ELECTRICS / ELECTRONICS

SPECIAL ORIGINAL EQUIPMENT

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- → Animations
- → Configuration tools for many applications
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This brochure provides a glimpse into the HELLA electronics product range for on-highway and off-highway applications.

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First of all, select an appropriate vehicle or area of application (Tier X). After selecting the appropriate product by mouse click, you will receive further information including pdf files with important details and technical data for download. In addition, the tool provides clear animations showing how the products work.

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Driver assistance systems


77 GHz radar sensor

Energy management


Intelligent battery sensors


Voltage stabilisers


Voltage converters

Environmental and medium sensors


Level sensors


Oil pressure and temperature sensors

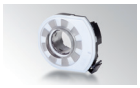

Rain-light sensors


Road condition sensors (RCS/ SHAKE)


Temperature sensors


Particulate matter sensors PM 2.5

Position sensors


Steering torque and angle sensors


Accelerator pedal sensors


Angular position sensors

Actuators


Actuators (Low Force)


Actuators (Medium Force)


Actuators (High Force)


Actuators (Smart URA)


Universal Turbo Actuators (UTA)

Thermal management and pumps


Vacuum pumps


Washer fluid pumps

Operating systems – vehicle/driver interface


Rocker switches

Body electronics

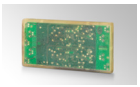

Remote control systems

Lighting electronics


LED flasher unit: towing vehicle


LED flasher unit: for LED direction indicators 12 V and 24 V


LED lamp control unit


Control unit for flashing side marker lamps


Control unit for current monitoring


Simulation device for cold check

Acoustic signal devices


Warning system AVAS


Electronic horns


Electromechanical horns


Backup alarm

Further components


Mirrors


Turbo fans


Cigarette lighters and power sockets

CONTENTS

OVERVIEW OF MATING CONNECTORS

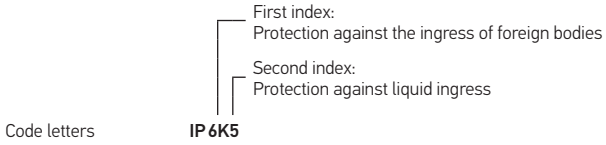
PRODUCT	PRODUCT DESCRIPTION	PART NUMBER	CORRESPONDING MATING CONNECTORS
Sensors	**Intelligent battery sensors**		
	IBS 200X	**6PK 010 842-001 / -007**	Hirschmann 872-858-565
	Cable lug, straight	**6PK 011 700-001 / -007**	Hirschmann 872-858-546
	Cable lug, right-angled	**6PK 011 700-317 / -311**	Hirschmann 872-858-546
	12 V, IBS Global	**6PK 013 824-001 / -007**	Hirschmann 872-857-561
	12 V, for agricultural and construction vehicles	**On request**	Hirschmann 872-858-546
	Particulate matter sensors		
	Particulate matter sensor PM 2.5	**On request**	Hirschmann 872-858-541 or TE Connectivity 1-1670917-1
	Steering torque and angle sensors		
	Steering torque and angle sensors	**On request**	Tyco C-965382-2
	Steering angle sensor	**On request**	Tyco C-965382-2
	Road condition sensor (RCS /SHAKE)	**On request**	Hirschmann 872-858-541 or TE Connectivity 1-1670917-1
	Radar sensors		
	Radar sensors 77 GHz	**On request**	TE Connectivity 1-1703639-1
	Level sensors		
	Recording the liquid level	**On request**	Hirschmann MLK 872-858-541 (3way 1.2 SealStar)
	Oil pressure and temperature sensors		
	Measuring oil pressure and oil temperature	**6PR 010 378-101**	Hirschmann 872-858-541 or TE Connectivity 1-1670917-1
	Temperature sensors		
	Measuring air temperature	**6PT 009 522-011**	TE Connectivity 2-1437712-5
	Rain-light sensors Recording environmental properties		
	For vehicles with flat windscreens	**On request**	TE Connectivity 114 18063-18, coding D
	For vehicles with steeply sloped windscreens	**On request**	AMP C-1718346, coding A
	Angular position sensors		
	Single sensors	**6PM 010 200-507** **6PM 010 200-517** **6PM 010 200-527** **6PM 010 200-537**	TE Connectivity 1801178-4
Voltage stabilisers	DC/DC 200 W	**On request**	TE Connectivity 156333-1
	DC/DC 400 W	**8ES 312 331-101**	TE Connectivity 1473672-1, 1897519-1
Voltage converters	DC/DC 48 V / 12 V, 3.5 kW, water-cooled	**On request**	Hirschmann 805-031-541
	DC/DC 48 V / 12 V, 1.8 kW, air-cooled	**On request**	TE 2-1534229-1
	DC/DC 24 V / 12 V	**On request**	Tyco 8-968970-02
Accelerator pedal sensors	Floor-mounted accelerator pedals	**On request**	Sumitomo F(6189-1083)
	Suspended accelerator pedals	**On request**	Sumitomo Denso 6189-1083
Remote control systems	Receiver control unit	**On request**	Lear 17848 000 000
Actuators	**Low force**		
	Electrical locking and unlocking, space-saving, electrical open and return rotation	**6NW 011 122-017**	Hirschmann Automotive 3-pole MLK coupling ELA 872-858-541
	Electrical locking and unlocking, space-saving with micro switch, electrical open and return rotation, with micro switch	**6NW 011 122-027**	Hirschmann Automotive 3-pole MLK Coupling ELA 872-858-...KA
	Without operating element and without locking element Without locking but with operating element	**6NW 011 122-031** **6NW 011 122-051**	Hirschmann Automotive 3-pole MLK coupling ELA 872-858-...KA
	Electrical locking/unlocking, space-saving with micro switch, electrical open rotation, return rotation via return spring, with soft-touch button	**6NW 011 122-047**	Hirschmann Automotive 3-pole MLK coupling ELA 872-858-541

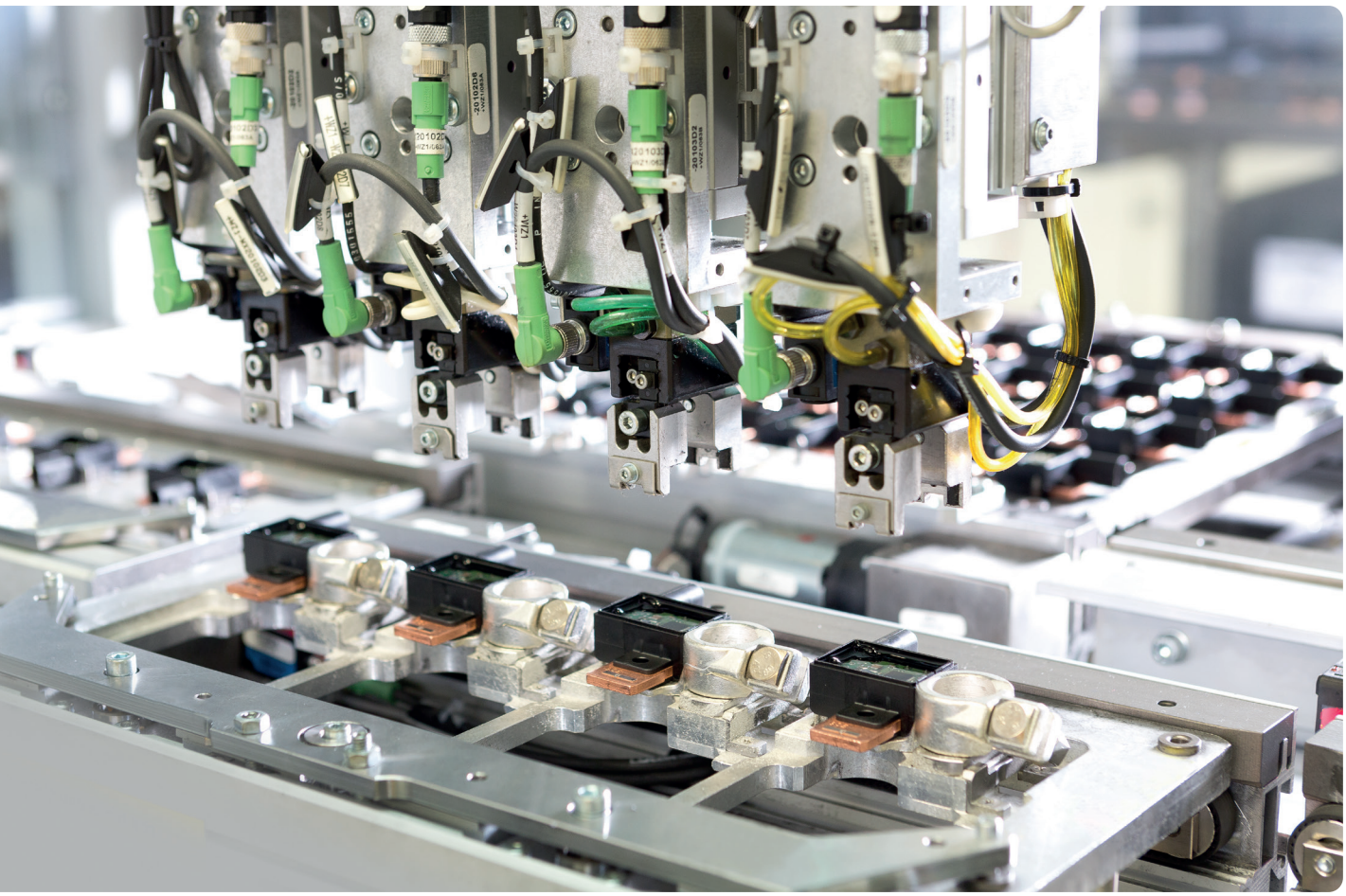
PRODUCT	PRODUCT DESCRIPTION	PART NUMBER	CORRESPONDING MATING CONNECTORS
Actuators	**Medium force**		
	Electrical locking/unlocking and closing, electrical retraction and extension	**6NW 009 203-401**	TE Connectivity 1355390-1
		6NW 009 203-411	TE Connectivity 1355390-1
		6NW 009 203-627 **6NW 009 203-637** **6NW 009 203-441** **6NW 009 203-557**	TE Connectivity 282080-1
	Electrical locking/unlocking and closing, electrical retraction, extension with spring	**6NW 009 203-461**	TE Connectivity 1355390-1
		6NW 009 203-471 **6NW 009 203-541**	TE Connectivity 282080-1
	Electrical locking/unlocking and closing, electrical extension, retraction with spring	**6NW 009 203-491**	TE Connectivity 1355390-1
		6NW 009 203-501 **6NW 009 203-521**	TE Connectivity 282080-1
	High force		
	Electrical locking/unlocking and closing, electrical rotation left, spring return right	**6NW 009 424-781**	TE Connectivity 1355390-1
	Electrical locking/unlocking and closing, electrical rotation right and left	**6NW 009 424-791** **6NW 009 424-777**	TE Connectivity 1355390-1
	Smart URA		
	Electrical locking/unlocking and closing, electrical rotation right and left, with position feedback using CIPOS® technology	**6NW 011 303-701**	TE Connectivity 1-1456426-1, coding A
	UTA		
	Universal turbo actuator	**On request**	Kostal, 09 4415 82, coding B
Vacuum pumps	UP 28 with relay box	**8TG 008 570-021**	Kostal, 09 4016-30
	UP 28 with engine compartment connector	**8TG 009 428-081**	Yazaki 2.8, 7283-5575-10
	UP 5.0	**8TG 012 377-701**	Yazaki Sealed: 7282-5575-10 With cable seal: 7158-3113-40 With coupling: 7117-4152-02
Acoustic warning system	AVAS	**3SL 015 329-007**	Tyco 1-967616-1
LED lamp control unit	**Basic variant**		
	12 V	**5DS 227 488-001**	Amphenol AT06-6S
	24 V	**5DS 227 488-101**	
	Premium variant		
	12 V (1 stop light channel)	**5DS 227 489-001**	OUT, B coding: Amphenol AT06-08SB
	12 V (2 stop light channels)	**5DS 227 489-011**	IN, A coding: Amphenol AT06-08SA
	24 V (1 stop light channel)	**5DS 227 489-101**	6-pin: Amphenol AT06-06S

IP PROTECTION CLASSES

IP stands for International Protection. The IP protection classes are defined in accordance with DIN 40050, Part 9. The purpose of the standard is to precisely define resistance to the ingress of solid foreign bodies, including dust, and similarly resistance to the ingress of water. The adjacent overview of the IP protection classes and the explanations of their meaning are intended to serve as a help in the selection of the right components so that these meet the relevant requirements of your application.

EXAMPLE





DEGREES OF PROTECTION AGAINST THE PENETRATION OF SOLID FOREIGN BODIES (DUST)			DEGREES OF PROTECTION AGAINST WATER INGRESS		
First digit	**Brief description**	**Definition**	**Second digit**	**Brief description**	**Definition**
0	Not protected	No requirements	0	Not protected	No requirements
1	Protected against solid foreign objects > 50 mm	The object probe, a ball 50 mm in diameter, must not be able to penetrate completely	1	Protected against dripping water	Vertically falling drops are not to have any harmful effects
2	Protected against solid foreign objects > 12.5 mm in diameter	The object probe, 12.5 mm in diameter, must not penetrate at all	2	Protection against dripping water when the housing is tilted by up to 15°	Vertically falling drops are to have no harmful effects if the housing is tilted at an angle of up to 15° on either side of the vertical
3	Protected against solid foreign objects > 2.5 mm in diameter	The object probe, 2.5 mm in diameter, must not penetrate at all	3	Protected against spray	Water sprayed at an angle of up to 60° on either side of the vertical must have no harmful effects
4	Protected against solid foreign objects > 1.0 mm in diameter	The object probe, 1.0 mm in diameter, must not penetrate at all	4	Protected against spray	Water sprayed or splashed against the housing from one direction must have no harmful effects
			4K	Protected against splash water at increased pressure	Water splashing against the housing from any direction at increased pressure must have no harmful effects
5K	Dust protected	The penetration of dust is not prevented completely, but dust must not penetrate to such an extent that the satisfactory operation of the device or its safety is affected	5	Protected against jets of water	Water directed as a jet against the housing from any direction must not have any harmful effects
6K	Dustproof	No ingress of dust	6	Protected against powerful jets of sprayed water	Water directed as a strong jet against the housing from any direction must not have any harmful effects
			6K	Protected against powerful jets of sprayed water under increased pressure	Water directed as a jet under increased pressure against the housing from any direction must not have any harmful effects
			7	Protected against the effects of temporary immersion in water	Water must not enter in quantities which would cause damaging effects if the housing is temporarily immersed in water under defined conditions of pressure and time
			8	Exposure to water during continuous immersion	Ingress of water is not to occur in a quantity that will cause harmful effects if the housing is permanently immersed in water under defined conditions
			9	Protected against the effects of permanent immersion in water	Water must not seep in to the extent that it would cause damage if the housing is permanently immersed in water.
			9K	Protected against water during high-pressure / steam jet cleaning	Water under greatly increased pressure directed against the housing from any direction must show no harmful effects

77 GHz radar sensor

PRODUCT FEATURES

- → Compact radar sensor developed for the most demanding environments IP 6K7 and IP X9K
- → Wide field of view and long range
- → Stable measuring signal even in adverse environmental conditions and when sensor cap is contaminated
- → Fast measurements and response to change of position

APPLICATION

Radar sensors are becoming increasingly important in on-highway and off-highway applications. Such sensors enable a 360° environment detection around the vehicle both of moving objects (such as cars, cyclists and pedestrians) and also of stationary objects.

Thanks to a FMCW radar (frequency-modulated continuous wave radar), these 77 GHz sensors detect objects even in extreme weather conditions: rain, snow, fog and extreme temperatures do not impair their function.

The compact sensor design opens up new integration options, for example in the side of the vehicle. In addition to measuring the distance away from an object, its relative velocity can also be measured.

DESIGN AND FUNCTION

The sensor is based on the frequency-modulated continuous wave method (FMCW). This means the frequency of a carrier frequency that is continuously emitted by the sensor is varied within a small range (the bandwidth). As soon as the signal is reflected back from an object to the sensor, the distance and speed of the detected object can be determined by comparing the frequency.

The centrepiece of the sensors is the Radar System Chip, which is based on RF-CMOS technology. The architecture makes it possible to integrate digital components and systems for self-diagnosis on one radar system chip, in addition to the components for transmitting and receiving.

APPLICATION EXAMPLES:

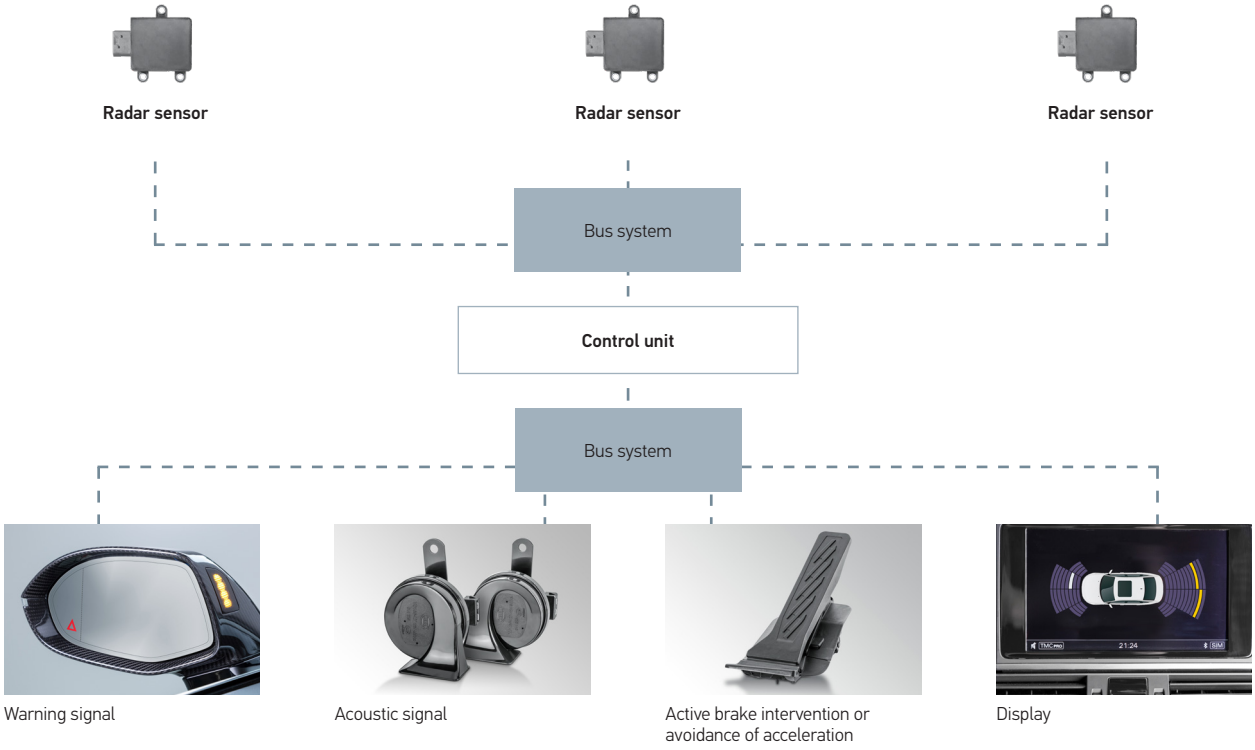
Vehicle rear end

- → Pre-crash scenario before rear-end collision of an approaching vehicle
- → Lane change assistant
- → Warning of rear cross traffic, of moving objects or of stationary objects when reversing
- → Safe exit assistant in uncertain situations
- → Detection of objects located in the blind spot

Vehicle front

- → Warning of cross traffic in the vicinity of crossroads
- → Warning of cross traffic when manoeuvring out
- → Detection of objects located in the blind spot
- → Early detection of slower vehicles up ahead
- → Maintaining a certain distance from the vehicle driving in front

FUNCTIONAL DIAGRAM



Warning signal

Acoustic signal

Active brake intervention or avoidance of acceleration

Display

PROGRAM OVERVIEW

Variants	Protection class	Part number	VPE**	Page
77 GHz radar sensor	IP 6K7, IP X9K*	**On request**	–	12

* If the diaphragm is protected according to an installation guideline for pressure compensation.

** Packaging unit

77 GHz radar sensor

Part number on request

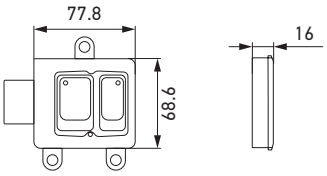
TECHNICAL DATA

Centre frequency	76.5 GHz
Azimuth (field of view)	±75° (10 dBsm @ 20 m)
Elevation (field of view)	±10° (10 dBsm @ 20 m)
Communication interface	CAN
Weight	< 100 g
Protection class	IP 6K7, IP X9K[1)]
Mounting	3 eyelets for M6 screws
Supply voltage	12 V / 24 V
Maximum quiescent current	100 µA
Minimum operating voltage	6.5 V at 12 V / 9 V at 24 V
Power	< 4 W
Operating temperature	-40°C to +85°C
Mating connector[2)]	1-1703639-1

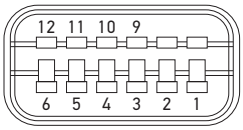
[1)] If the diaphragm is protected according to an installation guideline for pressure compensation

[2)] These accessories are not included in the scope of delivery. Available from TE Connectivity.

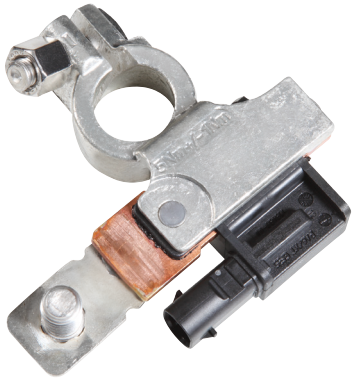
TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1: VCAN H
Pin 2: VCAN L
Pin 3: POS 3
Pin 4: POS 2
Pin 5: WAKE
Pin 6: V_{BAT}
Pin 7: –
Pin 8: –
Pin 9: PCAN H
Pin 10: PCAN L
Pin 11: POS 1
Pin 12: GND



Intelligent battery sensors

PRODUCT FEATURES

- → Accurate measurement of battery parameters: voltage, current and temperature
- → Determining battery condition parameters i.e. state of charge (SOC), state of health (SOH) and state of function (SOF)
- → Simple electrical and mechanical integration

APPLICATION

The intelligent battery sensor from HELLA (IBS) is the key element in vehicle energy management.

The IBS reliably and accurately measures the battery condition parameters of voltage, current, and temperature. Information on the state of charge (SoC),the state of ageing (SoH) and also on the anticipated starting capability (SoF) of the battery is calculated algorithmically using the measured values. The IBS is designed to be used in starter, gel and AGM batteries to monitor in-vehicle starter or consumer batteries. And the IBS can be directly integrated into the vehicle electrical system via the standardised LIN protocol.

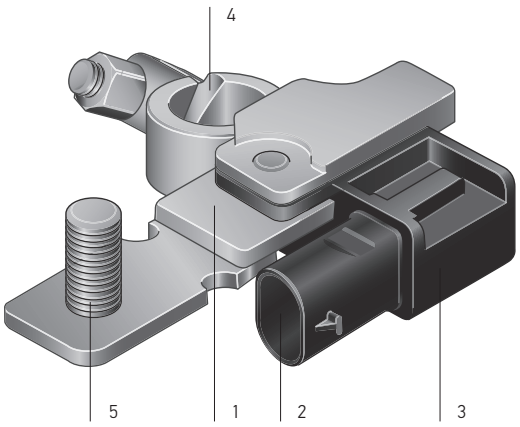
DESIGN AND FUNCTION

The IBS is attached directly to the negative pole of the battery via the pole terminal (4).

In addition to the terminal, the mechanical part of the battery sensor consists of the shunt (1) and earthing bolt (5) components. The shunt is attached to the vehicle's load path and serves as a measuring resistor for the purpose of indirect current measurement. The existing ground cable can be conveniently attached to the earthing bolt (5), e.g. with the optionally available battery pole adapter.

The electronics are located in a moulded housing (3) with a plug connector (2) functioning as an interface to the energy management system. The LIN protocol is the communication interface to the higher level control unit. The supply voltage, used simultaneously as the reference voltage for voltage measurement, is provided by the connection to the positive pole of the battery.

The ASIC is the main electronics component used to record and process measured values. Measured value acquisition, i.e. data logging in the ASIC, as a precision sensor, is the core function of the intelligent battery sensor and is used to record the physical parameters of current, voltage and temperature.



BATTERY CONDITION ALGORITHMS

The intelligent battery sensor calculates and monitors the following battery conditions

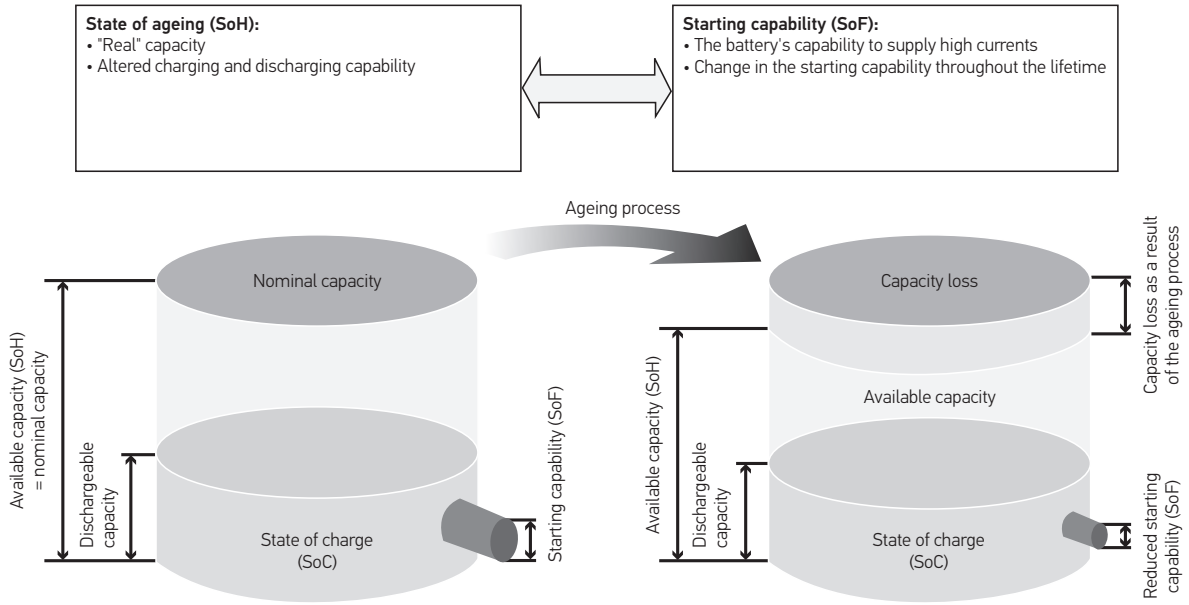
State of charge:
The state of charge (SoC) describes the current state of charge of the battery.
The SoC is defined as:
SoC [%]= dischargeable capacity/nominal capacity

State of health:
The state of health (SoH) indicates the battery's ageing condition.
The State of health (SoH) is defined as:
SoH [%]= available capacity/nominal capacity

The available capacity of the battery typically decreases with increasing battery age and after a long and useful service life.

State of function:
The state of function (SoF) describes the future starting capability of the engine based on the power currently measured and on the voltage

Monitoring of the various battery conditions

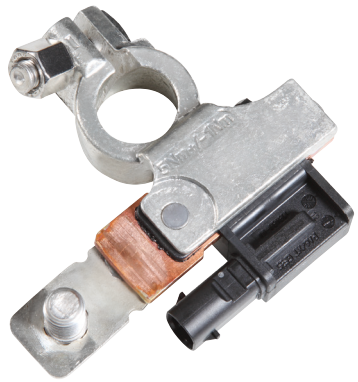


PROGRAM OVERVIEW

Four intelligent battery sensor variants are available. Sensor 1 is the basic version. Sensor 2 is used to monitor a second battery in the same communication network. The third variant is used when two 12 V batteries are series-connected (24 V vehicle electrical system). The fourth variant is intended for vehicles with high starting currents (e.g. agricultural and construction vehicles) and with higher ground cable cross-sections (> 70 mm²).

Operating voltage	Type	Mating connector	Part number	VPE*	Page
6 – 16.5 V	IBS 200X	Hirschmann 872-858-565	**6PK 010 842-001/-007**	1/100	16
7.5 – 32 V	Cable lug, straight	Hirschmann 872-858-546	**6PK 011 700-001/-007**	1/100	17
7.5 – 32 V	Cable lug, right-angled	Hirschmann 872-858-546	**6PK 011 700-311/-317**	1/100	18
6 – 18 V	IBS Global	Hirschmann 872-857-561	**6PK 013 824-001/-007**	1/100	19
6 – 16.5 V	For agricultural and construction vehicles	Hirschmann 872-858-546	**On request**	–	20

* Packaging unit



Intelligent battery sensors

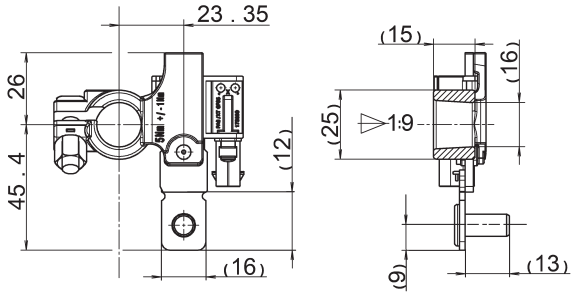
6PK 010 842-001 / -007 (IBS 200X)

TECHNICAL DATA

Operating voltage	6 – 16.5 V
Polarity reversal voltage	-16.5 V / 60 s
Test voltage	13.8 – 14.2 V
Operating current[1)]	≤ 15 mA (normal mode)
Quiescent current[1)]	≤ 120 µA (sleep mode)
Rated resistance (shunt)	100 µΩ
Permanent load current[2)]	± 155 A
Maximum current[2)]	± 1,500 A (500 ms)
Operating temperature	-40°C to +115°C
Reheating temperature	+105°C to +120°C
Storage temperature	-20°C to +55°C
Defined charge controller	18 V / 60 min
Jump start	27 V / 1 min
Load Dump	35 V / 400 ms
Output signal	LIN 2.0 or higher
Protection class	IP 6K7
Permissible pole terminal tightening torque	5 Nm ± 1 Nm
Thread for ground connection bolt	M8
Weight	125 g
Max. Battery capacity[3)]	249 Ah
Mating connector[4)]	872-858-565
Optional accessories	Battery pole adapter for plug-and-play installation **9MK 179 472-007**

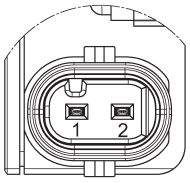
[1)] Condition: $T_a \leq 40°C$; $U_b = 14$ V
[2)] Typical condition: $T_a \leq 105°C$; $U_b = 14$ V
Typical ground cable: 35 mm²
Approved for maximum 500 ms.
Other configurations on request.
[3)] Expandable on request.
[4)] These accessories are not included in the scope of delivery.
Available from Hirschmann Automotive.

TECHNICAL DRAWING

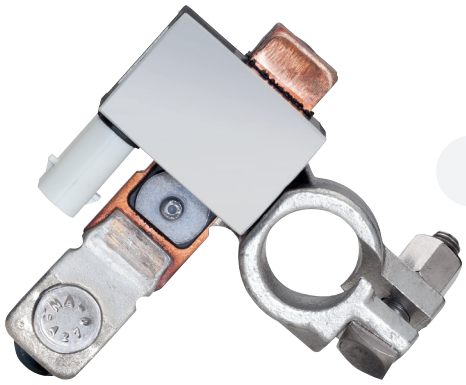


Tightening torque screw (terminal) 5 ± 1 Nm

PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1: Supply voltage
Pin 2: Connection for LIN bus



Intelligent battery sensors

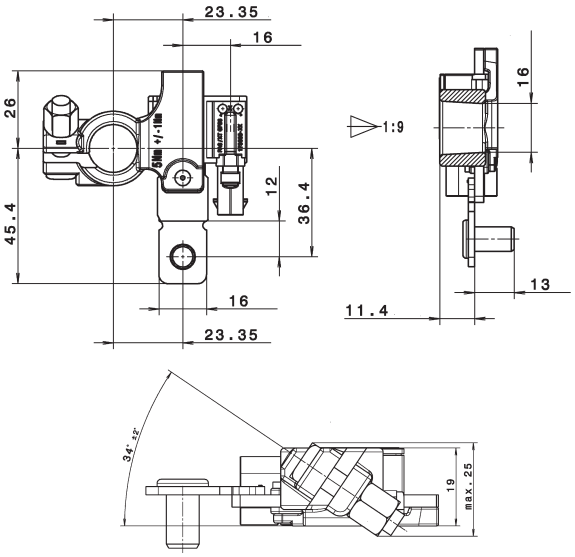
6PK 011 700-001 / -007

TECHNICAL DATA

Operating voltage	7.5 – 32 V
Polarity reversal voltage	- 28 V / 60 s
Test voltage	27.8 – 28.2 V
Operating current[1)]	≤ 16 mA (normal mode)
Quiescent current[1)]	≤ 230 µA (sleep mode)
Rated resistance (shunt)	68 µΩ
Permanent load current[2)]	± 200 A
Maximum current[2)]	± 2,000 A (20 ms)
Operating temperature	-40°C to +80°C
Reheating temperature	+105°C to +120°C
Storage temperature	-20°C to +50°C
Defined charge controller	36 V / 120 min
Jump start	48 V / 2 min
Load Dump	58 V / 500 ms
Output signal	LIN 2.0 or higher
Protection class	IP 6K7
Permissible pole terminal tightening torque	5 Nm ± 1 Nm
Thread for ground connection bolt	M8
Weight	119 g
Max. Battery capacity[3)]	255 Ah
Mating connector[4)]	872-858-546

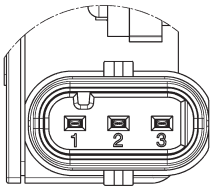
[1)] Condition: $T_a \leq 40°C$; $U_{bq} = 24$ V; $U_{brun} = 28$ V
[2)] Typical condition: $T_a \leq 80°C$; $U_b = 24$ V
Typical ground cable: ≥ 70 mm²
Approved for maximum 500 ms.
Other configurations on request.
[3)] Expandable on request.
[4)] These accessories are not included in the scope of delivery.
Available from Hirschmann Automotive.

TECHNICAL DRAWING

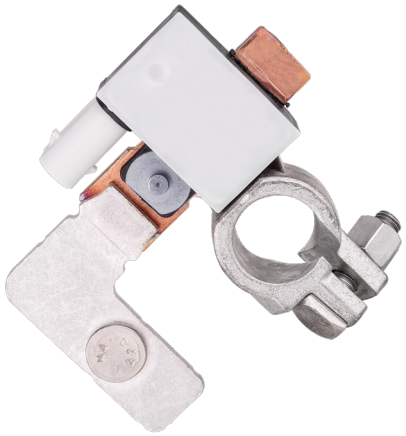


Tightening torque screw (terminal) 5 ± 1 Nm

PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1: Partial voltage 12 V
Pin 2: Connection for LIN bus
Pin 3: Supply voltage 24 V



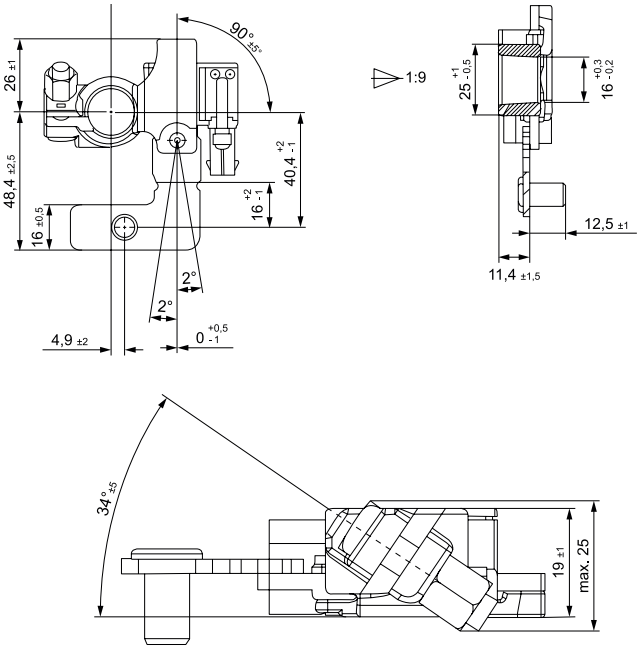
Intelligent battery sensors
6PK 011 700-317/-311

TECHNICAL DATA

Operating voltage	7.5 – 32 V
Polarity reversal voltage	- 28 V / 60 s
Test voltage	27.8 – 28.2 V
Operating current[1)]	≤ 16 mA (normal mode)
Quiescent current[1)]	≤ 230 µA (sleep mode)
Rated resistance (shunt)	68 µΩ
Permanent load current[2)]	± 200 A
Maximum current[2)]	± 2,000 A (20 ms)
Operating temperature	-40°C to +80°C
Reheating temperature	+105°C to +120°C
Storage temperature	-20°C to +50°C
Defined charge controller	36 V / 120 min
Jump start	48 V / 2 min
Load Dump	58 V / 500 ms
Output signal	LIN 2.0 or higher
Protection class	IP 6K7
Permissible pole terminal tightening torque[3)]	5 Nm ± 1 Nm
Thread for ground connection bolt	M8
Weight	119 g
Max. Battery capacity[4)]	255 Ah
Mating connector[5)]	872-858-546

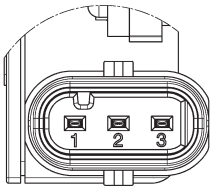
[1)] Condition: $T_a \leq 40°C$; $U_{bq} = 24$ V; $U_{brun} = 28$ V
[2)] Typical condition: $T_a \leq 80°C$; $U_b = 24$ V
Typical ground cable: ≥ 70 mm²
Approved for maximum 500 ms.
Other configurations on request.
[3)] When using a pole adapter, only one ground cable (max. 70 mm²) may be taken.
The cable must be fixed after a maximum length of 100 mm.
[4)] Expandable on request.
[5)] These accessories are not included in the scope of delivery.
Available from Hirschmann Automotive.

TECHNICAL DRAWING

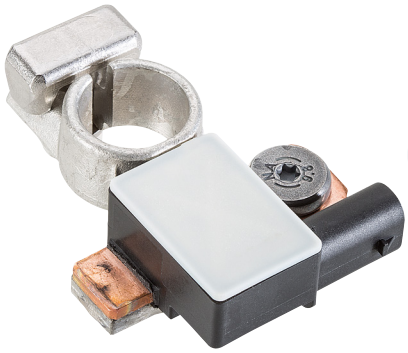


Tightening torque screw (terminal) 5 ± 1 Nm

PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1: Partial voltage 12 V
Pin 2: Connection for LIN bus
Pin 3: Supply voltage 24 V

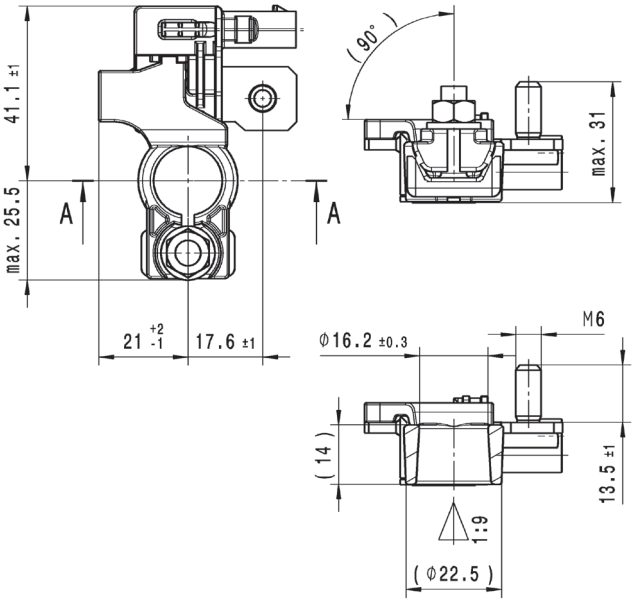


Intelligent battery sensors
12 V, IBS global
6PK 013 824-001 / -007

TECHNICAL DATA	
Operating voltage	6 – 18 V
Polarity reversal voltage	-16.5 V / 60 s
Test voltage	13.8 – 14.2 V
Operating current[1)]	10 mA
Quiescent current[1)]	≤ 200 µA
Rated resistance (shunt)	68 µΩ
Permanent load current[2)]	± 175 A
Maximum current[2) 3)]	1,500 A
Operating temperature	-40°C to +105°C
Reheating temperature	+105°C to +120°C
Storage temperature	-20°C to +55°C
Defined charge controller	18 V / 60 min
Jump start	27 V / 1 min
Load Dump	35 V / 400 ms
Protocol	LIN 2.0 or higher
Protection class	IP 9K9K
Permissible pole terminal tightening torque	5 Nm ± 1 Nm
Thread for ground connection bolt	M6
Weight	70 g
Mating connector[4)]	872-857-565
Max. Battery capacity[5)]	500 Ah
Optional accessories	Battery pole adapter for plug-and-play installation **9MK 230 836-007**

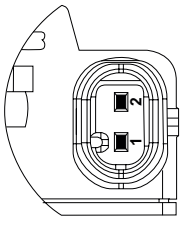
[1)] Condition: $T_a \leq 40°C$; $U_b = 14$ V
[2)] Typical condition: $T_a \leq 105°C$; $U_b = 14$ V, typical ground cable: 35 mm²
[3)] Approved for max. 500 ms. Other configurations on request.
[4)] These accessories are not included in the scope of delivery. Available from Hirschmann Automotive.
[5)] Expandable on request.

TECHNICAL DRAWING

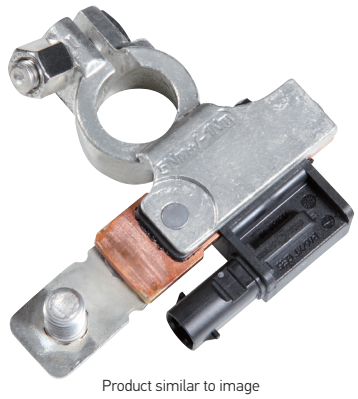


DESCRIPTION
Unlike its predecessors, the IBS Generation II boasts the following advantages: the sensor is now also able to monitor larger batteries. Thanks to the higher and adjustable nominal capacity, this battery sensor can also be used to monitor several series-connected batteries. Instead of 250 ampere hours, it can be configured for up to 500 ampere hours (Ah). This is particularly important in view of the growing energy requirements of motorhomes and caravans. In addition, these new IBS Generation II units are particularly robust and can also reliably detect short-term, high current consumption – for example when bow thrusters are used. The design has been optimised in such a way that installation even in locations with difficult access, e.g. under a seat, is easily possible. Furthermore, this product variant has the latest algorithms for battery condition detection. Reliable statements on charge condition and ageing are therefore possible even with higher quiescent currents such as can occur, for example, in motor homes.

PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1: Connection for LIN bus
Pin 2: Connection for B+



Product similar to image

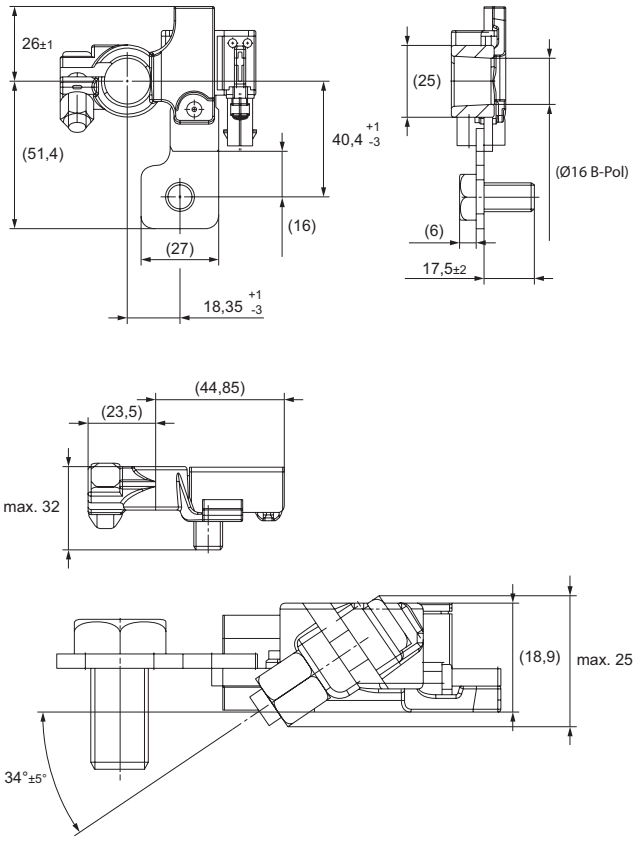
Intelligent battery sensors
12 V, for agricultural and construction vehicles
On request

TECHNICAL DATA

Operating voltage	6 – 16.5 V
Polarity reversal voltage	-16.5 V / 60 s
Test voltage	13.8 – 14.2 V
Operating current[1)]	≤ 15 mA
Quiescent current[1)]	≤ 120 µA
Rated resistance (shunt)	68 µΩ
Permanent load current[2)]	± 200 A
Maximum current[2)]	2,000 A
Operating temperature	-40°C to +115°C
Reheating temperature	+105°C to +120°C
Storage temperature	-20°C to +55°C
Defined charge controller	18 V / 60 min
Jump start	27 V / 1 min
Load Dump	35 V / 400 ms
Protocol	LIN 2.0 or higher
Protection class	IP 6K7
Permissible pole terminal tightening torque	5 Nm ± 1 Nm
Thread for ground connection bolt	M10
Weight	145 g
Mating connector[3)]	872-858-546
Max. Battery capacity[4)]	249 Ah

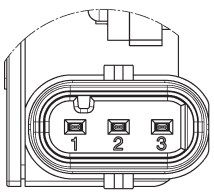
[1)] Condition: $T_a \leq 40°C$; $U_b = 14$ V
[2)] Typical condition: $T_a \leq 105°C$; $U_b = 14$ V
Typical ground cable: 35 mm²
Approved for max. 500 ms.
Other configurations on request.
[3)] These accessories are not included in the scope of delivery.
Available from Hirschmann Automotive.
[4)] Expandable on request.

TECHNICAL DRAWING

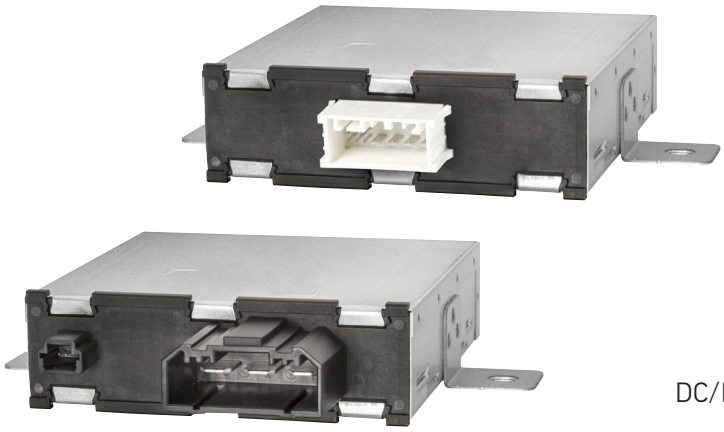


Tightening torque screw (terminal) 5 ± 1 Nm

PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1: Supply voltage 12 V
Pin 2: Connection for LIN bus
Pin 3: Not assigned



DC/DC voltage stabilizers 200 W / 400 W

PRODUCT FEATURES

- For 12 V systems
- Output power 200 - 400 W
- System stabiliser with temporary voltage drop

APPLICATION

The DC/DC converter is also referred to as a voltage stabiliser. In the event of a brief voltage drop (when the engine starts), it maintains the output voltage to the electric subsystem (e.g.with the start/stop system).

This primarily concerns the elements of the vehicle electrical system that are perceived by the driver but which are not critical from a safety perspective. These include, for example, the radio and navigation systems (infotainment systems), but also various terminals (e.g. for agricultural and construction vehicles) and information systems (e.g. in buses).

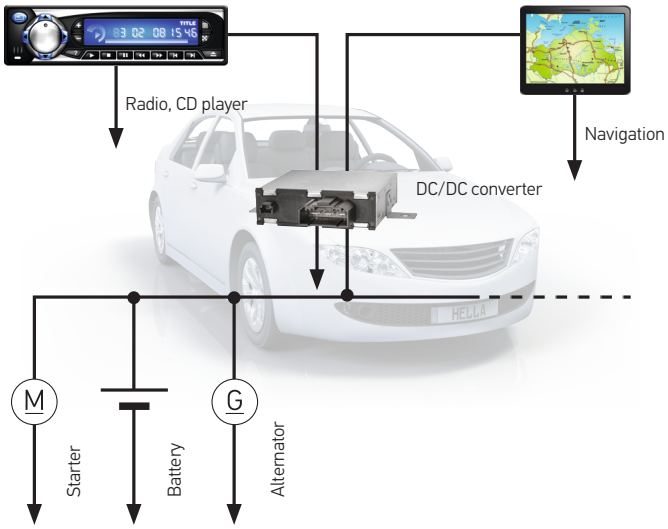
DESIGN AND FUNCTION

The voltage stabiliser is activated when the ignition is switched on. When stabilisation is not required, the subsystem of the vehicle electric system is coupled with the main system via a low-impedance cable.

The voltage drop at engine start up is indicated by the start signal. As a result the subsystem and the mains are decoupled from each other and stabilisation is carried out.

The device can also be equipped with a LIN diagnostic interface (optional).

FUNCTIONAL DIAGRAM

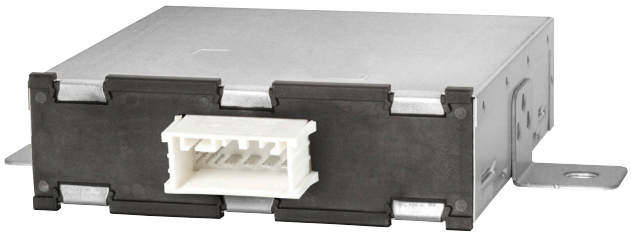


The voltage stabiliser is logically connected between the power supply of the vehicle electrical system and the (sub) vehicle electrical system to be stabilised. Stabilisation is activated as soon as the start information from the starter (terminal 50) is available. Stabilisation (boost mode) is limited to 5 seconds.

PROGRAM OVERVIEW

power	Output current	Type and mating connector	Part number	VPE*	Page
200 W	17 A	TE Connectivity 156333-1	**On request**	–	24
400 W	34 A	Mating connector 1: TE 1473672-1 Mating connector 2: TE 1897519-1	**8ES 312 331-101**	1	25

* Packaging unit



DC/DC voltage stabiliser 200 W

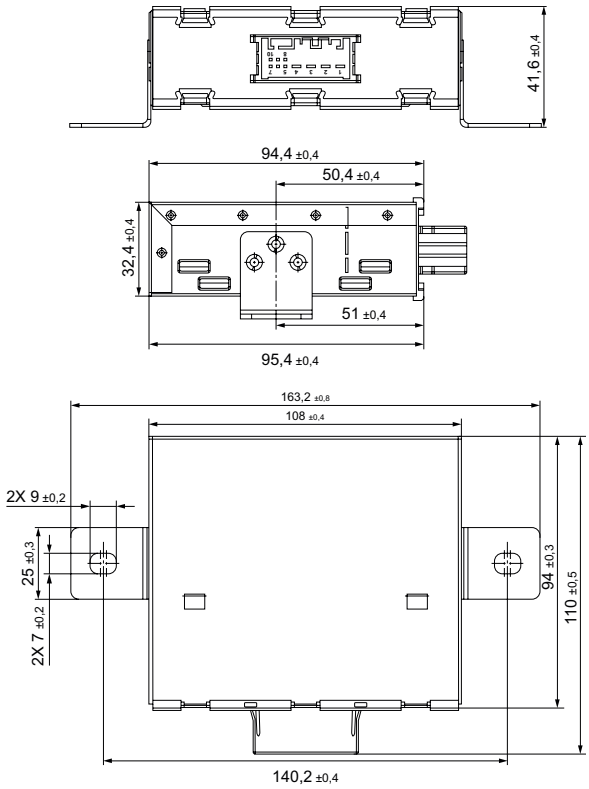
On request

TECHNICAL DATA

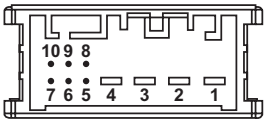
Operating temperature	-40°C to +85°C (-40°C to -20°C bypass mode)
Supply voltage	+ 6.0 V to +18 V
Stabilisation range	+ 6.0 V to +12 V
Output voltage	(Boost mode) 12 V ± 0.5 V Rippel < 200 mV
Power	200 W
Storage temperature	-40°C to +105°C
Cooling	Convection
Weight	Approx. 370 g
Mating connector[1)]	156333-1
Output current	17 A
Efficiency	Boost mode 85 % @ U > 8 V Bypass mode > 99 %
Protection class	IP 5K0

[1)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

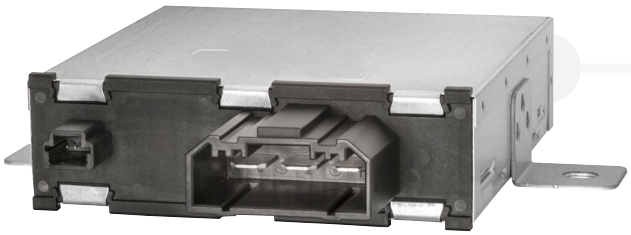
TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1: TERMINAL 30
Pin 2: TERMINAL 31
Pin 3: NA
Pin 4: TERMINAL 30_STABLE
Pin 5: NA
Pin 6: NA
Pin 7: NA
Pin 8: TERMINAL 15
Pin 9: TERMINAL 50
Pin 10: LIN



DC/DC voltage stabiliser 400 W

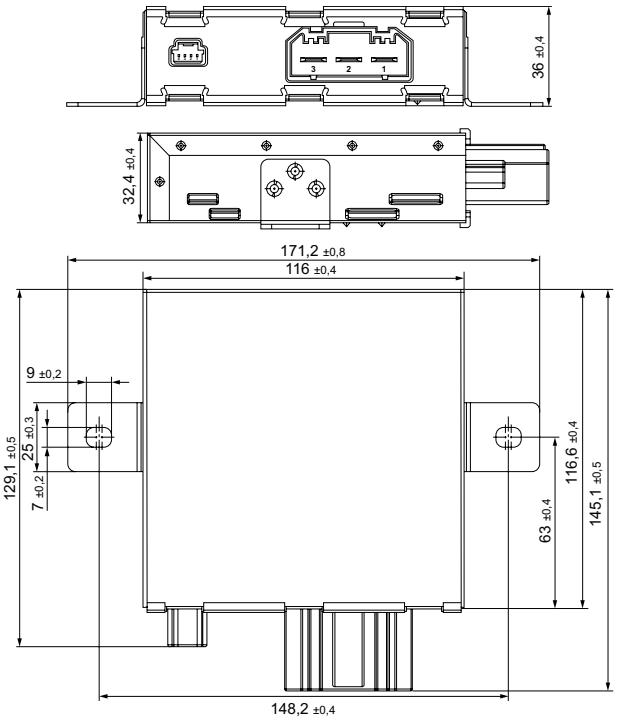
8ES 312 331-101

TECHNICAL DATA

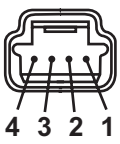
Operating temperature	-40°C to +85°C (-40°C to -20°C bypass mode)
Supply voltage	+6.0 V to +18 V
Stabilisation range	+6.0 V to +12 V
Output voltage	(Boost mode) 12 V ± 0.5 V Rippel < 200 mV
Power	400 W
Storage temperature	-40°C to +105°C
Cooling	Convection
Weight	Approx. 370 g
Mating connector[1)]	Mating connector 1: 1473672-1 Mating connector 2: 1897519-1
Output current	34 A
Efficiency	Boost mode 85 % @ U > 8 V Bypass mode > 99 %
Protection class	IP 5K0

[1)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

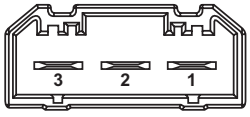
TECHNICAL DRAWING



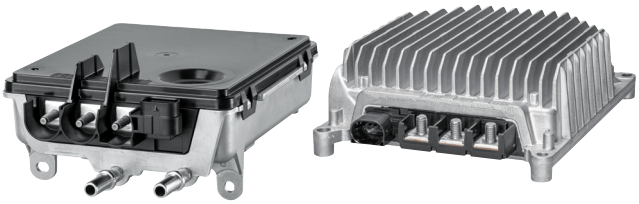
PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1: LIN
Pin 2: NC
Pin 3: TERMINAL 15 (IGN)
Pin 4: TERMINAL 50 (RE-CRANK)



Pin 1: TERMINAL 30 (V_{IN})
Pin 2: TERMINAL 31 (GND)
Pin 3: TERMINAL 30_stab (V_{OUT})



DC/DC converter 48 V/12 V

PRODUCT FEATURES

- → Scalable power up to 1.8 kW (air cooling) and 3.5 kW (water cooling)
- → Bi-directional energy transfer between 48 V and 12 V vehicle electrical system
- → Efficiency up to 97 %
- → Supply of special loads, e.g. electromechanical power steering

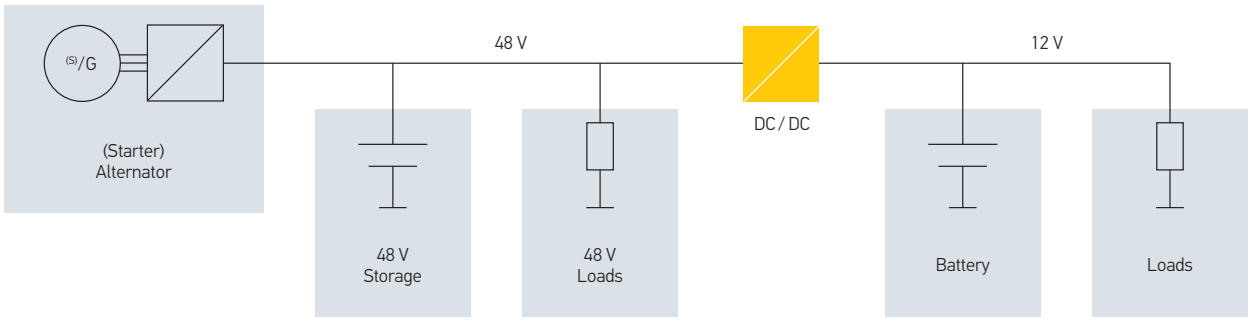
DESIGN AND FUNCTION

The DC/DC converters transform electrical energy between 48 V and 12 V vehicle electrical systems. With the growing number of loads and electrical functions in operation today, additional measures need to be introduced into vehicle electrical systems in order to ensure a reliable and stable power supply at all times. The converters are controlled via a CAN interface.

APPLICATION

The use of a 48 V vehicle electrical system enables new applications such as electrical steering support, recuperation, coasting and crawling to be introduced. The average fuel-saving during recuperation with a 10 kW electric motor is about 0.5 l/100 km in the WLTP driving cycle. In such an architecture, the DC/DC converters supply the parallel 12 V vehicle electrical system with energy. Furthermore, electrical energy from the 12 V network can also be fed back into the 48 V network.

FUNCTIONAL DIAGRAM



PROGRAM OVERVIEW

Type	Part number	VPE*	Page
DC/DC converter 48 V / 12 V, 3.5 kW, water-cooled	**On request**	–	28
DC/DC converter 48 V / 12 V, 1.8 kW, air-cooled	**On request**	–	29
DC/DC converter 24 V/12 V	**On request**	–	30 – 31

* Packaging unit

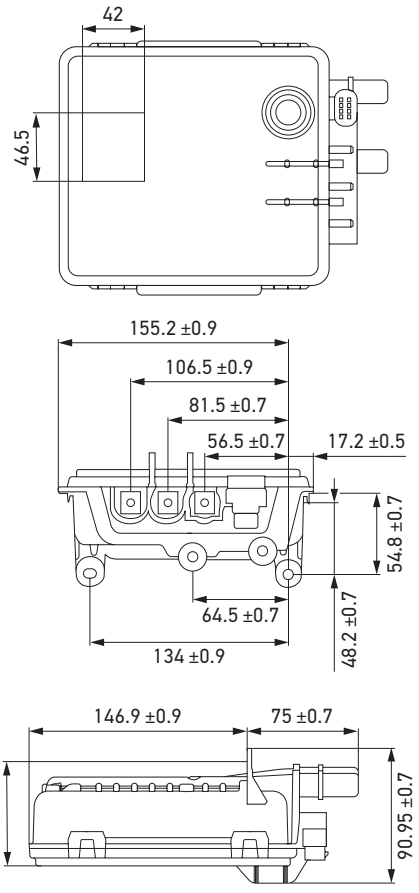
DC/DC converter 48 V / 12 V,
3.5 kW, water-cooled
On request

TECHNICAL DATA

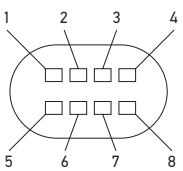
Operating temperature	-40°C to +105°C
Max. power in boost mode	1.0 kW
Max. power in buck mode	3.5 kW
Voltage on 48 V side	24 - 58 V (derating under 36 V and over 52 V)
Voltage on 12 V side	8 – 16.5 V
Functional safety	QM
Data connection	CAN (FD)
Dimensions	200 x 165 x 67 mm
Weight	Approx. 1.7 kg
Connector	Power 12 V: M6 threaded bolt Power GND: M6 threaded bolt Power 48 V: M6 threaded bolt Signal: Hirschmann, 8-pin
Mating connector*	805-031-541
Cooling concept	Water-cooled
Water connection	SAE J 2044 – 7 mm Ø
Mounting points	M6 / M8
Protection class	IP 6K9K

* These accessories are not included in the scope of delivery.
Available from Hirschmann.

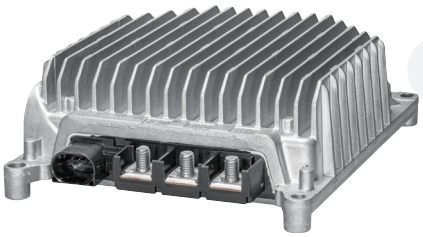
TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1: –
Pin 2: CAN_L
Pin 3: TERMINAL31
Pin 4: –
Pin 5: –
Pin 6: –
Pin 7: CAN_H
Pin 8: TERMINAL30B



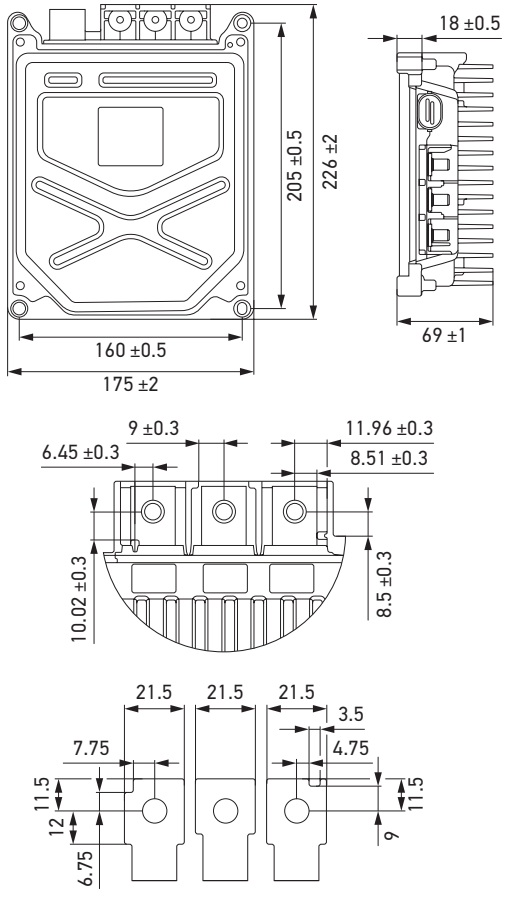
DC/DC converter 48 V / 12 V,
1.8 kW, air-cooled
On request

TECHNICAL DATA

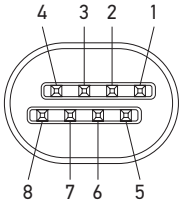
Operating temperature	-40°C to approx. +105°C
Derating temperature (no air flow)	1.8 kW at 60°C
Max. power in boost mode	600 W
Max. power in buck mode	1.8 kW
Voltage on 48 V side	36 - 58 V (derating under 36 V and over 52 V)
Voltage on 12 V side	8 – 16.5 V
Functional safety	QM
Data connection	CAN (FD)
Dimensions	226 x 175 x 70 mm
Weight	< 3 kg
Connector	Power 12 V: M8 threaded bolt Power GND: M8 threaded bolt Power 48 V: M8 threaded bolt Signal: TE Connectivity, 8-pin
Mating connector*	TE 2-1534229-1
Cooling concept	Air passive
Protection class	IP 6K7, IP 6K9K

* These accessories are not included in the scope of delivery.
Available from TE Connectivity.

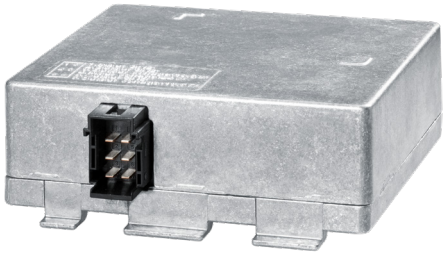
TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1: CAN_1_H
Pin 2: CAN_1_L
Pin 3: CAN_2_H
Pin 4: CAN_2_L
Pin 5: Ground
Pin 6: TERMINAL30
Pin 7: TERMINAL15
Pin 8: Reserved



DC/DC converter 24 V/12 V

PRODUCT FEATURES

- → Power transmission from 24 V to 12 V voltage systems up to 300 W
- → Passive air cooling
- → Power supply for 12 V loads such as lighting, ECUs, sensors etc.
- → Uncomplicated integration without data interface
- → Built-in protection from short circuits and polarity reversal
- → Efficiency of up to 90%

DESIGN AND FUNCTION

The 24 V / 12 V converter is a state-of-the-art switched-mode power supply that uses highly reliable components suitable for automotive manufacturing. It can accept wide-range input voltages from 18 V to 32 V and delivers stable output power at 13.5 V and up to 20 A rated current. Integration into the vehicle E/E architecture is made as simple as possible since no data interface is required. So as to reduce electromagnetic noise and interference, it uses spread spectrum techniques for the driving of MOSFETs. Protection against polarity reversal of input supply, output short-circuit and also of over-voltage and over-current etc. is integrated. Passive air cooling ensures extremely low maintenance. The converter is designed for use inside the cabin (IP 30).

APPLICATION

This 24 V/12 V converter enables 12 V loads to be used in a 24 V based E/E architecture. The DC/DC converter is designed to supply power to conventional 12 V loads such as fans, lamps and also navigation and infotainment systems.

PROGRAM OVERVIEW

Variants	Part number	VPE*
DC/DC converter 24 V to 12 V	**On request**	–

* Packaging unit

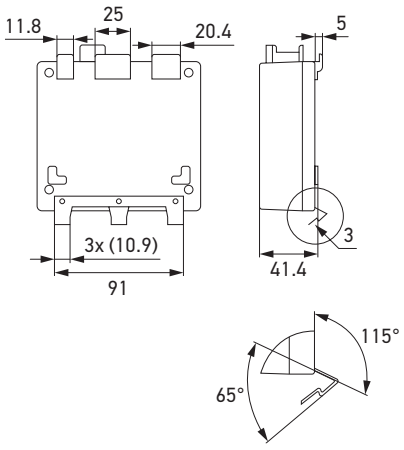
DC/DC converter 24 V/12 V

On request

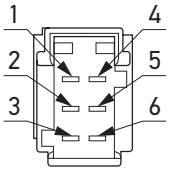
TECHNICAL DATA	
Operating temperature	-40°C to +85°C
Working temperature	-40°C to +75°C
PWM centre frequency	200 kHz (with dithering)
Max. power	Up to 300 W
Input voltage	18 – 32 V
Output voltage	13.5 V
Rippel	< 200 mV_{pp}
No-load/idling current	< 5 mA
Functional safety	QM
Data connection	N/A
Efficiency	Up to 90%
Dimensions	115.5 mm (L) x 105.5 mm (W) x 41.4 mm (H) without mounting bracket
Weight	Approx. 600 g
Connector	6-pin connector strip (Tyco), 90° Nr. 9-966140-5
Mating connector*	Nr. 8-968970-02
Cooling concept	Air passive
Protection class	IP 30

[1] These accessories are not included in the scope of delivery. Available from Tyco.

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1 Input: GND
Pin 2 Output: GND
Pin 3 Output: 13.5 V
Pin 4 Input: 24 V
Pin 5 Output: GND
Pin 6 Output: 13.5 V

Level sensors
Recording the liquid level
(static and dynamic)

PRODUCT FEATURES

- → Level sensors of the fourth generation: revamped design and function
- → Particularly high robustness against interference (environmental and media compatibility).
- → The external temperature element reacts with an improved response time
- → Continuous measurement of the engine oil level in the static and dynamic range
- → Compact sensor architecture with a multi-chip module
- → Immediate measurement after switch-on

APPLICATION

Oil sensors in vehicles ensure that the engine does not run with insufficient oil without such a situation being noticed. The tried-and-tested technology of ultrasonic sensors works on the run-time principle and records the fill level continuously when the vehicle is being driven. When the engine is running (dynamic measuring range), the fill level is significantly lower than the fill level when the engine is at a standstill (static measuring range). In mobile engines, an oil dipstick measures the oil level only in the static range. This oil level sensor can measure the oil level continuously, i.e. in both the dynamic and also the static range. Thus information is provided about the oil level during the entire engine operation, a process which can often last several hours in construction vehicles, tractors and forklifts.

The sensor continuously monitors the oil level during the entire operation of the engine. This function ensures that the oil level does not fall below the required minimum during engine operation, thus preventing the oil film from breaking down (which would result in engine damage). Another advantage of the sensor is the integrated temperature sensor, which provides an input variable for the thermal management of the engine.

Marginal influences such as vehicle leaning, lateral and longitudinal accelerations are compensated by averaging out in the vehicle's control unit.

The use of the oil level sensor for the measurement of special media, e.g. transmission and hydraulic oils require prior testing and approval by HELLA.

DESIGN AND FUNCTION

The sensor architecture of the PULS (Packed Ultrasonic Level Sensor) oil level sensor consists of one single multi-chip module that integrates the ultrasonic sensor, the temperature sensor and also an ASIC (Application Specific Integrated Circuit).
This compactness gives the sensors a higher level of impact and vibration resistance than those sensors fitted with a large number of electronic components. The ultrasonic sensor integrated in the multi-chip module emits a signal that is reflected by the engine oil/air interface.

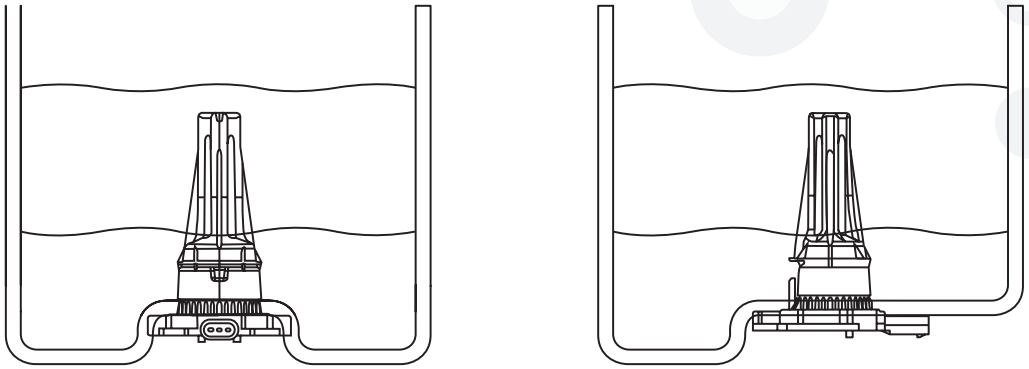
The term of the signal is measured and the height is calculated in line with the sound velocity in the medium. The damping cup installed above the multi-chip module is designed "to calm" the medium, (especially) in the dynamic measuring range. The damping cup has openings at the base and at the tip, which allow the oil to flow permanently.

INSTALLATION

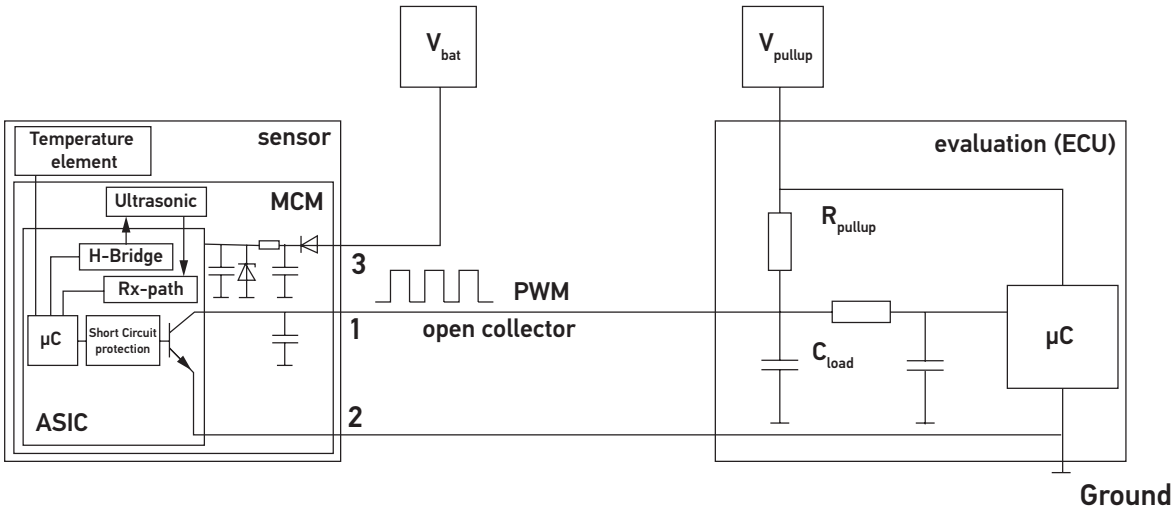
The sensor is designed to be vertically flush-mounted from below into the bottom of the oil pan. Usually the oil level sensor is located on a ledge in the oil pan in order to protect the sensor base. This installation position, combined with the openings which make a permanent flow of oil possible, prevents sludge from forming within the damping cup.

SCHEMATIC DIAGRAM

Optimal sensor position: central positioning in the oil pan for dynamic measurement



BLOCK DIAGRAM



PROGRAM OVERVIEW

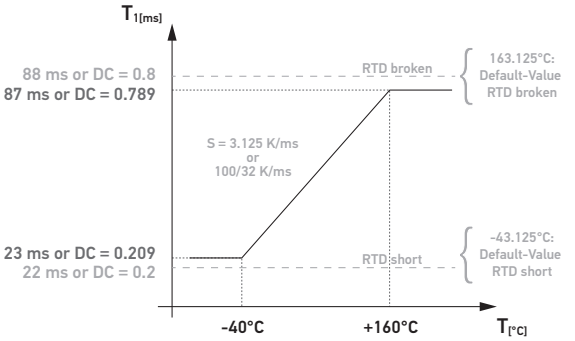
Length of damping cup	Supply voltage	Measuring range	Part number	VPE*	Page
85 mm	12 V	Static and dynamic 13 – 79 mm	**On request**	–	
95 mm	12 V	Static and dynamic 13 – 89 mm	**On request**	–	
109.8 mm	12 V	Static and dynamic 13 – 103.8 mm	**On request**	–	34 – 37
135 mm	12 V	Static and dynamic 13 – 129 mm	**On request**	–	
150 mm	12 V	Static and dynamic 13 – 144 mm	**On request**	–	
Accessories					
Sealing ring**			**On request**	–	–

** Whenever the sensor is remounted, a new sealing ring must be used. This is available from HELLA.

* Packaging unit

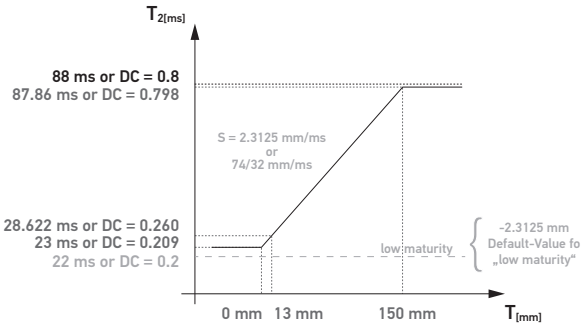
Level sensors
Recording the liquid level
(static and dynamic)

T_1: TEMPERATURE EVALUATION (T_1 TEMP)



T_1/T = DC = 0.2 : T_1 = 22 ms => Short circuit temp sensor (-43,125°C)
T_1/T = DC = 0.209 : T_1 = 23 ms => -40°C
T1/T = DC = 0.789 : T_1 = 87 ms => 160°C
T_1/T = DC = 0.8 : T_1 = 88 ms => Temp sensor defective (163,125°C)

T_2: LEVEL EVALUATION (T_2 LEVEL)



T_2/T = DC = 0.2 : T_2 = 22 ms => Unreliable signal (Level output -2.3125 mm)
T_2/T = DC = 0.209 : T_2 = 23 ms => Level = 0 mm
T_2/T = DC = 0.260 : T_2 = 28.622 ms => Level = 13 mm
T_2/T = DC = 0.798 : T_2 = 87.86 ms => Level = 150 mm
For levels below 13 mm or above 150 mm, T_2 is fixed at 28.622 ms or alternatively at 87.86 ms.

T_3: DIAGNOSTIC EVALUATION

PWM Pulse (Diagnostic values marked in bold print)			Diagnostic information	Diagnostics of environmental conditions	Diagnostics of sensor failure	Transmission priority diagnostics (Signal with the highest priority is transmitted)
Temp. T_1	Level T_2	Diagnostic T_3				
23...87 ms	23...87.86 ms	**22 ms**	Status OK			5
23...87 ms	**28.62 ms** (13 mm)	**66 ms**	Level outside the range (<13 mm)	X		4
23...87 ms	**87.86 ms** (150 mm)	**66 ms**	Level outside the range (>150 mm)	X		4
≤ 10°C 23...32.6 ms	**22 ms** (-2.3125 mm)	**66 ms**	Temperature outside the range for level measurement	X		4
≤ 10°C 23...32.6 ms	**22 ms** (-2.3125 mm)	**66 ms**	Level out of range (noise)	X		4
22 ms (-43, 125°C)	**22 ms** (-2.3125 mm)	**55 ms**	**Temperature element short-circuited**		X	1
23 ms (-40°C)	**22 ms** (-2.3125 mm)	**55 ms**	Temperature out of range (low)	X		1
87 ms (-160°C)	**22 ms** (-2.3125 mm)	**55 ms**	Temperature out of range (high)	X		1
88 ms (-163 to125°C)	**22 ms** (-2.3125 mm)	**55 ms**	**Temperature element broken**		X	1
32.6...87 ms	**22 ms** (-2.3125 mm)	**44 ms**	**Piezoceramics open/short-circuited**		X	3
32.6...87 ms	**22 ms** (-2.3125 mm)	**33 ms**	Voltage out of range	X		2

T_3/T = DC
DC = 0.2, 0.3, 0.4, 0.5 or 0.6

CONVERSION FORMULAS IN THE CONTROL UNIT

$$Temp_{comp}\,[°C] = 3.125\,\frac{K}{ms} \cdot \left(T_1 \cdot \frac{110\,ms}{T[ms]} - 23\,ms \right) - 40\,K$$

or

$$Temp_{comp}\,[°C] = \frac{100}{32}\,\frac{K}{ms} \cdot \left(T_1 \cdot \frac{110\,ms}{T[ms]} - 23\,ms \right) - 40\,K$$

$$diagnostic[ms] = T_3[ms]$$

$$Level_{comp}\,[mm] = 2.3125\,\frac{mm}{ms} \cdot \frac{T[ms]}{110\,ms} \cdot \left(T_2[ms] \cdot \frac{110\,ms}{T[ms]} - 23\,ms \right)$$

or

$$Level_{comp}\,[mm] = 2.3125\,\frac{mm}{ms} \cdot \left(T_2[ms] - 23\,ms \cdot \frac{T[ms]}{110\,ms} \right)$$

or

$$Level_{comp}\,[mm] = \frac{74}{32}\,\frac{mm}{ms} \cdot \left(T_2[ms] - 23\,ms \cdot \frac{T[ms]}{110\,ms} \right)$$

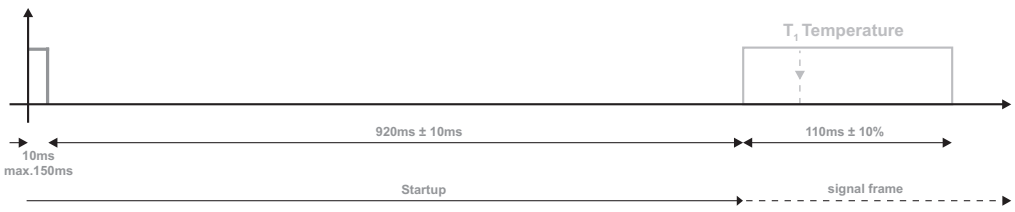
OUTPUT CHARACTERISTICS

The minimum pull-up voltage of the sensor depends on the low-level threshold value stored in the control unit and also on a potential ground offset. It can be calculated using the following formula:

Name	Symbol	Min.	Typical	Max.	Unit	Remarks
Output voltage, low	V_{ol}	–	–	$0.0375 \times V_{pullup} + 1\,V$	V	The required ground displacement of 1 V must be taken into account for dimensioning of the low level threshold
Output voltage, high[1)]	V_{oh}	V_{pullup} - 0.5 V	–	–	V	Open circuit with output capacity = 1nF (Under external capacitive load, please observe the slew rate)
Pull-up voltage	V_{pullup}			16	V	The minimum voltage results from the ECU; high / low limit values in consideration of output voltages at PIN 1 (signal)
Output current at low level	I_{ol}	–	–	10	mA	For $V_{ol} > 0.0375 \times V_{pullup} + 1\,V$
Output current at high level	I_{oh}	-50	0	50	µA	For $GND < V_{oh} < V_{pullup}$
PWM open collector resistor[2)]	R_{pullup}	1.6	–	10	kOhm	To be implemented in the engine control unit
Capacitive load[3)]	C_{load}	–	–	50	nF	
Output current - short-circuit detection	I_{ol_SHORT}	65	–	–	mA	

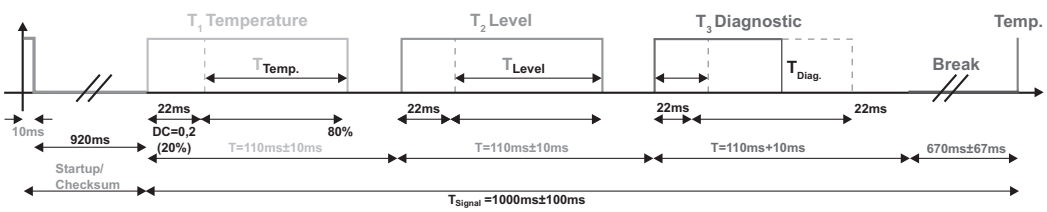
[1)] Open collector with output capacitance = 1nF (with external capacitive load, please observe slew rate).
[2)] To be implemented in the on-board computer.
[3)] Capacitive load at pulse communication output.

STARTUP BEHAVIOUR AFTER POWER ON



PWM (OPEN COLLECTOR) SIGNAL EVALUATION

The PWM output signal consists of three pulses that are repeated cyclically every 1,000 ms ± 10%. The pulses contain coded information about the oil temperature, oil level and diagnosis.



Level sensors
Recording the liquid level
(static and dynamic)
On request

TECHNICAL DATA	
Operating voltage (for oil level measurement)	9 – 16 V
Operating voltage (for temperature measurement)	9 – 16 V
Polarity reversal voltage	- 14 V / 60 s
Overvoltage	15 s at 28 V 250 ms at 32 V
Measuring range (static and dynamic)	13 mm to L -6 mm[1)]
Operating temperature	-40°C to +160°C
Operating temperature (for oil level measurement)[1)]	-10°C to +150°C
Reheating temperature	max. 5,700 h at 125°C max. 240 h at 145°C max. 60 h at 160°C
Storage temperature	-40°C to +150°C
Current consumption	8 mA
Max. current consumption during measurement	50 mA
Protocol[2)]	PWM
Mating connector[3)]	MLK 872-858-541 (3way 1.2 SealStar)
Protection class	IP 6K9K
Weight	Variant-dependent
Viscosities	1 mm^2/s to 1,300 mm^2/s

[1)] Dependent on damping cup length (see variant overview)
[2)] Level output above -10°C. At temperatures below -10°C, an "empty" signal is sent (18 mm) together with the diagnostic signal "out of tolerance".
[3)] These accessories are not included in the scope of delivery. Available from Hirschmann.

NEW GENERATION SENSOR
This sensor has an improved meander structure for optimised behaviour under dynamic conditions in oil and it also has improved response times.

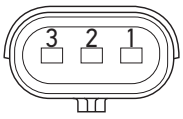
Tolerance of level measurement

Oil level	Temperature range	Operating voltage	Tolerance
13 mm to L -6 mm	-10°C ≤ T < 30°C	9 to 16 V	±4 mm
13 mm to L -6 mm	30°C ≤ T < 150°C	9 to 16 V	+2 mm

Temperature measurement tolerance

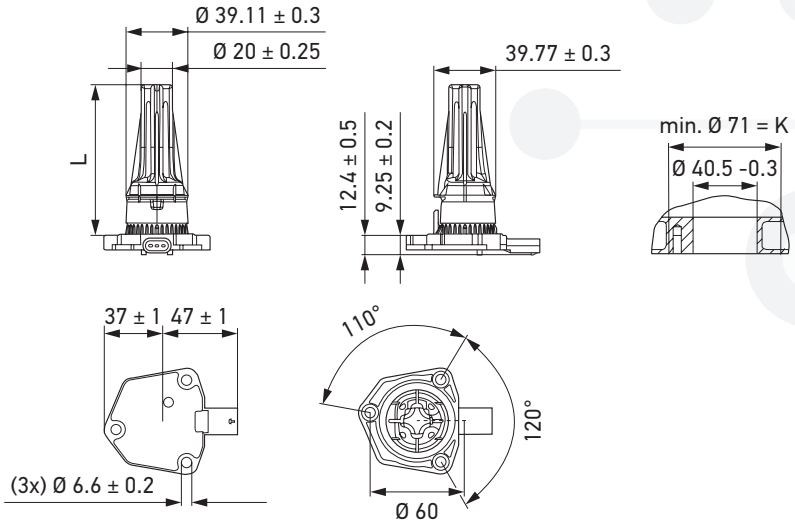
Oil level	Temperature range	Operating voltage	Tolerance
All	60°C ≤ T < 120°C	6 to 16 V	±2 K

PIN ASSIGNMENT/ELECTRICAL CONNECTION



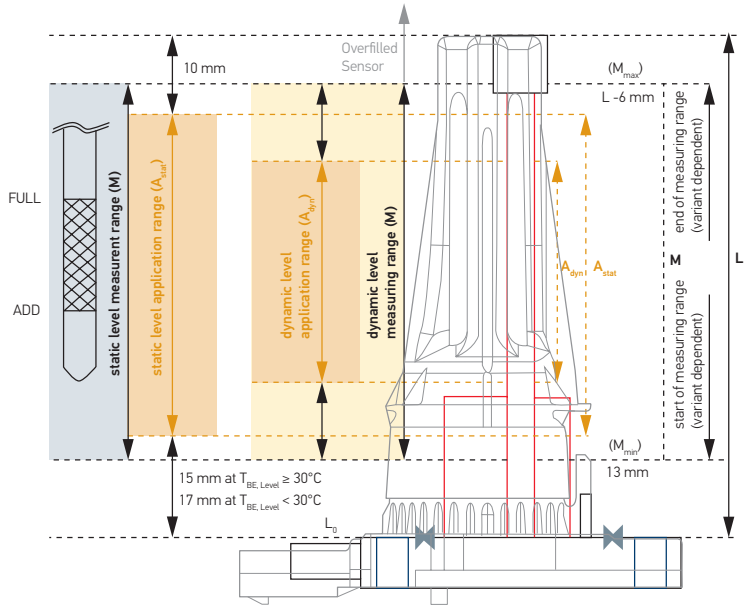
Pin 1: OUTPUT
Pin 2: TERMINAL 31 GND
Pin 3: TERMINAL 15 V_{BAT}

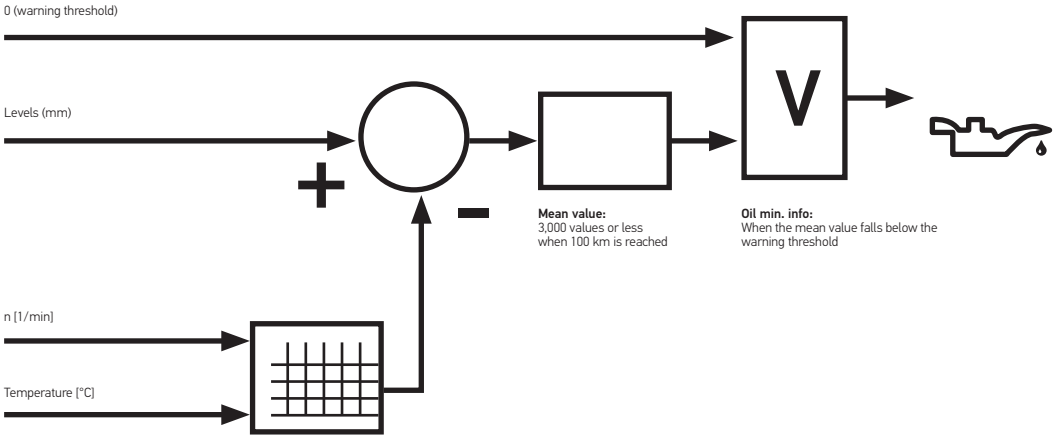
TECHNICAL DRAWING



DYNAMIC MEASUREMENT OF THE ENGINE OIL LEVEL

For dynamic measurement (while the engine is running), an evaluation algorithm in the control unit must be developed, which compensates for the marginal influences of the engine (oil volume, oil temperature, speed) and of the vehicle (longitudinal and lateral acceleration, uphill and downhill motion).
As a result of subsequent averaging, the influences brought about by driving conditions cancel themselves out over longer periods of time.
Hence, either a warning can be triggered with respect to the minimum oil volume reached or the oil volume that is actually still available can be calculated.





3D characteristic diagram: compensation of engine speed and oil temperature

Level sensors
Measuring oil pressure and oil temperature

PRODUCT FEATURES

- → Continuous measurement of the oil pressure
- → Continuous measurement of the oil temperature
- → Robust and reliable design

APPLICATION

The oil pressure and temperature sensor OPS+T is used to measure the absolute oil pressure and the oil temperature directly in the main oil channel behind the oil filter.

It uses the pressure value to carry out demand-responsive control of mechanical or electrical oil pumps. This lowers the CO_2 emissions and reduces fuel consumption. Recording of the temperature serves as input data for the thermal management of the engine. Both signals are evaluated in the higher-level control unit.

The use of the multi-chip module means the sensor can be utilised in harsh environments.

DESIGN AND FUNCTION

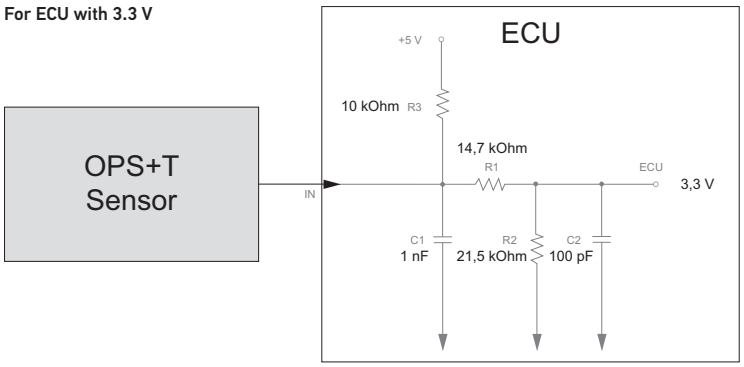
The OPS+T is based on a multi-chip module (MCM) consisting of a piezoresistive cell for measuring absolute pressure and also of an ASIC for digital evaluation and further processing of the information. In addition, the oil temperature can be established using a diode which is integrated in the MCM. Both the oil pressure and also the oil temperature are transmitted via the PWM output signal. The engine control unit (ECU) evaluates the PWM output signal of the sensor. The patented technology guarantees protection against oil leakage.

EXTERNAL CIRCUITRY IN THE CONTROL UNIT

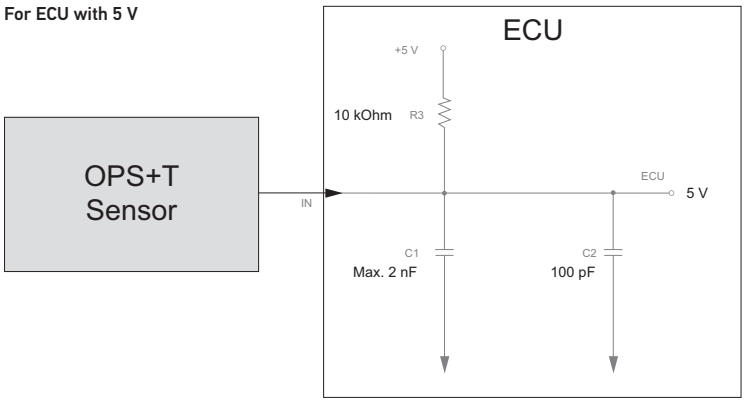
A 10 kΩ pull-up resistor should be integrated in the ECU of the vehicle in order to define an idle mode.

For optimum reading of the PWM signal, a capacitance of max. 2.2 nF should be integrated so as to compensate for the oscillations.

For ECU with 3.3 V



For ECU with 5 V



PROGRAM OVERVIEW

Mounting	Supply voltage	Measuring range	Part number	VPE*	Page
Sensor with screw thread, M12 x 1.5	4.75 – 5.25 V	Pressure 0.5 - 10.5 bar, Temperature -40°C to +160°C	**6PR 010 378-101/-107**	1/120	40 – 41

* Packaging unit

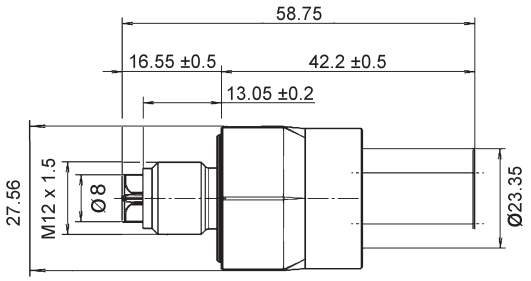
Level sensors
Measuring oil pressure and oil temperature
6PR 010 378-101

TECHNICAL DATA

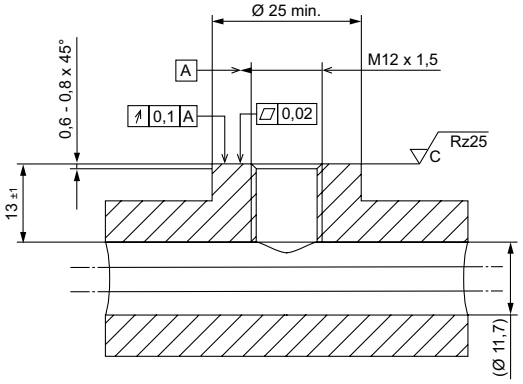
Temperature range	-40°C to +150°C
Max. Temperature	160°C (max. 100 h)
Supply voltage	4.75 – 5.25 V
Output signal	PWM
Response time	2 ms
Sampling frequency	< 3 kHz
Max. Operating pressure	40 bar
Overpressure	60 bar
Pressure measuring range	0.5 bis 10.5 bar
Temperature measuring range	-40°C to +160°C
Protection class	IP 69K
Mating connector[1)]	Hirschmann 872-858-541 or TE Connectivity 1-1670917-1

[1)] These accessories are not included in the scope of delivery.
Available from Hirschmann Automotive or TE Connectivity.

TECHNICAL DRAWING



INSTALLATION SPACE



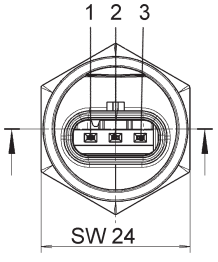
TOLERANCE BAND FOR PRESSURE MEASUREMENT

Temperature	0.50–3.00 bar	3.00–5.50 bar	5.50–10.50 bar
70°C to 160°C	± 0.15 bar	± 0.20 bar	± 0.30 bar
20°C to 70°C	± 0.15 bar	± 0.20 bar	± 0.30 bar
0°C to 20°C	± 0.20 bar	± 0.25 bar	± 0.35 bar
-40°C to 0°C	± 0.40 bar	± 0.40 bar	± 0.50 bar

TOLERANCE BAND FOR TEMPERATURE MEASUREMENT

Temperature	Genauigkeit
135°C to 160°C	± 1 K
20°C to 135°C	± 2 K
-40°C to 20°C	± 3 K

PIN ASSIGNMENT/ELECTRICAL CONNECTION

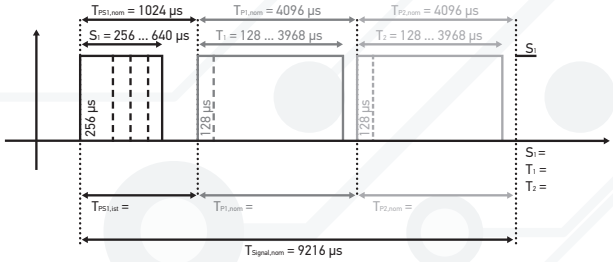


Pin 1: Supply
Pin 2: Ground
Pin 3: Output

OUTPUT SIGNAL

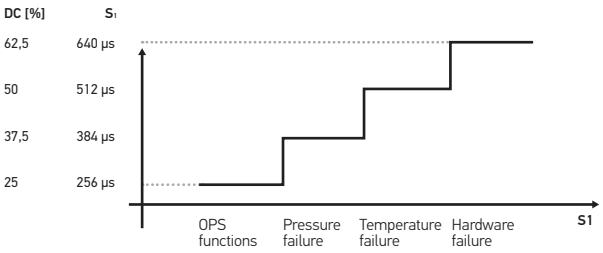
A pulse width modulated signal (PWM) is used to provide temperature, pressure and diagnostic information. All the information is sent every 9,216 µs. The higher-level control unit must be able to measure the different pulse widths of the three square wave signals, which can vary from 128 µs to 3,958 µs. The control unit must provide a suitable sampling frequency and logic for measuring and recording the signals.

General information on the evaluation of PWM communication:
Because of the adjustment accuracy of the oscillator and its temperature dependence, the length of a PWM frame is subject to a maximum tolerance of ±10 %. Serious hardware errors in the program sequence of the ASIC cancel the PWM communication and are then detectable by the control unit on account of a permanent high level.



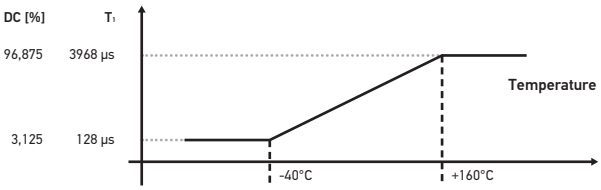
S1: Signal
T_1: Temperature
T_2: Pressure

S_1: DIAGNOSTIC SIGNAL



DC = 0.25 (S_1 = 256 µs ± 25 µs) => OPS functional state
DC = 0.375 (S_1 = 384 µs ± 25 µs) => pressure failure
DC = 0.5 (S_1 = 512 µs ± 25 µs) => temperature failure
DC = 0.625 (S_1 = 640 µs ± 25 µs) => hardware failure

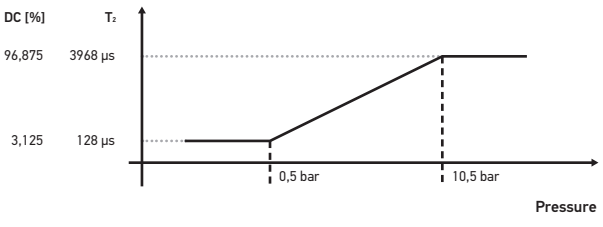
T_1: TEMPERATURE EVALUATION



96.9 % of the PWM block duration T1 (3,968 µs) corresponds to the uppermost point of the measuring range of 160°C.
3.1 % of the PWM block duration T1 (128 µs) corresponds to the lowest point of the measuring range of -40°C.

$$T_1|_{\mu s} = 19.2 \frac{\mu s}{°C} \cdot \text{Temp} + 896\ \mu s$$

T_2: PRESSURE EVALUATION(T_2 LEVEL)



96.9 % of the PWM block duration T2 (3,968 µs) corresponds to the uppermost point of the measuring range of 10.5 bar.
3.1 % of the PWM block duration T2 (128 µs) corresponds to the lowest point of the measuring range of 0.5 bar.

$$T_2|_{\mu s} = 384 \frac{\mu s}{bar} \cdot \text{Pressure} - 64\ \mu s$$

ECU CALCULATION

$$\text{Temperature} = \left(\frac{4096\ \mu s}{T_{P1,is}|_{\mu s}} \cdot T_1|_{\mu s} - 128\ \mu s \right) \cdot \frac{1}{19.2} \frac{°C}{\mu s} - 40°C$$

$$\text{Pressure} = \left(\frac{4096\ \mu s}{T_{P1,is}|_{\mu s}} \cdot T_2|_{\mu s} - 128\ \mu s \right) \cdot \frac{1}{384} \frac{bar}{\mu s} + 0.5\ bar$$

$$\text{Diagnostics} = \left(\frac{1024\ \mu s}{T_{PS1,is}|_{\mu s}} \cdot S_1|_{\mu s} \right)$$

Rain-light sensors
Recording environmental properties

PRODUCT FEATURES

- → The fourth generation in a long established line of rain sensors from HELLA
- → Five functions in one product: rain, light, solar load and humidity measurement as well as adjustment of the luminous intensity of the head-up display
- → Optimised design - extremly compact installation space

APPLICATION
The rain-light sensors (RLS) are used in a variety of vehicles, primarily for automatic rain or light control.

These features reduce the driver's workload by virtually eliminating the need for him to react in order to manually operate the wiper lever in rain or the light switch in darkness (tunnels, garages, twilight).

In the case of sensors for passenger cars, it is also possible to integrate the solar and humidity detection functions so as to link them to an automatic climate control system. Furthermore, the sensor can optionally be equipped with a head-up display function.

HELLA offers a variety of sensors that are optimally tailored to suit individual vehicle makes. Installation conditions and the characteristics of the windscreen to which the sensors are to be attached are always tested very individually and in close collaboration with the vehicle manufacturer.

HELLA views the lighting function of the RLS as safety-relevant in accordance with ISO 26262.

DESIGN AND FUNCTION
This new sensor offers the user five functions in one product:

Rain sensor
The rain sensor is used to recognise different rain conditions in the sensor area and then to activate the windscreen wipers accordingly. Driver intervention is virtually no longer necessary.

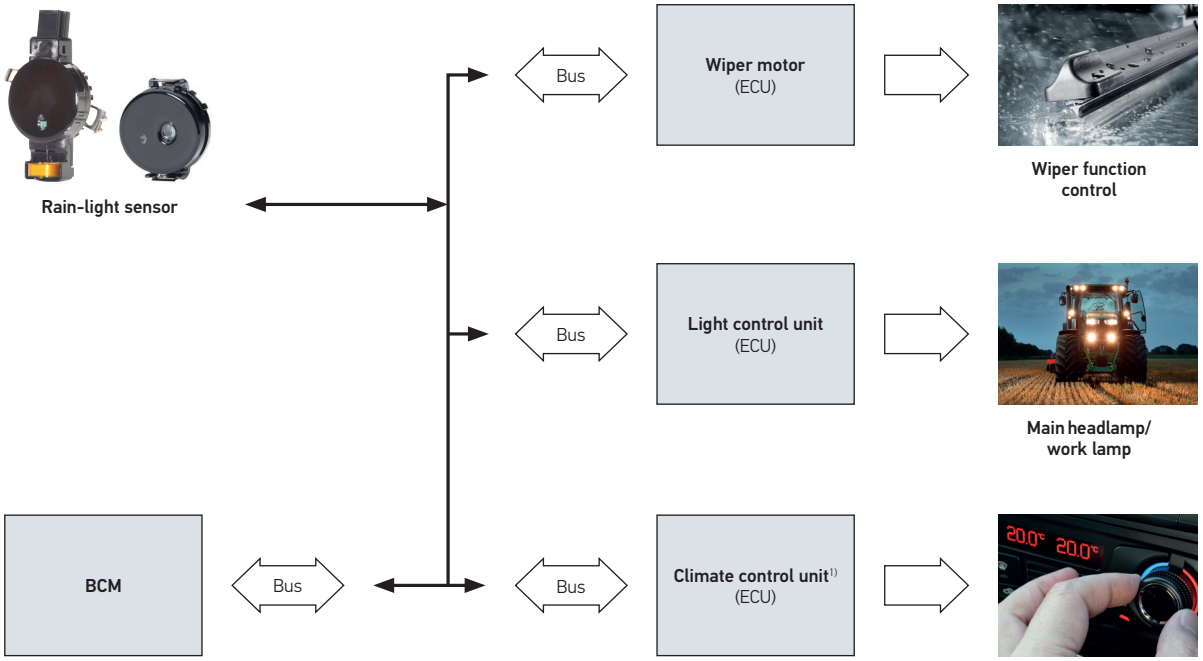
Light sensor
As a light sensor, it controls the switching on and off of the low beam in various lighting conditions or in special situations, e.g. when driving through tunnels.

Head-up display
When used for the head-up display, the sensor records the brightness immediately in front of the vehicle and adjusts the light intensity on the display in line with the prevailing lighting conditions.

Solar sensor
As a solar sensor, it measures insolation levels and thus supports air conditioning and general climate control in the vehicle.

Humidity measurement
Humidity measurement is used to control the air-conditioning control unit serving the air conditioning in the vehicle interior, which includes tasks such as automatic ventilation of the windscreen.

FUNCTIONAL DIAGRAM



1) Function can only be used in conjunction with the car sensor

PROGRAM OVERVIEW

The sensors have to be specially adapted to suit each vehicle type. Consequently all part numbers are assigned on a manufacturer-specific basis.

Areas of application	Permitted windscreen thickness	Permitted windscreen tilt	Part number	VPE*	Page
Passenger cars	4 – 6 mm	22° – 32°	**On request**	–	44
Passenger cars (van)	4 – 6 mm	32° – 54°	**On request**	–	
Vehicles with steeply sloping windscreens	6 – 9 mm	80° – 90°	**On request**	–	46

* Packaging unit

Rain-light sensors
Recording environmental properties
On request

TECHNICAL DATA

Operating temperature	-40°C to +85°C
Storage temperature	-40°C to +100°C
Protection class	IP 50
Protection class (in the range of fogging sensor technology)	IP 20
Operating voltage	9 – 16 V
Overvoltage	24 V
Rated current consumption	< 50 mA
Communication interface	LIN 2.0
Weight	< 17 g
Mating connector[1)]	114 18063-18, coding D
Windscreen requirements	
Spectral range of operation	400 - 1,050 nm
Permitted windscreen transmission	20 - 80 % (at 950 nm)
Permitted windscreen thickness	4 – 6 mm
Permitted windscreen tilt	22° - 32° or 32° - 54°
Permitted radius in the area of the sensor	r => 1,400 mm
Diameter of printed section	28 ± 0.2 mm

[1)] These accessories are not included in the scope of delivery. Available from TE Connectivity.

TECHNICAL DRAWING

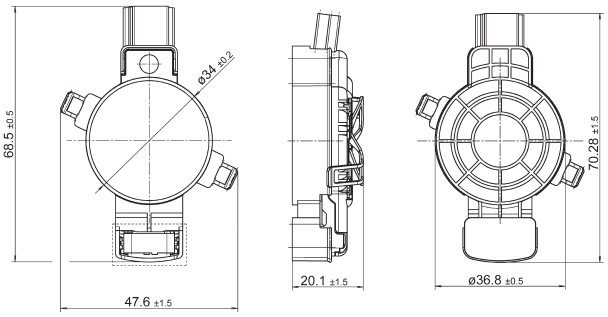
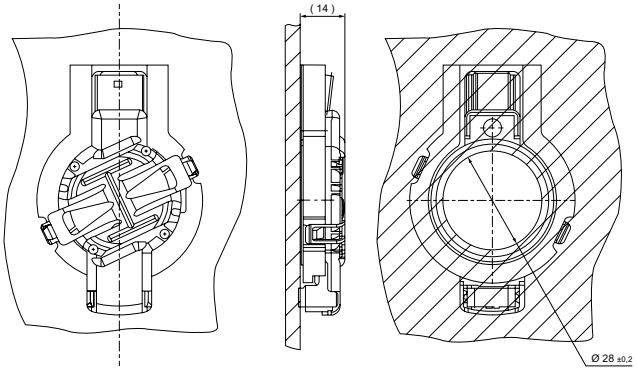
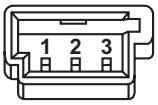


ILLUSTRATION TO SHOW MOUNTING ON WINDSCREEN



PIN ASSIGNMENT/ELECTRICAL CONNECTION



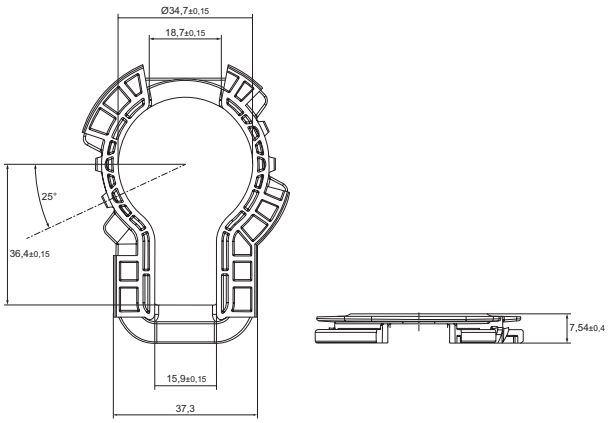
Pin 1: VCC
Pin 2: LIN
Pin 3: GND

Rain-light sensors
Bracket

Accessories[1)]

PART NUMBER		VPE[2)]
9XD 420 747-601	For mounting with 3m adhesive tape Plastic	1
9XD 420 747-501	For mounting with PUR liquid adhesive Plastic	1

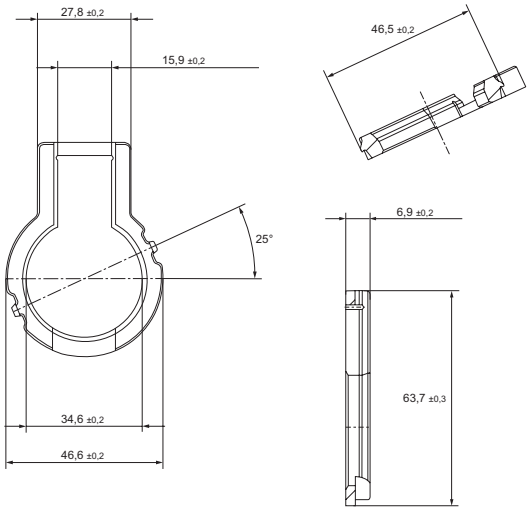
TECHNICAL DRAWING



Accessories[1)]

PART NUMBER		VPE[2)]
9XD 420 747-007	For mounting with 3m adhesive tape Sintered metal	100
On request	For mounting with PUR liquid adhesive Sintered metal	–

TECHNICAL DRAWING



[1)] These accessories are not included in the scope of delivery.
[2)] Packaging unit

Rain-light sensors
for vehicles with steeply sloping windscreens
Recording environmental properties
On request

TECHNICAL DATA

Operating temperature	-40°C to +85°C
Storage temperature	-40°C to +100°C
Protection class	IP 50
Operating voltage	9 – 16 V
Rated voltage	12 V
Overvoltage	24 V
Rated current consumption	< 50 mA
Communication interface	LIN 2.1
Weight	≤ 42 g
Mating connector[1)]	AMP C-1718346, coding A
Windscreen requirements[2)]	
Spectral range of operation	400 - 1,050 nm
Permitted windscreen transmission	23 - 80 % (at 800 - 1,100 nm)
Permitted windscreen thickness	6 – 9 mm
Permitted windscreen tilt	80° – 90°
Permitted radius in the area of the sensor	r => 1,400 mm
Diameter of printed section	40 ± 0.2 mm

[1)] These accessories are not included in the scope of delivery. Available from TE Connectivity.
[2)] Other windscreen configurations available on request.

TECHNICAL DRAWING

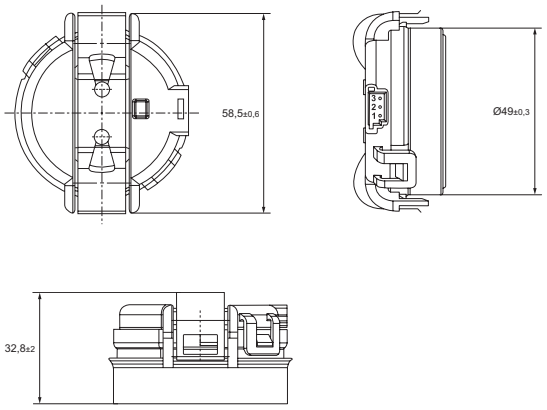
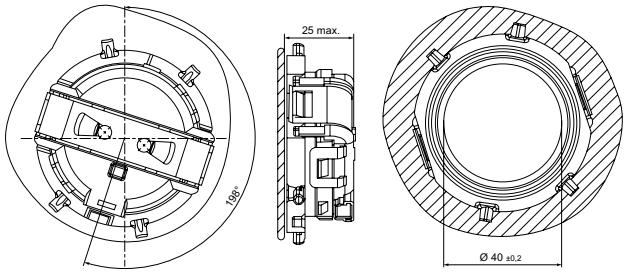
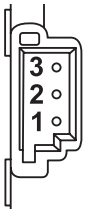


ILLUSTRATION TO SHOW MOUNTING ON WINDSCREEN



PIN ASSIGNMENT/ELECTRICAL CONNECTION



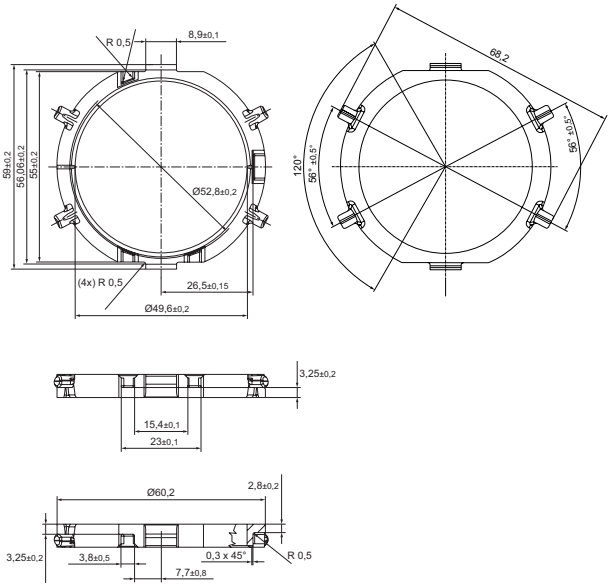
Pin 1: 12 V
Pin 2: LIN
Pin 3: GND

Rain-light sensors
Bracket

Accessories[1)]

PART NUMBER		VPE[1)]
9XD 420 696-104	For mounting with PUR liquid adhesive Sintered metal	1

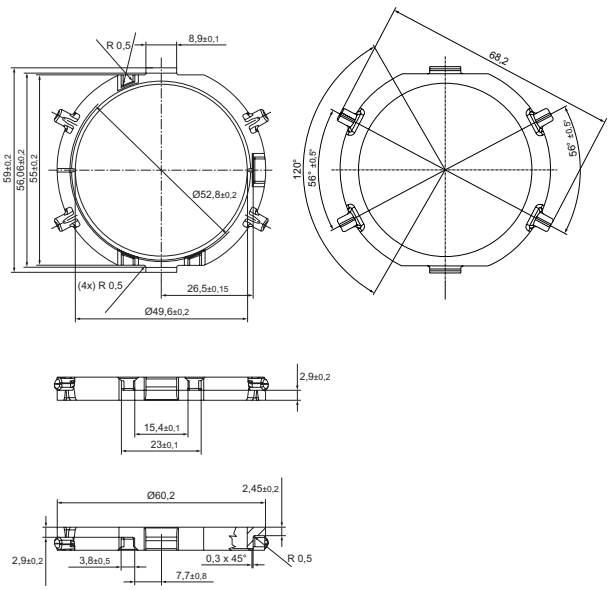
TECHNICAL DRAWING



Accessories[1)]

PART NUMBER		VPE[1)]
9XD 420 696-001	For mounting with 3m adhesive tape Sintered metal	1

TECHNICAL DRAWING



[1)] These accessories are not included in the scope of delivery.
[2)] Packaging unit

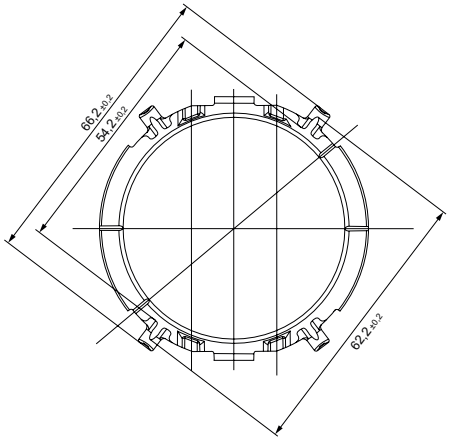
Rain-light sensors
Bracket

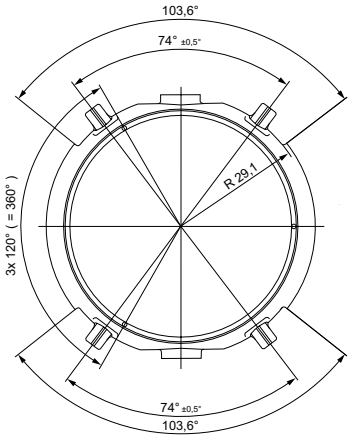
Accessories

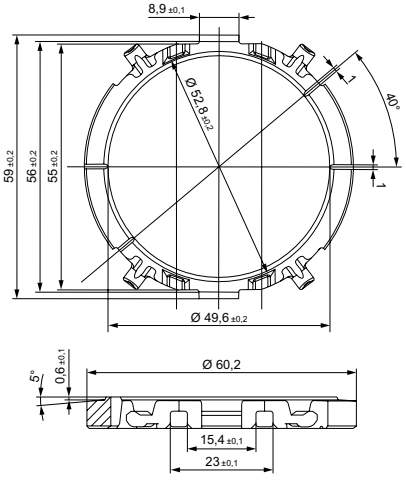
PART NUMBER		VPE*
9XD 748 921-011	For mounting with PUR liquid adhesive Sintered metal	1

This bracket can be used together with a design cover (9HB 748 851-107).

TECHNICAL DRAWING





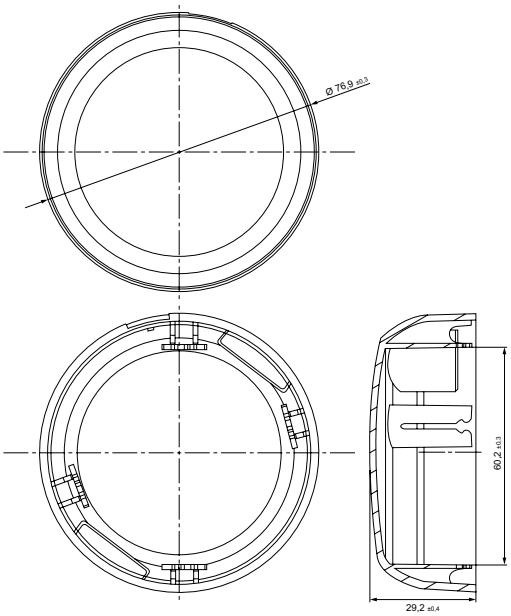


* Packaging unit

Accessories

PART NUMBER		VPE*
9HB 748 851-101	Design cover	1

TECHNICAL DRAWING



* Packaging unit

Road condition sensor (RCS/ SHAKE)

PRODUCT FEATURES

- → Detects wetness on roads reliably and at an early stage both day and night
- → Enables warning to be given on wet roads in order to prevent aquaplaning
- → Input variable for friction coefficient calculation in brake and control systems
- → Robust measuring principle of airborne and structure-borne sound analysis in the wheel well, tried-and-tested over many years

APPLICATION

The road condition sensor (RCS) is a sensor capable of providing an input variable (the wetness) for driver assistance systems.

If the sensor is positioned in the wheel arch (application-specific on each front wheel arch cover), it measures the amount of water pooling on the road. This information can then be made available to the driver or to the appropriate systems in order to alert him to a possible risk of aquaplaning. In this way, driving behaviour can be adapted so as to avoid causing accidents.

By measuring the road wetness at a constant driving speed, the RCS provides an extension to the dynamic friction value calculation (e.g. for ABS or ESP).

Depending on customer requirements, different vehicle reactions can be triggered whenever road moisture is detected:

- → Warning given to driver when level of moisture on road / speed becomes critical
- → Prediction of braking distance depending on road wetness
- → Adjusting distance to the vehicle ahead on wet roads (ACC)
- → Influence on control systems of longitudinal and transverse dynamics

DESIGN AND FUNCTION

When road moisture occurs, the sensor detects vibrations and noises from water swirling around in the area of the wheel housing. Specific algorithms free the signal from disturbance variables and calculate the water film height.

The signal is processed by the embedded electronics and software of the sensor and sent via a LIN interface (bidirectional) to the vehicle control unit (ECU). Details on the sensor communication can be customised. The RCS sensor can contribute to better driving stability by lowering, for example, the activation thresholds for ABS and traction control. The sensor signals can also be used to adjust the drive train control in order to ensure stability during acceleration – especially when cornering.

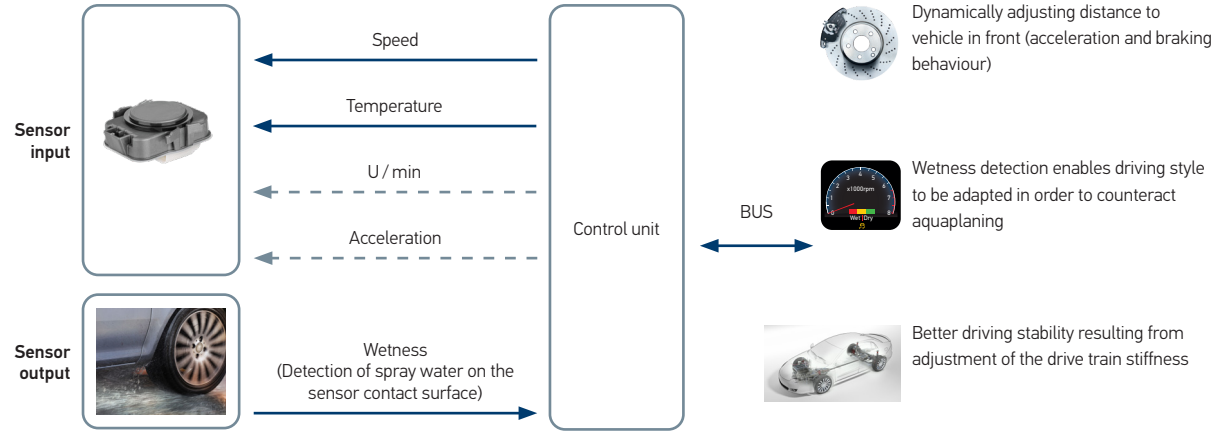
If the road condition sensor is used for partially or highly automated driving, the information about the degree of wetness can also be used to dynamically adjust the distance to the vehicle in front.

In order to fix the sensor to the wheel arch cover, the sensor housing is connected to a bracket. This can either be injected directly into the wheel housing, i.e. the wheel arch, by the manufacturer or alternatively a special, separate fastening element can be used.

The sensor is mechanically robust against:

- → Dirt / dust
- → Ice / ice build-up
- → Stones / impact of objects
- → Distortion of the wheel arch liner during driving (dynamic and fast)

FUNCTIONAL DIAGRAM



Key

Required information

Optional information – if available – serves to increase performance during dynamic driving.

PROGRAM OVERVIEW

Variants	Part number	VPE*	Page
Road condition sensor (RCS/ SHAKE)	**On request****	–	52–53

** The sensors must be specially adapted to suit every vehicle model. All part numbers are therefore assigned on a customer-specific basis.

* Packaging unit

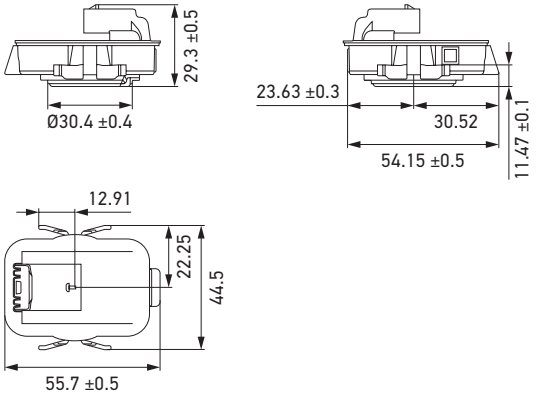
Road condition sensor (RCS/ SHAKE)
On request

TECHNICAL DATA

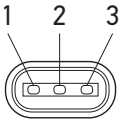
Operating voltage	9 –16 V
Operating temperature	-40°C to +90°C
Current consumption	Approx. 20 mA at 12 V
Protection class	IP 6K9K
V_{max}	180 km/h[1)]
Minimum detection limit (road wetness)	250 µm
Interface	LIN 2.1
Mating connector[2)]	Hirschmann 872-858-541 or TE Connectivity 1-1670917-1
Weight	< 30 g

[1)] The wetness detection has been validated by HELLA up to a speed of 180 km/h. As wet roads pose a risk to life and limb, beyond this the ultimate responsibility lies with the customer. Dryness detection functions up to a speed of 300 km/h.
[2)] These accessories are not included in the scope of delivery. Available from Hirschmann Automotive or TE Connectivity.

TECHNICAL DRAWING



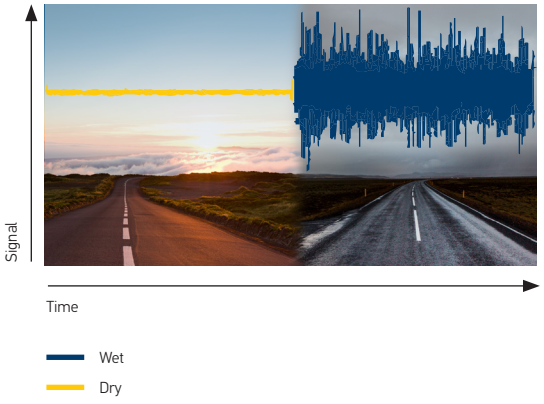
PIN ASSIGNMENT/ELECTRICAL CONNECTION



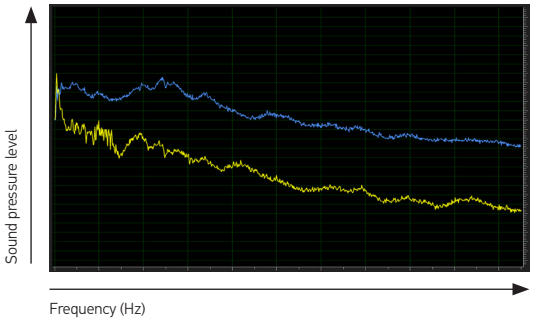
Pin 1: U_{BAT}
Pin 2: LIN
Pin 3: GND

FUNCTIONAL PRINCIPLE / STRUCTURE-BORNE SOUND RECOGNITION

Raw signal



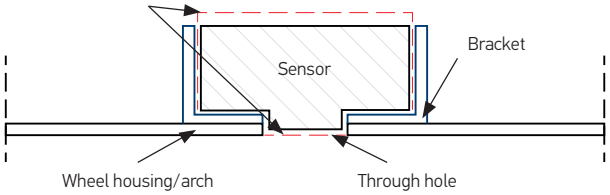
Sensitivity of sound pressure



MOUNTING IN THE WHEEL HOUSING

The road condition sensor (RCS) may only be connected directly to the wheel housing/arch via the bracket and the decoupling element.
A clearance of 10 mm to adjacent components must be guaranteed.

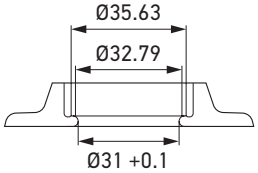
Clearance



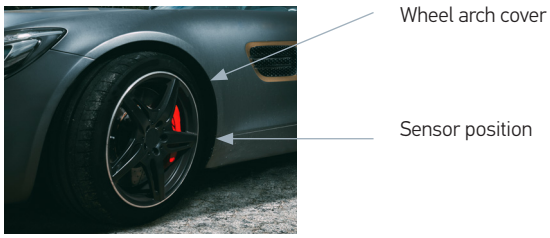
Bracket for wheel housing/arch

MOUNTING OPENING

Example showing cross section of the wheel arch through hole



Optimal positioning of the SHAKE sensor in the wheel housing



Temperature sensors
Measurement of air temperatures

PRODUCT FEATURES

- → EMC stable
- → Fast response times

APPLICATION

The air temperature sensors are used to measure temperatures in the air flow of the air-conditioning system. Furthermore, this variant can be used for measuring the outside temperature in compliance with relevant response times and protection classes in the various industrial spheres.

Examples include air-conditioning systems in
- → Vehicles
- → Heating and sanitation systems

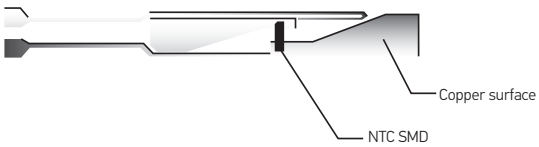
DESIGN AND FUNCTION

The basic design of this sensor variant consists of an NTC resistor. NTC resistors have a negative temperature coefficient and increase their conductivity as temperatures rise.

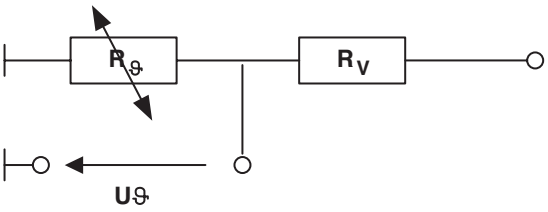
The basic wiring diagram consists of the sensor and a series-connected constant resistor. By means of the voltage drop on the resistor or on the sensor, it is possible to apply the voltage divider law to calculate the resistance of the NTC temperature sensor. The resistance curve can be used to match the temperature to the resistance of the NTC sensor.

The variant (Part no.: 6PT 009 522-011) was designed as an outdoor temperature sensor and is splash-proof. The use of a parallel resistor linearises the temperature characteristic curve. A parallel capacitor improves the electromagnetic compatibility of this variant.

SCHEMATIC SENSOR DESIGN



BLOCK DIAGRAM



PROGRAM OVERVIEW

Temperature range	Areas of application	Time constant	Mating connector	Housing	Protection class	Part number	VPE*	Page
-40°C to +65°C	Outside air temperature	< 35 s (Water / alcohol bath)	2-1437712-5	Yes	IP 67	**6PT 009 522-011**	1	55

* Packaging unit

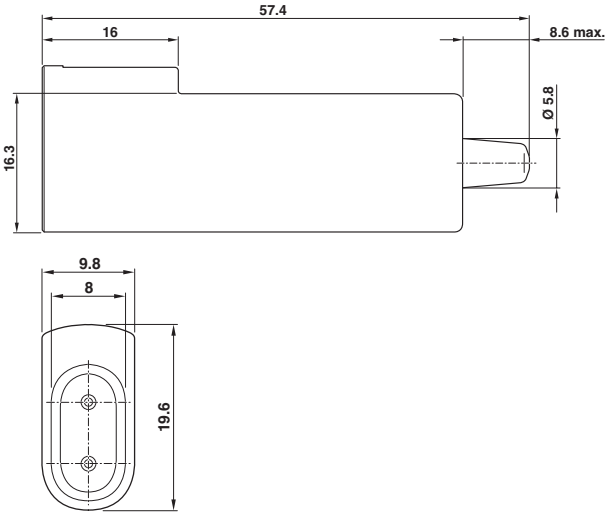
Temperature sensors
Measurement of air temperatures
6PT 009 522-011

TECHNICAL DATA

Rated voltage	5 V
Temperature measurement range	-40°C to +65°C
Time constant	< 35 s (In water / alcohol bath)
Vibration resistance	1 g, frequency cycle 10 Hz to 100 Hz to 10 Hz, change in frequency 1 Hz/s, test time of 94 hours per direction (flat), in three test directions
Storage temperature	-40°C to +90°C
Protection class	IP 67
Corrosion tested in accordance with	ASTM 13117, 96 h
Lifetime	15 years
Housing material	PA6 GF30
Contact pin	CuSn6, gold plated
Pin coating	NiAu and NiSn, solderable
Mating connector[1)]	2-1437712-5
Weight	5.9 g

[1)] These accessories are not included in the scope of delivery. Available from TE Connectivity.

TECHNICAL DRAWING



CHARACTERISTIC RESISTANCE VALUES

Temperature	Resistance (R nom.)	Percentage deviation (±)
-40°C	9.820 kΩ	1.5 %
-20°C	7.931 kΩ	1.5 %
0°C	5.179 kΩ	0.5 %
+4°C	4.632 kΩ	0.5 %
+25°C	2.354 kΩ	1.0 %
+65°C	0.588 kΩ	1.0 %

PIN ASSIGNMENT/ELECTRICAL CONNECTION

No fixed pin assignment.

Particulate matter sensor PM 2.5
for particles 0.3 µm to 5 µm
On request

PRODUCT FEATURES

- → Monitors and controls the concentration of particulate matter precisely
- → Based on the optical principle of scattered light for particle detection
- → Fast response time of < 5 seconds enables reaction to environmental conditions to take place in real time

APPLICATION

The particulate matter sensor was developed for monitoring and measuring the quality of indoor air (in the cabin) and that of supply air.

Particulate matter is one of the most dangerous pollutants for the human body. Because of their small size, the particles can penetrate deep into the lungs. Over longer periods of time, they can cause lung diseases such as bronchitis or asthma and even contribute towards cardiovascular disease. With the PM 2.5 sensor, long-term damage to health caused by air pollution can be reduced if the sensor in the vehicle is used to bring about extended air recirculation.

DESIGN AND FUNCTION

The PM 2.5 sensor is integrated into the ventilation control system. Because of its compact design, the sensor can usually be placed in the same spot as where the air is to be sucked in. A cover cap is sufficient to prevent coarse dirt and water from entering the sensor. If the air is to be drawn in elsewhere, hoses for supply and exhaust air must be laid there. The organising of such hoses can either be arranged by the customer or provided by HELLA following the relevant consultation.

The PM 2.5 sensor detects and counts particulate matter such as fine dust by means of light scattering: when air flows through the detection chamber, the particles pass a laser beam which is scattered on them. The scattered light is received by a diode and converted into an electrical signal which is used to calculate the particle concentration.

The calculated values are transmitted to the vehicle via a LIN interface and thus signal to the air-conditioning system to switch, for example, to air recirculation mode before larger quantities of particulate matter can enter the vehicle.

If two sensors are used, both the indoor and outdoor air quality can be monitored. This provides the user with additional benefits such as an automatic air recirculation function or a demand-oriented display of a filter service as required.

These measures help to significantly improve air quality in the vehicle interior and to reduce the health consequences of exposure to particulate matter. As a welcome side effect, vehicle operating costs can be reduced because the intervals at which filters are changed become significantly longer.

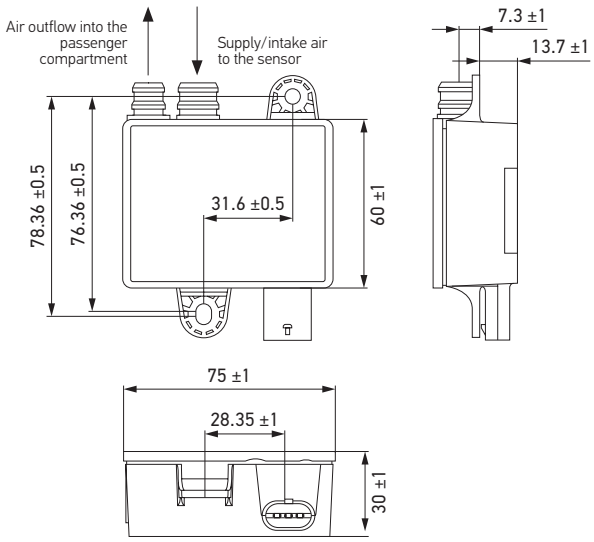
TECHNICAL DATA

Voltage	12 V
Operating temperature	-40°C to +85°C
Relative air humidity	5 to 95 %
Interface	LIN
Overvoltage	18.5 V (1 h); 26 V (1 min)
Protection class	IP 5K4K
Noise development	≤ 40 dB(A) at 0.5 m distance
Measuring range (inside / outside)	5 to 1,000 µg/m³
Particle size[1)]	0.3 µm to 5 µm
Response time	≤ 5 s
Resolution	1 µg/m³
Tolerances	5 µg/m³: with 5 to 50 µg/m³ +10 %: for > 50 to 1,000 µg/m³ 10 µg/m³: with 10 to 50 µg/m³ 20 %: for > 50 to 1,000 µg/m³
Mating connector[2)]	Hirschmann 872-858-541 or TE Connectivity 1-1670917-1
Weight	< 150 g

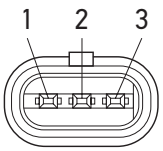
[1)] The air must be pre-filtered for particles > 50 µm and water droplets

[2)] These accessories are not included in the scope of delivery.
Available from Hirschmann Automotive or TE Connectivity.

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1: GND
Pin 2: LIN
Pin 3: 12 V

PROGRAM OVERVIEW

Variants	Part number	VPE*
Particulate matter sensor PM 2.5	**On request**	–

* Packaging unit

Steering torque sensors and combined steering torque and angle sensors

PRODUCT FEATURES

- → Modular sensors for all types of electromechanical power steering (EPS)
- → High measuring accuracy thanks to HELLA CIPOS® technology
- → Freely programmable torque range up to ±8°
- → Multi-turn function allows measurement of multiple steering wheel revolutions
- → Intelligent software concept for enhanced safety

DESIGN AND FUNCTION

The steering torque and angle sensor provides two types of feedback. The steering torque sensor records the torsion bar angle required for the steering movement. The (steering) angle sensor measures the angle and speed of change in the position of the steering wheel. Both functions benefit from HELLA's own CIPOS® technology.

The steering torque range is freely programmable for up to ±8°. In addition, the (steering) angle sensor can detect several steering wheel revolutions (multi-turn sensor). Thanks to two output signals each for steering torque and steering angle and also an intelligent software concept, a high level of system safety can be achieved.

APPLICATION

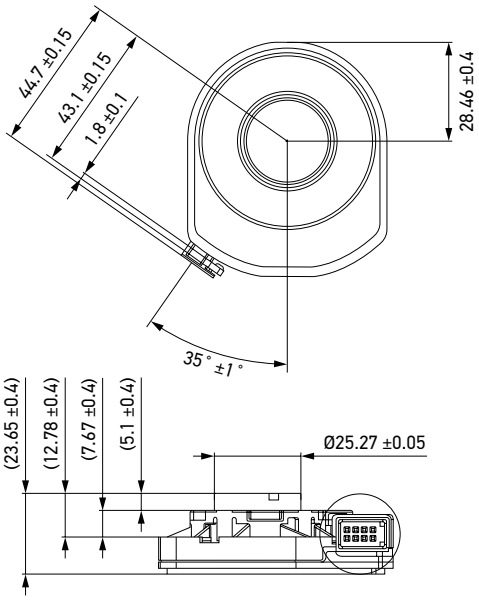
The steering torque and angle sensor is integrated in the electromechanical power steering. It provides the driver with up to two feedback signals simultaneously. The information on steering torque and steering angle is processed in various assistance systems. On the basis of the determined steering torque, for example, the required steering assist is similarly determined via the control unit.

Information about the steering angle is also processed in the electronic stability program, for example. The sensor is available both as a combined steering torque and (steering) angle sensor and also as a sensor exclusively for the steering torque.

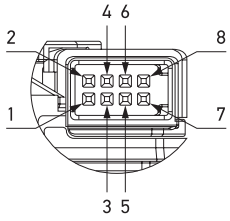
TECHNICAL DATA	
Operating voltage	5 V
Dimensions	Typically Ø 60 mm, R 40 mm (with connector)
Installation location	Integration in the electric power steering
Operating temperature	-40°C to +125°C
Measuring range	Max. ±8° (steering torque) / max. ±738° (steering angle)
Current consumption	< 36 mA per channel
Output signal	Torque: PWM Angle: PWM
Measurement accuracy	< 0.1° (steering torque) and < 1.0° (steering angle) over lifetime and temperature
Resolution	< 0.005° (torque) / < 0.01° (angle)
Mating connector[1)]	C-965382-2
EMV	CISPR 25, Class 3

[1)] These accessories are not included in the scope of delivery. Available from Tyco Electronics.

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1: VCC1
Pin 2: VCC2
Pin 3: PWM-P
Pin 4: PWM-T1
Pin 5: PWM-T2
Pin 6: PWM-S
Pin 7: GND2
Pin 8: GND1

PROGRAM OVERVIEW

Variants	Part number	VPE*
Steering torque and (steering)angle sensor	**On request**	–
Steering torque sensor	**On request**	–

* Packaging unit

Floor-mounted accelerator pedals

PRODUCT FEATURES

- → Contactless measuring principle
- → Slim yet sturdy design
- → Simple mechanical connection
- → Redundant output signal
- → High measurement precision
- → No programming/teaching in the vehicle necessary
- → High interference immunity against electrical and magnetic fields

DESIGN AND FUNCTION

The housing and pedal plate are made entirely from recyclable glass-fibre reinforced plastic. The actuating force is generated by two springs, each individually ensuring safe return to the original position. The electrical output signal is obtained via the CIPOS® measuring principle. For this purpose, a sheet metal cursor is routed from the pedal plate with a guide rod via sensor conductor paths on the measuring board. Two galvanically isolated sensors then each generate an output signal there.

APPLICATION

HELLA accelerator pedals designed for upright or pendant mounting can be used in a wide variety of vehicles – ranging from automotive sector applications, such as sports cars and electric vehicles, to robust applications in agricultural and construction vehicles. Thanks to the contactless system of measurement provided by HELLA's own CIPOS® sensor (see description of construction and function) and its extremely low level of mechanical wear, it is advisable to choose such a sensor system over contact-type accelerator pedals, especially for small, frequently recurring movements.

PROGRAM OVERVIEW

Accelerator pedal material	Part number	VPE*	Page
Plastic	**On request**	–	62 – 63

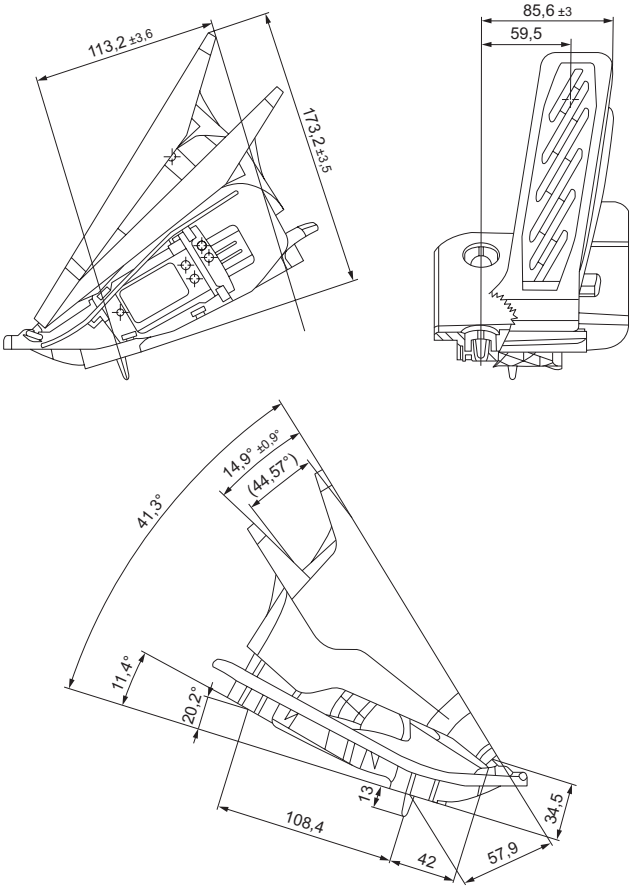
* Packaging unit

Floor-mounted accelerator pedals
On request

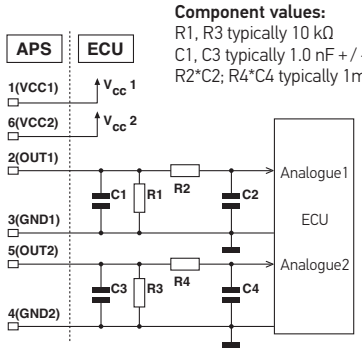
TECHNICAL DATA	
Operating voltage	5 V ± 6 %
Power consumption per channel	max. 10 mA
Overvoltage protection, duration t = 60 min	16 V
Initial force	15.5 N
Final force	31 N
Actuation angle	15°
Output signal	2 x analogue ratiometric, 2nd channel half pitch
Linearity	≤ 1 %
Synchronisation	≤ 1.2 %
Idling voltage	16 % / 8 %
Full throttle voltage	79 % / 39 %
Load resistance	10 kΩ to 225 kΩ
Load capacity	max. 15 nF
Filter constant in control unit	1 ms ± 5 %
Signal output current	max. 0.525 mA
Operating temperature	-40°C to +85°C
Storage temperature	-40°C to +105°C
Protection class (electronics)	IP 5K4
Housing material	PP-GF30
Mating connector[1)]	F(6189-1083)
Weight	≤ 500 g
Actuations	min. 2 million
EMV	CISPR 25, class 5, electric and magnetic fields
ESD	2 kV, 12 kV[2)]

[1)] These accessories are not included in the scope of delivery.
Available from Sumitomo.
Gold-plated contacts and individual wire sealing are required.
[2)] With ESD-protected connector and wiring

TECHNICAL DRAWING

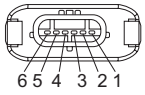


RECOMMENDED WIRING IN THE CONTROL UNIT



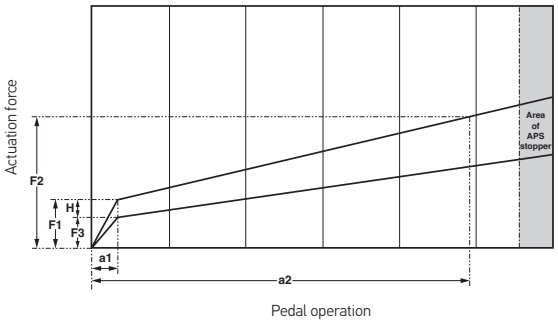
Component values:
R1, R3 typically 10 kΩ
C1, C3 typically 1.0 nF +/- 10 %
R2*C2; R4*C4 typically 1ms

PIN ASSIGNMENT/ELECTRICAL CONNECTION

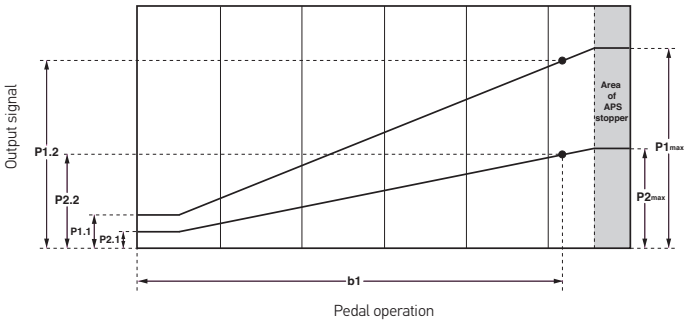


Pin 1: Vcc +5 V DC: sensor 1
Pin 2: signal: sensor 1
Pin 3: GND: sensor 1
Pin 4: GND: sensor 2
Pin 5: signal: sensor 2
Pin 6: Vcc +5 V DC: sensor 2

MECHANICAL CHARACTERISTIC CURVE



ELECTRICAL CHARACTERISTIC CURVE

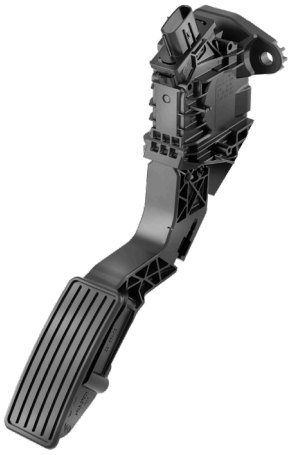


RATED VALUES

F1	Initial force	Newton (N)	15.5 ± 3.5
F2	Final force	Newton (N)	31 ± 4
F3	Restoring force	Newton (N)	> 5
H	Force hysteresis	Newton (N)	> 6
a1	Start angle	Degrees (°)	< 0.7
a2	End angle	Degrees (°)	14.9 ± 0.9

RATED VALUES

P1.1	Idling voltage S1	Per cent (%)	16 ± 0.6
P2.1	Idling voltage S2	Per cent (%)	8 ± 0.6
P1.2	Full throttle voltage S1	Per cent (%)	78.8 ± 1
P2.2	Full throttle voltage S2	Per cent (%)	39.4 ± 1
$P1_{max}$	Maximum voltage S1	Per cent (%)	91 ± 1
$P2_{max}$	Maximum voltage S2	Per cent (%)	45.5 ± 1
b1	Full throttle angle	Degrees (°)	14



Suspended accelerator pedals

PRODUCT FEATURES

- → Contactless measurement
- → Slim yet sturdy design
- → Simple mechanical connection
- → Redundant output signal
- → High measurement precision
- → No programming/teaching in the vehicle necessary
- → High interference immunity against electrical and magnetic fields

DESIGN AND FUNCTION

Housing and operating lever are completely made of recyclable, glass-fibre reinforced plastic.
The actuating force is generated by two springs, each individually ensuring safe return to the original position. The electrical output signal is obtained via the CIPOS® measuring principle. For this purpose, a sheet metal cursor is routed from the pedal arm via sensor paths on the measuring board. An output signal is generated by two galvanically isolated sensors there. Different output signals can be generated depending on the measuring board used. In addition, individual characteristic curves can be programmed on request.

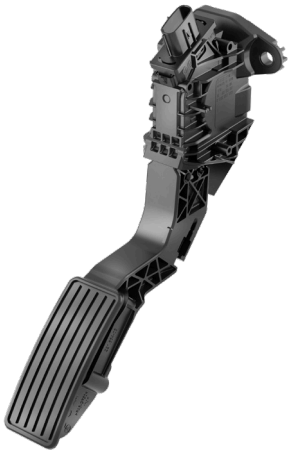
APPLICATION

HELLA accelerator pedals designed for upright or pendant mounting can be used in a wide variety of vehicles – ranging from automotive sector applications, such as sports cars and electric vehicles, to robust applications in agricultural and construction vehicles. Thanks to the contactless system of measurement provided by HELLA's own CIPOS® sensor (see description of construction and function) and its extremely low level of mechanical wear, it is advisable to choose such a sensor system over contact-type accelerator pedals, especially for small, frequently recurring movements.

PROGRAM OVERVIEW

Accelerator pedal material	Part number	VPE*	Page
Plastic	**On request**	–	66 – 67

* Packaging unit



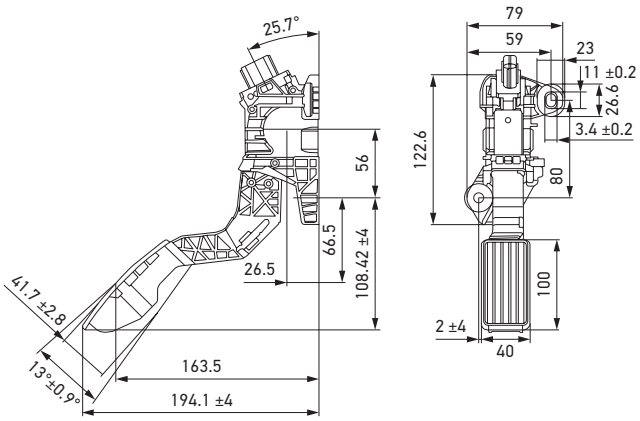
Suspended accelerator pedals

On request

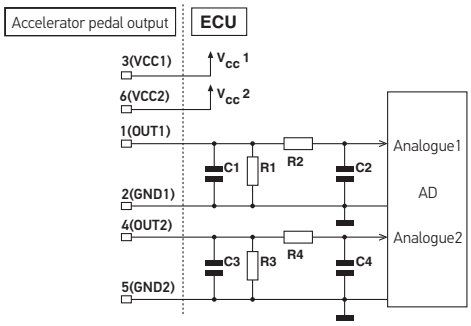
TECHNICAL DATA	
Operating voltage	5 V ± 10 %
Power consumption per channel	max. 10 mA
Surge voltage withstand capability, duration t → ∞	16 V
Initial force	20 N
Final force	35 N
Actuation angle	13°
Resolution	0.04°
Output signal	2 x analogue ratiometric, 2nd channel half pitch
Linearity	≤ 3 %
Synchronisation	≤ 2 %
Idling voltage	15 % / 7.5 %
Full throttle voltage	88 % / 44 %
Load resistance	10 kΩ ± 1 %
Load capacity	1 nF ± 5 %
Filter constant in control unit	1 ms ± 5 %
Signal output current	max. 0.55 mA
Operating temperature	-40°C to +80°C
Storage temperature	-40°C to +80°C
Protection class (electronics)	IP 5K4
Housing material	PA66-GF40
Mating connector[1)]	6189-1083
Weight	≤ 290 g
Actuations	min. 2 million
EMV	CISPR 25, Class 5; electrical and magnetic fields
ESD	10 kV

[1)] These accessories are not included in the scope of delivery.
Available from Sumitomo Denso.
Gold-plated contacts and individual wire sealing are required.

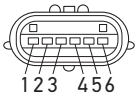
TECHNICAL DRAWING



RECOMMENDED WIRING IN THE CONTROL UNIT

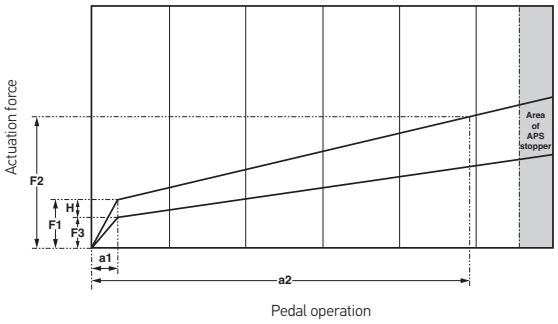


PIN ASSIGNMENT/ELECTRICAL CONNECTION

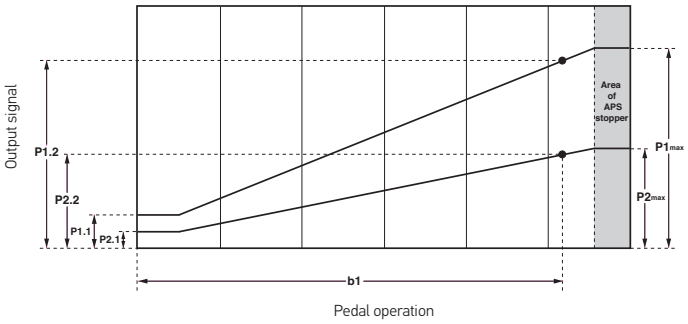


Pin 1: Analogue signal: sensor 1
Pin 2: Ground: sensor 1
Pin 3: Supply 5 V: sensor 1
Pin 4: Analogue signal: sensor 2
Pin 5: Ground: sensor 2
Pin 6: Supply 5 V: sensor 2

MECHANICAL CHARACTERISTIC CURVE



ELECTRICAL CHARACTERISTIC CURVE



RATED VALUES

F1	Initial force	Newton (N)	20 ± 4
F2	Final force	Newton (N)	35 ± 5
F3	Restoring force	Newton (N)	> 5
H	Force hysteresis	Newton (N)	> 4
a1	Start angle	Degree (°)	< 1.1
a2	End angle	Degree (°)	13

RATED VALUES

P1.1	Idling voltage S1	Per cent (%)	15 ± 1
P2.1	Idling voltage S2	Per cent (%)	7.5 ± 1
P1.2	Full throttle voltage S1	Per cent (%)	88
P2.2	Full throttle voltage S2	Per cent (%)	44
$P1_{max}$	Maximum voltage S1	Per cent (%)	< 89
$P2_{max}$	Maximum voltage S2	Per cent (%)	> 45
b1	Full throttle angle	Degrees (°)	11.9 ± 0.6

Angular position sensors

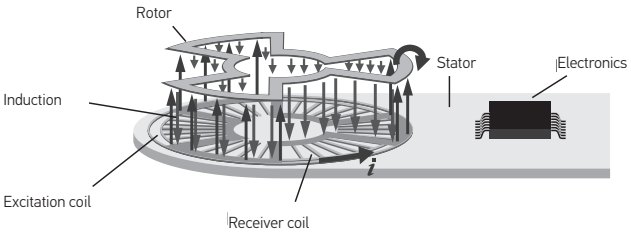
PRODUCT FEATURES

- → High precision thanks to internal 14 bit resolution
- → High temperature stability and linearity
- → High insensitivity to magnetic fields
- → Zero position can be individually programmed
- → Various connecting elements available
- → Two-channel solutions possible for safety-critical applications

APPLICATION

These CIPOS® angular position sensors (Contactless Inductive Position Sensor) can be used in many different applications to return accurate and reliable angular measurements even in tough environmental conditions. Their insensitivity to magnetic fields and their high level of temperature stability in particular are the characteristic qualities of the CIPOS® technology used in all angular position sensors. Angles are measured inductively using a non-contact and, consequently, wear-free method. A high degree of measuring precision is therefore guaranteed throughout the sensor's entire lifetime.

DESIGN AND FUNCTION

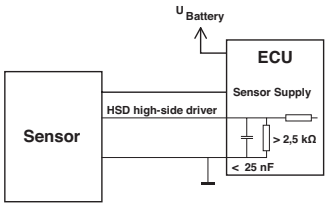


Inside the laser-welded housing made of polyamide PA66, the lever arm torque above the rotor is determined via the induction method. An ASIC (Application Specific Integrated Circuit) calculates the rotor position precisely. Various mounting positions are possible via the repetitive characteristic curve of the output signal path (depending on the sensor structure used).
This increases the number of flexible application options for the sensor.

ANALOGUE

ANALOGUE OUTPUT

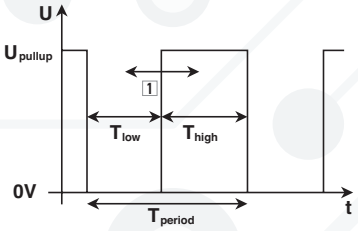
At a supply voltage of 5 V DC, the measured angle is reflected through the ratio of the output voltage (U_{out}) to the operating voltage (U_S) (ratiometrically to the supply voltage). This signal is output via a high side driver (HSD). At a supply voltage of 9 V to 32 V (multi-voltage), the measured angle is reflected through a voltage of 0.5 V to 4.5 V.



CIRCUIT FOR RATIOMETRIC (10 % TO 90 %) OR FIXED VOLTAGE OUTPUT (0.5 – 4.5 V)

An external pull-down resistor is required for this variant. With 5 V supply, for example, 2.7 kΩ to 10 kΩ is to be selected. The maximum output current of the analogue output should not exceed 2 mA. Since the high side driver (HSD) is used as an analogue output, the output voltage is set relative to the supply voltage.

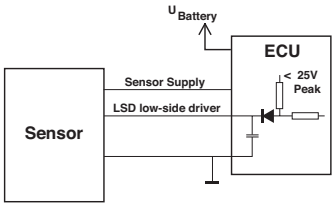
PWM



1 Variable to the angle

PWM OUTPUT (DIGITAL)

When using the PWM signal, the angular position of the angular position sensor results from the ratio between low time (T_{low}) of the PWM signal and the period duration (T_{period}). The absolute time of the high or low level is not a measure of the angle. The PWM signal is output via a low side driver (LSD). It is also possible, of course, to evaluate the ratio of high time (T_{high}) to period time (T_{period}). This results in a characteristic curve that is inverse to the analogue signal.



CIRCUIT FOR PWM OUTPUT AM LOW SIDE DRIVER (LSD)

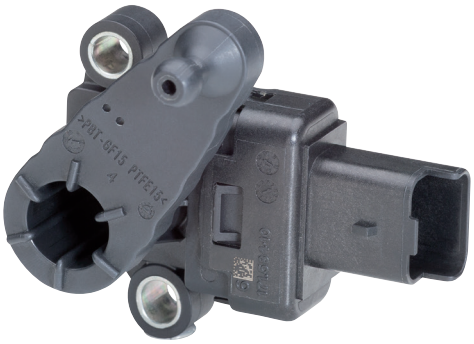
The maximum current through the pull-up resistor is specified in the external ECU as an LSD is used as PWM output. In order to keep the output current as low as possible, HELLA recommends the use of 10 kΩ. The pull-up resistor also limits the sensor output current, which should not exceed 5 mA. The voltage and transients at the pull-up resistor must not exceed 25 V.

PROGRAM OVERVIEW

Mechanical connection	Angle range	Supply voltage	Output signal[1)]	Zero position	Lever arm	Part number	VPE*	Page
Single sensors[2)]								
Ball, top	-54° to +54°	5 V	0.5 – 4.5 V ratiometric	0° / 120° / 240°	39 mm	**6PM 010 200-507**	–	70
Ball, bottom	-54° to +54°	5 V	0.5 – 4.5 V ratiometric	0° / 120° / 240°	39 mm	**6PM 010 200-517**	–	71
Ball, bottom	-54° to +54°	5 V	0.5 – 4.5 V ratiometric	0° / 120° / 240°	51 mm	**6PM 010 200-527**	–	72
Ball, top	-54° to +54°	5 V	0.5 – 4.5 V ratiometric	0° / 120° / 240°	70 mm	**6PM 010 200-537**	–	73

[1)] PWM on request.
[2)] Double sensors on request.

* Packaging unit

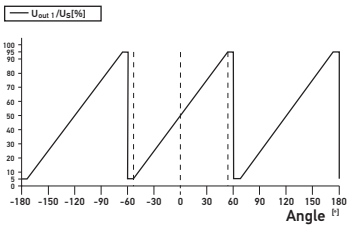


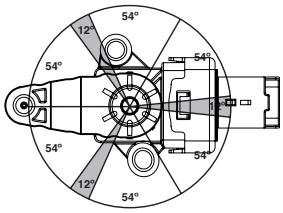
Angular position sensors
Single sensors – compact design
6PM 010 200-507

TECHNICAL DATA

Angle range	- 54° to + 54°
Mechanical angle range	Unlimited (full 360° rotation)
Supply voltage U_sUs	5 V ±0.5 V
Output signal	0.5 – 4.5 V ratiometric
Resolution	12 bit
Linearity error including temperature drift	1 % of the supply voltage
Current consumption	10 mA
Zero position	0° / 120° / 240°
Lever arm	39 mm, ball, top
Protection class	IP 6K9K according to DIN 40050
Operating temperature	-40°C to +125°C
Lifetime	6.75 million cycles
Polarity reversal protection	Only mechanical
Mating connector[1)]	1801178-4
Pin coating	CuNiSi, Au

[1)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

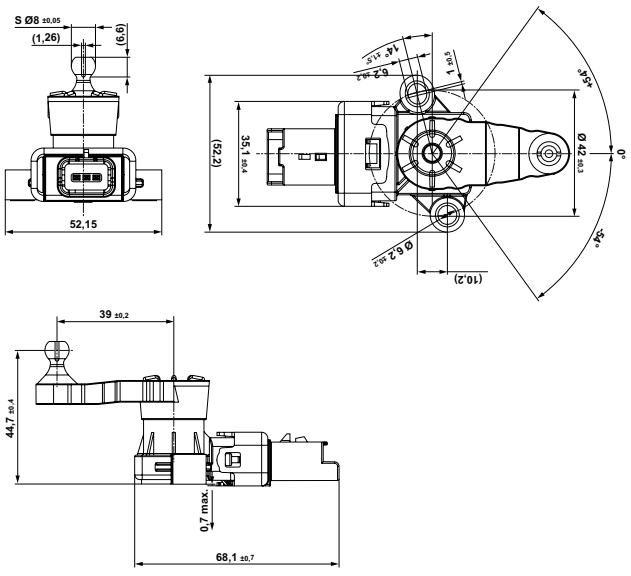




CHARACTERISTIC CURVE OF THE ANGULAR POSITION SENSOR

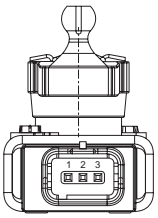
The characteristic curve of the angular position sensor repeats every 120°. The sensor can therefore not only be mounted in the position shown, but also rotated by 120° or 240°. This will not affect the behaviour of the connected system in any way. The measuring angle range is 108°. If it is exceeded by up to 6°, the output signal remains limited to the measuring range final value. If the signal further exceeds these values, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions are shown on the graph. The segments of the circle shown in grey represent the angles that cannot be measured.

TECHNICAL DRAWING



For length of lever arm, see Technical Data table

PIN ASSIGNMENT/ELECTRICAL CONNECTION FOR SINGLE SENSOR 2ND GENERATION

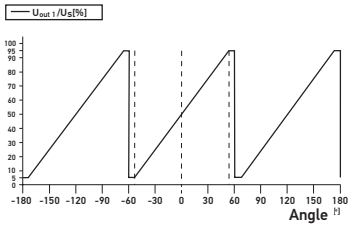


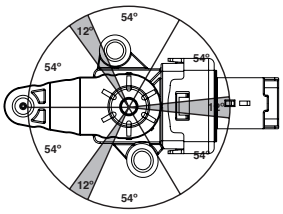
Pin 1: Supply 5 V DC
Pin 2: Ground
Pin 3: Output signal 0.5 – 4.5 V ratiometric

Angular position sensors
Single sensors – compact design
6PM 010 200-517

TECHNICAL DATA	
Angle range	- 54° to + 54°
Mechanical angle range	Unlimited (full 360° rotation)
Supply voltage U_sUs	5 V ±0.5 V
Output signal	0.5 – 4.5 V ratiometric
Resolution	12 bit
Linearity error including temperature drift	1 % of the supply voltage
Current consumption	10 mA
Zero position	0° / 120° / 240°
Lever arm	39 mm, ball, bottom
Protection class	IP 6K9K according to DIN 40050
Operating temperature	-40°C to +125°C
Lifetime	6.75 million cycles
Polarity reversal protection	Only mechanical
Mating connector[1)]	1801178-4
Pin coating	CuNiSi, Au

[1)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

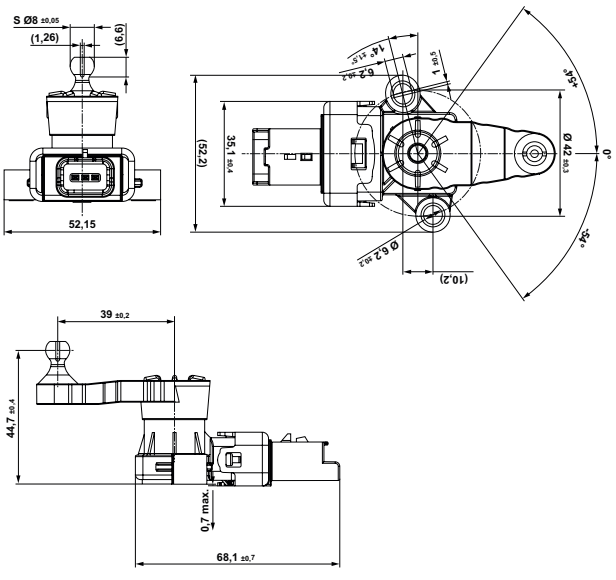




CHARACTERISTIC CURVE OF THE ANGULAR POSITION SENSOR

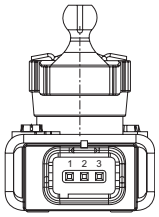
The characteristic curve of the angular position sensor repeats every 120°. The sensor can therefore not only be mounted in the position shown, but also rotated by 120° or 240°. This will not affect the behaviour of the connected system in any way. The measuring angle range is 108°. If it is exceeded by up to 6°, the output signal remains limited to the measuring range final value. If the signal further exceeds these values, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions are shown on the graph. The segments of the circle shown in grey represent the angles that cannot be measured.

TECHNICAL DRAWING



For length of lever arm, see Technical Data table

PIN ASSIGNMENT/ELECTRICAL CONNECTION FOR SINGLE SENSOR 2ND GENERATION



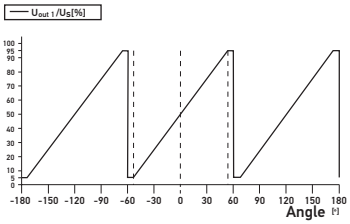
Pin 1: Supply 5 V DC
Pin 2: Ground
Pin 3: Output signal 0.5 – 4.5 V ratiometric

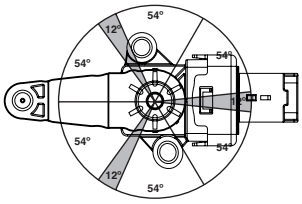
Angular position sensors
Single sensors – compact design
6PM 010 200-527

TECHNICAL DATA

Angle range	- 54° to + 54°
Mechanical angle range	Unlimited (full 360° rotation)
Supply voltage U_sUs	5 V ±0.5 V
Output signal	0.5 – 4.5 V ratiometric
Resolution	12 bit
Linearity error including temperature drift	1 % of the supply voltage
Current consumption	10 mA
Zero position	0° / 120° / 240°
Lever arm	51 mm, ball, bottom
Protection class	IP 6K9K according to DIN 40050
Operating temperature	-40°C to +125°C
Lifetime	6.75 million cycles
Polarity reversal protection	Only mechanical
Mating connector[1)]	1801178-4
Pin coating	CuNiSi, Au

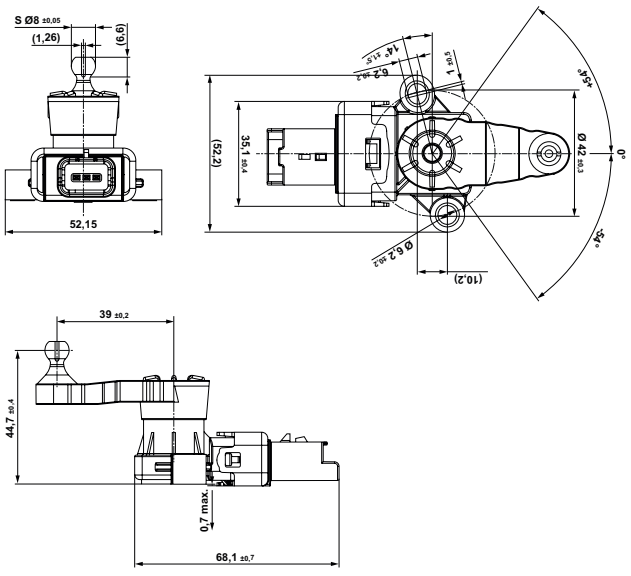
[1)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.





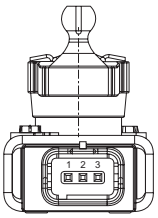
CHARACTERISTIC CURVE OF THE ANGULAR POSITION SENSOR
The characteristic curve of the angular position sensor repeats every 120°. The sensor can therefore not only be mounted in the position shown, but also rotated by 120° or 240°. This will not affect the behaviour of the connected system in any way. The measuring angle range is 108°. If it is exceeded by up to 6°, the output signal remains limited to the measuring range final value. If the signal further exceeds these values, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions are shown on the graph. The segments of the circle shown in grey represent the angles that cannot be measured.

TECHNICAL DRAWING



For length of lever arm, see Technical Data table

PIN ASSIGNMENT/ELECTRICAL CONNECTION FOR SINGLE SENSOR 2ND GENERATION

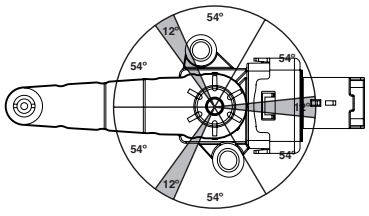


Pin 1: Supply 5 V DC
Pin 2: Ground
Pin 3: Output signal 0.5 – 4.5 V ratiometric

Angular position sensors
Single sensors – compact design
6PM 010 200-537

TECHNICAL DATA	
Angle range	- 54° to + 54°
Mechanical angle range	Unlimited (full 360° rotation)
Supply voltage U_sUs	5 V ±0.5 V
Output signal	0.5 – 4.5 V ratiometric
Resolution	12 bit
Linearity error including temperature drift	1 % of the supply voltage
Current consumption	10 mA
Zero position	0° / 120° / 240°
Lever arm	70 mm, ball, top
Protection class	IP 6K9K according to DIN 40050
Operating temperature	-40°C to +125°C
Lifetime	6.75 million cycles
Polarity reversal protection	Only mechanical
Mating connector[1)]	1801178-4
Pin coating	CuNiSi, Au

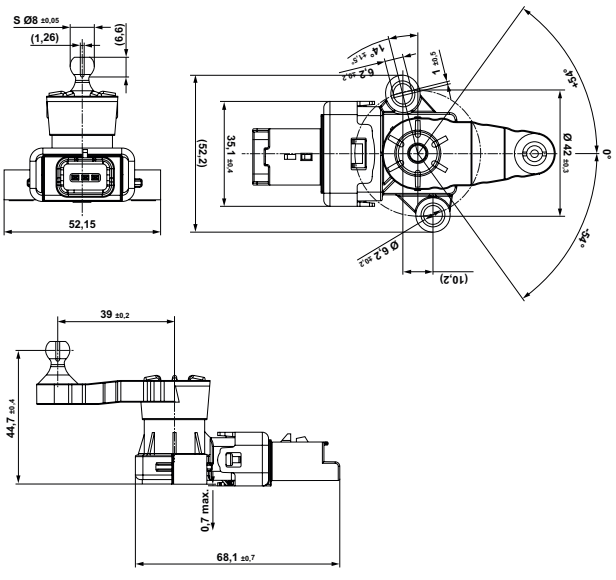
[1)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.



CHARACTERISTIC CURVE OF THE ANGULAR POSITION SENSOR

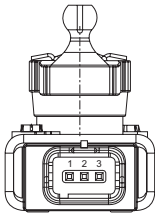
The characteristic curve of the angular position sensor repeats every 120°. The sensor can therefore not only be mounted in the position shown, but also rotated by 120° or 240°. This will not affect the behaviour of the connected system in any way. The measuring angle range is 108°. If it is exceeded by up to 6°, the output signal remains limited to the measuring range final value. If the signal further exceeds these values, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions are shown on the graph. The segments of the circle shown in grey represent the angles that cannot be measured.

TECHNICAL DRAWING



For length of lever arm, see Technical Data table

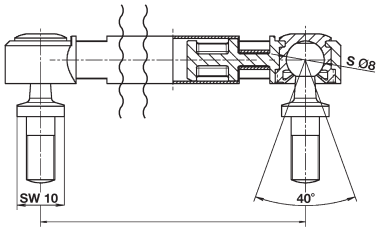
PIN ASSIGNMENT/ELECTRICAL CONNECTION FOR SINGLE SENSOR 2ND GENERATION

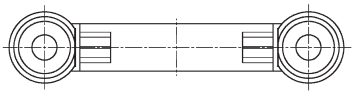


Pin 1: Supply 5 V DC
Pin 2: Ground
Pin 3: Output signal 0.5 – 4.5 V ratiometric

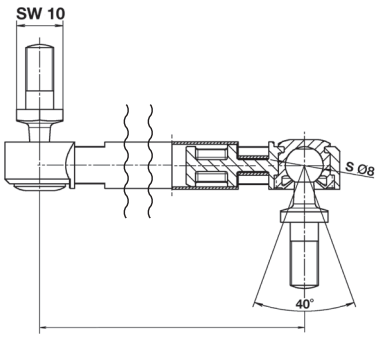
Angular position sensors
Connecting elements

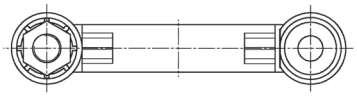
CONNECTING ELEMENT WITH TWO BALL HEAD SCREWS



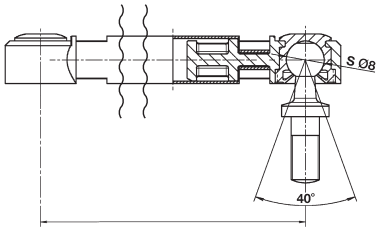


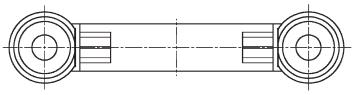
CONNECTING ELEMENT WITH TWO BALL HEAD SCREWS, ONE OF WHICH TURNED BY 180°





CONNECTING ELEMENT WITH A COVER CAP AND A BALL HEAD SCREW

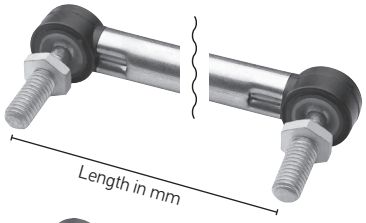




Head section, left
Type A - ball head screw
rotated 180°

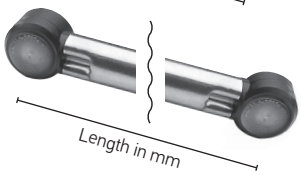
Head section, left
Type A - ball head screw

Head section, right
Type A - ball head screw



Head section, left
Type B - cover cap

Head section, right
Type B - cover cap



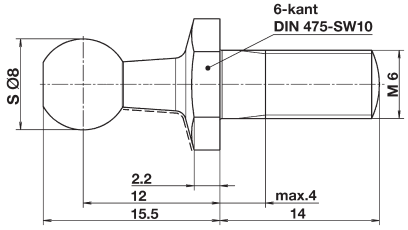
PROGRAM OVERVIEW

Head section, left	Rotation	Length of connecting element	Head section, right	Part number	VPE*
A	0°	56 mm	A	**9XB 732 588-207**	50
A	0°	78.2 mm	A	**9XB 732 588-197**	176
A	0°	90 mm	A	**9XB 732 588-167**	176
B	0°	120 mm	A	**9XB 732 588-237**	132
B	180°	56 mm	A	**9XX 736 603-167**	176
A	180°	70 mm	A	**9XX 736 603-107**	176
A	180°	90 mm	B	**9XX 736 603-117**	176

Part number 9NS 740 413-317

TECHNICAL DATA	
Length (total)	29.5 mm ±0.6
Length (screw)	14 mm ±0.3
Fitting	M6

TECHNICAL DRAWING



* Packaging unit

Electromotive actuators
Electrical locking/ unlocking, space-saving, with or without micro switch
Low Force

PRODUCT FEATURES

- → Compact, space-saving design
- → Electromotive reset or automatic (non-electric) reset
- → Easy to mount thanks to snap-fit mounting
- → Splash-proof
- → With or without micro switch
- → Explosion report for tank modules

APPLICATION

The extremely space-saving design of this actuator makes it especially suitable for locking and unlocking applications in dry and wet areas (also via remote control, for example) where there is only limited space available.

Examples include:
- → Tank modules
- → Service flaps
- → Glove compartments
- → Locking of charging plugs (e-mobility)

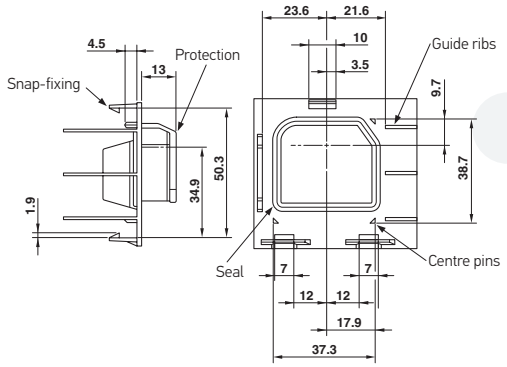
DESIGN AND FUNCTION

When a voltage is applied, the motor integrated in the electromotive actuator moves the locking lever attached to the motor shaft.

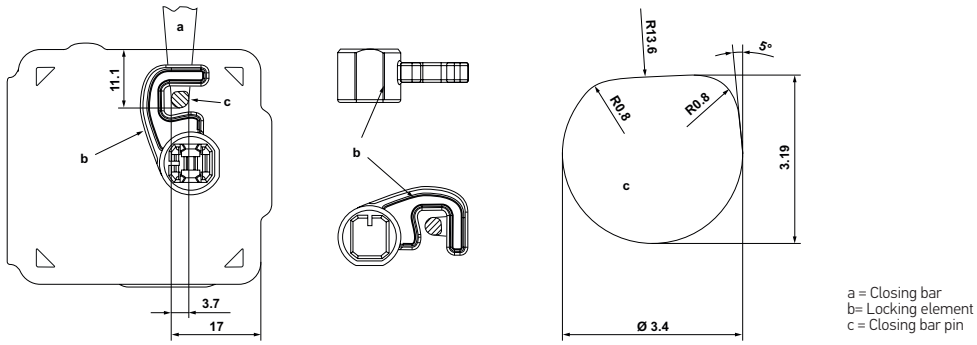
There are two product variants available in the product range. The first variant of the actuator with electrical locking and unlocking function is particularly suitable for traditional applications, where the locking lever locks a hinged arm attached to the locking system by applying a voltage and then unlocks it by reversing the voltage polarity. The stability of the open/closed locking positions is achieved by the motor being short-circuited following successful triggering. The position of the locking element can also be defined via an integrated micro switch.

The second actuator variant has a return spring and a micro switch integrated. The micro switch is actuated by a slight movement of the locking lever, e.g. by pressing a service flap. Current is then applied to the actuator via a control unit. This makes the actuator locking lever retract completely, leaving the closing system open and triggering the spring-loaded opening of the service flap. The actuator is then switched off and the integrated return spring causes the locking lever to return to the locking position without the use of any current. In order to lock the service flap, this flap is pushed closed when the hinged arm of the service flap snaps into the actuator's locking lever.

MOUNTING INTERFACE EXAMPLE

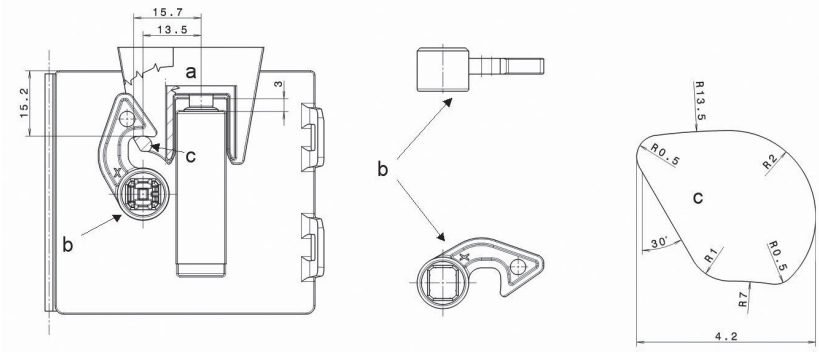


LOCKING INTERFACE (VARIANT -017 and -027)



a = Closing bar
b= Locking element
c = Closing bar pin

LOCKING INTERFACE (VARIANT -047)



a = Closing bar
b= Locking element
c = Closing bar pin

PROGRAM OVERVIEW

Function	Voltage	Manual adjustment	Protection class	Part number	VPE*	Page
Electrical open and return rotation						
	12 V	Yes	IP 5K4	**6NW 011 122-011/-017**	1/132	78
With micro switch	12 V	Yes	IP 5K4	**6NW 011 122-021/-027**	1/126	80–81
With micro switch, without operating element, without locking element	12 V	Yes	IP 5K4	**6NW 011 122-031/-037**	1/132	
With micro switch, with operating element, without locking element	12 V	Yes	IP 5K4	**6NW 011 122-051/-057**	1/126	
Electrical open rotation and return rotation via return spring with soft touch button						
	12 V	Yes	IP 5K4	**6NW 011 122-041/-047**	1/60	82–83

* Packaging unit

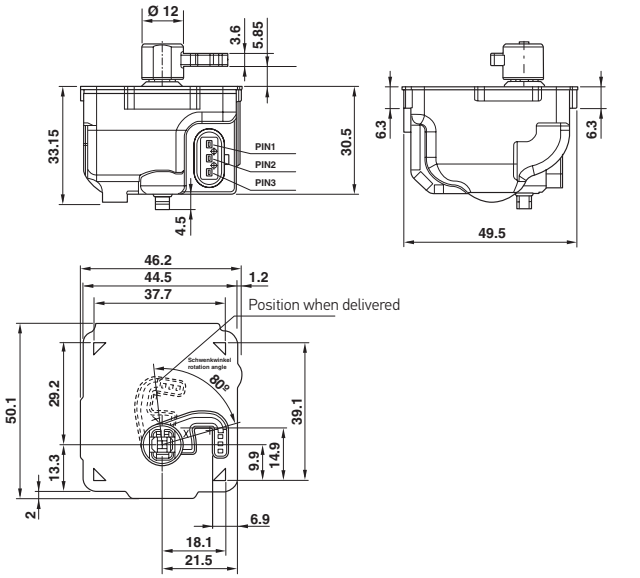
Electromotive actuators
Electrical locking/unlocking, space-saving
Electrical open and return rotation
6NW 011 122-011/017

TECHNICAL DATA

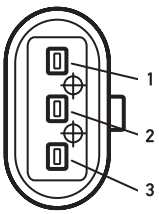
Function	Electrical open and return rotation
Weight	60 g
Rated voltage	12 V
Voltage range	9 – 15.5 V
Maximum current consumption (stall current)	3.2 A
No-load/idling current	≤ 250 mA
Locking lever pulling force	> 75 N (after lifetime > 50 N)
Locking lever breaking force	≥ 300 N
Functional angle	≤ 78°
Actuating time for 78° via functional angle[1)]	max. 200 ms
Triggering time	0.2 s < t < 10 s
Thermal overload protection	Not available
Operating temperature	-40°C to +85°C
Storage temperature	-40°C to +90°C
Lifetime[2)]	100,000 cycles
Conducted electromagnetic interference	DIN ISO 7637, SAE J1113-42
Interference suppression CISPR 25, SAE J-1113-41	Intensity level 1 + 10 dB µV
End position stability with motor short circuit	≤ 6°
Protection class	IP 5K4
Salt spray test in accordance with DIN 50 021 SS	96 h
Vibration resistance in accordance with IEC 68-2-64	2.7 g
Housing material	PP-GF30
Sealing ring	NBR 70 Shore A
Locking lever material	PAA GF60
Resistant to	Petrol, diesel, biodiesel, ozone
Pin coating	Galvanically tin-plated
Connector	Hirschmann, 3-pin
Mating connector[3)]	3-pin MLK coupling ELA 872-858-541

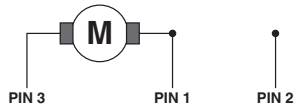
[1)] Over the operating voltage and temperature range.
[2)] One switching cycle equals one open and return rotation.
[3)] These accessories are not included in the scope of delivery. Available from Hirschmann Automotive.

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION





Hirschmann connector, 3-pin MLK	PIN 3	PIN 1
Unlocking central locking system	+	-
Locking central locking system	-	+

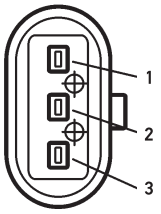
Electromotive actuators
Electrical locking/unlocking, space-saving with micro switch, electrical open and return rotation
6NW 011 122-021 / 027
6NW 011 122-031 / 037
(As variant -021 but without operating and locking elements)
6NW 011 122-051 / -057
(Without locking element, with operating element)

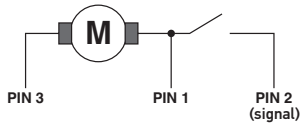
TECHNICAL DATA

Function	Electrical open and return rotation with micro switch
Weight	60 g
Rated voltage	12 V
Voltage range	9 – 15.5 V
Maximum current consumption (stall current)	3.2 A
No-load/idling current	≤ 250 mA
Locking lever pulling force	≥ 75 N
Locking lever breaking force	≥ 300 N
Functional angle	≤ 78°
Actuating time for 78° via functional angle[1)]	40 ms < t < 200 ms
Triggering time	0.2 s < t < 10 s
Thermal overload protection	Not available
Operating temperature	-40°C to +85°C
Storage temperature	-40°C to +90°C
Lifetime[2)]	60,000 cycles
Conducted electromagnetic interference	Intensity level 2
Interference suppression CISPR 25, SAE J-1113-41	≤ 18 mm Intensity level 1 + 10 dB µV
Micro switch switching angle	8° to 18°
End position stability with motor short circuit	≤ 6°
Protection class	IP 5K4
Salt spray test in accordance with DIN 50 021 SS	96 h
Vibration resistance in accordance with IEC 68-2-64	2.7 g
Housing material	PP-GF30
Sealing ring	NBR 70 Shore A black
Locking lever material	PAA GF60
Resistant to	Petrol, diesel, biodiesel, ozone
Pin coating	Galvanically tin-plated
Connector	Hirschmann, 3-pin
Mating connector[3)]	3-pin MLK coupling ELA 872-858-...KA

[1)] Over the operating voltage and temperature range.
[2)] One switching cycle equals one open and return rotation.
[3)] These accessories are not included in the scope of delivery. Available from Hirschmann Automotive.

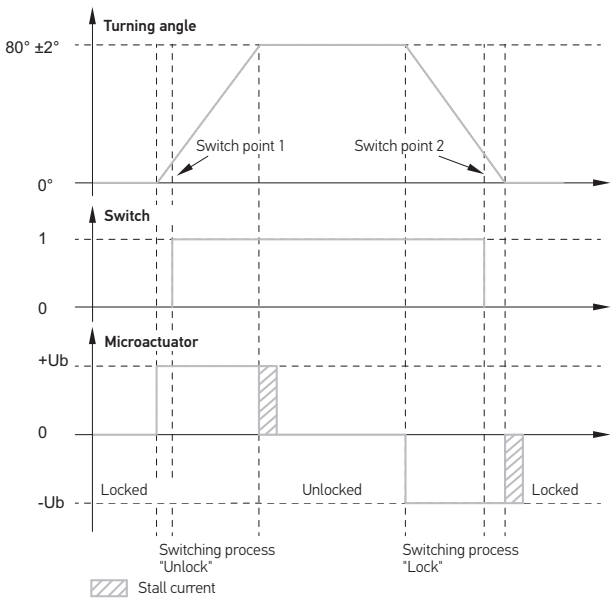
PIN ASSIGNMENT/ELECTRICAL CONNECTION



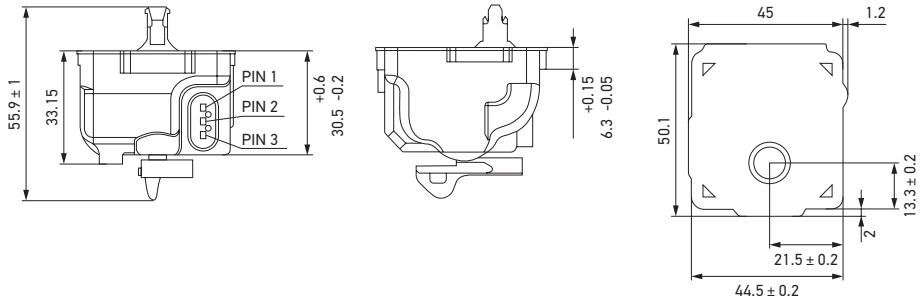


Hirschmann connector, 3-pin MLK	PIN 3	PIN 1
Unlocking	+	-
Locking	-	+

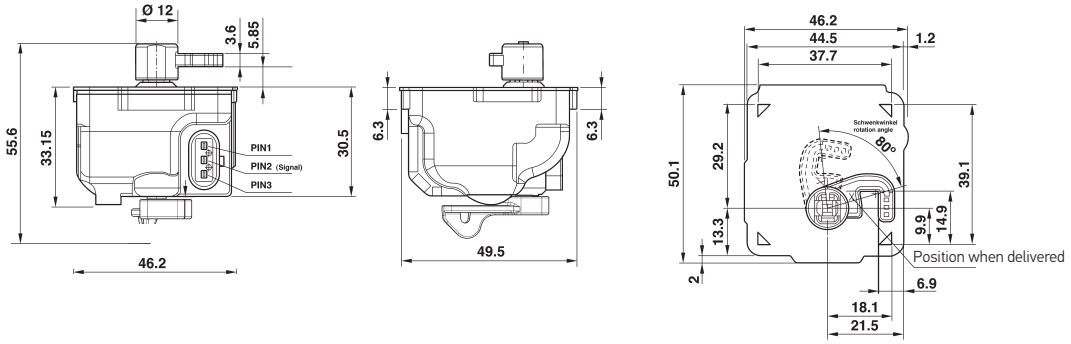
MICRO SWITCH TRIPPING



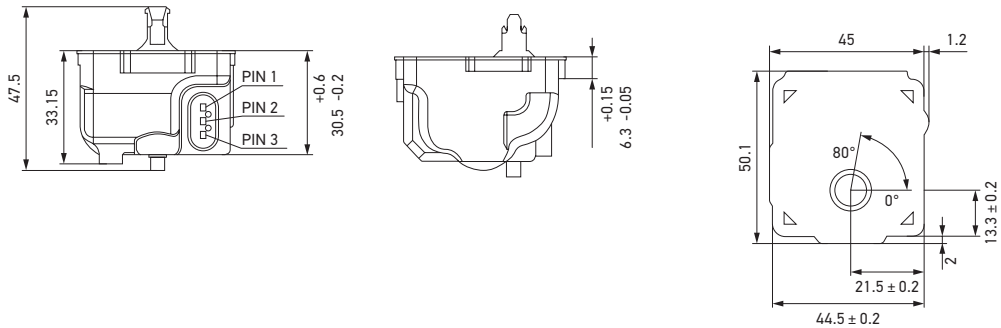
TECHNICAL DRAWING – 6NW 011 122-051



TECHNICAL DRAWING – 6NW 011 122-027



TECHNICAL DRAWING – 6NW 011 122-031



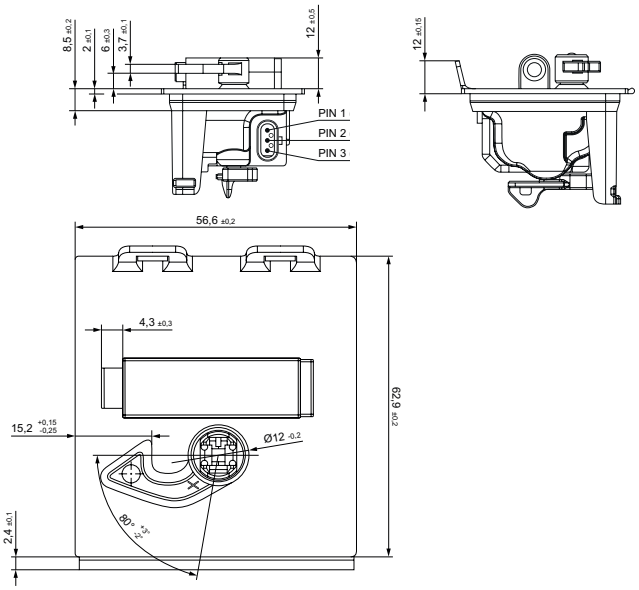
Electromotive actuators
Electrical locking/unlocking, space-saving
with micro switch, electrical open rotation,
return rotation via return spring,
with soft-touch button
6NW 011 122-041 / 047

TECHNICAL DATA

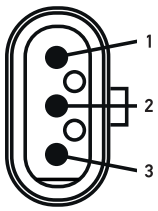
Function	Electrical open rotation, return rotation via return spring
Weight	60 g
Rated voltage	12 V
Voltage range	9 – 15.5 V
Maximum current consumption (stall current)	5.1 A
No-load/idling current	≤ 700 mA
Locking lever pulling force	75 N
Locking lever breaking force	300 N
Micro switch triggering force	≤ 24 N
Functional angle	≤ 78°
Actuating time for 78° via functional angle[1)]	max. 4 sec
Triggering time	0.3 s <t <4 s
Thermal overload protection	Not available
Operating temperature	-40°C to +85°C
Storage temperature	-40°C to +90°C
Lifetime[2)]	7,500 cycles
Conducted electromagnetic interference	DIN ISO 7637, SAE J1113-42
Interference suppression CISPR 25, SAE J-1113-41	Intensity level 1 + 10 dB µV
Micro switch switching angle	8° – 18°
End position stability with motor short circuit	≤ 6°
Protection class	IP 5K4
Salt spray test in accordance with DIN 50 021 SS	96 h
Vibration resistance in accordance with IEC 68-2-64	2.7 g
Housing material	PP-GF30
Sealing ring	NBR 70 Shore A
Locking lever material	PAA GF60
Resistant to	Petrol, diesel, biodiesel, ozone
Pin coating	CuSn6, bronze plate, galvanically tin-plated
Connector	Hirschmann, 3-pin
Mating connector[3)]	3-pin MLK coupling ELA 872-858-541

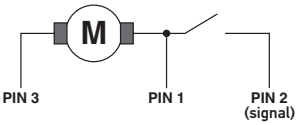
[1)] Over operating voltage and temperature range.
[2)] One switching cycle equals one open and return rotation.
[3)] These accessories are not included in the scope of delivery. Available from Hirschmann Automotive.

TECHNICAL DRAWING



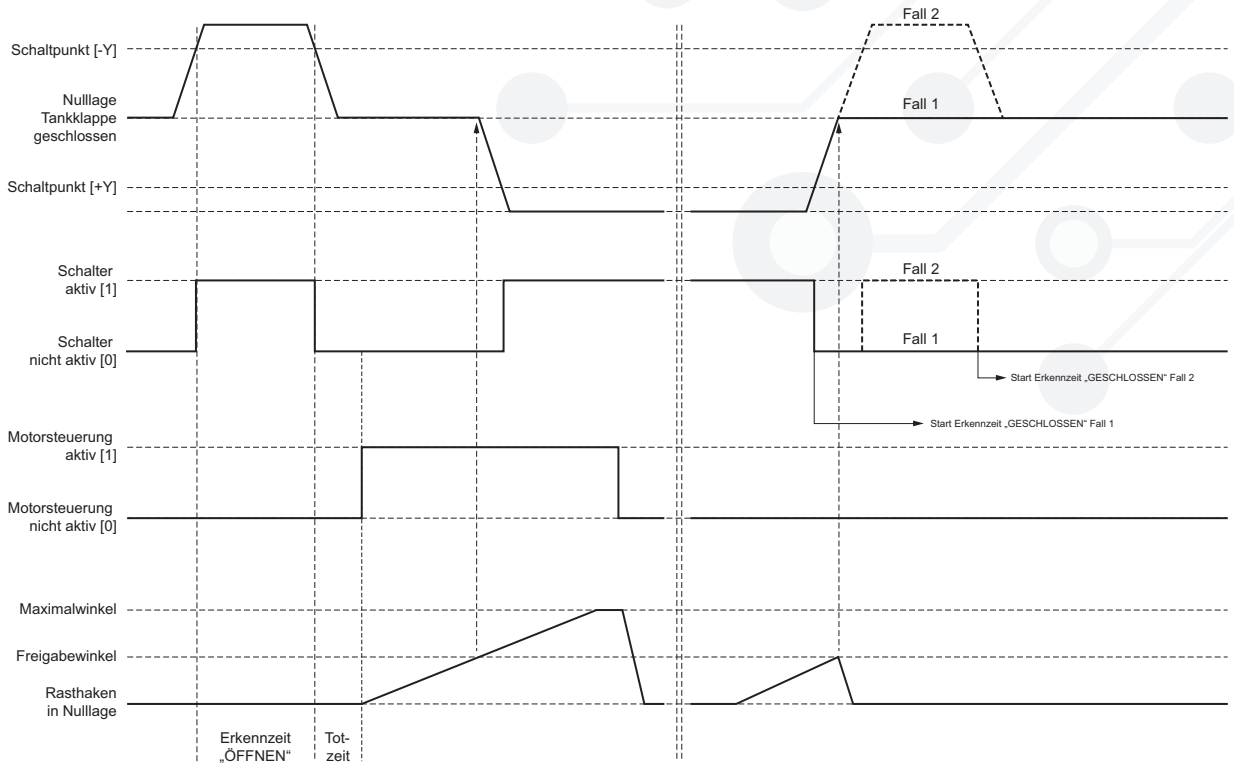
PIN ASSIGNMENT/ELECTRICAL CONNECTION





Hirschmann connector, 3-pin MLK	PIN 3	PIN 1	PIN 2 (signal)
Softtouch unlocking	+	-	
Softtouch locking	0	0	

SWITCHING PROCESS FUNCTION SEQUENCE



Detection time "OPEN"

Description:
Minimum period of time that the operator has to hold the operating element depressed for opening to take place.

Explanation:
In order that short pulses do not lead to unintentional opening, the "Open" detection time starts when the status changes from [0], operating element not depressed, to [1], operating element depressed. If the state [1] "Switch active" is detected for longer than the preset value, opening is initiated when the state changes from [1] to [0].

Dead time

Description:
Time between switch change to [0] and activation of the motor control [1] when an opening process is initiated.

Explanation:
On the electronic side, there occurs a system reaction time comprising switch debouncing and the system runtime. This can result in a delay of up to 70 ms, which then extends the non-parameterisable (actual) dead time of the opening process.

Detection time "CLOSED"

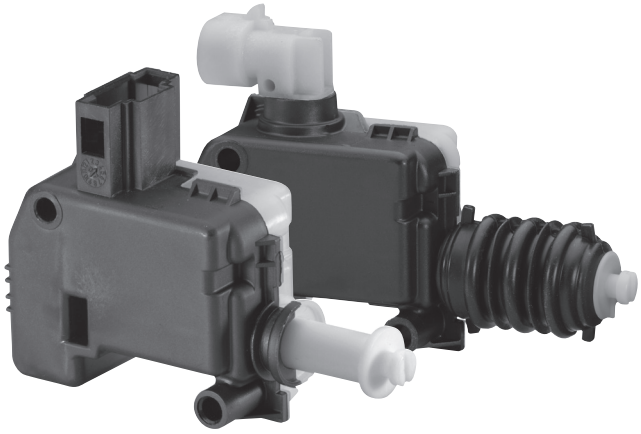
Description:
Minimum time that the application has to be closed before a new opening process can be initiated by the operator.

Explanation:
When the application is open, the switch signal is active [1]. As soon as the operator closes the application, the switch signal changes to inactive [0]. The "CLOSED" detection time starts to run when the switch is set to inactive [0]. Two instances are possible when closing (see case studies).

Case studies

Case 1:
The operator does not press down to the end stop when closing the application. The signal changes from "Switch active" [1] to "Switch not active" [0] and the detection time "CLOSED" starts. As soon as the preset time has expired, the application can be reopened.

Case 2:
When closing the application, the operator presses down to the end stop. This means that the signal first changes from "Switch active" [1] to "Switch not active" [0] and the "CLOSED" detection time starts. When the operator presses down again to the end stop, the signal changes back to "Switch active" [1] and the detection time "CLOSED" which has not yet expired is reset. As soon as the operator releases the application, the signal changes to "Switch not active" [0] and the "CLOSED" detection time starts again.



Electromotive actuators
Electrical locking/unlocking and closing
(Medium Force)

PRODUCT FEATURES

- → High actuating force
- → High-accuracy laser-welded housing
- → Three functioning variants
- → Dustproof or waterproof
- → With or without manual adjustment
- → Thermal overload protection through PTC (PolySwitch)
- → Multi-purpose usage
- → Various connecting elements available

APPLICATION

The motor-driven actuator is used for the electrical locking, unlocking or shutting function of the closing and flap systems in automotive and industrial applications.

Examples of applications in mechanisms include:

- → Electrical locking/unlocking
- → Electrical closing
- → Electrical opening and closing of all doors (locking systems), flaps, sunroofs, seats, covers, bonnets, glove compartments, etc.

DESIGN AND FUNCTION

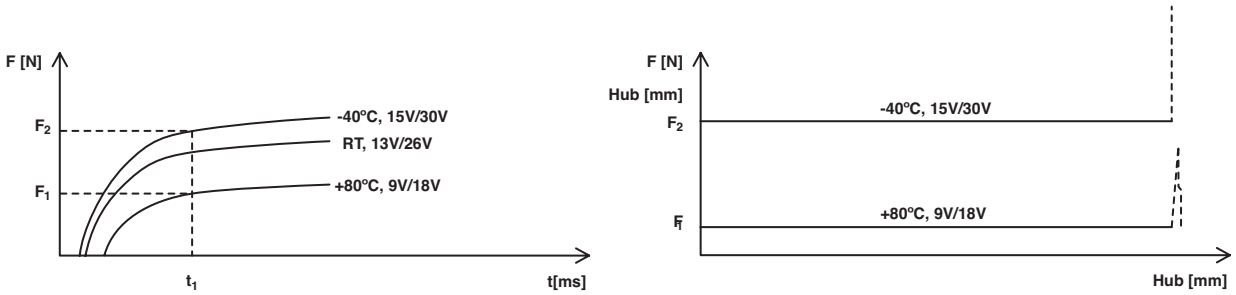
There is an electric motor installed in the two laser-welded polyamide housing halves. As a result of the electric motor being supplied with current via pin 1 and pin 2, it moves a spindle gear, which causes the tappet to retract or extend depending on the direction of rotation. The current supply with plus at pin 1 and minus at pin 2 causes the tappet to extend.

The current supply with minus at pin 1 and plus at pin 2, causes the plunger to retract. The stability of the retracted/extended locking positions is achieved by the short-circuited motor following successful actuation. A PolySwitch (PTC) integrated in the motor provides thermal overload protection. In addition, it is possible to equip the actuators with an automatic return function (retracting or extending) by way of a mainspring.

ACCESSORIES

The comprehensive range of accessories for the electromotive actuator includes a wide variety of different connecting elements. These allow the straightforward integration of the actuator in the application without additional development expenditure being necessary.

DEPENDENCIES OF ACTUATING FORCE - CHARACTERISTIC CURVES



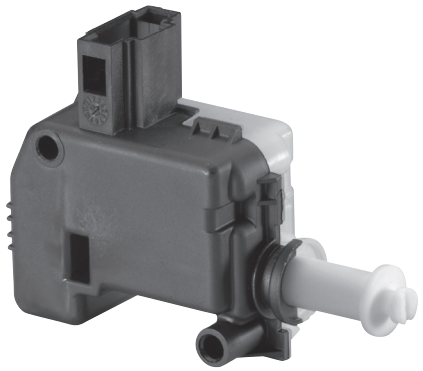
With a controller time of t_1, the actuator has an actuating force of $F_1 < F < F_2$. The constant actuating force on the tappet over the rated stroke depends on the operating voltage and ambient temperature. If the actuator has no load to move over the stroke, the actuator power is converted into a higher actuator speed, resulting in the dynamic impact pulse becoming a multiple of the constant actuating force.

PROGRAM OVERVIEW

Function	Voltage	Actuating force*	Manual adjustment	Protection class	Part number	VPE**	Page
Electrical retraction and extension							
	12 V	30 – 130 N	Yes	IP 5K0	**6NW 009 203-401/ -407**	1/128	86
	12 V	30 – 140 N	No	IP 5K0	**6NW 009 203-411/-417**	1/128	87
	12 V	20 – 130 N	Yes	IP 5K4	**6NW 009 203-627**	100	88
	12 V	30 – 160 N	No	IP 5K4	**6NW 009 203-637**	100	89
	24 V	30 – 130 N	Yes	IP 5K4	**6NW 009 203-441**	1	90
	12 V	30 – 140 N	No	IP 5K4	**6NW 009 203-551**	1	91
Electrical retraction, extension by mainspring							
	12 V	30 – 170 N	No	IP 5K0	**6NW 009 203-461 /-467**	1/110	92
	12 V	30 – 170 N	No	IP 5K4	**6NW 009 203-471/-477**	1/100	93
	24 V	15 – 90 N	Yes	IP 5K4	**6NW 009 203-541/-547**	1/100	94
Electrical extension, retraction by mainspring							
	12 V	30 – 170 N	No	IP 5K0	**6NW 009 203-491/-497**	1/128	95
	12 V	30 – 170 N	No	IP 5K4	**6NW 009 203-501**	1	96
	24 V	20 – 140 N	No	IP 5K4	**6NW 009 203-521/-527**	1/125	97

* Depending on the operating voltage and ambient temperature

** Packaging unit



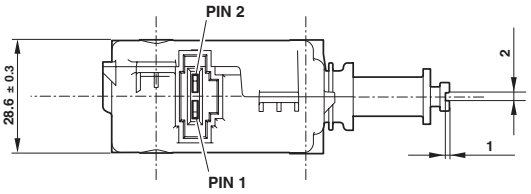
Electromotive actuators
Electrical locking/unlocking and closing
(Medium Force)
Electrical retraction and extension
6NW 009 203-401 / -407

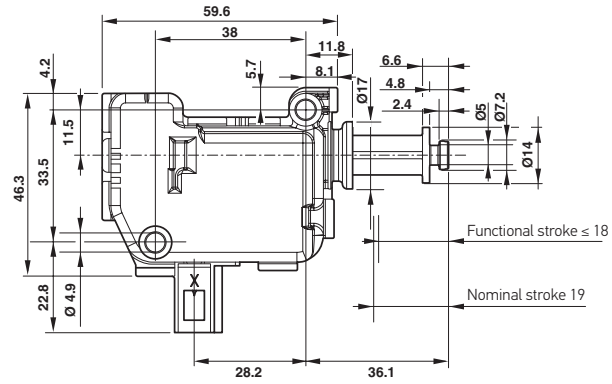
TECHNICAL DATA

Position when delivered	Retracted
Mainspring reset	None
Weight	90 g
Rated voltage	12 V
Voltage range	9 – 15 V
Maximum current consumption (stall current)	6.7 A
No-load/idling current	350 mA
Actuating force for tappet stroke via operating voltage range and operating temperature range	30 – 130 N
Manual adjustment	≤ 15 N
Actuating time for 18 mm stroke[1)]	max. 400 ms
Thermal overload protection	Via PTC (PolySwitch)
Operating temperature	-40°C to +80°C
Storage temperature	-40°C to +90°C
Lifetime	100,000 switching cycles
Conducted electromagnetic interference	< 75 V
Interference suppression (in all ranges)	Intensity level 1 + 10 dB µV
Functional stroke	≤ 18 mm
Protection class	IP 5K0
Vibration resistance	2.7 $g_{eff.}$
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector[2)]	1355390-1

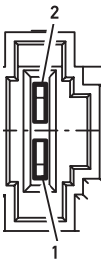
[1)] At the tappet over operating voltage range and operating temperature range.
[2)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

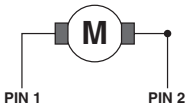
TECHNICAL DRAWING



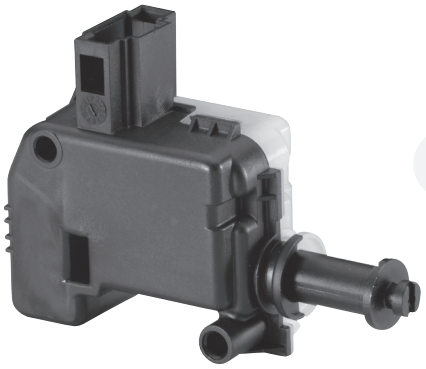


PIN ASSIGNMENT/ELECTRICAL CONNECTION





Electrical extension	+	-
Electrical retraction	-	+



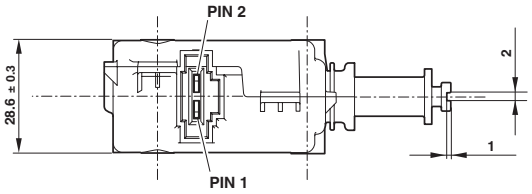
Electromotive actuators
Electrical locking/unlocking and closing
(Medium Force)
Electrical retraction and extension
6NW 009 203-411 / -417

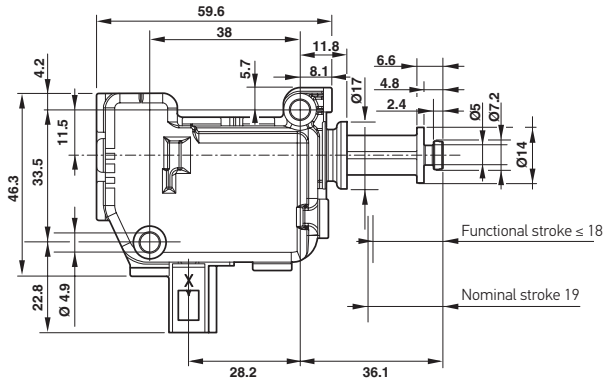
TECHNICAL DATA

Position when delivered	Retracted
Mainspring reset	None
Weight	90 g
Rated voltage	12 V
Voltage range	9 – 15 V
Maximum current consumption (stall current)	6.7 A
No-load/idling current	350 mA
Actuating force for tappet stroke via operating voltage range and operating temperature range	30 – 140 N
Manual adjustment	None
Actuating time for 18 mm stroke[1)]	max. 400 ms
Thermal overload protection	Via PTC (PolySwitch)
Operating temperature	-40°C to +80°C
Storage temperature	-40°C to +90°C
Lifetime	100,000 switching cycles
Conducted electromagnetic interference	< 75 V
Interference suppression (in all ranges)	Intensity level 1 + 10 dB µV
Functional stroke	≤ 18 mm
Protection class	IP 5K0
Vibration resistance	2.7 $g_{eff.}$
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector[2)]	1355390-1

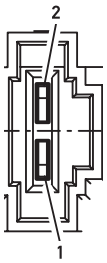
[1)] At the tappet over operating voltage range and operating temperature range.
[2)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

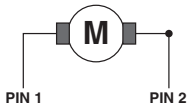
TECHNICAL DRAWING



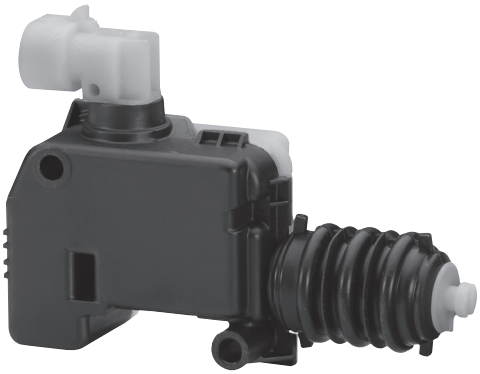


PIN ASSIGNMENT/ELECTRICAL CONNECTION





Electrical extension	+	-
Electrical retraction	-	+



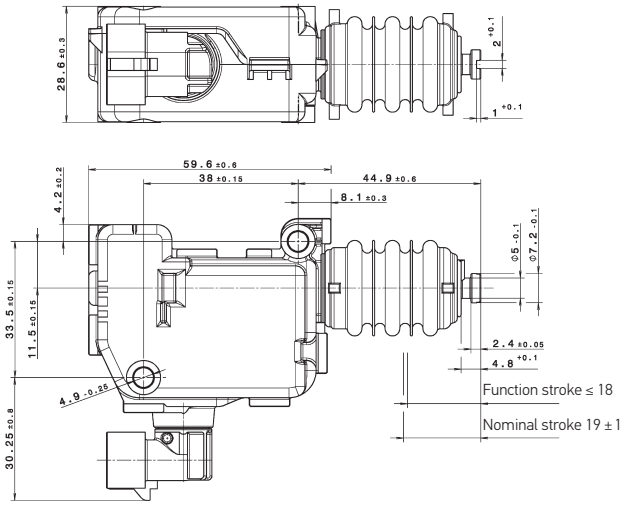
Electromotive actuators
Electrical locking/unlocking and closing
(Medium Force)
Electrical retraction and extension
6NW 009 203-627

TECHNICAL DATA

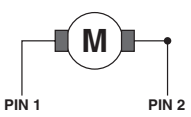
Position when delivered	Extended
Mainspring reset	None
Weight	90 g
Rated voltage	12 V
Voltage range	9 – 15 V
Maximum current consumption (stall current)	6.7 A
No-load/idling current	350 mA
Actuating force for tappet stroke via operating voltage range and operating temperature range	20 – 130 N
Manual adjustment	≤ 15 N
Actuating time for 18 mm stroke[1)]	max. 400 ms
Thermal overload protection	Via PTC (PolySwitch)
Operating temperature	-40°C to +80°C
Storage temperature	-40°C to +90°C
Lifetime	100,000 switching cycles
Conducted electromagnetic interference	< 75 V
Interference suppression (in all ranges)	Intensity level 1 + 10 dB µV
Functional stroke	≤ 18 mm
Protection class	IP 5K4
Vibration resistance	2.7 $g_{eff.}$
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector[2)]	282080-1

[1)] At the tappet over operating voltage range and operating temperature range.
[2)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

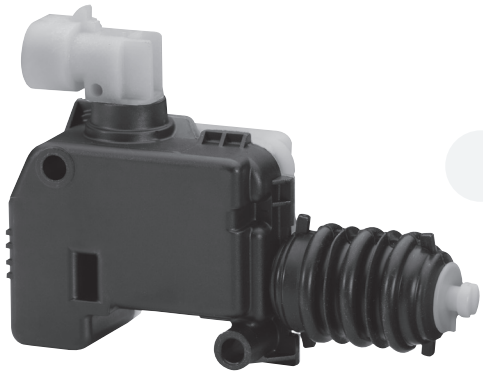
TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



Electrical extension	+	-
Electrical retraction	-	+



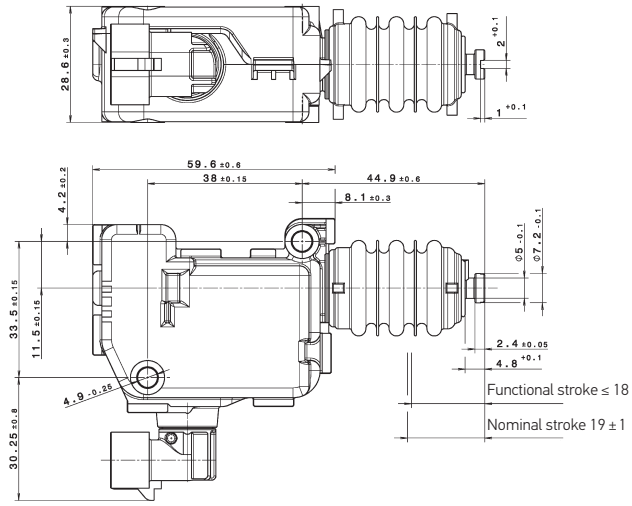
Electromotive actuators
Electrical locking/unlocking and closing
(Medium Force)
Electrical retraction and extension
6NW 009 203-637

TECHNICAL DATA

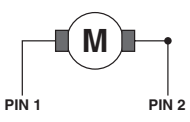
Position when delivered	Extended
Mainspring reset	None
Weight	90 g
Rated voltage	12 V
Voltage range	9 – 15 V
Maximum current consumption (stall current)	6.7 A
No-load/idling current	350 mA
Actuating force for tappet stroke via operating voltage range and operating temperature range	30 – 160 N
Manual adjustment	None
Actuating time for 18 mm stroke[1)]	max. 400 ms
Thermal overload protection	Via PTC (PolySwitch)
Operating temperature	-40°C to +80°C
Storage temperature	-40°C to +90°C
Lifetime	100,000 switching cycles
Conducted electromagnetic interference	< 75 V
Interference suppression (in all ranges)	Intensity level 1 + 10 dB µV
Functional stroke	≤ 18 mm
Protection class	IP 5K4
Vibration resistance	2.7 $g_{eff.}$
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector[2)]	282080-1

[1)] At the tappet over operating voltage range and operating temperature range.
[2)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

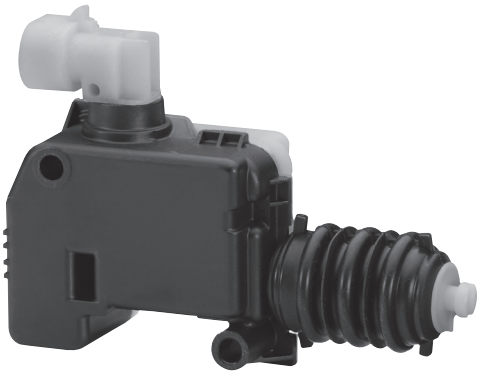
TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



Electrical extension	+	-
Electrical retraction	-	+



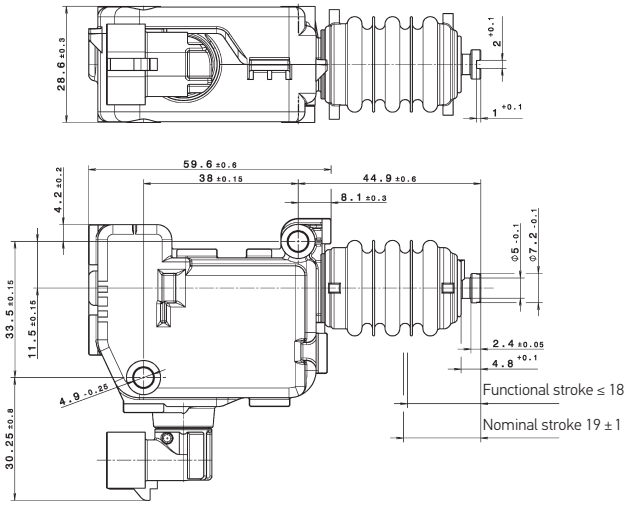
Electromotive actuators
Electrical locking/unlocking and closing
(Medium Force)
Electrical retraction and extension
6NW 009 203-441

TECHNICAL DATA

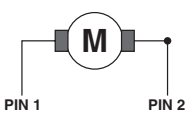
Position when delivered	Extended
Mainspring reset	None
Weight	90 g
Rated voltage	24 V
Voltage range	18 – 30 V
Maximum current consumption (stall current)	4.2 A
No-load/idling current	185 mA
Actuating force for tappet stroke via operating voltage range and operating temperature range	30 – 130 N
Manual adjustment	≤ 15 N
Actuating time for 18 mm stroke[1)]	max. 400 ms
Thermal overload protection	Via PTC (PolySwitch)
Operating temperature	-40°C to +80°C
Storage temperature	-40°C to +90°C
Lifetime	50,000 switching cycles
Conducted electromagnetic interference	< 75 V
Interference suppression (in all ranges)	Intensity level 1 + 10 dB µV
Functional stroke	≤18 mm
Protection class	IP 5K4
Vibration resistance	2.7 $g_{eff.}$
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector[2)]	282080-1

[1)] At the tappet over operating voltage range and operating temperature range.
[2)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



Electrical extension	+	-
Electrical retraction	-	+

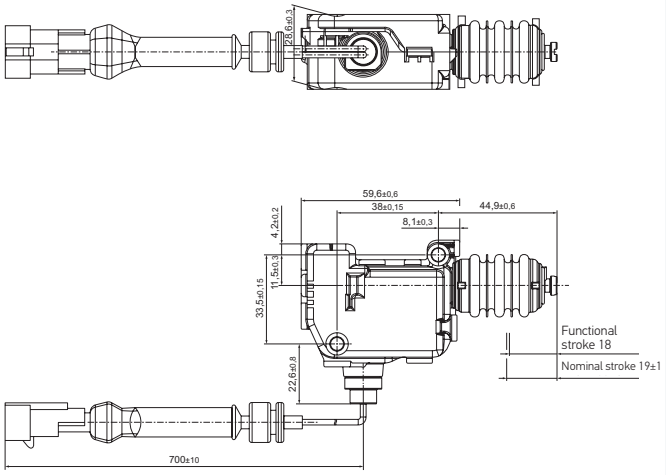
Electromotive actuators
Electrical locking/unlocking and closing
(Medium Force)
Electrical retraction and extension
With cable
6NW 009 203-551

TECHNICAL DATA

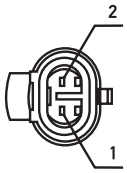
Position when delivered	Extended
Mainspring reset	None
Weight	90 g
Rated voltage	12 V
Voltage range	9 – 15 V
Maximum current consumption (stall current)	6.7 A
No-load/idling current	350 mA
Actuating force for tappet stroke via operating voltage range and operating temperature range	30 – 140 N
Manual adjustment	None
Actuating time for 18 mm stroke[1)]	max. 400 ms
Thermal overload protection	Via PTC (PolySwitch)
Operating temperature	-40°C to +80°C
Storage temperature	-40°C to +90°C
Lifetime	70,000 switching cycles
Conducted electromagnetic interference	< 75 V
Interference suppression (in all ranges)	Intensity level 1 + 10 dB µV
Functional stroke	≤ 18 mm
Protection class	IP 5K4
Vibration resistance	2.7 $g_{eff.}$
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector[2)]	282080-1

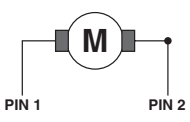
[1)] At the tappet over operating voltage range and operating temperature range.
[2)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

TECHNICAL DRAWING

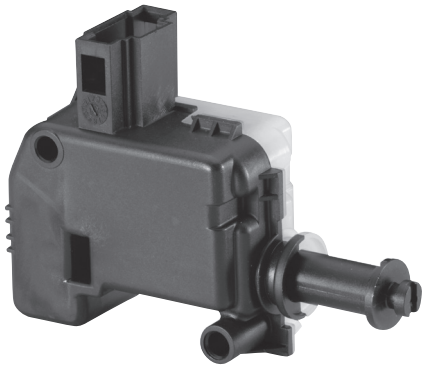


PIN ASSIGNMENT/ELECTRICAL CONNECTION





Electrical extension	+	-
Electrical retraction	-	+



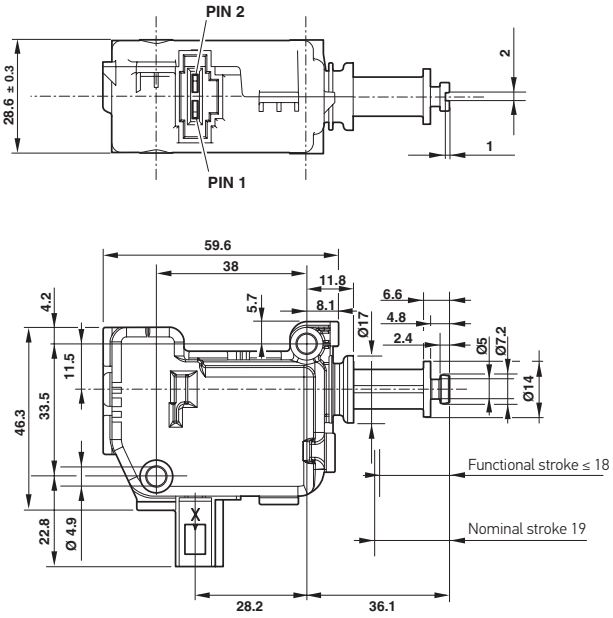
Electromotive actuators
Electrical locking/unlocking and closing
(Medium Force)
Electrical retraction and extension with mainspring
6NW 009 203-461 / -467

TECHNICAL DATA

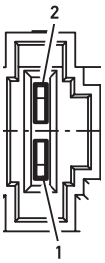
Position when delivered	Extended
Mainspring reset	Extend
Weight	90 g
Rated voltage	12 V
Voltage range	9 – 15 V
Maximum current consumption (stall current)	10.5 A
No-load/idling current	545 mA
Actuating force for tappet stroke via operating voltage range and operating temperature range	30 – 170 N
Manual adjustment	None
Actuating time for 18 mm stroke[1)]	max. 400 ms
Thermal overload protection	Via PTC (PolySwitch)
Operating temperature	-40°C to +80°C
Storage temperature	-40°C to +90°C
Lifetime	50,000 switching cycles
Conducted electromagnetic interference	< 75 V
Interference suppression (in all ranges)	Intensity level 1 + 10 dB µV
Functional stroke	≤ 18 mm
Protection class	IP 5K0
Vibration resistance	2.7 $g_{eff.}$
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector[2)]	1355390-1

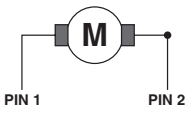
[1)] At the tappet over operating voltage range and operating temperature range.
[2)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

TECHNICAL DRAWING

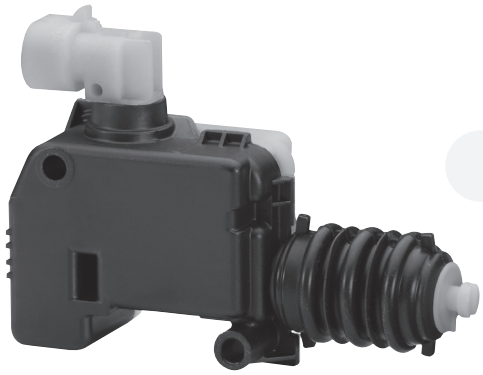


PIN ASSIGNMENT/ELECTRICAL CONNECTION





Electrical extension with mainspring	0	0
Electrical retraction	-	+



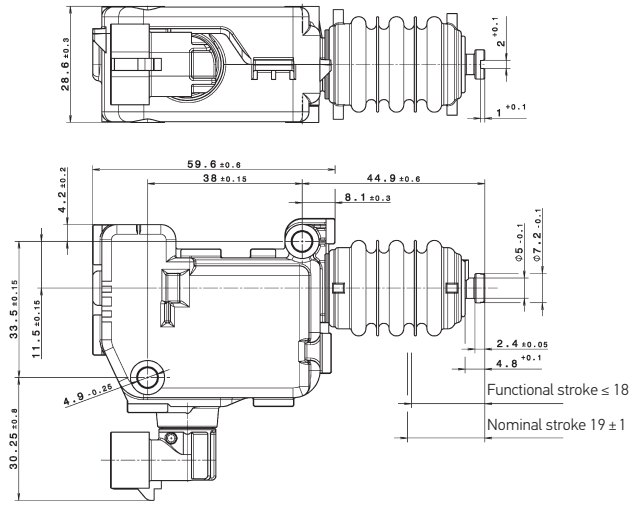
Electromotive actuators
Electrical locking/unlocking and closing
(Medium Force)
Electrical retraction and extension with mainspring
6NW 009 203-471 / -477

TECHNICAL DATA

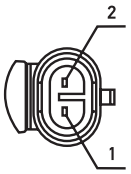
Position when delivered	Extended
Mainspring reset	Extend
Weight	90 g
Rated voltage	12 V
Voltage range	9 – 15 V
Maximum current consumption (stall current)	10.5 A
No-load/idling current	545 mA
Actuating force for tappet stroke via operating voltage range and operating temperature range	30 – 170 N
Manual adjustment	None
Actuating time for 18 mm stroke[1)]	max. 400 ms
Thermal overload protection	Via PTC (PolySwitch)
Operating temperature	-40°C to +80°C
Storage temperature	-40°C to +90°C
Lifetime	50,000 switching cycles
Conducted electromagnetic interference	< 75 V
Interference suppression (in all ranges)	Intensity level 1 + 10 dB µV
Functional stroke	≤ 18 mm
Protection class	IP 5K4
Vibration resistance	2.7 $g_{eff.}$
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector[2)]	282080-1

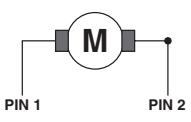
[1)] At the tappet over operating voltage range and operating temperature range.
[2)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

TECHNICAL DRAWING

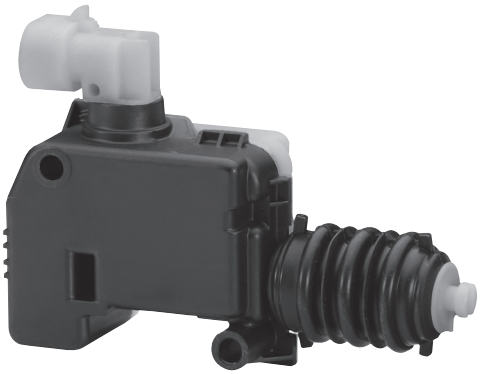


PIN ASSIGNMENT/ELECTRICAL CONNECTION





Electrical extension with mainspring	0	0
Electrical retraction	-	+



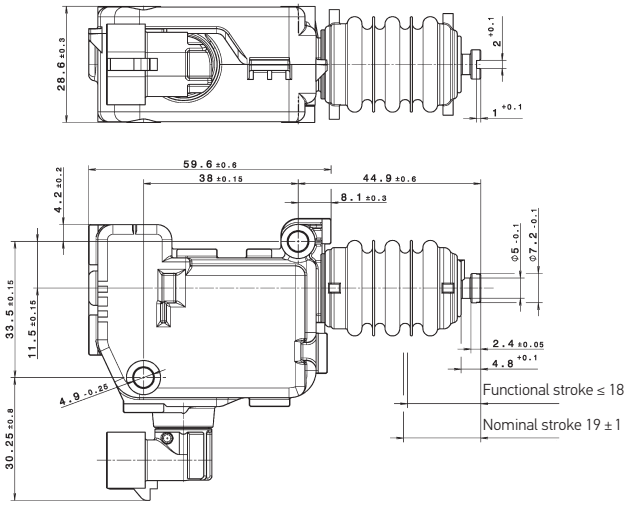
Electromotive actuators
Electrical locking/unlocking and closing
(Medium Force)
Electrical retraction and extension with mainspring
6NW 009 203-541 / -547

TECHNICAL DATA

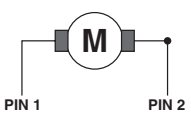
Position when delivered	Extended
Mainspring reset	Extend
Weight	90 g
Rated voltage	24 V
Voltage range	18 – 30 V
Maximum current consumption (stall current)	4.2 A
No-load/idling current	185 mA
Actuating force for tappet stroke via operating voltage range and operating temperature range	15 – 90 N
Manual adjustment	< 35 N
Actuating time for 18 mm stroke[1)]	max. 400 ms
Thermal overload protection	Via PTC (PolySwitch)
Operating temperature	-40°C to +80°C
Storage temperature	-40°C to +90°C
Lifetime	50,000 switching cycles
Conducted electromagnetic interference	< 75 V
Interference suppression (in all ranges)	Intensity level 1 + 10 dB µV
Functional stroke	≤ 18 mm
Protection class	IP 5K4
Vibration resistance	2.7 $g_{eff.}$
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector[2)]	282080-1

[1)] At the tappet over operating voltage range and operating temperature range.
[2)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

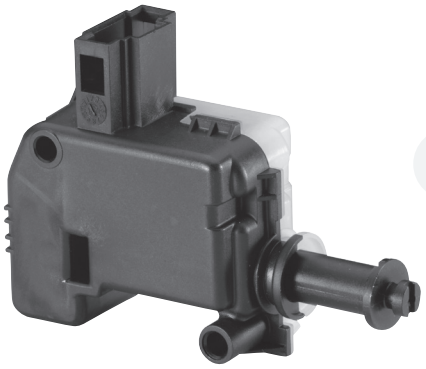
TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



Electrical extension with mainspring	0	0
Electrical retraction	-	+

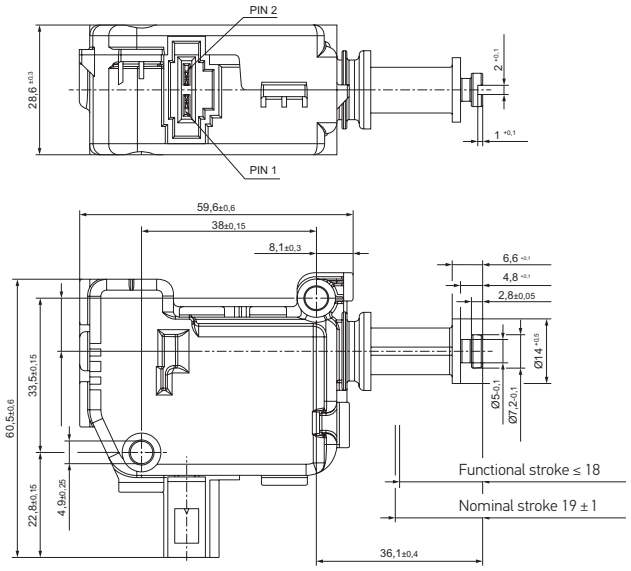


Electromotive actuators
Electrical locking/unlocking and closing
(Medium Force)
Electrical extension and retraction with mainspring
6NW 009 203-491 / 497

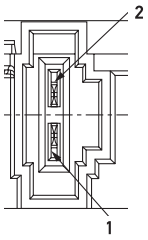
TECHNICAL DATA	
Position when delivered	Retracted
Mainspring reset	Retract
Weight	90 g
Rated voltage	12 V
Voltage range	9 – 15 V
Maximum current consumption (stall current)	10.5 A
No-load/idling current	577 mA
Actuating force for tappet stroke via operating voltage range and operating temperature range	30 – 170 N
Manual adjustment	None
Actuating time for 18 mm stroke[1)]	max. 400 ms
Thermal overload protection	Via PTC (PolySwitch)
Operating temperature	-40°C to +80°C
Storage temperature	-40°C to +90°C
Lifetime	50,000 switching cycles
Conducted electromagnetic interference	< 75 V
Interference suppression (in all ranges)	Intensity level 1 + 10 dB µV
Functional stroke	≤ 18 mm
Protection class	IP 5K0
Vibration resistance	2.7 $g_{eff.}$
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector[2)]	1355390-1

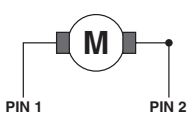
[1)] At the tappet over operating voltage range and operating temperature range.
[2)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

TECHNICAL DRAWING

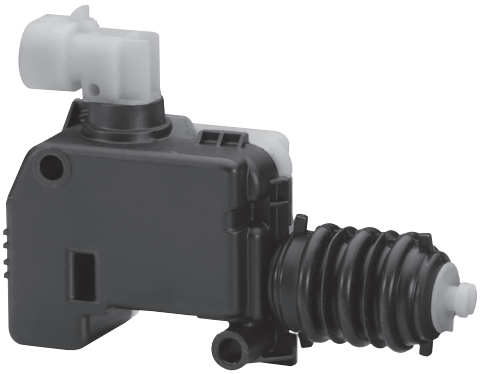


PIN ASSIGNMENT/ELECTRICAL CONNECTION





	PIN 1	PIN 2
Electrical extension	+	-
Electrical retraction with mainspring	0	0



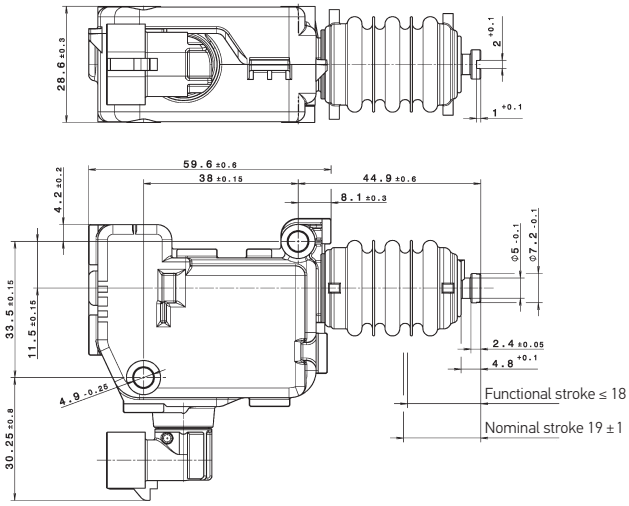
Electromotive actuators
Electrical locking/unlocking and closing
(Medium Force)
Electrical extension and retraction with mainspring
6NW 009 203-501

TECHNICAL DATA

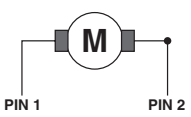
Position when delivered	Retracted
Mainspring reset	Retract
Weight	90 g
Rated voltage	12 V
Voltage range	9 – 15 V
Maximum current consumption (stall current)	10.5 A
No-load/idling current	577 mA
Actuating force for tappet stroke via operating voltage range and operating temperature range	30 to 170 N
Manual adjustment	None
Actuating time for 18 mm stroke[1)]	max. 400 ms
Thermal overload protection	Via PTC (PolySwitch)
Operating temperature	-40°C to +80°C
Storage temperature	-40°C to +90°C
Lifetime	50,000 switching cycles
Conducted electromagnetic interference	< 75 V
Interference suppression (in all ranges)	Intensity level 1 + 10 dB µV
Functional stroke	≤ 18 mm
Protection class	IP 5K4
Vibration resistance	2.7 $g_{eff.}$
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector[2)]	282080-1

[1)] At the tappet over operating voltage range and operating temperature range.
[2)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

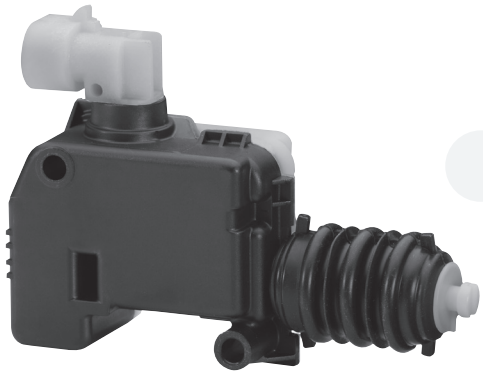
TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



Electrical extension	0	0
Electrical retraction with mainspring	-	+

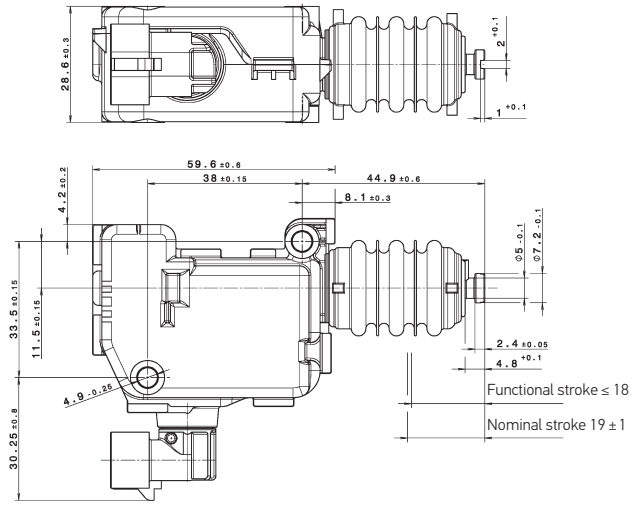


Electromotive actuators
Electrical locking/unlocking and closing
(Medium Force)
Electrical extension and retraction with mainspring
6NW 009 203-521 / -527

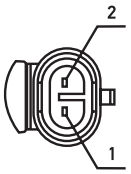
TECHNICAL DATA	
Position when delivered	Retracted
Mainspring reset	Retract
Weight	90 g
Rated voltage	24 V
Voltage range	18 – 30 V
Maximum current consumption (stall current)	4.2 A
No-load/idling current	185 mA
Actuating force for tappet stroke via operating voltage range and operating temperature range	20 to 140 N
Manual adjustment	None
Actuating time for 18 mm stroke[1)]	max. 400 ms
Thermal overload protection	Via PTC (PolySwitch)
Operating temperature	-40°C to +80°C
Storage temperature	-40°C to +90°C
Lifetime	50,000 switching cycles
Conducted electromagnetic interference	< 75 V
Interference suppression (in all ranges)	Intensity level 1 + 10 dB µV
Functional stroke	≤ 18 mm
Protection class	IP 5K4
Vibration resistance	2.7 $g_{eff.}$
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector[2)]	282080-1

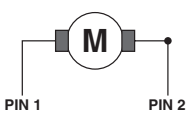
[1)] At the tappet over operating voltage range and operating temperature range.
[2)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION





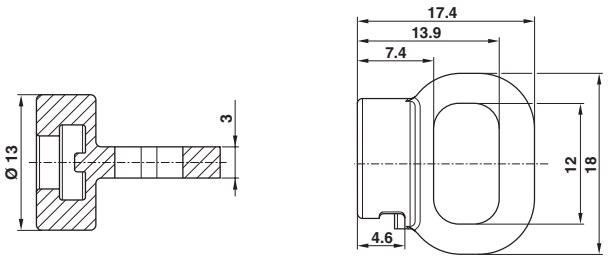
Electrical extension	+	-
Electrical retraction with mainspring	0	0

Electromotive actuators
Electrical locking/unlocking and closing (Medium Force)
Connecting elements for actuator function
Retraction and extension

TECHNICAL DATA	
Storage temperature	-40°C to +90°C
Material	POM white

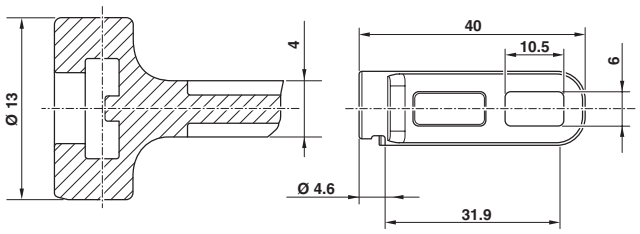
Part number 9XD 860 912-001

TECHNICAL DRAWING



Part number 9XD 862 354-001

TECHNICAL DRAWING

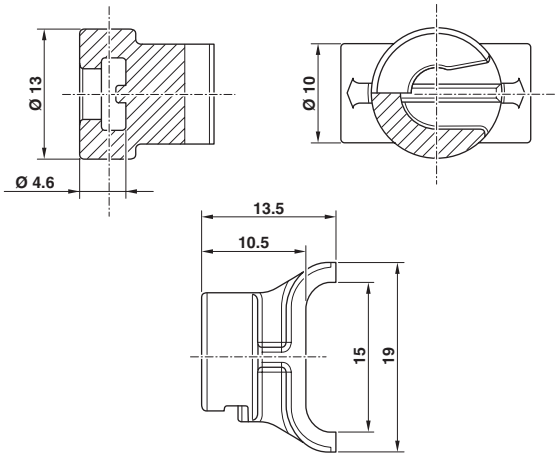


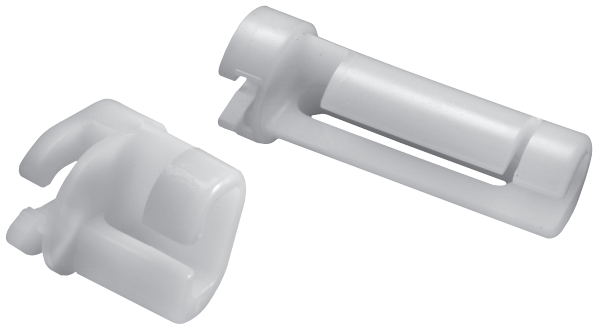
Electromotive actuators
Electrical locking/unlocking and closing
(Medium Force)
Connecting elements for actuator function
Extension

TECHNICAL DATA	
Storage temperature	-40°C to +90°C
Material	POM black

Part number 9XD 861 450-001

TECHNICAL DRAWING



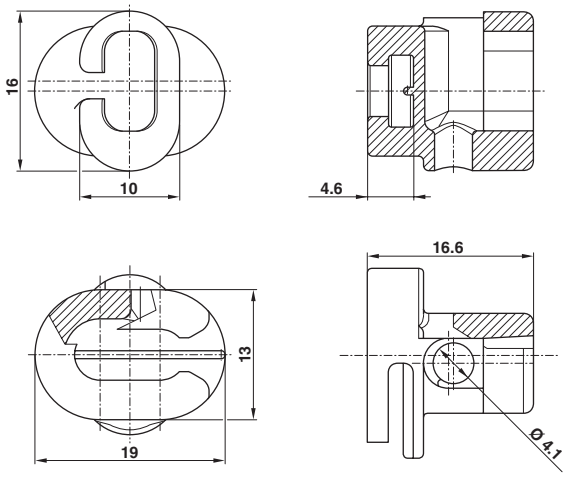


Electromotive actuators
Electrical locking/unlocking and closing (Medium Force)
Connecting elements for actuator function
Retraction and extension with rod

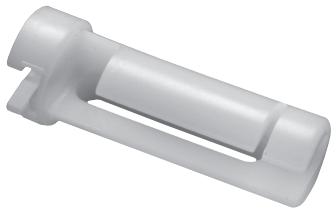
TECHNICAL DATA	
Storage temperature	-40°C to +90°C
Material	POM white

Part number 9XD 861 771-001

TECHNICAL DRAWING



Part number 9XD 862 516-001



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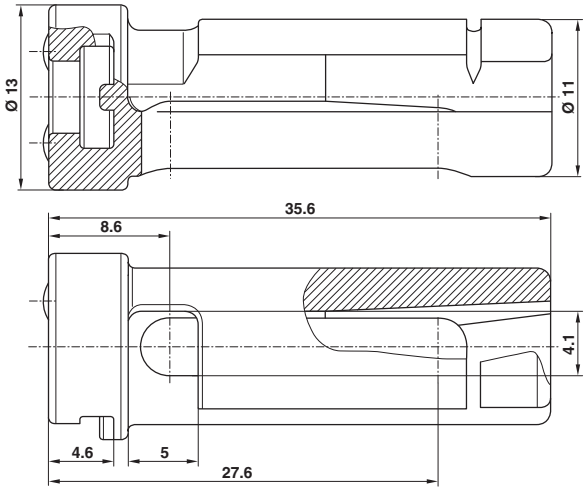
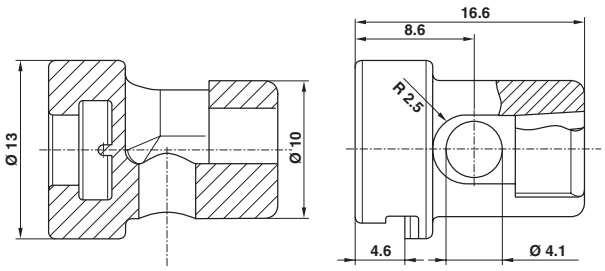


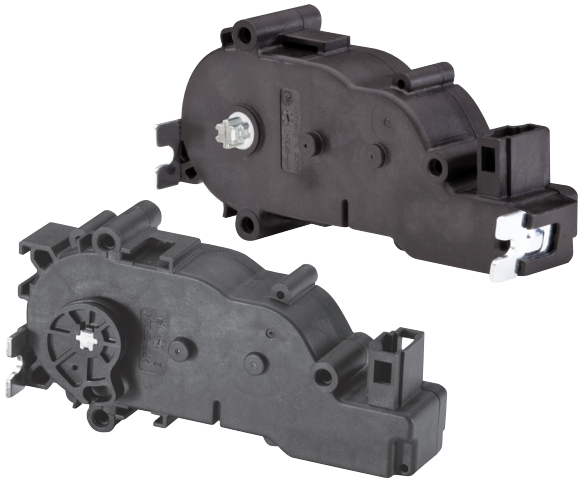
Electromotive actuators
Electrical locking/unlocking and closing
(Medium Force)
Connecting elements for actuator function
Retraction and extension with rod

TECHNICAL DATA	
Storage temperature	-40°C to +90°C
Material	POM white

Part number 9XD 860 913-001

TECHNICAL DRAWING





Electromotive actuators
Electrical locking/unlocking and closing
(High Force)

PRODUCT FEATURES

- → Very high positioning forces
- → Robust and compact design
- → Interference suppression Class 3
- → Universal interface for Bowden cable
- → For universal use

APPLICATION
The actuator is particularly suitable for locking and closing applications where High Forces are required.

Examples include:
- → Large locks and
- → Large flaps
- → Seat release

Where a Bowden cable is used, the actuator can also work without being attached to the vehicle body, since it is fixed to the application by means of the Bowden cable sleeve. The actuator can be embedded in a foam body for the purpose of noise insulation.

DESIGN AND FUNCTION
This electromotive actuator is driven by a DC motor with rotary output. The actuator is operated by applying a voltage via a 2-pin connector with the contacts "+" and "Ground". It is reset by simply reversing the polarity or, alternatively, automatically via a spring. Direction of rotation and running time are defined by the control unit. The actuator can be attached to three connection points.

APPLICATION REQUIREMENTS:
The actuator is not to be mechanically limited or restricted in any way by the application. The high impact pulse (approx. 7 - 8 Nm) can damage the application, the bracket or the Bowden cable.

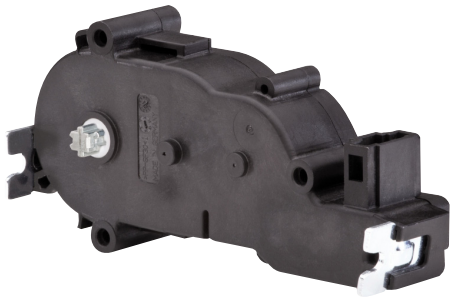
The customer application must ensure that in the rest position (end position following counterclockwise rotation) no load is applied to the actuator in order to avoid damaging the internal limit stop.

During the mainspring reset (only 6NW 009 424-781), a motor short circuit is absolutely necessary. This short circuit takes place using a 1N 4005 diode during the lifetime test. The short-circuited motor has a braking effect that protects the internal limit stop. Without such protection, the dynamism in the system can damage the limit stop during the return action, which in turn can cause the device to become blocked.

PROGRAM OVERVIEW

Function	Voltage	Torque	Manual adjustment	Protection class	Part number	VPE*	Page
Retraction via spring, extension electric	12 V	150 Ncm	No	IP 5K0	**6NW 009 424-781**	1	104
Retraction and extension electrical	12 V	300 Ncm	No	IP 5K0	**6NW 009 424-791**	1	105
Retraction and extension electrical, without shaft, without cable sheave and without metal clip	12 V	300 Ncm	No	IP 5K0	**6NW 009 424-777**	70	

* Packaging unit



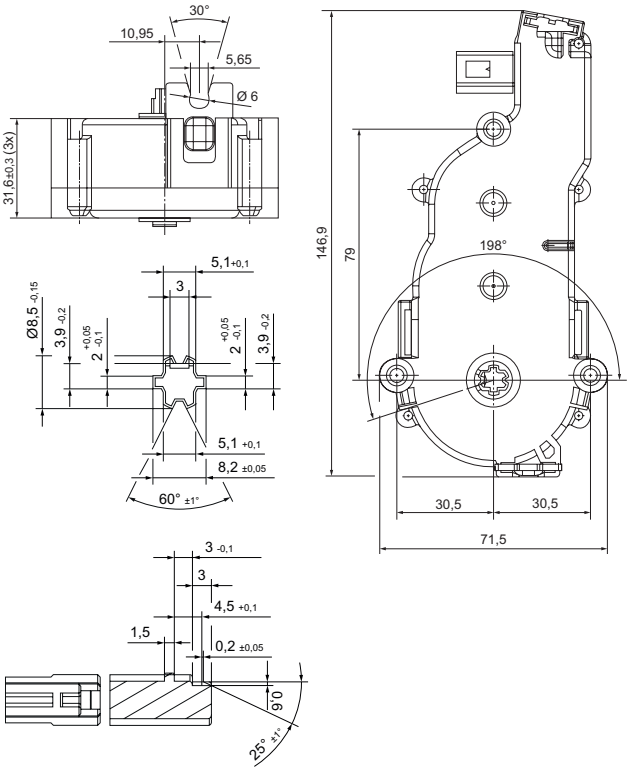
Electromotive actuators
Electrical locking/unlocking and closing
(High Force)
Electrical rotation (left),
Return by spring (right)
6NW 009 424-781

TECHNICAL DATA

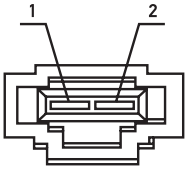
Mainspring reset	Available
Weight	181 g
Rated voltage	12 V
Voltage range	9 – 16 V
Maximum current consumption (stall current)	7 A
No-load/idling current	150 mA
Rated torque	150 Ncm
Functional angle	0° to 198°
Tensile path	Approx. 45 mm
Rated speed (at rated load and room temperature)	32 min^{-1}
Manual adjustment	None
Thermal overload protection	Available
Operating temperature	-40°C to +85°C
Lifetime	8,000 switching cycles
Conducted electromagnetic interference	< - 75 V
Interference suppression (in all ranges)	Intensity level 3
Protection class	IP 5K0
Vibration resistance (IEC 68-2-64)	3 $g_{eff.}$
Housing material (top side)	PP-GF30
Housing material (bottom side)	PP-GF30
Pin coating	Tin
Mating connector[1)]	1355390-1

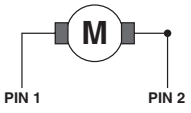
[1)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION





Electrical rotation to the left	+	-
Reset by spring to the right	0	0

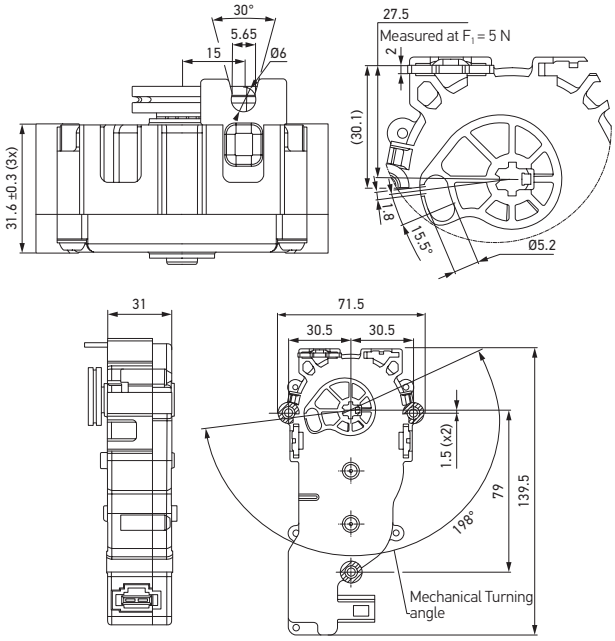
Electromotive actuators
Electrical locking/unlocking and closing (High Force)
Electrical rotation to right and left
6NW 009 424-791
6NW 009 424-777
(As -791 but without shaft, without cable sheave and without metal clip)

TECHNICAL DATA

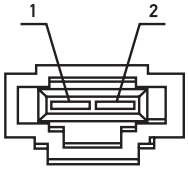
Mainspring reset	None
Weight	181 g
Rated voltage	12 V
Voltage range	9 – 16 V
Maximum current consumption (stall current)	6 A
No-load/idling current	< 0.4 (≤ 0.45) A
Speed at rated load	U_p / RT ≥12 (≥10) rmp
Rated torque	300 Ncm
Functional angle	0° to 198°
Tensile path	Approx. 45 mm
Rated speed (at rated load and room temperature)	15 min $^{-1}$ at RT and 13 V
Manual adjustment	None
Thermal overload protection	Not available
Operating temperature	-40°C to +85°C
Lifetime	50,000 switching cycles
Conducted electromagnetic interference	< -75 V
Interference suppression (in all ranges)	Intensity level 3
Protection class	IP 5K0
Vibration resistance (IEC 68-2-64)	3 $g_{eff.}$
Housing material (top side)	PP-GF30
Housing material (bottom side)	PP-GF30
Pin coating	Tin
Mating connector[1)]	1355390-1

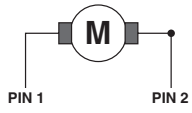
[1)] These accessories are not included in the scope of delivery. Available from TE Connectivity.

TECHNICAL DRAWING 6NW 009 424-791



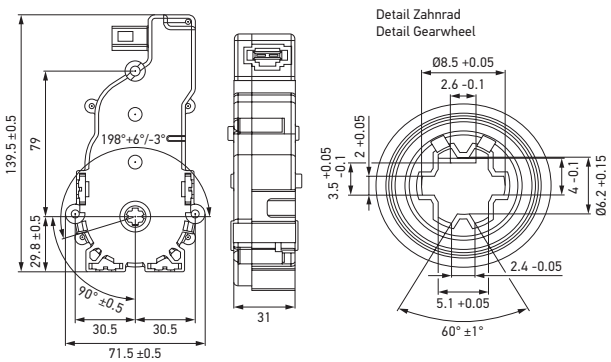
PIN ASSIGNMENT/ELECTRICAL CONNECTION





	PIN 1	PIN 2
Electrical rotation to the right	+	-
Electrical rotation to the left	-	+

TECHNICAL DRAWING 6NW 009 424-777



Electromotive actuators
Electrical locking/unlocking and closing (Smart URA)
Electrical rotation left and right, with high torque
Flexible operating angle range
6NW 011 303-701

PRODUCT FEATURES

- → Actuator controls the position of its output gear according to the set position
- → Precise position control with HELLA CIPOS® technology
- → Electrical rotation (right / left) with high torque
- → Flexible operating angle range with up to eight full rotations
- → "True power on" -functionality for angle ranges < 180
- → Integrated electronics monitor actuator function
- → Error feedback and error memory
- → Self-blocking transmission

DESIGN AND FUNCTION

The Smart URA monitors the position of the output gear and the integrated electronics continuously calculate the position with the help of an ASIC (Application Specific Integrated Circuit). The actuator boasts the "True power on" function for angles under 180°, i.e. it enables direct startup without calibration. When in operation, the actuator carries out controlled movement to the programmable soft stops. The self-blocking transmission minimises current consumption (< 25 mA), which is required in order to maintain a defined position.

APPLICATION

The Smart URA can be used in a wide range of applications in harsh environments and it succeeds in providing precise and reliable positioning. The CIPOS® technology used in the Smart URA is characterised in particular by its insensitivity to magnetic fields and also by its high temperature stability. Angles are measured inductively using a non-contact and consequently wear-free method, thus guaranteeing high measuring precision throughout the entire lifetime. An error memory records errors and the actuator is able to react differently and appropriately to all manner of faults.

APPLICATION EXAMPLES

- → Seed metering/singling
- → Control of supply air/exhaust air flaps
- → Control of valves in a cooling circuit
- → Control of air flaps of radiator grille

PWM INTERFACE – INPUT SIGNAL

A PWM signal can be used as an input signal for communication between the actuator and the control unit. This PWM signal has to be be provided by the external control unit as a low side driver (open collector). The PWM input signal is defined by the period duration and by the duty cycle. The period duration begins (and ends) with a rising edge. The duty cycle is defined as the ratio between the time with a high signal and the total period duration.

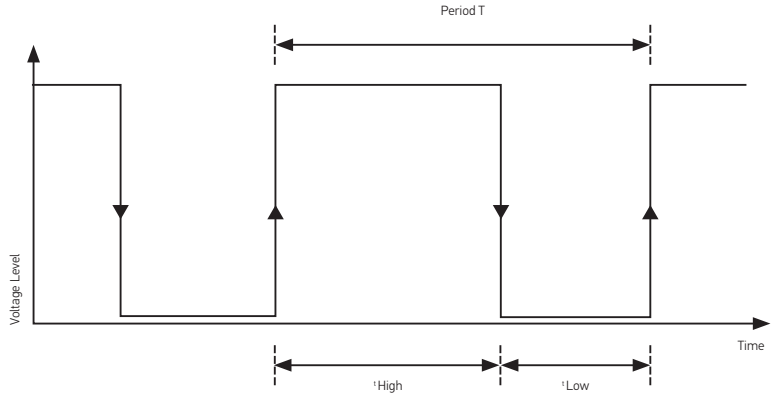
PWM FEEDBACK AND PWM GROUNDING

So as to transmit errors via PWM grounding, the PWM input signal is set to "Low" for a defined time and then reset again to "High". The time during which the PWM signal is set to "Low" depends on the error group.

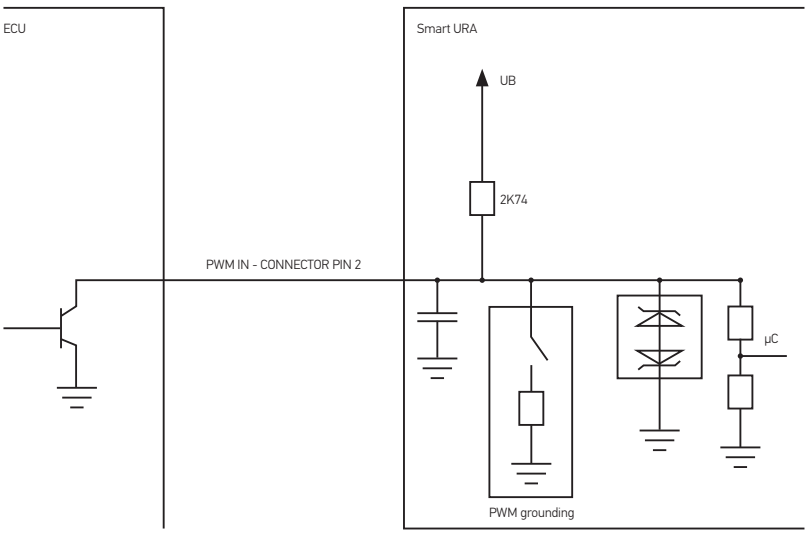
LIN INTERFACE / LIN BUS SPECIFICATIONS:

A LIN signal coming from the control unit can be used as an input/output signal for communication with the actuator. The Smart URA functions here as a LIN slave. The Smart URA works with the LIN 2.0 protocol without a diagnostic function (diagnostic function with 2.1 or 2.2 is possible). The hardware is compatible with the LIN 2.2 protocol. The typical baud rate is 19.2 kbps (± 10%).

PWM SIGNAL: DEFINITION



INTERFACE CIRCUIT PWM-INPUT



PROGRAM OVERVIEW

Function	Voltage	Torque	Manual adjustment	Protection class	Part number	VPE*	Page
Electrical locking/unlocking & closing, electrical rotation right and left, with position feedback using CIPOS® technology	12 V	Up to 300 Ncm	No	IP 6K9K or IP 6K7[1)]	**6NW 011 303-701**	1	108 – 109

[1)] Depends on connector classification

* Packaging unit

Electrical locking/unlocking and closing,
electrical rotation right and left,
with position feedback using CIPOS® technology

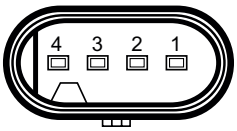
6NW 011 303-701

TECHNICAL DATA

Weight	106 g
Rated voltage	13.5 V
Voltage range	9 – 16 V
Rated current	0.5 A
Maximum current consumption (Stall current)	3.7 A
No-load current in idle mode	< 100 µA (typical 20 µA)
Rated torque (at 13.5 V and RT)	60 Ncm
Maximum torque after lifetime (at 13.5 V and RT)	< 300 Ncm
Operating angle	> 360° (< 180° true power on)
Actuating time for 0°-90°	< 2 s (no load; 13.5 V and RT)
Thermal overload protection	Self-protection through self-diagnosis
Operating temperature	-40°C to +85°C
Storage temperature	-40°C to +105°C
Lifetime	250,000 cycles (1 cycle = angle of 90° open - closed)
EMV	CISPR 25, Class 5[1)]
Protocol	LIN 2.0 and PWM
Protection class	IP 6K9K; IP 6K7[2)]
Vibration resistance	9.6 g
Housing material	PPA-GF40
Pin Coating	Tin
Manual adjustment	No
Mating connector[3)]	1-1456426-1, coding A

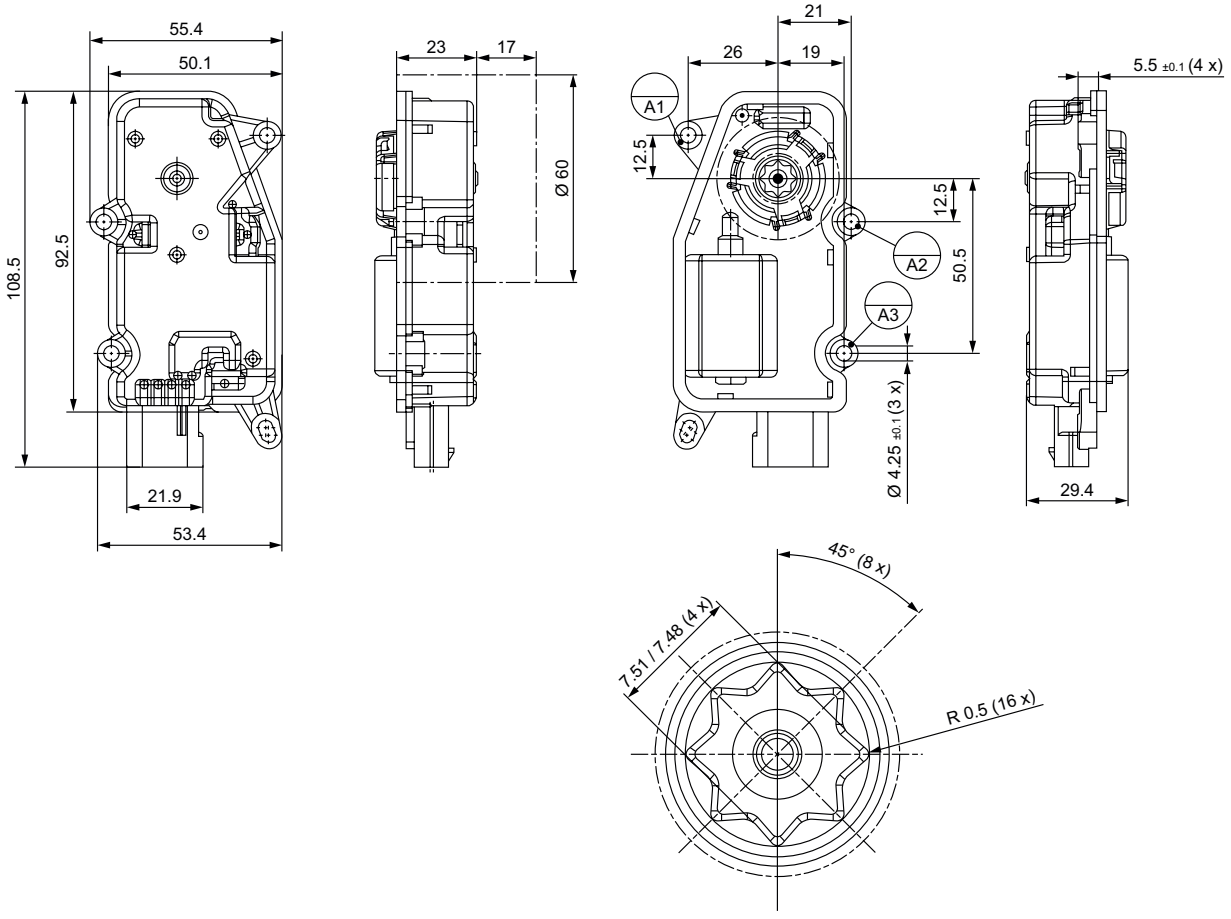
[1)] Limits may be exceeded in the frequency range of 3 - 4 MHz.
[2)] Depends on connector classification
[3)] These accessories are not included in the scope of delivery.
Available from TE Connectivity.

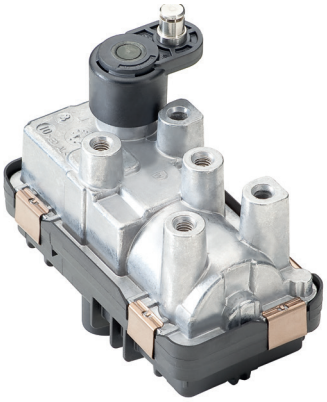
PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1: U_{Bat}
Pin 2: PWM input
Pin 3: LIN / PWM output
Pin 4: Ground

TECHNICAL DRAWING





Turbo actuators

PRODUCT FEATURES

- → Integrated electronics consisting of CIPOS® (Contactless Inductive Position Sensor) position sensor, motor control and error diagnosis
- → Short response time
- → Self-blocking transmission and low current consumption in order to hold position

DESIGN AND FUNCTION

The main function of the UTA is to bring the shaft into the position specified by the control unit. With the aid of the CIPOS® sensor, the position of the shaft is continuously calculated and actively reported back. In addition to the CIPOS® sensor responsible for precise positioning, the integrated electronics include motor control and error diagnosis.
In this way, errors can be detected, reported back and appropriate reactions automatically derived from them. The error messages are stored in a memory.

APPLICATION

The Universal Turbo Actuator is mainly used for the VNT /VTG (Variable Nozzle Turbine / Variable Turbine Geometry) turbocharger technology so as to provide reliable and precise positioning. It is especially the insensitivity to magnetic fields and the high level of temperature stability that are the characteristic qualities of the CIPOS® technology used in conjunction with the UTA. Angles are measured inductively using a non-contact and consequently wear-free method, thus guaranteeing high measuring precision throughout the entire lifetime.

PROGRAM OVERVIEW

Voltage range	Operating angle	Torque	Part number	VPE*	Page
10.5 – 16 V	100°	> 55 Ncm	**On request**	–	112 – 113

* Packaging unit

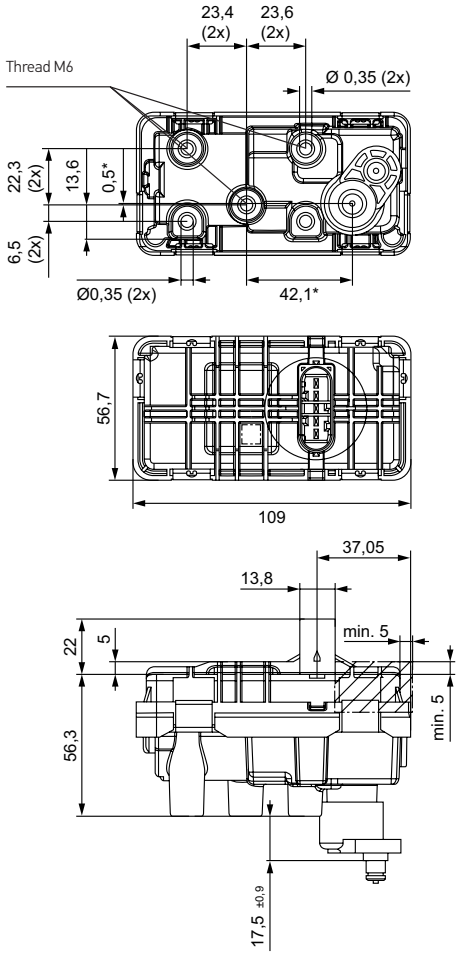
Universal Turbo Actuator (UTA)
On request

TECHNICAL DATA

Rated voltage	14 V
Operating voltage	10.5 – 16 V
Operating temperature	-40°C to +125°C
Short-term maximum temperature	Up to 150°C
Operating angle range	100°
Angular velocity (at 20 Ncm)	> 0.35°/ms
Max. current consumption	< 9 A
Minimum torque (at 14 V, 0.1° / ms)	> 55 Ncm
Sensor resolution	0.125°
Position tolerance over angle range	±2%
Protection class	IP 6K9K
Protocol	CAN or PWM
Mating connector[1)]	09 4415 82, coding B

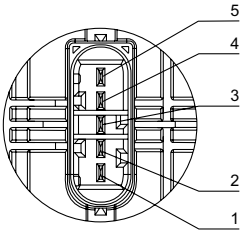
[1)] These accessories are not included in the scope of delivery.
Available from Kostal.

TECHNICAL DRAWING



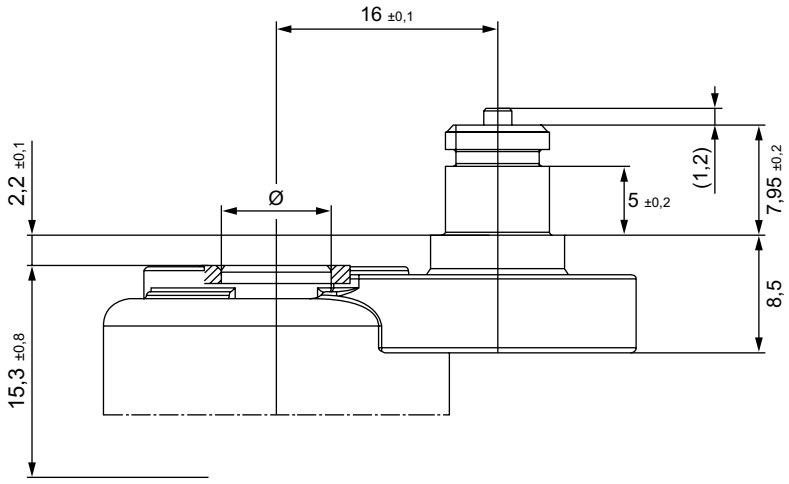
* Relates to housing domes only.

PIN ASSIGNMENT/ELECTRICAL CONNECTION

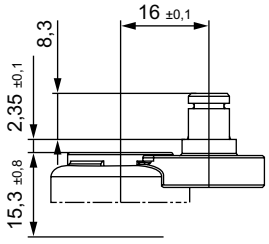


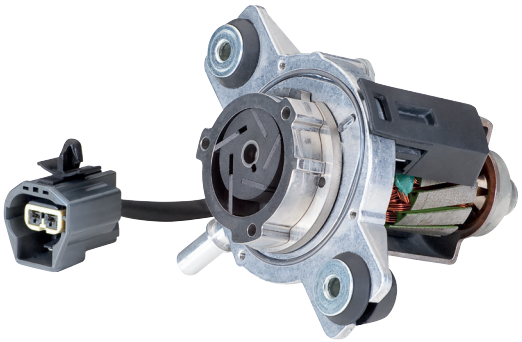
Pin 1: Ub
Pin 2: Ground
Pin 3: CAN High
Pin 4: PWM Input / PWM Grounding
Pin 5: CAN Low

EXAMPLE OF A CONNECTING ELEMENT



VIEW OF ALTERNATIVE CONNECTING ELEMENT





Vacuum pumps

PRODUCT FEATURES

- → Electrical vacuum pumps for the support or for the sole generating of the vacuum for the pneumatic brake booster system
- → Applicable for all engine concepts, also for electric motors and hybrid drives
- → HELLA is market leader and has more than 10 years of experience in the development and manufacture of electric vacuum pumps

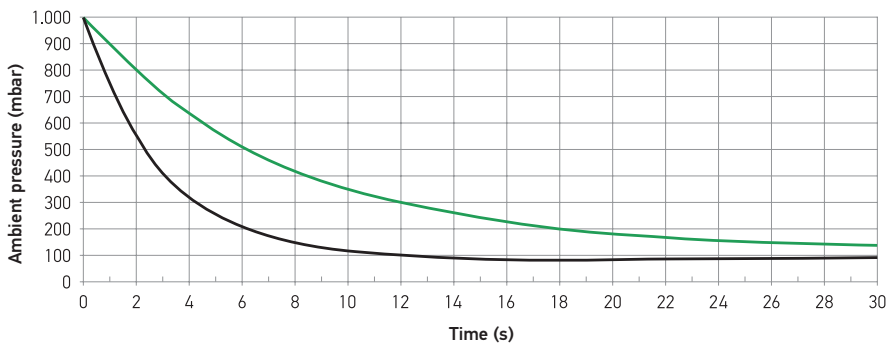
DESIGN AND FUNCTION

The vacuum pumps' function is based on the rotary vane compressor principle. The pump contains a rotor that is off-centre to the pump chamber. The blades set in the rotor slide along the interior wall of the pump chamber.
The volume enclosed by the blades is continuously compressed by rotation. This change in the chamber volume causes a vacuum with the effect that air is sucked in by the brake booster through the vacuum pump via the brake system's pneumatic line system.

APPLICATION

Under certain driving conditions or depending on the engine layout, no vacuum or an insufficient vacuum is supplied to the brake booster through the intake manifold of an internal combustion engine. The UP 28 variant can support the system by generating an additional vacuum (Support application). The UP 5.0, on the other hand, can provide the pneumatic vacuum supply alone (Stand-alone application). In this way, the pump acts as the sole vacuum source and ensures an adequate supply for the brake booster and for any other auxiliary equipment.

COMPARISON OF VACUUM CURVES OF UP 28 ~ UP 5.0



UP 28
UP 5.0

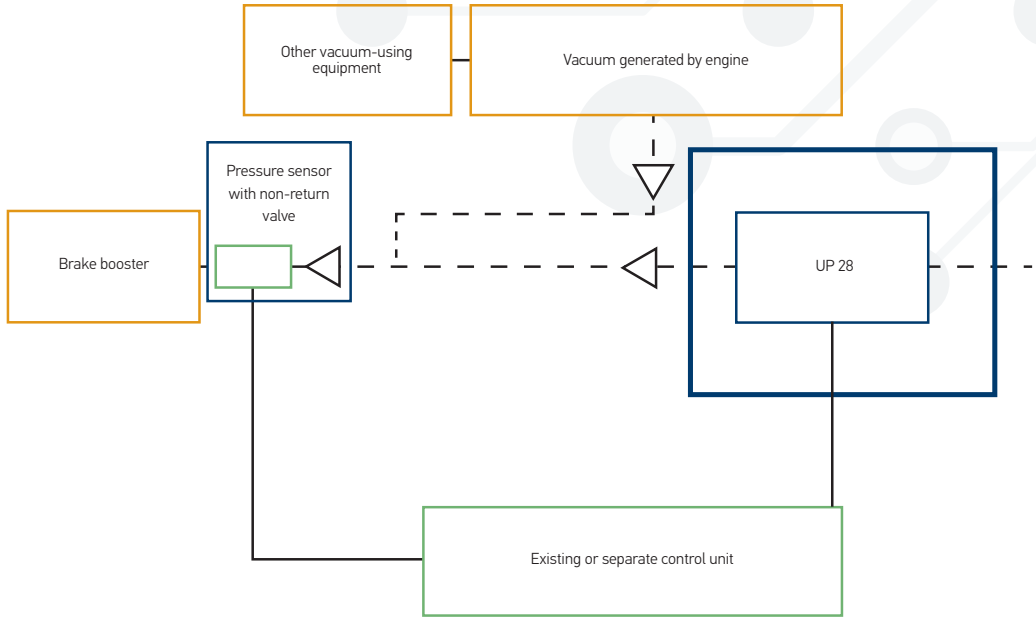
Booster volume = 4 L

Voltage = 13 V

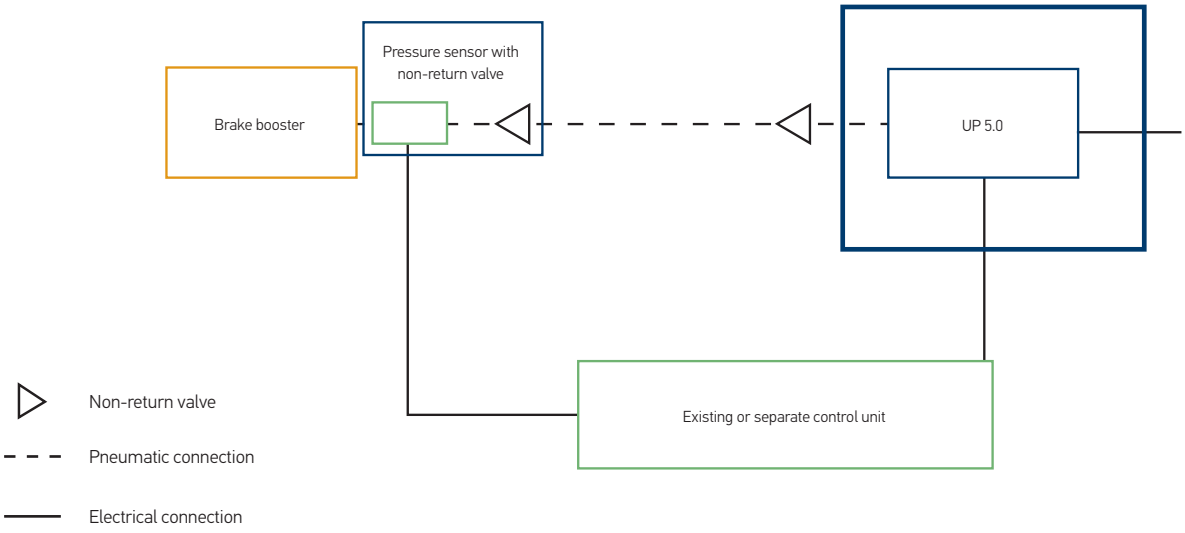
Temperature = RT

COMPARISON OF SUPPORT AND STAND-ALONE APPLICATION
TECHNICAL DETAILS

SUPPORT APPLICATION UP 28



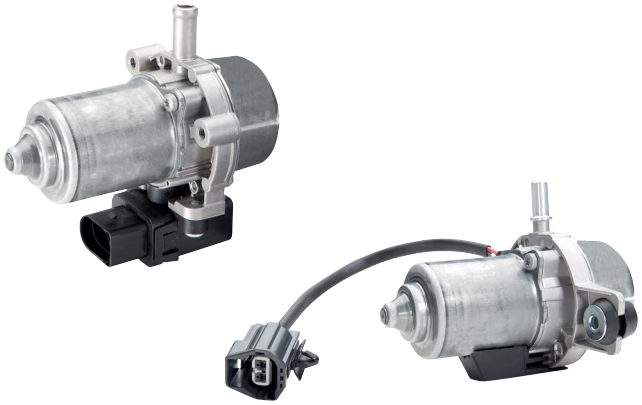
STAND-ALONE APPLICATION UP 5.0



PROGRAM OVERVIEW

Variants	Part number	VPE*	Page
UP 28 - with relay box	**8TG 008 570-021 / -027**	1 / 6	116
UP 28 - with engine compartment connector	**8TG 009 428-081 / -087**	1 / 6	
UP 5.0 – with engine compartment connector	**8TG 012 377-701 / -707**	1 / 10	117
Accessories: pressure sensor with non-return valve	**6PP 233 518-011 / -017**	1 / 72	116 / 117

* Packaging unit



Vacuum pump UP 28

8TG 008 570-021 / -027 (with relay box)

8TG 009 428-081 / -087 (with engine compartment connector)

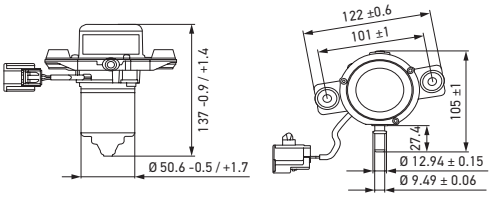
TECHNICAL DATA

- → Rotor and pump chamber eccentrically fixed
- → 5-vane technology
- → **Typical of support applications**

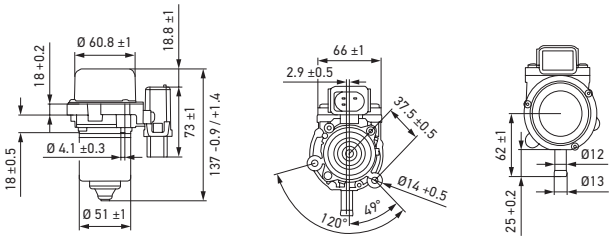
Rated voltage	13.5 V
Average current consumption between the threshold values	< 10 A
Lifetime	600 h
Maximum vacuum	86 % (≥ 88 % typical)
50 % of ambient pressure	≤ 5.5 s
70 % of ambient pressure	≤ 11 s
Booster size	3.2 l
Operating temperature	-40°C to +100°C
Noise level	< 70 db (A)
Protection class	IP 6K9K
Mating connector UP 28 with relay box[1)]	09 4016-30
Mating connector for UP 28 with engine compartment connector[2)]	2.8, 7283-5575-10

[1)] These accessories are not included in the scope of delivery. Available from Kostal.
[2)] These accessories are not included in the scope of delivery. Available from Yazaki.

TECHNICAL DRAWING

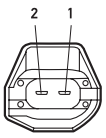


UP 28 - with engine compartment connector



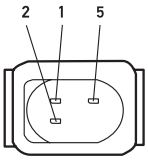
UP 28 – with relay box

PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1: Motor terminal "+"
Pin 2: Motor terminal "-"

UP 28 - with engine compartment connector



Pin 1: Terminal 31 -
Pin 2: Signal, low active (engine control unit)
Pin 5: Terminal 30 +

UP 28 - with relay box

Accessories

Pressure sensor with non-return valve

	Part number	VPE*
This pressure sensor is used for measuring the vacuum. It is suitable for applications such as the monitoring of the brake booster's vacuum circuit. It can be integrated directly into the vacuum line.	**6PP 233 518-011/-017**	1 / 72

* Packaging unit

Vacuum pump UP 5.0
8TG 012 377-701 / -707
(with engine compartment connector)

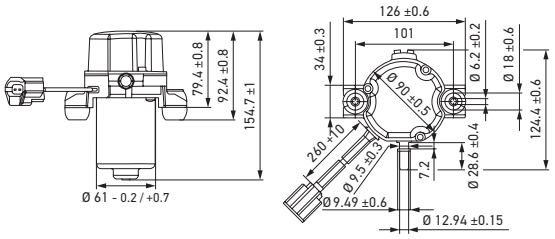
TECHNICAL DATA

- → Rotor with 8 vanes, optimised shape of pump chamber
- → Plastic silencer with specific shape for noise level improvement
- → **Typical of stand-alone applications**

Rated voltage	13 V
Average current consumption between the threshold values	16 A
Lifetime	1,500 h
Maximum vacuum	≥ 90 %
50 % of ambient pressure	≤ 3.0 s
70 % of ambient pressure	≤ 6.0 s
Booster size	5 l
Operating temperature	-40°C to +120°C
Sound pressure level	< 73 db (A)
Protection class	IP 6K9K
Mating connector[1)]	Sealed: 7282-5575-10 With cable seal: 7158-3113-40 With coupling: 7117-4152-02

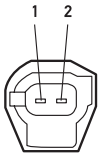
[1)] These accessories are not included in the scope of delivery.
Available from Yazaki.

TECHNICAL DRAWING



UP 5.0 – with engine compartment connector

PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1: Motor terminal "+"
Pin 2: Motor terminal "-"

UP 5.0 – with engine compartment connector

Accessories

Pressure sensor with non-return valve

	Part number	VPE*
This pressure sensor is used for measuring the vacuum. It is suitable for applications such as the monitoring of the brake booster's vacuum circuit. It can be integrated directly into the vacuum line.	**6PP 233 518-011/-017**	1 / 72

* Packaging unit

Washer pumps
for cleaning headlamps and windscreens

PRODUCT FEATURES

- → Flexible installation possibilities thanks to compact design
- → High cleaning performance with minimal water consumption
- → Excellent performance on a running vehicle

APPLICATION

These pumps were developed for two different applications: for windscreen cleaning systems and for front headlamp cleaning systems.

Pumps for windscreen cleaning systems are required for demand-oriented cleaning of windscreens and rear windows. These functions can either be performed by a single outlet pump or by a dual outlet one.
If a dual outlet pump is used, both the windscreen and the rear window are supplied from a single pump with a reversible direction of rotation. The dual outlet pump has an integrated non-return valve that prevents the long tube leading to the rear window from emptying when the pump is switched off.

Headlamp cleaning system pumps require more power than pumps for windscreen washer systems because the headlamps are cleaned with water using the jet-blast principle, i.e. under higher pressure. To connect up to the piping system, a connection is used which enables simple, quick and reliable modification of the tubing configuration.

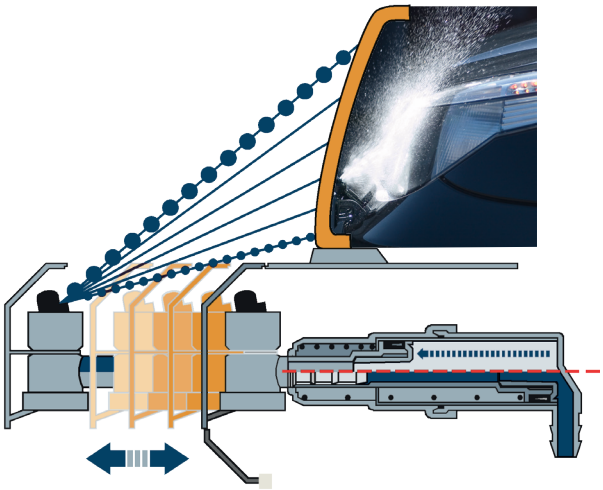
DESIGN AND FUNCTION

Cleaning fluid is sprayed in a cone pattern and under high pressure onto the headlamp cover lens. The cone-shaped drops are formed by means of special whirl chamber nozzles.

The headlamp cleaning system is usually triggered together with the windscreen cleaning system. This means that every time the driver activates the windscreen washers the headlamps are also automatically cleaned at the same time. Such a coupling only takes place when the lights are switched on. When the centrifugal pump is triggered, water is pressed into a cylinder, the piston of which has a nozzle head attached which is then extended against a pressure spring, bringing the nozzles into their working position.

Until the working position is reached, a valve ensures that initially only the movement is carried out without any water for the cleaning escaping from the nozzles. When the working position has been reached, the valve opens and water is sprayed under high pressure onto the headlamps. Once the pump has been switched off, the return spring moves the piston back into its initial position. One washing impulse takes approx. 0.5 s for stationary nozzles and approx. 0.8 s for telescopic nozzles (extra time required for extension).

FUNCTIONAL SKETCH OF THE HEADLAMP CLEANING SYSTEM



The operating principle of telescopic nozzles: the impact of the "micro drops" on the cover lens has the effect of loosening and rinsing off the dirt.

PROGRAM OVERVIEW

Application	Voltage	Protection class	Part number	VPE*	Page
Windscreen	12 V	IP 4	**8TW 004 223-031 / -037**	1 / 60 / 54	120
Windscreen	12 V	IP 4	**8TW 004 223-061**	1	
Windscreen	24 V	IP 4	**8TW 004 223-097**	40	121
Windscreen	12 V	IP 4	**8TW 004 223-107**	60	
Windscreen	12 V	IP 4	**8TW 005 206-011 / -017**	1 / 88	
Windscreen	12 V	IP 4	**8TW 005 206-031**	1	122
Windscreen	12 V	IP 4	**8TW 005 206-051**	1	
Windscreen	12 V	IP 4	**8TW 005 496-011**	1	123
Windscreen	24 V	IP 4	**8TW 005 496-051 / -057**	1 / 60	
Headlamp	12 V	IP 4	**8TW 007 540-141**	1	124
Headlamp	24 V	IP 4	**8TW 010 720-227**	54	

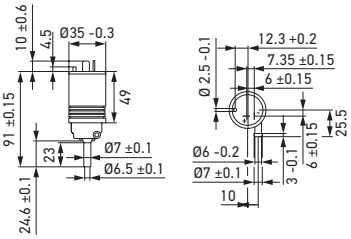
* Packaging unit

Washer pump

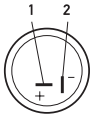
8TW 004 223-031 / -037

TECHNICAL DATA	
Application	Windscreen
Rated voltage	12 V
Pressure and pumping capacity	2 bar, 1 l/ min
Pump type	Mono
Protection class	IP 4
Housing diameter	35 mm
Input diameter	7 mm
Output diameter	6 mm
Contact	Flat connector 6.3 x 0.8 mm
Mating connector	VAG: 1J0 973 722 A

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



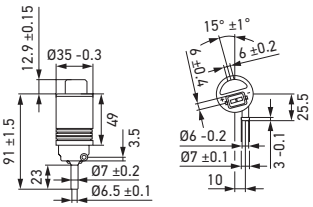
Pin 1: +
Pin 2: -

Washer pump

8TW 004 223-061

TECHNICAL DATA	
Application	Windscreen
Rated voltage	12 V
Pressure and pumping capacity	2 bar, 1 l/ min
Pump type	Mono
Protection class	IP 4
Housing diameter	35 mm
Input diameter	7 mm
Output diameter	6 mm
Contact	Plug connector with 2.8 mm flat connectors
Mating connector	8JD 008 151-021

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION

Pin 1: +
Pin 2: -

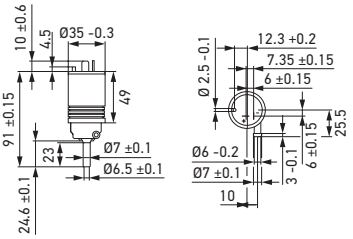
Washer pump

8TW 004 223-097 (12 V)

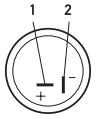
8TW 004 223-107 (24 V)

TECHNICAL DATA	
Application	Windscreen
Rated voltage	12 V (-097) / 24 V (-107)
Pressure and pumping capacity	1.5 bar, 1 l / min
Pump type	Mono
Protection class	IP 4
Housing diameter	35 mm
Input diameter	7 mm
Output diameter	6 mm
Contact	Flat connector 6.3 x 0.8 mm
Mating connector	8JD 008 151-021

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



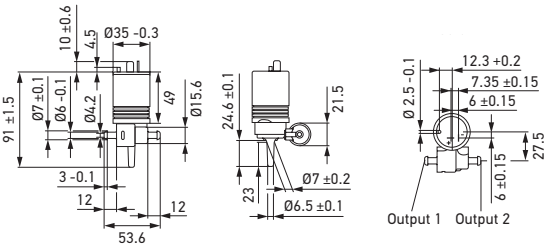
Pin 1: +
Pin 2: -

Washer pump

8TW 005 206-011 / -017

TECHNICAL DATA	
Application	Windscreen
Rated voltage	12 V
Pressure and pumping capacity	2 bar, 1 l / min
Pump type	Dual
Protection class	IP 4
Housing diameter	35 mm
Input diameter	7 mm
Output diameter	6 mm
Contact	Flat connector 6.3 x 0.8 mm
Mating connector	8JD 008 151-021

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION

Output 1

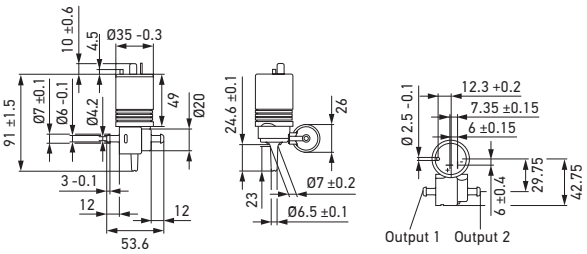
Output 2

Washer pump

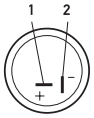
8TW 005 206-031

TECHNICAL DATA	
Application	Windscreen
Rated voltage	12 V
Pressure and pumping capacity	2 bar, 1 l/ min
Pump type	Dual
Protection class	IP 4
Housing diameter	35 mm
Input diameter	7 mm
Output diameter	6 mm
Contact	Flat connector 6.3 x 0.8 mm
Mating connector	8JD 008 151-021

TECHNICAL DRAWING

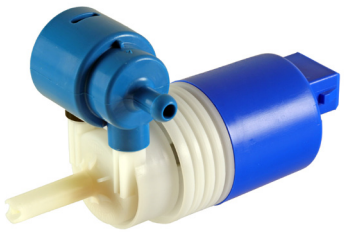


PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1: +
Pin 2: -

Output 1
Output 2

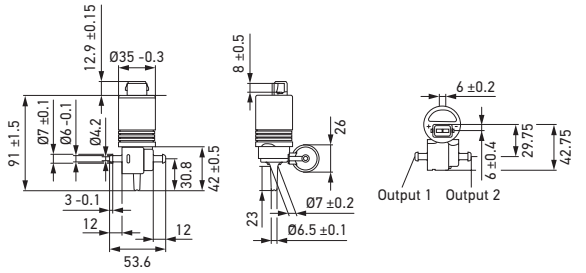


Washer pump

8TW 005 206-051

TECHNICAL DATA	
Application	Windscreen
Rated voltage	12 V
Pressure and pumping capacity	2 bar, 1 l/ min
Pump type	Dual
Protection class	IP 4
Housing diameter	35 mm
Input diameter	7 mm
Output diameter	6 mm
Contact	Plug connector with 2.8 mm flat connectors
Mating connector	AMP 828962

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION

Pin 1: +
Pin 2: -

Output 1:
1 2
1

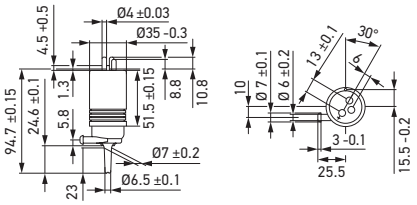
Output 2:
1 2
1

Washer pump

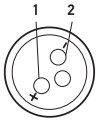
8TW 005 496-011

TECHNICAL DATA	
Application	Windscreen
Rated voltage	12 V
Pressure and pumping capacity	2 bar, 1 l / min
Pump type	Mono
Protection class	IP 4
Housing diameter	35 mm
Input diameter	7 mm
Output diameter	6 mm
Contact	Circular connector 3 x 4 mm
Mating connector	Vehicle-specific

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



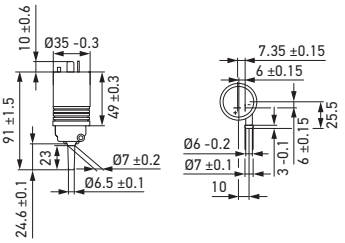
Pin 1: +
Pin 2: -

Washer pump

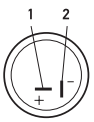
8TW 005 496-051 / -057

TECHNICAL DATA	
Application	Windscreen
Rated voltage	24 V
Pressure and pumping capacity	2 bar, 1 l / min
Pump type	Mono
Protection class	IP 4
Housing diameter	35 mm
Input diameter	7 mm
Output diameter	6 mm
Contact	Flat connector 6.3 x 0.8 mm
Mating connector	8JD 008 151-021

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



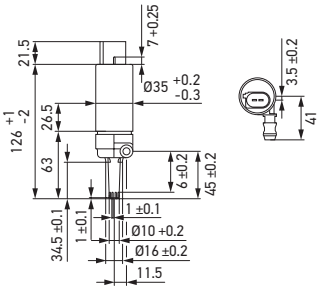
Pin 1: +
Pin 2: -

Washer pump

8TW 007 540-141

TECHNICAL DATA	
Application	Headlamp
Rated voltage	12 V
Pressure and pumping capacity	2.5 bar, 7.2 l / min
Pump type	Mono
Protection class	IP 4
Housing diameter	35 / 46 mm
Input diameter	10.5 mm
Output diameter	11 mm
Contact	Plug connector with 2.8 mm flat connectors
Mating connector	VAG: 1J0 973 722 A

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION

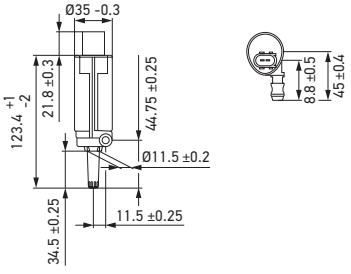
Pin 1: +
Pin 2: -

Washer pump

8TW 010 720-227

TECHNICAL DATA	
Application	Headlamp
Rated voltage	24 V
Pressure and pumping capacity	≤ 5 bar
Pump type	Mono
Protection class	IP 6
Housing diameter	35 mm
Input diameter	10.5 mm
Output diameter	11.5 mm
Contact	Plug connector with 2.8 mm flat connectors
Mating connector	Tyco C14 18483 key D

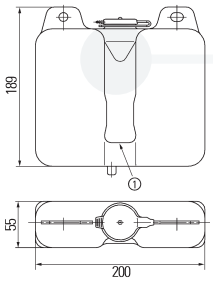
TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION

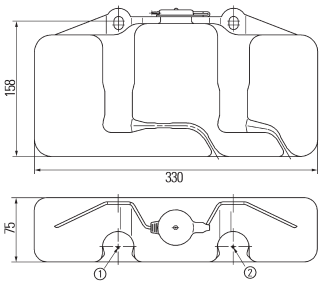
Pin 1: +
Pin 2: -

Water tanks for windscreen and headlamp cleaning systems



PROGRAM OVERVIEW

Water tank	Rated voltage	Volume	Colour	Description	Part number	VPE*
With bracket and pump	12 V	1.5 l	White	Pump holder: Position 1: Ø 35 mm, bore Ø 11 mm	**8WB 003 248-001**	1
					8WB 003 248-007	50



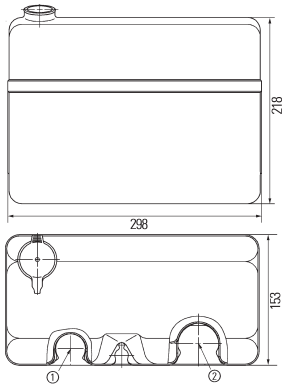
PROGRAM OVERVIEW

Water tank	Rated voltage	Volume	Colour	Description	Part number	VPE*
With a water pump	24 V	3 l	White	Pump holder: Positions 1,2: Ø 35 mm Position 1: Bore Ø 11 mm Position 2: closed	**8WB 003 443-011**[1)]	1
	12 V	3 l	White		**8BW 003 443-067**[2)]	51
With two pumps	12 V	3 l	White	Pump holder: Positions 1,2: Ø 35 mm Position 1: Bore Ø 11 mm Position 2: Bore Ø 11 mm	**8BW 003 443-057**	51

[1)] Without grommet
[2)] Grommet

* Packaging unit

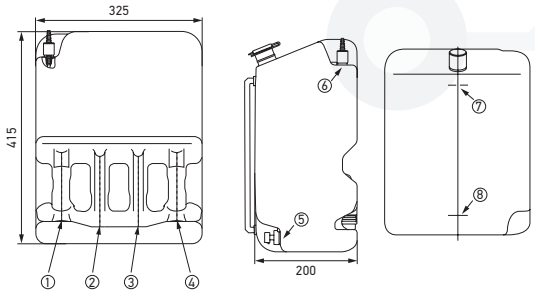
Water tanks for windscreen and headlamp cleaning systems



PROGRAM OVERVIEW

Water tank	Rated voltage	Volume	Colour	Description	Part number	VPE*
With a water pump	24 V	8 l	White	Pump holder Position 1: Ø 35 mm Bore Ø 11 mm Position 2: Ø 46 mm Bore Ø 20 mm, Grommet with plug	**8BW 003 966-067**	28
	24 V	8 l	White	Position 1: Ø 35 mm Position 2: Ø 46 mm Position 1: Bore Ø 11 mm Position 2: Bore Ø 11 mm, with adapter ring	**8BW 504 000-037**	24

* Packaging unit



PROGRAM OVERVIEW

Water tank	Rated voltage	Volume	Colour	Description	Part number	VPE*
With two pumps	24 V	20 l	Black	Pump holder: Positions 1-4: Ø 35 mm Position 1: Closed Position 2: Bore Ø 11 mm Position 3: Bore Ø 11 mm Positions 4 - 6: Closed Positions 7 – 8: Bore Ø 11 mm, Fill level indicator	**8BW 007 757-017**	20
	24 V	20 l	Black	Pump holder: Positions 1 – 4: Ø 35 mm Position 1: Closed Position 2: Bore Ø 11 mm Position 3: Bore Ø 11 mm Positions 4 – 8: Closed	**8BW 007 757-027**	20
	24 V	20 l	Black	Pump holder: Positions 1-4: Ø 35 mm Position 1: Closed Position 2: Bore Ø 11 mm Position 3: Bore Ø 11 mm Position 4: Bore Ø 20 mm, Grommet with plug Positions 5 – 8: Closed	**8BW 007 757-037**	20
	24 V	20 l	Black	Pump holder: Positions 1-4: Ø 35 mm Position 1: Closed Position 2: Bore Ø 11 mm Position 3: Bore Ø 11 mm Position 4: Closed Position 5: Level control switch 6PR 005 345-017 Position 6: Bore Ø 11 mm, One-way valve 9XL 564 781-002 Positions 7 – 8: Bore Ø 11 mm, Fill level indicator	**8BW 007 757-047**	20
With pump and grommet	24 V	20 l	Black	Pump holder: Positions 1-2: Ø 35 mm Position 1: Closed Position 2: 11-mm hole diameter	**8BW 007 757-097**	1
With four pumps	24 V	20 l	Black	Pump holder: Positions 1-4: Ø 35 mm Position 1: Bore Ø 11 mm Position 2: Bore Ø 11 mm Position 3: Bore Ø 11 mm Position 4: Bore Ø 20 mm	**8BW 007 757-117**	1

* Packaging unit

Rocker switches
A choice of 3 different series

PRODUCT FEATURES

Rocker switch:
- → Modular structure covering individual applications right up to complete vehicle equipment
- → Multifaceted applications
- → High degree of coverage as regards standard functions
- → Clear allocation of switch functions, even under extreme conditions
- → Timeless design
- → High abrasion resistance of lasered symbols
- → Replacement and retrofitting via standardised mounting hole and mounting frame

APPLICATION
The HELLA rocker switch range, which boasts three series, offers the right configuration for every application thanks to its wide range of functions and countless symbols.

The 4570 / 7832 series: Basic range of simple electrical systems, tried and tested and proven its worth for more than 20 years The snap-in symbol discs are available in accordance with DIN or in the customer's choice of colours. The symbols are lit by bulbs or LEDs, which can be ordered as accessories. Replacement and retrofitting are possible by means of standardised mounting holes and mounting frames.

The 3100 series - for robust and waterproof applications: It meets the requirements of protection class IP 68 (dustproof and waterproof). The series is ideal for use in agricultural and construction vehicles because of its high degree of reliability under extreme conditions. And an added bonus: it is simple to install either directly in the mounting hole or using a modular mounting frame. Choose from a wide variety of standard and customer-specific symbols. These abrasion-resistant, lasered symbols are illuminated by integrated LEDs.

The 4100 series - for interior applications and safe switching of low currents: The rocker switch series with self-cleaning micro switch is suitable for modern electrical and electronic systems. This ensures reliable switching even of small currents without contamination of the contacts occurring. The series stands out from the crowd with its timeless design. Its abrasion-resistant, lasered symbols are illuminated by integrated LEDs. A wide range of standard and customer-specific symbols is also on offer for this series.

DESIGN AND FUNCTION
The switches are modular and can be individually configured to suit customer requirements - starting with a single application right through to complete vehicle equipment. The following models are available: on/off switch (0-I), changeover switch (0-I-II, I-0-II), warning light switch, locking switch.

In addition to a large selection of switches and functions, we offer individualised and abrasion-resistant laser marking in addition to the standard characters. Customers can select their own personalised symbols themselves. And always all inclusive: the high-class HELLA quality.

Safe switching is guaranteed even under difficult conditions. This is ensured by means of precise feedback, unambiguous symbols and the integrated orientation and functional lighting. A disable mode is also available as an option.

The rocker switches are mounted as snap-on fixtures on a pre-determined installation opening either directly or by means of an installation frame. In addition to individual frames, modular intermediate and end pieces that can be combined together are available, which means that switch rows can be created. Matching mating connectors, warning lamps and dismantling tools complete the range of accessories available.

PROGRAM OVERVIEW

The HELLA switch configurator
Configure your custom switches at
www.hella.com/switch.

Select switching functions, symbol combinations and all the right accessories in just a few clicks.

Switch series 4570 / 7832

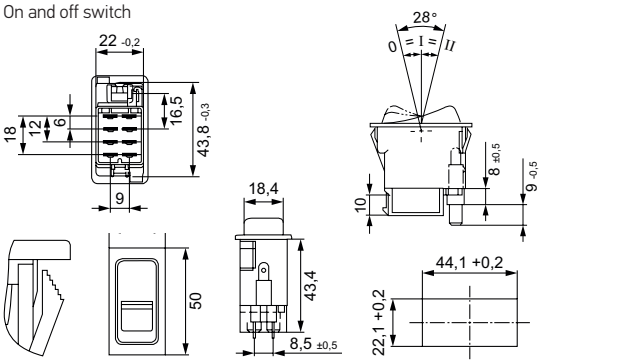
Basic range for simple electrical systems with snap-on symbol buttons

TECHNICAL DATA

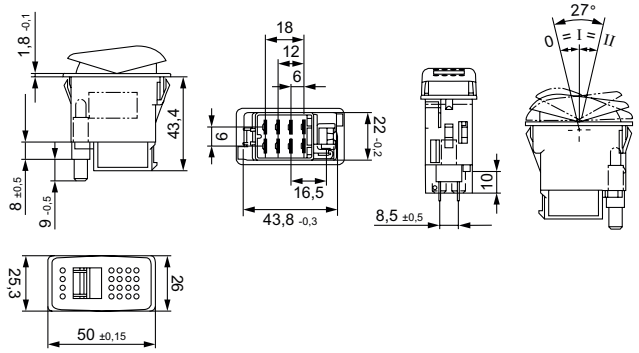
Mounting hole, without installation frame	44.1 x 22.1 mm
Mounting hole, with installation frame	51.3 x 48.1 mm (for two units)
Dashboard thickness for direct installation	1 to 2.5 mm
Dashboard thickness with installation frame	1 to 2.5 mm
Switch functions	Normally open contact, changeover contact, combination switch, normally open contact with lock, changeover contact with lock, hazard warning light, warning lamp
Switch principle	Bridge switch
Operation	Pushbutton, toggle
Circuits	max. 2
Switching steps	0-1, 0-1-2, 1-0-2
Protection class	IP 5
Rated switching current, resistive load, 12 V	16 A
Rated switching current, resistive load, 24 V	8 A
Electrical lifetime, resistive load, 12 V	20,000, 16 A
Electrical lifetime, resistive load, 24 V	20,000, 8 A
Mechanical lifetime	250,000
Flat connector	6.3 x 0.8 mm
Operating temperature	-35°C to +65°C
Housing material	PA6
Rocker switch material	PA6
Function check	Yes, partly
Orientation lighting	Yes
Light source	LED / bulb
Type of symbols	Symbol button, coloured
Configurable online?	No
Part numbers	
12 V	**On request**
24 V	**On request**

TECHNICAL DRAWING

On and off switch



Switch



ACCESSORIES	PART NUMBER	VPE*
Warning lamps		
For switch series 007 832 with 12 V bulb	**2AA 713 628-021**	10
For switch series 007 832 with 24 V bulb	**2AA 713 628-031**	10
For switch series 007 832 with LED, 12 V and 24 V	**2AA 713 628-041**	10
For switch series 004 570 with 12 V bulb	**2AA 713 628-001**	10
For switch series 004 570 with 24 V bulb	**2AA 713 628-011**	10
For switch series 004 570 with LED, 12 V and 24 V	**2AA 713 628-051**	10
Spare parts: W5 / 1.2 bulb, 12 V 1.2 W	**8GP 002 095-121**	10
Spare parts: W5 / 1.2 bulb, 24 V 1.2 W	**8GP 002 095-241**	10

* Packaging unit

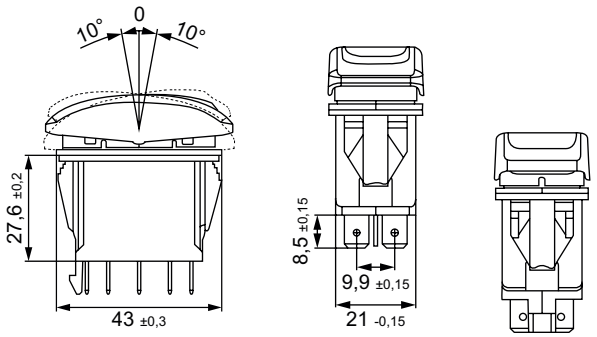
Switch series 3100

Modular switches for robust and waterproof applications

TECHNICAL DATA	
Mounting hole, without installation frame	37.0 x 21.1 mm
Mounting hole, with installation frame	51.3 x 48.3 mm (for two units)
Dashboard thickness for direct installation	1.6 to 6.3 mm
Dashboard thickness with installation frame	2.5 to 6.5 mm
Switch functions	Normally open contact, changeover contact, Normally open contact with lock, Changeover contact with lock, Hazard warning light, warning lamp
Switch principle	Bridge switch
Operation	Pushbutton, toggle
Circuits	max. 2
Switching steps	0-1, 0-2, 0-1-2, 1-0-2
Protection class	IP 68, connector side: IP 66
Rated switching current, resistive load, 12 V	20 A
Rated switching current, resistive load, 24 V	15 A
Electrical lifetime, resistive load, 12 V	50,000, 20 A
Electrical lifetime, resistive load, 24 V	50,000, 15 A
Mechanical lifetime	150,000
Flat connector	6.3 x 0.8 mm
Operating temperature	-40°C to +85°C
Housing material	PBT
Rocker switch material	PC transparent, painted
Function check	Yes, partly
Orientation lighting	Yes
Light source	LED
Type of symbols	Laser
Configurable online?	Yes

Part numbers	
12 V	Our switch configurator can be found at: **www.hella.com/switch**
24 V	

TECHNICAL DRAWING

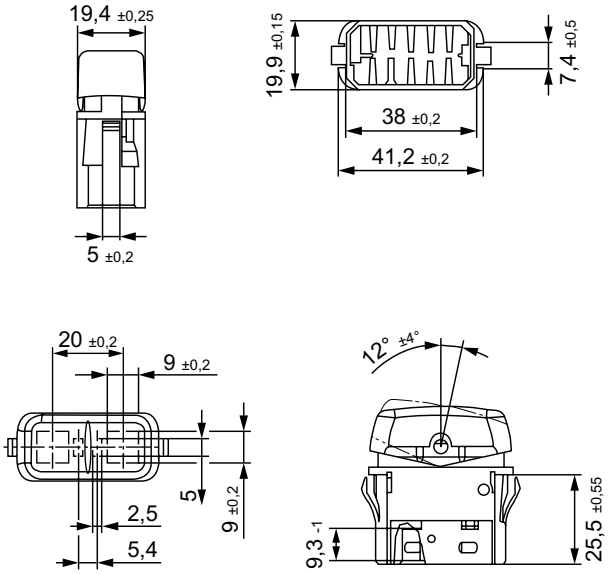


Switch series 4100

Rocker switch for interior applications and safe switching of low currents

TECHNICAL DATA	
Mounting hole, without installation frame	41.8 x 19.8 mm
Mounting hole, with installation frame	44.1 x 22.1 mm per unit
Dashboard thickness for direct installation	2 (+ / - 0.3) mm
Dashboard thickness with installation frame	3 to 4 mm
Switch functions	Normally open contact, changeover contact, changeover contact with lock, hazard warning light, warning lamp
Switch principle	Micro switch with self-cleaning contacts
Operation	Pushbutton, toggle
Circuits	max. 2
Switching steps	0-1, 0-1-2, 1-0-2
Protection class	IP 52
Rated switching current, resistive load, 12 V	10 A
Rated switching current, resistive load, 24 V	10 A
Electrical lifetime, resistive load, 12 V	50,000, 10 A
Electrical lifetime, resistive load, 24 V	50,000, 10 A
Mechanical lifetime	450,000
Flat connector	2.8 x 0.8 mm
Operating temperature	-40°C to +85°C
Housing material	PA
Rocker switch material	PC transparent, painted
Function check	Yes, partly
Orientation lighting	Yes
Light source	LED
Type of symbols	Laser
Configurable online?	Yes
Part numbers	
12 V	Our switch configurator can be found at: **www.hella.com/switch**
24 V	

TECHNICAL DRAWING



Accessories

	4570- / 7832-	VPE*	3100-	VPE*	4100-	VPE*
Installation strips/frames						
Installation strip for 6 switches	**8HG 713 626-001**	12	–	–	–	–
Installation strip for 3 switches	**8HG 714 504-001**	24	–	–	–	–
Installation frame plug-in system						
Single frame	–	–	–	–	**9AR 168 396-002**	10
Single frame	–	–	–	–	**9AR 168 396-007**	200
End piece, left	**8HG 716 734-001**	10	**9AR 169 209-102**	10	**9AR 169 209-002**	10
End piece, left	**8HG 716 734-007**	200	**9AR 169 209-107**	100	**9AR 169 209-007**	100
Intermediate piece	**8HG 716 735-001**	1	**9AR 169 208-102**	10	**9AR 169 208-002**	10
Intermediate piece	**8HG 716 735-007**	200	**9AR 169 208-107**	200	**9AR 169 208-007**	200
End piece, right	**8HG 716 734-001**	10	**9AR 169 209-102**	10	**9AR 169 210-002**	10
End piece, right	**8HG 716 734-007**	200	**9AR 169 209-107**	100	**9AR 169 210-007**	200
Cover plate	**9HB 713 629-001**	10	**9HB 172 229-101**	10	**9HB 172 229-002**	10
Cover plate	–	–	**9HB 172 229-107**	10	**9HB 172 229-007**	52
Female connector housing						
Female connector housing, type 1	**8JA 713 631-001**	10	**8JD 010 076-102**	10	**8JD 010 076-002**	10
Female connector housing, type 1	**8JA 713 631-007**	1000	**8JD 010 076-107**	50	**8JD 010 076-007**	440
Female connector housing, type 2	–	–	**8JD 010 076-112**	10	–	–
Female connector housing, type 2	–	–	**8JD 010 076-117**	50	–	–
Female connector housing, type 3	–	–	**8JD 010 076-122**	10	–	–
Female connector housing, type 3	–	–	**8JD 010 076-127**	50	–	–
Female connector housing, bulb holder	**8JA 715 600-001**	10	–	–	–	–
Dismantling tool	–	–	**8PE 197 631-001**	1	–	–
Flat receptacle/junior power timer						
Flat receptacle CuSn / Sn, Cross section: 0.5 – 1.0 mm²	–	–	**8KW 744 882-003**	100	**8KW 863 934-003**	50
Flat receptacle CuSn / Sn, Cross section: 1.0 – 2.5 mm²	–	–	**8KW 744 825-003**	100	**8KW 863 934-023**	50
Flat receptacle CuSn / Sn, Cross section: 1.0 – 2.5 mm²	–	–	–	–	**8KW 863 934-003**	1000
Bulb holders						
Bulb holders for warning lamps with 12 V bulb	**9FF 713 627-001**	10	–	–	–	–
Bulb holders for warning lamps with 24 V bulb	**9FF 713 627-011**	10	–	–	–	–
Spare parts: W5 / 1.2 bulb, 12 V 1.2 W	**8GP 002 095-121**	10	–	–	–	–
Spare parts: W5 / 1.2 bulb, 24 V 1.2 W	**8GP 002 095-241**	10	–	–	–	–
Bulb holders with LED, 12 V and 24 V	**9FF 713 627-031**	10	–	–	–	–

* Packaging unit

Remote control systems
Switching on and off and/or opening and locking

PRODUCT FEATURES

Electronic remote key:
- → Unlocking cab doors / flaps
- → Controlling lamps / work lamps
- → Activating/deactivating an electronic immobiliser via transponder
- → Robust design

APPLICATION

The remote control system has been specifically developed for use in tough operating conditions (agricultural and construction vehicles, lorries).
The system enables the driver of the vehicle to comfortably and conveniently unlock the cab door. The remote control can be equipped with one or two buttons, depending on customer requirements. The robust design has been specially developed for use in agricultural and construction vehicles. An additional control unit, which sends up to four output signals, also enables the controlling of lamps, e.g. work lamps or beacons. HELLA's remote control system can easily be used to activate direction indicator lights and for opening or locking covers and flaps to engine compartments and toolboxes, for example. The design can be individualised on request, such as by incorporating customised logos.

DESIGN AND FUNCTION

In terms of its electrical function, the remote control transmitter consists of two units: the remote control transmitter - electronics and the transponder. The transponder responsible for the immobiliser function is independent of the remote control transmitter electronics and can be customised.

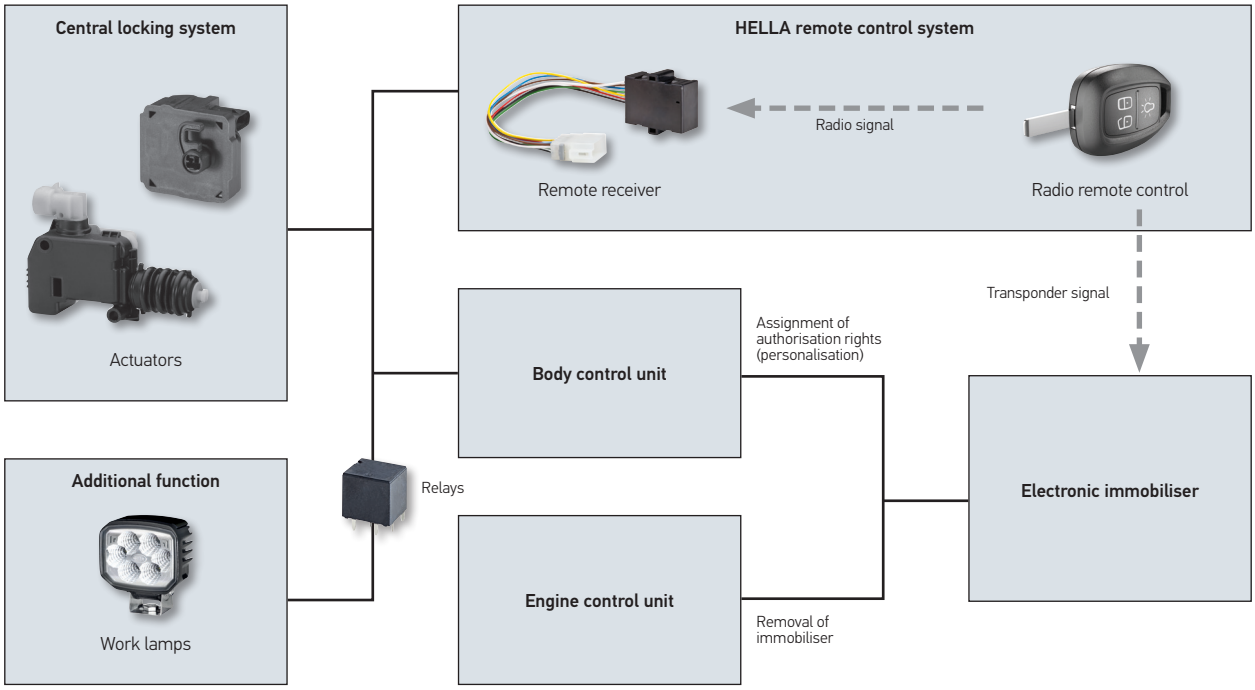
The remote control transmitter electronics are mounted on a printed circuit board populated on two sides In addition to the actual remote control transmitter electronics, the printed circuit board also contains the "Lock/Unlock" button and, depending on the variant, another button again (operating an additional function). Spring contact elements are used to provide the electrical connection between the printed circuit board and the battery. When a button is pressed, the radio remote control sends data packages with a rolling code in an updated 128 bit encryption. If the receiver control unit of the radio remote control positively decrypts the data, this then activates the output signals of the control unit.

The remote control system can be used without restrictions in all European countries, in North America (USA + Canada) and also in India. System radio approvals outside Europe can be carried out in consultation with HELLA.

The radio remote control is equipped with a holder for a key bit. This key bit is not included in the scope of delivery for the radio transmitter electronics.
The key bit is usually mounted (by using a special mounting device) either at the customer's premises or at those of the key bit manufacturer.

Two remote keys are programmed or "taught" and assigned to the device when the remote receiver is produced. Programming additional remote keys requires at least one functioning, already "taught" or programmed key to be available. For radio remote controls with two buttons, a maximum of 7 remote keys can be programmed. If the maximum number of remote keys has already been programmed, the last key position is overwritten when programming an additional key. If the radio remote control only has one button, no other keys can be subsequently programmed.

FUNCTIONAL DIAGRAM



PROGRAM OVERVIEW

There are two variants of the receiver control unit available: the basic variant and the enhanced variant. Customer-specific output signal characteristics are available upon request. If a customer-specific logo or emblem is to be included, a new part number is created for this. Each device variant includes two dummy plugs made from hard plastic. This also enables the remote control transmitters to be operated without a key bit.

Variants	Part number	VPE*	Page
2 remote control transmitters and receiver, enhanced variant	**5FA 012 485-817**	1	136 – 137
Spare key for **5FA 012 485-817**	**5FA 012 485-201**	1	
2 remote control transmitters with light symbol button and receiver, enhanced variant	**On request**	–	–

Further variants and configurations available on request.

* Packaging unit

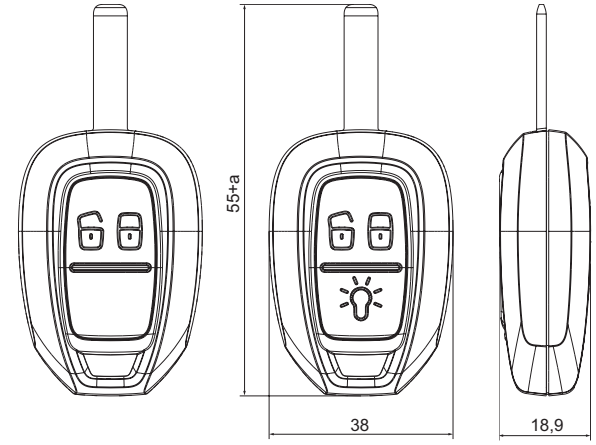
Remote control systems
Switching on and off and/or opening and locking
Basic variant on request
Enhanced variant 5FA 012 485-817
Spare key 5FA 012 485-201

TECHNICAL DATA FOR REMOTE CONTROL TRANSMITTER

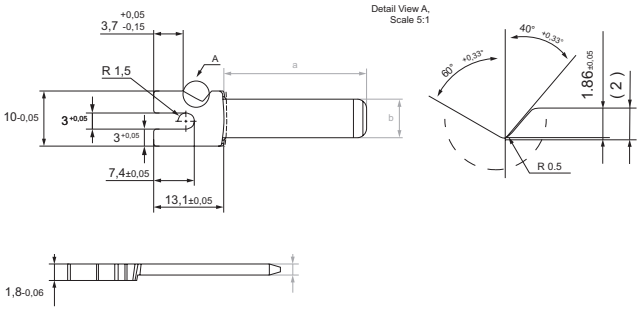
Key bit - joining force	max. 350 N
Key bit - pull-out force	> 180 N
Torque around key shaft axis	3 Nm
Torque around key width axis	4 Nm
Separation of housing parts, joining/ separating force	110 N (in new condition)
Housing cover	PA66+PA6I / X-GF50 and TPU
Housing base	PA6-GF30
Contact Elements	X10CrNi 18-8
Customer logo/emblem	PU logo/emblem, customer-specific
Keypad	Hytrel, black
Transmission frequency	434.42 MHz
Transmission power	30 µW ERP
Battery type[1)]	CR2032
Battery lifetime	100,000 clicks (approx. 3 years of use)
Max. range[2)]	119 m
Min. range[2)]	51 m
Average range[2)]	70.5 m
Operating temperature	-20°C to +60°C
Storage temperature	-20°C to +60°C
Protection class	IP 6K7 and IP X5

[1)] A battery comes with the remote control transmitter.
[2)] Ranges are dependent on installation location and interference factors. The values specified are merely an example and must be verified for each new application.

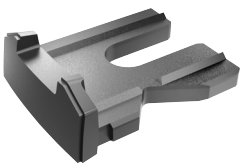
TECHNICAL DRAWING

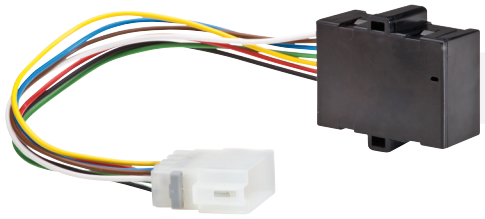


Interface to key bit (Dimensions a, b and c are customer-specific)



Dummy plug





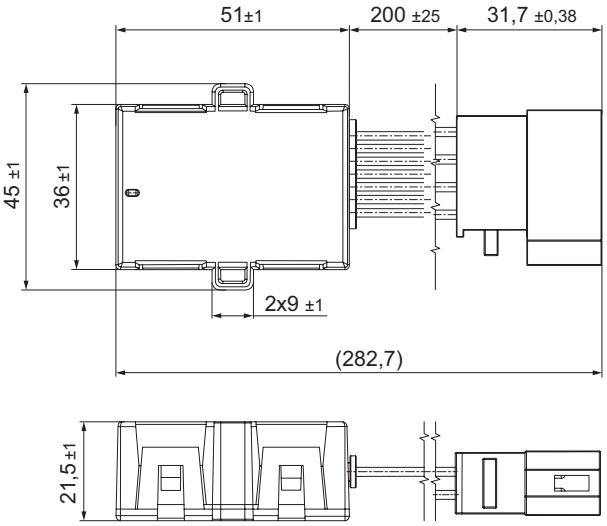
Receiver control unit

TECHNICAL DATA FOR REMOTE RECEIVER	
Operating voltage	6 – 32 V
Power consumption	11 mA (signal output not activated)
No-load/idling current	< 2 mA
Minimum voltage	6 V
Max. voltage	58 V for a period of 250 ms
Rated voltage	12 / 24 V
Test voltage	27.6 ± 0.4 V
Overvoltage	36 V (at 40°C, 1 hour)
Housing cover	PC recycled material
Housing base	PC recycled material
Connector housing	PBT-GF20, V0
Operating temperature	-40°C to +80°C
Storage temperature	-40°C to +90°C
Protection class	IP 5K0
Length	51 mm
Width	45 mm
Height	21.5 mm
Mating connector[1)]	17848 000 000

[1)] These accessories are not included in the scope of delivery. Available from Lear.

TECHNICAL DRAWING

Receiver control unit



BASIC VARIANT

Pin configuration	Function	Description
1 V+	Input	Power supply (+ 12 / 24 V)
2 GND	Input	Power supply (ground)
3 Door control	Output	Low active (< 300 mA), signal duration 3.5 s when button 1 is pressed
4		Not documented
5 Reserve	Output	High active (< 300 mA), signal duration 0.5 s when button 2 is pressed
6		Not documented
7		Not documented
8		Not documented

EXTENDED/ENHANCED VARIANT

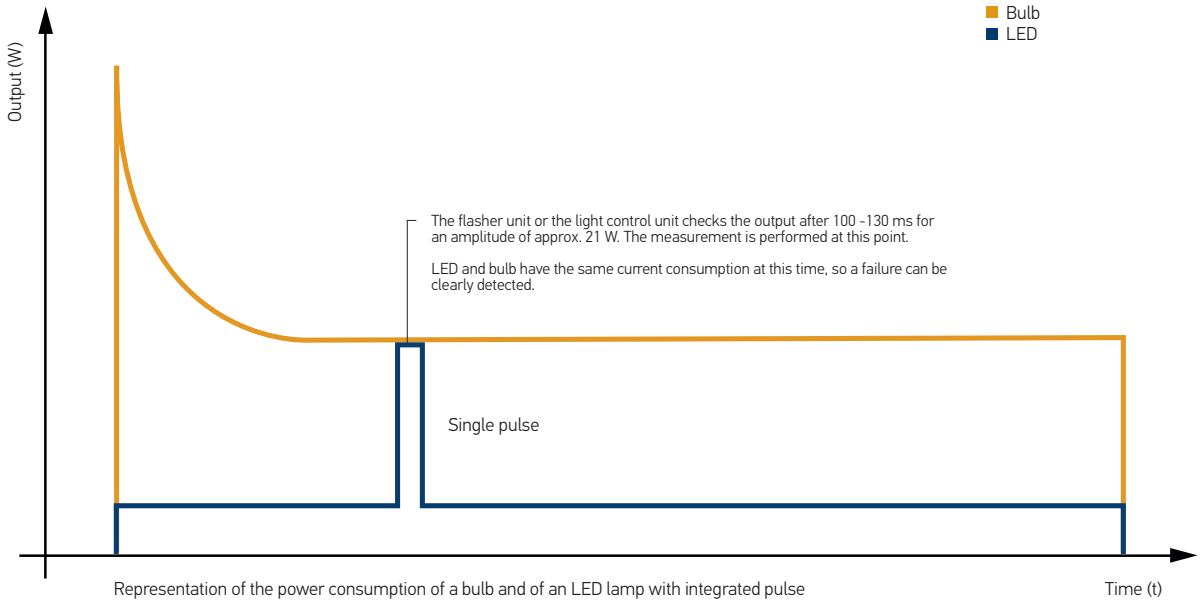
Pin configuration	Function	Description
1 V+	Input	Power supply (+ 12 / 24 V)
2 GND	Input	Power supply (ground)
3 Mode	Input signal	Mode = low or mode = high (high at 70 % of the vehicle electrical system voltage)
4		Not documented
5 Door 1	Output	High active (< 300 mA) when pressing button 1 mode = low: signal duration 3 s, mode = high: signal duration 0.5 s
6 Door 2	Output	High active (< 300 mA) when pressing button 2 mode = low: signal duration 3 s, mode = high: signal duration 0.5 s
7 Wake-up function	Output	High active (< 300 mA), signal duration 3.5 s
8 Reserve	Output	High active (< 300 mA), signal duration 3 s when button 2 is pressed

LED lighting:
Failure control and electrical connection

In the ECE R48 area of application, it is necessary by law to ensure failure control of LED lamps / LED headlamps in the vehicle's electrical system by means of suitable measures. The driver must be made aware of the failure visually or acoustically in the vehicle.

HELLA recommends, as the best solution, detecting the electrical pulse directly in the car manufacturer's vehicle electrical system. It is merely necessary to integrate the check according to ISO 13207-1. This means that you no longer have to rely on interim solutions and use direction indicator control units.

FUNCTIONAL DIAGRAM



Representation of the power consumption of a bulb and of an LED lamp with integrated pulse

All HELLA LED direction indicators with integrated electronics for failure control run checks on themselves and generate a single pulse. This pulse is evaluated by the electronic ballasts. The ballasts simulate a 21 W bulb. This makes operation with conventional flasher units possible.

In the event of a defect in the lamp, which can occur even if a single LED fails, the above-mentioned impulse is not generated. The ballasts switch off the bulb simulation and the flasher unit reports the defect to the driver. By measuring the lamp current during the time window of 10 ms, a direct comparison between the HELLA LED lamp and a bulb version is possible.

If the vehicle manufacturer does not provide direction indicator failure control via the vehicle electrical system, HELLA offers the following solutions:

HELLA provides electronic ballasts which make it possible to display and warn of direction indicator failure for various vehicle assemblies and modifications.

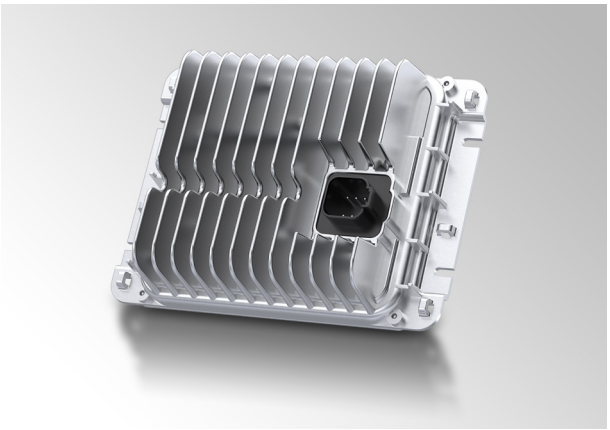
This is necessary if the vehicle manufacturer does not guarantee direction indicator failure control via the vehicle's electrical system.

ISO 13207-compliant LED lamps and LED flasher units
LED flasher unit: towing vehicle

» Page 142 – 143

Simulation devices for cold check in switched-off state
Simulation device for cold check

» Page 146



LED lamp control units for function monitoring
LED lamp control unit

» Page 147

The right solution for your vehicle electronics

ISO 13207-1 SOLUTION

RETROFITTING/ EQUIPING THE VEHICLE

Start

Is a direction indicator relay installed in the vehicle? **Yes**

No Switch on vehicle ignition and remove the bulb of a direction indicator without pressing the direction indicator switch.

A flasher unit failure is shown. **Yes**

No Press the direction indicator switch

A flasher unit failure is shown. **Yes**

No Vehicle not ECE-compliant

RETROFITTING/EQUIPPING TRAILERS

Solution 1:
Light control unit with integrated check of the failure pulse in accordance with ISO 13207-1

Vehicle manufacturers' light control units are able to check the failure pulse in a standardised and unified manner in accordance with ISO 13207-1.

Therefore interim solutions 1 - 3 will not be necessary since communication takes place directly with the direction indicators. HELLA recommends this solution.

(Since trailers do not currently have their own vehicle electrical system, this solution must be integrated in the towing vehicle.)

Solution 2:
LED flasher unit

	12 V	12 V	24 V
Operating voltage	10 – 15 V	10.5 – 16 V	32 V
Operating temperature	-40 to +85°C	-40 to +85°C	-40 to +85°C
Protection class	IP 53 (contacts underneath)	IP 53 (contacts underneath)	IP 53 (contacts underneath)
LED flasher unit	**3+1**	**–**	**3+1**
3 direction indicators on the vehicle / towing vehicle 1 direction indicator on an optional trailer	**4DW 009 492-111**	**–**	**4DW 009 492-011**
LED flasher unit	**2+1+1**	**2+1**	
2 direction indicators on the vehicle / towing vehicle 1 direction indicator on optional trailers	**4DN 009 492-101** 1 direction indicator on a max. of 2 optional trailers	**4DM 009 492-001**	

Solution 1:
By means of monitoring in compliance with ISO 13207-1 in the vehicle manufacturer's vehicle electrical system.

Light control unit already integrated in the vehicle by the manufacturer.

Solution 2:
Replacement of the existing flasher unit by an LED flasher unit from HELLA with ISO pulse.

One flasher unit is required per vehicle. Any possible combination of bulbs and HELLA LED direction indicators is permitted: from a full package with bulbs through mixed variants right up to a full package with LED lights. Bulbs or HELLA LED direction indicators are also permitted on trailers.

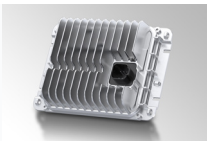
Solution 3:
Using simulation device for cold check.

One simulation device is required per LED lamp.

Solution 4:
Using LED lamp control unit from HELLA with ISO pulse.

Two LED direction indicators per vehicle can be monitored with one simulation device (only one simulation device can be used per vehicle).

Solution 4:
Using LED lamp control unit from HELLA with ISO pulse.



Failure control

2BA 013 334-021

2BA 011 172-031

2SD 013 155-001

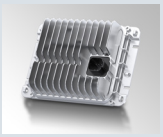
2VP 340 960-011

2VD 012 381-...

2SD 013 342-121

Solution 3:
Simulation device for cold check

	12 V	24 V
Operating voltage	10 – 15 V	18 – 32 V
Rated current	1.5 A	1.5 A
Operating temperature	-40 to +85°C	-40 to +85°C
Protection class	IP 54 (contacts underneath)	IP 54 (contacts underneath)
Simulation device		
for cold check	**5DS 009 602-011**	**5DS 009 602-001**



Solution 4:
LED lamp control unit
Universal trailer solution, truck-independent, hazard warning signal mode must be taken into consideration separately

	Basic / Premium
Operating temperature	-40 to +50°C
Protection class	IP 6K9K
Basic control unit	
12 V	**5DS 227 488-001***
24 V	**5DS 227 488-101***
Premium control unit	
12 V (1 stop light channel)	**5DS 227 489-001***
12 V (2 stop light channel)	**5DS 227 489-011***
24 V (1 stop light channel)	**5DS 227 489-101***

* The LED control unit does not generate a load supplement in the event of a hazard warning light flashing. This must also be taken into account.

Solution 2: LED flasher unit - towing vehicle

Failure control and electrical connection

LED direction indicators conforming to ISO 13207 can "communicate" with the flasher unit. The flasher unit checks for a defined energy requirement at a defined point in time: exactly 21 W for 100-130 ms after each activation of the direction indicator. The energy requirement or "pulse" corresponds to that of a bulb in this case, meaning that the flasher unit notices no difference between a bulb and an LED lamp that conforms to ISO 13207.

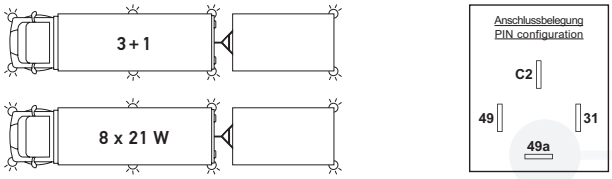
The advantage is that bulbs and ISO LED lamps can be operated in any combination on a flasher unit that conforms to ISO 13207. This is relevant both for vehicles that are frequently operated with different trailers and also for manufacturers who wish to offer several variants of the lighting system without having to modify the underlying electronics.

Control function: The failure of a direction indicator in a motor vehicle or trailer has to be indicated to the driver either acoustically or by means of indicator lamps. HELLA flasher units ensure such control by means of the following:

1. Doubling of the flashing frequency (e-controller) or
2. Control lamp switch-off system (p-control).

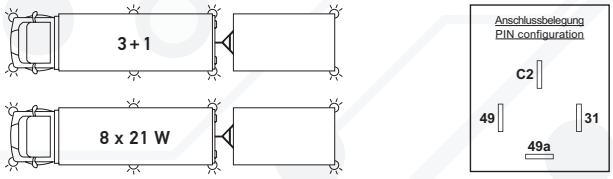
Technical data – 12 V		
Rated voltage	12 V	
Operating voltage	10.5 – 15 V	
Rated load	4DN 009 492-101 4DN 008 768-161	2+1+1 x 21 W (84 W)
	4DW 009 492-111	3+1 x 21 W (84 W)
Failure control	EP / EPP	
Flashing frequency	75 – 110 Hz	
Bright-light time	40 – 60 %	
Protection class	IP 54	
Operating temperature	-40°C to +85°C	
Storage temperature	-40°C to +85°C	
Contact	Flat connector DIN 46244 A6: 6.3 x 0.8 mm	

Technical data – 24 V		
Rated voltage	24 V	
Operating voltage	18 – 32 V	
Rated load	4DM 009 492-001	2+1 x 21 W (63 W)
	4DW 009 492-011	3+1 x 21 W (84 W)
Failure control	EP	
Flashing frequency	70 – 110 Hz	
Bright-light time	40 – 60 %	
Protection class	IP 54	
Operating temperature	-40°C to +85°C	
Storage temperature	-40°C to +85°C	
Contact	Flat connector DIN 46244 A6: 6.3 x 0.8 mm	



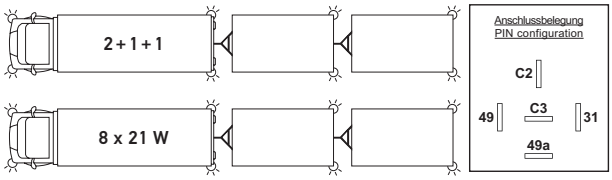
12 V, LED flasher unit 3+1		
EP-control		
Lamp failure control C: tractor, high frequency		
Lamp failure control C2: 1st trailer C2 lamp off		
Load	**C2**	**Frequency (49a)**
1 x 21 W	Off	F2
2 x 21 W	Off	F2
3 x 21 W	Off	F1
(3+1) x 21 W	F1	F1

4DW 009 492-111



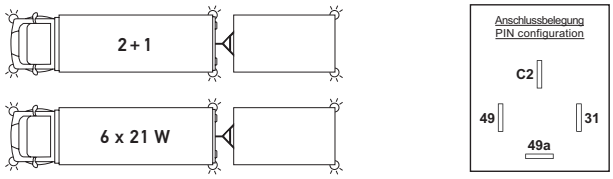
24 V, LED flasher unit 3+1		
EP-control		
Lamp failure control C: tractor, high frequency		
Lamp failure control C2: 1st trailer C2 lamp off		
Load	**C2**	**Frequency (49a)**
1 x 21 W	Off	F2
2 x 21 W	Off	F2
3 x 21 W	Off	F1
(3+1) x 21 W	F1	F1

4DW 009 492-011



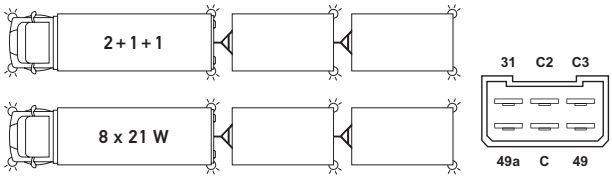
12 V, LED flasher unit 2+1+1			
EP-control			
Lamp failure control C: tractor, high frequency			
Lamp failure control C2: 1st trailer C2 lamp off			
Lamp failure control C3: 2nd trailer C3 lamp off			
Load	**C2**	**C3**	**Frequency (49a)**
1 x 21 W	Off	Off	F2
2 x 21 W	Off	Off	F1
(2+1) x 21 W	F1	Off	F1
(2+1+1) x 21 W	F1	F1	F1

4DN 009 492-101



24 V, LED flasher unit 2+1		
EP-control		
Lamp failure control C: tractor, high frequency		
Lamp failure control C2: 1st trailer C2 lamp off		
Load	**C2**	**Frequency (49a)**
1 x 21 W	Off	F2
2 x 21 W	Off	F1
(2+1) x 21 W	F1	F1

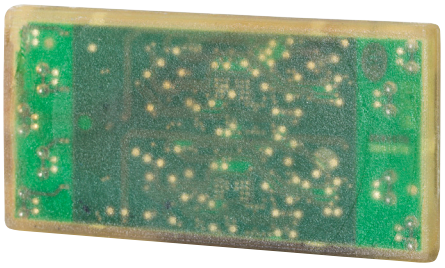
4DM 009 492-001



12 V, LED flasher unit 2+1+1				
EPP-control				
Lamp failure control C: tractor, high frequency				
Lamp failure control C2: 1st trailer C2 lamp off				
Lamp failure control C3: 2nd trailer C3 lamp off				
Load	**C**	**C2**	**C3**	**Frequency (49a)**
1 x 21 W	F2	Off	Off	F2
2 x 21 W	F1	Off	Off	F1
(2+1) x 21 W	F1	F1	Off	F1
(2+1+1) x 21 W	F1	F1	F1	F1

4DN 008 768-161

Key
F1: normal flashing frequency, F2: increased flashing frequency



Control unit for side marker lamps

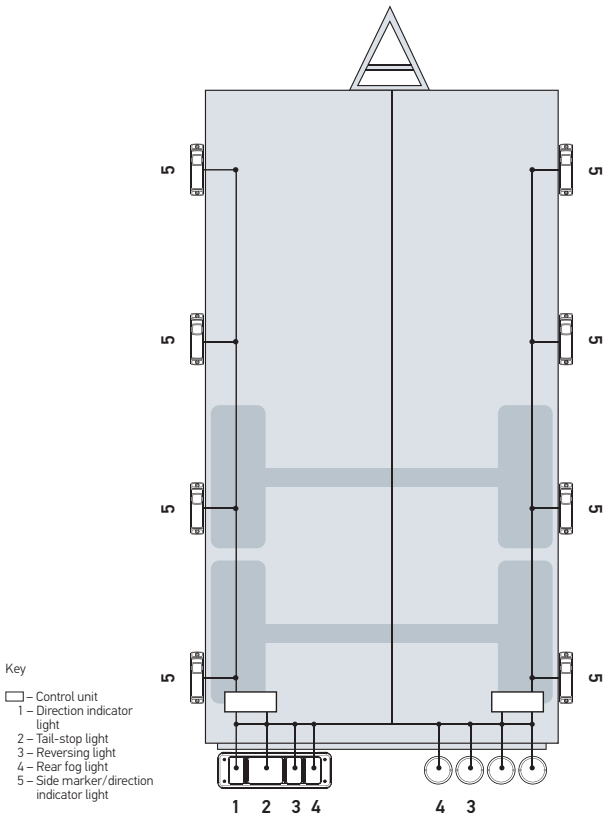
Optional for towing vehicle with trailer, in connection with the operating of an LED flasher unit

In order to increase the safety of trailers, the side marker lamps can flash synchronously with the direction indicators.

PRODUCT FEATURES

The control unit monitors functioning of the rear direction indicator. In the event of any fault, it switches off the flasher function of the side marker lamps to ensure that the failure monitoring of the towing vehicle conforms to the law.

- → Only one control unit is required
- → The compact design enables mounting in a distribution box
- → Very robust and waterproof thanks to full encapsulation
- → High degree of EMC protection for use in very challenging environments
- → Suitable for use with all LED side marker lamps



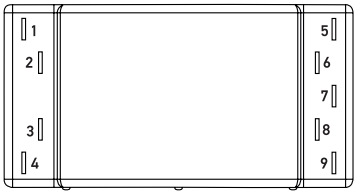
Key
□ – Control unit
1 – Direction indicator light
2 – Tail-stop light
3 – Reversing light
4 – Rear fog light
5 – Side marker/direction indicator light

TECHNICAL DATA	
Operating temperature	-40°C to +65°C
Protection class	IP 6K9K
Contact	Flat connector DIN 46244 A6, 3 x 0.8

This control unit can be connected to any side marker lamp and allows it to flash, if necessary.

CONTROL UNIT FOR FLASHING SIDE MARKER LAMPS		VPE*
ECE R48 Category 6, 24 V	**5DS 223 544-001**	1

PIN ASSIGNMENT/ELECTRICAL CONNECTION



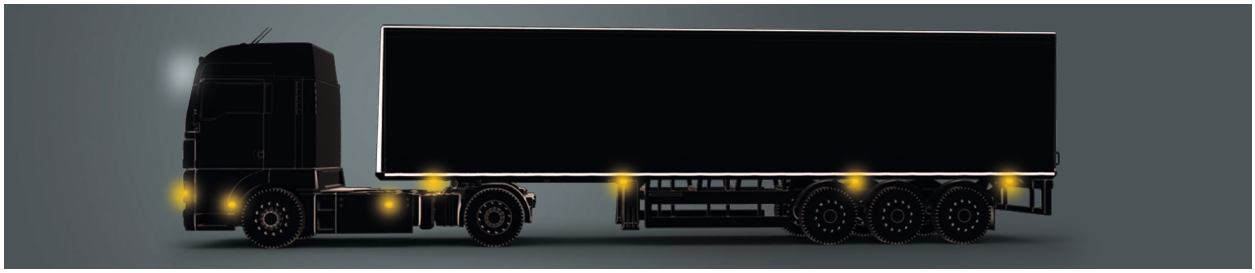
Pin 1 Output: side marker, left
Pin 2: Output: direction indicator light, left
Pin 3 Output: side marker, right
Pin 4 Output: direction indicator light, right
Pin 5 Input: tail light, left
Pin 6 Input: direction indicator light, left
Pin 7 Ground
Pin 8 Input: tail light, right
Pin 9 Input: direction indicator light, right

* Packaging unit

ECE-R48 REVISION 6

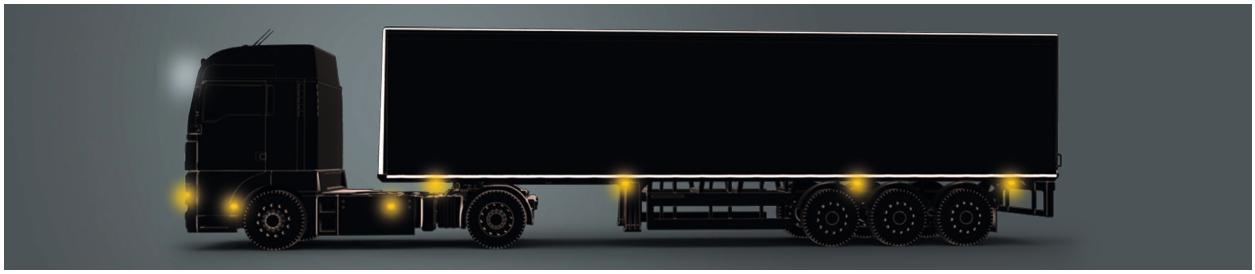
Mandatory: The vehicle **must** be equipped with a side direction indicator light.

Option 1: Direction indicators of the CAT 5 approval class are operated on vehicles with side marker lamps.



OR

Option 2: The existing side marker lamps on the vehicle are switched on / off together with the direction indicator. The existing side marker lamps are switched on and off together (in phase) to indicate the direction of travel, i.e. all side marker lamps on one side must flash (the exception is combination lamps such as rubber arm lamps). All amber lamps take over the flasher function synchronously.



FAILURE CONTROL

If the side marker lamps flash together (in phase) with the rear direction indicator, they obtain their energy from the same supply line. This can lead to a situation where, in the event of a defect in the rear direction indicator, the failure monitor system installed in the towing vehicle no longer functions in accordance with the law and therefore cannot detect a failure. The driver electronics developed by HELLA will ensure the necessary safety. And any defect in the rear direction indicator is reliably detected so that the towing vehicle can inform the driver.

Option 3: LED lamps - simulation device for cold check

Failure control and electrical connection

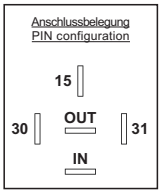
If the existing vehicle electrical system is programmed to monitor the lighting even when it is not in operation, this is referred to as a cold check. During a cold check, a small test pulse is transmitted to the lamp while it is switched off to see whether this pulse is discharged via the bulb to ground. The energy here is so low that the bulb does not light up.

As LED lamps are essentially not suitable for this form of monitoring, HELLA offers an electronic system for "simulation of the cold check" in order to ensure operation.

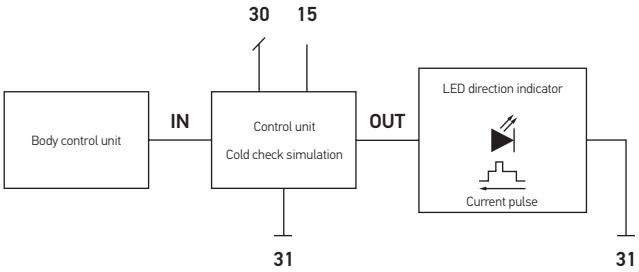
The control unit for cold checking is connected between the body control unit and an ISO 13207-compliant LED direction indicator.

The cold check control unit checks the function of the direction indicator during operation using the ISO pulse. If the direction indicator fails the device saves the last status, which means this can then be displayed during the next cold check.

PIN ASSIGNMENT/ELECTRICAL CONNECTION



BLOCK DIAGRAM

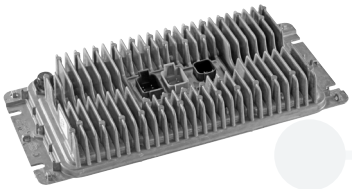


TECHNICAL DATA

	12 V	24 V
Operating voltage	10 – 15 V	18 – 32 V
Rated current	1.5 A	1.5 A
Operating temperature	-40 to +85°C	-40 to +85°C
Protection class	IP 54 (contacts underneath)	IP 54 (contacts underneath)

Simulation device		
For cold check	**5DS 009 602-011**	**5DS 009 602-001**

Basic



Premium

Solution 4: LED lamps - control unit

Failure control and electrical connection

HELLA offers two different types of LED lamp control units designed to monitor lighting functions.

- → Basic version: this only monitors the direction indicator
- → Premium version: This monitors the stop light and direction indicator light

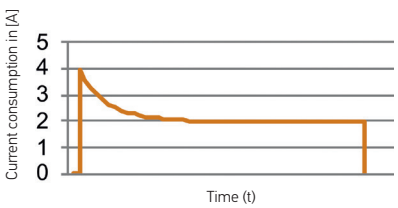
Only one control unit is required for both sides (right and left).

- → The DEUTSCH connector integrated in the housing allows easy integration into the vehicle architecture
- → Active thermal management including overheating protection to ensure a long lifetime
- → Completely watertight and dustproof for maximum functioning safety
- → Electromagnetic compatibility (EMC) for trouble-free use of, for example, radio
- → In the event of a hazard warning light starting to flash, the simulation is switched off

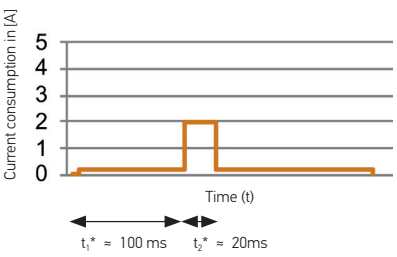
Configuration example with ISO pulse

In accordance with ISO 13207

Current consumption
LED lamp control unit

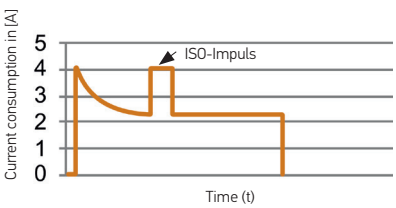


Shapeline current consumption
with integrated pulse

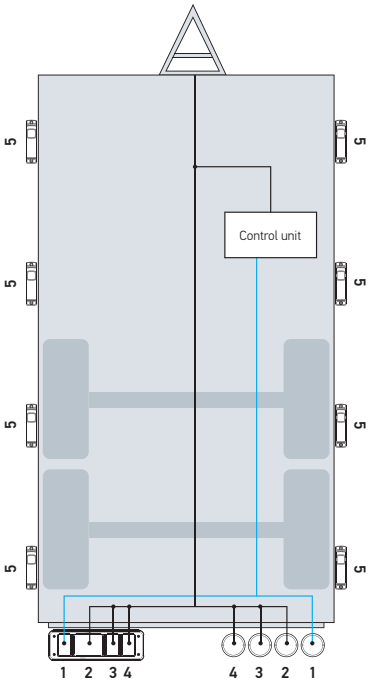


*for more details see ISO 13207

Total current consumption of control
unit and lamps with integrated pulse



System representation: Basic
Control unit is **only** responsible for monitoring the direction indicators.



Key

1 – Direction indicator light
2 – Tail-stop light
3 – Reversing light
4 – Rear fog light
5 – Side marker light

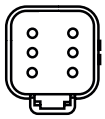
TECHNICAL DATA	
Operating voltage (12 V version)	9 – 16 V
Operating voltage (24 V version)	18 – 32 V
Operating temperature	-40°C to +50°C
Protection class	IP 6K9K

For cold check: avoid pulses between 30 µA and 10 mA!

BASIC CONTROL UNIT		VPE**
12 V Basic, with 6-pin socket housing	**5DS 227 488-001***	**1**
12 V Basic, with EasyConn connector	**5DS 340 128-001**	**1**
12 V Basic, with open cable ends	**5DS 340 128-021**	**1**
24 V Basic, with 6-pin socket housing	**5DS 227 488-101**	**1**

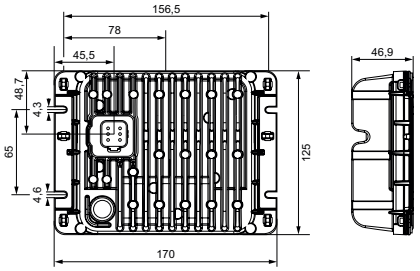
* Constant vehicle electric system voltage to the rear combination lamps must be guaranteed.

PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1 Input: direction indicator light, right
Pin 2: Input: Ground
Pin 3 Input: direction indicator light, left
Pin 4 Output: direction indicator light, left
Pin 5 Output: ground
Pin 6 Output: direction indicator light, right

TECHNICAL DRAWING

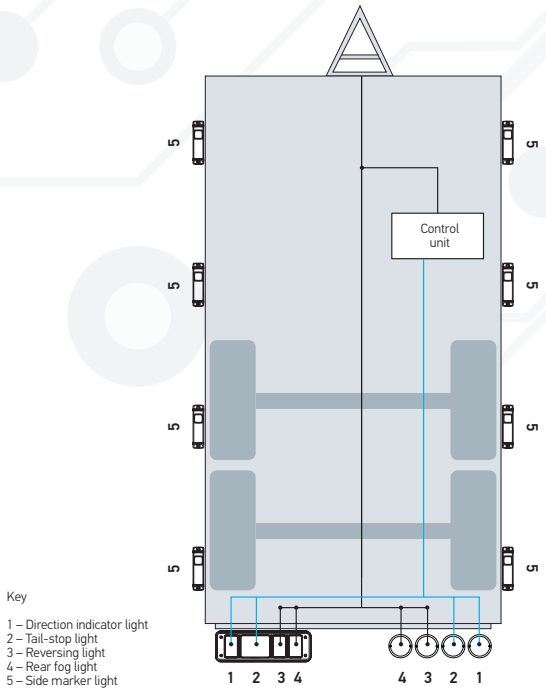


Mating connectors can be found on page 7.

** Packaging unit

System representation: Premium

Control unit is responsible for monitoring the stop light and direction indicator light.



Key

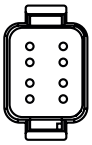
1 – Direction indicator light
2 – Tail-stop light
3 – Reversing light
4 – Rear fog light
5 – Side marker light

TECHNICAL DATA	
Operating voltage (12 V version)	9 – 16 V
Operating voltage (24 V version)	18 – 32 V
Operating temperature	-40°C to +50°C
Protection class	IP 6K9K

For cold check: avoid pulses between 30 µA and 10 mA!

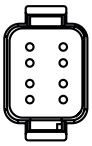
PREMIUM CONTROL UNIT		VPE**
12 V Premium, with 8-pin socket housing (1 stop light channel)	**5DS 227 489-001**	1
12 V Premium, with 8-pin socket housing (2 stop light channels)	**5DS 227 489-011**	1
12 V Premium, with EasyConn connector	**5DS 340 128-011**	1
24 V Premium, with 8-pin socket housing (1 stop light channel)	**5DS 227 489-101**	1

PIN ASSIGNMENT 12 V



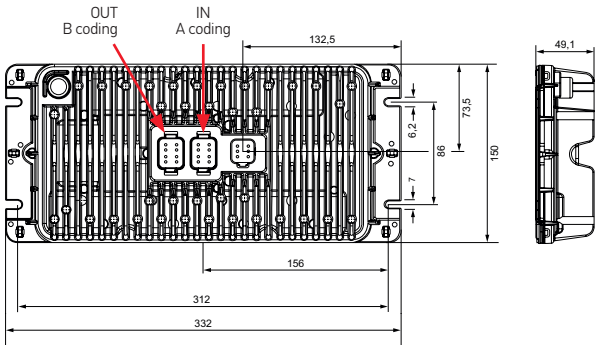
1	Input	Stop light, left
2	Input	Tail light, right
3	Input	Tail light, left
4	Input	Stop light, right
5	Input	Reversing light
6	Input	Rear fog light
7	Masse	
8	Not used	

PIN ASSIGNMENT 12 V/24 V

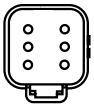


1	Input / output	Stop light
2	Input	Tail light, right
3	Input	Tail light, left
4	Not used	
5	Input	Reversing light
6	Input	Rear fog light
7	Masse	
8	Not used	

TECHNICAL DRAWING



PIN ASSIGNMENT 6-PIN CONNECTION



1	Input	Direction indicator light, right
2	Masse	
3	Input	Direction indicator light, left
4	Output	Direction indicator light, left
5	Masse	
6	Output	Direction indicator light, right

Mating connectors can be found on page 7.

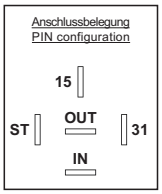
** Packaging unit

LED lighting
Failure control and electrical connection
Control unit for current monitoring

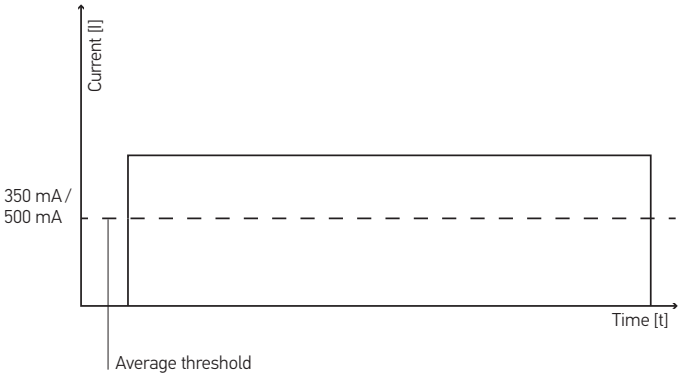
In order to test LED low beam headlamps or LED beacons, the average energy consumption is determined by measuring the current. The current monitors are matched to the HELLA products and enable very reliable monitoring.

The beacon control unit is connected upstream of the LED headlamp and continuously measures the current consumption in the switched-on state. If a minimum current value is exceeded, the OK function is displayed by a high level at the status output. If it is undershot, the defect function is displayed by a low level. Monitoring is only carried out when the ignition and lighting function are on.

PIN ASSIGNMENT/ELECTRICAL CONNECTION



BLOCK DIAGRAM



PART NUMBER	VOLTAGE
5DS 011 630-001	12 V
5DS 011 630-211	24 V
5DS 011 630-011	24 V

TECHNICAL DATA

Operating temperature	-40°C to +85°C
Protection class	IP 5KX
Contact	Flat connector DIN 46244 A6, 3 x 0.8

The adjacent control unit can be used for current monitoring (direct measurement) of the main light function in the following examples of our module headlamps:

R 80/L 4060	12 V	24 V
Low beam	500 mA threshold value	500 mA threshold value 350 mA threshold value
High beam	500 mA threshold value	**Only** 350 mA threshold value

90 mm LED module headlamp L 4060

LED low beam headlamp L 4060

CONNECTORS/VARIANTS	PART NUMBER
FEP connector, right-hand traffic, ECE, SAE	**1BL 012 488-001**
FEP connector, left-hand traffic, ECE	**1ML 012 488-011**
DEUTSCH connector, right-hand traffic, ECE, SAE	**1BL 012 488-101**
DEUTSCH connector, left-hand traffic, ECE	**1ML 012 488-111**

LED low beam headlamp L 4060 with daytime running light and position light

CONNECTORS/VARIANTS	PART NUMBER
FEP connector, right-hand traffic, ECE, SAE	**1BL 012 488-021**
FEP connector, left-hand traffic, ECE	**1ML 012 488-031**
DEUTSCH connector, right-hand traffic, ECE, SAE	**1BL 012 488-121**
DEUTSCH connector, left-hand traffic, ECE	**1ML 012 488-131**

LED high beam headlamp L 4060

CONNECTORS/VARIANTS	PART NUMBER
With preassembled carrier frame	**1F0 011 988-021**
For performance mounting	**1F0 011 988-121**

LED high beam headlamp L 4060 with daytime running light and position light

CONNECTORS/VARIANTS	PART NUMBER
With preassembled carrier frame	**1F0 011 988-031**
For performance mounting	**1F0 011 988-131**

LED high beam headlamp L 4060 with direction indicator light

CONNECTORS/VARIANTS	PART NUMBER
With pulse generator and preassembled carrier frame	**1F0 011 988-081**
With pulse generator, for performance mounting	**1F0 011 988-181**
Without pulse generator and with preassembled carrier frame	**1F0 011 988-071**
Without pulse generator, for performance mounting	**1F0 011 988-171**
With pulse generator, for performance mounting, with fording ability	**1FO 011 988-191**

90 mm LED module headlamp R 80

LED low beam headlamp R 80

CONNECTORS/VARIANTS	PART NUMBER
FEP connector, right-hand traffic, ECE	**1B0 015 050-101**
FEP connector, left-hand traffic, ECE	**1M0 015 050-111**
FEP connector, right-hand traffic, SAE	**1B0 015 050-131**
DEUTSCH connector, right-hand traffic, ECE	**1B0 015 050-001**
DEUTSCH connector, left-hand traffic, ECE	**1M0 015 050-011**
DEUTSCH connector, right-hand traffic, SAE	**1B0 015 050-031**

LED high beam headlamp R 80

CONNECTORS/VARIANTS	PART NUMBER
FEP connector, ECE, SAE	**1K0 015 050-121**
DEUTSCH connector, ECE, SAE	**1K0 015 050-021**

Acoustic vehicle alerting system (AVAS)

PRODUCT FEATURES

- → Designed for vehicles with noiseless engines in order to increase the safety of road users
- → For vehicles solely with electric drive (PEV), hybrid electric vehicles (HEV) and fuel cell vehicles (FCV)
- → Simulates simple engine noise
- → Space-saving and compact sensor
- → Low power consumption

DESIGN AND FUNCTION

As soon as a pre-defined speed has been reached, the noise fades in or fades out as required. The AVAS warning system also has to automatically give off an acoustic signal when the vehicle is reversing. Real-time signal communication between the AVAS warning system and the CAN bus. The driver can easily activate or deactivate the AVAS system by means of a switch. When restarting, the AVAS must automatically be set on the "ON" position. And the AVAS itself is protected by a dustproof and waterproof housing.

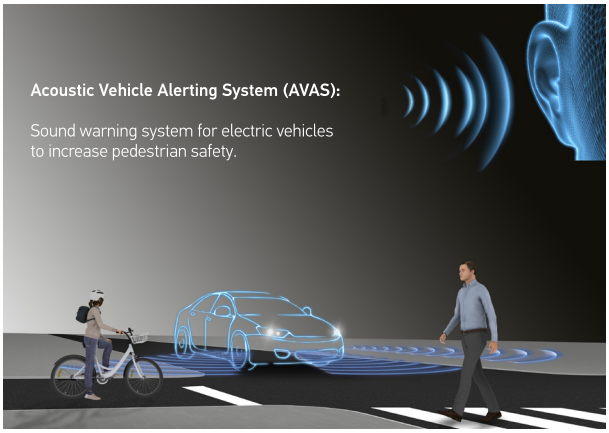
APPLICATION

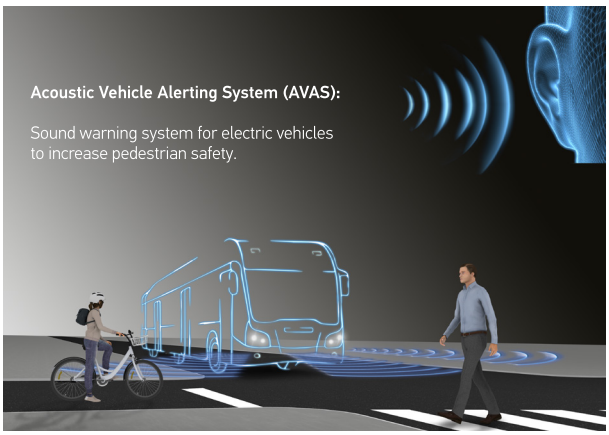
In the USA, all new electric and hybrid models operating in purely electric mode below 30 km/h already have to systematically emit sounds. The installation of an acoustic alerting system has also been mandatory for all newly developed electric and hybrid cars in the European Union since July 2019. And from July 2020, all newly registered electric models must be equipped with an acoustic vehicle alerting system. The sound limit for vehicles in the EU has been set at 20 km/h. Cars driving below this speed must then emit a sound. When driving faster than this, the rolling noise generated by the tyres on the road is sufficient as a warning.

AVAS Sound

Standard sound. Customised sounds are available on request.

APPLICATION EXAMPLES



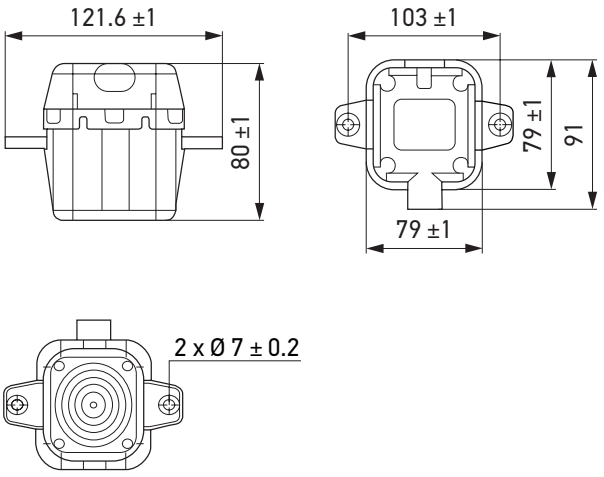


TECHNICAL DATA

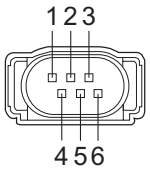
Operating voltage	9 – 16 V
Current consumption	100 mA (normal condition)
Maximum current consumption	150 mA
No-load current in idle mode	100 uA
Weight	350 g
Operating temperature	-40°C to +85°C
CAN	Diagnostics (based on UDS standard)
Loudspeaker	(Impedance 4 Ω)
Mute function	Support for On/Off status via CAN
Frequency range	160 Hz – 5 kHz
Sound pressure level	65 ± 5 dB at 1 m distance Generation 0 km/h - 30 km/h (TBD) Minimum frequency shift speed: 0.8 % (km/h)
Vehicle speed	0 to 20 km/h
Protection class	IP 6K9K
Digital amplifier	32 bits sampled at max 96 kHz
Housing volume	0.4 l
Housing material	PBT-GF15
Thermal overload protection	Yes
Connector	TYCO 114-18063-126
Mating connector[1)]	TYCO 1-967616-1

[1)] These accessories are not included in the scope of delivery.
Available from Tyco Electronics.

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



Pin 1: V_BAT
Pin 2: IGN
Pin 3: CAN_bus_L
Pin 4: N.A
Pin 5: GND
Pin 6: CAN_bus_H

PROGRAM OVERVIEW

Variants	Part number	VPE*
Acoustic vehicle alerting system (AVAS)	**3SL 015 329-007**	30

* Packaging unit

Electronic horns

PRODUCT FEATURES

- → Durable horns in innovative technology
- → Compact size and lightweight
- → Multi-voltage horn available in the range
- → No mechanical wear thanks to electronic design

DESIGN AND FUNCTION

Signal horns are powered by battery current, which is normally controlled by a switching current, which is, in turn, controlled by the steering wheel. This is sent to a relay, which ensures a uniform power supply for the horn.
As soon as there is supply voltage at the horn's solenoid, its armature is attracted together with the diaphragm. The power supply is triggered cyclically, meaning that there is an audible oscillation: the signal.
If the horn is electronic, the oscillation is, of course, generated via the electronics. That is the reason why an electronic horn is much more trouble-free than a classic horn, where the oscillation is generated by mechanically controlling the solenoid.

APPLICATION

Horns are required by law for motor vehicles and are part of the safety equipment of a vehicle.

A particularly clearly perceptible sound is necessary in order to be able to warn other road users effectively in dangerous situations.

Our signal horns offer you a high level of functional reliability.

PROGRAM OVERVIEW

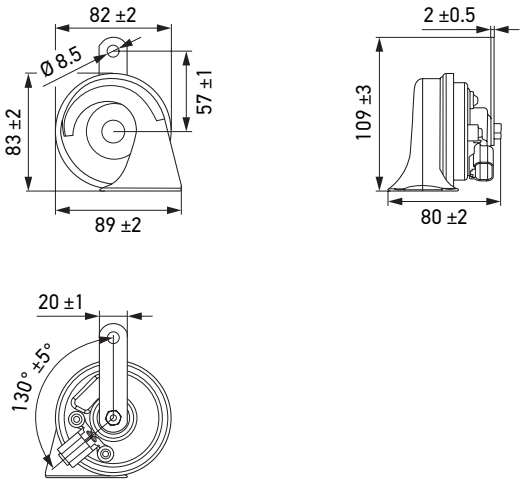
Variants	Part number	VPE*	Page
TE 16E, Ideal for passenger cars, electric cars and sports cars			
12 V, 400 Hz, low tone	**3FG 014 763-207**	40	155
12 V, 500 Hz, high tone	**3FG 014 763-217**	40	
B133E, Robust housing with distinctive grille, corrosion protected, Teflon seal to protect against moisture/humidity (option)			
24 V, 300 Hz, low tone	**3AF 005 631-221**	1	156
	3AF 005 631-227	32	
24 V, 450 Hz, high tone	**3AF 005 631-231**	1	
	3AF 005 631-237	32	
S92E			
Ideal for all kinds of commercial vehicles			
24 V, 300 Hz, low tone	**3AL 012 588-207**	48	157
24 V, 400 Hz, high tone	**3AL 012 588-217**	48	
12 V, 300 Hz, low tone	**3AL 012 588-227**	48	
12 V, 400 Hz, high tone	**3AL 012 588-237**	48	
Ideal for forklift trucks			
12 – 80 V, 300 Hz, low tone	**3AL 012 588-247**	48	
12 – 80 V, 400 Hz, high tone	**3AL 012 588-257**	48	

* Packaging unit

Long-life, twin-tone horn TE16E

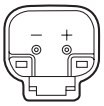
TECHNICAL DATA	
Diameter	82 mm
Rated voltage	12 V
Frequency range	400 Hz (low tone) 500 Hz (high tone)
Sound pressure level at 2 m distance	110 dB (A) ± 5 dB (A)
Energy consumption	72 W
Current consumption	max. 6.0 A
Operating temperature	-40°C to +85°C
Protection class	IP 67
Lifetime	500,000 cycles (ECE R28)
Housing material	ABS
Type approval	ECE-R10 ECE-R28

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION

Splash-proof DEUTSCH connector DT 06-25



Pin (-): GND
Pin (+): 12 V

PROGRAM OVERVIEW

Variants	Part number	VPE*
12 V, 400 Hz, low tone	**3FG 014 763-207**	40
12 V, 500 Hz, high tone	**3FG 014 763-217**	40

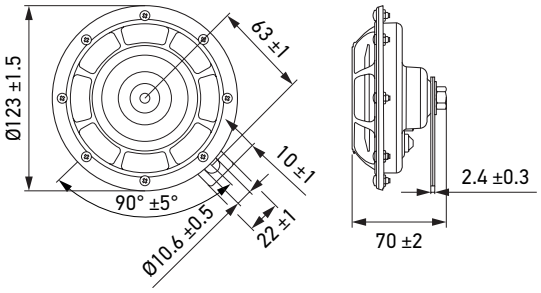
* Packaging unit

Long-life electronic horn B133E

TECHNICAL DATA

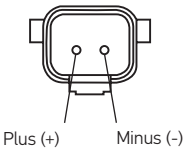
Diameter	123 mm
Rated voltage	24 V
Frequency range	300 Hz (low tone) 450 Hz (high tone)
Sound pressure level at 2 m distance	115 ± 3 dB (A)
Energy consumption	60 W
Current consumption	max. 2.5 A
Operating temperature	-40°C to +85°C
Protection class	IP 67
Lifetime	500,000 cycles (ECE R28)
Housing material	Metal
Type approval	ECE-R28 ECE-R10

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION

Splash-proof DEUTSCH connector DT 06-25



PROGRAM OVERVIEW

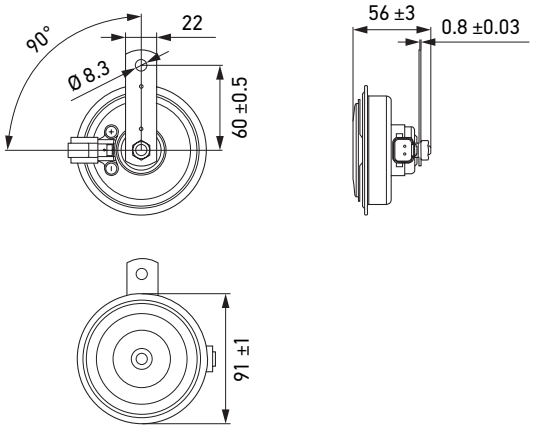
Variants	Part number	VPE*
Ideal for all kinds of commercial vehicles Robust housing with distinctive grid, corrosion protected, Teflon seal to protect against moisture/humidity (option)		
24 V, 300 Hz, low tone	**3AF 005 631-221**	1
	3AF 005 631-227	32
24 V, 450 Hz, high tone	**3AF 005 631-231**	1
	3AF 005 631-237	32

* Packaging unit

Long-life electronic horn S92E

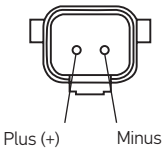
TECHNICAL DATA	
Diameter	92 mm
Rated voltage	12 V / 24 V / multi-voltage
Frequency range	300 Hz (low tone) 400 Hz (high tone)
Sound pressure level at 2 m distance	112 dB (A) ±5 dB (A)
Energy consumption	72 W (24 V) 60 W (12 V)
Current consumption	max. 3.0 A (24 V) max. 5.0 A (12 V)
Operating temperature	-40°C to +85°C
Protection class	IP 67
Lifetime	500,000 cycles (ECE R28)
Housing material	Metal
Type approval	ECE-R28 ECE-R10

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION

Splash-proof DEUTSCH connector DT 06-25



PROGRAM OVERVIEW

Variants	Part number	VPE*
Ideal for all kinds of commercial vehicles		
24 V, 300 Hz, low tone	**3AL 012 588-207**	48
24 V, 400 Hz, high tone	**3AL 012 588-217**	48
12 V, 300 Hz, low tone	**3AL 012 588-227**	48
12 V, 400 Hz, high tone	**3AL 012 588-237**	48
Ideal for forklift trucks		
12 – 80 V, 300 Hz, low tone	**3AL 012 588-247**	48
12 – 80 V, 400 Hz, high tone	**3AL 012 588-257**	48

* Packaging unit. Single packaging on request.

Electromechanical horns

PRODUCT FEATURES

- → Optimal tonal pattern achieved when a high and low tone horn set is installed
- → Compact size and lightweight
- → Variants with high supply voltage range available
- → Variants with additional interference suppression available

APPLICATION

Horns are a mandatory part of the safety equipment of every vehicle.

A particularly perceptible signal is necessary so that other road users can be warned effectively in dangerous situations. Our signal horns offer you a high level of functional reliability.

DESIGN AND FUNCTION

Horns are powered by battery current, which is normally controlled by the steering wheel via a control current. This is directed to a relay, which transmits the entire control current so that no voltage drops occur.

The control current activates the solenoid in the horn and generates a magnetic field that attracts a metal core (armature) to which the horn's steel diaphragm is attached. In an attracted state, the power supply is interrupted, the magnetic field breaks down, the armature and diaphragm move back to the rest position and the power supply is re-established. The process then begins again. This causes an oscillation, which can be heard as a low or high sound.

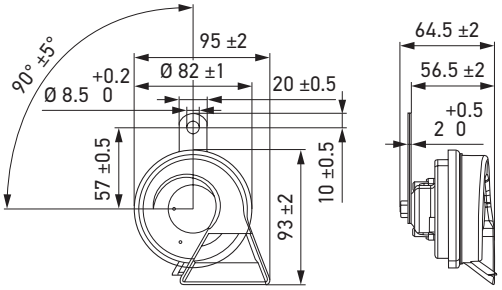
PROGRAM OVERVIEW

Variants	Part number	VPE*	Page
Electric twin-tone trumpet horn TE16 Ideal for small and large passenger cars, off-road vehicles and motorbikes			
12 V, 400 Hz, low tone	**3FG 007 728-141**	1	160
12 V, 500 Hz, high tone	**3FG 007 728-491**	1	
Heavy Tone horn DL50 V2 Ideal for commercial vehicles, 2nd generation optimised horn; riveted			
12 V, 310 Hz, low tone, DEUTSCH connector	**3CA 004 811-001**	1	161
12 V, 380 Hz, high tone, DEUTSCH connector	**3CA 004 811-011**	1	
24 V, 310 Hz, low tone, DEUTSCH connector	**3CA 004 811-021**	1	
24 V, 380 Hz, high tone, DEUTSCH connector	**3CA 004 811-031**	1	
12 V, 310 Hz, low tone, 6.3 mm blade terminal connection	**3CA 004 811-141**	1	
12 V, 380 Hz, high tone, 6.3 mm blade terminal connection	**3CA 004 811-151**	1	
24 V, 310 Hz, low tone, 6.3 mm blade terminal connection	**3CA 004 811-161**	1	
24 V, 380 Hz, high tone, 6.3 mm blade terminal connection	**3CA 004 811-171**	1	
S 92 Ideal for commercial vehicles, full protective coating on diaphragm and housing			
24 V, 335 Hz, low tone	**3AL 012 588-097**	48	162
24 V, 435 Hz, high tone	**3AL 012 588-087**	48	
12 V, 335 Hz, low tone	**3AL 012 588-107**	48	
12 V, 435 Hz, high tone	**3AL 012 588-117**	48	
B36 Ideal for commercial vehicles, diaphragm to protect against moisture/humidity penetration			
12 V, 400 Hz, high tone, diameter 97 mm, 6.3 mm flat connector	**3AL 002 952-811**	1	163
24 V, 335 Hz, low tone, diameter 97 mm, 6.3 mm flat connector	**3AL 002 952-871**	1	
24 V, 335 Hz, low tone, diameter 113 mm, 6.3 mm flat connector	**3BA 002 768-382**	1	
24 V, 400 Hz, high tone, diameter 113 mm, 6.3 mm flat connector	**3BA 002 768-431**	1	
24 V, 335 Hz, low tone, diameter 113 mm, 6.3 mm splash-proof, copper flat connector in conjunction with rubber grommet (9GT 700 452-005)	**3BA 922 200-827**	24	
24 V, 400 Hz, high tone, diameter 113 mm, 6.3 mm splash-proof, copper flat connector in conjunction with rubber grommet (9GT 700 452-005)	**3BA 922 200-817**	24	
48 V, 335 Hz, low tone, diameter 113 mm, DEUTSCH connector	**3BA 002 768-777**	24	
80 V, 335 Hz, low tone, diameter 113 mm, DEUTSCH connector	**3BA 002 768-007**	24	

Electric twin-tone trumpet horn TE16

TECHNICAL DATA	
Diameter	82 mm
Rated voltage	12 V
Frequency range	400 Hz (low tone) 500 Hz (high tone)
Sound pressure level at 2 m distance	110 ± 5 dB(A)
Energy consumption	72 W
Current consumption	max. 6.0 A
Operating temperature	-40°C to +85°C
Protection class	IP 6K7 and IP X5
Lifetime	100,000 cycles (ECE R28)
Housing material	ABS
Type approval	ECE R28

TECHNICAL DRAWING



PROGRAM OVERVIEW

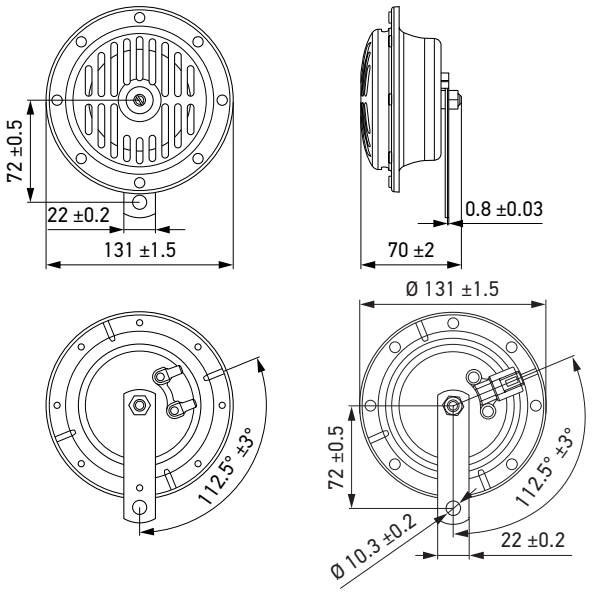
Variants	Part number	VPE*
Ideal for small and large passenger cars, off-road vehicles and motorbikes Vertical and horizontal installation possible; increased corrosion protection; plastic trumpet		
12 V, 400 Hz, low tone	**3FG 007 728-141**	1
12 V, 500 Hz, high tone	**3FG 007 728-491**	1

* Packaging unit

Heavy Tone horn DL50 V2

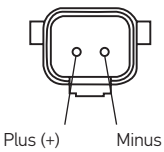
TECHNICAL DATA	
Diameter	130 mm
Rated voltage	12 V / 24 V
Frequency range	310 Hz (low tone) 380 Hz (high tone)
Sound pressure level at 2 m distance	114 dB (A) ± 4 dB (A)
Energy consumption	84 W (24 V) 72 W (12 V)
Current consumption	max. 3.5 A (24 V) max. 6 A (12 V)
Operating temperature	-40°C to +85°C
Protection class	IP 54
Lifetime	100,000 cycles (ECE R28)
Housing material	Metal
Type approval	ECE-R28

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION

Splash-proof DEUTSCH connector DT 06-25



PROGRAM OVERVIEW

Variants	Part number	VPE*
Ideal for commercial vehicles 2nd generation optimised horn; riveted		
12 V, 310 Hz, low tone, DEUTSCH connector	**3CA 004 811-001**	1
12 V, 380 Hz, high tone, DEUTSCH connector	**3CA 004 811-011**	1
24 V, 310 Hz, low tone, DEUTSCH connector	**3CA 004 811-021**	1
24 V, 380 Hz, high tone, DEUTSCH connector	**3CA 004 811-031**	1
12 V, 310 Hz, low tone, 6.3 mm blade terminal connection	**3CA 004 811-141**	1
12 V, 380 Hz, high tone, 6.3 mm blade terminal connection	**3CA 004 811-151**	1
24 V, 310 Hz, low tone, 6.3 mm blade terminal connection	**3CA 004 811-161**	1
24 V, 380 Hz, high tone, 6.3 mm blade terminal connection	**3CA 004 811-171**	1

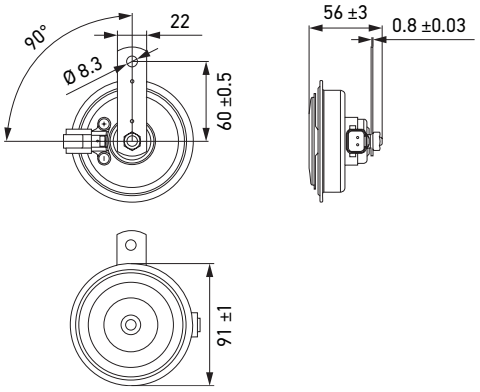
* Packaging unit

Rich Tone horn S92

TECHNICAL DATA

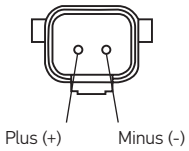
Diameter	92 mm
Rated voltage	12 / 24 V
Frequency range	335 Hz (low tone) 435 Hz (high tone)
Sound pressure level at 2 m distance	112 dB(A) ± 5 dB(A)
Energy consumption	60 W (12 V) 72 W (24 V)
Current consumption	max. 5.0 A (12 V) max. 3.0 A (24 V)
Operating temperature	-40°C to +85°C
Protection class	IP 67
Lifetime	100,000 cycles (ECE R28)
Housing material	Metal
Type approval	ECE-R28

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION

Splash-proof DEUTSCH connector DT 06-25



PROGRAM OVERVIEW

Variants	Part number	VPE*
Ideal for commercial vehicles Full protective coating on diaphragm and housing		
24 V, 335 Hz, low tone	**3AL 012 588-097**	48
24 V, 435 Hz, high tone	**3AL 012 588-087**	48
12 V, 335 Hz, low tone	**3AL 012 588-107**	48
12 V, 435 Hz, high tone	**3AL 012 588-117**	48

* Packaging unit. Single packaging on request.

Full Tone horn B36

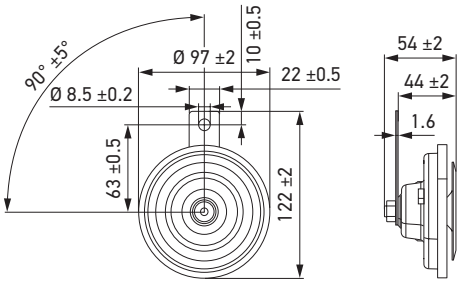
TECHNICAL DATA

Diameter	97 mm / 113 mm
Rated voltage	12 V / 24 V / 48 V / 80 V
Frequency range	335 Hz (low tone) 400 Hz (high tone)
Sound pressure level at 2 m distance	115 ± 3 dB(A)
Energy consumption	66 W (12 V) 84 W (24 V) 62 W (48 V) 40 W (80 V)
Current consumption	max. 6.0 A (12 V) max. 3.5 A (24 V) max. 1.3 A (48 V) max. 0.5 A (80 V)
Operating temperature	-40°C to +85°C
Protection class	IP 6K7 and IP X5
Lifetime	100,000 cycles (ECE R28)
Housing material	Metal
Type approval	ECE-R28*

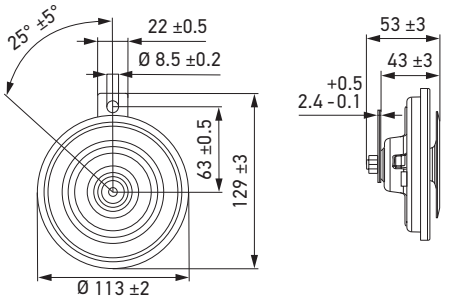
* ECE R28 only applies to 12 V and 24 V horns.

TECHNICAL DRAWING

3AL 002 952-811 / -871



3BA 002 768-007 / -382 / -431 / -777 and 3BA 922 200-817 / -827



PIN ASSIGNMENT/ELECTRICAL CONNECTION

Splash-proof DEUTSCH connector DT 06-25

PROGRAM OVERVIEW

Variants	Part number	VPE*
Ideal for commercial vehicles Diaphragm to protect against moisture/humidity penetration		
12 V, 400 Hz, high tone, diameter 97 mm, 6.3 mm flat connector	**3AL 002 952-811**	1
24 V, 335 Hz, low tone, diameter 97 mm, 6.3 mm flat connector	**3AL 002 952-871**	1
24 V, 335 Hz, low tone, diameter 113 mm, 6.3 mm flat connector	**3BA 002 768-382**	1
24 V, 400 Hz, high tone, diameter 113 mm, 6.3 mm flat connector	**3BA 002 768-431**	1
24 V, 335 Hz, low tone, diameter 113 mm, 6.3 mm splash-proof, copper flat connector in conjunction with rubber grommet (9GT 700 452-005)	**3BA 922 200-827**	24
24 V, 400 Hz, high tone, diameter 113 mm, 6.3 mm splash-proof, copper flat connector in conjunction with rubber grommet (9GT 700 452-005)	**3BA 922 200-817**	24
48 V, 335 Hz, low tone, diameter 113 mm, DEUTSCH connector	**3BA 002 768-777**	24
80 V, 335 Hz, low tone, diameter 113 mm, DEUTSCH connector	**3BA 002 768-007**	24

* Packaging unit

Reversing and warning alarm BM10 and BM30

PRODUCT FEATURES

- → Penetrating, long-range alarm sound
- → Housing of glass-fibre reinforced nylon with integrated mounting bracket (BM30)
- → Insulated electronics encapsulated with epoxy resin to protect against rust, moisture/humidity and vibration
- → Various options for sound pressure level suitable for town traffic and construction environments
- → Optionally available with automatic adjustment to environments, thus providing changing sound levels

APPLICATION

The reversing alarm is an indispensable feature in hazardous working environments. The high-frequency alarm can actively prevent accidents. It gives commercial vehicles additional safety when they have to manoeuvre and reverse.

In some countries the installation of a reversing alarm is mandatory for vehicles with limited rearward visibility. It is obligatory for the vehicle to be fitted with an audible reversing alarm that is louder than the ambient noise. Many of the regulations require a sound level higher than 90 dB.

DESIGN AND FUNCTION

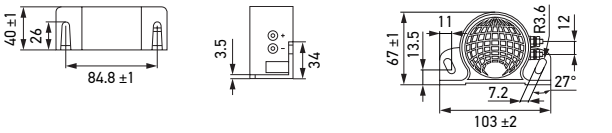
The reversing alarm emits a warning sound as soon as reverse gear is engaged. In this way, it warns other road users about the vehicle backing up.

Warning alarms are available with various volumes depending on the application. So, for example, reversing alarms with a signal volume of approx. 90 dB are used in city traffic while warning alarms with a volume of more than 100 dB are found on construction sites where ambient noise is very high. A reversing alarm that is just 3 dB louder than a similar one already has twice the volume.

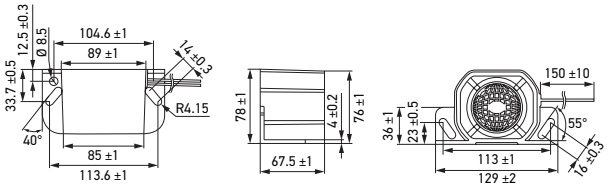
TECHNICAL DATA	
Rated voltage	12 – 48 V
Frequency range	700 – 2,800 Hz
Sound pressure level at 1.2 m distance	Fixed / automatic adjustment (see table)
Energy consumption	12 W
Current consumption	max. 0.6 A
Operating temperature	-40°C to +85°C
Protection class	IP 67
Lifetime	100 hours (SAE J994)
Housing material	BM10: ABS BM30: Glass-fibre reinforced nylon
Type approval	ECE-R10 SAE J994

TECHNICAL DRAWING

BM10

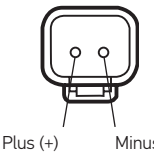


BM30



PIN ASSIGNMENT/ELECTRICAL CONNECTION

DEUTSCH connector DT 04-2P



PROGRAM OVERVIEW

Variants	Part number	VPE*
BM10: Ideal for light commercial vehicles		
With 2 screws, 97 dB(A)	**3SL 009 148-177**	50
With 2 screws, 107 dB(A)	**3SL 009 148-187**	50
With 140 mm cable and DEUTSCH connector, 97 dB(A)	**3SL 009 148-197**	50
With 140 mm cable and DEUTSCH connector, 107 dB(A)	**3SL 009 148-207**	50
BM30: Ideal for heavy duty commercial vehicles, automatic adjustment to suit ambient sound levels		
With 150 mm cable, 97 dB(A)	**3SL 996 139-217**	36
With 150 mm cable, 107 dB(A)	**3SL 996 139-227**	36
With 150 mm cable, 112 dB(A)	**3SL 996 139-237**	36
With 140 mm cable and DEUTSCH connector, 107 dB(A)	**3SL 996 139-247**	36
With 140 mm cable and DEUTSCH connector, 112 dB(A)	**3SL 996 139-257**	36
With 150 mm cable, 87 - 112 dB(A)	**3SL 996 139-267**	36
With 140 mm cable and DEUTSCH connector, 87 - 112 dB(A)	**3SL 996 139-277**	36

* Packaging unit. Single packaging on request.

Dual-glass mirror for agricultural and construction vehicles

PRODUCT FEATURES

- → Standardised mirror, manually adjustable or electrically adjustable and electrically heated
- → Main and wide angle mirror in one housing
- → Housing made of PP material
- → Glass in optimised size in accordance with ISO 5721-2 and ECE R46
- → Side-specific positioning of the wide-angle segment for a larger and optimised field of view

DESIGN AND FUNCTION

This dual-glass mirror provides greater safety for the driver during daily work and in traffic. The mirror has a maximised curvature with a glass radius of 1,260 or 310 mm, which is fully utilised to increase the driver's indirect field of vision. At the same time, its smart and compact design minimises any obstruction of the driver's direct view when he finds himself in traffic or in the work environment. No metal components are used so the risk of corrosion is avoided and also a low weight is achieved.

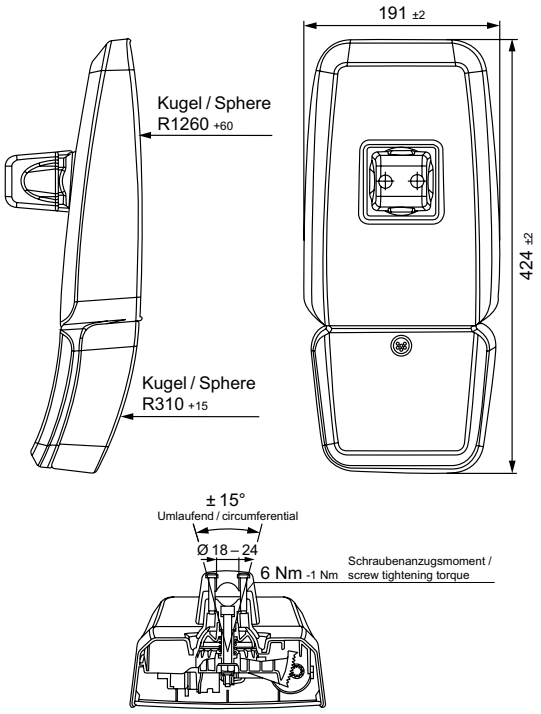
APPLICATION

The mirror is suitable for a variety of vehicles, such as construction vehicles, telescopic handlers, front loaders, tractors, field sprayers, combine harvesters and other special vehicles.

It is very versatile and offers a convincing solution for the increasing demands of the daily work routine found on construction sites and in the agricultural sector.

TECHNICAL DATA	
Operating voltage	12 V
Surface mounting	Vertical and horizontal, manually or electrically adjustable
Support rod	Ø 18 to 24 mm
Housing	PP housing with high UV stability
Size	424 x 191 mm
Curvature radius of main mirror glass	1,260 mm
Curvature radius of wide angle mirror glass	310 mm
Mounting	Preassembled screws for easy mounting

TECHNICAL DRAWING



PROGRAM OVERVIEW

Variants	Part number	VPE*
Outside mirror, manual	**8SB 015 039-041 / -047 (right)**	1/49
	8SB 015 039-051 / -057 (left)	1/49
Outside mirror, electric, 12 V	**8SB 015 039-061 / -067 (right)**	1/49
	8SB 015 039-071 / -077 (left)	1/49

* Packaging unit

Mirrors for agricultural and construction vehicles

PRODUCT FEATURES

- → Vertical and horizontal mounting on mirror arm possible
- → Wide adjustment range in x and y positions and also rotatable around the z axis, for an optimal view
- → Surface of chromium-plated glass with highest degree of corrosion resistance
- → Reduced weight and optimised ergonomics thanks to slim housing and minimised frame
- → Modern, aerodynamic styling in line with today's vehicle designs

DESIGN AND FUNCTION

This mirror provides greater safety for the driver during daily work and in traffic. It has a maximised curvature with a glass radius of 1,400 mm, which is fully utilised, therefore increasing the driver's indirect field of vision. Because of its compact design, it minimises any obstruction of the driver's direct view in traffic and in work situations. In case of an emergency, it can easily be folded away.

APPLICATION

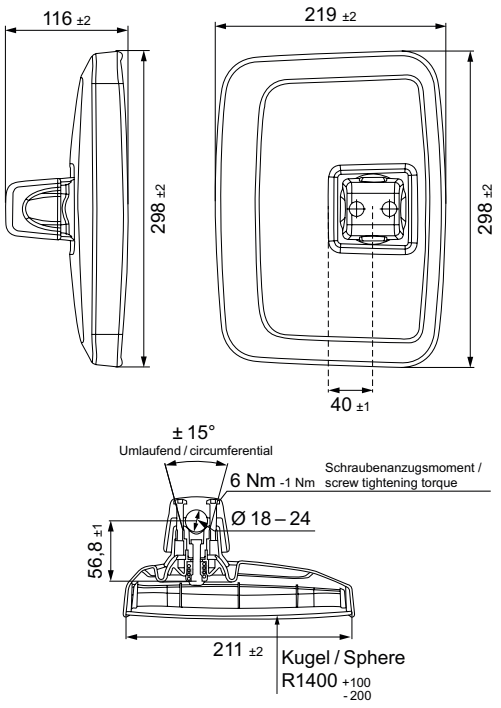
The mirror is suitable for a variety of vehicles, such as construction vehicles, telescopic handlers, front loaders, tractors, field sprayers, combine harvesters and special vehicles.

It is very versatile and offers a convincing solution for the increasing demands of the daily work routine found on construction sites and in the agricultural sector.

TECHNICAL DATA

Surface mounting	Right and left, manually adjustable, large adjustment range in x and y positions and also rotatable around the z axis
Support rod	Ø 18 to 24 mm
Housing	PP housing with high UV stability
Mounting	Preassembled screws for easy mounting

TECHNICAL DRAWING



PROGRAM OVERVIEW

Variants	Part number	VPE*
Outside mirrors		
The mirror head can be used with a variety of vehicles including those produced by the following manufacturers: JOHN DEERE / AL221771 CLAAS / 06821462 AGCO INTERNATIONAL GMBH / G737812151020 CATERPILLAR / 558-8103 WACKER NEUSON, KRAMER, EIDEMANN / 1000316535 ATLAS MASCHINEN GMBH / 6163527	**8SB 501 550-001**	1

* Packaging unit

Wide-angle mirrors for agricultural and construction vehicles

PRODUCT FEATURES

- → Reduced weight and optimised ergonomics thanks to slim housing and minimised frame
- → PP housing with high UV stability
- → Modern, aerodynamic styling in line with today's vehicle designs
- → Surface of chromium-plated glass with highest degree of corrosion resistance

DESIGN AND FUNCTION

This wide-angle mirror provides greater safety for the driver during daily work and in traffic. The mirror has a maximised curvature with a glass radius of 315 mm, which is fully utilised, therefore increasing the driver's indirect field of vision. Because of its compact design, it minimises any obstruction of the driver's direct view in traffic and in work situations.

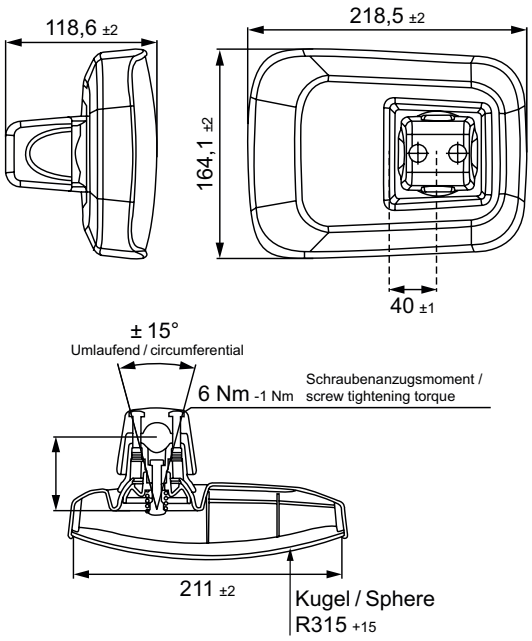
APPLICATION

The mirror is suitable for a variety of vehicles, such as construction vehicles, telescopic handlers, front loaders, tractors, field sprayers, combine harvesters and other special vehicles.

It is very versatile and offers a convincing solution for the increasing demands of the daily work routine found on construction sites and in the agricultural sector.

TECHNICAL DATA	
Surface mounting	Vertical and horizontal, wide adjustment range in x and y positions for an optimal view, and also rotatable around the z axis
Support rod	Ø 18 to 24 mm
Housing	PP housing with high UV stability
Mounting	Preassembled screws for easy mounting

TECHNICAL DRAWING



PROGRAM OVERVIEW

Variants	Part number	VPE*
Outside mirrors		
The mirror head can be used with a variety of vehicles including those produced by the following manufacturers: JOHN DEERE / AL221772 ATLAS MASCHINEN / 6187344 VOLVO / 17500365 CLAAS / 29003530	**8SB 015 039-081 / -087**	1/12

* Packaging unit

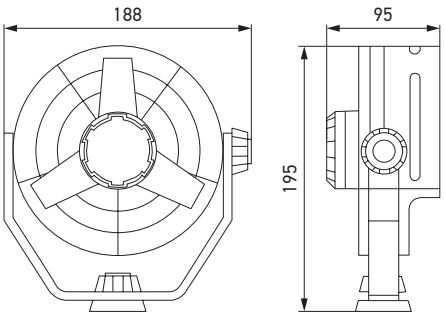
Turbo fans

PRODUCT FEATURES

- → Airflow can be adjusted using a 2-position switch.
- → Can be swivelled to all sides and fixed in any position
- → Propeller shielded by a guard
- → 150 mm propeller
- → Lateral, upright or pendant mounting possible

TECHNICAL DATA	
Connecting cable	1,400 mm
Air flow rate	Level 1: 70 l per second Level 2: 95 l per second
Power consumption	6.5 W

TECHNICAL DRAWING



APPLICATION

The task of a fan is to move air around in a room. Fans are being used more and more frequently and make everyday life or work more bearable, even on the particularly hot days of the year. The moving air automatically creates a cooling, comfortable envioronment for all.

DESIGN AND FUNCTION

The fan operates by pressing air from back to front, which in turn leads to air circulation.

In this way, the cool air can be optimally distributed throughout the room, which means that fans are used especially on warm summer days.

PROGRAM OVERVIEW

Variants	Part number	VPE*
Fan, 12 V, black	**8EV 003 361-001**	1
Fan, 12 V, white	**8EV 003 361-022**	1
Fan, 24 V, black	**8EV 003 361-011**	1

* Packaging unit

Cigarette lighter

PRODUCT FEATURES

- Design for compact installation
- For the operating of auxiliary equipment in cars, commercial vehicles, motor homes and boats

TECHNICAL DATA	
Load-carrying capacity as socket	10 A (12 V), 5 A (24 V)
Connection	Flat connector 6.3 mm
Installation opening	Ø 23.5 mm (8EZ 008 022) Ø 28 mm (8EZ 088 021)

APPLICATION

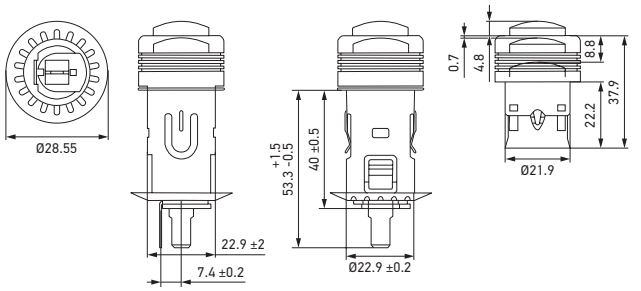
A cigarette lighter is usually installed in a vehicle and is used to light cigarettes. But it is possible to use the interface to the vehicle electrical system not only for cigarette lighters. In the aftermarket, there are practical gadgets that can all be operated using this connection. The selection ranges from superchargers and breakdown aids, such as warning and work lamps, right up to air pumps and fans.

DESIGN AND FUNCTION

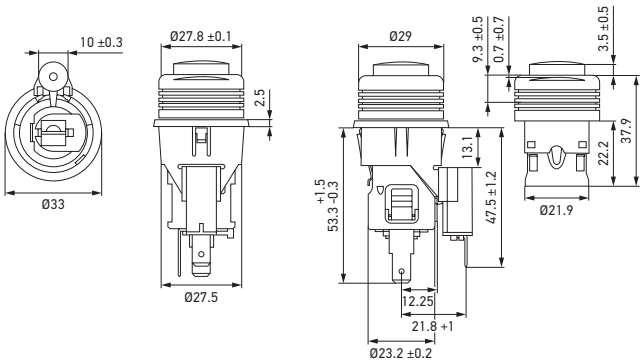
Cigarette lighters consist of a vehicle electrical system socket and an insert (lighter). The positive pole is located in the centre. The housing (or lateral contacts) is connected to the vehicle ground. If you press the button on the back of the lighter, a metal spiral heats up as a result of the large flow of current. This can then be used to light cigarettes, for example.

TECHNICAL DRAWING

8EZ 008 022-00 / -01



8EZ 008 021-00



Power sockets

TECHNICAL DATA	
Load-carrying capacity	max. 15 A at 24 V
Connection	Blade terminal connection 6.3 mm
Installation opening	Ø 28 mm
Console thickness	max. 2.5 mm

TECHNICAL DATA	
Load-carrying capacity	max. 20 A for a cable cross-section of 2.5 mm^2, 15 A for a cable cross-section of 1.5 mm^2
Connection	Blade terminal connection 6.3 mm
Installation opening	Ø 28 mm Inner: Ø 21.0 mm

PROGRAM OVERVIEW

Variants	Mounting	Part number	VPE*
Cigarette lighter			
12 V, green, with lighting	Clamping sleeve	**8EZ 008 021-001**	1
24 V, green, with lighting		**8EZ 008 021-011**	1
12 V, red, without lighting	Hexagon nut	**8EZ 008 021-041**	1
24 V, red, without lighting		**8EZ 008 021-051**	1
12 V, without lighting	Spring washer mounting	**8EZ 008 022-001**	1
24 V, without lighting		**8EZ 008 022-011**	1

Variants	Mounting	Part number	VPE*
Power socket with cover			
12 V, green, with bulb	Clamping sleeve	**8JB 008 023-011**	1
24 V, green, without lighting		**8JB 008 023-001**	1
Power socket with bulb			
12 V, red	Clamping sleeve	**8JB 008 023-021**	1
24 V, red		**8JB 008 023-031**	1
Power socket with bulb			
12 V / 24 V, red, unlit	Clamping sleeve	**8JB 008 023-051**	1
12 V / 24 V, black, unlit		**8JB 008 023-067**	160

* Packaging unit

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