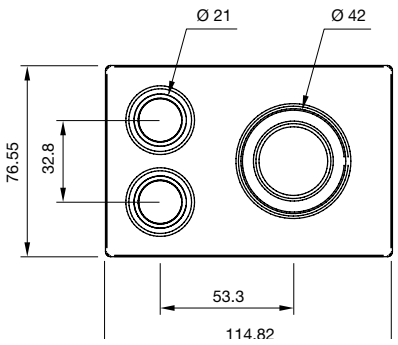
Symbols (on pushbuttons, RCC without symbol)
- Symbols in accordance with ISO 7000
- Customer-specific symbols on request

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

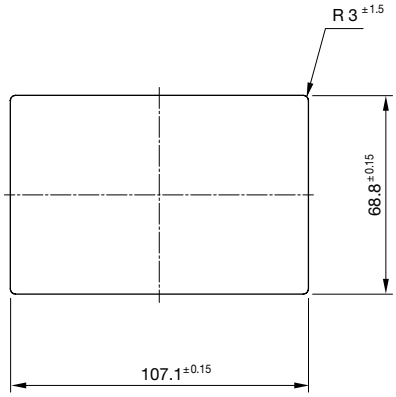
Ambient conditions
- Operating temperature: –40 °C … +85 °C
- Storage temperature: –40 °C … +85 °C

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

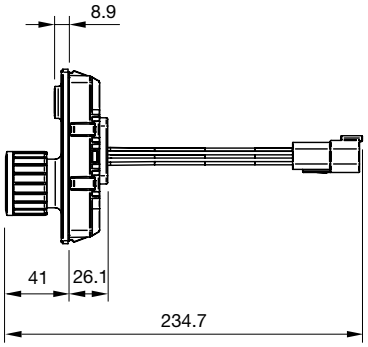
Dimensions
(All dimensions in mm)



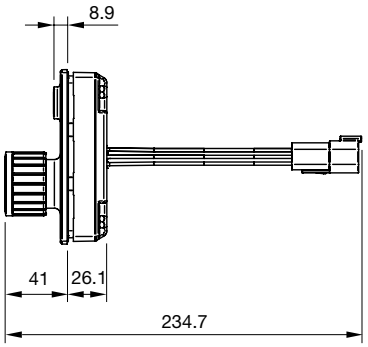
Mounting cut-out
(Panel thickness 1.0 mm … 4.0 mm)



Mounting
Clip-in mounting



Screw-in mounting



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: 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: ~5°

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/m², dimmable
- Halo ring illumination
  – Colour: red
  – luminance: 1500 cd/m² (buttons)
  – Four segments on buttons

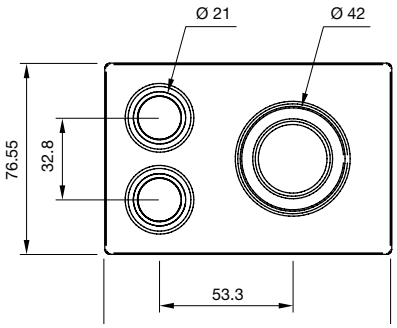
Symbols (on pushbuttons, RCC without symbol)
- Symbols in accordance with ISO 7000
- Customer-specific symbols on request

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

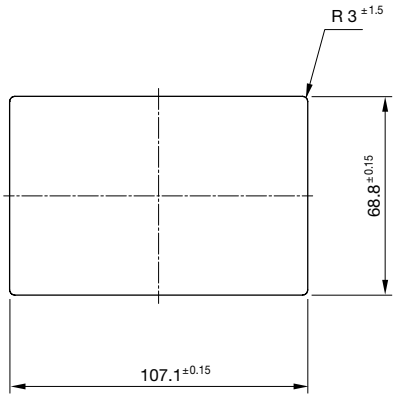
Ambient conditions
- Operating temperature: –40 °C … +85 °C
- Storage temperature: –40 °C … +85 °C

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

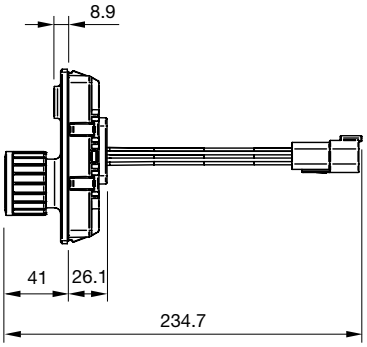
Dimensions
(All dimensions in mm)



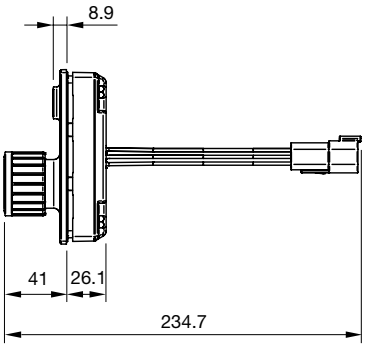
Mounting cut-out
(Panel thickness 1.0 mm … 4.0 mm)



Mounting
Clip-in mounting

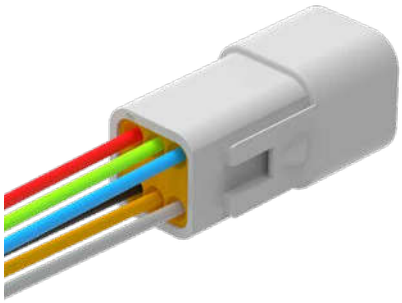


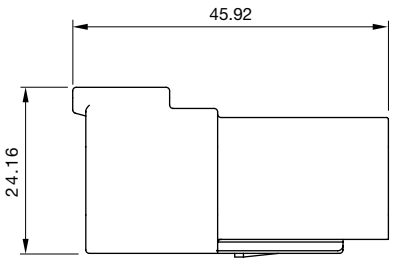
Screw-in mounting

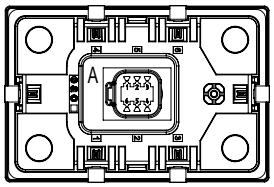


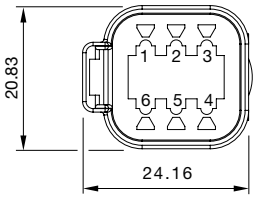
Accessories

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 – 32 VDC

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.

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 12 VDC and 24 VDC vehicle electrical system
- Maximum power*: 1 VA
- Maximum current*: 50 mA
- Minimum current*: 1 mA
- Contact resistance*: < 10 Ω
- 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/m² at 28 VDC and 23 °C ± 2 °K
- Colour: red (for hazard warning light) with luminance: ~ 90 cd/m² at 28 VDC and 23 °C ± 2 °K

LED status indicator

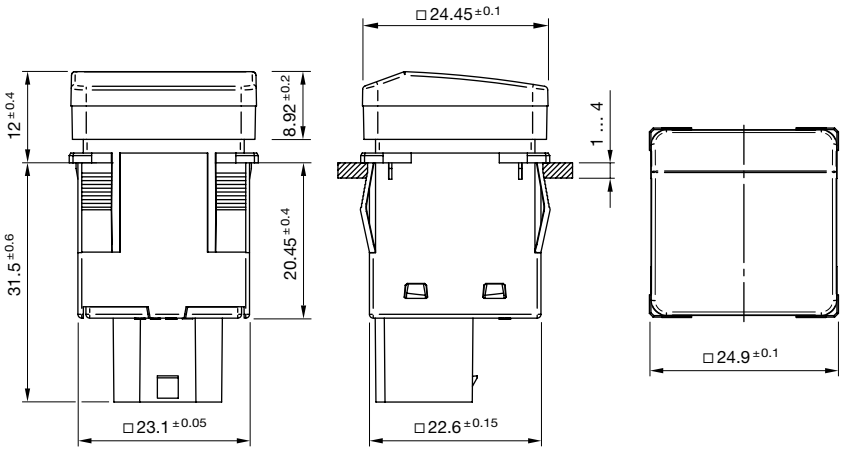
- Colour: Red
- Luminance: ~ 200 cd/m² at 28 VDC and 23 °C ± 2 °K

Symbols

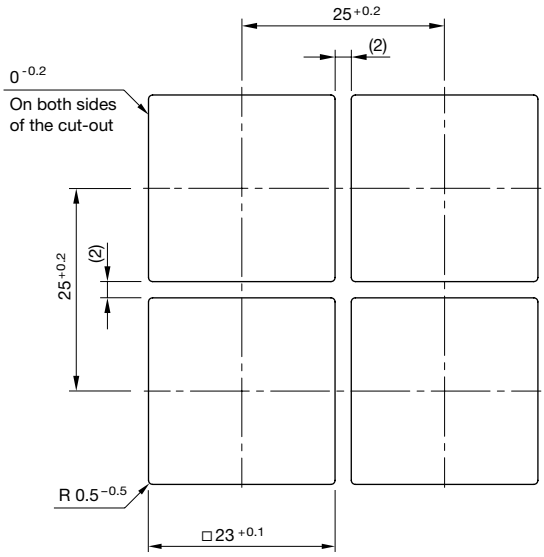
- Symbols in accordance with ISO 7000
- Customer-specific symbols on request

Dimensions

(All dimensions in mm)



Mounting cut-outs



Connections/interfaces

- Hardwired with integrated connector recess

Environmental conditions

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

Protection degree

- IP5K4 front side (mounted into panel)
- IP20 rear side (mounted into panel)

Approvals and conformities

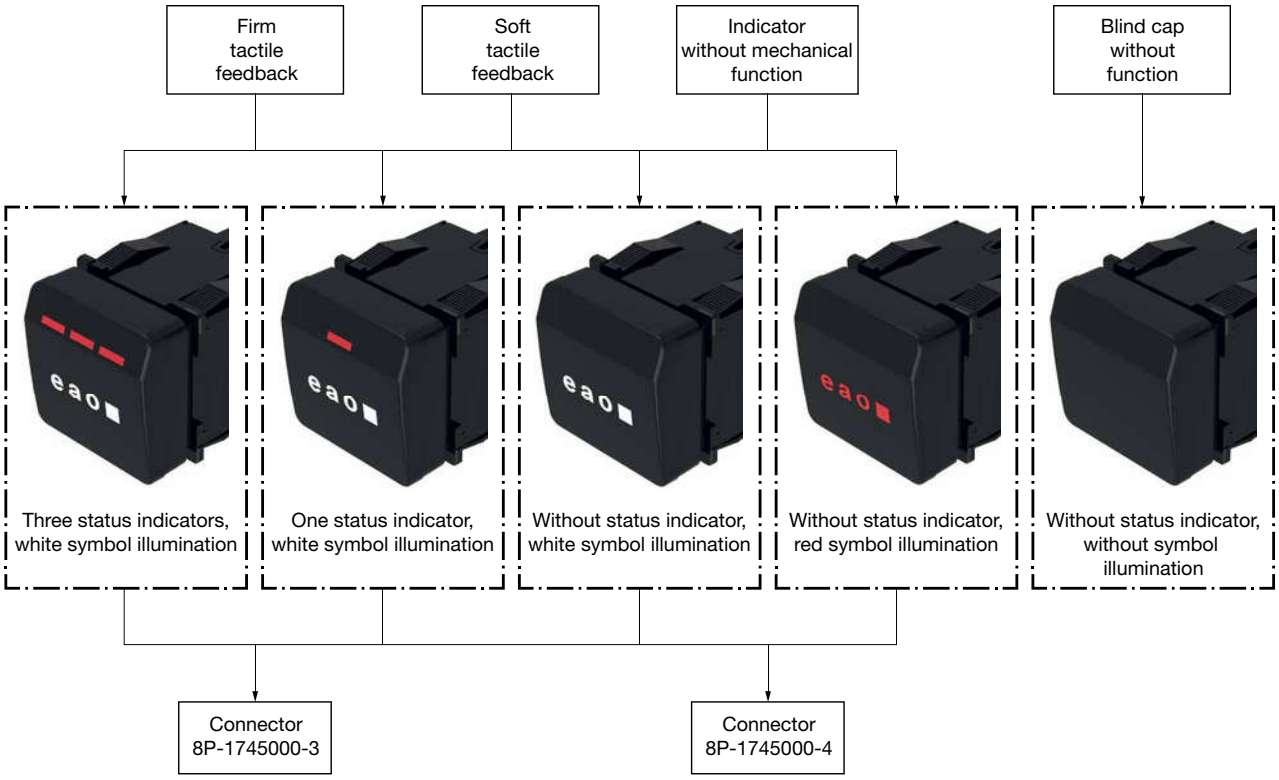
- E1 (ECE R10, ECE R118)
- CE
- UL

Please note

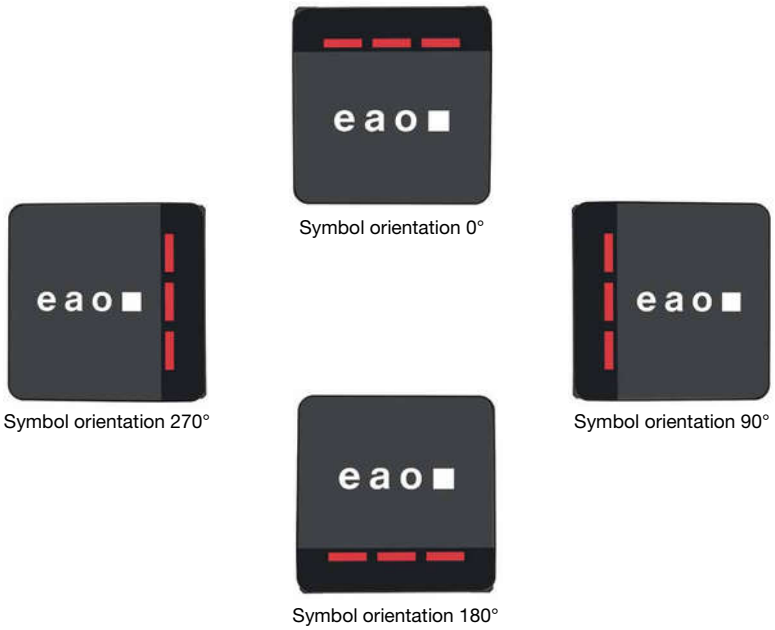
- The view shows the minimum possible distance between the cut-outs for two universal switches
- Another mounting option is using the mounting frame that fits into radio slot according to DIN ISO 7736

Options

Product options

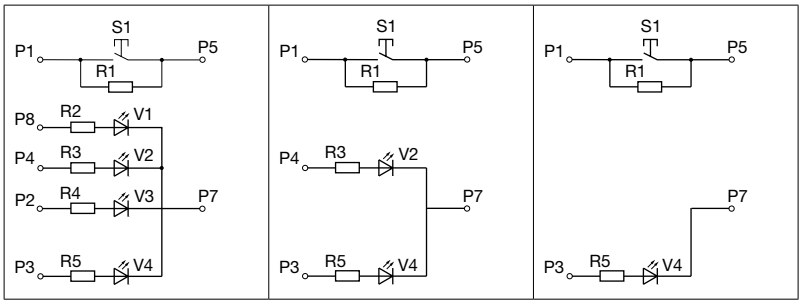


Options of the symbol orientation



Wiring diagrams

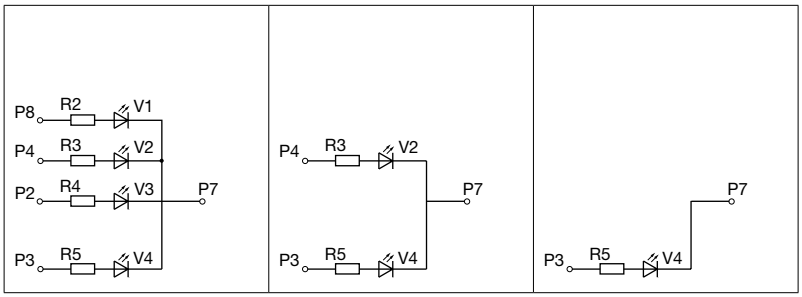
Wiring diagrams



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

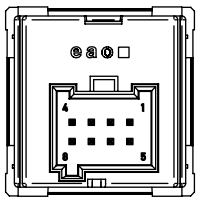
Backlight

Please note

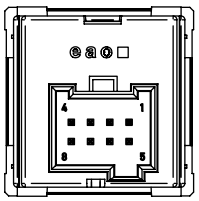
R1 not placed as standard.

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 mm²), 928999-1 (0.25 – 0.35 mm²)

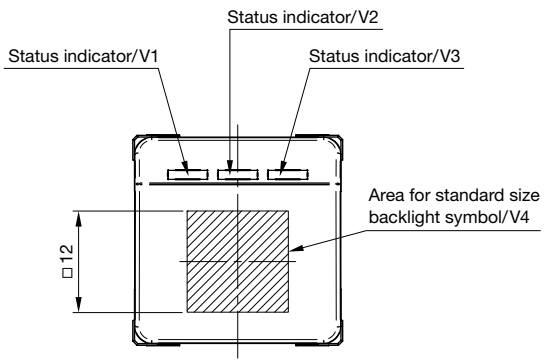


Connector
8P-1745000-3



Connector
8P-1745000-4

Illumination specification



Haptic specifications

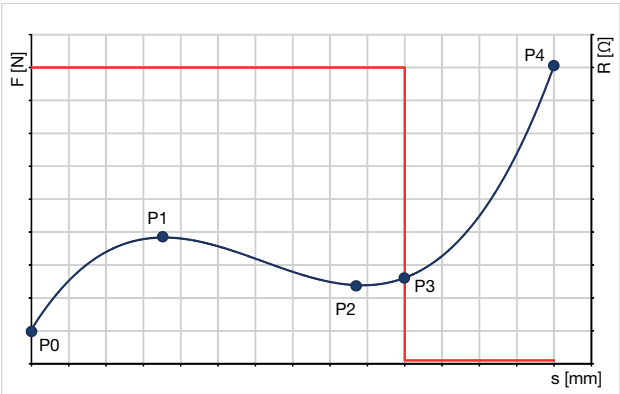
Universal switch with firm tactile feedback



Parameters
P0: F_0 ~ 2 N
P1: s_1 ~ 0.65 mm / F_1 ~ 6 N
P2: s_2 ~ 0.775 mm / F_2 ~ 4 N
P3: s_3 ~ 1.4 mm / F_3 ~ 10 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 ~ 2N
P1: s_1 ~ 0.3 mm / F_1 ~ 5 N
P2: s_2 ~ 0.65 mm / F_2 ~ 2,5 N
P3: s_3 ~ 0.825 mm / F_3 ~ 3 N
P4: s_4 ~ 1.4 mm / F_4 ~ 10 N

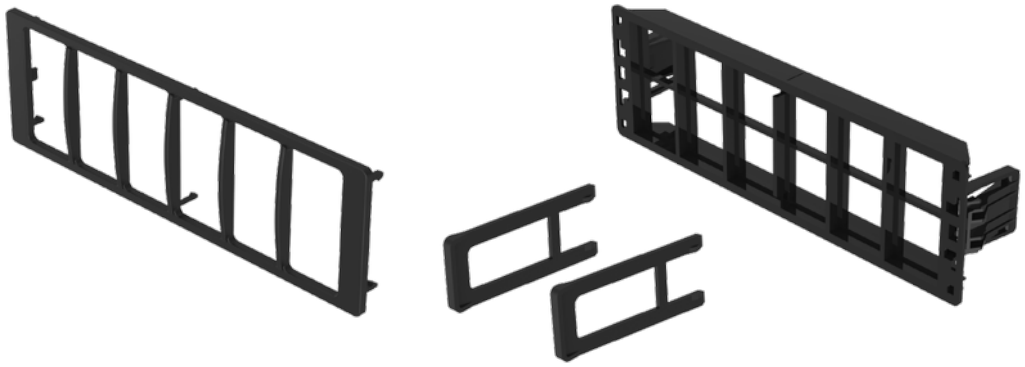
S_n: travel at point P_n
F_n: force at point P_n

Please note

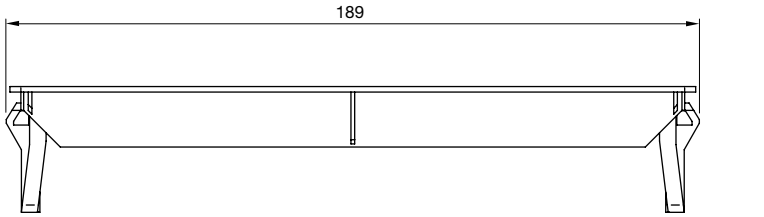
The customer must ensure the functional and product safety compliance of the integration. The customer must perform all safety activities on the integration level and confirm that no functional safety requirements have been derived from the integration with the HMI.

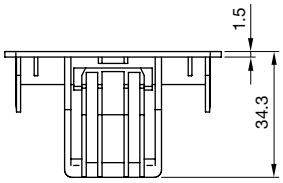
As a consequence, no functional safety requirements have been assigned to the HMI. The customer should be aware that the HMI has been developed according IATF 16949 and fulfils the ISO 26262 classification of a QM level.

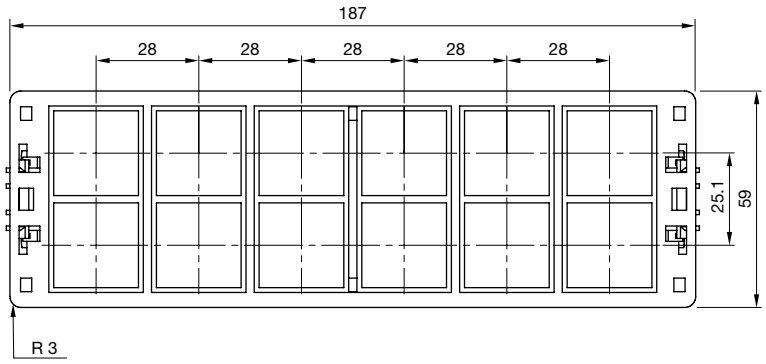
Radio slot frame

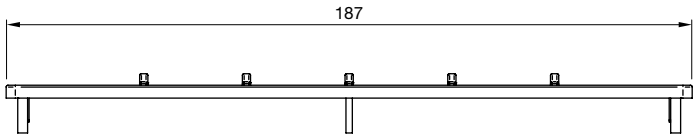


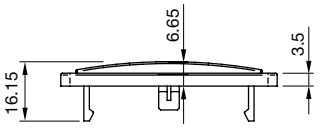
Dimensions

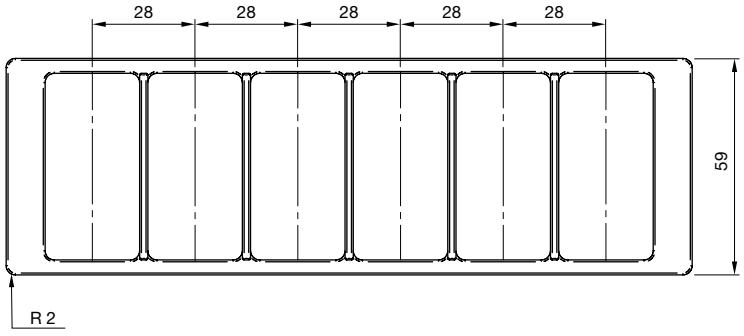


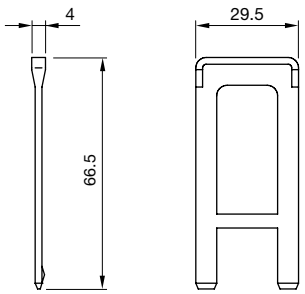












All dimensions in mm.
The radio slot frame is always customer specific and the above dimensions are an example only.

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/m²
- Colour red with luminance
  ~90 cd/m²

LED status indicator
- Colour
  Red
- Luminance
  ~600 cd/m²

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

Connections/interfaces
- LIN interface

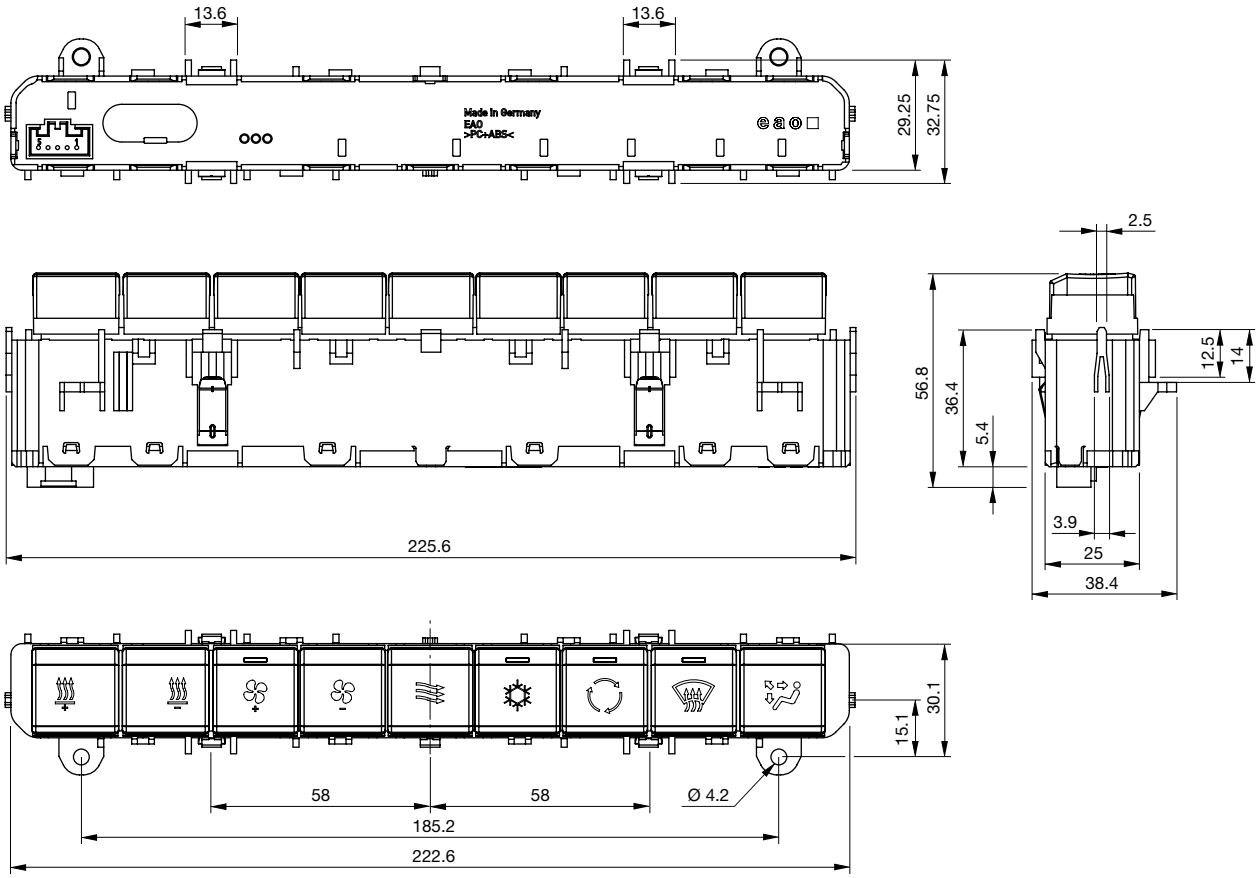
Ambient conditions
- Operating temperature
  –40 °C … +85 °C
- Storage temperature
  –40 °C … +85 °C

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

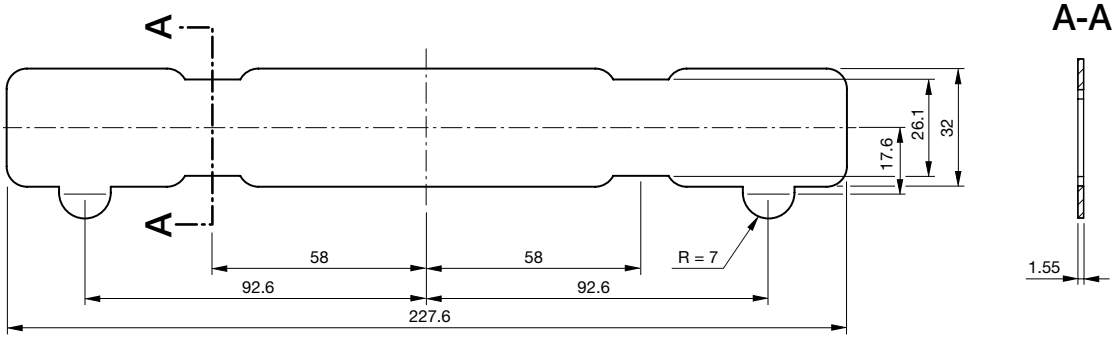
Approvals and conformities
- E1 R10
- E1 R118
- CE

09 LIN Switch Panel

Dimensions

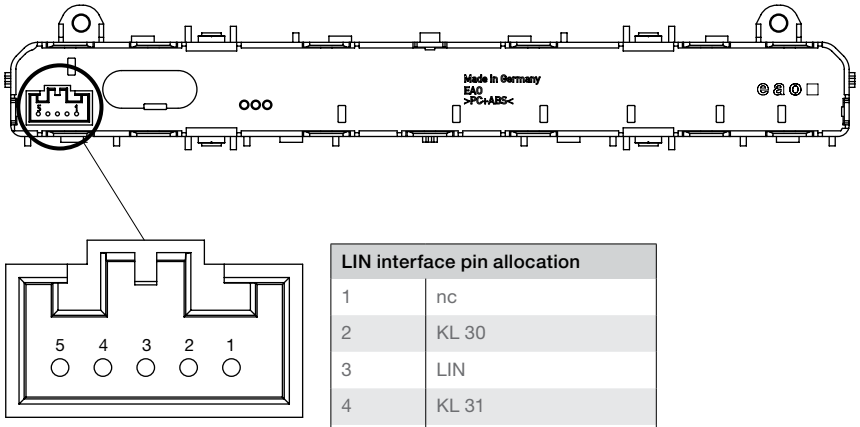


Mounting cut-out (clip-in version)



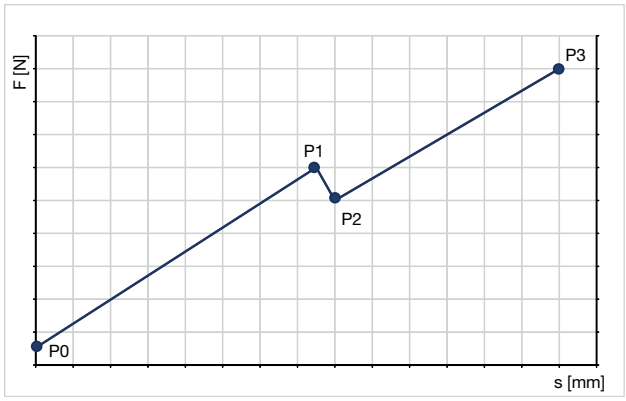
All dimensions in mm.
Dimensional tolerance according to DIN 16472 – TGS/2768-mk.

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 ~ 1 N
P1: s_1 ~ 0.65 mm / F_1 ~ 5 N
P2: s_2 ~ 0.75 mm / F_2 ~ 4 N
P3: s_3 ~ 1.35 mm / F_3 ~ 10 N

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

Please note

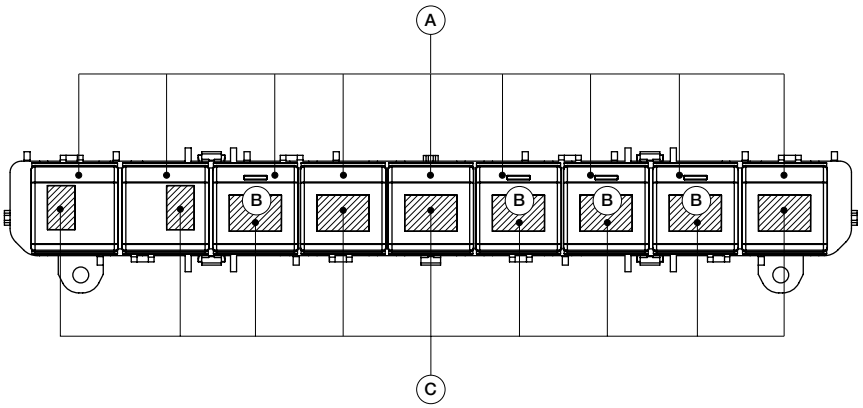
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As a consequence, no functional safety requirements have been assigned to the HMI. The customer should be aware that the HMI has been developed according IATF 16949 and fulfils the ISO 26262 classification of a QM level.

09 LIN Switch Panel

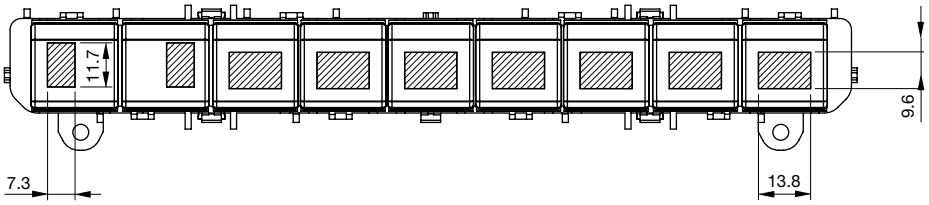
Illumination specifications

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/m²	~20 cd/m²	~20 cd/m²	~20 cd/m²	~90 cd/m²	~20 cd/m²	~20 cd/m²	~20 cd/m²	~20 cd/m²
Indicator colour (optional)	–	–	red	–	–	red	red	red	–
Indicator brightness (optional)	–	–	~600 cd/m²	–	–	~600 cd/m²	~600 cd/m²	~600 cd/m²	–

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
  (Ø3.5 mm)
- 1 axis
- No cross guidance
- No gate shape
- 20° 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
  5 VDC
- Output signal
  proportional (–y = 0.5 V/
  Mid = 2.5 V/+y = 4.5 V)
- Redundancy
  yes

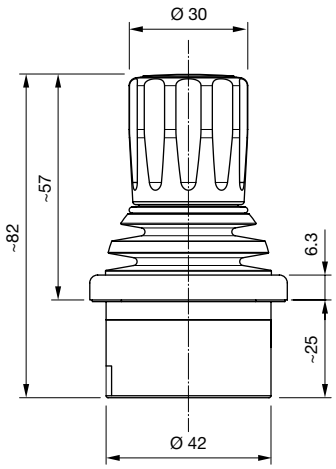
Technology
- Hall effect sensors

Connections
- Minitek plug (8-pole)

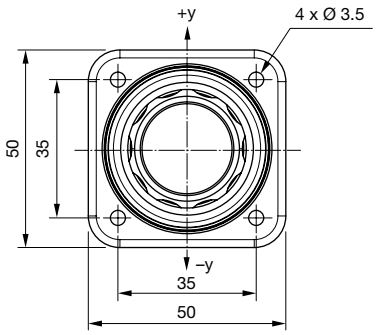
Ambient conditions
- Operating temperature
  –30 °C to +80 °C
- Storage temperature
  –40 °C to +85 °C

Degree of protection
- IP65 front protection
- IP40 rear protection

Dimensions



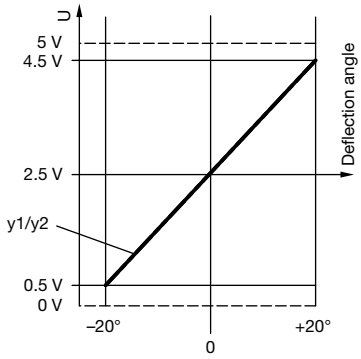
View from above



Gate



Diagram Y-axis



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: ±20°/Z: ±30°
- 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 = 0.5 V/
  Mid = 2.5 V/+x/y/z = 4.5 V)
- Redundancy
  all axes

Technology
- Hall effect sensors

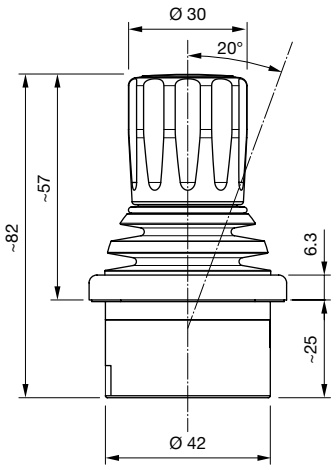
Connections
- Minitek plug (8-pole)

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

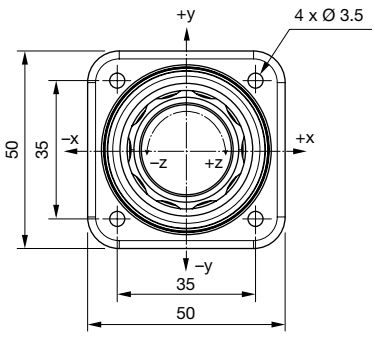
Degree of protection
- IP65 front protection
- IP40 rear protection



Dimensions



View from above



Gate

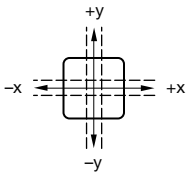


Diagram X-, Y-axis

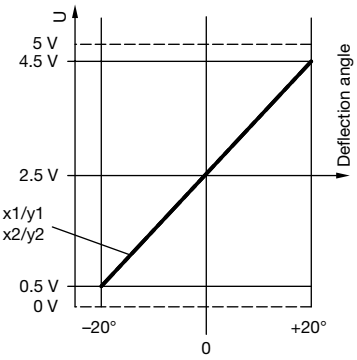
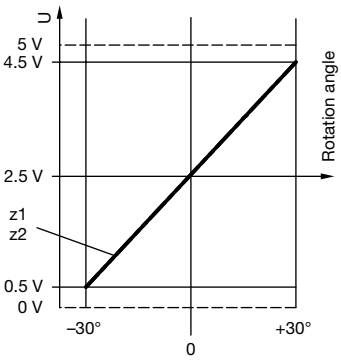


Diagram Z-axis



Joystick, small and beautiful

Part No.
09-01.22224.0128



Mechanical characteristics
- Mounting
  from above, four screws (Ø 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
  5 VDC
- Output signal
  proportional (–x1/y1 = 0.5 V/average = 2.5 V/+x1/y1 = 4.5 V) (–x2/y2 = 4.5 V/average = 2.5 V/+x2/y2 = 0.5 V)
- Redundancy
  all axes

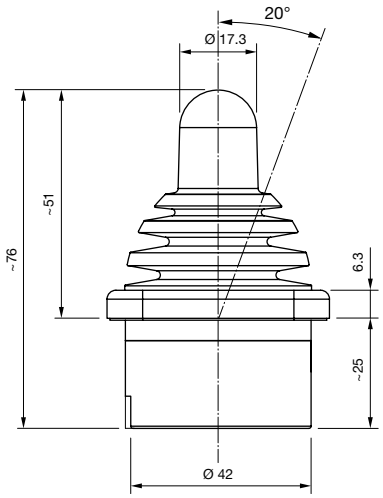
Technology
- Hall effect sensors

Connections
- Minitek plug (8-pole)

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

Degree of protection
- IP67 front protection
- IP40 rear protection

Dimensions



Gate

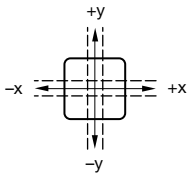
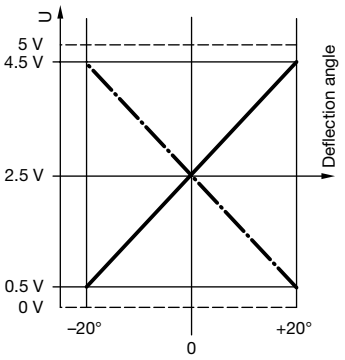
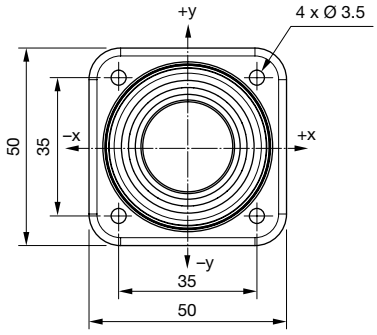


Diagram X-, Y-axis



View from above



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. 30 VDC
- Output signal
  proportional with centre tab at ±1.75°, switch point at ±2.3° (see diagram X-, Y-axis)

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

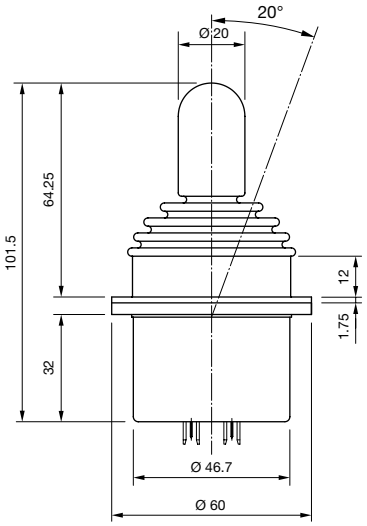
Connections
- Dubox plug (6- and 8-pole)

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

Degree of protection
- IP67 front protection
- IP40 rear protection



Dimensions



Gate

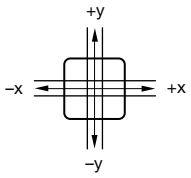
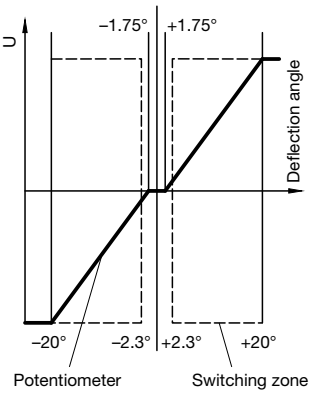
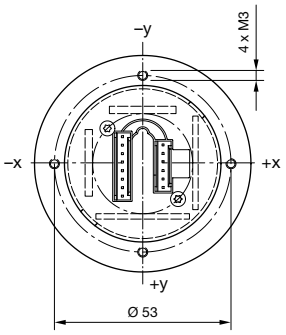


Diagram X-, Y-axis



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

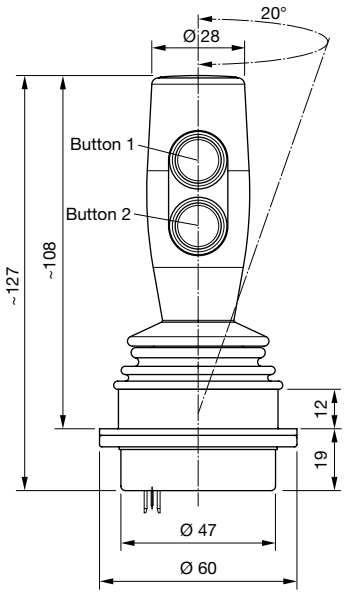
Connections
- Dubox plug (4-pole)

Interfaces
- CANopen/J1939 interface

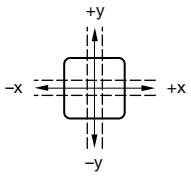
Ambient conditions
- Operating temperature
  –30 °C to +80 °C
- Storage temperature
  –40 °C to +85 °C

Degree of protection
- IP65 front protection
- IP40 rear protection

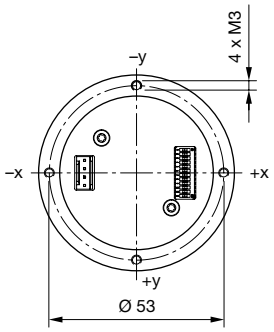
Dimensions



Gate



Bottom view



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 mm²
  Molex Micro-Fit (4-pole)

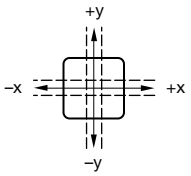
Interfaces
- CANopen/J1939 interface

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

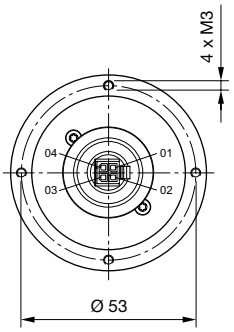
Degree of protection
- IP65 front protection
- IP40 rear protection



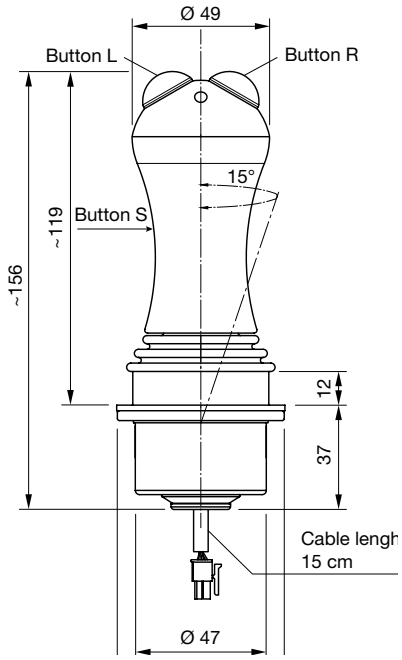
Gate



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 ±3.33°

Technology
- Digital grid/switching segment 3-1-3

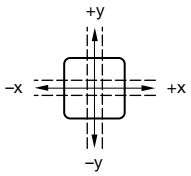
Connections
- Dubox plug (2 and 8-pole)

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

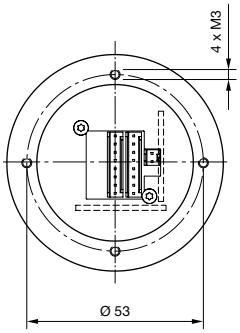
Degree of protection
- IP65 front protection
- IP40 rear protection



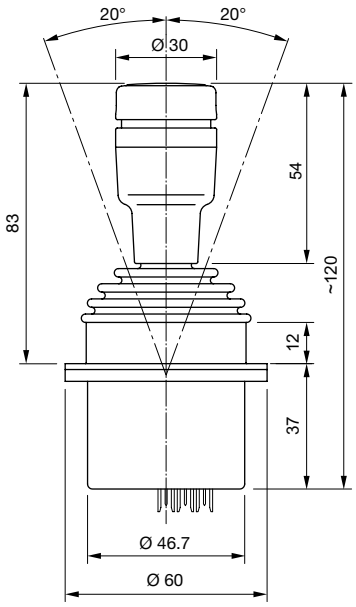
Gate



Bottom view



Dimensions



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. 30 VDC
- 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



Gate

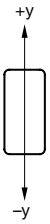
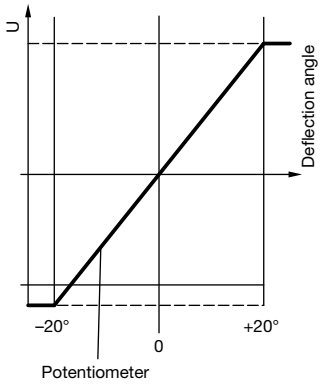
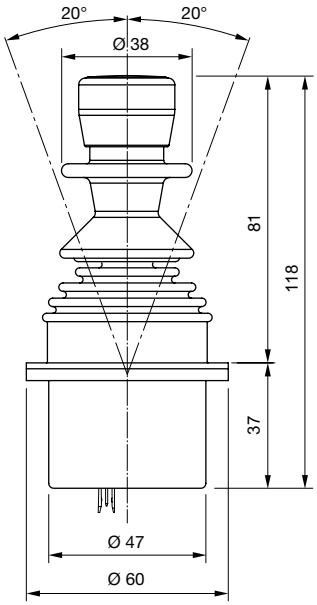


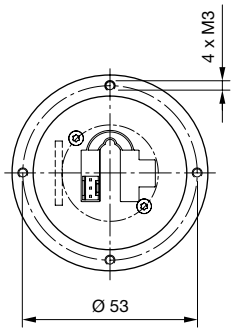
Diagram Y-axis



Dimensions



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

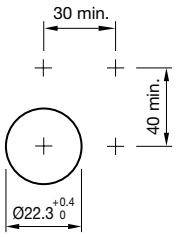
Ambient conditions
- Operating temperature
  –25 °C to +70 °C
- Storage temperature
  –40 °C to +85 °C

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

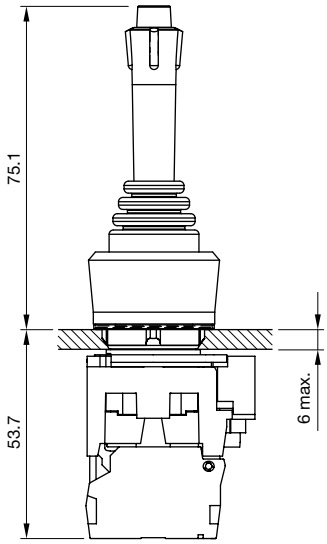
Configure your product in a few steps at eao.com/products.



Mounting cut-outs



Dimensions



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
  5 A / 4 NC + 4 NO
- Contact material
  gold-plated silver alloy

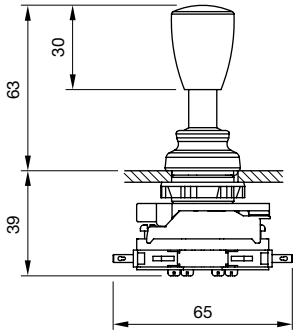
Ambient conditions
- Operating temperature
  −30 °C to +80 °C
- Storage temperature
  −40 °C to +85 °C

Degree of protection
- IP65 front protection
- IP20, IP40 rear protection

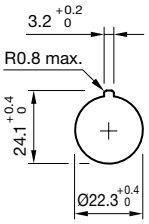
A choice of three lever switches can be found at eao.com/products.



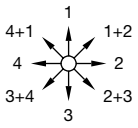
Dimensions



Mounting cut-outs



Wiring diagram



Approvals and conformities modules*

Test	Standard		Load
Mechanical specifications	**(acc. ISO16750-3: mounting location codes D, E, F, G, K, L, R, S)**		
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, 300 m/s², 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, 500 m/s², 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
Environmental specifications	**(acc. ISO16750-4: temperature code G, climatic load code H)**		
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
Electromagnetic specification			
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
Electromagnetic compatibility tests	**(acc. ISO16750-2: supply voltage code min. B, max. F)**		
Electrostatic discharge (ESD)	ISO 10605	8	powered-up, up to ± 15 kV, 10 pulses
Electrostatic discharge (ESD)	ISO 10605	9	unpowered, up to ± 15 kV, 10 pulses
Electromagnetic disturbances (conducted)	DIN EN 55025	6.3	
Electromagnetic disturbances (radiated emissions)	DIN EN 55025	6.4	
	ISO 11452-2		200 MHz to 3.2 GHz, 100 V/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, 200 V/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
Electrical specifications	**(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
Superimposed alternating voltage	ISO 16750-2	4.4	U_{max} = 36 V, U_{PP} = 4 V, 50 Hz - 20 kHz
Slow decrease and increase of supply voltage	ISO 16750-2	4.5	U_{max} = 32 V, U_{min} = 0 V, 1 V/min
Momentary drop in supply voltage	ISO 16750-2	4.6.1	U_{Smin} = 8 V, U_{min} = 4,5 V, t = 100 ms
Reset behaviour at voltage drop	ISO 16750-2	4.6.2	U_{Smin} = 8 V, U_{min} = 0 V, thold_drop = 5 s
Starting profile	ISO 16750-2	4.6.3	U_N = 12 V severity level II, U_N = 24 V severity level II,
Load dump (Test A)	ISO 16750-2	4.6.4.2.2	12V: Us = 101 V; Ri = 4 Ohm, td = 400 ms 24V: Us = 202 V; Ri = 8 Ohm, td = 350 ms
Load dump (Test B)	ISO 16750-2	4.6.4.2.3	12V: Us = 101 V; Ri = 4 Ohm, td = 400 ms 24V: Us = 202 V; Ri = 8 Ohm, td = 350 ms
Reverse voltage	ISO 16750-2	4.7	–28 V, 60 s
Ground reference and supply offset	ISO 16750-2	4.8	28 V, offset 1 V
Single line interruption	ISO 16750-2	4.9.1	28 V, interruption 10 s
Multiple line interruption	ISO 16750-2	4.9.2	28 V, interruption 10 s
Short circuit protection	ISO 16750-2	4.10	32 V, R_{i_PSU} < 100 mOhm, 60 s
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 ICC test severity Level III

* Available as of 2021.

Approvals and conformities Universal Switch*

Test	Standard		Load
Mechanical specifications	**(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 Shock profile 1: 500 m/s², 11 ms, 13 000 Shock profile 2: 300 m/s², 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, 500 m/s², 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_{min} = −40 °C, T_{max} = +80 °C)
Environmental specifications	**(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_{min} = −40 °C, T_{max} = +85 °C
Temperature cycle with specified change rate	ISO 16750-4	5.3.1	T_{min} = −40 °C, T_{max} = +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_{min} = −40 °C, T_{max} = +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_{max} = 55 °C, 6 cycles
Dewing test	ISO 16750-4	5.6.2.4	T_{max} = 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) 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
Surface tests			
Chemical resistance	ISO 16750-5		Chemical load codes: B, C (chemical agends: AD, CA, DA, DB, DC, DD, DF, DJ, DK, EB, EC, ED, EF)
Electromagnetic compatibility tests			
ESD	ISO 10605	9	Unpowered, up to ±15 kV, 10 pulses

* Some validations are in progress.

Approvals and conformities Universal Switch*

Test	Standard		Load
Electrical performance tests	**(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
Approvals and Conformity			
E1	ECE R10		
E1	ECE R118		
CE	EMC		

Specifications	Parameters
Electrical specifications	
Resistance opened	R_{off} > 2 MΩ
Resistance closed sharp tactile feedback	R_{on} ≤ 200 mΩ
Resistance closed soft tactile feedback	R_{on} ≤ 10 Ω
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
Materials	
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
Illumination	
Colour backlight white	White at 28 VDC and 23 °C ±2 K
Brightness colour backlight white	L_v ~ 20 cd/m²
Colour indicator	Rot λ_{dom} ~ 633 nm
Brightness status indicator	L_v ~ 200 cd/m²
Colour backlight red	Rot λ_{dom} ~ 630 nm
Brightness colour backlight red	L_v ~ 90 cd/m²

Radio slot frame

Specifications	Parameters
Ambient conditions radio slot frame	
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
Mechanical specifications radio slot frame	
Vibration/shock in assembly with universal pushbutton and bezel	ISO 16750-3 4.1
Ambient conditions bezel	
Service temperature	–40 °C … +85 °C
Storage temperature	–40 °C … +85 °C
Transport temperature	–40 °C … +85 °C
Mechanical specifications bezel	
Vibration/shock in assembly with universal pushbutton and bezel	ISO 16750-3 4.1
Ambient conditions clamp	
Service temperature	–40 °C … +85 °C
Storage temperature	–40 °C … +85 °C
Transport temperature	–40 °C … +85 °C

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