

Product overview

# Electrics & Electronics



# ELECTRONIC MADE FOR INDIVIDUAL CHALLENGES



## Extensive expertise: The broad electronics portfolio from HELLA!

Whether on or off the motorway: there is a suitable technical solution for every requirement. In the field of special original equipment, HELLA offers a comprehensive electronics programme with components in the areas of sensors & actuators, automated driving, lighting and body electronics and energy management - always with the aim of developing this further. That is why HELLA continues to expand its electronics portfolio.

One thing always comes first: no matter how specific your requirements are, HELLA will find an individual solution for you. Our application specialists will also support you in integrating the most recent technologies and functions. The sales, product management and development departments are by your side with your electronics projects - flexibly and always with the technical support required within your product application.



### INFORMATIVE, COMPACT, INTERACTIVE. Information about our electronics range.

Our online information is designed to let you reliably and conveniently identify the latest HELLA products and find out all the important details.

- Product information
- Product videos
- Animations
- Configuration tools for many applications
- Online catalogues

Here you will find everything you need to know about our electronics portfolio.  
[www.hella.com/soe](http://www.hella.com/soe)

This brochure provides a glimpse into the HELLA electronics product range for on-highway and off-highway applications.

	<b>Agricultural machinery</b>		<b>Construction vehicles</b>
	<b>Mining</b>		<b>Trucks and trailers</b>
	<b>City buses and coaches</b>		<b>Municipal vehicles and special vehicles</b>
	<b>Emergency vehicles</b>		<b>Motorhomes</b>
	<b>Motorbikes and quads</b>		<b>E-Mobility</b>
	<b>Some of our products are likewise also relevant for Tier X customers.</b>		<b>Premium Car Solutions</b>
	<b>Marine</b>		<b>Forklifts</b>

### THE ROCKER SWITCH CONFIGURATOR

Your dream switch in just a few steps! With the new rocker switch configurator, you can now put together your individual switch even more easily and in a clearer, more straightforward way!

With just a few clicks, choose between various criteria and accessories for the 3100 or 4100 series - it could not be more convenient!

[www.hella.com/switch](http://www.hella.com/switch)



### THE ELECTRONICS TOOL: SPECIAL ORIGINAL EQUIPMENT

In the field of special original equipment, HELLA offers an extensive range of electronics products for a wide variety of applications.

Our electronics tool informs you quickly and clearly which electronic products HELLA offers for special original equipment.


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. Furthermore, the tool provides clear animations showing how the products work.


















[www.hella.com/electronicstool](http://www.hella.com/electronicstool)







Sensors & actuators




				
Angular position sensors	Level sensors	Oil pressure and temperature sensors	Particulate matter sensors	Rain-light sensors
				
Accelerator pedal sensors	Road condition sensor (RCS / SHAKE)	Linear actuators	Rotatory actuators for high forces	
				
Rotatory actuators for low forces	Intelligent, rotatory actuators for 360° angles	Intelligent, rotatory actuators for high temperatures	Rotatory actuators for high temperatures	
				
Vacuum pumps	AVAS warning system	Horns, electromechanical	Horns, electronic	









Automated driving





77 GHz radar sensor




Lighting & body electronics



				
Relays, flasher units, simulation devices	LED lamp control unit	Control unit for flashing side marker lamps	Rocker switches	Reversing alarm
				
Mirrors	Trailer connection units	Fans		

Energy management



		
Intelligent battery sensors	DC/DC voltage stabilisers	DC/DC voltage converters

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**ENERGY MANAGEMENT**

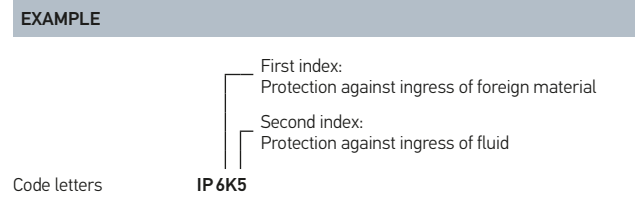
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PRODUCT	PRODUCT DESCRIPTION	PART NUMBER	CORRESPONDING MATING CONNECTORS
Sensors	<b>Intelligent battery sensors</b>		
	24 V, cable lug, straight	<b>6PK 011 700-001 / -007</b>	Hirschmann 872-858-546
	24 V, cable lug, right-angled	<b>6PK 011 700-317 / -311</b>	Hirschmann 872-858-546
	12 V, IBS global	<b>6PK 013 824-001 / -007</b>	Hirschmann 872-857-565
	<b>Particulate matter sensors</b>		
	Particulate matter sensor PM 2.5	<b>On request</b>	Hirschmann 872-858-541 or TE Connectivity 1-1670917-1
	<b>Road condition sensor (RCS /SHAKE)</b>	<b>On request</b>	Hirschmann 872-858-541 or TE Connectivity 1-1670917-1
	<b>Radar sensors</b>		
	Radar sensors 77 GHz	<b>On request</b>	TE Connectivity 1-1703639-1
	<b>Level sensors</b>		
	Recording the liquid level	<b>On request</b>	Hirschmann MLK 872-858-541 (3way 1.2 SealStar)
	<b>Oil pressure and temperature sensors</b>		
	Measuring oil pressure and oil temperature	<b>6PR 010 378-207</b>	Hirschmann 872-858-541 or TE Connectivity 1-1670917-1
	<b>Rain-light sensors</b>		
	Recording environmental properties		
For vehicles with flat windscreens (PWK/VAN)	<b>On request</b>	TE Connectivity 1-1718346-3	
For vehicles with steeply sloped windscreens	<b>On request</b>	AMP C-1718346, coding A	
<b>Angular position sensors</b>			
Double sensors – compact design	<b>6PD 009 583-001 6PD 009 583-011 6PD 009 580-017 6PD 009 584-017</b>	TE Connectivity 1394416-1	
Voltage stabilisers	DC/DC 200 W	<b>On request</b>	TE Connectivity 156333-1
	DC/DC 400 W	<b>8ES 312 331-101</b>	TE Connectivity 1473672-1, 1897519-1
	DC/DC converter 24 V/12 V	<b>On request</b>	Tyco 8-968970-02
Voltage converters	Floor-mounted accelerator pedals	<b>On request</b>	Sumitomo F(6189-1083)
	Suspended accelerator pedals	<b>On request</b>	Sumitomo Denso 6189-1083
Actuators	<b>Rotatory actuators for low forces</b>		
	Electrical locking and unlocking, space-saving, electrical forward and reverse rotation	<b>6NW 011 122-011 / -017</b>	Hirschmann Automotive 3-pin MLK coupling ELA 872-858-541
	Electrical locking/unlocking, space-saving with micro switch, electrical forward and reverse rotation	<b>6NW 011 122-021 / -027</b>	Hirschmann Automotive 3-pin MLK Coupling ELA 872-858-...KA
	Electrical locking/unlocking, space-saving with micro switch, electrical forward and reverse rotation, without locking and operating element	<b>6NW 011 122-031 / -037</b>	
	Electrical locking/unlocking, space-saving with micro switch, electrical forward and reverse rotation, without locking element, with operating element	<b>6NW 011 122-051 / -057</b>	Hirschmann Automotive 3-pin MLK coupling ELA 872-858-...KA
	Electrical locking/unlocking, space-saving with micro switch, electrical forward rotation, reverse rotation via return spring, with soft-touch button	<b>6NW 011 122-041 / -047</b>	Hirschmann Automotive 3-pin MLK coupling ELA 872-858-541

PRODUCT	PRODUCT DESCRIPTION	PART NUMBER	CORRESPONDING MATING CONNECTORS
Actuators	<b>Linear actuators</b>		
		<b>6NW 009 203-607</b>	TE Connectivity 1355390-1
		<b>6NW 009 203-411 / -417</b>	TE Connectivity 1355390-1
	Electrical locking/unlocking and closing, electrical retraction and extension	<b>6NW 009 203-627 6NW 009 203-637</b>	TE Connectivity 282080-1
		<b>6NW 009 203-461 / -467</b>	TE Connectivity 1355390-1
	Electrical locking/unlocking and closing, electrical retraction, extension with mainspring	<b>6NW 009 203-471 / -477</b>	TE Connectivity 282080-1
		<b>6NW 009 203-491 / -497</b>	TE Connectivity 1355390-1
	Electrical locking/unlocking and closing, electrical extension, retraction with mainspring	<b>6NW 009 203-501</b>	TE Connectivity 282080-1
	<b>Rotatory actuators for high forces</b>		
	Electrical locking/unlocking and closing, electrical rotation left, reset via spring to right	<b>6NW 009 424-781</b>	TE Connectivity AMP C1355390
	Electrical locking/unlocking and closing, electrical rotation right and left	<b>6NW 009 424-791</b>	
	Electrical locking/unlocking and closing, electrical rotation right and left, without shaft, pulley and metal clip	<b>6NW 009 424-777</b>	TE Connectivity AMP C1355390
	<b>Intelligent, rotatory actuators for 360° angles</b>		
	Electrical locking/unlocking and closing, electrical rotation left, right, with high torque, precise position control using CIPOS® technology	<b>6NW 011 303-717</b>	TE Connectivity 1-1456426-1, coding A
	<b>Intelligent, rotatory actuators for high temperatures</b>	<b>On request</b>	Kostal, 09 4415 82, coding B
Vacuum pumps	UP 28 with relay box	<b>8TG 008 570-021 / -027</b>	Kostal, 09 4016-30
	UP 28 with engine compartment connector	<b>8TG 009 428-081 / -087</b>	Yazaki 2.8, 7283-5575-10
	UP 5.0 with engine compartment connector	<b>8TG 012 377-701 / -707</b>	Yazaki Sealed: 7282-5575-10 With cable seal: 7158-3113-40 With coupling: 7117-4152-02
Acoustic warning system	<b>AVAS pedestrian warning system for vehicles</b>	<b>3SL 015 329-007</b>	Tyco 1-967616-1
LED lamp control unit	<b>Basic variant</b>		
	12 V	<b>5DS 227 488-001</b>	Amphenol AT06-6S
	24 V	<b>5DS 227 488-101</b>	
	<b>Premium variant</b>		
12 V (1 stop light channel)	<b>5DS 227 489-001</b>	OUT, B coding: Amphenol AT06-08SB	
12 V (2 stop light channels)	<b>5DS 227 489-011</b>	IN, A coding: Amphenol AT06-08SA	
24 V (1 stop light channel)	<b>5DS 227 489-101</b>	6-pin: Amphenol AT06-06S	



IP stands for International Protection. The IP protection classes are determined according to 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 selecting the right components so that these meet the relevant requirements of your application.



PROTECTION CLASSES AGAINST THE PENETRATION OF SOLID FOREIGN MATERIAL (DUST)			PROTECTION CLASSES 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 material > 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 material > 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 material > 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 material > 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 that would cause damaging effects if the housing is temporarily immersed in water under defined time and pressure conditions
			8	Exposure to water during continuous immersion	Ingress of water is not to occur in a quantity that would 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



Angular position sensors

**PRODUCT FEATURES**

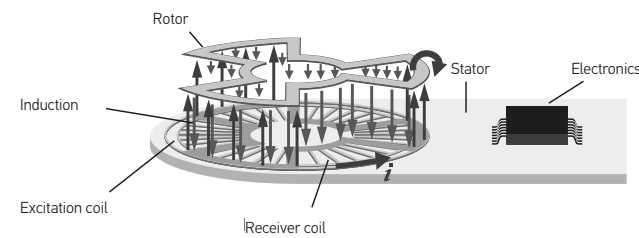
- High precision thanks to internal 14 bit resolution
- High temperature stability and linearity
- Highly insensitive to magnetic fields
- Zero position can be individually programmed
- Various connecting elements available
- Two-channel solutions possible for safety-critical applications

**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.

The redundant sensors (double sensors) enable failure detection and thus provide a higher level of safety for the complete system.

**DESIGN AND FUNCTION**

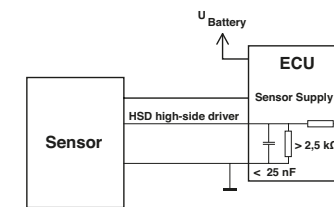


Inside the laser-welded housing made of polyamide PA66, the lever arm torque above the rotor is determined via the induction method. An ASIC (Application Specific Integrated Circuit) calculates the rotor position precisely. Various installation positions are possible via the repetitive characteristic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

**OUTPUT SIGNAL**

**ANALOGUE**

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. For a 5 V supply, 2.7 kΩ to 10 kΩ must be selected for example. 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.

**PROGRAM OVERVIEW**

Mechanical connection	Angle range	Supply voltage	Output signal	Zero position	Lever arm	Part number	PU*	Page
<b>Double sensors</b>								
Bush	- 30° to + 30°	5 V or 9-32 V	0.5-4.5 V ratiometric / absolute	0° / 120° / 240°	50 mm	6PD 009 583-001	-	12
Bush	- 54 to + 54°	5 V or 9-32 V	0.5-4.5 V ratiometric / absolute	0° / 120° / 240°	50 mm	6PD 009 583-011	-	14
Bush	- 54 to + 54°	5 V or 9-32 V	0.5-4.5 V ratiometric / absolute	0° / 120° / 240°	70 mm	6PD 009 580-017	-	16
Ball, top	- 54 to + 54°	5 V or 9-32 V	0.5-4.5 V ratiometric / absolute	0° / 120° / 240°	90 mm	6PD 009 584-017	-	18

\* Packaging unit



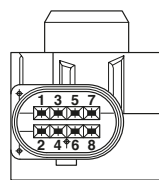
Angular position sensors  
 Double sensors (redundant angle measurement for safety-critical applications)  
**Part number 6PD 009 583-001**

**TECHNICAL DATA**

Angle range	- 30° to + 30°
Mechanical angle range	Unlimited (full 360° rotation)
Supply voltage	5 V ± 10 % or 9 - 32 V
"Crossed Scale" output signal	
Power supply	U <sub>s</sub> 5 V
	Output U <sub>out1</sub> 0.5–4.5 V ratiometric
	Output U <sub>out2</sub> 4.5–0.5 V ratiometric
Power supply	U <sub>s</sub> 9–32 V
	Output U <sub>out1</sub> 0.5–4.5 V
	Output U <sub>out2</sub> 4.5–0.5 V
Resolution	0.06°
Linearity error including temperature drift	±0.3°
Current consumption	< 15 mA
Max. current (analogue output)	< 2 mA
Housing type	B
Zero position	0° / 120° / 240°
Lever arm	50 mm, bush
Degree of protection	IP 6K9K
Operating temperature	-40°C to +85°C
Lifetime	5 million cycles
Polarity reversal protection	None, mechanical protection only
Mating connector <sup>1)</sup>	1394416-1
Pin coating	Sn

<sup>1)</sup> This accessory is not included in the scope of delivery. Available from TE Connectivity.

**PIN ASSIGNMENT**



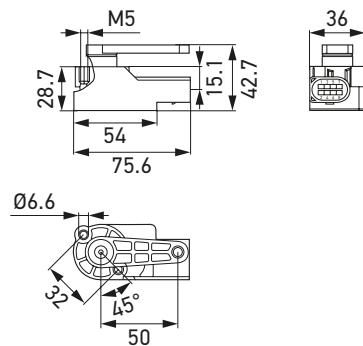
**Power supply with 5 V DC<sup>2)</sup>**  
 Pin 1: 5 V DC sensor 2  
 Pin 2: Output U<sub>out1</sub> 0.5–4.5 V ratiometric  
 Pin 3: Not assigned  
 Pin 4: 5 V DC sensor 1  
 Pin 5: Output U<sub>out2</sub> 4.5–0.5 V ratiometric  
 Pin 6: Not assigned  
 Pin 7: Ground sensor 2  
 Pin 8: Ground sensor 1

<sup>2)</sup> The power supply (Pin 1 and Pin 4) and the ground supply (Pin 7 and Pin 8) can be bridged externally (e.g. in the mating connector) to reduce the number of cables.

**Power supply with 9–32 V DC<sup>3)</sup>**  
 Pin 1: Bridge to Pin 4 (external)  
 Pin 2: Output U<sub>out1</sub> 0.5–4.5 V  
 Pin 3: 9–32 V DC sensor 1 and 2  
 Pin 4: Bridge to Pin 1 (external)  
 Pin 5: Output U<sub>out2</sub> 4.5–0.5 V  
 Pin 6: Not assigned  
 Pin 7: Ground sensor 2  
 Pin 8: Ground sensor 1

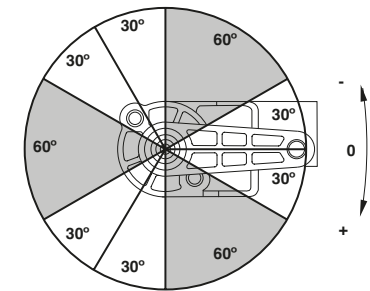
<sup>3)</sup> Pin 1 and Pin 4 must be bridged externally (e.g. in the mating connector). The ground supply lines (Pin 7 and Pin 8) can be bridged externally (e.g. in the mating connector) to reduce the number of cables.

**TECHNICAL DRAWING**

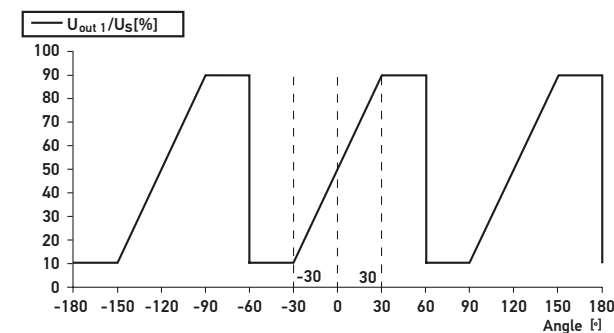


**CHARACTERISTIC CURVE OF THE ANGULAR POSITION SENSOR**

The characteristic curve of the angular position sensor repeats itself every 120°. This results in freedom for the mounting of the position shown but also to be staggered at a multiple of 120°. This will not affect the behaviour of the connected system in any way. The measuring angle range is 60°. If it is exceeded by up to 30°, the output signal remains limited to the measuring range final value. If exceeded further, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions can be seen on the graphic representation. The segments of the circle shown in grey represent the angle range that cannot be measured.

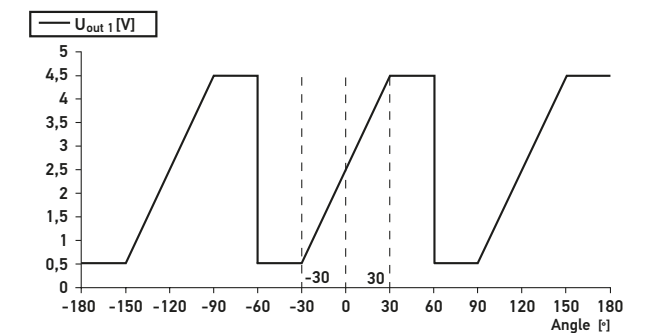


**Ratiometric output signal U<sub>out1</sub> with 5 V power supply**



Output signal U<sub>out2</sub> = 100% - U<sub>out1</sub>/U<sub>s</sub> [%] (opposite characteristic curves)

**Absolute output signal U<sub>out1</sub> with 9–32 V power supply**



Output signal U<sub>out2</sub> = 5 V - U<sub>out1</sub> [V] (opposite curve)





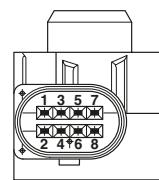
Angular position sensors  
 Double sensors (redundant angle measurement for safety-critical applications)  
**Part number 6PD 009 583-011**

**TECHNICAL DATA**

Angle range	- 54° to + 54°
Mechanical angle range	Unlimited (full 360° rotation)
Supply voltage	U <sub>s</sub> 5 V ± 10% or 9 – 32 V
"Crossed Scale" output signal	
Power supply	U <sub>s</sub> 5 V Output U <sub>out1</sub> 0.5 – 4.5 V ratiometric Output U <sub>out2</sub> 4.5 – 0.5 V ratiometric
Power supply	U <sub>s</sub> 9 – 32 V Output U <sub>out1</sub> 0.5 – 4.5 V Output U <sub>out2</sub> 4.5 – 0.5 V
Resolution	0.06°
Linearity error including temperature drift	± 0.3°
Current consumption	< 15 mA
Max. current (analogue output)	< 2 mA
Housing type	B
Zero position	0° / 120° / 240°
Lever arm	50 mm, bush
Degree of protection	IP 6K9K
Operating temperature	- 40°C to + 85°C
Lifetime	5 million cycles
Polarity reversal protection	None, mechanical protection only
Mating connector <sup>1)</sup>	1394416-1
Pin coating	Sn

<sup>1)</sup> This accessory is not included in the scope of delivery. Available from TE Connectivity.

**PIN ASSIGNMENT**



**Power supply with 5 V DC<sup>2)</sup>**  
 Pin 1: 5 V DC sensor 2  
 Pin 2: Output U<sub>out1</sub> 0.5 – 4.5 V ratiometric  
 Pin 3: Not assigned  
 Pin 4: 5 V DC sensor 1  
 Pin 5: Output U<sub>out2</sub> 4.5 – 0.5 V ratiometric  
 Pin 6: Not assigned  
 Pin 7: Ground sensor 2  
 Pin 8: Ground sensor 1

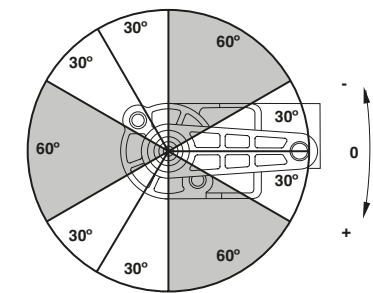
<sup>2)</sup> The power supply (Pin 1 and Pin 4) and the ground supply (Pin 7 and Pin 8) can be bridged externally (e.g. in the mating connector) to reduce the number of cables.

**Power supply with 9 – 32 V DC<sup>3)</sup>**  
 Pin 1: Bridge to Pin 4 (external)  
 Pin 2: Output U<sub>out1</sub> 0.5 – 4.5 V  
 Pin 3: 9 – 32 V DC sensor 1 and 2  
 Pin 4: Bridge to Pin 1 (external)  
 Pin 5: Output U<sub>out2</sub> 4.5 – 0.5 V  
 Pin 6: Not assigned  
 Pin 7: Ground sensor 2  
 Pin 8: Ground sensor 1

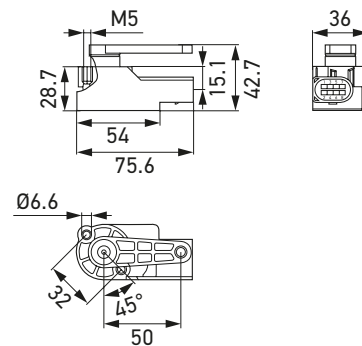
<sup>3)</sup> Pin 1 and Pin 4 must be bridged externally (e.g. in the mating connector). The ground supply lines (Pin 7 and Pin 8) can be bridged externally (e.g. in the mating connector) to reduce the number of cables.

**CHARACTERISTIC CURVE OF THE ANGULAR POSITION SENSOR**

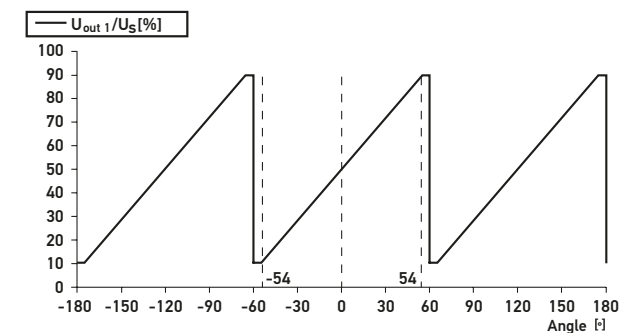
The characteristic curve of the angular position sensor repeats itself every 120°. This results in freedom for the mounting of the position shown but also to be staggered at a multiple of 120°. This will not affect the behaviour of the connected system in any way. The measuring angle range is 108°. If it is exceeded by up to 6°, the output signal remains limited to the measuring range final value. If exceeded further, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions can be seen on the graphic representation. The segments of the circle shown in grey represent the angle range that cannot be measured.



**TECHNICAL DRAWING**

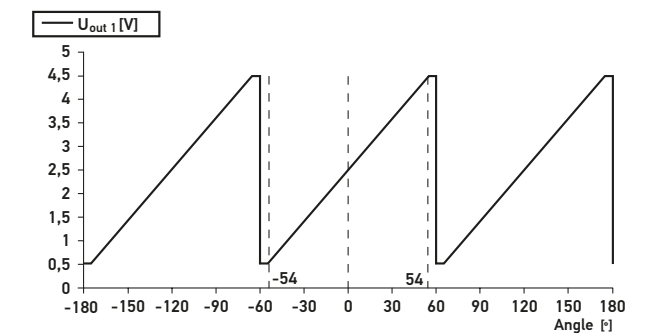


**Ratiometric output signal U<sub>out1</sub> with 5 V power supply**



Output signal U<sub>out2</sub> = 100% – U<sub>out1</sub>/U<sub>s</sub> [%] (opposite characteristic curves)

**Absolute output signal U<sub>out1</sub> with 9 – 32 V power supply**



Output signal U<sub>out2</sub> = 5 V – U<sub>out1</sub> [V] (opposite curve)



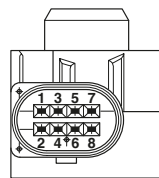
Angular position sensors  
 Double sensors (redundant angle measurement for safety-critical applications)  
**Part number 6PD 009 580-017**

**TECHNICAL DATA**

Angle range	- 54° to + 54°
Mechanical angle range	Unlimited (full 360° rotation)
Supply voltage	U <sub>s</sub> 5 V ± 10% or 9–32 V
"Crossed Scale" output signal	
Power supply	U <sub>s</sub> 5 V
	Output U <sub>out1</sub> 0.5–4.5 V ratiometric
	Output U <sub>out2</sub> 4.5–0.5 V ratiometric
Power supply	U <sub>s</sub> 9–32 V
	Output U <sub>out1</sub> 0.5–4.5 V
	Output U <sub>out2</sub> 4.5–0.5 V
Resolution	0.06°
Linearity error including temperature drift	± 0.3°
Current consumption	< 15 mA
Max. current (analogue output)	< 2 mA
Housing type	B
Zero position	0° / 120° / 240°
Lever arm	70 mm, bush
Degree of protection	IP 6K9K
Operating temperature	-40°C to +85°C
Lifetime	5 million cycles
Polarity reversal protection	None, mechanical protection only
Mating connector <sup>1)</sup>	1394416-1
Pin coating	Sn

<sup>1)</sup> This accessory is not included in the scope of delivery. Available from TE Connectivity.

**PIN ASSIGNMENT**



**Power supply with 5 V DC<sup>2)</sup>**

- Pin 1: 5 V DC sensor 2
- Pin 2: Output U<sub>out1</sub> 0.5–4.5 V ratiometric
- Pin 3: Not assigned
- Pin 4: 5 V DC sensor 1
- Pin 5: Output U<sub>out2</sub> 4.5–0.5 V ratiometric
- Pin 6: Not assigned
- Pin 7: Ground sensor 2
- Pin 8: Ground sensor 1

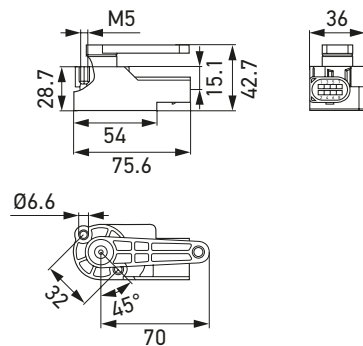
<sup>2)</sup> The power supply (Pin 1 and Pin 4) and the ground supply (Pin 7 and Pin 8) can be bridged externally (e.g. in the mating connector) to reduce the number of cables.

**Power supply with 9–32 V DC<sup>3)</sup>**

- Pin 1: Bridge to Pin 4 (external)
- Pin 2: Output U<sub>out1</sub> 0.5–4.5 V
- Pin 3: 9–32 V DC sensor 1 and 2
- Pin 4: Bridge to Pin 1 (external)
- Pin 5: Output U<sub>out2</sub> 4.5–0.5 V
- Pin 6: Not assigned
- Pin 7: Ground sensor 2
- Pin 8: Ground sensor 1

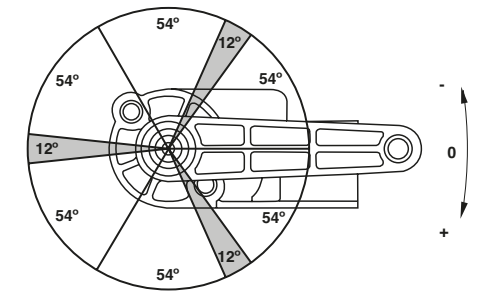
<sup>3)</sup> Pin 1 and Pin 4 must be bridged externally (e.g. in the mating connector). The ground supply lines (Pin 7 and Pin 8) can be bridged externally (e.g. in the mating connector) to reduce the number of cables.

**TECHNICAL DRAWING**

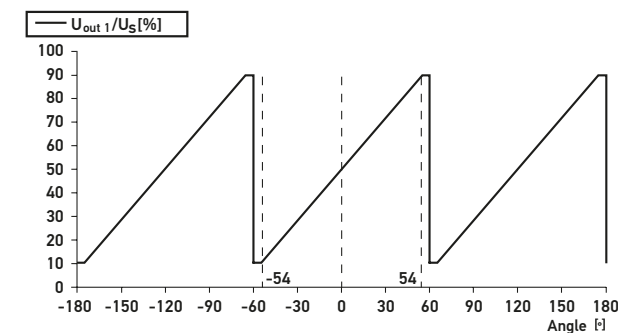


**CHARACTERISTIC CURVE OF THE ANGULAR POSITION SENSOR**

The characteristic curve of the angular position sensor repeats itself every 120°. This results in freedom for the mounting of the sensor, which enables it to be placed not only in the position shown but also to be staggered at a multiple of 120°. 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 exceeded further, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions can be seen on the graphic representation. The segments of the circle shown in grey represent the angle range that cannot be measured.

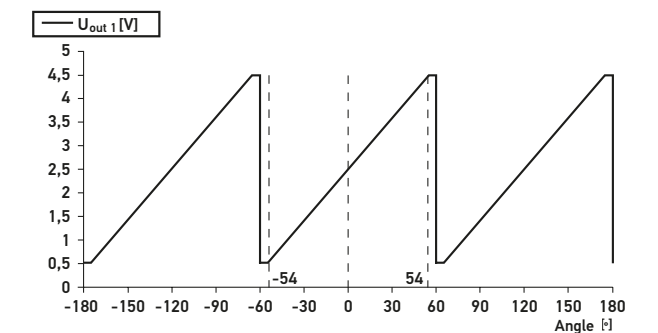


**Ratiometric output signal U<sub>out1</sub> with 5 V power supply**



Output signal U<sub>out2</sub> = 100% - U<sub>out1</sub>/U<sub>s</sub> [%] (opposite characteristic curves)

**Absolute output signal U<sub>out1</sub> with 9 to 32 V power supply**



Output signal U<sub>out2</sub> = 5 V - U<sub>out1</sub> [V] (opposite curve)



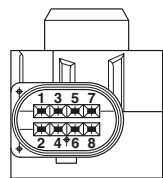
Angular position sensors  
 Double sensors (redundant angle measurement for safety-critical applications)  
**Part number 6PD 009 584-017**

**TECHNICAL DATA**

Angle range	- 54° to + 54°
Mechanical angle range	Unlimited (full 360° rotation)
Supply voltage	U <sub>s</sub> 5 V ± 10% or 9–32 V
"Crossed Scale" output signal	
Power supply	U <sub>s</sub> 5 V
	Output U <sub>out1</sub> 0.5–4.5 V ratiometric
	Output U <sub>out2</sub> 4.5–0.5 V ratiometric
Power supply	U <sub>s</sub> 9–32 V
	Output U <sub>out1</sub> 0.5–4.5 V
	Output U <sub>out2</sub> 4.5–0.5 V
Resolution	0.06°
Linearity error including temperature drift	± 0.3°
Current consumption	< 15 mA
Max. current (analogue output)	< 2 mA
Housing type	B
Zero position	0° / 120° / 240°
Lever arm	90 mm, ball, top
Degree of protection	IP 6K9K
Operating temperature	- 40°C to + 85°C
Lifetime	5 million cycles
Polarity reversal protection	None, mechanical protection only
Mating connector <sup>1)</sup>	1394416-1
Pin coating	Sn

<sup>1)</sup> This accessory is not included in the scope of delivery. Available from TE Connectivity.

**PIN ASSIGNMENT**



**Power supply with 5 V DC<sup>2)</sup>**

- Pin 1: 5 V DC sensor 2
- Pin 2: Output U<sub>out1</sub> 0.5–4.5 V ratiometric
- Pin 3: Not assigned
- Pin 4: 5 V DC sensor 1
- Pin 5: Output U<sub>out2</sub> 4.5–0.5 V ratiometric
- Pin 6: Not assigned
- Pin 7: Ground sensor 2
- Pin 8: Ground sensor 1

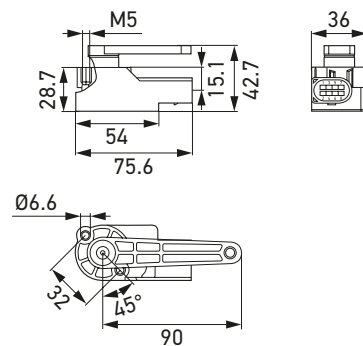
<sup>2)</sup> The power supply (Pin 1 and Pin 4) and the ground supply (Pin 7 and Pin 8) can be bridged externally (e.g. in the mating connector) to reduce the number of cables.

**Power supply with 9–32 V DC<sup>3)</sup>**

- Pin 1: Bridge to Pin 4 (external)
- Pin 2: Output U<sub>out1</sub> 0.5–4.5 V
- Pin 3: 9–32 V DC sensor 1 and 2
- Pin 4: Bridge to Pin 1 (external)
- Pin 5: Output U<sub>out2</sub> 4.5–0.5 V
- Pin 6: Not assigned
- Pin 7: Ground sensor 2
- Pin 8: Ground sensor 1

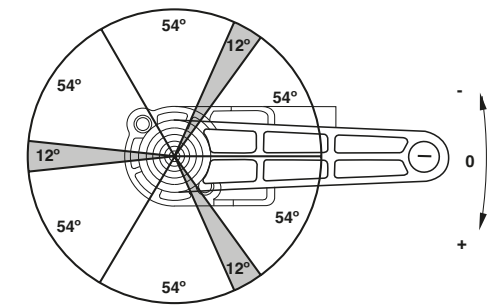
<sup>3)</sup> Pin 1 and Pin 4 must be bridged externally (e.g. in the mating connector). The ground supply lines (Pin 7 and Pin 8) can be bridged externally (e.g. in the mating connector) to reduce the number of cables.

**TECHNICAL DRAWING**

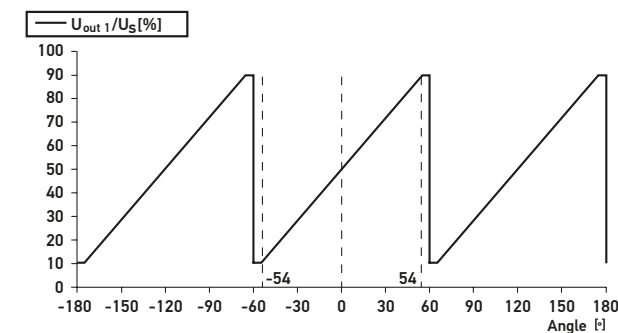


**CHARACTERISTIC CURVE OF THE ANGULAR POSITION SENSOR**

The characteristic curve of the angular position sensor repeats itself every 120°. This results in freedom for the mounting of the sensor, which enables it to be placed not only in the position shown but also to be staggered at a multiple of 120°. 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 exceeded further, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions can be seen on the graphic representation. The segments of the circle shown in grey represent the angle range that cannot be measured.

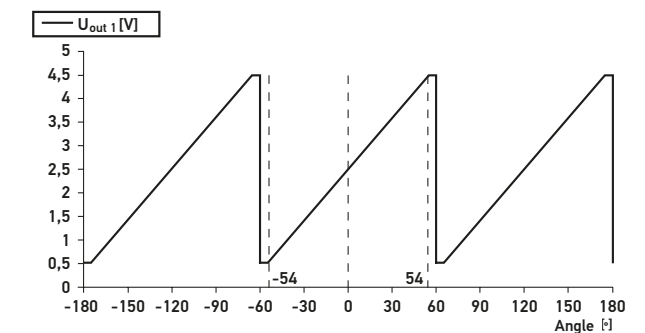


**Ratiometric output signal U<sub>out1</sub> with 5 V power supply**



Output signal U<sub>out2</sub> = 100% - U<sub>out1</sub> / U<sub>s</sub> [%] (opposite characteristic curves)

**Absolute output signal U<sub>out1</sub> with 9 to 32 V power supply**

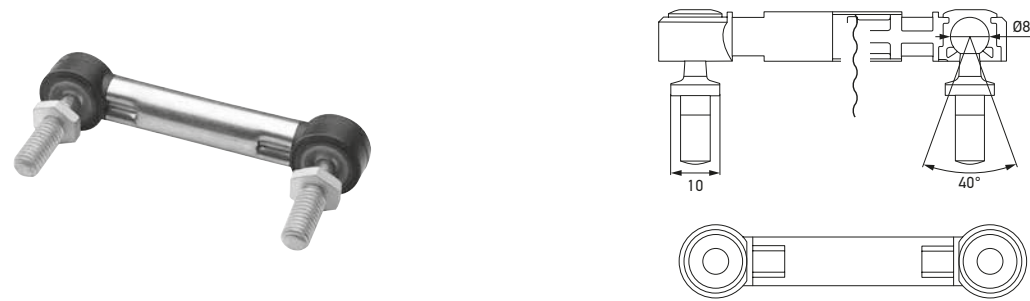


Output signal U<sub>out2</sub> = 5 V - U<sub>out1</sub> [V] (opposite curve)

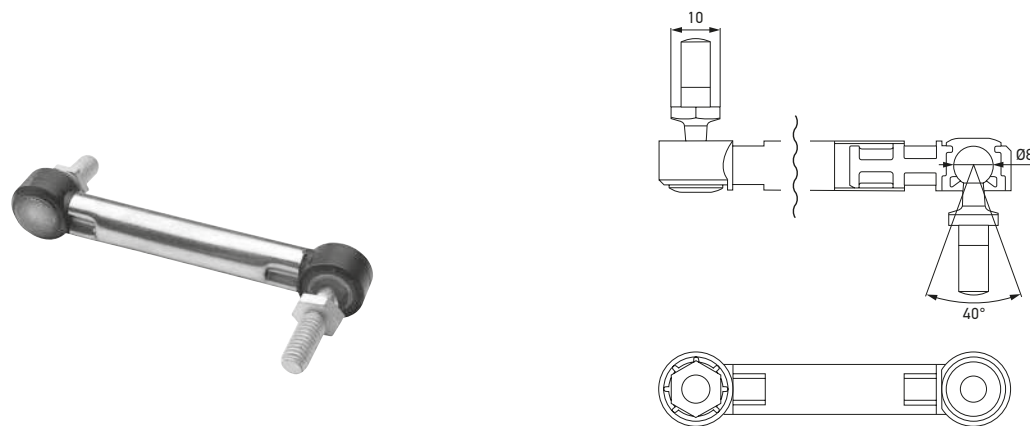


Angular position sensors  
Connecting elements

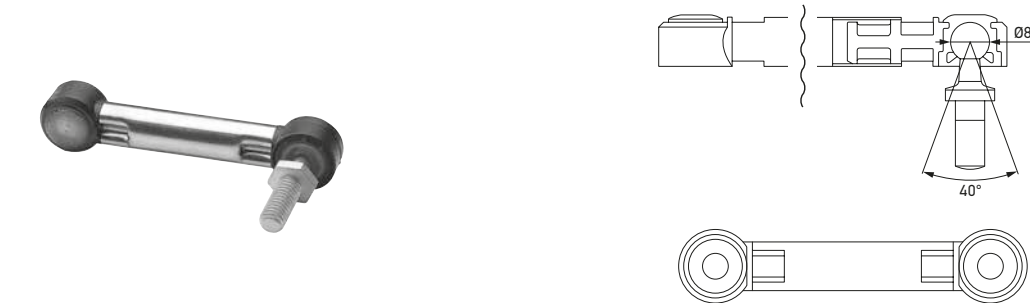
CONNECTING ELEMENT WITH TWO BALL HEAD SCREWS



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



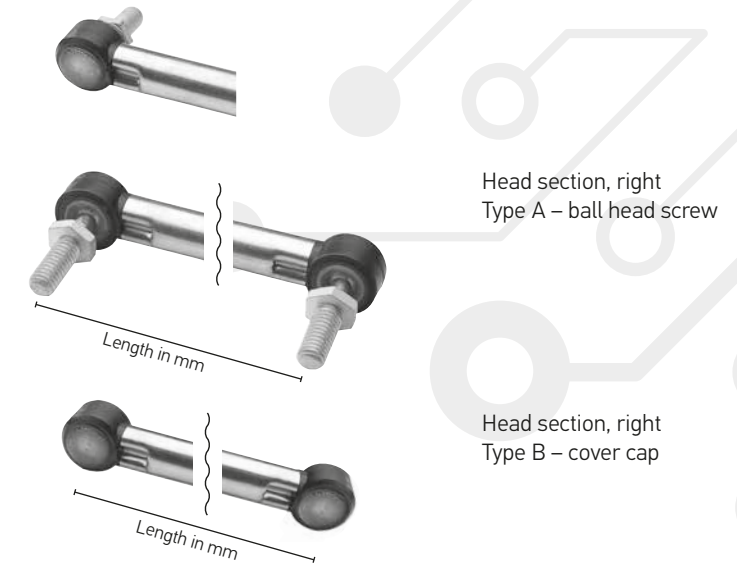
CONNECTING ELEMENT WITH A COVER CAP AND A BALL HEAD SCREW



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

Head section, left  
Type A – ball head screw

Head section, left  
Type B – cover cap



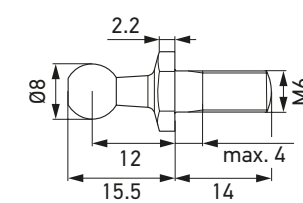
PROGRAM OVERVIEW

Head section, left	Rotation	Length of connecting element	Head section, right	Part number	PU*
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	9XX 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



Level sensors  
Recording the liquid level  
(static and dynamic)

**PRODUCT FEATURES**

- Fourth generation level sensors: Revision in terms of 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.

Using the oil level sensor for measuring special media, e.g. transmission and hydraulic oils, requires prior inspection 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.

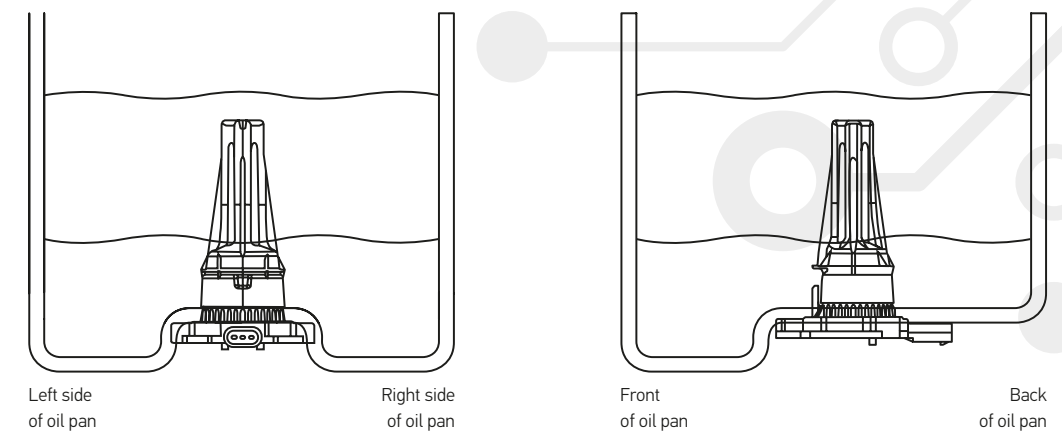
The term of the signal is measured and the height is calculated in line with the sound velocity in the medium. The damping cup installed above the multi-chip module is designed "to calm" the medium, (especially) in the dynamic measuring range. The damping cup has openings at the base and at the tip,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

**INSTALLATION**

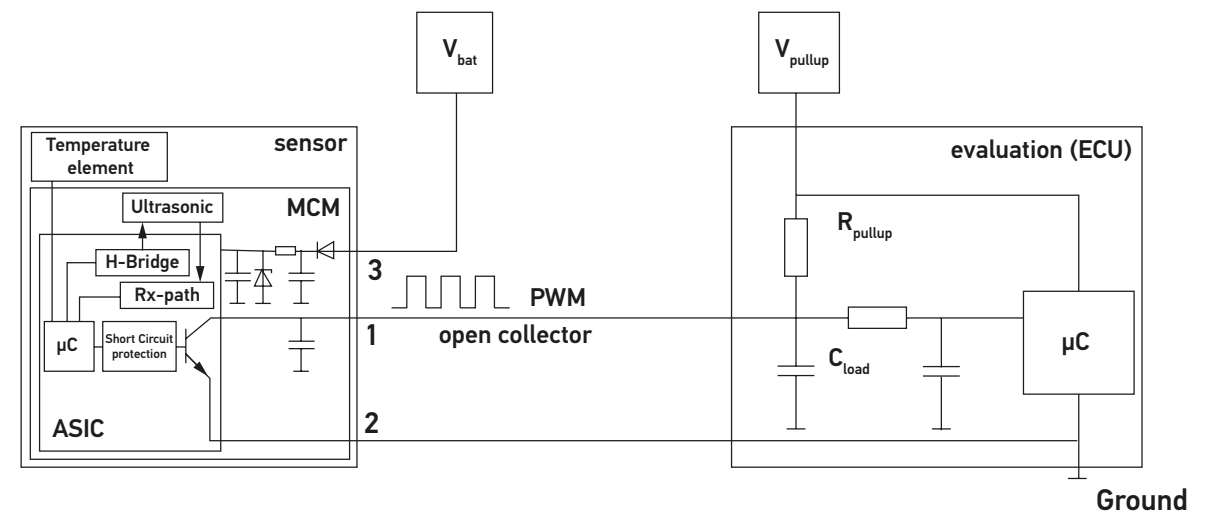
The sensor is designed to be vertically flush-mounted from below into the bottom of an oil pan. Usually the oil level sensor is located on a ledge in the oil pan in order to protect the sensor base. This installation position, combined with the openings which make a permanent flow of oil possible, prevents 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	PU*	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	–	24–27
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	–	–
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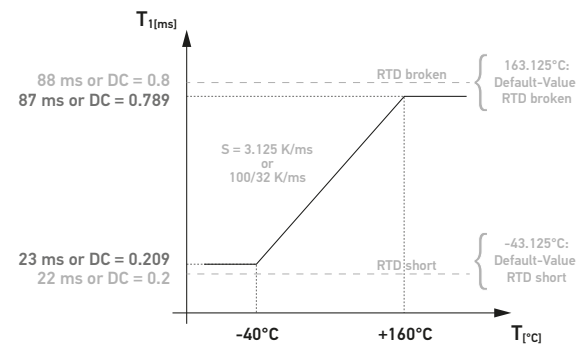
\*\* Whenever the sensor is remounted, a new sealing ring must be used. This is available from HELLA.

\* Packaging unit



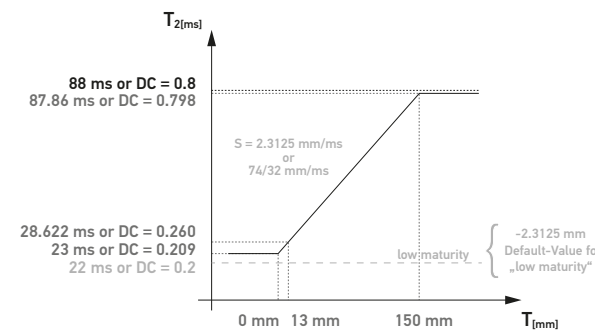
Level sensors  
Recording the liquid level  
(static and dynamic)

**T<sub>1</sub>: TEMPERATURE EVALUATION (T<sub>1</sub> TEMP)**



T<sub>1</sub>/T = DC = 0.2 : T<sub>1</sub> = 22 ms => short-circuit temperature sensor (-43.125 °C)  
 T<sub>1</sub>/T = DC = 0.209 : T<sub>1</sub> = 23 ms => -40 °C  
 T<sub>1</sub>/T = DC = 0.789 : T<sub>1</sub> = 87 ms => 160 °C  
 T<sub>1</sub>/T = DC = 0.8 : T<sub>1</sub> = 88 ms => temperature sensor defective (163.125 °C)

**T<sub>2</sub>: LEVEL EVALUATION (T<sub>2</sub> LEVEL)**



T<sub>2</sub>/T = DC = 0.2 : T<sub>2</sub> = 22 ms => unreliable signal (level output -2.3125 mm)  
 T<sub>2</sub>/T = DC = 0.209 : T<sub>2</sub> = 23 ms => level = 0 mm  
 T<sub>2</sub>/T = DC = 0.260 : T<sub>2</sub> = 28.622 ms => level = 13 mm  
 T<sub>2</sub>/T = DC = 0.798 : T<sub>2</sub> = 87.86 ms => level = 150 mm  
 For levels below 13 mm or above 150 mm, T<sub>2</sub> is fixed at 28.622 ms or alternatively at 87.86 ms.

**T<sub>3</sub>: DIAGNOSIS EVALUATION**

PWM Pulse (Diagnostic values marked in bold print)			Diagnostic information	Diagnostics of environmental conditions	Diagnostics of sensor failure	Transmission priority of diagnostics (Signal with the highest priority is transmitted)
Temp. T <sub>1</sub>	Level T <sub>2</sub>	Diagnostics T <sub>3</sub>				
23...87 ms	23 to 87.86 ms	<b>22 ms</b>	Status OK			5
23...87 ms	<b>28.62 ms</b> (13 mm)	<b>66 ms</b>	Level outside the range (<13 mm)	X		4
23...87 ms	<b>87.86 ms</b> (150 mm)	<b>66 ms</b>	Level outside the range (>150 mm)	X		4
≤ 10 °C 23 to 32.6 ms	<b>22 ms</b> (-2.3125 mm)	<b>66 ms</b>	Temperature outside the range for level measurement	X		4
≤ 10 °C 23 to 32.6 ms	<b>22 ms</b> (-2.3125 mm)	<b>66 ms</b>	Level outside the range (noise)	X		4
<b>22 ms</b> (-43.125°C)	<b>22 ms</b> (-2.3125 mm)	<b>55 ms</b>	<b>Temperature element short-circuited</b>		X	1
<b>23 ms</b> (-40 °C)	<b>22 ms</b> (-2.3125 mm)	<b>55 ms</b>	Temperature outside the range (low)	X		1
<b>87 ms</b> (-160 °C)	<b>22 ms</b> (-2.3125 mm)	<b>55 ms</b>	Temperature outside the range (high)	X		1
<b>88 ms</b> (-163.125 °C)	<b>22 ms</b> (-2.3125 mm)	<b>55 ms</b>	<b>Temperature element broken</b>		X	1
32.6...87 ms	<b>22 ms</b> (-2.3125 mm)	<b>44 ms</b>	<b>Piezoceramics open/short-circuited</b>		X	3
32.6...87 ms	<b>22 ms</b> (-2.3125 mm)	<b>33 ms</b>	Voltage outside the range	X		2

T<sub>3</sub>/T = DC  
 DC = 0.2, 0.3, 0.4, 0.5 or 0.6

**CONVERSION FORMULAS IN THE CONTROL UNIT**

$$\text{Temp}_{\text{comp}} [^{\circ}\text{C}] = 3.125 \frac{\text{K}}{\text{ms}} \cdot \left( T_1 \cdot \frac{110 \text{ ms}}{T[\text{ms}]} - 23 \text{ ms} \right) - 40 \text{ K}$$

or

$$\text{Temp}_{\text{comp}} [^{\circ}\text{C}] = \frac{100}{32} \frac{\text{K}}{\text{ms}} \cdot \left( T_1 \cdot \frac{110 \text{ ms}}{T[\text{ms}]} - 23 \text{ ms} \right) - 40 \text{ K}$$

$$\text{diagnostic}[\text{ms}] = T_3[\text{ms}]$$

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

or

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

or

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

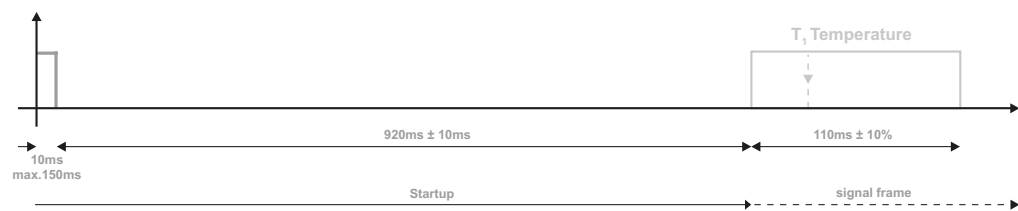
**OUTPUT CHARACTERISTICS**

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 <sub>ol</sub>	-	-	0.0375 x V <sub>pullup</sub> + 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 <sup>1)</sup>	V <sub>oh</sub>	V <sub>pullup</sub> - 0.5 V	-	-	V	Open circuit with output capacity = 1nF (Under external capacitive load, please observe the slew rate)
Pull-up voltage	V <sub>pullup</sub>	-	-	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 <sub>ol</sub>	-	-	10	mA	For V <sub>ol</sub> > 0.0375 x V <sub>pullup</sub> + 1 V
Output current at high level	I <sub>oh</sub>	-50	0	50	μA	For GND < V <sub>oh</sub> < V <sub>pullup</sub>
PWM open collector resistor <sup>2)</sup>	R <sub>pullup</sub>	1.6	-	10	kOhm	To be implemented in the engine control unit
Capacitive load <sup>3)</sup>	C <sub>load</sub>	-	-	50	nF	
Output current - short-circuit detection	I <sub>ol_SHORT</sub>	65	-	-	mA	

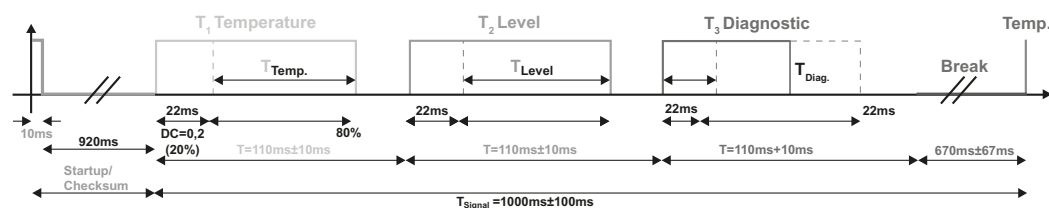
<sup>1)</sup> Open collector with output capacitance = 1nF (with external capacitive load, please observe slew rate).  
<sup>2)</sup> To be implemented in the on-board computer.  
<sup>3)</sup> Capacitive load at pulse communication output.

**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 <sup>1)</sup>
Operating temperature	-40°C to +160 °C
Operating temperature (for oil level measurement) <sup>1)</sup>	-10 °C to +150 °C
Re-heating 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 <sup>2)</sup>	PWM
Mating connector <sup>3)</sup>	MLK 872-858-541 (3way 1.2 SealStar)
Degree of protection	IP 6K9K
Weight	Variant-dependent
Viscosities	1 mm <sup>2</sup> /s to 1,300 mm <sup>2</sup> /s

<sup>1)</sup> Dependent on damping cup length (see variant overview)  
<sup>2)</sup> Level output over -10 °C. At temperatures below -10 °C, an "empty" signal is sent (18 mm) together with the diagnostic signal "out of tolerance".  
<sup>3)</sup> This accessory is 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.

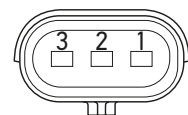
**Tolerance of level measurement**

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

**Temperature measurement tolerance**

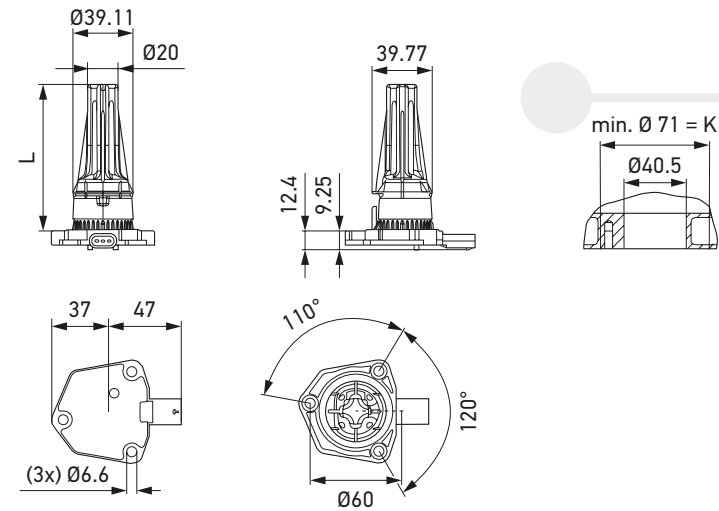
Oil level	Temperature range	Operating voltage	Tolerance
All	60 °C ≤ T < 120 °C	6–16 V	±2 K

**PIN ASSIGNMENT/ELECTRICAL CONNECTION**



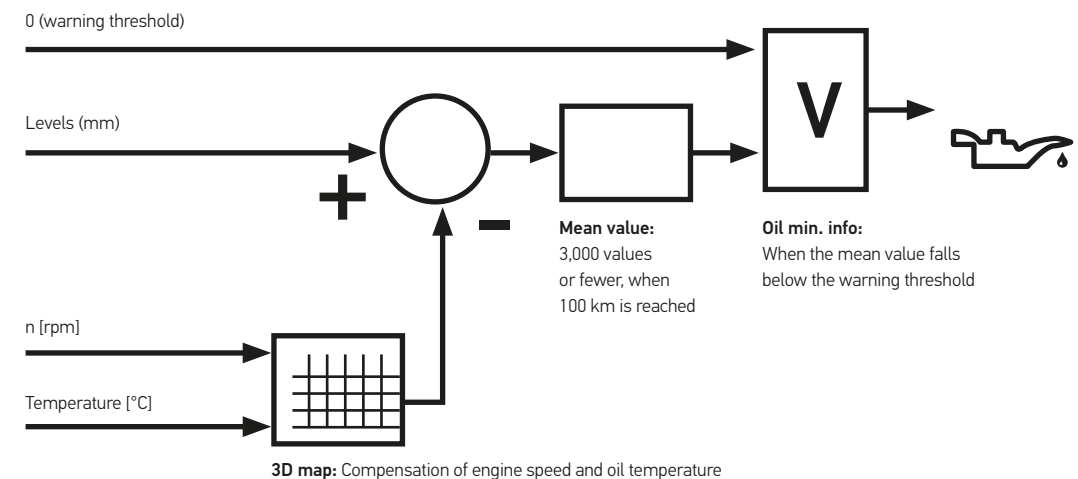
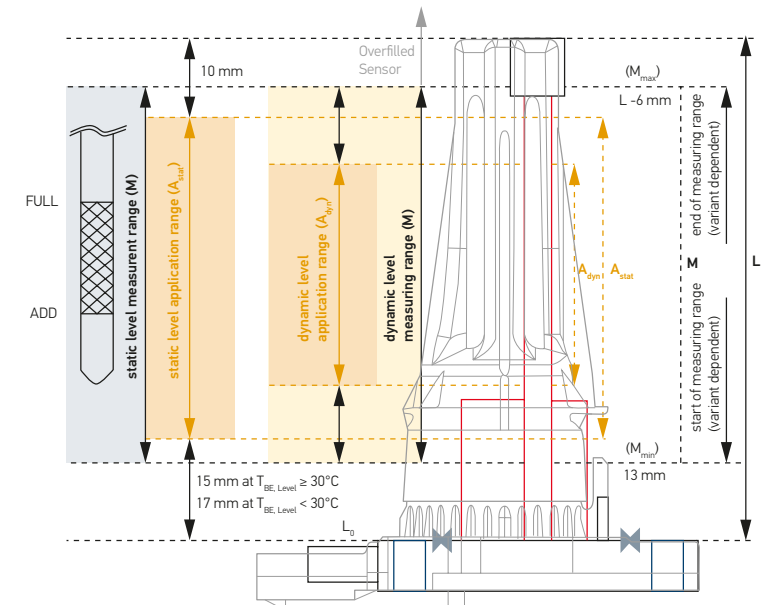
Pin 1: OUTPUT  
Pin 2: TML 31 GND  
Pin 3: KL 15 U<sub>BAT</sub>

**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.





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

**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.

**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.

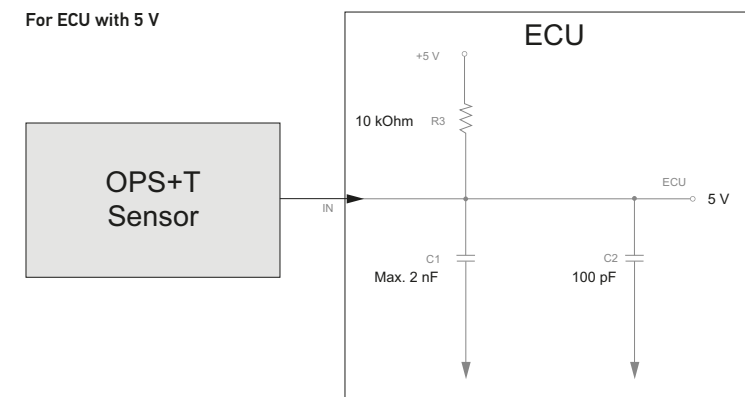
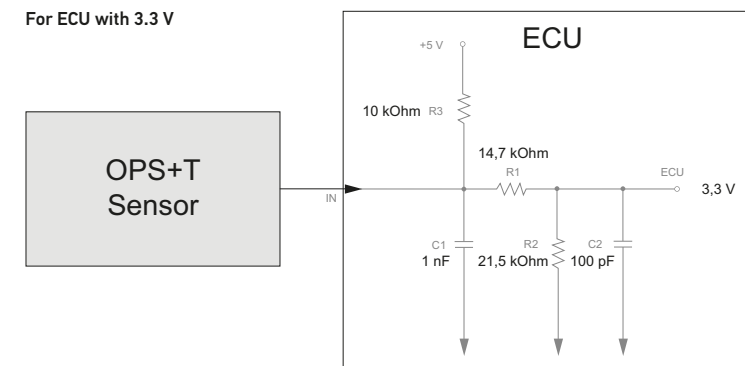
It uses the pressure value to carry out demand-responsive control of mechanical or electrical oil pumps. This lowers the CO<sub>2</sub> emissions and reduces fuel consumption. Recording of the temperature serves as input data for the thermal management of the engine. Both signals are evaluated in the higher-level control unit.

Using the multi-chip module means the sensor can be utilised in harsh environments.

**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.



**PROGRAM OVERVIEW**

Mounting	Supply voltage	Measuring range	Part number	PU*
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 010 378-201/207	1/120

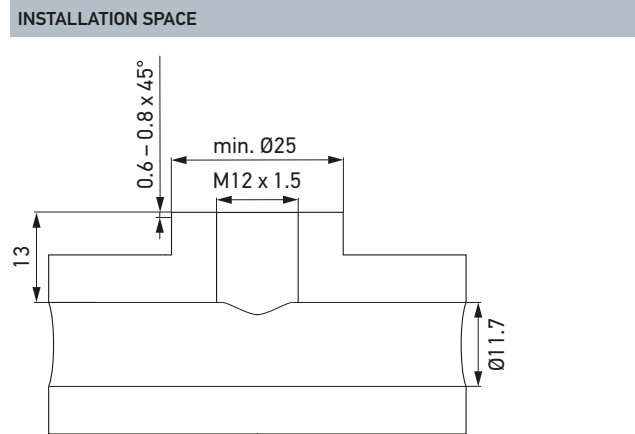
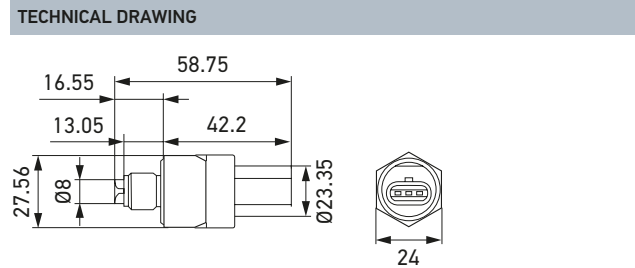
\* Packaging unit



Level sensors  
Measuring oil pressure and oil temperature  
**6PR 010 378-207**

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 to 10.5 bar
Temperature measuring range	-40°C to +160 °C
Degree of protection	IP 69K
Mating connector <sup>1)</sup>	Hirschmann 872-858-541 or TE Connectivity 1-1670917-1

<sup>1)</sup> This accessory is not included in the scope of delivery.  
Available from Hirschmann Automotive or TE Connectivity.

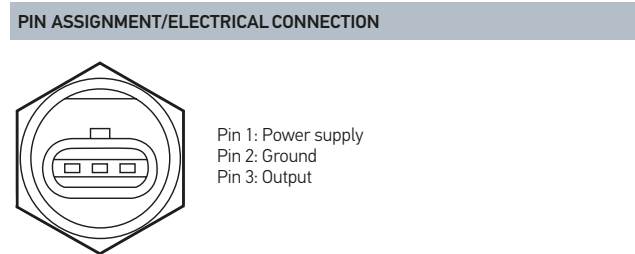


**TOLERANCE BAND FOR PRESSURE MEASUREMENT**

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**

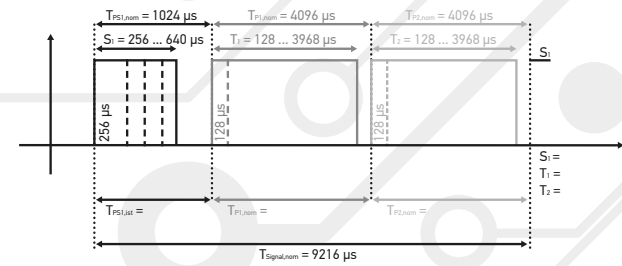
Temperature	Accuracy
135 °C to 160 °C	± 1 K
20 °C to 135 °C	± 2 K
-40°C to 20 °C	± 3 K



**OUTPUT SIGNAL**

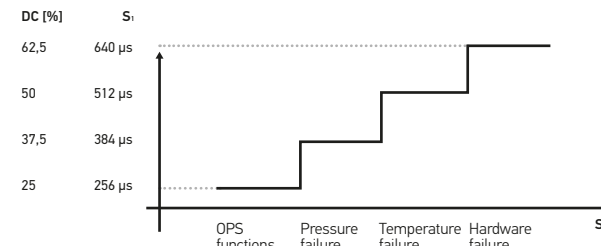
A pulse width modulated signal (PWM) is used to provide temperature, pressure and diagnostic information. All the information is sent every 9,216 µs. The higher-level control unit must be able to measure the different pulse widths of the three square wave signals, which can vary from 128 µs to 3,958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



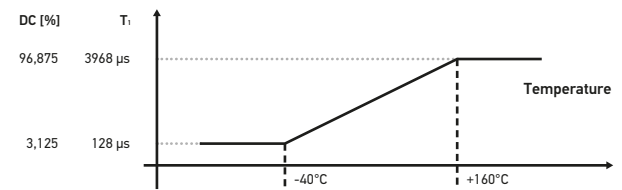
S<sub>1</sub>: Signal  
T<sub>1</sub>: Temperature  
T<sub>2</sub>: Pressure

**S<sub>1</sub>: DIAGNOSTIC SIGNAL**



DC = 0.25 (S<sub>1</sub> = 256 µs ± 25 µs) => OPS functional state  
DC = 0.375 (S<sub>1</sub> = 384 µs ± 25 µs) => pressure failure  
DC = 0.5 (S<sub>1</sub> = 512 µs ± 25 µs) => temperature failure  
DC = 0.625 (S<sub>1</sub> = 640 µs ± 25 µs) => hardware failure

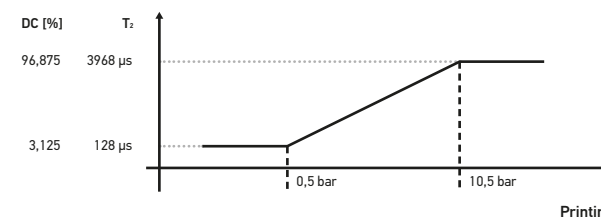
**T<sub>1</sub>: TEMPERATURE EVALUATION**



96.9 % of the PWM block duration T1 (3968 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.

$$T_{1|\mu s} = 19.2 \frac{\mu s}{^\circ C} \cdot \text{Temp} + 896 \mu s$$

**T<sub>2</sub>: PRESSURE EVALUATION(T<sub>2</sub> LEVEL)**



96.9 % of the PWM block duration T2 (3968 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.

$$T_{2|\mu s} = 384 \frac{\mu s}{\text{bar}} \cdot \text{Pressure} - 64 \mu s$$

**ECU CALCULATION**

$$\text{Temperature} = \left( \frac{4096 \mu s}{T_{P1,adj \mu s}} \cdot T_{1|\mu s} - 128 \mu s \right) \cdot \frac{1}{19.2} \frac{^\circ C}{\mu s} - 40 \text{ } ^\circ C$$

$$\text{Pressure} = \left( \frac{4096 \mu s}{T_{P1,adj \mu s}} \cdot T_{2|\mu s} - 128 \mu s \right) \cdot \frac{1}{384} \frac{\text{bar}}{\mu s} + 0.5 \text{ bar}$$

$$\text{Diagnostics} = \left( \frac{1024 \mu s}{T_{P1,adj \mu s}} \cdot S_{1|\mu s} \right)$$





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 fine dust particles using light scattering: When air flows through the detection chamber, the particles pass a laser beam that is scattered by 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.

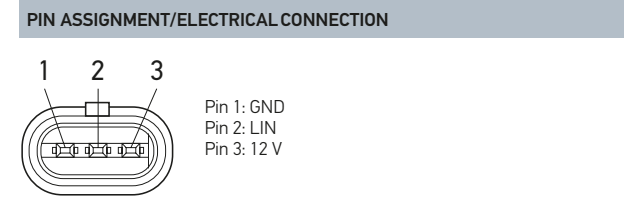
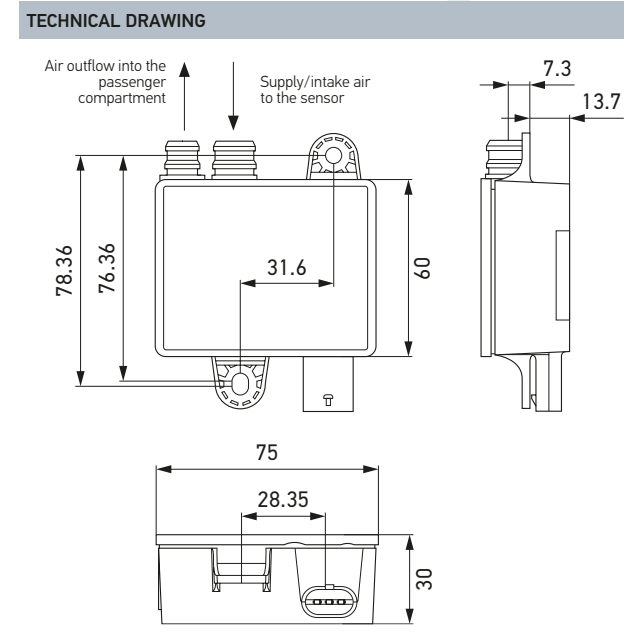
If two sensors are used, both the indoor and outdoor air quality can be monitored. This provides the user with additional benefits such as an automatic air recirculation function or a demand-oriented display of a filter service as required.

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)
Degree of protection	IP 5K4K
Noise development	≤ 40 dB(A) at 0.5 m distance
Measuring range (inside/outside)	5 to 1,000 µg/m <sup>3</sup>
Particle size <sup>1)</sup>	0.3 µm to 5 µm
Response time	≤ 5 s
Resolution	1 µg/m <sup>3</sup>
Tolerances	5 µg/m <sup>3</sup> : with 5 to 50 µg/m <sup>3</sup> +10 %: for > 50 to 1,000 µg/m <sup>3</sup> 10 µg/m <sup>3</sup> : with 10 to 50 µg/m <sup>3</sup> 20 %: for > 50 to 1,000 µg/m <sup>3</sup>
Mating connector <sup>2)</sup>	Hirschmann 872-858-541 or TE Connectivity 1-1670917-1
Weight	< 150 g

<sup>1)</sup> The air must be pre-filtered for particles > 50 µm and water droplets.

<sup>2)</sup> This accessory is not included in the scope of delivery. Available from Hirschmann Automotive or TE Connectivity.



**PROGRAM OVERVIEW**

Variants	Part number	PU*
Particulate matter sensor PM 2.5	<b>On request</b>	-

\* Packaging unit



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 and moisture measurements and also adjustment of the light intensity on the head-up display
- Optimised design – extremely compact package 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 the driver to react and manually operate the wiper lever in rain or the light switch in darkness (tunnels, garages, twilight).

With 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 be equipped with an optional 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.

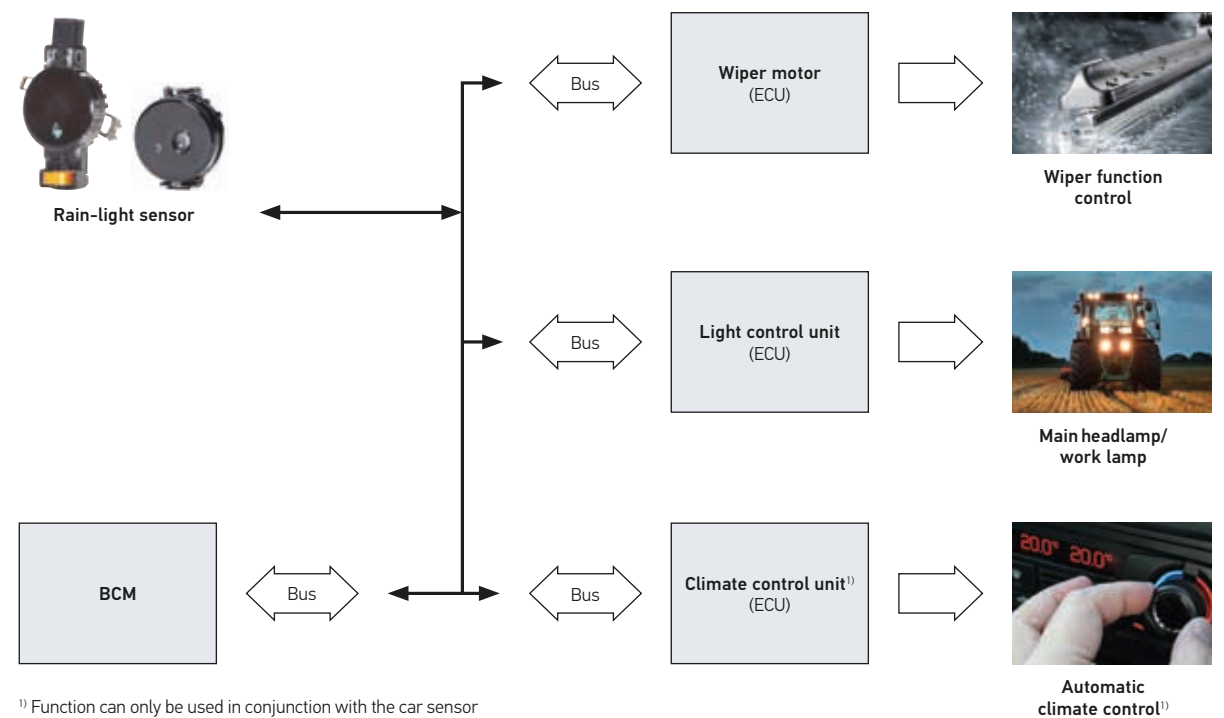
**Solar sensor**

As a solar sensor, it measures insolation levels, which supports the climate control system.

**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**



**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	PU*	Page
Passenger cars	4 – 6 mm	20° – 36°	On request	–	36
Passenger cars (van)	4 – 6 mm	37° – 54°	On request	–	
Vehicles with steeply sloping windscreens	6 – 9 mm	80° – 90°	On request	–	38

\* 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
Degree of protection	IP 50
Protection class (in the area of fogging sensors)	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 <sup>1)</sup>	1-1718346-3
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	20° – 36° resp. 37° – 54°
Permitted curvature radius in the area of the sensor	r => 1,400 mm
Diameter of printed section	28 ± 0.2 mm

<sup>1)</sup> This accessory is not included in the scope of delivery. Available from TE Connectivity. The connector coding is variant-specific.

TECHNICAL DRAWING

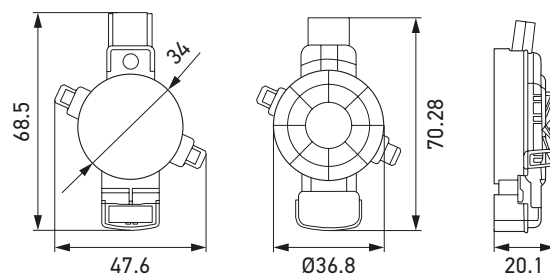
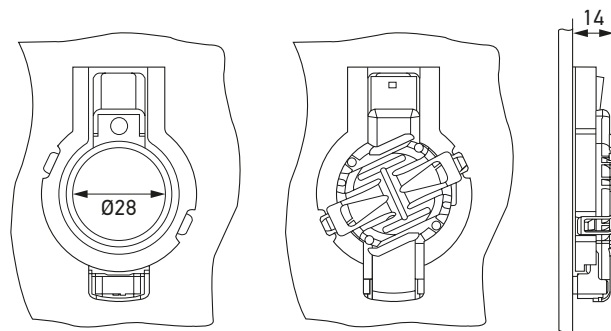


ILLUSTRATION TO SHOW MOUNTING ON WINDSCREEN



PIN ASSIGNMENT/ELECTRICAL CONNECTION



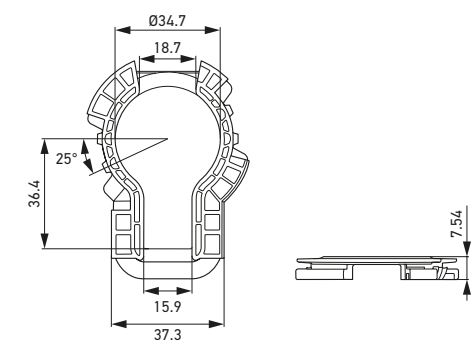
Rain-light sensors  
Bracket

Accessories<sup>1)</sup>

PART NUMBER		PU <sup>2)</sup>
9XD 420 747-601	For mounting with 3M adhesive tape Plastic	1
9XD 420 747-501	For mounting with PUR liquid adhesive Plastic	1



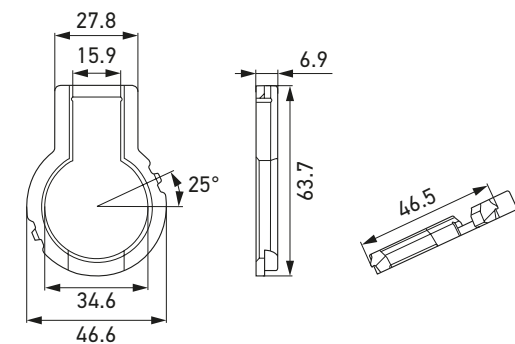
TECHNICAL DRAWING



PART NUMBER		PU <sup>2)</sup>
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



<sup>1)</sup> This accessory is not included in the scope of delivery.  
<sup>2)</sup> Packaging unit

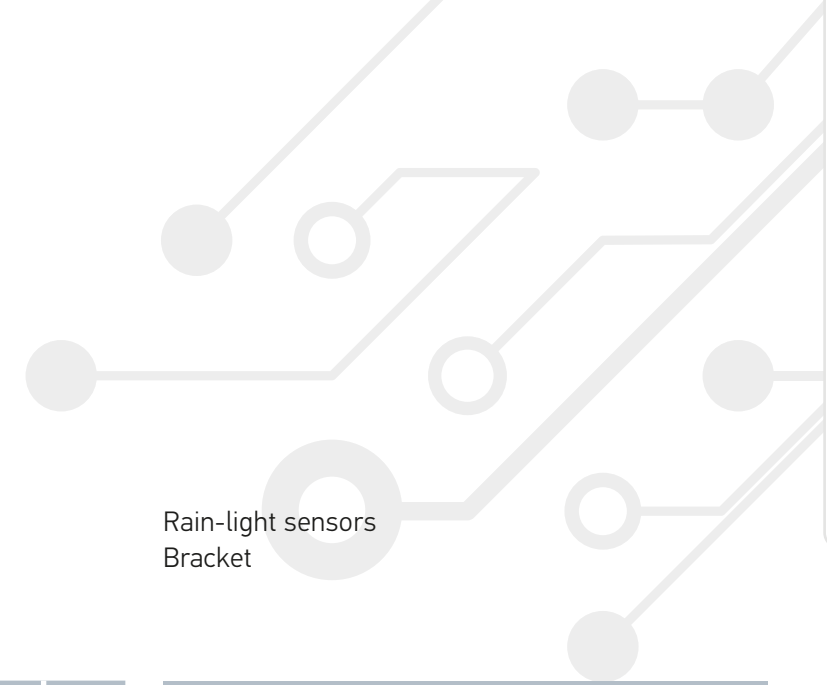
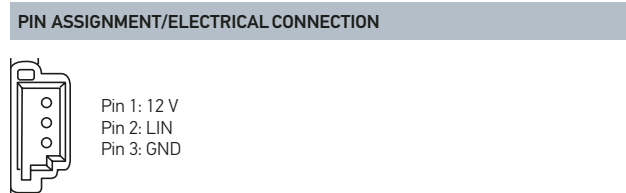
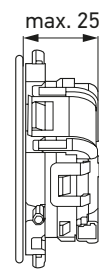
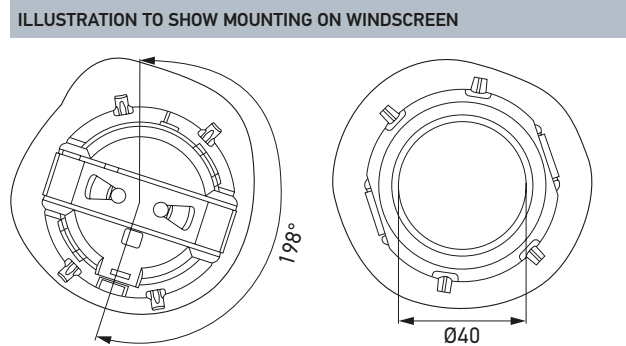
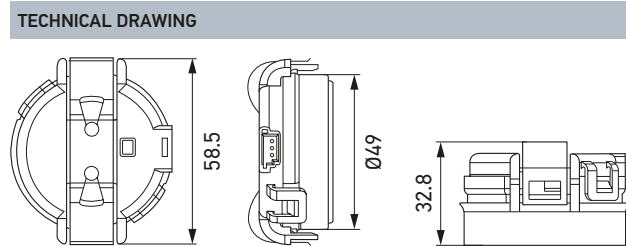


Rain-light sensors  
for vehicles with steeply sloping windscreens  
Recording environmental properties  
**On request**

TECHNICAL DATA	
Operating temperature	-40°C to +85 °C
Storage temperature	-40°C to +100 °C
Degree of protection	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 <sup>1)</sup>	AMP C-1718346, coding A
Windscreen requirements <sup>2)</sup>	
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 curvature radius in the area of the sensor	$r \Rightarrow 1,400$ mm
Diameter of printed section	40 ± 0.2 mm

<sup>1)</sup> This accessory is not included in the scope of delivery.  
Available from TE Connectivity.

<sup>2)</sup> Other windscreen configurations available on request.



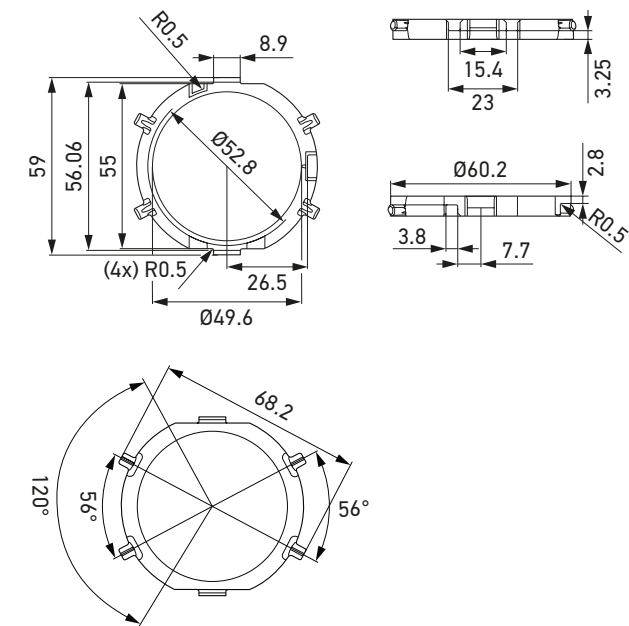
Rain-light sensors  
Bracket

**Accessories<sup>1)</sup>**

PART NUMBER	PU <sup>1)</sup>
9XD 420 696-104 For mounting with PUR liquid adhesive Sintered metal	1



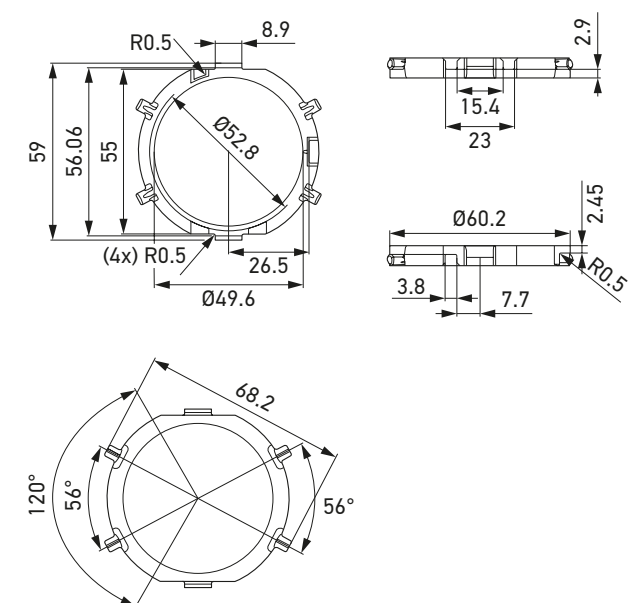
**TECHNICAL DRAWING**



PART NUMBER	PU <sup>1)</sup>
9XD 420 696-001 For mounting with 3M adhesive tape Sintered metal	1



**TECHNICAL DRAWING**



<sup>1)</sup> This accessory is not included in the scope of delivery.  
<sup>2)</sup> Packaging unit



Rain-light sensors  
Bracket

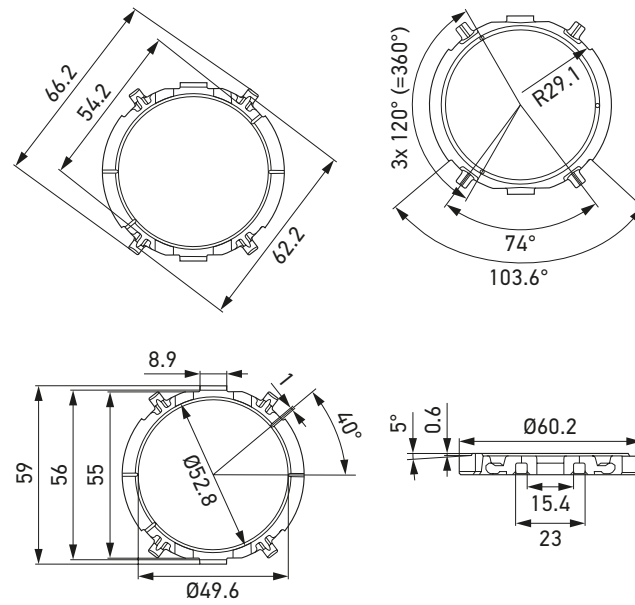
Accessories

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



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

TECHNICAL DRAWING



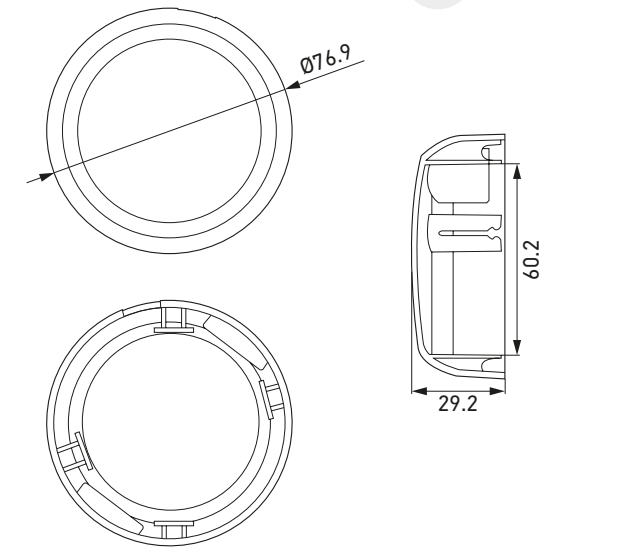
Rain-light sensors  
Cover

Accessories

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



TECHNICAL DRAWING



\* Packaging unit

\* Packaging unit



Floor-mounted accelerator pedals



Floor-mounted accelerator pedals  
On request

**PRODUCT FEATURES**

- Contactless measuring principle
- Slim yet sturdy design
- Simple mechanical connection
- Redundant output signal
- High measurement accuracy
- 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**

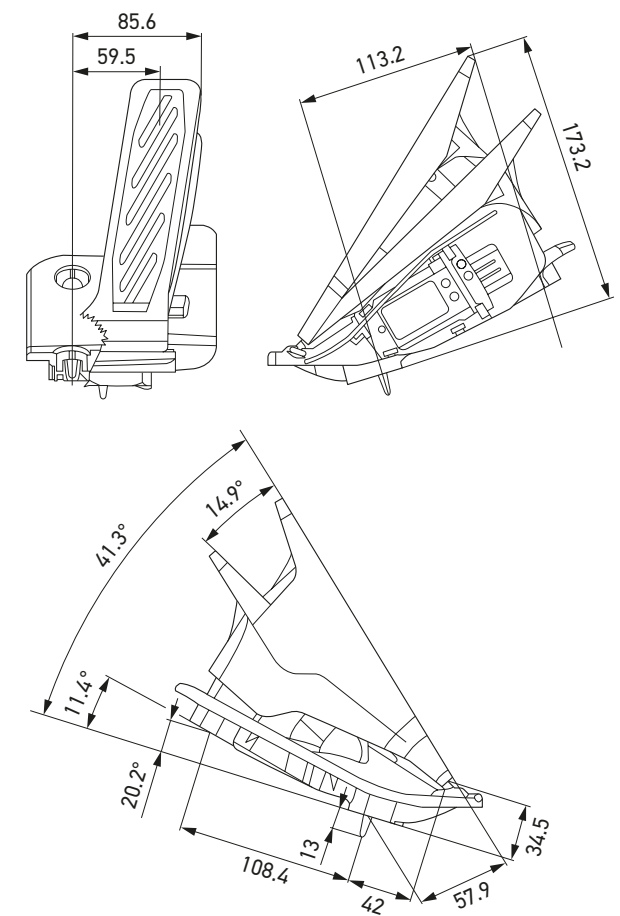
HELLA accelerator pedals designed for upright or pendant mounting can be used in a wide variety of vehicles – ranging from automotive sector applications, such as sports cars and electric vehicles, to robust applications in agricultural and construction vehicles. Thanks to the contactless system of measurement 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.

**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 <sup>1)</sup>	F(6189-1083)
Weight	≤ 500 g
Actuations	min. 2 million
EMV	CISPR 25, class 5, electric and magnetic fields
ESD	2 kV, 12 kV <sup>2)</sup>

<sup>1)</sup> This accessory is not included in the scope of delivery. Available from Sumitomo. Gold-plated contacts and single conductor insulation are required.  
<sup>2)</sup> With ESD-protected connector and wiring

**TECHNICAL DRAWING**



**PROGRAM OVERVIEW**

Accelerator pedal material	Part number	PU*
Plastic	On request	-

\* Packaging unit

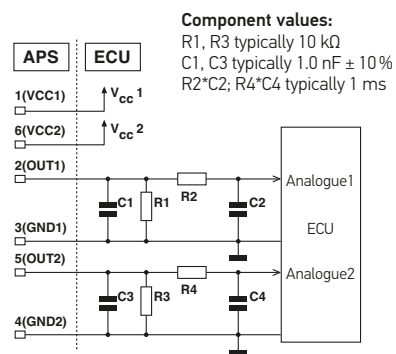


Floor-mounted accelerator pedals

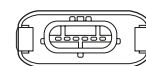


Suspended accelerator pedals

RECOMMENDED WIRING IN THE CONTROL UNIT



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

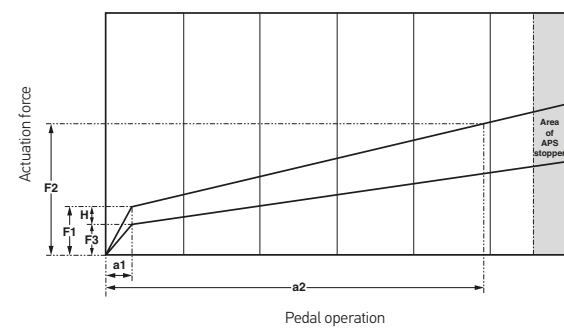
PRODUCT FEATURES

- Contactless measurement
- Slim yet sturdy design
- Simple mechanical connection
- Redundant output signal
- High measurement accuracy
- 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.

MECHANICAL CHARACTERISTIC CURVE



ELECTRICAL CHARACTERISTIC CURVE



RATED VALUES

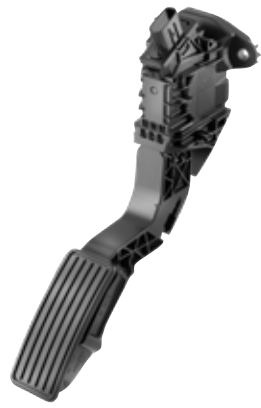
F1	Initial force	Newton (N)	15.5 ± 3.5
F2	Final force	Newton (N)	31 ± 4
F3	Restoring force	Newton (N)	> 5
H	Force hysteresis	Newton (N)	> 6
a1	Start angle	Degrees (°)	< 0.7
a2	End angle	Degrees (°)	14.9 ± 0.9

RATED VALUES

P1.1	Idling voltage S1	Percent (%)	16 ± 0.6
P2.1	Idling voltage S2	Percent (%)	8 ± 0.6
P1.2	Full throttle voltage S1	Percent (%)	78.8 ± 1
P2.2	Full throttle voltage S2	Percent (%)	39.4 ± 1
P1 <sub>max</sub>	Maximum voltage S1	Percent (%)	91 ± 1
P2 <sub>max</sub>	Maximum voltage S2	Percent (%)	45.5 ± 1
b1	Full throttle angle	Degrees (°)	14

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.



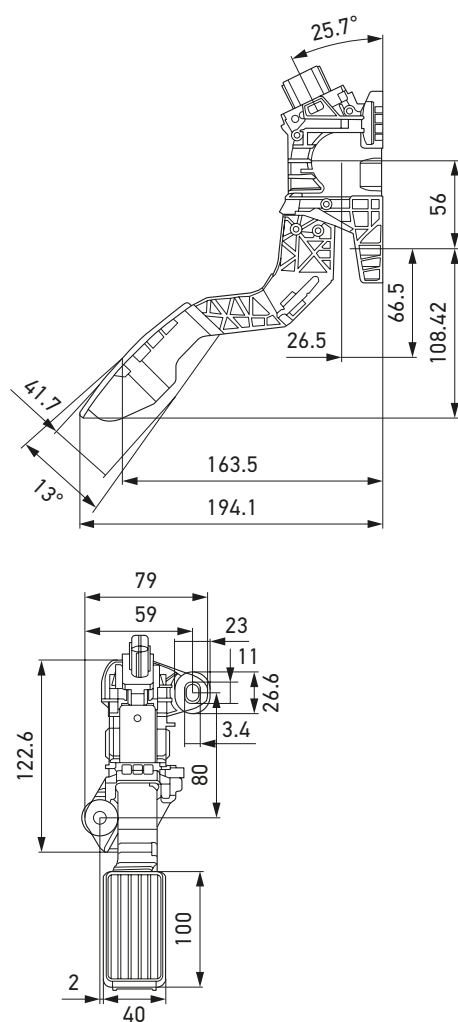
Suspended accelerator pedals  
On request

TECHNICAL DATA

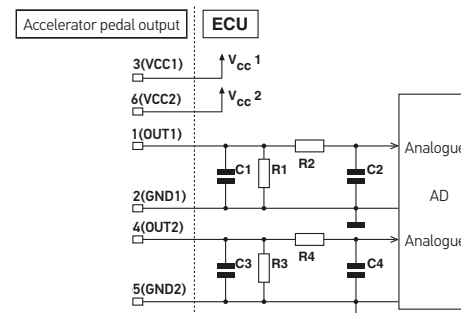
Operating voltage	5 V ± 10 %
Power consumption per channel	max. 10 mA
Surge voltage withstand capability, duration $t \rightarrow \infty$	16 V
Initial force	20 N
Final force	35 N
Actuation angle	13°
Resolution	0.04°
Output signal	2 x analogue ratiometric, 2nd channel half pitch
Linearity	≤ 3 %
Synchronisation	≤ 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 <sup>1)</sup>	6189-1083
Weight	≤ 290 g
Actuations	min. 2 million
EMV	CISPR 25, Class 5; electrical and magnetic fields
ESD	10 kV

<sup>1)</sup> This accessory is not included in the scope of delivery. Available from Sumitomo Denso. Gold-plated contacts and single conductor insulation are required.

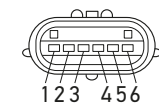
TECHNICAL DRAWING



RECOMMENDED WIRING IN THE CONTROL UNIT

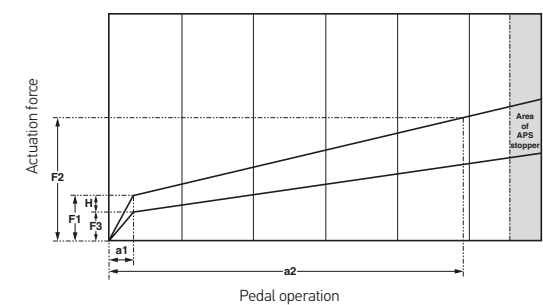


PIN ASSIGNMENT/ELECTRICAL CONNECTION

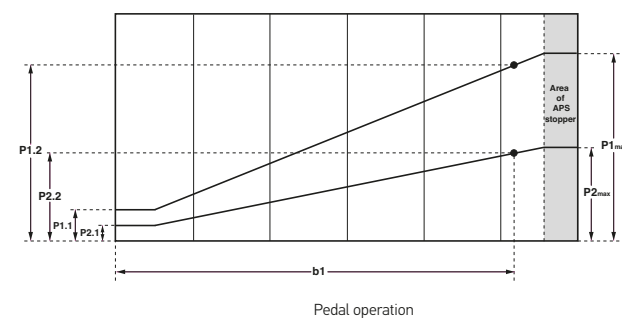


Pin 1: Analogue signal: Sensor 1  
Pin 2: Ground: Sensor 1  
Pin 3: 5 V supply: Sensor 1  
Pin 4: Analogue signal: Sensor 2  
Pin 5: Ground: Sensor 2  
Pin 6: 5 V supply: Sensor 2

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	Percent (%)	15 ± 1
P2.1	Idling voltage S2	Percent (%)	7.5 ± 1
P1.2	Full throttle voltage S1	Percent (%)	88
P2.2	Full throttle voltage S2	Percent (%)	44
P1 <sub>max</sub>	Maximum voltage S1	Percent (%)	< 89
P2 <sub>max</sub>	Maximum voltage S2	Percent (%)	> 45
b1	Full throttle angle	Degrees (°)	11.9 ± 0.6

PROGRAM OVERVIEW

Accelerator pedal material	Part number	PU*
Plastic	On request	-

\* 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 arch, 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 them 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 from 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 arch. 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.

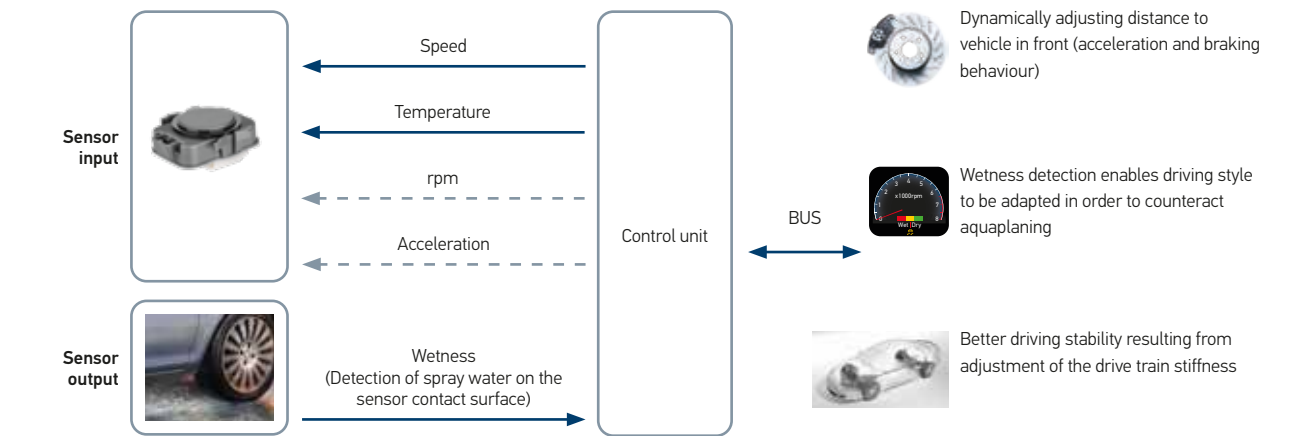
If the road condition sensor is used for partially or highly automated driving, the information about the degree of wetness can also be used to dynamically adjust the distance to the vehicle in front.

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 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	PU*
Road condition sensor (RCS/ SHAKE)	On request**	-

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

\* Packaging unit



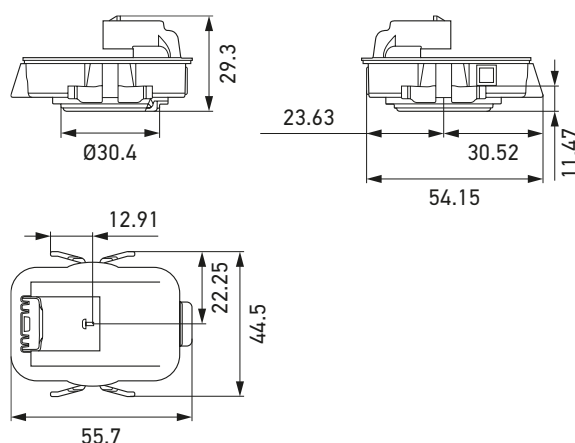
Road condition sensor (RCS/ SHAKE)  
On request

**TECHNICAL DATA**

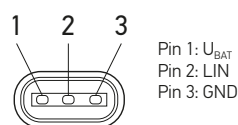
Operating voltage	9-16 V
Operating temperature	-40°C to +90 °C
Current consumption	approx. 20 mA at 12 V
Degree of protection	IP 6K9K
V <sub>max</sub>	180 km/h <sup>1)</sup>
Minimum detection limit (road wetness)	250 µm
Interface	LIN 2.1
Mating connector <sup>2)</sup>	Hirschmann 872-858-541 or TE Connectivity 1-1670917-1
Weight	< 30 g

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

**TECHNICAL DRAWING**

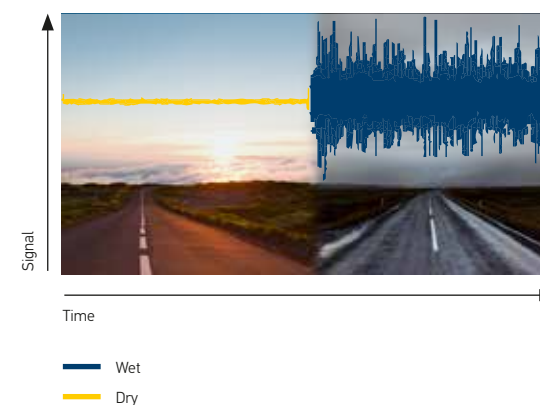


**PIN ASSIGNMENT/ELECTRICAL CONNECTION**

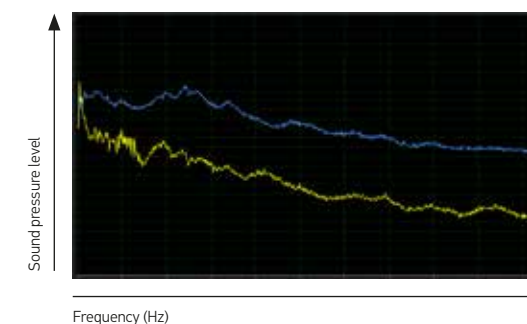


**FUNCTIONAL PRINCIPLE/STRUCTURE-BORNE SOUND RECOGNITION**

Raw signal



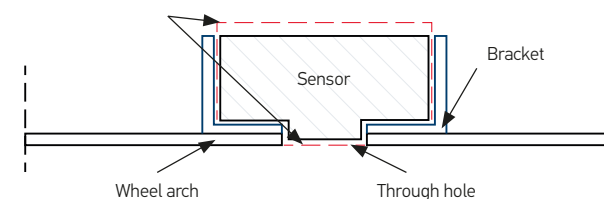
Sensitivity of sound pressure



**MOUNTING IN THE WHEEL ARCH**

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

Clearance

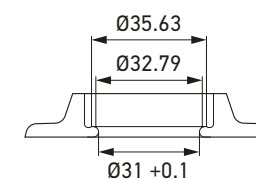


Bracket for wheel arch

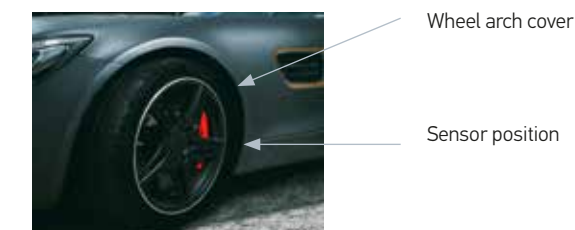


**MOUNTING OPENING**

Example showing cross section of the wheel arch through hole



Optimal positioning of the SHAKE sensor in the wheel arch





Linear actuators  
Electrical locking/unlocking and closing

**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

**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 tappet 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 linear 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.

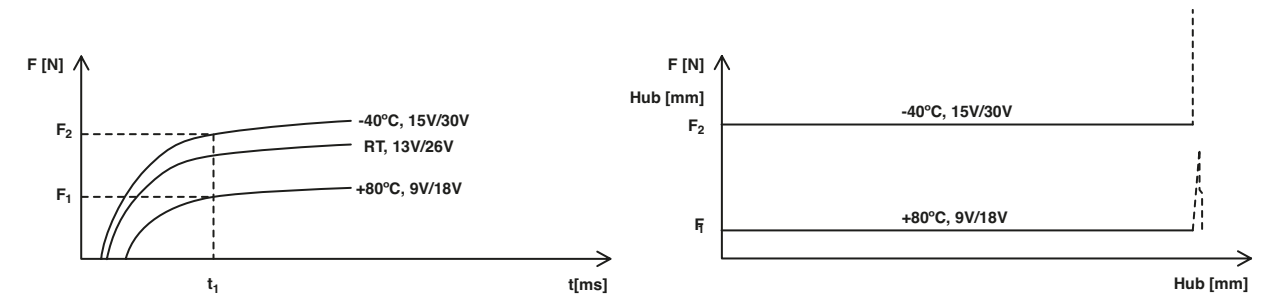
**APPLICATION**

The linear actuator is used for the electrical locking, unlocking or closing 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.

**DEPENDENCIES OF ACTUATING FORCE – CHARACTERISTIC CURVES**



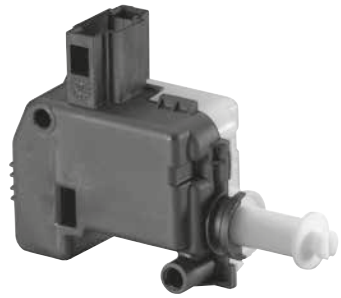
With a controller time of  $t_1$ , the actuator has an actuating force of  $F_1 < F < F_2$ . The constant actuating force on the tappet over the rated stroke depends on the operating voltage and ambient temperature. If the actuator has no load to move over the stroke, the actuator power is converted 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	Degree of protection	Part number	PU**	Page
Electrical retraction and extension							
	12 V	25 – 130 N	Yes	IP 5K0	<b>6NW 009 203-607</b>	128	54
	12 V	30 – 140 N	No	IP 5K0	<b>6NW 009 203-411/-417</b>	1/128	55
	12 V	20 – 130 N	Yes	IP 5K4	<b>6NW 009 203-627</b>	100	56
	12 V	30 – 160 N	No	IP 5K4	<b>6NW 009 203-637</b>	100	57
Electrical retraction, extension by mainspring							
	12 V	30 – 170 N	No	IP 5K0	<b>6NW 009 203-461 /-467</b>	1/110	58
	12 V	30 – 170 N	No	IP 5K4	<b>6NW 009 203-471/-477</b>	1/100	59
Electrical extension, retraction by mainspring							
	12 V	30 – 170 N	No	IP 5K0	<b>6NW 009 203-491/-497</b>	1/128	60
	12 V	30 – 170 N	No	IP 5K4	<b>6NW 009 203-501</b>	1	61

\* Depending on the operating voltage and ambient temperature

\*\* Packaging unit

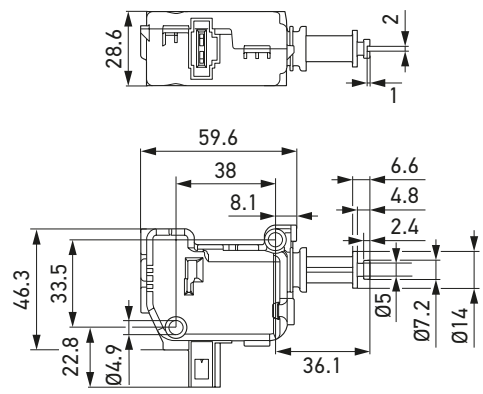


Linear actuators  
Electrical locking/unlocking and closing  
Electrical retraction and extension  
**6NW 009 203-607**

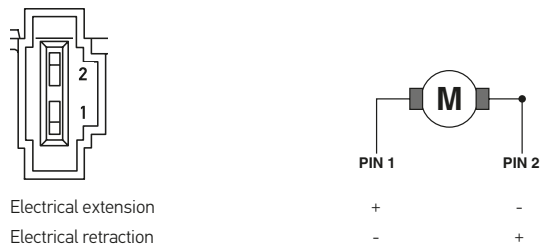
TECHNICAL DATA	
Position when delivered	Retracted
Mainspring reset	None
Weight	90 g
Rated voltage	12 V
Voltage range	9 – 15 V
Maximum current consumption (stall current)	6.7 A
Idling current	350 mA 350 ± 200 mA (variant -607)
Actuating force for tappet stroke via operating voltage range and operating temperature range	30 – 130 N
Manual adjustment	≤ 15 N
Actuating time for 18 mm stroke <sup>1)</sup>	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
Degree of protection	IP 5K0
Vibration resistance	2.7 g <sub>eff</sub>
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector <sup>2)</sup>	1355390-1

<sup>1)</sup> At the tappet over operating voltage range and operating temperature range.  
<sup>2)</sup> This accessory is not included in the scope of delivery. Available from TE Connectivity.

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION

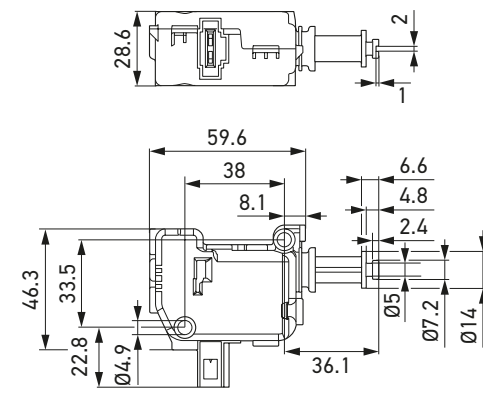


Linear actuators  
Electrical locking/unlocking and closing  
Electrical retraction and extension  
**6NW 009 203-411 / -417**

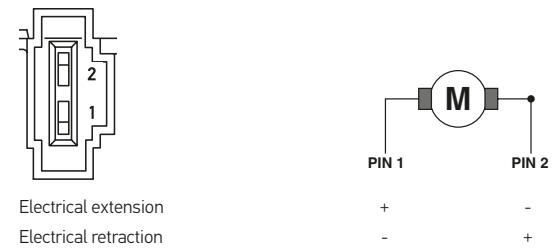
TECHNICAL DATA	
Position when delivered	Retracted
Mainspring reset	None
Weight	90 g
Rated voltage	12 V
Voltage range	9 – 15.5 V
Maximum current consumption (stall current)	6.7 A
Idling current	350 mA
Actuating force for tappet stroke via operating voltage range and operating temperature range	30 – 140 N
Manual adjustment	None
Actuating time for 18 mm stroke <sup>1)</sup>	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
Degree of protection	IP 5K0
Vibration resistance	2.7 g <sub>eff</sub>
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector <sup>2)</sup>	1355390-1

<sup>1)</sup> At the tappet over operating voltage range and operating temperature range.  
<sup>2)</sup> This accessory is not included in the scope of delivery. Available from TE Connectivity.

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION







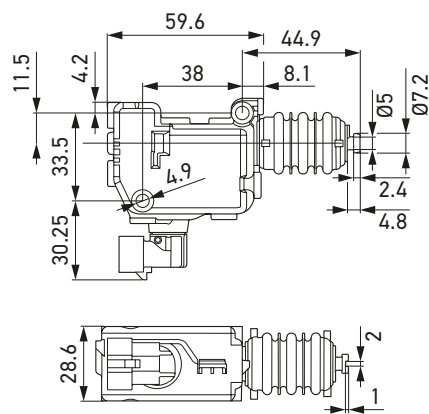
Linear actuators  
Electrical locking/unlocking and closing  
Electrical retraction and extension  
**6NW 009 203-627**

TECHNICAL DATA	
Position when delivered	Extended
Mainspring reset	None
Weight	90 g
Rated voltage	12 V
Voltage range	9 – 15.5 V
Maximum current consumption (stall current)	6.7 A
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 <sup>1)</sup>	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
Degree of protection	IP 5K4
Vibration resistance	2.7 g <sub>eff.</sub>
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector <sup>2)</sup>	282080-1

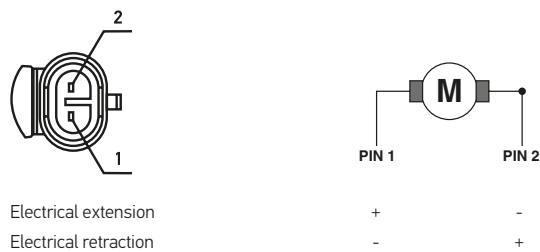
<sup>1)</sup> At the tappet over operating voltage range and operating temperature range.

<sup>2)</sup> This accessory is not included in the scope of delivery. Available from TE Connectivity.

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



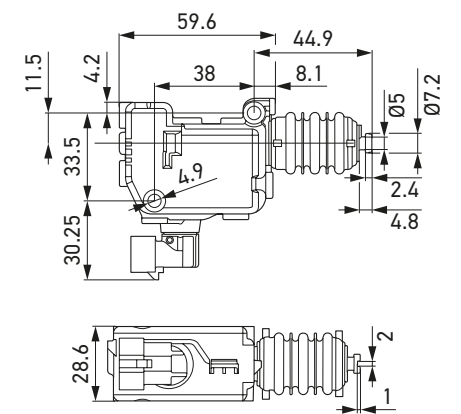
Linear actuators  
Electrical locking/unlocking and closing  
Electrical retraction and extension  
**6NW 009 203-637**

TECHNICAL DATA	
Position when delivered	Extended
Mainspring reset	None
Weight	90 g
Rated voltage	12 V
Voltage range	9 – 15.5 V
Maximum current consumption (stall current)	6.7 A
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 <sup>1)</sup>	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
Degree of protection	IP 5K4
Vibration resistance	2.7 g <sub>eff.</sub>
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector <sup>2)</sup>	282080-1

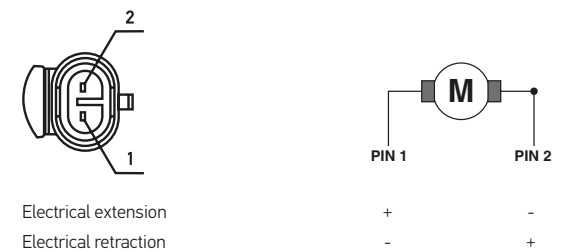
<sup>1)</sup> At the tappet over operating voltage range and operating temperature range.

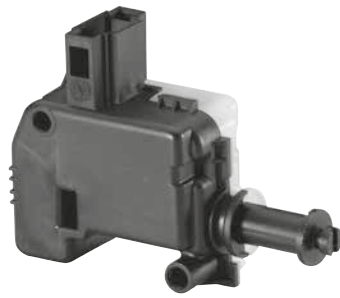
<sup>2)</sup> This accessory is not included in the scope of delivery. Available from TE Connectivity.

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION





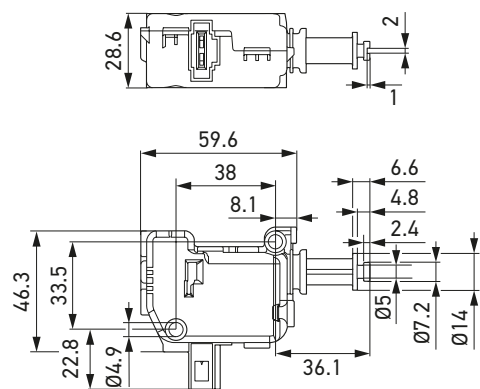
Linear actuators  
Electrical locking/unlocking and closing  
Electrical retraction, extension with mainspring  
**6NW 009 203-461 / -467**

**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
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 <sup>1)</sup>	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
Degree of protection	IP 5K0
Vibration resistance	2.7 g <sub>eff</sub>
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector <sup>2)</sup>	1355390-1

<sup>1)</sup> At the tappet over operating voltage range and operating temperature range.  
<sup>2)</sup> This accessory is not included in the scope of delivery. Available from TE Connectivity.

**TECHNICAL DRAWING**



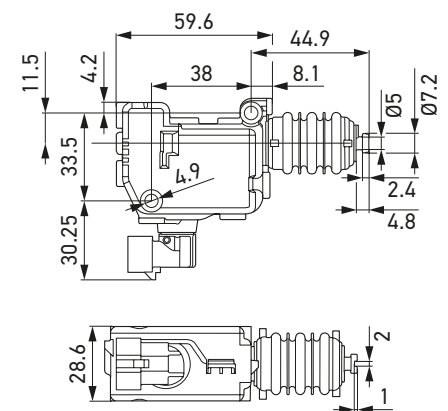
Linear actuators  
Electrical locking/unlocking and closing  
Electrical retraction, extension with mainspring  
**6NW 009 203-471 / -477**

**TECHNICAL DATA**

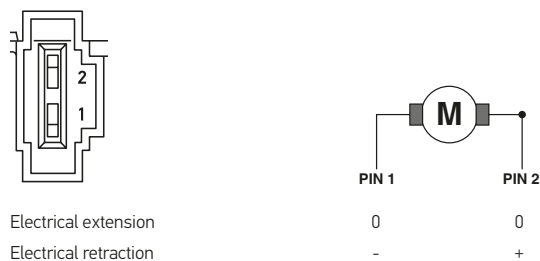
Position when delivered	Extended
Mainspring reset	Extend
Weight	90 g
Rated voltage	12 V
Voltage range	9 – 15 V
Maximum current consumption (stall current)	10.5 A
Idling current	545 mA
Actuating force for tappet over operating voltage range and operating temperature range	30 – 170 N
Manual adjustment	None
Actuating time for 18 mm stroke <sup>1)</sup>	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
Degree of protection	IP 5K4
Vibration resistance	2.7 g <sub>eff</sub>
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector <sup>2)</sup>	282080-1

<sup>1)</sup> At the tappet over operating voltage range and operating temperature range.  
<sup>2)</sup> This accessory is not included in the scope of delivery. Available from TE Connectivity.

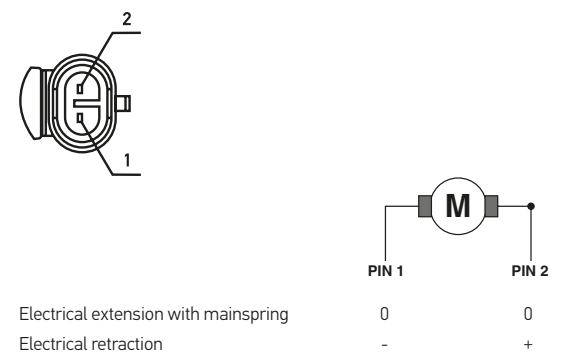
**TECHNICAL DRAWING**

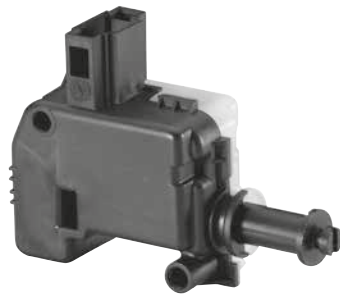


**PIN ASSIGNMENT/ELECTRICAL CONNECTION**



**PIN ASSIGNMENT/ELECTRICAL CONNECTION**



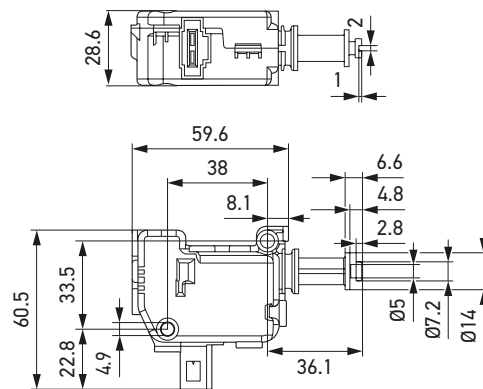


Linear actuators  
Electrical locking/unlocking and closing  
Electrical extension, retraction with mainspring  
**6NW 009 203-491 / 497**

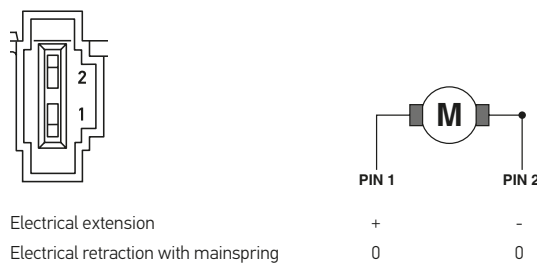
TECHNICAL DATA	
Position when delivered	Retracted
Mainspring reset	Retract
Weight	90 g
Rated voltage	12 V
Voltage range	9 – 15 V
Maximum current consumption (stall current)	10.5 A
Idling current	577 mA
Actuating force for tappet stroke via operating voltage range and operating temperature range	30 – 170 N
Manual adjustment	None
Actuating time for 18 mm stroke <sup>1)</sup>	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 $\mu$ V
Functional stroke	$\leq$ 18 mm
Degree of protection	IP 5K0
Vibration resistance	2.7 g <sub>eff</sub>
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector <sup>2)</sup>	1355390-1

<sup>1)</sup> At the tappet over operating voltage range and operating temperature range.  
<sup>2)</sup> This accessory is not included in the scope of delivery. Available from TE Connectivity.

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION

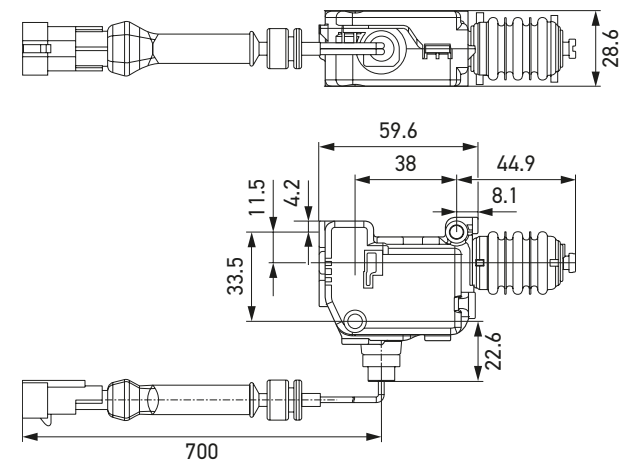


Linear actuators  
Electrical locking/unlocking and closing  
Electrical extension, retraction with mainspring  
**6NW 009 203-501**

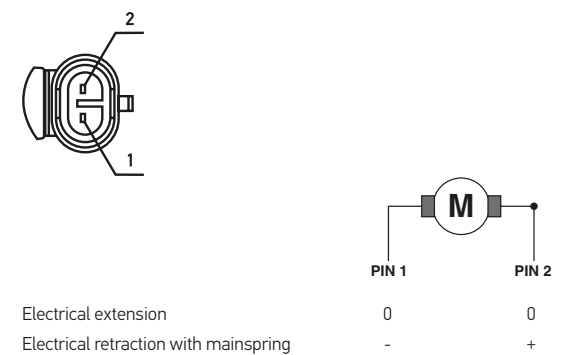
TECHNICAL DATA	
Position when delivered	Retracted
Mainspring reset	Retract
Weight	90 g
Rated voltage	12 V
Voltage range	9 – 15 V
Maximum current consumption (stall current)	10.5 A
Idling current	577 mA
Actuating force for tappet stroke via operating voltage range and operating temperature range	30 to 170 N
Manual adjustment	None
Actuating time for 18 mm stroke <sup>1)</sup>	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 $\mu$ V
Functional stroke	$\leq$ 18 mm
Degree of protection	IP 5K4
Vibration resistance	2.7 g <sub>eff</sub>
Housing material (top side)	Polyamide 6 GF15
Housing material (bottom side)	Polyamide 6 M25 GF15
Pin coating	Tin
Mating connector <sup>2)</sup>	282080-1

<sup>1)</sup> At the tappet over operating voltage range and operating temperature range.  
<sup>2)</sup> This accessory is not included in the scope of delivery. Available from TE Connectivity.

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION





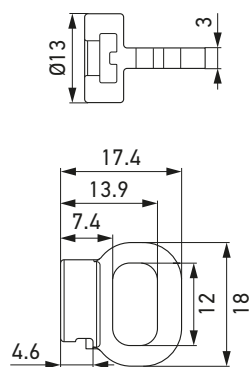
Linear actuators  
 Electrical locking/unlocking and closing  
 Connecting elements for actuator function  
 Retraction and extension

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

Part number 9XD 860 912-001



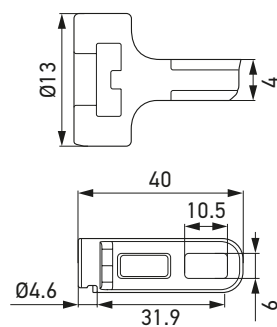
TECHNICAL DRAWING



Part number 9XD 862 354-001



TECHNICAL DRAWING



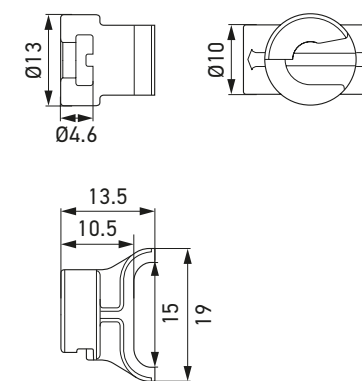
Linear actuators  
 Electrical locking/unlocking and closing  
 Connecting elements for actuator function  
 Extension

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

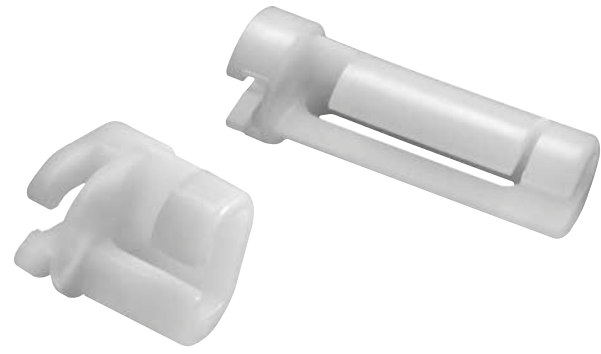
Part number 9XD 861 450-001



TECHNICAL DRAWING



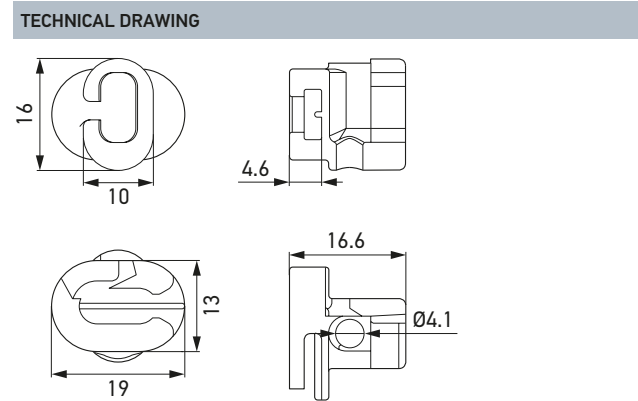




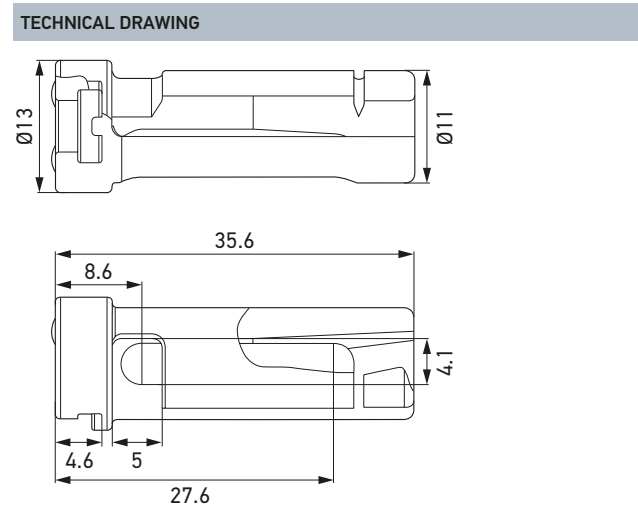
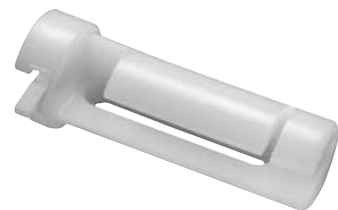
Linear actuators  
 Electric locking/unlocking & closing  
 Connecting elements for actuator function  
 Retraction and extension with rod

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

Part number 9XD 861 771-001



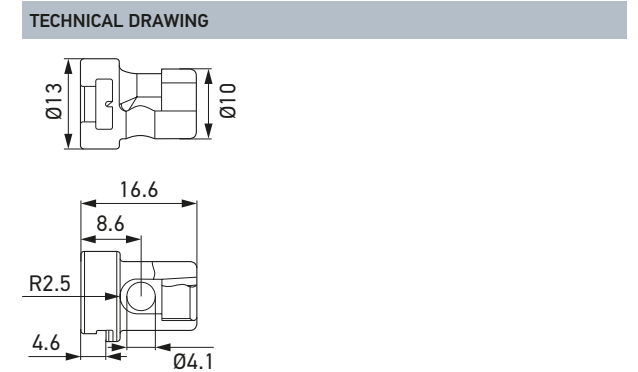
Part number 9XD 862 516-001

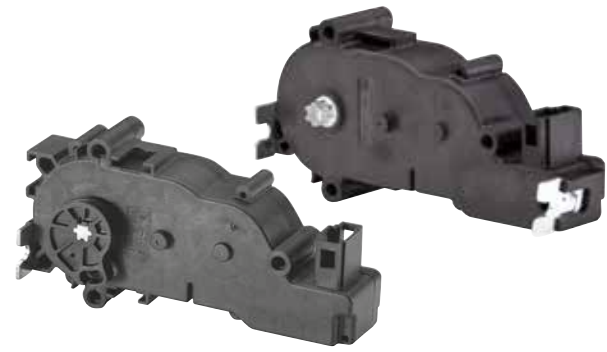


Linear actuators  
 Electric locking/unlocking & closing  
 Connecting elements for actuator function  
 Retraction and extension with rod

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

Part number 9XD 860 913-001





Rotatory actuators for high forces  
Electrical locking/unlocking and closing

**PRODUCT FEATURES**

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

**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 anti-clockwise 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.

**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.



**PROGRAM OVERVIEW**

Function	Voltage	Torque	Manual adjustment	Degree of protection	Part number	PU*	Page
Retraction via spring, electric extension	12 V	150 Ncm	No	IP 5K0	<b>6NW 009 424-781</b>	1	68
Power extension and retraction	12 V	300 Ncm	No	IP 5K0	<b>6NW 009 424-791</b>	1	
Electrical retraction and extension, without shaft, without cable sheave and without metal clip	12 V	300 Ncm	No	IP 5K0	<b>6NW 009 424-777</b>	70	69

\* Packaging unit



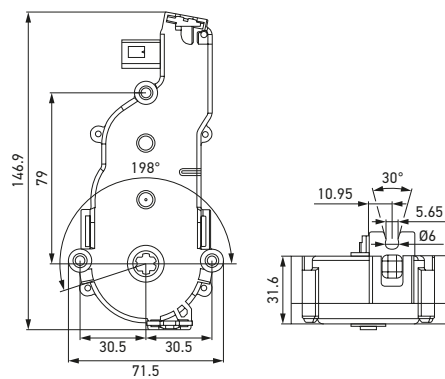
Rotatory actuators for high forces  
 Electrical locking/unlocking and closing  
 Electrical rotation left,  
 reset via spring to right  
**6NW 009 424-781**

**TECHNICAL DATA**

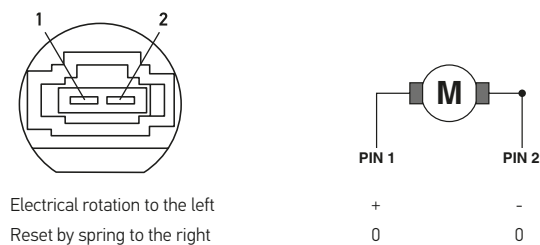
Mainspring reset	Available
Weight	181 g
Rated voltage	12 V
Voltage range	9–16 V
Maximum current consumption (stall current)	≤ 10.5 A
Idling current	≤ 1.5 A
Speed at rated load	$U_p / RT \geq 41 (\geq 39)$ rpm
Rated torque	150 Ncm
Functional angle	0° to 198°
Tensile path	approx. 45 mm
Rated speed (at rated load and room temperature)	32 min <sup>-1</sup>
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
Degree of protection	IP 5K0
Vibration resistance (IEC 68-2-64)	3 g <sub>eff</sub>
Housing material (top side)	PP-GF30
Housing material (bottom side)	PP-GF30
Pin coating	Tin
Mating connector <sup>1)</sup>	AMP C1355390

<sup>1)</sup> This accessory is not included in the scope of delivery. Available from TE Connectivity.

**TECHNICAL DRAWING**



**PIN ASSIGNMENT/ELECTRICAL CONNECTION**



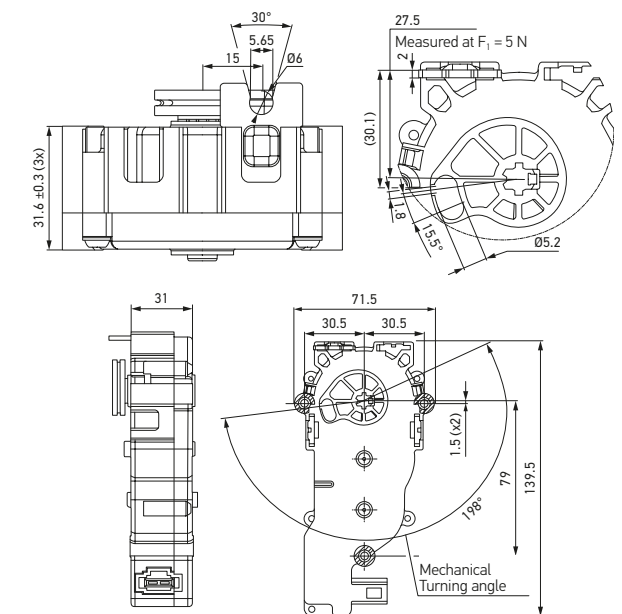
Rotatory actuators for high forces  
 Electrical locking/unlocking & closing  
 Electrical rotation right and left  
**6NW 009 424-791**  
**6NW 009 424-777**  
 (As -791 but without shaft, without cable sheave and without metal clip)

**TECHNICAL DATA**

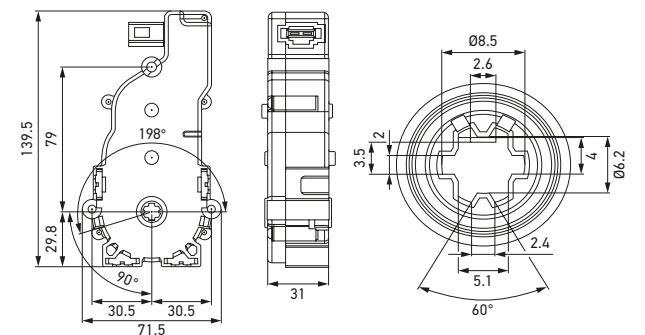
Mainspring reset	None
Weight	181 g
Rated voltage	12 V
Voltage range	9–16 V
Maximum current consumption (stall current)	≤ 6 A
Idling current	≤ 0.4 (≤ 0.45) A
Speed at rated load	$U_p / RT \geq 12 (\geq 10)$ rpm
Rated torque	300 Ncm
Functional angle	0° to 198°
Tensile path	approx. 45 mm
Rated speed (at rated load and room temperature)	15 rpm 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
Degree of protection	IP 5K0
Vibration resistance (IEC 68-2-64)	3 g <sub>eff</sub>
Housing material (top side)	PP-GF30
Housing material (bottom side)	PP-GF30
Pin coating	Tin
Mating connector <sup>1)</sup>	AMP C1355390

<sup>1)</sup> This accessory is not included in the scope of delivery. Available from TE Connectivity.

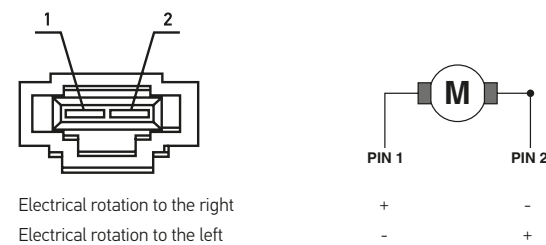
**TECHNICAL DRAWING 6NW 009 424-791**



**TECHNICAL DRAWING 6NW 009 424-777**



**PIN ASSIGNMENT/ELECTRICAL CONNECTION**





Rotatory actuators for low forces  
Electrical locking/unlocking,  
space-saving, with or without micro switch

**PRODUCT FEATURES**

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

**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, at which point the hinged arm of the service flap snaps into the actuator's locking lever.

**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 very little space available.

Examples include:

- Tank modules
- Service flaps
- Glove compartments
- Locking of charging plugs (e-mobility)

**PROGRAM OVERVIEW**

Function	Voltage	Manual adjustment	Degree of protection	Part number	PU*	Page
<b>Electrical forward and reverse rotation</b>						
	12 V	No	IP 5K4	<b>6NW 011 122-011/-017</b>	1/132	73
With micro switch	12 V	No	IP 5K4	<b>6NW 011 122-021/-027</b>	1/126	
With micro switch, without operating element, without locking element	12 V	No	IP 5K4	<b>6NW 011 122-031/-037</b>	1/132	74
With micro switch, with operating element, without locking element	12 V	No	IP 5K4	<b>6NW 011 122-051/-057</b>	1/126	
<b>Electrical forward rotation, and reverse rotation via return spring with soft touch button</b>						
	12 V	Yes	IP 5K4	<b>6NW 011 122-041/-047</b>	1/60	76

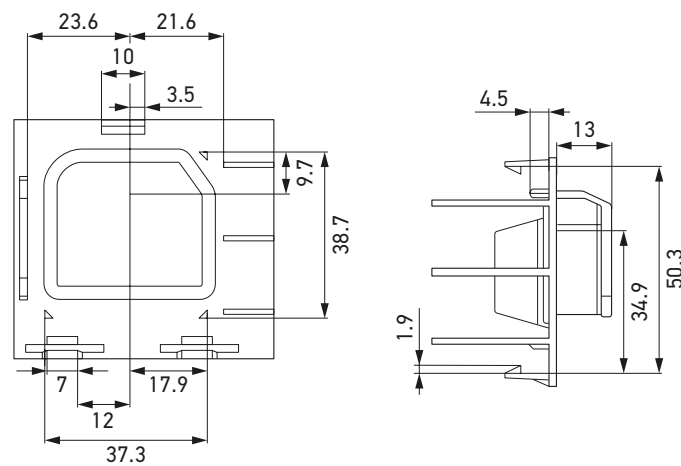
\* Packaging unit



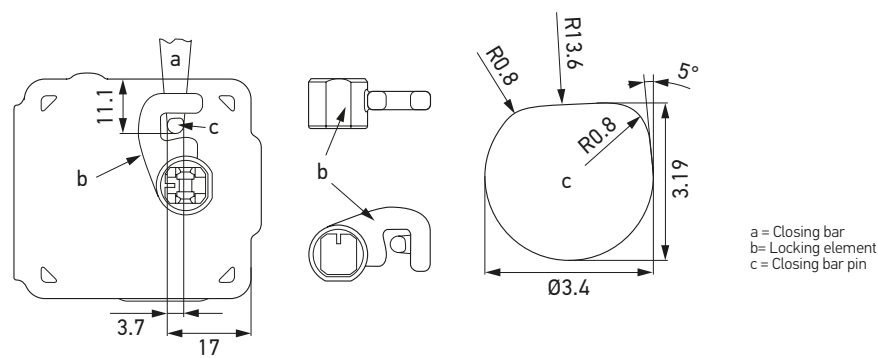


Rotary actuators for low forces  
Electrical locking/unlocking, space-saving,  
electrical forward and reverse rotation  
**6NW 011 122-011/017**

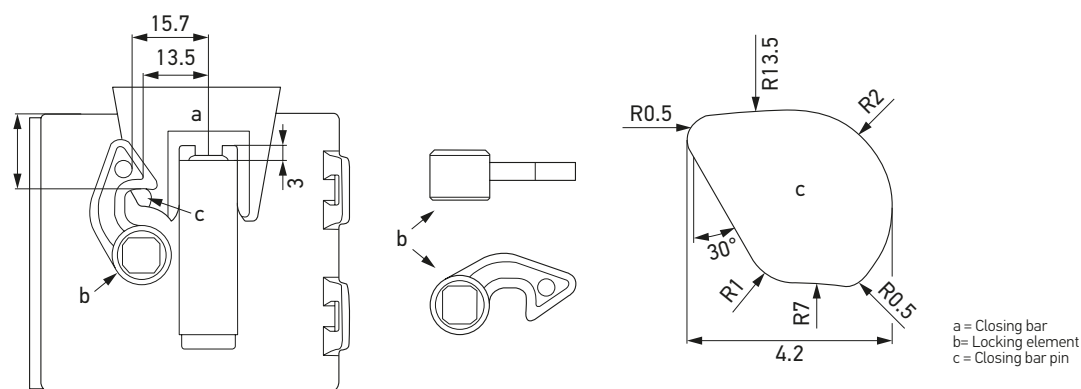
**MOUNTING INTERFACE EXAMPLE**



**LOCKING INTERFACE (VARIANT -017 and -027)**



**LOCKING INTERFACE (VARIANT -047)**

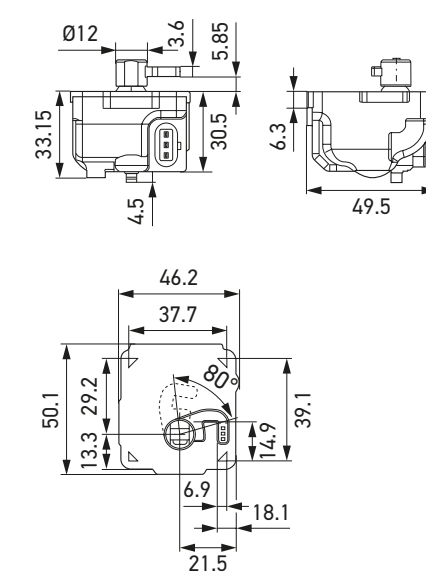


**TECHNICAL DATA**

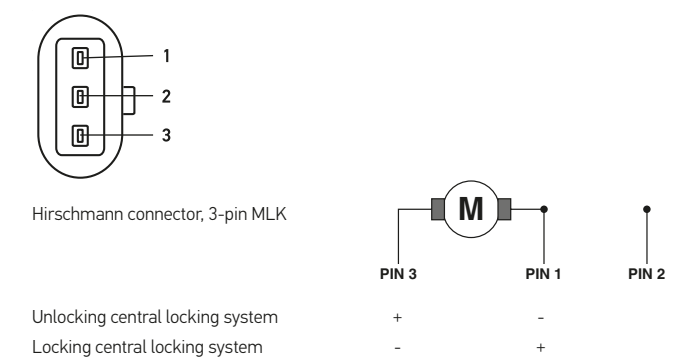
Function	Electrical forward and reverse rotation
Weight	60 g
Rated voltage	12 V
Voltage range	9 – 15.5 V
Maximum current consumption (stall current)	≤ 3.2 A
Idling current	≤ 2.0 A
Locking lever pulling force	> 75 N (after lifetime > 50 N)
Locking lever breaking force	≥ 300 N
Functional angle	≤ 78°
Actuating time for 78° via functional angle <sup>1)</sup>	40 ms < t < 200 ms
Triggering time	0.2 s < t < 10 s
Minimum switch on-time	t <sub>on, min</sub> = 200 ms
Maximum switch on-time	t <sub>on, max</sub> = 10 s
Breaking time	8 x t <sub>on</sub>
Thermal overload protection	Not available
Operating temperature	-40°C to +85 °C
Storage temperature	-40°C to +90 °C
Lifetime <sup>2)</sup>	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°
Degree of protection	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 <sup>3)</sup>	3-pin MLK coupling ELA 872-858-541

<sup>1)</sup> Over the operating voltage and temperature range.  
<sup>2)</sup> One switching cycle equals one forward and reverse rotation.  
0.7 s on; 14 s off (reverse voltage);  
0.7 s on; 14 s off (reverse voltage)  
<sup>3)</sup> This accessory is not included in the scope of delivery.  
Available from Hirschmann Automotive.

**TECHNICAL DRAWING**



**PIN ASSIGNMENT/ELECTRICAL CONNECTION**





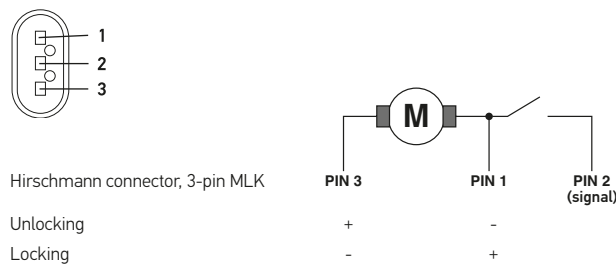
Rotatory actuators for low forces  
 Electrical locking/unlocking, space-saving with micro switch, electrical forward and reverse rotation  
**6NW 011 122-021/027**  
**6NW 011 122-031/037**  
 (As variant -021 but without operating and locking elements)  
**6NW 011 122-051/-057**  
 (Without locking element, with operating element)

#### TECHNICAL DATA

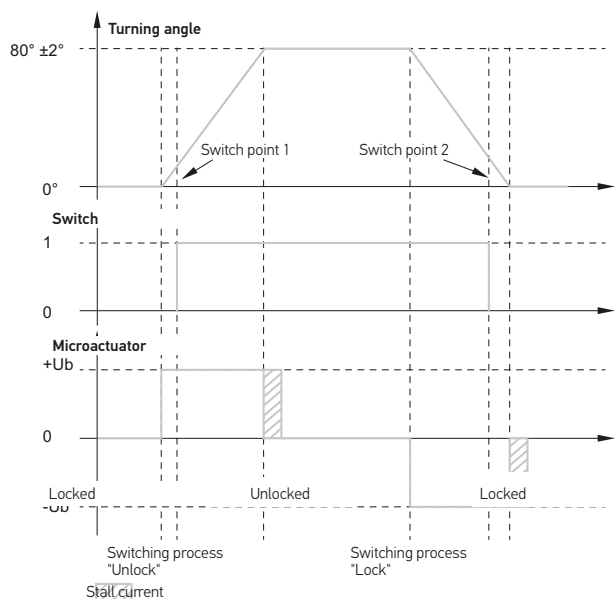
Function	Electrical forward and reverse rotation with micro switch
Weight	60 g
Rated voltage	12 V
Voltage range	9 – 15.5 V
Maximum current consumption (stall current)	≤ 2.4 A
Idling current	≤ 1.0 A
Locking lever pulling force	≥ 75 N
Locking lever breaking force	≥ 300 N
Functional angle	≤ 78°
Actuating time for 78° via functional angle <sup>1)</sup>	40 ms < t < 200 ms
Triggering time	0.2 s < t < 10 s
Minimum switch on-time	t <sub>on,min</sub> = 200 ms
Maximum switch on-time	t <sub>on,max</sub> = 10 s
Breaking time	8 x t <sub>on</sub>
Thermal overload protection	Not available
Operating temperature	-40°C to +85 °C
Storage temperature	-40°C to +90 °C
Lifetime <sup>2)</sup>	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°
Degree of protection	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 <sup>3)</sup>	3-pin MLK coupling ELA 872-858-...KA

<sup>1)</sup> Over the operating voltage and temperature range.  
<sup>2)</sup> One switching cycle equals one forward and reverse rotation.  
 0.7 s on; 14 s off (reverse voltage);  
 0.7 s on; 14 s off (reverse voltage)  
<sup>3)</sup> This accessory is not included in the scope of delivery.  
 Available from Hirschmann Automotive.

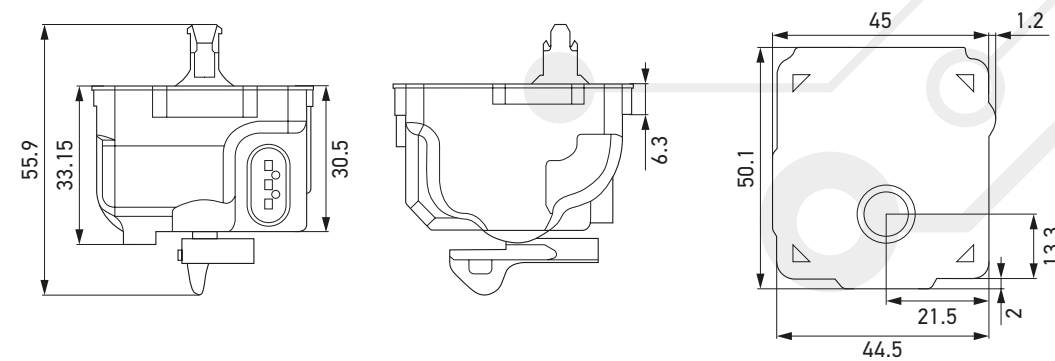
#### PIN ASSIGNMENT/ELECTRICAL CONNECTION



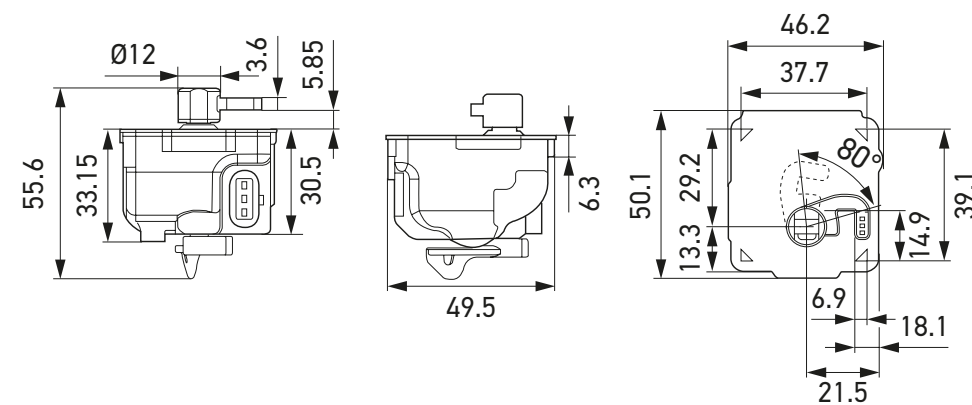
#### MICRO SWITCH TRIPPING



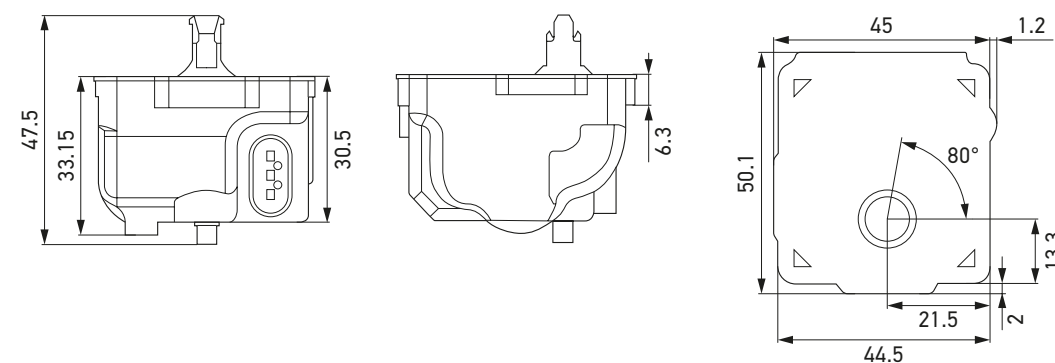
#### TECHNICAL DRAWING – 6NW 011 122-051



#### TECHNICAL DRAWING – 6NW 011 122-021



#### TECHNICAL DRAWING – 6NW 011 122-031





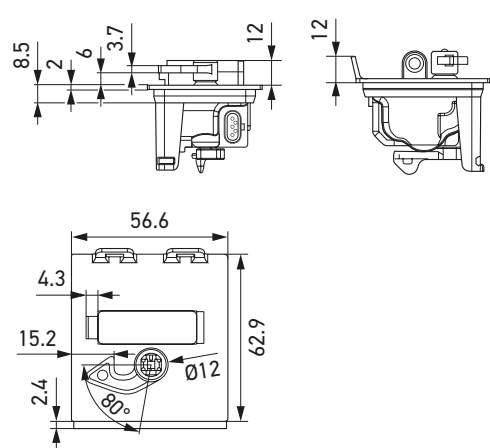
Rotary actuators for low forces  
 Electrical locking/unlocking, space-saving  
 with micro switch, electrical forward rotation,  
 reverse rotation via return spring,  
 with soft-touch button  
**6NW 011 122-041 / 047**

#### TECHNICAL DATA

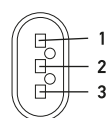
Function	Electrical forward rotation, reverse rotation via return spring
Weight	60 g
Rated voltage	12 V
Voltage range	9 – 15.5 V
Maximum current consumption (stall current)	≤ 4.0 A
Idling current	≤ 2.0 A
Locking lever pulling force	75 N
Locking lever breaking force	300 N
Micro switch triggering force	≤ 24 N
Functional angle	≤ 78°
Actuating time for 78° via functional angle <sup>1)</sup>	45 ms < t < 220 ms
Triggering time	0.3 s < t < 4 s
Minimum switch on-time	t <sub>on, min</sub> = 300 ms
Maximum switch on-time	t <sub>on, max</sub> = 4 s
Breaking time	20 x t <sub>on</sub>
Thermal overload protection	Not available
Operating temperature	-40°C to +85 °C
Storage temperature	-40°C to +90 °C
Lifetime <sup>2)</sup>	10,000 cycles
Conducted electromagnetic interference	DIN ISO 7637, SAE J1113-42
Interference suppression CISPR 25, SAE J-1113-41	Intensity level 1 + 10 dB µV
Micro switch switching angle	8° – 18°
End position stability with motor short circuit	≤ 6°
Degree of protection	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 <sup>3)</sup>	3-pin MLK coupling ELA 872-858-541

<sup>1)</sup> Over the operating voltage and temperature range.  
<sup>2)</sup> One switching cycle equals one forward and reverse rotation.  
 0.7 s on; 14 s off (reverse voltage);  
 0.7 s on; 14 s off (reverse voltage)  
<sup>3)</sup> This accessory is not included in the scope of delivery.  
 Available from Hirschmann Automotive.

#### TECHNICAL DRAWING

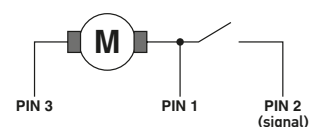


#### PIN ASSIGNMENT/ELECTRICAL CONNECTION

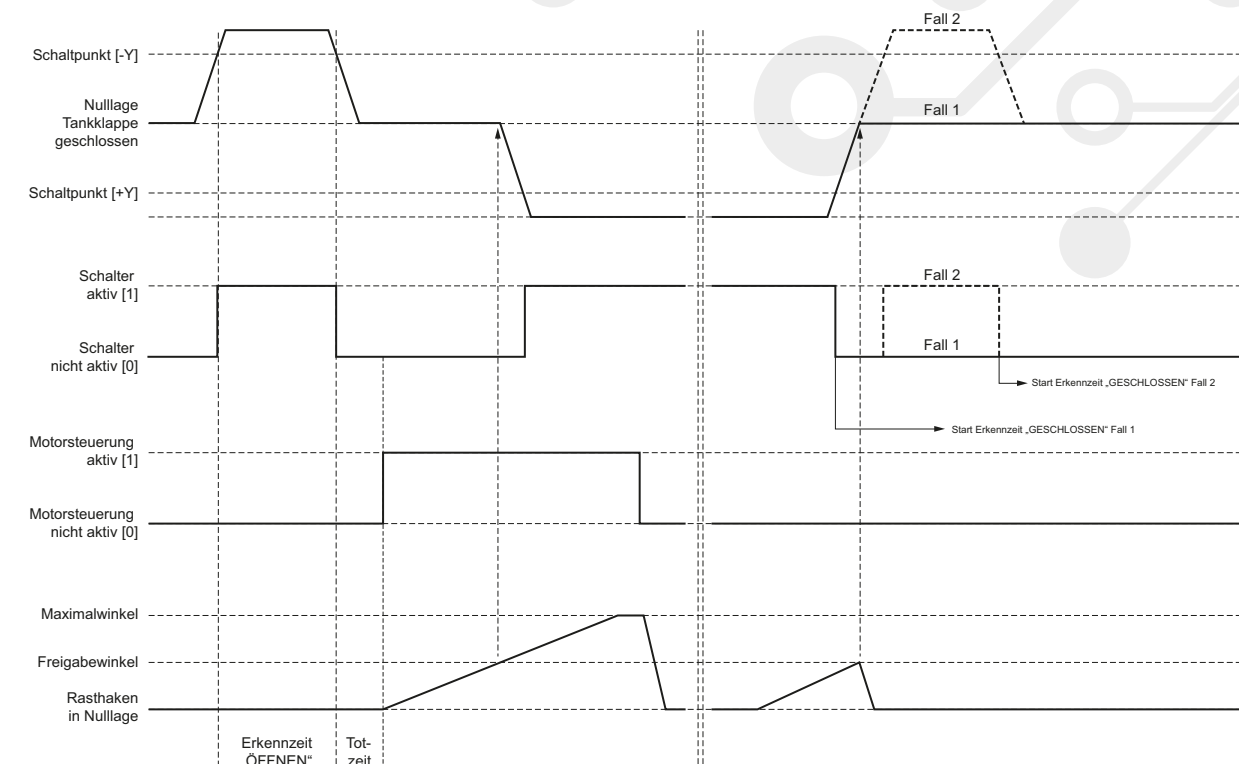


Hirschmann connector, 3-pin MLK

Softtouch unlocking  
 Softtouch locking



#### 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 status 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 is 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-parametrisable (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 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.



Intelligent, rotatory actuators for 360° angles  
 Electrical locking/unlocking and closing  
 Electrical rotation left, right,  
 with high torque  
 Position feedback using CIPOS® technology

**PRODUCT FEATURES**

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

**DESIGN AND FUNCTION**

The intelligent, rotatory actuators for 360° angles monitor the position of the output gear and the integrated electronics continuously calculate the position using 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.

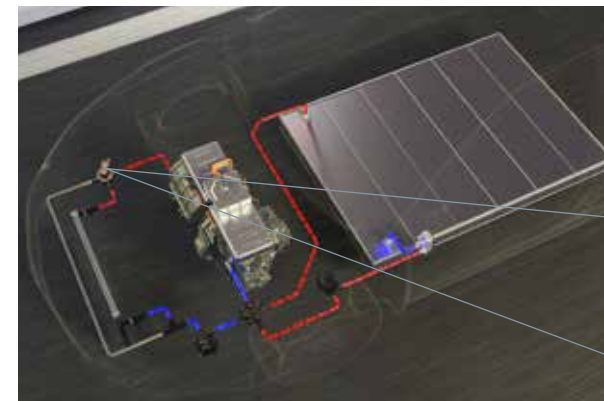
**APPLICATION**

The intelligent, rotatory actuators for 360° angles can be used in a wide range of applications involving harsh environmental conditions and can make precise and reliable positionings. The CIPOS® technology used in the intelligent, rotatory actuators for 360° angles 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 measurement accuracy throughout the entire lifetime. An error memory records errors and the actuator is able to react differently and appropriately to all manner of errors.

**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

**COOLING CIRCUITS IN DIFFERENT VEHICLE SEGMENTS**



The intelligent, rotatory actuator for 360° angles controls the coolant valve, supporting the variable flow of coolant by regulating the heat quantities particularly precisely.



More on this in our video:



**PROGRAM OVERVIEW**

Function	Voltage	Torque	Manual adjustment	Degree of protection	Part number	PU*
Electric locking/unlocking and closing, electrical rotational movement to right and left, with position feedback via CIPOS® technology	12 V	Up to 300 Ncm	No	IP 6K9K or IP 6K7 <sup>1)</sup>	<b>6NW 011 303-717</b>	1

<sup>1)</sup> Depends on connector classification

\* Packaging unit





Intelligent, rotatory actuators for 360° angles  
 Electrical locking/unlocking and closing  
 Electrical rotation left and right,  
 with high torque  
 Precise position control using CIPOS® technology

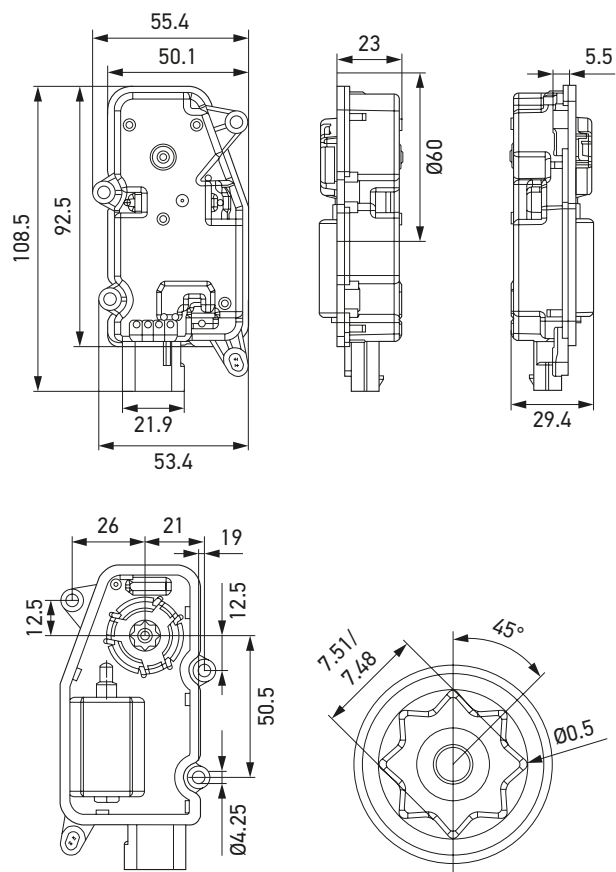
**6NW 011 303-717**

**TECHNICAL DATA**

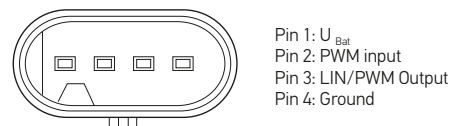
Weight	106 g
Rated voltage	13.5 V
Voltage range	9 – 16 V
Rated current	0.5 A
Maximum current consumption (Stall current)	3.7 A
No-load current in idle mode	< 100 µA (typical 20 µA)
Rated torque (at 13.5 V and RT)	60 Ncm
Maximum torque after lifetime (at 13.5 V and RT)	< 300 Ncm
Operating angle	> 360° (< 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	Typically 250,000 cycles (1 cycle = 90° angle open - closed - open)
EMV	CISPR 25, Class 5 <sup>1)</sup>
Protocol	LIN 2.0 and PWM
Degree of protection	IP 6K9K; IP 6K7 <sup>2)</sup>
Vibration resistance	9.6 g
Housing material	PPA-GF40
Pin coating	Tin
Manual adjustment	No
Mating connector <sup>3)</sup>	1-1456426-1, coding A

<sup>1)</sup> Limits may be exceeded in the frequency range of 3 – 4 MHz.  
<sup>2)</sup> Depends on connector classification  
<sup>3)</sup> This accessory is not included in the scope of delivery. Available from TE Connectivity.

**TECHNICAL DRAWING**



**PIN ASSIGNMENT/ELECTRICAL CONNECTION**



**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 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.

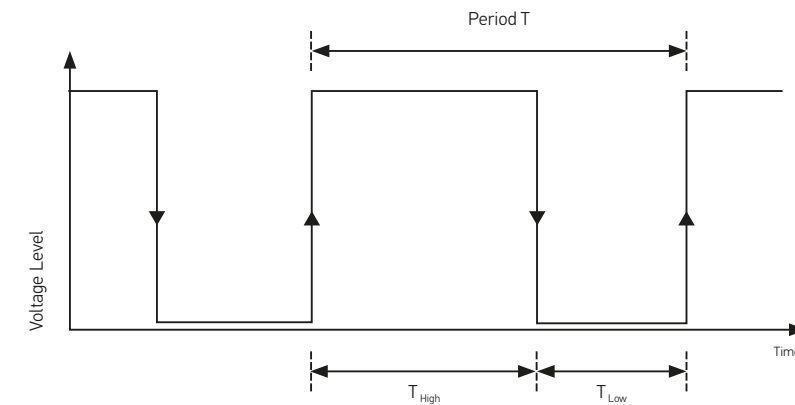
**PWM FEEDBACK AND PWM GROUNDING**

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.

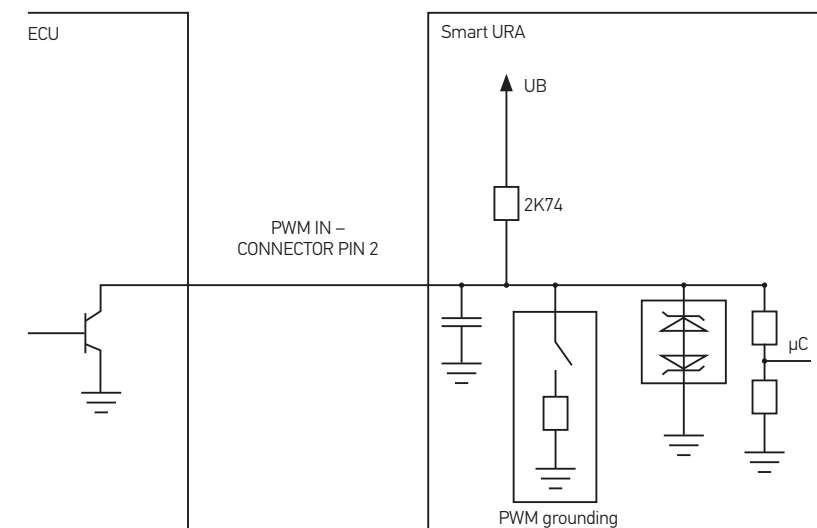
**LIN INTERFACE/LIN BUS SPECIFICATIONS:**

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**





Intelligent, rotatory actuators for high temperatures

**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 intelligent, rotatory actuator for high temperatures 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**

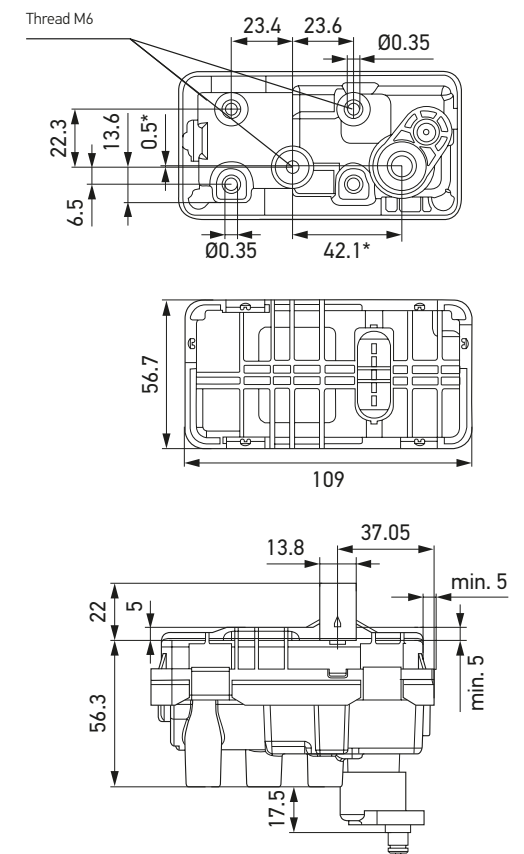
The intelligent, rotatory actuator for high temperatures is mainly used for the VNT /VTG (Variable Nozzle Turbine/Variable Turbine Geometry) turbocharger technology so as to provide reliable and precise positioning. The CIPOS® technology used in the intelligent, rotatory actuators for high temperatures 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 measurement accuracy throughout the entire lifetime.

**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%
Degree of protection	IP 6K9K
Protocol	CAN or PWM
Mating connector <sup>1)</sup>	09 4415 82, coding B

<sup>1)</sup> This accessory is not included in the scope of delivery. Available from Kostal.

**TECHNICAL DRAWING**



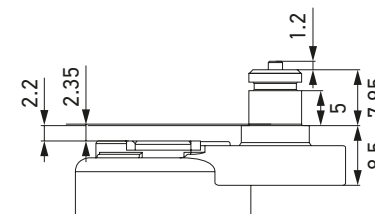
\* Relates to housing domes only.

**PROGRAM OVERVIEW**

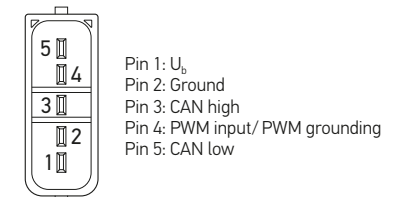
Voltage range	Operating angle	Torque	Part number	PU*
10.5 – 16 V	100°	> 55 Ncm	On request	-

\* Packaging unit

**EXAMPLE OF A CONNECTING ELEMENT**



**PIN ASSIGNMENT/ELECTRICAL CONNECTION**





Rotatory actuator for high temperatures  
**On request**

**PRODUCT FEATURES**

- Integrated electronics consisting of CIPOS® (Contactless Inductive Position Sensor) position sensor, motor control and error diagnosis
- Spur gear, adapted to the exhaust gas pressure characteristics
- High measurement accuracy

**DESIGN AND FUNCTION**

The main function of the rotatory actuator for high temperatures is to control a valve that regulates the flow of exhaust gas to the turbine and allows reliable and precise positioning. In other words, it regulates the boost pressure to create a wider power spectrum, eliminate turbo lag and protect the engine and turbocharger. What distinguishes the CIPOS® technology used with the actuator is its particular insensitivity to magnetic fields and high level of temperature stability. Positions are measured inductively using a non-contact and consequently wear-free method, which guarantees high measurement accuracy throughout the entire lifetime.

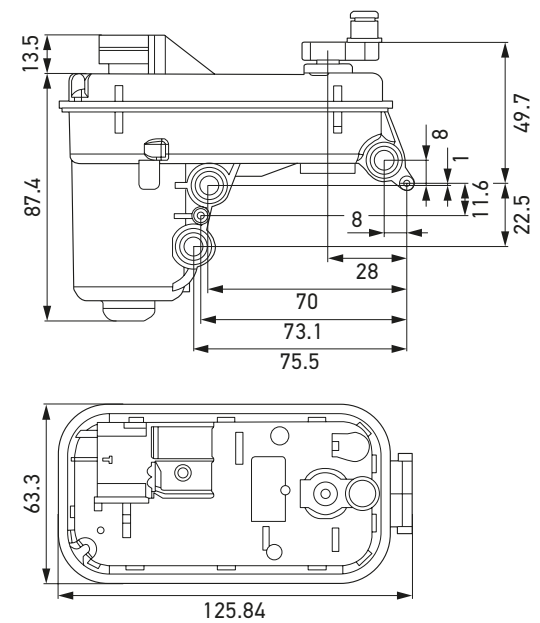
**APPLICATION**

The rotatory actuator for high temperatures is used to operate the flap of the boost pressure control valve of turbocharged petrol engines.

If the waste gate flap is closed, the boost pressure increases. In the lower speed range, this leads to the turbocharger supplying the boost pressure or the corresponding air volume that is required for a high torque. The actuators are used in turbochargers to improve fuel efficiency.

TECHNICAL DATA	
Rated voltage	13.5 V
Operating voltage	10.5 V – 16 V
Operating temperature	-40°C to +160 °C
Temperature hot soak	-40°C to +160 °C
Nominal angle	108 ± 1.5°
Nominal speed (at 20 Ncm)	> 0.45°/ms
Max. Current consumption	< 11 A
Min. torque ( $U_p$ , 0,1°/ms)	≥ 250 Ncm
Sensor resolution	0.039°
Position tolerance over full angle range	± 2%
Degree of protection	IP 6K9K

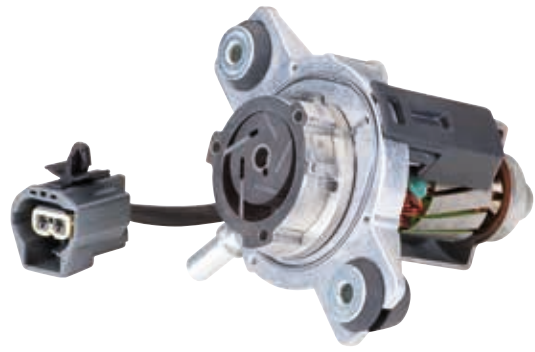
**TECHNICAL DRAWING**



**PROGRAM OVERVIEW**

Test voltage	Voltage range	Torque	Part number	PU*
13.5 V	10.5 V – 16 V	≥ 250 Ncm	On request	-

\* Packaging unit



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**

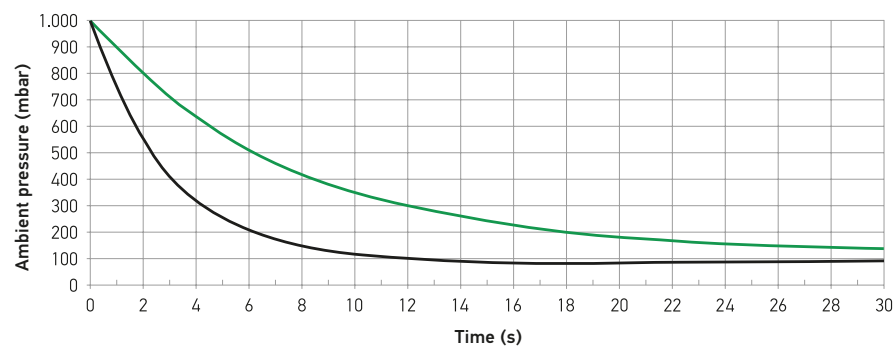
The vacuum pumps' function is based on the rotary vane compressor principle. The pump contains a rotor that is off-centre to the pump chamber. The blades set in the rotor slide along the interior wall of the pump chamber.

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 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**

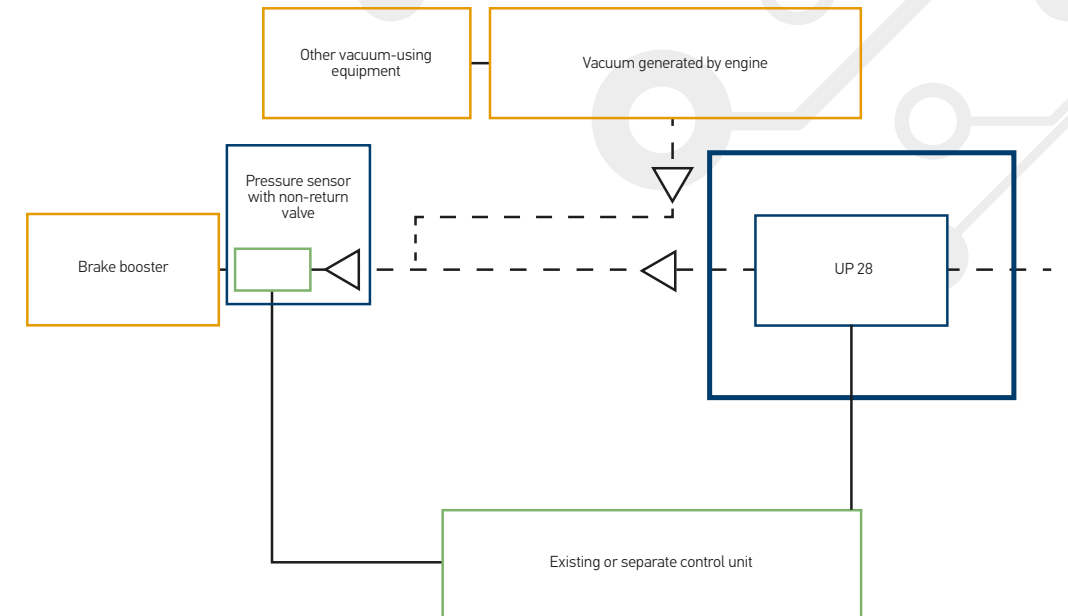


— UP 28  
— UP 5.0

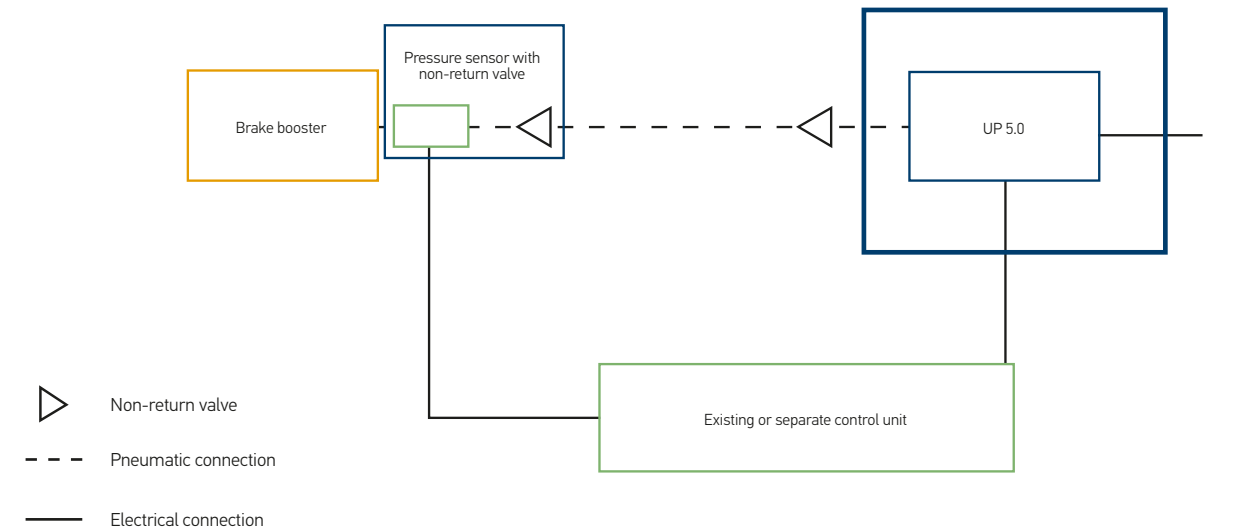
Booster volume = 4 L  
Voltage = 13 V  
Temperature = RT

**COMPARISON OF SUPPORT AND STAND-ALONE APPLICATION TECHNICAL DETAILS**

**SUPPORT APPLICATION UP 28**



**STAND-ALONE APPLICATION UP 5.0**



**PROGRAM OVERVIEW**

Variants	Part number	PU*	Page
UP 28 – with relay box	8TG 008 570-021/-027	1 / 6	88
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	89
Accessories: Pressure sensor with non-return valve	6PP 233 518-011/-017	1 / 72	88 / 89

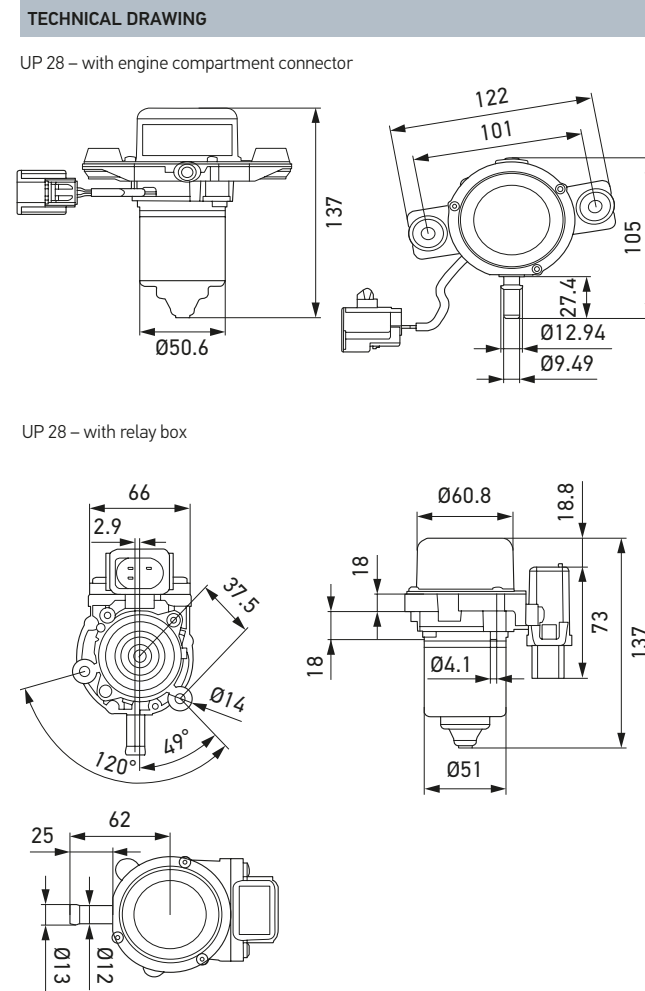
\* Packaging unit



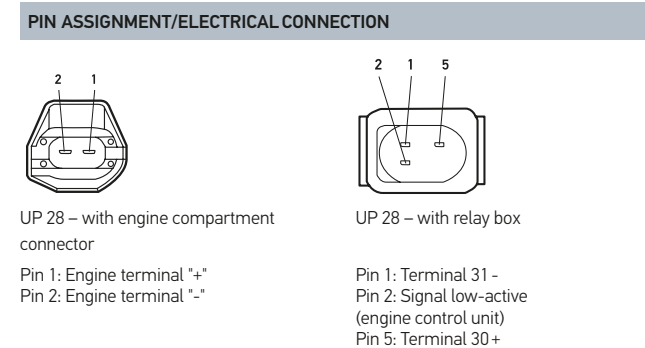
Vacuum pump UP 28  
**8TG 008 570-021 / -027 (with relay box)**  
**8TG 009 428-081 / -087 (with engine compartment connector)**

TECHNICAL DATA	
→ Rotor and pump chamber eccentrically fixed	
→ 5-vane technology	
→ <b>Typical of support applications</b>	
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)
Degree of protection	IP 6K9K
Mating connector UP 28 with relay box <sup>1)</sup>	09 4016-30
Mating connector for UP 28 with engine compartment connector <sup>2)</sup>	2.8, 7283-5575-10

<sup>1)</sup> These accessories are not included in the scope of delivery. Available from Kostal.  
<sup>2)</sup> These accessories are not included in the scope of delivery. Available from Yazaki.



ACCESSORIES		
Variant	Part number	PU*
<b>Pressure sensor with non-return valve</b>		
This pressure sensor is used for measuring the vacuum. It is suitable for applications such as monitoring the brake booster's vacuum circuit. It can be integrated directly into the vacuum line.	<b>6PP 233 518-011 / -017</b>	1 / 72



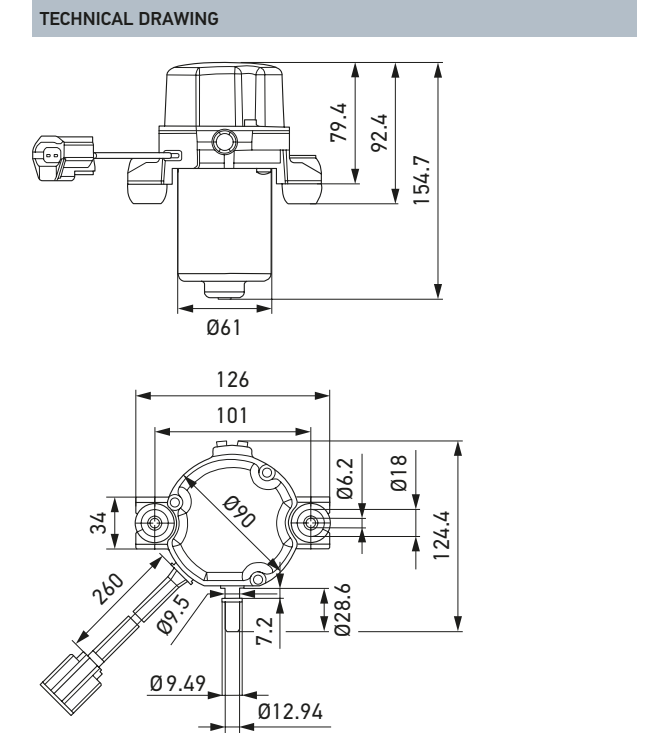
\* Packaging unit



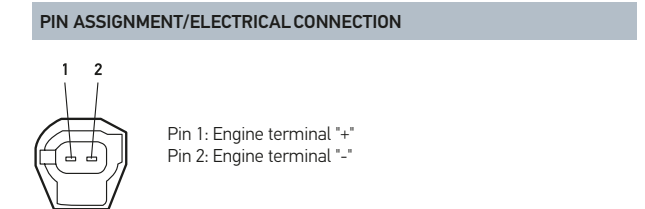
Vacuum pump UP 5.0  
**8TG 012 377-701 / -707 (with engine compartment connector)**

TECHNICAL DATA	
→ Rotor with 8 vanes, optimised shape of pump chamber	
→ Plastic silencer with specific shape for noise level improvement	
→ <b>Typical of stand-alone applications</b>	
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)
Degree of protection	IP 6K9K
Mating connector <sup>1)</sup>	Sealed: 7282-5575-10 With cable seal: 7158-3113-40 With coupling: 7117-4152-02

<sup>1)</sup> This accessory is not included in the scope of delivery. Available from Yazaki.



ACCESSORIES		
Variant	Part number	PU*
<b>Pressure sensor with non-return valve</b>		
This pressure sensor is used for measuring the vacuum. It is suitable for applications such as monitoring the brake booster's vacuum circuit. It can be integrated directly into the vacuum line.	<b>6PP 233 518-011 / -017</b>	1 / 72



\* Packaging unit





Acoustic vehicle alerting system (AVAS)

**PRODUCT FEATURES**

- For all-electric vehicles (PEV), hybrid electric vehicles (HEV) and fuel cell vehicles (FCV) with a silent engine for the purpose of improving road user safety
- Simulates simple engine noise
- Space-saving and compact loudspeaker
- Low power consumption

**DESIGN AND FUNCTION**

The AVAS pedestrian alerting system essentially consists of a signalling device and electronics. The AVAS pedestrian alerting system and the vehicle communicate via CAN bus. In this way, the AVAS system receives information from the vehicle about the vehicle speed and the gear position. As a result, the tone frequency and volume of the simulated engine noise are raised with increasing speed (when starting) and reduced accordingly with decreasing speed. The simulated engine noise is generated when the vehicle is driving forwards and backwards. From a speed of 20 or 30 km/h (country-specific), the rolling noise of the tyres drowns out the actual engine sound, disabling the function of the AVAS.

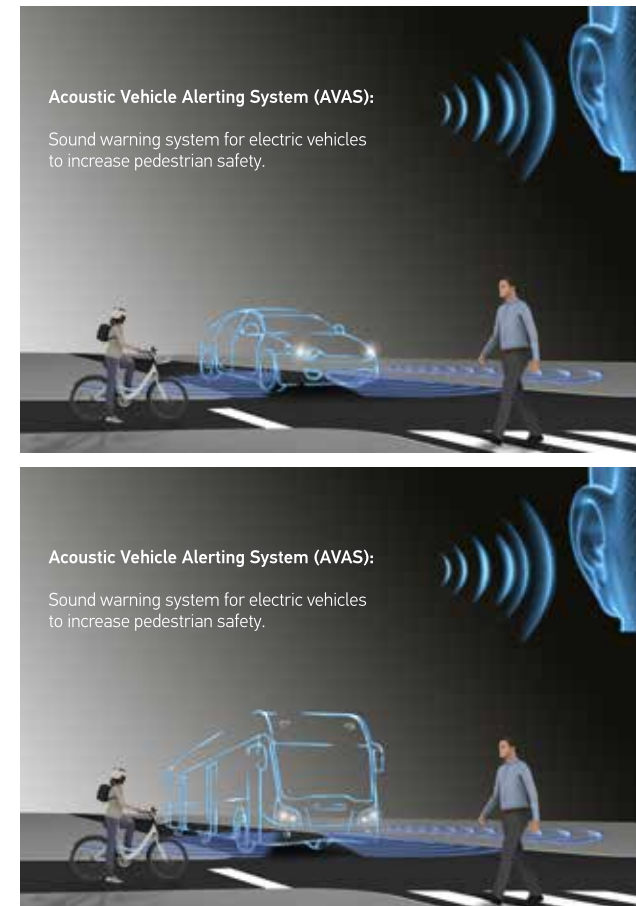
**APPLICATION**

Installing an acoustic alerting system has been mandatory for all newly developed electric and hybrid cars in the European Union since July 2019. And since July 2021, 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. In the USA, the threshold value is 30km/h. Below this level, cars have to produce sounds that resemble an internal combustion engine. When driving faster than this speed, the rolling noise produced by the tyres on the road is sufficient for the vehicle to be perceived by other road users.

**CUSTOMER BENEFITS**

Vehicles can normally be recognised acoustically in road traffic by the sound of their engines. However, electrically powered vehicles emit more or less no sound. This makes them dangerous for pedestrians, blind people, cyclists and other road users. Our acoustic alerting system has therefore been developed for e-vehicles and generates a sound based on an internal combustion engine noise.

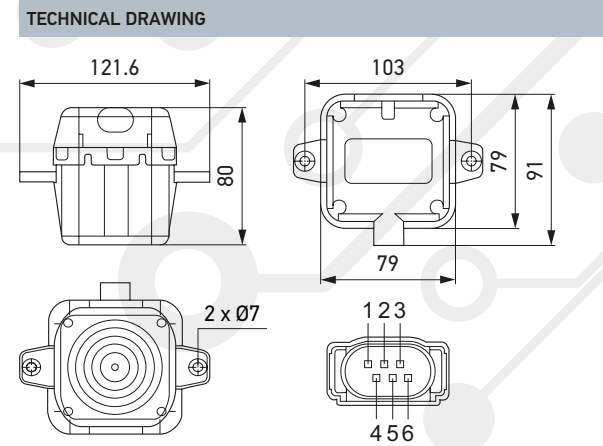
**APPLICATION EXAMPLES**



Standard sound. Customer-specific sounds are available on request.

TECHNICAL DATA	
Operating voltage	9–16 V
Current consumption	150 mA (normal state), Idle current 100 µA
Weight	350 g
Operating temperature	-40°C to +85 °C
CAN	Diagnostics (based on UDS standard)
Loudspeaker	2 inch (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 0–30 km/h (N. N.) Minimum frequency shift speed: 0.8% (km/h)
Vehicle speed	2 to 20 km/h
Degree of protection	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 <sup>1)</sup>	TYCO 1-967616-1

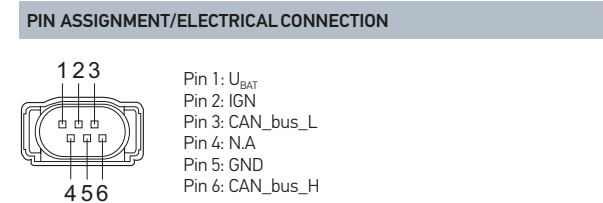
<sup>1)</sup> This accessory is not included in the scope of delivery. Available from Tyco Electronics.



TECHNICAL DATA CAN BUS INTERFACE <sup>1)</sup>	
CAN Specification	High speed automotive CAN
CAN baud rate	500 kbps
Diagnostics	according to UDS standard

<sup>1)</sup> The HELLA AVAS has CAN communication as standard. A DBC file can be provided. Customer-specific adaptations can be implemented on a project-specific basis in consultation with HELLA.

Compatibility to higher level protocols such as SAE J1939 on request.



**PROGRAM OVERVIEW**

Variants	Part number	PU*
AVAS pedestrian alerting system with high-speed CAN communication and standard sound**	3SL 015 329-001/-007	1/30

\* Packaging unit  
\*\* Customised tones available 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

**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.

**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.

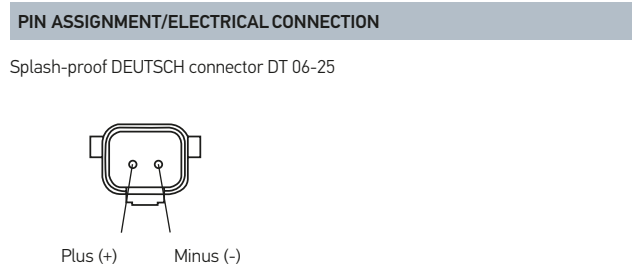
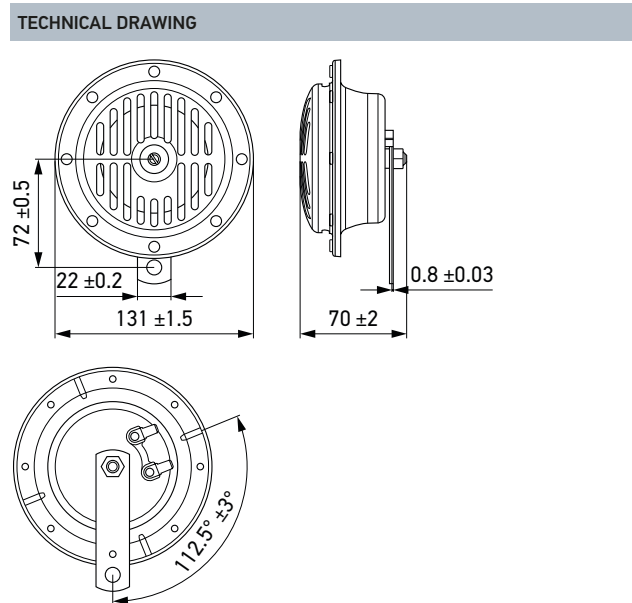
**PROGRAM OVERVIEW**

Variants	Part number	PU*	Page	
<b>Heavy Tone horn DL50 V2</b>				
12 V, 310 Hz, low tone, 6.3 mm flat connector	3CA 004 811-001	1	94	
12 V, 380 Hz, high tone, 6.3 mm flat connector	3CA 004 811-011	1		
24 V, 310 Hz, low tone, 6.3 mm flat connector	3CA 004 811-021	1		
24 V, 380 Hz, high tone, 6.3 mm flat connector	3CA 004 811-031	1		
<b>Rich Tone horn S92</b>				
24 V, 335 Hz, low tone	3AL 012 588-097	48	95	
24 V, 435 Hz, high tone	3AL 012 588-087	48		
12 V, 435 Hz, high tone	3AL 012 588-117	48		
<b>Rich Tone horn M26</b>				
12 V, 335/400 Hz, with Teflon pellet, 6.3 mm flat connector	3AM 002 952-891	1	96	
12 V, 400 Hz, high tone, with Teflon pellet, 6.3 mm flat connector	3AL 002 952-811	1		
12 V, 335 Hz, low tone, with Teflon pellet, 6.3 mm flat connector	3AL 002 952-861	1		
24 V, 335 Hz, low tone, 6.3 mm flat connector	3AL 002 952-871	1		
12 V, 335 Hz, low tone, with Teflon pellet, 6.3 mm splash-proof flat connector with rubber grommet	3AL 002 952-841	1		
12 V, 400 Hz, high tone, 6.3 mm splash-proof flat connector (electrogalvanized) with rubber grommet	3AL 002 952-827	40		
12 V, 400 Hz, high tone, with Teflon pellet, 6.3 mm flat connector	3AL 002 952-857	40		
12 V, 335 Hz, low tone, 6.3 mm splash-proof flat connector (electrogalvanized) with rubber grommet	3AL 002 952-917	40		
12 V, 400 Hz, high tone, 6.3 mm flat connector	3AL 002 952-907	40		
24 V, 400 Hz, high tone, with Teflon pellet, 6.3 mm flat connector	3AL 006 958-821	1		
24 V, 335 Hz, low tone, 6.3 mm flat connector	3AL 002 952-927	40		
<b>Full Tone horn B36</b>				
24 V, 335 Hz, low tone, 6.3 mm flat connector	3BA 002 768-382	1	97	
24 V, 400 Hz, high tone, 6.3 mm flat connector	3BA 002 768-431	1		
24 V, 335 Hz, low tone, 6.3 mm splash-proof flat connector with rubber grommet	3BA 922 200-827	24		
48 V, 335 Hz, low tone, DEUTSCH connector	3BA 002 768-777	24		
80 V, 335 Hz, low tone, DEUTSCH connector	3BA 002 768-007	24		
<b>Horn M28</b>				
12 V, 335 Hz, low tone, 6.3 mm flat connector	3AL 007 425-427	32	98	
<b>Super Tone Horn B133</b>				
12 V, 375/500 Hz, super tone, with Teflon pellet, 6.3 mm splash-proof flat connector with rubber grommet	3AG 003 399-081	1 set	99	
24 V, 375/500 Hz, super tone, with Teflon pellet, 6.3 mm splash-proof flat connector with rubber grommet	3AG 003 399-101	1 set		
12 V, 375 Hz, super tone, with Teflon pellet, 6.3 mm splash-proof flat connector with rubber grommet	3AF 003 399-041	1		
12 V, 500 Hz, super tone, with Teflon pellet, 6.3 mm splash-proof flat connector with rubber grommet	3AF 003 399-051	1		
24 V, 375 Hz, super tone, with Teflon pellet, 6.3 mm splash-proof flat connector with rubber grommet	3AF 003 399-061	1		
24 V, 500 Hz, super tone, with Teflon pellet, 6.3 mm splash-proof flat connector with rubber grommet	3AF 003 399-071	1		
24 V, 375 Hz, super tone, with Teflon pellet, 6.3 mm splash-proof flat connector with rubber grommet	3AF 003 399-327	24		
24 V, 500 Hz, super tone, with Teflon pellet, 6.3 mm splash-proof flat connector with rubber grommet	3AF 003 399-337	24		
24 V, 375 Hz, super tone, splash-proof DEUTSCH connector	3AF 003 399-347	24		
24 V, 500 Hz, super tone, splash-proof DEUTSCH connector	3AF 003 399-357	24		
<b>Horn S70</b>				
Ideal for cars and motorbikes/scooters				
12 V, 420 Hz, 6.3 mm flat connector	3AL 922 196-011		100	
<b>Strong tone horn S90</b>				
12 V, 350 Hz, high tone, 6.3 mm flat connector	3AM 922 100-267	24	101	
12 V, 415 Hz, high tone, 6.3 mm flat connector	3AM 922 200-617	24		
12 V, 350 Hz, low tone, DEUTSCH connector	3AM 922 200-761	1		
12 V, 350 Hz, low tone, DEUTSCH connector	3AM 922 200-767	24		



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)
Power 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
Degree of protection	IP 54
Lifetime	100,000 cycles (ECE-R28)
Housing material	Metal
Type approval	ECE-R28



PROGRAM OVERVIEW

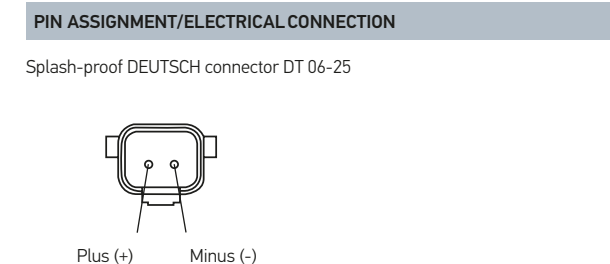
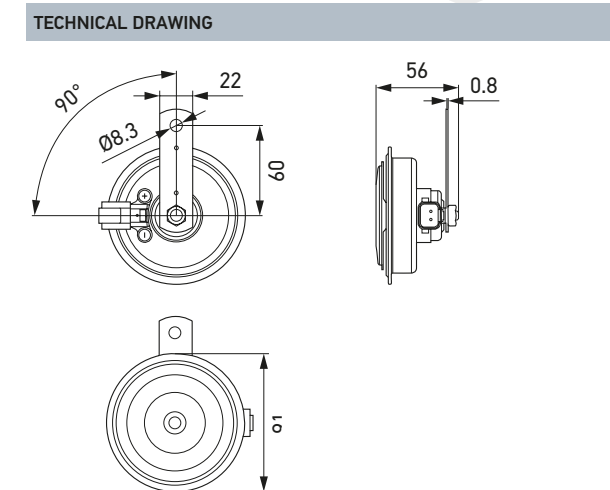
Variants	Part number	PU*
12 V, 310 Hz, low tone, 6.3 mm flat connector	3CA 004 811-001	1
12 V, 380 Hz, high tone, 6.3 mm flat connector	3CA 004 811-011	1
24 V, 310 Hz, low tone, 6.3 mm flat connector	3CA 004 811-021	1
24 V, 380 Hz, high tone, 6.3 mm flat connector	3CA 004 811-031	1

\* 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)
Power 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
Degree of protection	IP 67
Lifetime	100,000 cycles (ECE-R28)
Housing material	Metal
Type approval	ECE-R28



PROGRAM OVERVIEW

Variants	Part number	PU*
24 V, 335 Hz, low tone	3AL 012 588-097	48
24 V, 435 Hz, high tone	3AL 012 588-087	48
12 V, 435 Hz, high tone	3AL 012 588-117	48

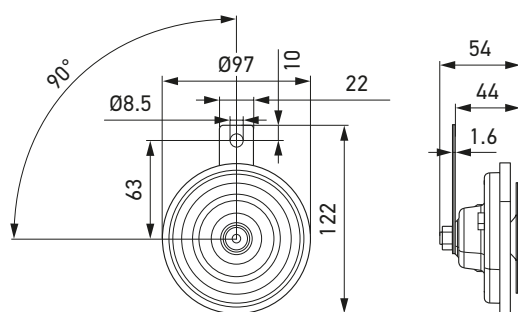
\* Packaging unit. Single packaging on request.



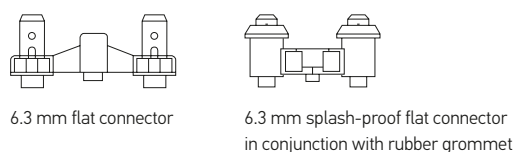
Rich Tone horn M26

TECHNICAL DATA	
Diameter	97 mm
Rated voltage	12 / 24 V
Frequency range	335 Hz (low tone) 400 Hz (high tone)
Sound pressure level at 2 m distance	15 dB(A)
Power consumption	12 V horns: 66 W (-891, -811, -861), 72 W (-841, -917, -907), 54 W (-827), 60 W (-857) 24 V horns: 84 W
Current consumption	-891, -811, -861 max. 5.5 A -841, -917, -907 max. 6 A -827 max. 4.5 A -871, -821, -927 max. 3.5 A
Operating temperature	-40 °C to +60 °C
Degree of protection	IP X9K -841, -827, 917, -871, -927 additionally IP X7
Lifetime	50,000 cycles (ECE-R28)
Housing material	Metal
Type approval	ECE R28, (E) 0020011

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



PROGRAM OVERVIEW

Variants	Part number	PU*
12 V, 335/400 Hz, with Teflon pellet, diameter 97 mm, 6.3 mm flat connector	3AM 002 952-891	1
12 V, 400 Hz, high tone, with Teflon pellet, diameter 97 mm, 6.3 mm flat connector	3AL 002 952-811	1
12 V, 335 Hz, low tone, with Teflon pellet, diameter 97 mm, 6.3 mm flat connector	3AL 002 952-861	1
24 V, 335 Hz, low tone, diameter 97 mm, 6.3 mm flat connector	3AL 002 952-871	1
12 V, 335 Hz, low tone, with Teflon pellet, diameter 97 mm, 6.3 mm splash-proof flat connector with rubber grommet	3AL 002 952-841	1
12 V, 400 Hz, high tone, diameter 97 mm, 6.3 mm splash-proof flat connector (electrogalvanized) with rubber grommet	3AL 002 952-827	40
12 V, 400 Hz, high tone, with Teflon pellet, diameter 97 mm, 6.3 mm flat connector	3AL 002 952-857	40
12 V, 335 Hz, low tone, diameter 97 mm, 6.3 mm splash-proof flat connector (electrogalvanized) with rubber grommet	3AL 002 952-917	40
12 V, 400 Hz, high tone, diameter 97 mm, 6.3 mm flat connector	3AL 002 952-907	40
24 V, 400 Hz, high tone, with Teflon pellet, diameter 97 mm, 6.3 mm flat connector	3AL 006 958-821	1
24 V, 335 Hz, low tone, diameter 97 mm, 6.3 mm flat connector	3AL 002 952-927	40

\* Packaging unit

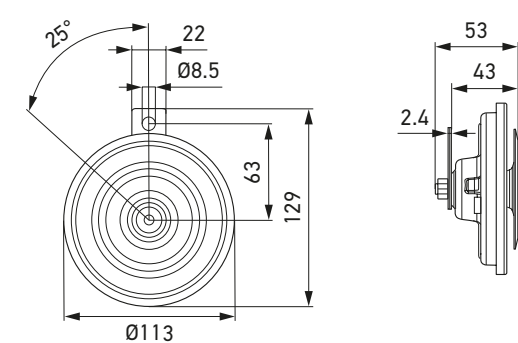


Full Tone horn B36

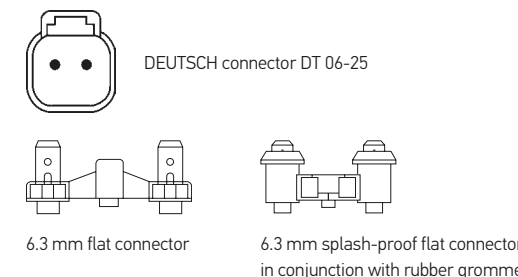
TECHNICAL DATA	
Diameter	97 mm / 113 mm
Rated voltage	12 V / 24 V / 48 V / 80 V
Frequency range	335 Hz (low tone) 400 Hz (high tone)
Sound pressure level at 2 m distance	115 ± 3 dB(A)
Power consumption	72 W (12 V) 72 W (24 V) 64 W (48 V) 48 W (80 V)
Current consumption	max. 6.0 A (12 V) max. 3 A (24 V) max. 1.3 A (48 V) max. 0.5 A (80 V)
Operating temperature	-40°C to +85 °C
Degree of protection	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



PIN ASSIGNMENT/ELECTRICAL CONNECTION



PROGRAM OVERVIEW

Variants	Part number	PU*
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 flat connector in conjunction with rubber grommet (9GT 700 452-005)	3BA 922 200-827	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

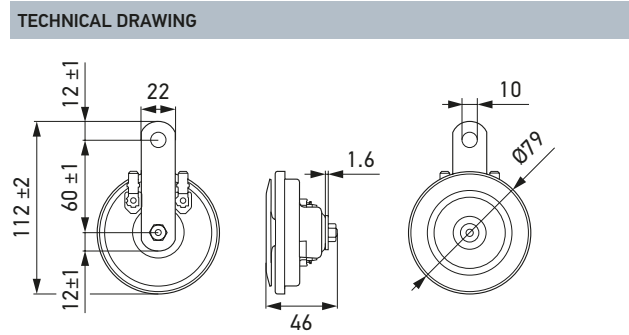
\* Packaging unit





Horn M28

TECHNICAL DATA	
Diameter	80 mm
Operating voltage	9 – 15 V
Frequency range	335 Hz
Sound pressure level at 2 m distance	105 – 118 dB(A)
Power consumption	60 W
Current consumption	3.5 A max.
Operating temperature	-40 °C to +80 °C
Degree of protection	IP 67
Lifetime	500,000 cycles
Housing material	Metal
Type approval	ECE R28 (lifetime) ECE R10 (EMC)



PROGRAM OVERVIEW

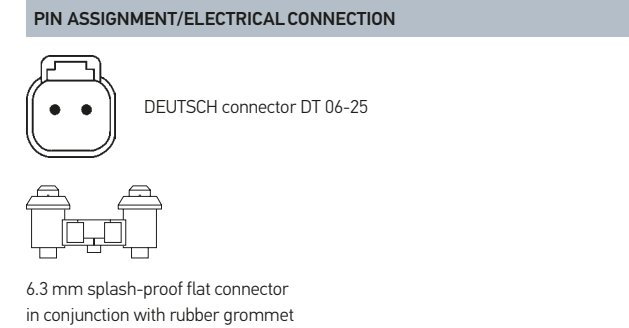
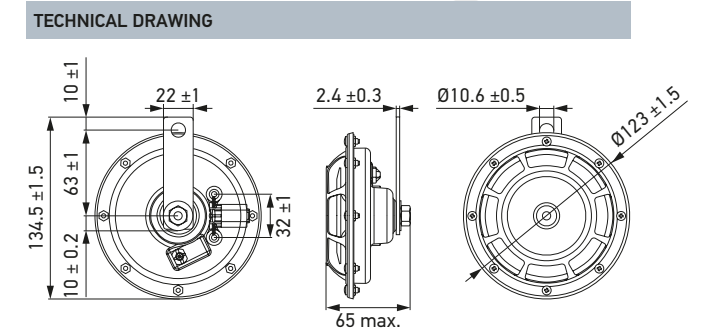
Variants	Part number	PU*
12 V, 335 Hz, low tone, 6.3 mm flat connector	3AL 007 425-427	32

\* Packaging unit



Super Tone horn B133

TECHNICAL DATA	
Diameter	123 mm
Operating voltage	12 / 24 V
Frequency range	375 / 500 Hz
Sound pressure level at 2 m distance	118 dB(A)
Power consumption	78 W (12 V) 84 W (24 V)
Current consumption	6.5 A max. (12 V) 3.5 A max. (24 V)
Operating temperature	-40 °C to +60 °C
Degree of protection	IP X9K, IP X7
Lifetime	50,000 cycles
Housing material	CRCS class EDD
Type approval	ECE R28, (E) 000414



PROGRAM OVERVIEW

Variants	Part number	PU*
12 V, 375/500 Hz, super tone, with Teflon pellet, 6.3 mm splash-proof flat connector with rubber grommet	3AG 003 399-081	1 set
24 V, 375/500 Hz, super tone, with Teflon pellet, 6.3 mm splash-proof flat connector with rubber grommet	3AG 003 399-101	1 set
12 V, 375 Hz, super tone, with Teflon pellet, 6.3 mm splash-proof flat connector with rubber grommet	3AF 003 399-041	1
12 V, 500 Hz, super tone, with Teflon pellet, 6.3 mm splash-proof flat connector with rubber grommet	3AF 003 399-051	1
24 V, 375 Hz, super tone, with Teflon pellet, 6.3 mm splash-proof flat connector with rubber grommet	3AF 003 399-061	1
24 V, 500 Hz, super tone, with Teflon pellet, 6.3 mm splash-proof flat connector with rubber grommet	3AF 003 399-071	1
24 V, 375 Hz, super tone, with Teflon pellet, 6.3 mm splash-proof flat connector with rubber grommet	3AF 003 399-327	24
24 V, 500 Hz, super tone, with Teflon pellet, 6.3 mm splash-proof flat connector with rubber grommet	3AF 003 399-337	24
24 V, 375 Hz, super tone, splash-proof DEUTSCH connector	3AF 003 399-347	24
24 V, 500 Hz, super tone, splash-proof DEUTSCH connector	3AF 003 399-357	24

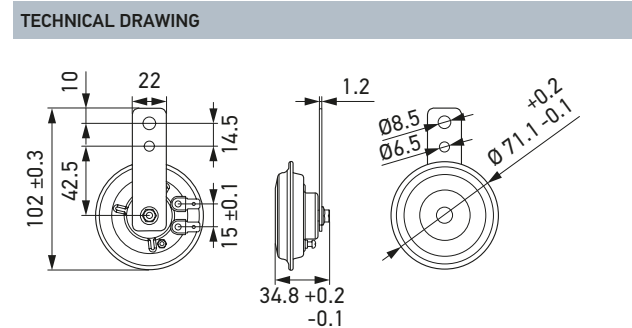
\* Packaging unit





Horn S70

TECHNICAL DATA	
Diameter	70 mm
Operating voltage	12 V
Frequency range	420 Hz
Sound pressure level at 2 m distance	112 dB(A)
Power consumption	30 W
Current consumption	2.5 A max.
Operating temperature	-40°C to +90 °C
Degree of protection	IP X4K / IP X7 / IP X9K
Lifetime	100,000 cycles
Housing material	CRCS class EDD
Type approval	ECE / ECE-R28, 006053



PROGRAM OVERVIEW

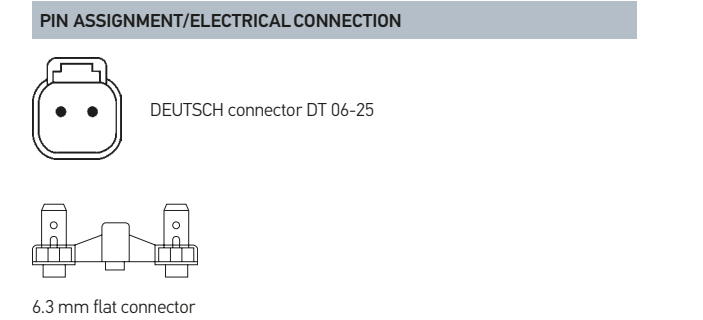
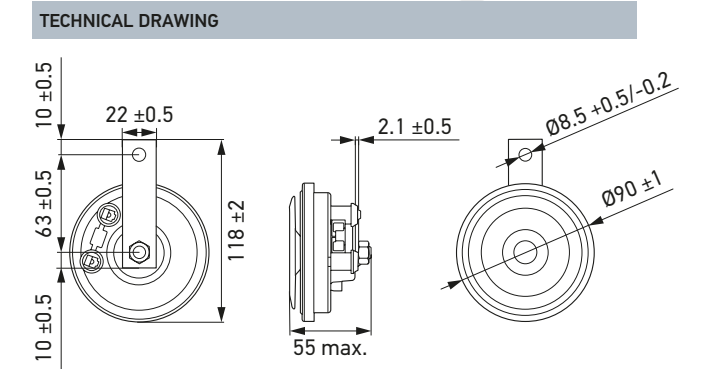
Variants	Part number	PU*
12 V, 420 Hz, 6.3 mm flat connector	3AL 922 196-011	1

\* Packaging unit



Strong tone horn S90

TECHNICAL DATA	
Diameter	90 mm
Frequency range	350 / 415 Hz
Sound pressure level at 2 m distance	113 dB (A)
Power consumption	42 W
Current consumption	3.5 A max.
Operating temperature	-40° to +90° C
Degree of protection	IP X9K / IP X7
Lifetime	50,000 cycles
Housing material	CRCS class EDD
Type approval	ECE-R28



PROGRAM OVERVIEW

Variants	Part number	PU*
12 V, 350 Hz, low tone, 6.3 mm flat connector	3AM 922 100-267	24
12 V, 415 Hz, high tone, 6.3 mm flat connector	3AM 922 200-617	24
12 V, 350 Hz, low tone, DEUTSCH connector	3AM 922 200-761	1
12 V, 350 Hz, low tone, DEUTSCH connector	3AM 922 200-767	24

\* 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**

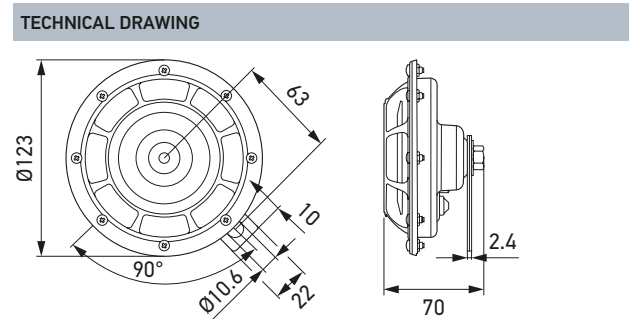
Variants	Part number	PU*	Page
<b>B133E</b>			
24 V, 300 Hz, low tone	3AF 005 631-221	1	104
	3AF 005 631-227	32	
24 V, 450 Hz, high tone	3AF 005 631-231	1	
	3AF 005 631-237	32	
<b>S92E</b>			
24 V, 300 Hz, low tone	3AL 012 588-207	48	105
24 V, 400 Hz, high tone	3AL 012 588-217	48	
12 V, 300 Hz, low tone	3AL 012 588-227	48	
12 V, 400 Hz, high tone	3AL 012 588-237	48	

\* Packaging unit



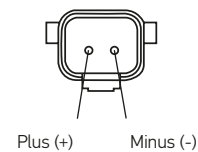
Long-life electronic horn B133E

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)
Power consumption	60 W
Current consumption	max. 2.5 A
Operating temperature	-40°C to +85 °C
Degree of protection	IP 67
Lifetime	500,000 cycles (ECE-R28)
Housing material	Metal
Type approval	ECE-R28 ECE-R10



PIN ASSIGNMENT/ELECTRICAL CONNECTION

Splash-proof DEUTSCH connector DT 06-25



PROGRAM OVERVIEW

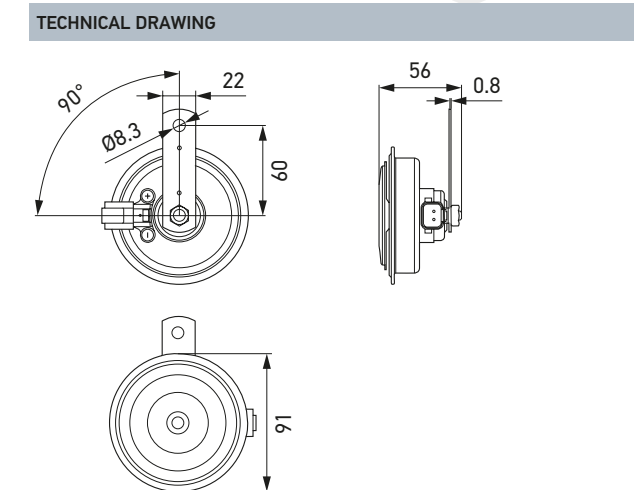
Variants	Part number	PU*
24 V, 300 Hz, low tone	3AF 005 631-221	1
	3AF 005 631-227	32
24 V, 450 Hz, high tone	3AF 005 631-231	1
	3AF 005 631-237	32

\* Packaging unit



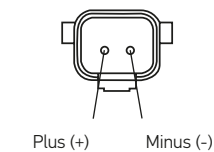
Long-life electronic horn S92E

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)
Power 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
Degree of protection	IP 67
Lifetime	500,000 cycles (ECE-R28)
Housing material	Metal
Type approval	ECE-R28 ECE-R10



PIN ASSIGNMENT/ELECTRICAL CONNECTION

Splash-proof DEUTSCH connector DT 06-25



PROGRAM OVERVIEW

Variants	Part number	PU*
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

\* Packaging unit. Single packaging on request.



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

**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**

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 FMCW radar (frequency modulated continuous wave radar), these 77 GHz sensors detect objects even under extreme weather conditions: Neither rain, snow, fog nor extreme temperatures affect 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.

**APPLICATION EXAMPLES:**

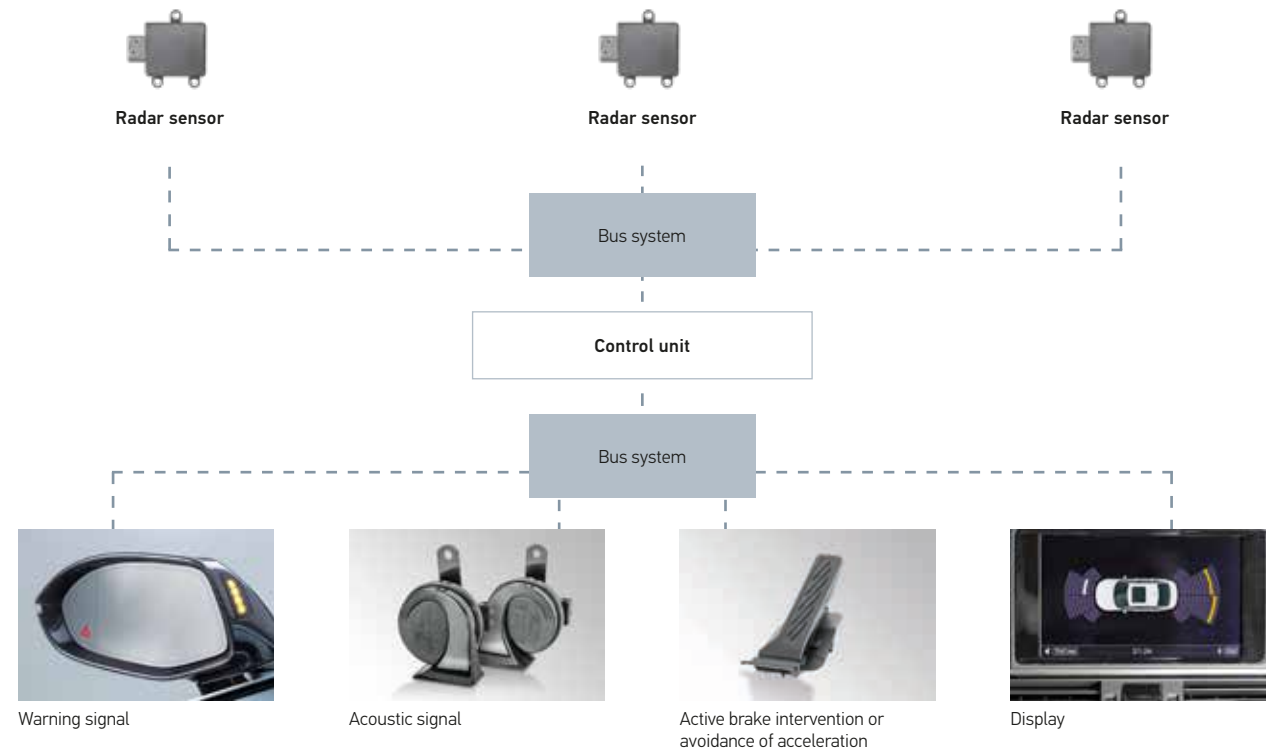
**Vehicle rear end**

- 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**



**PROGRAM OVERVIEW**

Variants	Degree of protection	Part number	PU**
77 GHz radar sensor	IP 6K7, IP X9K*	on request	-

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

\*\* Packaging unit



77 GHz radar sensor  
Part number on request

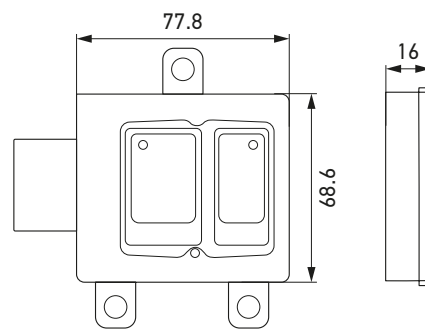
**TECHNICAL DATA**

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
Degree of protection	IP 6K7, IP X9K <sup>1)</sup>
Mounting	3 eyelets for M6 screws
Supply voltage	12 V / 24 V
Maximum idle 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 <sup>2)</sup>	1-1703639-1

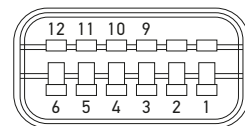
<sup>1)</sup> If the diaphragm is protected according to an installation guideline for pressure compensation

<sup>2)</sup> This accessory is not included in the scope of delivery. Available from TE Connectivity.

**TECHNICAL DRAWING**

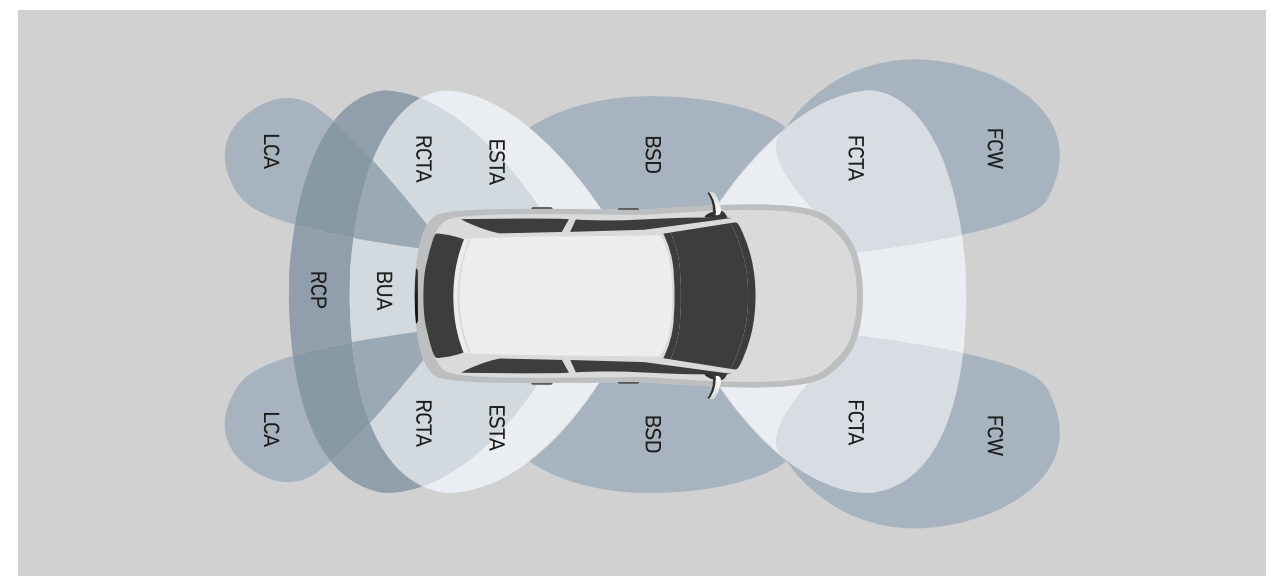


**PIN ASSIGNMENT/ELECTRICAL CONNECTION**



- Pin 1: VCAN H
- Pin 2: VCAN L
- Pin 3: POS 3
- Pin 4: POS 2
- Pin 5: WAKE
- Pin 6: U<sub>BAT</sub>
- Pin 7: -
- Pin 8: -
- Pin 9: PCAN H
- Pin 10: PCAN L
- Pin 11: POS 1
- Pin 12: GND

**POSSIBLE AREAS OF APPLICATION**



**REAR**

**LCA – Lane Change Assistant**

Lane Change Assist – Detects and warns of approaching vehicles remotely

**RCP – Rear Crash Detection**

Detects a collision situation and prepares the active safety systems

**RCTA – RearCross Traffic Alert**

Warning of rear cross traffic, of moving objects or of stationary objects when reversing

**ESTA – Exit Assistant**

Safe exit assistant in uncertain situations

**BSD – Blind Spot Detection**

Detection of objects located in the blind spot

**FRONT**

**BSD – Blind Spot Detection**

Detection of objects located in the blind spot

**FCTA – Front Cross Traffic Alert**

Warning of cross traffic in the vicinity of crossroads and when leaving a parking space

**FCW – Forward Collision Warning**

Early detection of slower vehicles up ahead





### Relays and relay devices

#### PRODUCT RANGE

- Mini relays (normally open and changeover relays)
- Micro relay (normally open/changeover relay)
- High power relay (normally open relay)
- Flasher units
- Washing/wiping interval control units
- Time control units

Relays are used in automotive engineering to switch high currents. The engine control unit, for example, is switched by a relay. Because relays are robust and not particularly susceptible to failure, they can be installed near electric consumers. They only require low control currents for switching, making small line cross-sections sufficient.

The switching and amplifier function of a relay could only be achieved with a lot more effort and a lot less reliability using more "modern" electronics. Another advantage of the relay: You can replace it quickly and easily. These many positive characteristics are the reason why relays are still in use. And they ensure that relays will continue to be at home in many vehicles in the future.

HELLA quality relays have many uses and are always reliable this is what our long-standing original equipment experience and our great production expertise stand for. Renowned automotive manufacturers have been relying on the trusted HELLA quality for decades.

#### → Manufacturing expertise:

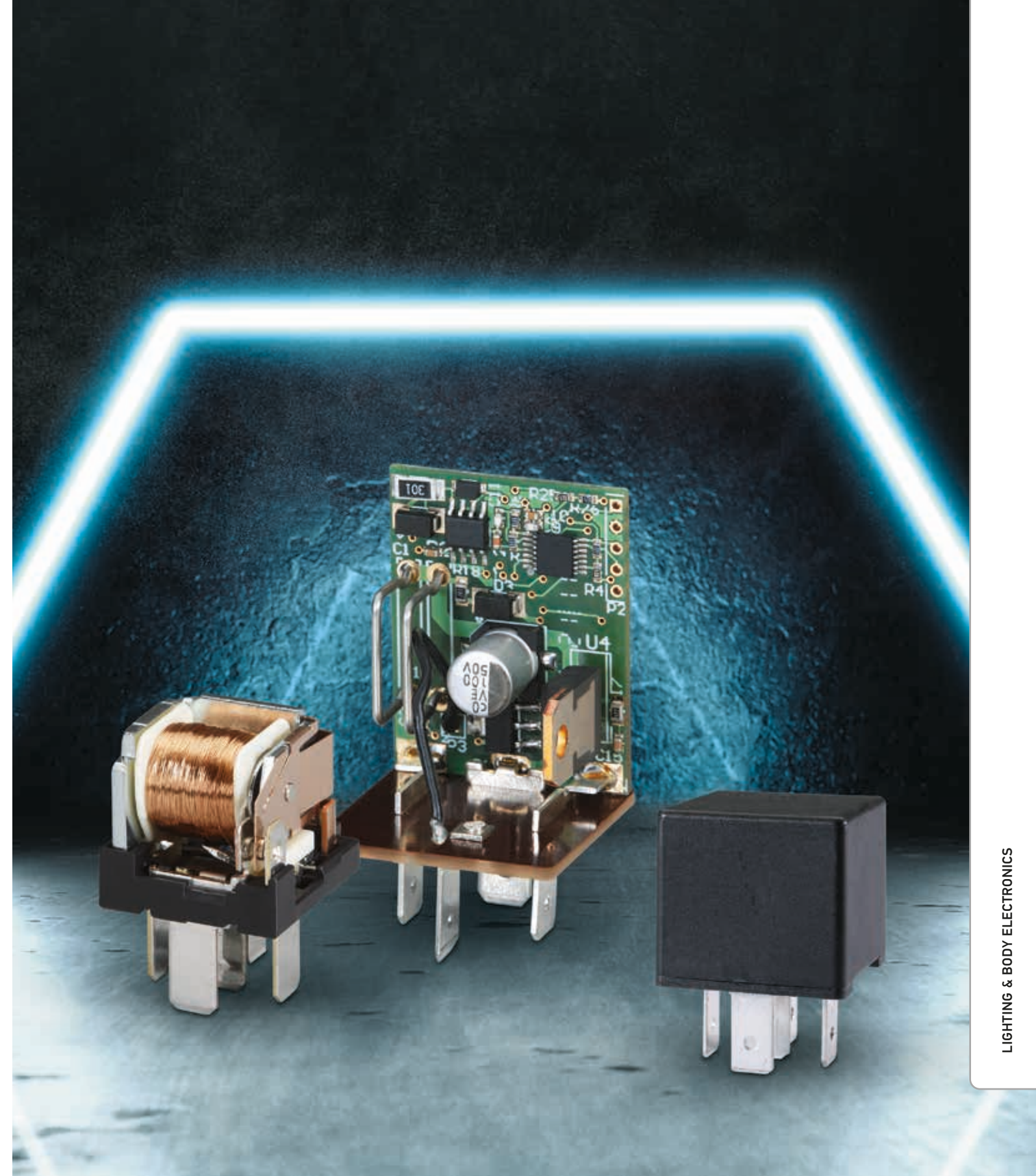
HELLA produces more than 100 million units each year in-house – thanks to optimised production at an attractive price and with one of the lowest failure rates in the entire industry.

#### → Flexibility:

At HELLA, large volumes are produced fully automatically, smaller volumes semi-automatically. This allows a quick changeover in semi-automatic operation. HELLA is able to react to customer wishes in the shortest possible time and to realise new variants promptly in addition to the existing product range.

#### → Original equipment customers:

HELLA develops and produces relays, for example for AGCO, Claas, Daimler, Ford, VW, GM, JCB, Opel, Nissan, John Deere, Chrysler, Jaguar/Land Rover, BMW, Audi, Volvo, Renault, PSA, BYD and FAW. Many of our customer relationships have existed for decades.



#### PRODUCTS AND APPLICATIONS



**Brochure – Relays and relay units**  
You can find the entire range in the specific brochure here as a PDF download.

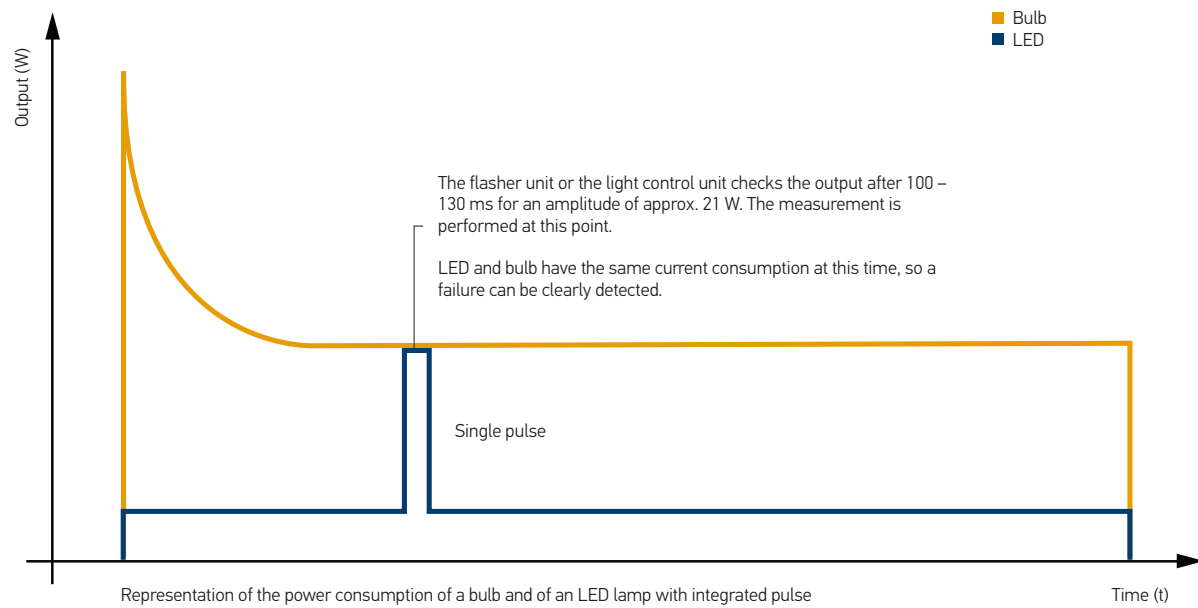


**LED lighting:  
Failure control and electrical connection**

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 using 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 using direction indicator control units.

**FUNCTIONAL DIAGRAM**



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 that make it possible to display the 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:



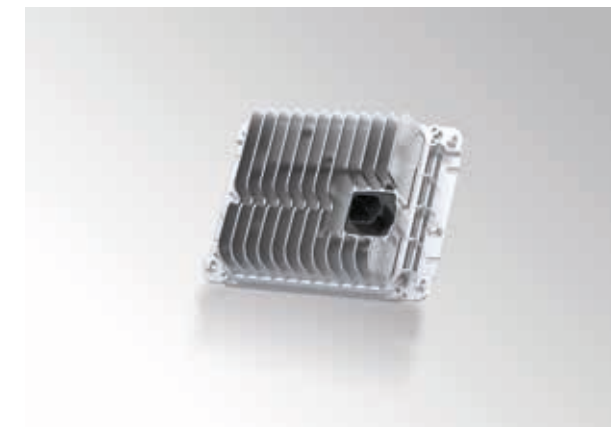
**ISO 13207-compliant LED lamps and LED flasher units**  
LED flasher unit: Towing vehicle

» Page 116–117



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

» Page 118

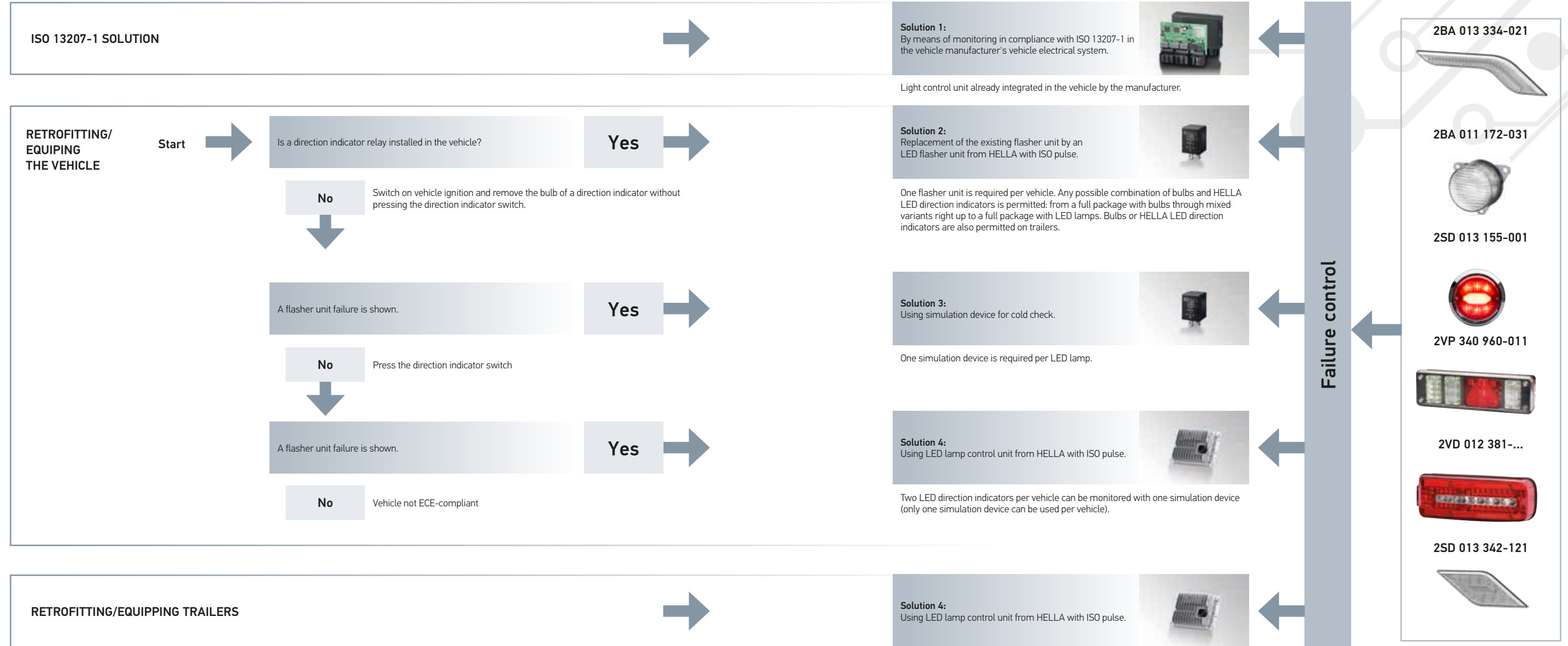


**LED lamp control units for function monitoring**  
LED lamp control unit

» Page 119–121



## The right solution for your vehicle electronics



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

**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°C to +85 °C	-40°C to +85 °C
Degree of protection	IP 54 (contacts underneath)	IP 54 (contacts underneath)

<b>Simulation device</b>		
for cold check	<b>5DS 009 602-011</b>	<b>5DS 009 602-001</b>

**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°C to +50 °C
Degree of protection	IP 6K9K
<b>Basic control unit</b>	
12 V	<b>5DS 227 488-001*</b>
24 V	<b>5DS 227 488-101*</b>
<b>Premium control unit</b>	
12 V (1 stop light channel)	<b>5DS 227 489-001*</b>
12 V (2 stop light channel)	<b>5DS 227 489-011*</b>
24 V (1 stop light channel)	<b>5DS 227 489-101*</b>

\* 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

Failure control and electrical connection

### PRODUCT FEATURES

- For controlling direction indicators in accordance with ISO 13207-1
- For vehicles with 12 V and 24 V vehicle electrical system voltage
- Any combination of bulbs and ISO LED lamps possible
- Suitable for additional operation of trailer direction indicators
- Pin diagram compatible with ISO 7588-2

### APPLICATION

Control function: The failure of a direction indicator in a motor vehicle or trailer has to be shown to the driver either acoustically or by means of warning 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).

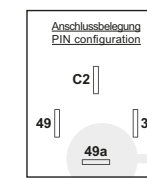
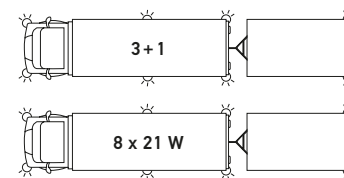
### DESIGN AND FUNCTION

LED direction indicators conforming to ISO 13207 can "communicate" with the flasher unit. The flasher unit checks a firmly defined energy requirement at a firmly defined time: Exactly 21 W from 100 – 130 ms after each time the direction indicator is switched on. 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: 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.

Technical data – 12 V	
Rated voltage	12 V
Operating voltage	10.5 – 15 V
Rated load	4DN 009 492-101 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 %
Degree of protection	IP 54
Operating temperature	-40°C to +85 °C
Storage temperature	-40°C to +85 °C
Contacting	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 %
Degree of protection	IP 54
Operating temperature	-40°C to +85 °C
Storage temperature	-40°C to +85 °C
Contacting	Flat connector DIN 46244 A6: 6.3 x 0.8 mm



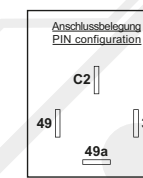
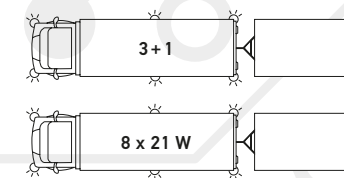
### 12 V, LED flasher unit 3+1

#### EP-control

Lamp failure control tractor: High frequency  
Lamp failure control C2: 1. 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



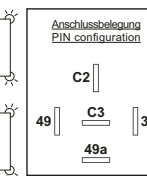
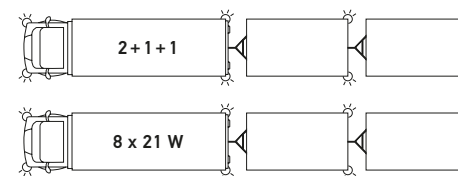
### 24 V, LED flasher unit 3+1

#### EP-control

Lamp failure control tractor: High frequency  
Lamp failure control C2: 1. 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



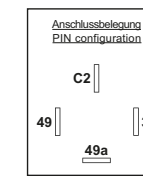
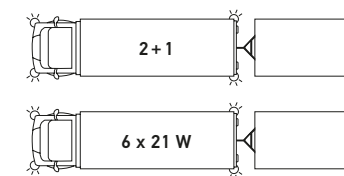
### 12 V, LED flasher unit 2+1+1

#### EP-control

Lamp failure control tractor: High frequency  
Lamp failure control C2: 1. Trailer C2 lamp off  
Lamp failure control C3: 2. 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 tractor: High frequency  
Lamp failure control C2: 1. 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

### Key

F1: normal flashing frequency, F2: increased flashing frequency



### Solution 3: Simulation device for cold check with LED lamps

Failure control and electrical connection

#### PRODUCT FEATURES

- For individual function monitoring of LED direction indicators compatible with ISO standard 13207-1
- Storage and transmission of the last function status of the LED direction indicator to the central control unit
- For vehicles with 12 V and 24 V vehicle electrical system voltage
- Pin diagram compatible with ISO 7588-2

#### APPLICATION

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.

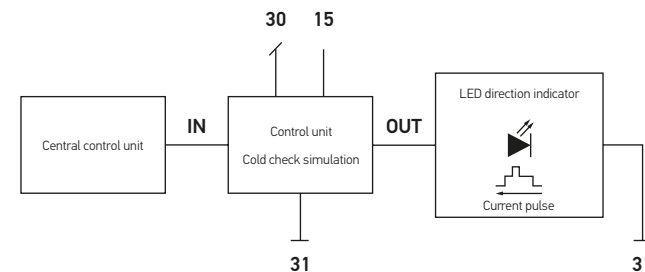
As LED lamps are essentially not suitable for this form of monitoring, HELLA offers an electronic system for "simulation of the cold check" in order to ensure operation.

#### DESIGN AND FUNCTION

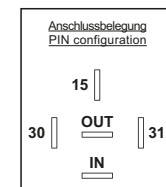
The control unit for cold checking is connected between the central control unit and an ISO 13207-compliant LED direction indicator.

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.

#### BLOCK DIAGRAM



#### PIN ASSIGNMENT/ELECTRICAL CONNECTION

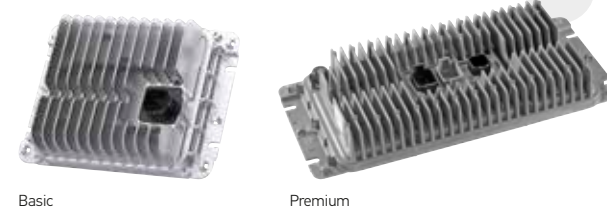


#### TECHNICAL DATA

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

#### Simulation device

For cold check	5DS 009 602-011	5DS 009 602-001
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### Solution 4: LED lamp control unit

Failure control and electrical connection

#### PRODUCT FEATURES

- To monitor the function of the light functions
- Only one control unit is required for both sides (right and left).
- The DEUTSCH connector, itself integrated in the housing, enables easy integration in 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

#### HELLA offers two different types of LED lamp control units designed to monitor light functions:

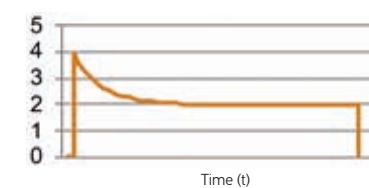
- Basic version: Monitors only the direction indicators
- Premium version: this monitors all lighting functions

### Configuration example with ISO pulse

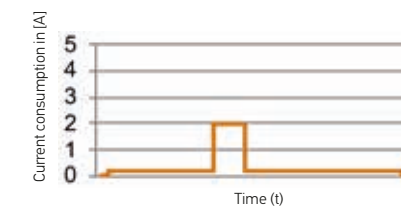
In accordance with ISO 13207



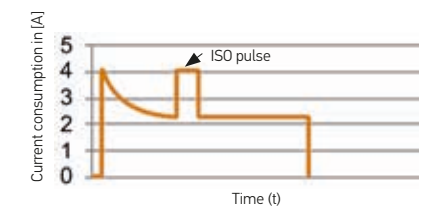
Current consumption LED lamp control unit



Shapeline current consumption with integrated pulse



Total current consumption of control unit and lamps with integrated pulse



\*for more details see ISO 13207





**System representation: Basic**

Control unit is **only** responsible for monitoring the direction indicators.

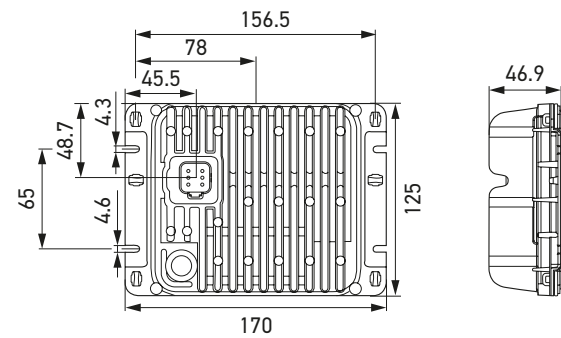
TECHNICAL DATA	
Operating voltage (12 V version)	9 – 16 V
Operating voltage (24 V version)	18 – 32 V
Operating temperature	-40°C to +50 °C
Degree of protection	IP 6K9K

With cold check: Avoid pulses between 30 µA and 10 mA!

BASIC CONTROL UNIT*		PU**
12 V, with 6-pin socket housing	5DS 227 488-001	1
24 V, with 6-pin socket housing	5DS 227 488-101	1
<b>Sets (control unit and wiring harness)*</b>		
24 V basic control unit and wiring harness with EasyConn connectors	5DS 009 552-081	1
24 V basic control unit and wiring harness with 6.3 mm flat receptacles	5DS 009 552-101	1
<b>Accessories</b>		
Wiring harness with EasyConn connectors, for basic control unit	8KA 340 128-001	1
Wiring harness with 6.3 mm flat receptacles	8KA 340 128-021	1

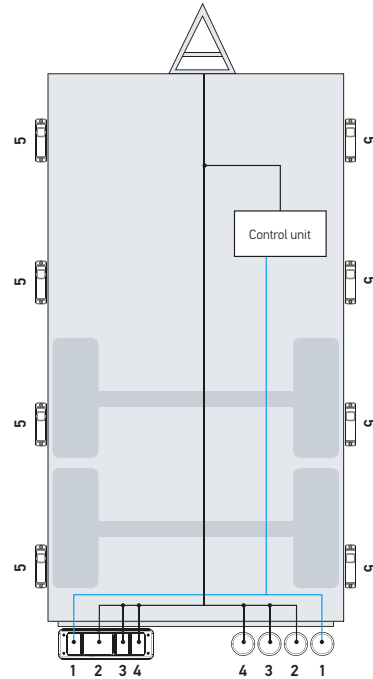
\* Constant vehicle electric system voltage to the rear lamps must be guaranteed.

**TECHNICAL DRAWING**

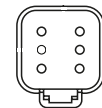


Key

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



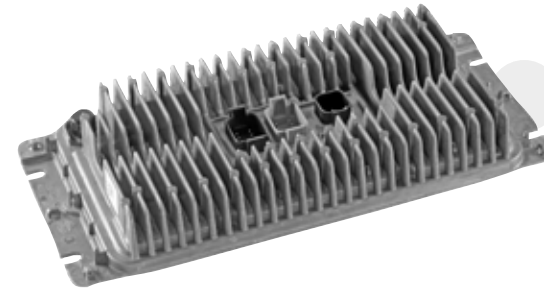
**PIN ASSIGNMENT/ELECTRICAL CONNECTION**



- Pin 1 Input: Right direction indicator light
- Pin 2 Input: Ground
- Pin 3 Input: Left direction indicator light
- Pin 4 Output: Left direction indicator light
- Pin 5 Output: Ground
- Pin 6 Output: Right direction indicator light

Mating connectors can be found on page 7.

\*\* Packaging unit



**System representation: Premium**

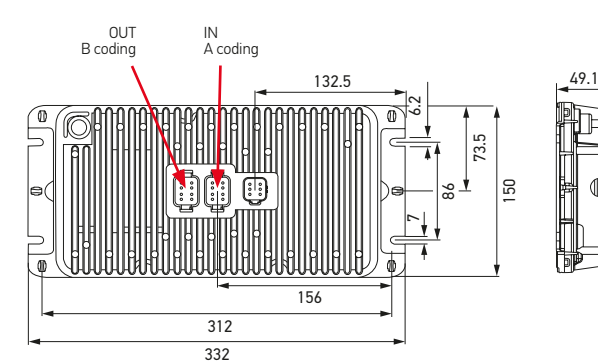
Control unit is responsible for monitoring the **whole** rear lighting (tail lights, stop lights, direction indicator lights, reversing light and rear fog light).

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
Degree of protection	IP 6K9K

With cold check: Avoid pulses between 30 µA and 10 mA!

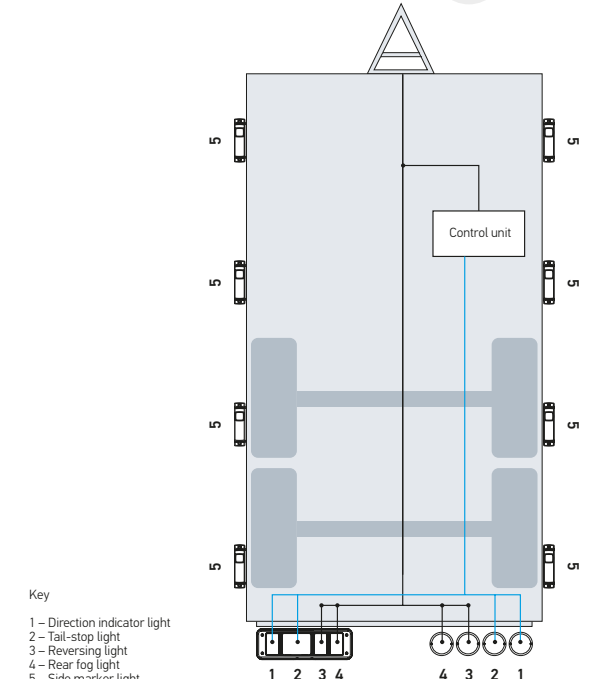
PREMIUM CONTROL UNIT		PU**
12 V, with 8-pin socket housing (1 stop light channel)	5DS 227 489-001	1
12 V, with 8-pin socket housing (2 stop light channels)	5DS 227 489-011	1
24 V, with 8-pin socket housing (1 stop light channel)	5DS 227 489-101	1
<b>Accessories</b>		
Wiring harness with EasyConn connectors, for Premium control unit	8KA 340 128-011	1
Wiring harness with 6.3 mm flat receptacles	8KA 340 128-021	1

**TECHNICAL DRAWING**

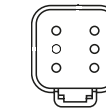


Key

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

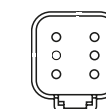


**PIN ASSIGNMENT 12 V**



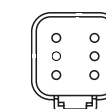
- 1 Input Stop light, left
- 2 Input Tail light, right
- 3 Input Tail light, left
- 4 Input Stop light, right
- 5 Input Reversing light
- 6 Input Rear fog light
- 7 Ground
- 8 Not used

**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 Ground
- 8 Not used

**PIN ASSIGNMENT 6-PIN CONNECTION**



- 1 Input Direction indicator light, right
- 2 Ground
- 3 Input Direction indicator light, left
- 4 Output Direction indicator light, left
- 5 Ground
- 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

### PRODUCT FEATURES

- For individual function monitoring of LED headlamps and beacons
- Failure indication via status output
- For vehicles with 12 V and 24 V vehicle electrical system voltage
- Pin diagram compatible with ISO 7588-2

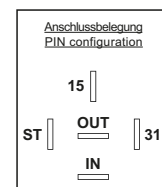
### APPLICATION

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.

### TECHNICAL DATA

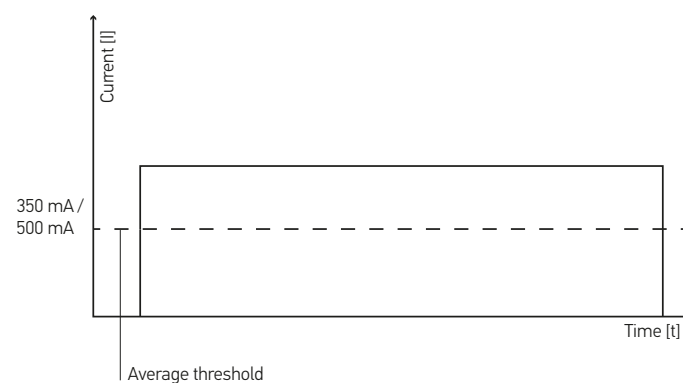
Operating temperature	-40°C to +85 °C
Degree of protection	IP 5KX
Connection	Flat connector DIN 46244 A6, 3x0.8

### PIN ASSIGNMENT/ELECTRICAL CONNECTION



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

### BLOCK DIAGRAM



### DESIGN AND FUNCTION

The 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 correct function of the headlamp is displayed by a high level at the status output. If it is undershot, the defect of the headlamp is displayed by a low level. Monitoring is only carried out when the ignition and lighting function are on.

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:

### 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 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 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	1F0 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

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

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

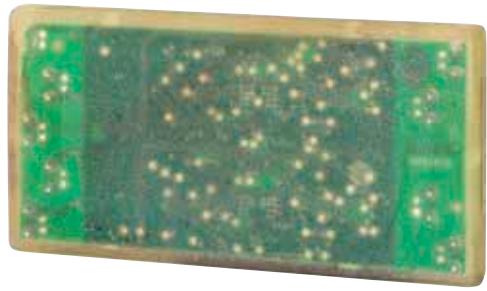
CONNECTORS/VARIANTS	PART NUMBER
FEP connector, right-hand traffic, ECE, SAE	1BL 012 488-021
FEP connector, left-hand traffic, ECE	1ML 012 488-031
DEUTSCH connector, right-hand traffic, ECE, SAE	1BL 012 488-121
DEUTSCH connector, left-hand traffic, ECE	1ML 012 488-131

#### LED high beam headlamp L 4060 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 R 80

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



**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**

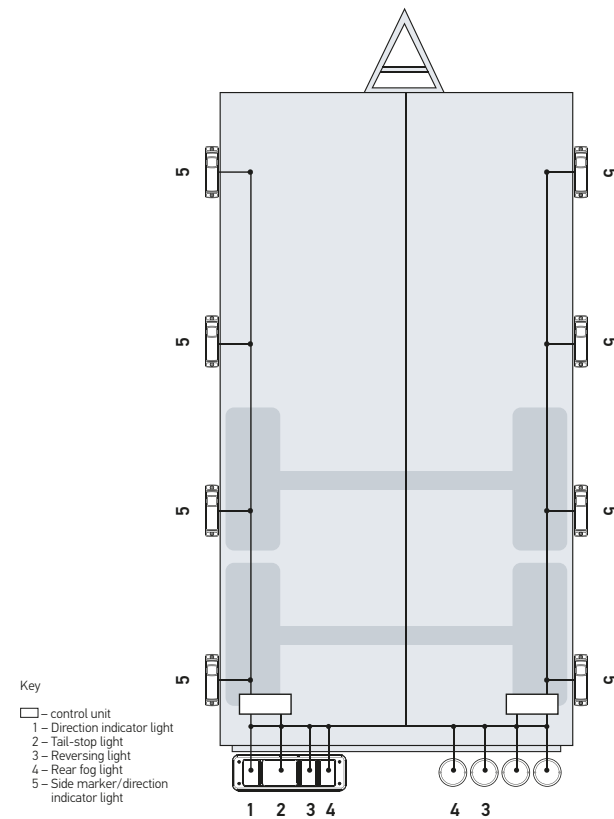
The control unit monitors functioning of the rear direction indicator. In the event of any fault, it switches off the flasher function of the side marker lamps to ensure that the failure control of the towing vehicle conforms to the law.

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

**TECHNICAL DATA**

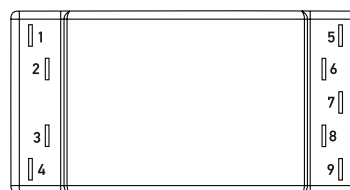
Operating temperature	-40°C to +65 °C
Degree of protection	IP 6K9K
Contacting	Flat connector DIN 46244 A6, 3 x 0.8

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



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

**PIN ASSIGNMENT/ELECTRICAL CONNECTION**



- Pin 1 Output: Left side marker
- Pin 2 Output: Left direction indicator light
- Pin 3 Output: Right side marker
- Pin 4 Output: Right direction indicator light
- Pin 5 Input: Left tail light
- Pin 6 Input: Left direction indicator light
- Pin 7 Ground
- Pin 8 Input: Right tail light
- Pin 9 Input: Right direction indicator light

<b>CONTROL UNIT FOR FLASHING SIDE MARKER LAMPS</b>	<b>PU*</b>
ECE R48 Category 6, 24 V	5DS 223 544-001 1

\* 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.





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.

**4570/7832 series:** Basic range of simple electrical systems that has 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.

**Series 4100 for interior applications and secure switching for small currents:** The modular 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 designs 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 thus select their own personalised symbols themselves. Always included: High 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 function 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 using 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 round off the range of accessories.



#### PROGRAM OVERVIEW



**The HELLA switch configurator**  
Configure your custom switches at  
[www.hella.com/switch](http://www.hella.com/switch).

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





### Switch series 4570/7832

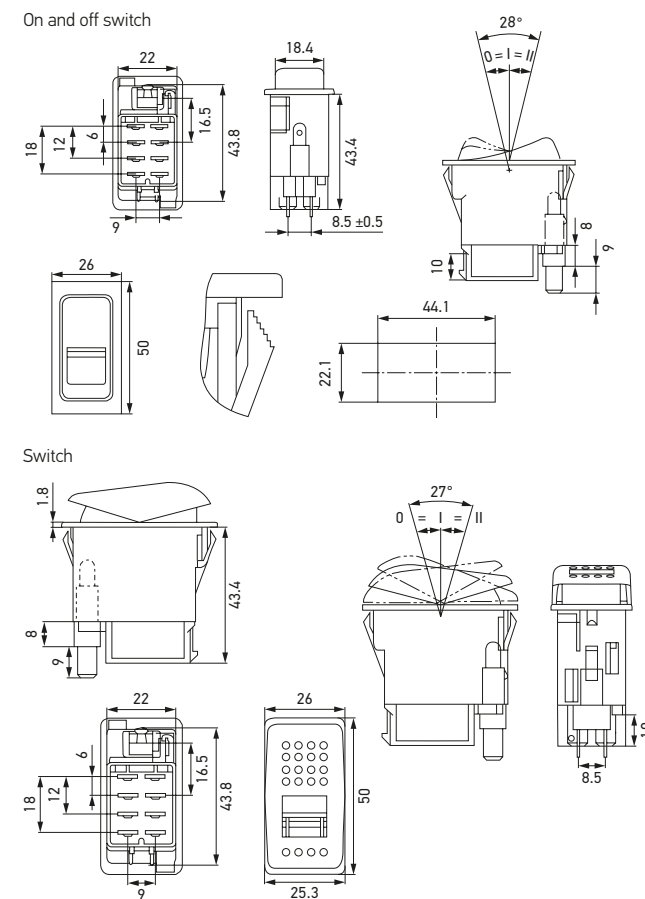
Basic range for simple electrical systems with snap-on symbol buttons

#### 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
Degree of protection	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



#### ACCESSORIES

Warning lamps	PART NUMBER	PU*
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



### Switch series 3100

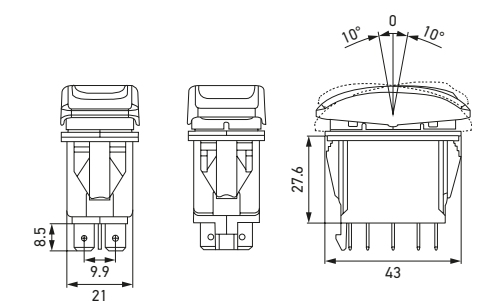
Modular switches for robust and waterproof applications

#### 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
Degree of protection	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:
24 V	<a href="http://www.hella.com/switch">www.hella.com/switch</a>

#### TECHNICAL DRAWING



\* Packaging unit



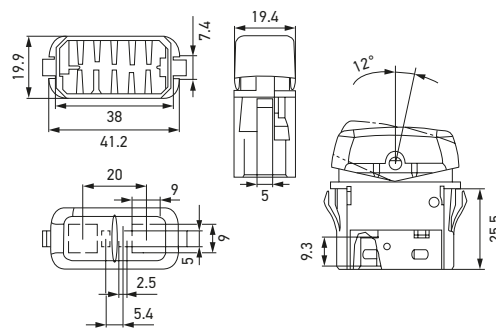


### Switch series 4100

Rocker switch for interior applications and safe switching of small 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
Degree of protection	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
<b>Part numbers</b>	
12 V	Our switch configurator can be found at: <a href="http://www.hella.com/switch">www.hella.com/switch</a>
24 V	

### TECHNICAL DRAWING



### Accessories

	4570- / 7832-	PU*	3100-	PU*	4100-	PU*
<b>Installation strips</b>						
Installation strip for 6 switches	8HG 713 626-001	12	-	-	-	-
Installation strip for 3 switches	8HG 714 504-001	24	-	-	-	-
<b>Installation strip plug-in system</b>						
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
<b>Female connector housing</b>						
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	-	-
<b>Flat receptacle/junior power timer</b>						
Flat receptacle CuSn / Sn, Cross section: 0.5 – 1.0 mm <sup>2</sup>	-	-	8KW 744 882-003	100	8KW 863 934-003	50
Flat receptacle CuSn / Sn, Cross section: 1.0 – 2.5 mm <sup>2</sup>	-	-	8KW 744 825-003	100	8KW 863 934-023	50
Flat receptacle CuSn / Sn, Cross section: 1.0 – 2.5 mm <sup>2</sup>	-	-	-	-	8KW 863 934-003	1000
<b>Bulb holders</b>						
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



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 with changing sound levels

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)
Power consumption	12 W
Current consumption	max. 0.6 A
Operating temperature	-40°C to +85 °C
Degree of protection	IP 67
Lifetime	100 hours (SAE J994)
Housing material	BM10: ABS BM30: Glass-fibre reinforced nylon
Type approval	ECE-R10 SAE J994

**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, installing 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.

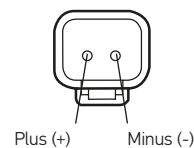
**DESIGN AND FUNCTION**

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 another has twice the volume.

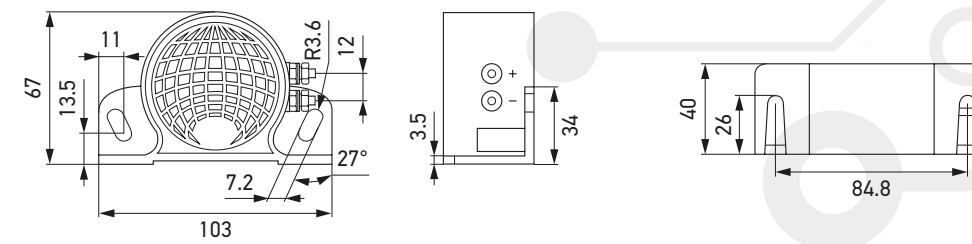
**PIN ASSIGNMENT/ELECTRICAL CONNECTION**

DEUTSCH connector DT 04-2P

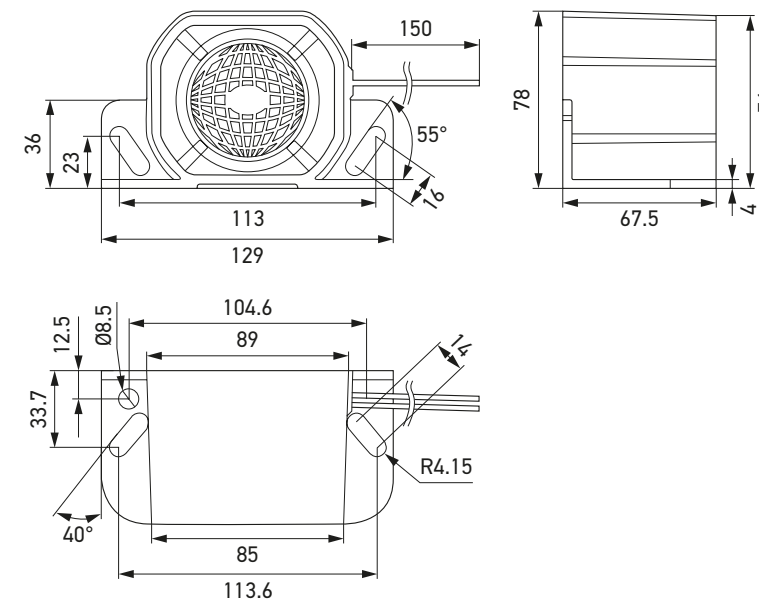


**TECHNICAL DRAWING**

BM10



BM30



**PROGRAM OVERVIEW**

Variants	Part number	PU*
<b>BM10: Ideal for light commercial vehicles</b>		
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
<b>BM30: Ideal for heavy duty commercial vehicles, automatic adjustment to suit ambient sound levels</b>		
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.



Reversing and warning alarm BM20 and BM40

### PRODUCT FEATURES

- Penetrating, long-range alarm sound
- White noise technology that reduces noise pollution (BM20)
- Insulated electronics with epoxy to protect against rust, moisture and vibrations
- Various options for sound pressure level suitable for town traffic and construction environments

TECHNICAL DATA	
Rated voltage	12 – 32 V 12 – 48 V (-271)
Frequency range	80 – 140 Hz 140 ± 200 Hz (-551 and -571)
Sound pressure level at 1.2 m distance	87 – 112 dB(A)
Power consumption	BM20: 12 W BM40: 18 W
Current consumption	BM20: ≤ 1.5 A BM40: ≤ 1.6 A 0.6 A V (-271)
Operating temperature	-40°C to +85 °C
Degree of protection	BM20: IP 6K7 BM40: IP 65
Lifetime	100 h
Housing material	BM20: PA66+15% GA BM40: PA60
Type approval	ECE-R10 SAE J994

### APPLICATION

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

In some countries, installing 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.

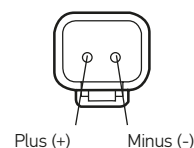
### DESIGN AND FUNCTION

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 reversing 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 another has twice the volume.

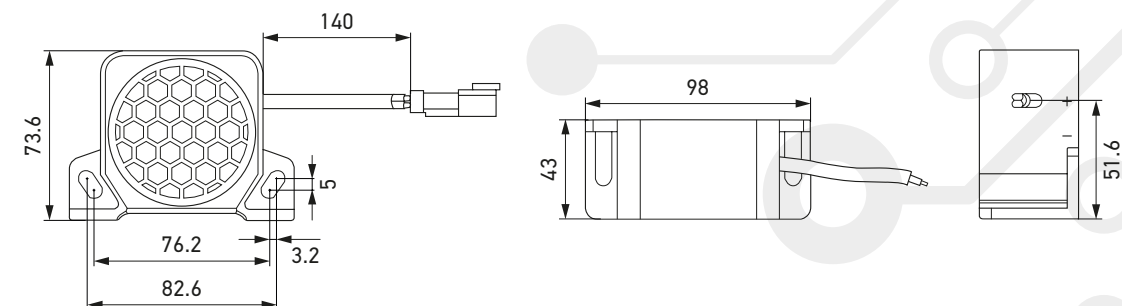
### PIN ASSIGNMENT/ELECTRICAL CONNECTION

DEUTSCH connector DT 04-2P

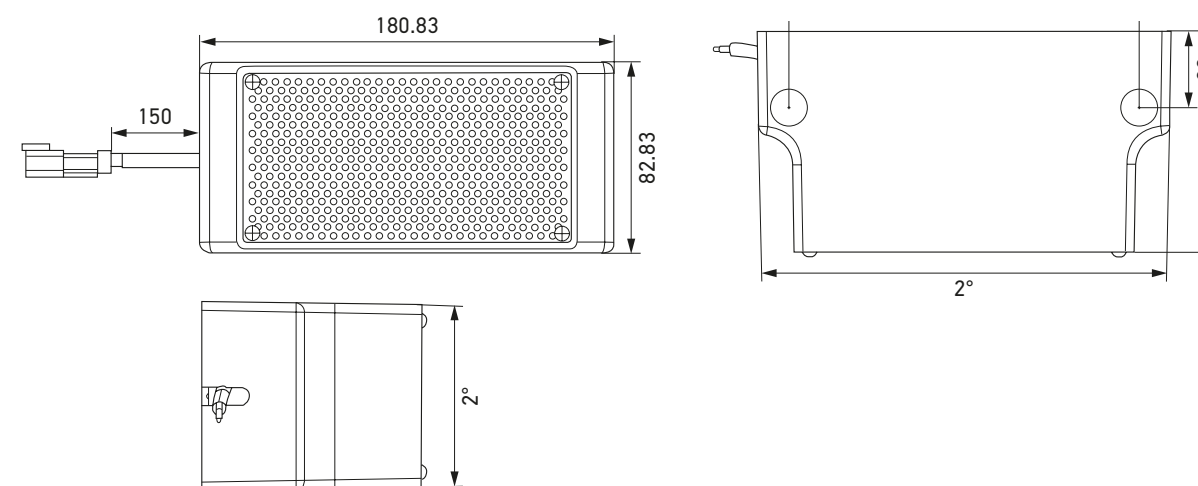


### TECHNICAL DRAWING

BM20



BM40



### PROGRAM OVERVIEW

Variants	Part number	PU*
<b>BM 20: Ideal for light commercial vehicles</b>		
White noise, 140 mm cable with DEUTSCH connector, 92 dB(A)	3SL 996 139-501	1
White noise, 140 mm cable with DEUTSCH connector, 97 dB(A)	3SL 996 139-511	1
White noise, 140 mm cable with DEUTSCH connector, 102 dB(A)	3SL 996 139-521	1
White noise, 140 mm cable with DEUTSCH connector, 92 – 102 dB(A)	3SL 996 139-531	1
<b>BM40: Ideal for heavy duty commercial vehicles, automatic adjustment to suit ambient sound levels</b>		
Standard, 150 mm cable with DEUTSCH connector, low: 97 dB(A), medium: 107 dB(A), high: 112 dB(A)	3SL 996 139-551	1
White noise + standard, 150 mm cable with DEUTSCH connector, low: 92 dB(A), medium: 102 dB(A), high: 107 dB(A)	3SL 996 139-561	1
Smart, 150 mm cable and DEUTSCH connector, 112 dB(A)	3SL 996 139-571	1
Smart + white noise, 150 mm cable with DEUTSCH connector, 92 – 107 dB(A)	3SL 996 139-581	1

\* Packaging unit



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 intelligent and compact design improves the driver's direct view when 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**

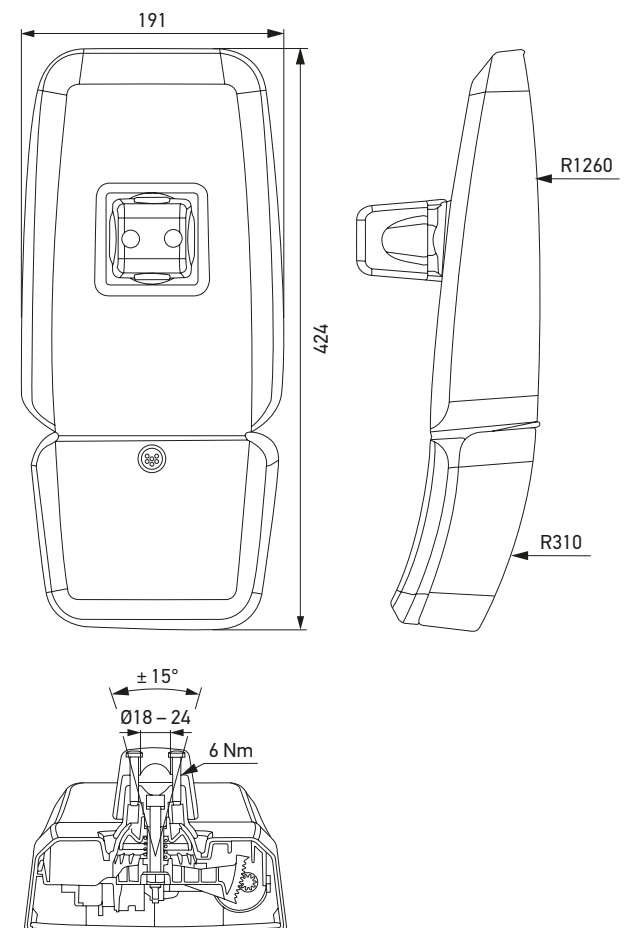
The mirror is suitable for a wide range of vehicles, such as construction equipment, telehandlers, front loaders, tractors, sprayers, combine harvesters and other special vehicles.

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	PU*
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 improves the driver's direct view in traffic and in work situations. In case of an emergency, it can be folded away.

**APPLICATION**

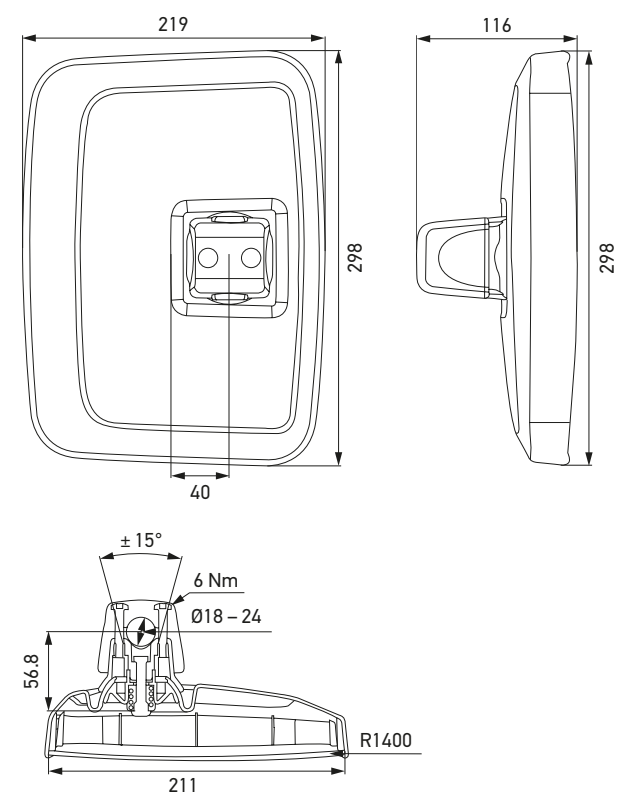
The mirror is suitable for a wide range of vehicles, such as construction machinery, telehandlers, front loaders, tractors, sprayers, combine harvesters and special vehicles.

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	PU*
<b>Outside mirrors</b>		
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 improves the driver's direct view in traffic and in work situations.

#### APPLICATION

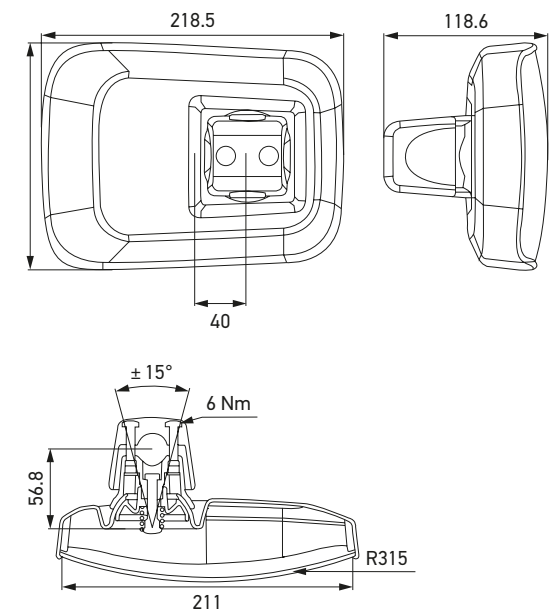
The mirror is suitable for a wide range of vehicles, such as construction equipment, telehandlers, front loaders, tractors, sprayers, combine harvesters and other special vehicles.

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	PU*
<b>Outside mirrors</b>		
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	<b>8SB 015 039-081 / -087</b>	1/12

\* Packaging unit



Trailer connection devices 24 V / 12 V

**PRODUCT FEATURES**

- Power transmission from 24 V to 12 V voltage systems
- Power supply for 12 V lighting
- Uncomplicated integration without data interface

**APPLICATION**

Allows the use of 12 V trailers on vehicles with 24 V operating voltage.

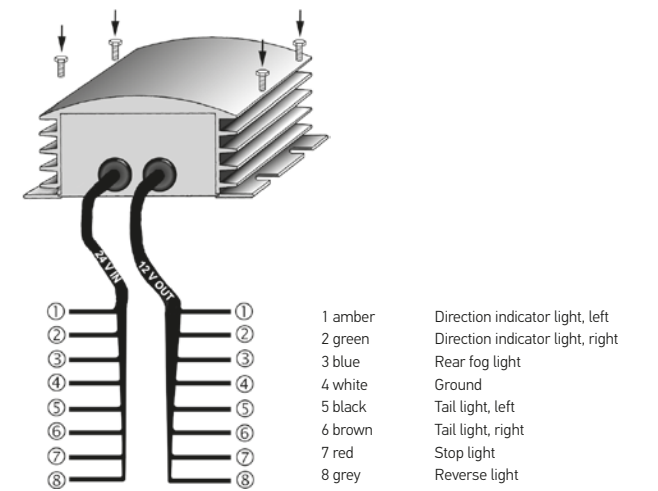
**DESIGN AND FUNCTION**

The trailer connection unit has 7 channels for the trailer lamp function. The series indicator lamp indicates if the 12 V trailer's direction indicator has malfunctioned.

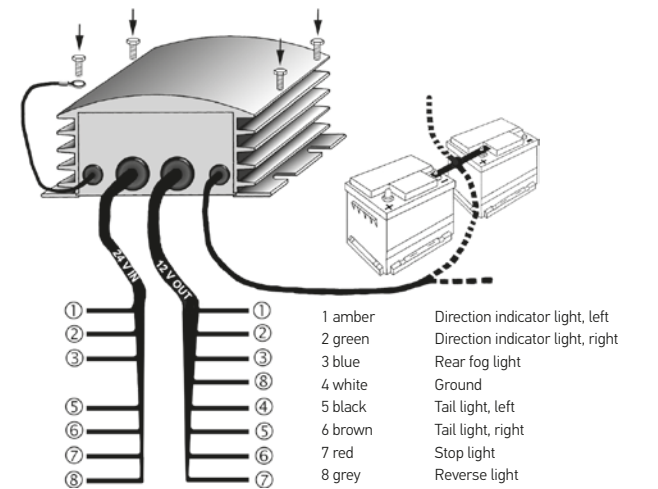
Known vehicle limitations: not for Mercedes-Benz Atego model series MP2, not for DAF 75.360 CF. Vehicle applications between towing vehicle and trailer must be checked before permanent installation with 24 V connector and 12 V coupling; especially for towing vehicles equipped with a bulb monitor.

TECHNICAL DATA	
Rated voltage	24 V / 12 V
Power per switching channel	2x 21 W
Power per direction indicator	21 W
Operating temperature	-30°C to +80°C
Polarity reversal protection	Permanently polarity-reversal protected
Degree of protection	IP 5K9K in accordance with DIN 50021-55
Type approvals	e1 / CE
Idle current	8 mA
Control current of the switching channels	2.5 mA
Voltage loss of the switching channels	200 mV

**PIN ASSIGNMENT/ELECTRICAL CONNECTION 5DS 008 125-011**



**PIN ASSIGNMENT/ELECTRICAL CONNECTION 5DS 008 125-001**



**PROGRAM OVERVIEW**

Voltage range	Variants	Part number	PU*
24 V / 12 V	With integrated voltage converter; operation possible without a separate charge compensation device	5DS 008 125-011	1
24 V / 12 V	Separate charge compensation device or a separate voltage converter with 8 A 12 V required**	5DS 008 125-001	1

\* Packaging unit

\*\* The following devices can be used for this purpose: 8ES 008 123-001, 8ES 008 124-001 or 8ES 006 658-021



Fans

**PRODUCT FEATURES**

- Airflow can be adjusted using a two-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	Stage 1: 70 l per second Stage 2: 95 l per second
Power consumption	6.5 W

**APPLICATION**

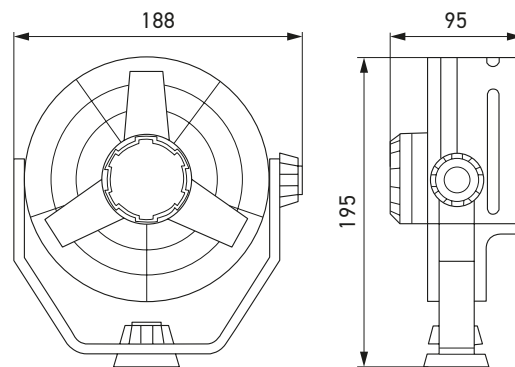
The task of a fan is to move air around in a room. Fans are being used more and more frequently and make everyday life or work more bearable, even on the particularly hot days of the year. The moving air automatically creates a cooling sensation for human beings.

**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.

**TECHNICAL DRAWING**



**PROGRAM OVERVIEW**

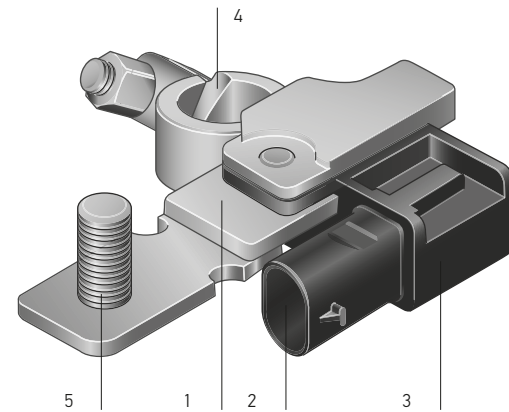
Variants	Part number	PU*
Fan, 12 V, black	8EV 003 361-001	1
Fan, 12 V, white	8EV 003 361-022	1
Fan, 24 V, black	8EV 003 361-011	1



Intelligent battery sensors

**PRODUCT FEATURES**

- Accurate measurement of battery condition parameters: voltage, current and temperature
- Determining battery condition parameters i.e. state of charge (SOC), state of health 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 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.

**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 machinery) and for those with higher ground cable cross-sections (> 70 mm<sup>2</sup>).

Operating voltage	Type	Mating connector	Part number	PU*	Page
7.5 – 32 V	Cable lug, straight	Hirschmann 872-858-546	<b>6PK 011 700-001/-007</b>	1/100	149
7.5 – 32 V	Cable lug, right-angled	Hirschmann 872-858-546	<b>6PK 011 700-311/-317</b>	1/100	150
6 – 18 V	12 V, IBS Global	Hirschmann 872-857-565	<b>6PK 013 824-001/-007</b>	1/100	151

\* Packaging unit



Intelligent battery sensors  
6PK 011 700-001 / -007

### 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

### TECHNICAL DATA

Operating voltage	7.5 – 32 V
Polarity reversal voltage	-28 V / 60 s
Test voltage	27.8 – 28.2 V
Operating current <sup>1)</sup>	≤ 16 mA (normal mode)
Idle current <sup>1)</sup>	≤ 230 µA (sleep mode)
Nominal resistance (shunt)	68 µΩ
Permanent load current <sup>2)</sup>	± 200 A
Maximum current <sup>2)</sup>	± 2,000 A (20 ms)
Operating temperature	-40°C to +80 °C
Re-heating 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
Degree of protection	IP 6K9K
Permissible pole terminal tightening torque	5 Nm ± 1 Nm
Thread for ground connection bolt	M8
Weight	119 g
Max. Battery capacity <sup>3)</sup>	255 Ah
Mating connector <sup>4)</sup>	872-858-546

<sup>1)</sup> Condition: T<sub>a</sub> ≤ 40 °C; U<sub>bg</sub> = 24 V; U<sub>brun</sub> = 28 V

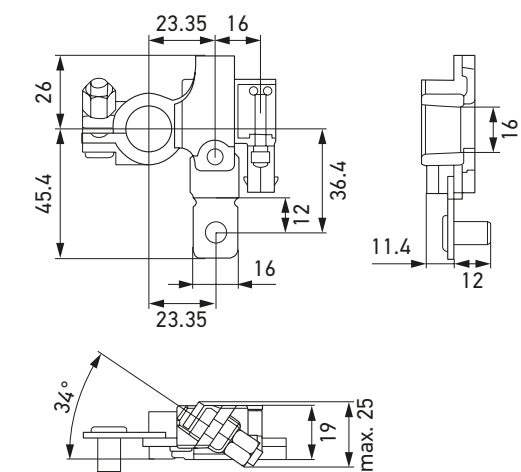
<sup>2)</sup> Typical condition: T<sub>a</sub> ≤ 80 °C; U<sub>b</sub> = 24 V  
Ground cable typical: ≥ 70 mm<sup>2</sup>  
Approved for max. 500 ms.

Other configurations on request.

<sup>3)</sup> Expandable on request.

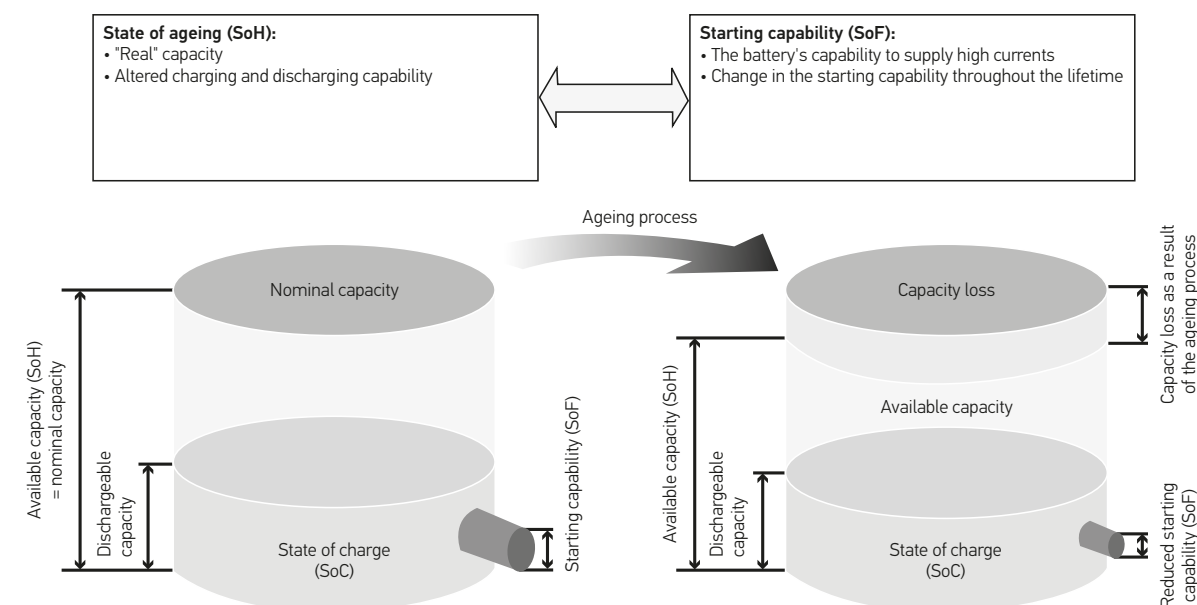
<sup>4)</sup> This accessory is not included in the scope of delivery.  
Available from Hirschmann Automotive.

### TECHNICAL DRAWING

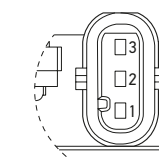


Tightening torque screw (terminal) 5 ± 1 Nm

### Monitoring the various battery conditions



### PIN ASSIGNMENT/ELECTRICAL CONNECTION



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





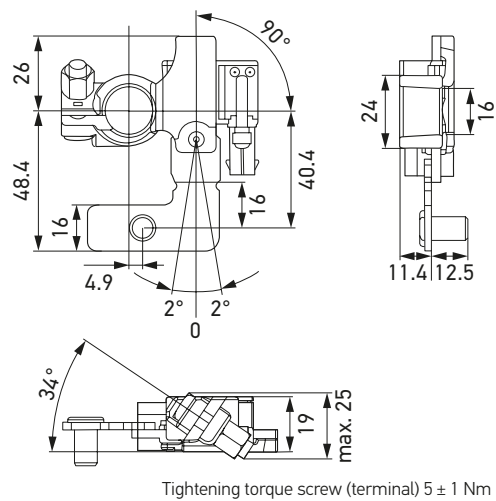
Intelligent battery sensors  
6PK 011 700-311 / -317

**TECHNICAL DATA**

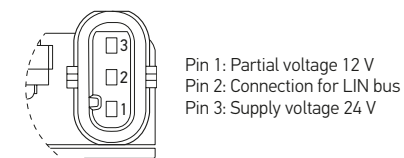
Operating voltage	7.5 – 32 V
Polarity reversal voltage	–28 V / 60 s
Test voltage	27.8 – 28.2 V
Operating current <sup>1)</sup>	≤ 16 mA (normal mode)
Idle current <sup>1)</sup>	≤ 230 µA (sleep mode)
Nominal resistance (shunt)	68 µΩ
Permanent load current <sup>2)</sup>	± 200 A
Maximum current <sup>2)</sup>	± 2,000 A (500 ms)
Operating temperature	–40°C to +80 °C
Re-heating 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
Degree of protection	IP 6K9K
Permissible pole terminal tightening torque <sup>3)</sup>	5 Nm ± 1 Nm
Thread for ground connection bolt	M8
Weight	119 g
Max. battery capacity <sup>4)</sup>	255 Ah
Mating connector <sup>5)</sup>	872-858-546

<sup>1)</sup> Condition:  $T_a \leq 40\text{ °C}$ ;  $U_{bat} = 24\text{ V}$ ;  $U_{brun} = 28\text{ V}$   
<sup>2)</sup> Typical condition:  $T_a \leq 80\text{ °C}$ ;  $U_{bat} = 24\text{ V}$   
 Ground cable typical:  $\geq 70\text{ mm}^2$   
 Approved for max. 500 ms.  
 Other configurations on request.  
<sup>3)</sup> When using a pole adapter, only one ground cable (max.  $70\text{ mm}^2$ ) may be used. The cable must be fixed after a maximum length of 100 mm.  
<sup>4)</sup> Expandable on request.  
<sup>5)</sup> This accessory is not included in the scope of delivery. Available from Hirschmann Automotive.

**TECHNICAL DRAWING**



**PIN ASSIGNMENT/ELECTRICAL CONNECTION**



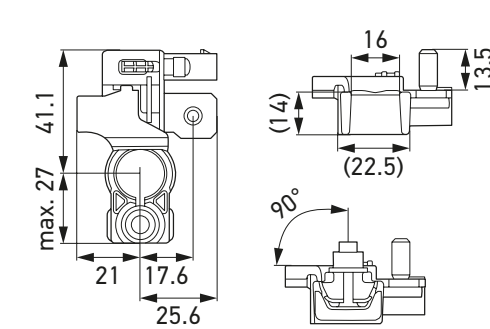
Intelligent battery sensors  
12 V, IBS global  
6PK 013 824-001 / -007

**TECHNICAL DATA**

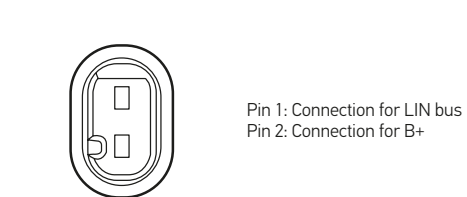
Operating voltage	6 – 18 V
Polarity reversal voltage	–16.5 V / 60 s
Test voltage	13.8 – 14.2 V
Operating current <sup>1)</sup>	10 mA
Idle current <sup>1)</sup>	≤ 200 µA
Nominal resistance (shunt)	68 µΩ
Permanent load current <sup>2)</sup>	± 175 A
Maximum current <sup>2)</sup>	1,500 A
Operating temperature	–40°C to +105 °C
Re-heating 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
Degree of protection	IP 6K9K
Permissible pole terminal tightening torque	5 Nm ± 1 Nm
Thread for ground connection bolt	M6
Weight	70 g
Mating connector <sup>4)</sup>	872-857-565
Max. Battery capacity <sup>5)</sup>	500 Ah

<sup>1)</sup> Condition:  $T_a \leq 40\text{ °C}$ ;  $U_b = 14\text{ V}$   
<sup>2)</sup> Typical condition:  $T_a \leq 105\text{ °C}$ ;  $U_b = 14\text{ V}$ , typical ground cable:  $35\text{ mm}^2$   
<sup>3)</sup> Approved for max. 500 ms. Other configurations on request.  
<sup>4)</sup> This accessory is not included in the scope of delivery. Available from Hirschmann Automotive.  
<sup>5)</sup> Expandable on request.

**TECHNICAL DRAWING**



**PIN ASSIGNMENT/ELECTRICAL CONNECTION**



**DESCRIPTION**

Optimal energy management for cars, EVs, agricultural machinery, last-mile vehicles, marine applications and motorhomes. Compared to previous IBS generations, the IBS Generation II offers the following benefits: The sensor can now also 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 idle currents such as can occur, for example, in motor homes.



DC/DC voltage stabilisers 200 W/400 W

**PRODUCT FEATURES**

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

**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.

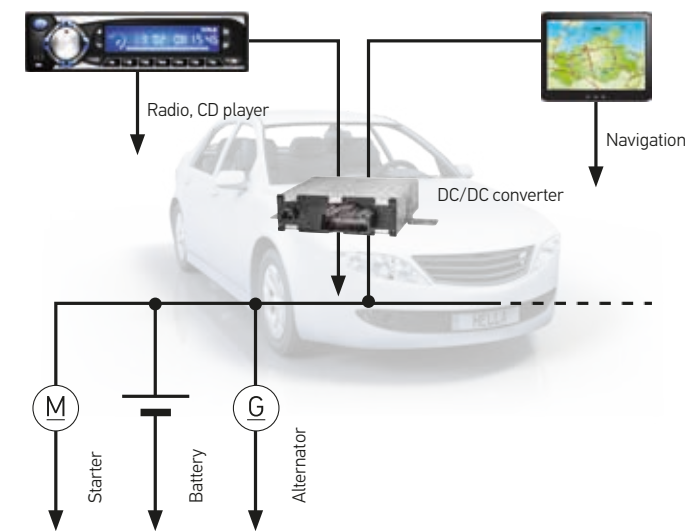
The device can also be equipped with a LIN diagnostic interface (optional).

**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).

**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	PU*	Page
200 W	17 A	TE Connectivity 156333-1	On request	-	154
400 W	34 A	Mating connector 1: TE 1473672-1 Mating connector 2: TE 1897519-1	8ES 312 331-101	1	155

\* Packaging unit

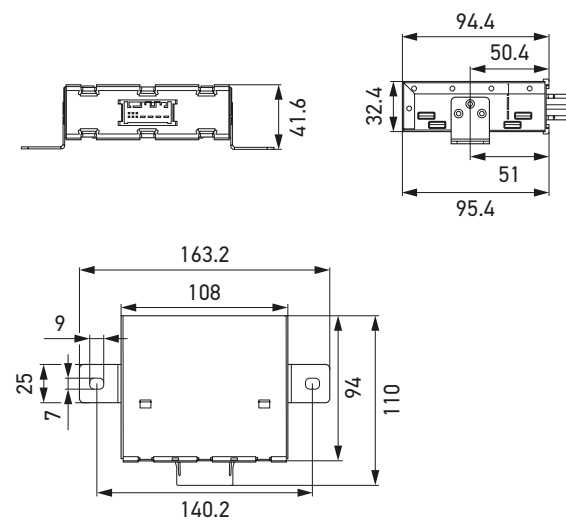


DC/DC voltage stabiliser 200 W  
On request

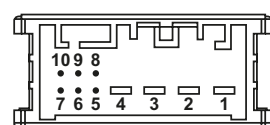
TECHNICAL DATA	
Operating temperature	-40°C to +85 °C (-40°C to -20°C bypass mode)
Supply voltage	+6.0 V to +18 V
Stabilisation range	+6.0 V to +12 V
Output voltage	(Boost mode) 12 V ± 0.5 V Rippel < 200 mV
Power	200 W
Storage temperature	-40°C to +105 °C
Cooling	Convection
Weight	approx. 370 g
Mating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

<sup>1)</sup> This accessory is not included in the scope of delivery.  
Available from TE Connectivity.

TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



- Pin 1: TML 30
- Pin 2: TML 31
- Pin 3: NA
- Pin 4: TML 30\_STABIL
- Pin 5: NA
- Pin 6: NA
- Pin 7: NA
- Pin 8: TML 15
- Pin 9: TML 50
- Pin 10: LIN

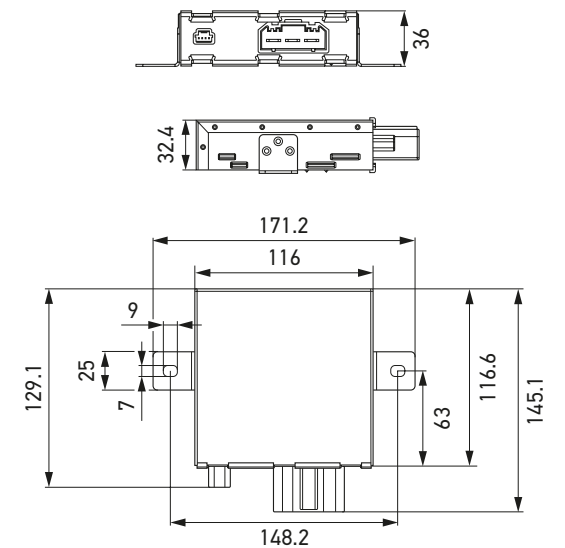


DC/DC voltage stabiliser 400 W  
8ES 312 331-101

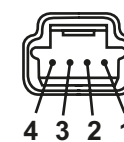
TECHNICAL DATA	
Operating temperature	-40°C to +85 °C (-40°C to -20°C bypass mode)
Supply voltage	+6.0 V – +18 V
Stabilisation range	+6.0 V – +12 V
Output voltage	(Boost mode) 12 V ± 0.5 V Rippel < 200 mV
Power	400 W
Storage temperature	-40°C to +105 °C
Cooling	Convection
Weight	approx. 370 g
Mating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

<sup>1)</sup> This accessory is not included in the scope of delivery.  
Available from TE Connectivity.

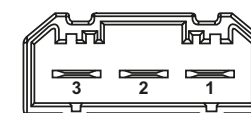
TECHNICAL DRAWING



PIN ASSIGNMENT/ELECTRICAL CONNECTION



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



- Pin 1: TML 30 (V<sub>IN</sub>)
- Pin 2: TML 31 (GND)
- Pin 3: TML 30\_stab (V<sub>OUT</sub>)



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%

**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.

**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).

**PROGRAM OVERVIEW**

Variants	Part number	PU*
DC/DC converter 24 V to 12 V	on request	-

\* Packaging unit

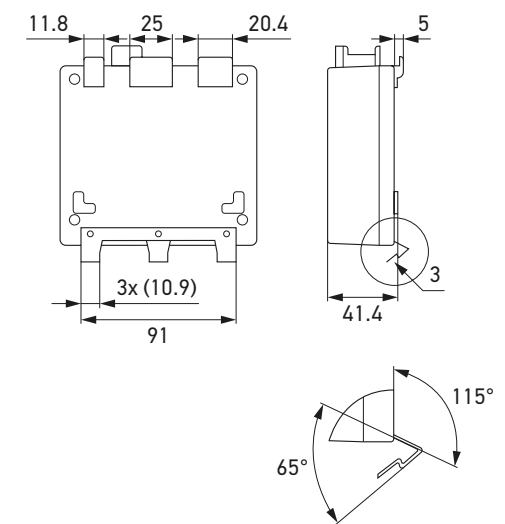
DC/DC converter 24 V/12 V  
**On request**

**TECHNICAL DATA**

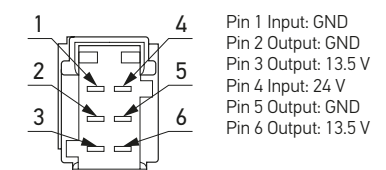
Operating temperature	-40°C to +85 °C
Working temperature	-40°C to +75 °C
PWM centre frequency	200 kHz (with dithering)
Max. Power	Up to 300 W
Input voltage	18–32 V
Output voltage	13.5 V
Rippel	< 200 mV <sub>pp</sub>
Idling current	< 5 mA
Functional safety	QM
Data connection	N/A
Efficiency	Up to 90%
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
Degree of protection	IP 30

<sup>1)</sup> This accessory is not included in the scope of delivery. Available from Tyco.

**TECHNICAL DRAWING**



**PIN ASSIGNMENT/ELECTRICAL CONNECTION**



**HELLA GmbH & Co. KGaA**

Kunden-Service-Center  
Rixbecker Straße 75  
59552 Lippstadt/Germany

Tel.: 0180-6-250001 (0,20 €/Anruf aus dem deutschen Festnetz)

Fax: 0180-2-250001 (0,06 € je Verbindung)

Internet: [www.hella.com](http://www.hella.com)

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[www.hella.com/soe](http://www.hella.com/soe)