

ELECTRONICS FOR SPECIAL ORIGINAL EQUIPMENT



Energy management



Drive train



Components



Lighting electronics

ELECTRONIC MADE FOR INDIVIDUAL CHALLENGES



ELECTRONICS FOR INDIVIDUAL CHALLENGES.

HELLA – also a leader in electronic components. We develop customer-specific products and manufacture high grade electronic components for agricultural and construction machines, buses, caravans and trucks. At the same time, we invest considerably in research and development every year with the aim of knowing today what the customer needs tomorrow.

By using our components, you will also benefit from our decades of experience in the development and production of small and large production runs! HELLA offers a broad product range of electronic components that also meet the increased demands of commercial vehicles – for example, the products are particularly robust and temperature and vibration resistant.

The HELLA success strategy: Electronics for individual challenges.



This brochure shows you an extract from the HELLA electronics product range and is aimed at manufacturers of special vehicles such as:



Agricultural Vehicles www.hella.com/agriculture



Construction Machinery www.hella.com/construction



Mining www.hella.com/mining



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TECHNICAL SERVICE

Intensive, personal support is the foundation of all customer relations at HELLA. It is precisely here that we combine the advantages of a medium-sized company with the characteristics of a global player. Slim organisation, flexibility and short delivery times coupled with a strong network of office branches.

Please contact us for technical support in pre-selecting components, for electrical integration, sample requirements, and any other detailed technical questions you may have.

PRODUCT DIVISION

Energy management



Careful use of energy by appropriately influencing of the consumer:

These electronic systems make it possible to monitor and plan the energy budget and maintain the power supply.



Increasing the safety and efficiency of the overall system and preventing failures:

These electronic systems make it possible to precisely measure and record values in the engine compartment and drive train.



Provide added convenience with compact solutions in a variety of areas:

These electronic systems are generally invisible little helpers for the various automatic processes within the vehicle.





Provide added convenience with compact solutions in a variety of areas:

These electronic systems are generally invisible little helpers for the various automatic processes within the vehicle.



sensors

Intelligent battery



Voltage stabilisers



Oil level

switches

Oil level

sensors

Accelerator

pedal sensors

Oil pressure sensors

Accelerator

pedal sensors



Turning angle

sensors

Remote

controls

Actuators

Air quality sensors

Rain/light

sensors

Temperature

sensors



vehicle



LED lamp control unit



Control unit for flashing side marker lights



Simulation device for cold checking

Current monitoring control unit



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ÜBERSICHT GEGENSTECKER



| PRODUCT | PRODUCT DESCRIPTION | PART NUMBER | ASSOCIATED MATING CONNECTORS |
|-----------------------------|--|------------------------------------|--|
| | MENT | | |
| Intelligent battery sensors | Sensor 1 | 6PK 010 842-001 | Hirschmann 872-858-565 |
| | Sensor 2 | 6PK 010 842-011 | Hirschmann 872-858-565 |
| | 24 V | 6PK 011 700-001 | Hirschmann 872-858-546 |
| | 12 V, for motor homes | 6PK 013 824-001 | Hirschmann 872-857-561 |
| | 12 V, for agricultural and construction machinery | on request | Hirschmann 872-858-546 |
| Voltage stabilisers | DC / DC 200 W | on request | TE Connectivity 156333-1 |
| | DC / DC 400 W | 8ES 312 331-101 | Mating connector 1: TE Connectivity 1473672-1, Mating connector 2: TE Connectivity 1897519-1 |
| DRIVE TRAIN | | | |
| Level sensors | Recording the liquid level | 6PR 007 968-041 | TE Connectivity 1-967644-1 |
| | Recording the liquid level (static or dynamic) | 6PR 232 000-001 6PR 232 000-011 | Delphi ZFW2-141, Bosch ZFW2-83 |
| | Recording the liquid level (static and dynamic) | 6PR 010 497-501 6PR 010 497-511 | Kostal 09 44 13 82 |
| | Measuring the oil pressure and oil temperature | 6PR 010 378-101 | Hirschmann Automotive 872-597-501, 872-597-506, coding A |
| Pedal sensors | Floor-mounted pedals | 6PV 312 010-107 | TE Connectivity 1-967616-1 |
| | Suspended pedals | 6PV 009 591-011 | Yazaki 7283-1968-30 |

| PRODUCT | ODUCT PRODUCT DESCRIPTION PART NUMBER | | ASSOCIATED MATING CONNECTORS | |
|---------------------------------------|--|---|--|--|
| Components | | | | |
| Radio transmitter systems | Switching on and off or opening and locking | on request | Lear 17848 000 000 | |
| Actuators electric motor actuators | Electrical locking/unlocking, space-saving, electrical forward and reverse rotation | 6NW 011 122-017 | Hirschmann Automotive 3-pin MLK coupler ELA 872-858-541 | |
| | Electrical locking/unlocking, space-saving, with micro-switch, electrical forward and reverse rotation, with micro-switch | 6NW 011 122-027 | Hirschmann Automotive 3-pin MLK coupler ELA 872-858KA | |
| | Electrical locking/unlocking, space-saving, with micro-switch, electrical forward rotation, reverse rotation via return spring, with soft touch button | 6NW 011 122-047 | Hirschmann Automotive 3-pin MLK coupler ELA 872-858-541 | |
| | Electrical locking/unlocking and closing (medium | 6NW 009 203-401 | TE Connectivity 282080-1 | |
| | Torce), electrical retraction and extension | 6NW 009 203-411 | TE Connectivity 1355390-1 | |
| | | 6NW 009 203-421 6NW 009 203-431 6NW 009 203-441 6NW 009 203-451 6NW 009 203-557 | TE Connectivity 282080-1 | |
| | Electrical locking/unlocking and closing (medium force), electrical retraction, extension with mainspring | 6NW 009 203-461 | TE Connectivity 1355390-1 | |
| | Electrical locking/unlocking and closing (medium force), electrical retraction, extension with mainspring | 6NW 009 203-471 6NW 009 203-541 | TE Connectivity 282080-1 | |
| | Electrical locking/unlocking and closing (medium force), electrical extension, retraction with mainspring | 6NW 009 203-491 | TE Connectivity 1355390-1 | |
| | Electrical locking/unlocking and closing (medium force), electrical extension, retraction with mainspring | 6NW 009 203-501 6NW 009 203-521 | TE Connectivity 282080-1 | |
| | Electrical locking/unlocking and closing (high force), electrical rotation left, reset per spring right | 6NW 009 424-781 | TE Connectivity 1355390-1 | |
| | Electrical locking/unlocking and closing (high force), electrical rotation right and left | 6NW 009 424-791 | TE Connectivity 1355390-1 | |
| | URA- Electrical locking/unlocking and closing (high force), electrical rotation right and left with position feedback via CIPOS technology | 6NW 011 303-701 | TE Connectivity 1-1456426-1, coding A | |
| Sensors | Temperature sensors measurement of air temperatures | 6PT 009 522-011 | TE Connectivity 2-1437712-5 | |
| | Rain/light sensors recording environmental properties | on request | TE Connectivity 114 18063-18, coding D | |
| | Rain/light sensors for vehicles with high-angled windshields recording environmental properties | on request | TE Connectivity 114 18063-18, coding A | |
| Turning angle sensors | Single sensors 1st generation | 6PM 011 081-001 6PM 008 161-241 | TE Connectivity 1-967616-1 | |
| | | 6PD 009 583-101 | TE Connectivity 1394416-1 | |
| | | 6PM 008 161-251 | TE Connectivity 1-967616-1 | |
| | | 6PM 008 161-121 6PM 008 161-131 6PM 008 161-131 6PM 008 161-141 | TE Connectivity 1-967616-1 | |
| | Single sensors 2nd generation | on request | Sigma 2 | |
| | Double sensors (redundant angle measurement for safety-critical applications) 1st generation | 6PD 009 583-001 6PD 009 583-011 6PD 009 580-017 6PD 009 584-017 | TE Connectivity 1394416-1 | |

IP PROTECTION CLASS

IP stands for International Protection. The IP level of protection is determined according to DIN 40050 Part 9. The purpose of the standard is the exact definition against the penetration of solid foreign objects including dust and against water penetration. The adjacent overview of the IP levels of protection and the explanation of their meanings should serve to help you select the correct components to meet the respective requirements of your application.





| t not | |
|-------|---|
| | 1 |

INTRODUCTION

| LEVEL OF PROTECTION AGAINST SOLID FOREIGN OBJECTS (DUST) | | LEVEL PROTECTION AGAINST WATER | | | |
|--|--|--|--------------|---|---|
| First digit | Brief Description | Definition | Second digit | Brief Description | Definition |
| 0 | Not protected | No requirements | 0 | Not protected | No requirements |
| 1 | Protected against solid foreign objects > 50 mm | The object probe, a sphere of 50 mm diameter, must not be able to penetrate completely | 1 | Protected against drops of water | Vertically falling drops must not have any effect |
| 2 | Protected against solid foreign objects > 12.5 mm diameter | The object probe, 12.5 mm diameter, must not be able to penetrate at all | 2 | Protection against dripping water when the housing is tilted by 15° | Vertically falling drops must not have any harmful effects when the housing is tilted by an angle of up to 15° on both sides of its normal position |
| 3 | Protected against solid foreign objects > 2.5 mm diameter | The object probe, 2.5 mm diameter, must not be able to penetrate at all | 3 | Protected against spraying water | Water, which is sprayed at an angle of up to 60° on both sides of the normal position must not have any harmful effects |
| 4 | Protected against solid foreign objects > 1,0 mm diameter | The object probe, 1.0 mm diameter, must not be able to penetrate at all | 4 | Protected against spraying water | Water, which is sprayed from one direction against the housing, must not have any harmful effects |
| | | | 4K | Protected against splashwater at increased pressure | Water, which is sprayed against the casing from any direction at increased pressure, must not have any harmful effects |
| 5K | Dust protected | Penetration of dust is not entirely prevented, but dust must not be able to penetrate in such quantities that will impair the satisfactory operation of the equipment or its safety | 5 | Protected against sprayed water | Water, which is sprayed against the casing from any direction as a jet, must not have any harmful effects |
| 6К | Dustproof | No penetration from dust | 6 | Protected against powerfully sprayed water | Water, which is sprayed against the casing from any direction as a jet, must not have any harmful effects |
| | | | бK | Protected against powerfully sprayed water with increased pressure | Water, which is sprayed against the casing from any direction as a jet with increased pressure, must not have any harmful effects |
| | | | 7 | Protected against the effect of temporary immersion in water | Water must not penetrate in quantities which will cause harmful effects when the casing is temporarily immersed under water under pressure and time conditions |
| | | | 8 | Continuous immersion in water | Water must not penetrate in quantities which will cause harmful effects when the casing is continuously immersed under water under defined conditions |
| | | | 9 | Protected against the effects of continuous immersion in water | Water must not penetrate in quantities which will cause harmful effects when the casing is continuously immersed under water |
| | | | 9K | Protected against water during high pressure/ steam jet cleaning | Water, which is sprayed against the casing from any direction under strong pressure, must not have any harmful effects |



| ENERGY MANAGEMENT | | EXAMPLES OF VEHICLE APPLICATIONS | |
|--|---|----------------------------------|--|
| Intelligent battery sensors | | | |
| Measurement of battery capacity and ageing. | Intelligent battery sensors 12 V | | |
| | Intelligent battery sensors 24 V | | |
| | Intelligent battery sensors 12 V, for motorhomes | E. | |
| | Intelligent battery sensors 12 V for agricultural and construction machines | | |
| DC/DC voltage stabilisers | | | |
| System stabiliser for short-term voltage drop. | DC / DC voltage stabiliser 200 W | | |
| | DC / DC voltage stabiliser 400 W | 50 12 60 | |







ENERGY MANAGEMENT

Careful use of energy by appropriately influencing of the consumer:

These electronic systems make it possible to monitor and plan the energy budget and maintain the power supply.



Intelligent battery sensors

PRODUCT FEATURES

- → High-accuracy measurement of battery voltage, current and temperature parameters
- → Determining the battery condition parameters State of Charge (SOC), State of Health und State of Function (SOF)
- → Simple electrical and mechanical integration

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 portion of the battery sensor consists of shunt (1) and ground bolt (5) components. The shunt is attached to the vehicle's load path and is used as a measuring resistor to measure the current indirectly. On the ground bolt (5), the existing ground cable can be conveniently attached, for example, to the optionally available battery pole adapter.

The electronics are located in molded casing (3) with plug connector (2), functioning as the interface to the energy management system. The communication interface to the higherlevel control unit is the LIN protocol. 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 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.



APPLICATION

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

The IBS reliably and accurately measures the battery parameters: voltage, current and temperature. Information about the battery's state of charge (SOC), state of health (SOH) and state of function (SOF) is calculated algorithmically from the measurements. The IBS is designed for use in starter, gel and AGM batteries to monitor in-vehicle starter or consumer batteries. The IBS can be directly integrated into the vehicle's electrical system with the standardised LIN protocol.

BATTERY STATUS ALGORITHMS:

The intelligent battery sensor calculates and monitors the following battery conditions

State of charge: The state of charge (SOC) describes the current charge status of the battery. The SOC is defined as: SOC [%]= extractable capacity/rated capacity

State of health: The state of health (SOH) indicates the ageing status of the battery.

The state of health (SOH) is defined as:

SOH [%]= available capacity/rated capacity

Typically, the available capacity of the battery falls with age and long use.

State of function:

The state of function (SOF) describes the future cranking health of the engine on the basis of the currently measured current and the voltage



VARIANT OVERVIEW

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

| Operating voltage | Туре | Mating connector | Part Number | Page reference |
|-------------------|---|------------------------|-----------------|----------------|
| 6–16,5 V | Sensor 1 | Hirschmann 872-858-565 | 6PK 010 842-001 | 14 |
| 6–16,5 V | Sensor 2 | Hirschmann 872-858-565 | 6PK 010 842-011 | 14 |
| 7.5 – 32 V | - | Hirschmann 872-858-546 | 6PK 011 700-001 | 15 |
| 6–16,5 V | for motorhomes | Hirschmann 872-857-561 | 6PK 013 824-001 | 16 |
| 6–16,5 V | for agricultural and construction machinery | Hirschmann 872-858-546 | on request | 17 |



Intelligent battery sensors Order number 6PK 010 842-001 (Sensor 1) 6PK 010 842-011 (Sensor 2)

TECHNICAL DATA

| Operating voltage | 6–16,5 V |
|---|------------------------|
| Reverse-polarity voltage | - 16,5 V / 60 s |
| Test voltage | 13,8-14,2 V |
| Operating current ¹⁾ | ≤ 15 mA (normal mode) |
| Quiescent current ¹⁾ | ≤ 120 μA (sleep mode) |
| Nominal resistance (shunt) | 100 μΩ |
| Permanent load current ²⁾ | ±155 A |
| Maximum current ²⁾ | ± 1.500 A (500 ms) |
| Operating temperature | - 40°C to + 115°C |
| Reheating temperature | + 105°C to + 120°C |
| Storage temperature | - 20°C to + 55°C |
| Defined charge regulator | 18 V / 60 min |
| Jump Start | 27 V / 1 min |
| Load Dump | 35 V/400 ms |
| Output signal | LIN 2.0 or higher |
| Protection class | IP 6K7 |
| Permissible pole terminal tightening torque | 5 Nm +/- 1 Nm |
| Threaded bolt ground connection | M8 |
| Weight | 125 g |
| Max. battery capacity ³⁾ | 249 Ah |
| Mating connector ⁴⁾ | Hirschmann 872-858-565 |

 $^{1)}$ Condition: $T_a \leq 40^\circ C; U_b = 14$ V $^{2)}$ Typical condition: $T_a \leq 105^\circ C; U_b = 14$ V Typical ground cable: 35 mm²

Approved for maximum 500 ms. Other configurations on request.

^a This accessory is not included. It may be purchased from Hirschmann Automotive or TE Connectivity.

TECHNICAL DRAWING





Screw tightening torque (terminal) 5 $\pm\,1$ Nm

PIN ASSIGNMENT



Pin 1: supply voltage Pin 2: connection for LIN bus



Intelligent battery sensors Part number 6PK 011 700-001

TECHNICAL DRAWING

TECHNICAL DATA

| Operating voltage | 7.5 –32 V |
|---|------------------------|
| Reverse-polarity voltage | -28 V/60 s |
| Test voltage | 27,8-28,2 V |
| Operating current ¹⁾ | ≤ 16 mA (normal mode) |
| Quiescent current ¹⁾ | ≤ 255 µA (sleep mode) |
| Nominal resistance (shunt) | Ωμ 8ծ |
| Permanent load current ²⁾ | ±200 A |
| Maximum current ²⁾ | ± 2.000 A (20 ms) |
| Operating temperature | - 40°C to + 80°C |
| Reheating temperature | + 105°C to + 120°C |
| Storage temperature | - 20°C to + 50°C |
| Defined charge regulator | 36 V / 120 min |
| Jump Start | 48 V / 2 min |
| Load Dump | 58 V / 500 ms |
| Output signal | LIN 2.0 or higher |
| Protection class | IP 6K7 |
| Permissible pole terminal tightening torque | 5 Nm +/- 1 Nm |
| Threaded bolt ground connection | M8 |
| Weight | 119 g |
| Max. battery capacity ³⁾ | 255 Ah |
| Mating connector ⁴⁾ | Hirschmann 872-858-546 |

23.35 16 1:9 45.4 36. Ο 13 16 <u>11.4</u> 23.35 25 max.

Screw tightening torque (terminal) 5 \pm 1 Nm

PIN ASSIGNMENT



Pin 1: subvoltage 12 V Pin 2: connection for LIN bus Pin 3: supply voltage 24 V

| Condition T | < /0°C 11 | - 2/ \/. 1 | _ 20 \/ |
|----------------|-------------------------|------------|-----------------------------|
| Condition: 1 s | ≤ 40 C; U _{ba} | = 24 V; U | $V_{\rm brun} = Z \delta V$ |

 $\label{eq:condition: $T_a \le 40^\circ C; $U_{bq} = 24 V; $U_{brun} = 28 V$ $2 Typical condition: $T_a \le 80^\circ C; $U_b = 24 V$ Typical ground cable: $$> 70 mm^2$ Approved for maximum 500 ms. Other configurations on request. $3 Expandable on request. $3 Expandable on request. $4 This accessory is not included. It may be purchased from Hirschmann Automotive.$



Intelligent battery sensors 12 V, for motor homes 6PK 013 824-001

TECHNICAL DRAWING

TECHNICAL DATA

| Operating voltage | 6–16,5 V |
|---|------------------------|
| Reverse-polarity voltage | - 16,5 V / 60 s |
| Test voltage | 13,8-14,2 V |
| Operating current ¹⁾ | ≤ 15 mA |
| Quiescent current ¹⁾ | ≤ 100 µA |
| Nominal resistance (shunt) | Ωμ 8ծ |
| Permanent load current ²⁾ | ±200 A |
| Maximum current ²⁾ | 2.000 A |
| Operating temperature | - 40°C to +115°C |
| Reheating temperature | + 105°C to + 120°C |
| Storage temperature | -20°C to +55°C |
| Defined charge regulator | 18 V / 60 min |
| Jump Start | 27 V / 1 min |
| Load Dump | 35 V / 400 ms |
| Protocol | LIN 2.0 or higher |
| Protection class | IP 6K7 |
| Permissible pole terminal tightening torque | 5 Nm +/- 1 Nm |
| Threaded bolt ground connection | M6 |
| Weight | 70 g |
| Mating connector ³⁾ | Hirschmann 872-857-561 |
| Max. battery capacity4) | 500 Ah |





Screw tightening torque (terminal) 5 ± 1 Nm

 $^{\rm 1)}$ Condition: $T_a \leq 40^\circ C;~U_b = 14$ V $^{\rm 2)}$ Typical condition: $T_a \leq 105^\circ C;~U_b = 14$ V Typical ground cable: 35 mm²

⁴⁾ Expandable on request.

Approved for maximum 500 ms. Other configurations on request. ³⁾ This accessory is not included.

It may be purchased from Hirschmann Automotive.

Description

This variant of the battery sensor was developed specially for recreational vehicles. The package space 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 aging are therefore possible even with high idle currents such as can occur, e.g. in mobile homes.

Thanks to the higher nominal capacity that can be set, this battery sensor can also be used to monitor several batteries connected in series.

PIN ASSIGNMENT



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



For illustrative purposes only

Intelligent battery sensors 12 V, for agricultural and construction machines on request

TECHNICAL DATA

| Operating voltage | 6-16,5 V |
|---|------------------------|
| Reverse-polarity voltage | - 16,5 V / 60 s |
| Test voltage | 13,8-14,2 V |
| Operating current ¹⁾ | ≤ 15 mA |
| Quiescent current ¹⁾ | ≤ 120 μA |
| Nominal resistance (shunt) | Ωμ 8ծ |
| Permanent load current ²⁾ | ±200 A |
| Maximum current ²⁾ | 2.000 A |
| Operating temperature | - 40°C to +115°C |
| Reheating temperature | +105°C to +120°C |
| Storage temperature | - 20°C to + 55°C |
| Defined charge regulator | 18 V / 60 min |
| Jump Start | 27 V / 1 min |
| Load Dump | 35 V / 400 ms |
| Protocol | LIN 2.0 or higher |
| Protection class | IP 6K7 |
| Permissible pole terminal tightening torque | 5 Nm +/- 1 Nm |
| Threaded bolt ground connection | M10 |
| Weight | 145 g |
| Mating connector ³⁾ | Hirschmann 872-858-546 |
| Max. battery capacity ⁴⁾ | 249 Ah |





Screw tightening torque (terminal) 5 \pm 1 Nm

PIN ASSIGNMENT



Pin 1: supply voltage 12 V Pin 2: connection for LIN bus Pin 3: not assigned

 $^{1)}$ Condition: $T_a \leq 40^{\circ}$ C; $U_b = 14$ V $^{2)}$ Typical condition: $T_a \leq 105^{\circ}$ C; $U_b = 14$ V Typical ground cable: 35 mm²

Approved for maximum 500 ms.

³⁾ This accessory is not included.

⁽⁴⁾ Expandable on request.





DC / DC voltage stabiliser

PRODUCT FEATURES

- → For 12 V systems
- → Output power 200-400 W
- → System stabiliser for short-term voltage drop

DESIGN AND FUNCTION

The voltage stabiliser is activated by ignition. As long as no stabilisation is required, the sub-system of the vehicle electric system is coupled with the main system via a low-impedance cable.

The voltage drop when starting the engine is signalised via the start signal. This leads to the sub-system and the main network being decoupled from each other and stabilisation is carried out.

Optionally, the device can be equipped with an LIN diagnostic interface.

APPLICATION

The DC/DC converter is also referred to as a voltage stabiliser. In the case of a short-term voltage drop (when starting the engine), it maintains the output voltage to the electrical sub-system (e.g. for the start/stop system).

This essentially concerns the elements of the vehicle electric system which the vehicle driver perceives and which are not safety-critical. The radio and navigation (infotainment system are part of this), but also various terminals (e.g. for agricultural and construction machines) and information systems (e.g. in buses).

FUNCTIONAL DIAGRAM



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

VARIANT OVERVIEW

| Power | Output current | Type and mating connector | Page reference |
|-------|----------------|--|----------------|
| 200 W | 17 A | TE Connectivity 156333-1 | 20 |
| 400 W | 34 A | Mating connector 1: TE 1473672-1 Mating connector 2: TE 1897519-1 | 21 |



DC/DC voltage stabiliser 200 W **on request**

TECHNICAL DATA

| Operating temperature | -40 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 to +105°C |
| Cooling | Convection |
| Weight | approx. 370 g |
| Mating connector ¹⁾ | 156333-1 |
| Output current | 17 A |
| Efficiency | Boost mode 85 % @ U >8 V Bypass mode > 99 % |
| Protection class | IP 5K0 |

TECHNICAL DRAWING



¹⁾ This accessory is not included. It may be purchased from TE Connectivity.



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

TECHNICAL DATA

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

¹⁾ This accessory is not included. It may be purchased from TE Connectivity.

TECHNICAL DRAWING





| DRIVE TRAIN | | EXAMPLES OF VEHICLE APPLICATIONS | |
|---|--|----------------------------------|--------------------|
| Level sensors | | | |
| | Recording the liquid level | 5-0 (rz 6-0 | Motor manufacturer |
| Recording or measuring levels. | Recording the liquid level (static or dynamic) | 50 12 68 | Motor manufacturer |
| | Recording the liquid level (static and dynamic) | 58 E 57 68 | Motor manufacturer |
| Relative pressure measurement of liquids and gases. | Measuring the oil pressure and oil temperature | 50 12 00 | Motor manufacturer |
| Accelerator nedal sensors | | | |
| Accelerator pedat Sensors | | | |
| Floor-mounted and suspended pedal sensors. | Floor-mounted pedals | 58 E | |
| | Suspended pedals | 5-8 E | |





DRIVE TRAIN

Increasing the safety and efficiency of the overall system and preventing failures:

These electronic systems make it possible to precisely measure and record values in the engine compartment and drive train.



Level Sensors Recording the liquid level

PRODUCT FEATURES

- → Simple application solution for minimum level monitoring
- → Simple electrical connection
- → Level monitoring of media such as water or coolant

DESIGN AND FUNCTION

The coolant/windscreen washer level switch consists of a Reed contact and a float that is buoyant and is activated depending on the level. Opening the Reed switch indicates that the level has fallen below the fixed switching point of the level switch. As the level switch is closed over the minimum level, this allows a fault to be diagnosed.

APPLICATION

This level switch serves to monitor levels in tanks. The main application is guaranteeing the minimum level in water or coolant tanks. The sensor can also be used in industrial applications to guarantee minimum levels and the minimum filling quantities of tanks and containers thanks to the simplicity of its design.

SCHEMATIC DIAGRAM



CIRCUIT DIAGRAM



VARIANT OVERVIEW

| Installation | Mating connector | Material | Part Number | Page reference |
|---------------|------------------|---|-----------------|----------------|
| From the page | 1-967644-1 | POM black (base plate and male connector casing) | 6PR 007 968-041 | 26-27 |



Level sensors Recording the liquid level Part number 6PR 007 968-041

INSTALLATION INFORMATION



TECHNICAL DATA

| Switching current | ≤ 20 mA |
|---|--|
| Switch opens | as the level falls (according to the installation position shown on the technical drawing) |
| Operating voltage | e.g. 8 V (with input resistance 357 Ω) |
| Nominal resistance | Rp = 174 Ω ± 1 % 0,25 W (DIN 4592) |
| Test criterion | U _{max} at operating voltage and Reed closed 10 mV |
| Operating temperature (functional reliability) | -40°C to +80°C |
| Storage temperature | - 40°C to + 80°C |
| Lifetime | 50,000 switching cycles |
| Air-tightness in the tank with mating connector attached | IP 68 |
| Resistant to reagents | antifreeze, water, anticorrosive, salt water, cold cleaner |
| Vibration resistance (installed, without liquid, with rubber parts) according to DIN IEC68 Parts 2 to 6 | a-3 g (swept sine-vibration test) |
| | f = 10 to 50 Hz, t = 8 h / main axis |
| Insertion force per flat plug | min. 25 N at RT |
| Electromagnetic properties | specified for the field-free space ¹⁾ |
| Mating connector ²⁾ | 1-967644-1 |
| Male connector casing and base plate material | POM black |
| Pin material | POM natural colour |
| Float material | PP foamed natural colour |
| Magnet material | Hard ferrite |
| Pin coating | Cu Ni tin-plated |
| Rubber grommet material ³⁾ | Soft rubber 60-6, Shore hardness 60 black Hella-N 38 014 |

 $^{\scriptscriptstyle 1)}$ The level switch is specified for the field-free space. The magnetic properties ²⁾ This accessory is not included.
 ³⁾ Not included in the scope of supply.

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TECHNICAL DRAWING





Level sensors Recording the liquid level (static or dynamic)

PRODUCT FEATURES

- → Compact sensor
- \rightarrow Installed in the oil pan
- → Simple electrical connection
- → Principally used for motor oil
- → Application in further media possible

DESIGN AND FUNCTION

The oil level switch consists of a Reed contact and a float that is buoyant and is activated depending on the level. Opening the Reed switch indicates that the level has fallen below the fixed switching point of the oil level switch. This allows a fault to be diagnosed, as the level switch is closed above the minimum level. The oil level switch signal is evaluated by means of a customer-specific evaluation algorithm which is stored in the vehicle control unit/ control system. The minimum warning is triggered by a defined switch-off length of the signal within the evaluation algorithm.

This sensor variant can be installed at the bottom of the oil pan. The oil level switch is typically found in a recessed area of the oil pan or on an additional bracket to align the minimum level of the application with that of the oil level switch.

APPLICATION

This level switch is used to monitor fill levels. The main application is to monitor the engine oil level to safeguard a minimum oil fill quantity in the non-transient range (engine standstill) and during dynamic states (engine operation) in various vehicle engines used in tractors, fork lifts, construction machines, etc. Thanks to the basic application of the sensor, it can also be used in industrial applications to safeguard minimum levels and, thus, minimum fill levels of tanks and containers.

SCHEMATIC DIAGRAM (OIL PAN INSTALLATION)



To fix the plug to the wall of the oil pan, a safety plate must be inserted. This is not included. The permissible wall thickness of the oil pan is 12.1 mm.



VARIANT OVERVIEW

| Installation | Mating connector | Material | Part Number | Page reference |
|--|--|---|-----------------|----------------|
| Inside (e.g. on the bottom of the oil pan) | Delphi ZFW2-141 or Bosch ZFW2-83 with 190 mm cable | PA6, 6T Ultramide TKR 4350, black (casing) | 6PR 232 000-001 | 30-31 |
| Inside (e.g. on the bottom of the oil pan) | Delphi ZFW2-141 or Bosch ZFW2-83 with 275 mm cable | PA6, 6T Ultramide TKR 4350, black (casing) | 6PR 232 000-011 | 32-33 |



Level sensors Recording the liquid level (static or dynamic) Part number 6PR 232 000-001

TECHNICAL DATA

| Switchpoint | 29 ± 1 mm |
|---|--|
| Max. tilt of the oil level switch | ≤ 8° |
| Supply voltage | 5 V \pm 5 % or 14,5 V \pm 5 % |
| Switching current | min. 5 mA / typ. 12 mA / max. 20 mA |
| Pin 1 | Signal |
| Pin 2 | Logic earth |
| Voltage drop | max. 2 mV |
| Insulation resistance | > 1 M ³ at 500 V direct voltage for 60 sec. |
| Dielectric strength up to 500 $V_{\mbox{\scriptsize eff.}}$ | At alternating voltage (50 Hz) and 2 sec |
| Permanent operating temperature | - 40°C to + 150°C |
| Qualified oils | Standard engine oils (e.g. Shell Helix Ultra 5W30) |
| Resistant to | exhaust gases, dust, diesel fuels as per DIN EN 590, rapeseed oil (DIN E 51606), lead-free fuels (DIN EN 339), brake fluid DOT4, hydraulic oil Pentosin CHF11S |
| Lifetime | 50,000 switching cycles |
| Storage temperature | - 40°C to + 70°C |
| Operating Pressure | - 5 kPa to 0 kPa |
| Protection level | IP 69K (Sealing between the plug and the oil pan) |
| Weight | ≤ 60 g |
| Cable length | 190 + 15 mm |
| Cable cross-section | 2 x 0,8 mm |
| Cable insulating material | Polyester Betax-HX FL 33 x 33 x 109 |
| Individual wire | tin-plated, oil-resistant |
| Plug casing material | PA66 Zytel 70G35 HSLX, black BK 357 |
| Plug O-ring material | ACM or AEM, black shore hardness 70 ± 5 |

| TECHNICAL DATA | |
|--------------------------------------|--|
| Oil level switch housing material | PA6, 6T Ultramide TKR 4350, black |
| Oil level switch base plate material | PA66 Zytel 70G35 HSLX, black BK 357 |
| Bushing material | CuZn 39Pb3 R430 EN12164 |
| Contact material | Bd EN 1652 O. 6 CuNi10Fe1Mn |
| Float material | PA6 Ultramid B3S, natural colour |
| Reed contact | Contact wire alloy 52 F52 % Ni48 %, Ri = 100 m Ω max. |
| Magnet material | Hard ferrite 24 / 23, M = 10.33 \pm 0,9 x 10 $^{-6}$ Vscm |
| Plug tightness | up to 50 ± 5 kPa oil pressure |
| Connector | Bosch compact plug 1928 497 999 E |
| Pin coating | galvanically silver-coated 2701 according to HELLA Norm 47102-6 (coat thickness according to DIN 50987, minimum 3µm Ag) |
| Mating connector ¹⁾ | Delphi ZFW2-141 or Bosch ZFW2-83 |

¹⁾ This accessory is not included. May be purchased from Delphi or Bosch.

TECHNICAL DRAWING









Mounting point for switch





Level sensors Recording the liquid level (static or dynamic) Part number 6PR 232 000-011

TECHNICAL DATA

| Switchpoint | 29 ± 1 mm | | |
|---|--|--|--|
| Max. tilt of the oil level switch | ≤ 8° | | |
| Supply voltage | 5 V ± 5 % or 14.5 V ± 5 % | | |
| Switching current | min. 5 mA / typ. 12 mA / max. 20 mA | | |
| Pin 1 | Signal | | |
| Pin 2 | Logic earth | | |
| Voltage drop | max. 2 mV | | |
| Insulation resistance | > 1 MΩ at 500 V direct voltage for 60 sec. | | |
| Dielectric strength up to 500 $V_{\mbox{\scriptsize eff.}}$ | At alternating voltage (50 Hz) and 2 sec | | |
| Permanent operating temperature | - 40°C to +150°C | | |
| Qualified oils | Standard engine oils (e.g. Shell Helix Ultra 5W30) | | |
| Resistant to | exhaust gases, dust, diesel fuels as per DIN EN 590, rapeseed oil (DIN E 51606), lead-free fuels (DIN EN 339), brake fluid DOT4, hydraulic oil Pentosin CHF11S | | |
| Lifetime | 50,000 switching cycles | | |
| Storage temperature | - 40°C to + 70°C | | |
| Operating Pressure | - 5 kPa to 0 kPa | | |
| Protection level | IP 69K (Sealing between the plug and the oil pan) | | |
| Weight | ≤ 60 g | | |
| Cable length | 275 + 15 mm | | |
| Cable cross-section | 2 x 0,8 mm | | |
| Cable insulating material | Polyester Betax-HX FL 33 x 33 x 109 | | |
| Individual wire | tin-plated, oil-resistant | | |
| Plug casing material | PA66 Zytel 70G35 HSLX, black BK 357 | | |
| Plug O-ring material | ACM or AEM, black shore hardness 70 ±5 | | |

| TECHNICAL DATA | | | |
|--------------------------------------|--|--|--|
| Oil level switch housing material | PA6, 6T Ultramide TKR 4350, black | | |
| Oil level switch base plate material | PA66 Zytel 70G35 HSLX, black BK 357 | | |
| Bushing material | CuZn 39Pb3 R430 EN12164 | | |
| Contact material | Bd EN 1652 O. 6 CuNi10Fe1Mn | | |
| Float material | PA6 Ultramid B3S, natural colour | | |
| Reed contact | Contact wire alloy 52 F52%Ni48%, Ri = 100 m Ω max. | | |
| Magnet material | Hard ferrite 24 / 23, M = 10.33 ± 0,9 x 10 ⁻⁶ Vscm | | |
| Plug tightness | up to 50 ± 5 kPa oil pressure | | |
| Connector | Bosch compact plug 1928 497 999 E | | |
| Pin coating | galvanically silver-coated 2701 according to HELLA Norm 47102-6 (coat thickness according to DIN 50987, minimum 3µm Ag) | | |
| Mating connector ¹⁾ | Delphi ZFW2-141 or Bosch ZFW2-83 | | |

¹⁾ This accessory is not included. May be purchased from Delphi or Bosch.

TECHNICAL DRAWING









Mounting point for switch





Level sensors Recording the liquid level (static and dynamic)

PRODUCT FEATURES

- → Continuous measurement of the engine oil level in the static and dynamic range
- → Compact sensor architecture with a multi-chip module
- → Integrated temperature sensor
- → Immediate measurement after switch-on

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 an ASIC (Application Specific Integrated Circuit). The compactness of our sensors increases their impact and vibration resistance compared with sensors that are fitted with numerous electronic components. The ultrasonic sensor integrated in the multi-chip module transmits a signal that is reflected by the bounding surface between the motor oil and the air.

The signal's running time is measured and the filling level is calculated depending on the speed of sound in the medium. The attenuation cup attached above the multi-chip module serves to calm the medium (particularly) in the dynamic measuring range. The damping cap has openings at the base and at the tip, which allow permanent oil flow.

INSTALLATION

The sensor has been designed for vertical installation from below, directly into the bottom of an oil pan. The oil level sensor is usually located on a ledge in the oil pan to protect the sensor substructure. This installation position, combined with the openings which make a permanent flow of oil possible, prevent sludge forming within the damping cup.

APPLICATION

In vehicles, oil sensors ensure that the engine cannot work unnoticed with too little oil. The tried-and-trusted technology of the ultrasonic sensors works on the delay time principle and records the filling level continuously during the trip. During engine operation (dynamic measuring range) the filling level is significantly lower than when the engine is at a standstill (static measuring range). An oil dipstick only records the oil level in the static range. This oil level sensor can measure the oil level continuously, i.e. both in the dynamic and in the static range. It thus provides information about the oil level throughout the period of time the engine is operated, which can often be a number of hours in the case of construction machinery, tractors and fork lift trucks.

The sensor provides continuous monitoring of the oil level throughout the period of time the engine is operated, thus preventing the oil level falling below the minimum level during operation and interrupting the oil film (which would cause engine damage).

Secondary influences such as the slope of the vehicle, lateral and longitudinal accelerations, are compensated by the vehicle control unit calculating a mean value.

Use of the oil level sensor with special media, e.g. transmission and hydraulic oils require prior testing and approval by HELLA.

SCHEMATIC DIAGRAM

Optimum sensor position in the oil pan for dynamic measurements





CIRCUIT DIAGRAM



VARIANT OVERVIEW

| Installation | Supply voltage | Measuring range | Part Number | Page reference |
|-------------------------------|----------------|--------------------------------|-----------------|----------------|
| From the bottom ¹⁾ | 12 V | static and dynamic 18–118.8 mm | 6PR 010 497-501 | 38-39 |
| From the bottom ¹⁾ | 12 V | Static and dynamic 18–95.8 mm | 6PR 010 497-511 | 40-41 |

¹⁾ Other installation positions on request



Level sensors Recording the liquid level (static and dynamic)

T₁: TEMPERATURE EVALUATION (T₁ TEMP)



T₂: LEVEL EVALUATION (T₂ LEVEL)



Level Duty Cycle (D2)

20% of the PWM block duration T_1 (22 ms) corresponds to the lowest measuring point of the measuring range, equal to -40 $^\circ\rm C$

80% of the PWM block duration $\rm T_1$ (88 ms) corresponds to the highest measuring point of the measuring range, equal to 160 $^\circ\rm C$

T1/T = DC = 0.2 (20 %) => -40°C T1/T = DC = 0.8 (80 %) => 160°C 20 % of the PWM block duration $T_{\rm 2}$ (22 ms) corresponds to the lowest measuring point of the measuring range of 18 mm

80% of the PWM block duration $T_{\rm 2}$ (88 ms) corresponds to the highest measuring point of the measuring range, equal to 147 mm

T2/T = DC = 0.2 (20 %) => 18 mm T2/T = DC = 0.8 (80 %) => 147 mm

| T ₃ : DIAGNOSTIC EVALUATION | | | | | | |
|--|--------------------------|--|-------------------------------|--|--|--|
| Diagnostics duty cycle (DC3) | T3 (ms) for T = 110ms | Diagnostics information | Signal transmission priority* | | | |
| 0,2 (20 %) | 22 | PULS ok | Prio 5 | | | |
| 0,3 (30 %) | 33 | Voltage outside the tolerance (<8.5 V \pm 0.5 V; > 16.5 V \pm 0.5 V) | Prio 1 | | | |
| 0,4 (40 %) | 44 | Open / short-circuited (signal converter) | Prio 2 | | | |
| 0,5 (50 %) | 55 | Temperature outside the tolerance (-48°C > temp. > $168°C$) | Prio 3 | | | |
| 0,6 (60 %) | 66 | Level outside the tolerance DC ₃ 0.6 and Level 18 mm = Level under 18 mm or temperature under -10°C DC ₃ 0.6 and Level 147 mm = Level over 147 mm DC ₃ 0.6 and Level L-14 mm = Noise filter active, i.e. foam entry detected | Prio 4 | | | |

* Signal with the highest priority is transmitted
BASIC INFORMATION ABOUT THE SIGNAL DURATION

 $\begin{array}{l} \mbox{Startup checksum} = 920\mbox{ ms} \\ \mbox{PWM block duration T = 110 ms \pm 10 ms} \\ \mbox{PWM block duration T_3$ = 68.2 ms (fixed)} \\ \mbox{Total PWM block duration T_{signal}$ = 1,000 ms \pm 100 ms} \\ \mbox{Brake signal $670 ms \pm 40 ms} \\ \end{array}$

All the calculation data only apply for standard motor oil on account of the dependence between ultrasonic speed and density of the medium. Hence, the above calculation only applies to standard engine oils (e.g. Castrol 10W30). In the case of other measurable, non-conductive media, the calculation must be checked in the respective application.

| Tem | perature [°C] = | $(T_1 / T - 0.32)$ 0,003 | |
|-----------------------------|-----------------------------|-----------------------------|---------------------|
| | | | |
| evel _{Camp} [mm] = | $[(T_2/T - 0,2) \cdot 215]$ | 5 + 13,95] • - | T[ms] 110 + 4,05 |

Diagnostics = $[T_3/T]$

| OUTPUT CHARACTERISTICS | | | | | |
|---|----------------------|------------------------|-----------|------------------------|------|
| Name | Symbol | Min. | Typically | Max. | Unit |
| Output voltage low | V _{ol} | _ | _ | 0,1 x V _{bat} | V |
| Output voltage high ¹⁾ | V _{oh} | 0,9 x V _{bat} | _ | _ | V |
| Output current at low level | I _{ol} | 0,6 | _ | 10 | mA |
| Output current at high level | I _{oh} | - 20 | 0 | 20 | μΑ |
| PWM Open Collector resistor ²⁾ | R _{pullup} | 1,6 | _ | 10 | k0hm |
| Peak output current short-circuit detection | I _{ol,peak} | 80 | _ | _ | mA |
| RMS output current short-circuit detection | I _{ol,RMS} | 80 | 100 | - | mA |
| Capacitive load ³⁾ | Cload | _ | _ | 40 | nF |

¹⁾ Open collector with output capacitance = 1 nF (with external capacitive loads, pay attention to flank gradient).

²⁾ To be implemented in on-board computer.

³⁾ Capacitive load at pulse communication output.

STARTING 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 encoded information on the oil temperature, oil level and diagnosis.





Level sensors Recording the liquid level (static and dynamic) 6PR 010 497-501

TECHNICAL DATA

| Operating voltage (for oil level measurement) | 9–16 V |
|--|--|
| Operating voltage (for temperature measurement) | 6-16 V |
| Reverse-polarity voltage | - 14 V / 60 s |
| Overvoltage | 15 s at 28 V 250 ms at 32 V |
| Measurement range (static and dynamic) | 18–118,8 mm |
| Operating temperature | - 40°C to + 160°C |
| Operating temperature (for oil level measurement) ¹⁾ | - 10°C to +150°C |
| Reheating temperature | max. 5.700 h at 125°C max. 240 h at 145°C max. 60 h at 160°C |
| Storage temperature | - 40°C to + 150°C |
| Current consumption | 4 mA |
| Max. current consumption during measuring | 50 mA |
| Protocol ²⁾ | PWM |
| Mating connector ³⁾ | 09 44 13 82 |
| Protection class | IP 6K9K |
| Weight | 76 g ± 3 % |
| Viscosities | 1 mm²/s to 1.300 mm²/s |

NEW GENERATION OF SENSORS

This sensor has an improved meander structure for optimiSed behaviour under dynamic conditions in oil as well as improved response times.

Tolerance of level measurement

| Oil level | Temperature range | Operating voltage | Tolerance |
|----------------|-------------------|-------------------|-----------|
| 18 to 118.8 mm | -10°C ≤ T <30°C | 9 to 16 V | ±4mm |
| 18 to 118.8 mm | 30°C < T <150°C | 9 to 16 V | + 2 mm |

Tolerance of temperature measurement

| Oil level | Temperature range | Operating voltage | Tolerance |
|-----------|-------------------|-------------------|-----------|
| All | 60°C ≤ T <120°C | 6 to 16 V | ± 4 K |
| All | -40°C ≤ T <60°C | 6 to 16 V | ± 3 K |
| All | 120°C ≤ T <160°C | 6 to 16 V | ± 3 K |
| | | | |

 $^{1)}$ Level output above - 10 °C. At temperatures below -10 °C, an "empty" signal is ^a Level output above - 10° c. At temperatures below - 10° c, an empirisment of the second se

TECHNICAL DRAWING











Gasket seat free of bur max. permissible circular radius R = 0.3 mm alternatively circular 0.3 mm x 45

DYNAMIC MEASUREMENT OF THE ENGINE OIL





Level sensors Recording the liquid level (static and dynamic) 6PR 010 497-511

TECHNICAL DATA

| Operating voltage (for oil level measurement) | 9–16 V |
|--|--|
| Operating voltage (for temperature measurement) | 6-16 V |
| Reverse-polarity voltage | - 14 V / 60 s |
| Overvoltage | 15 s at 28 V 250 ms at 32 V |
| Measurement range (static and dynamic) | 18 – 95,8 mm |
| Operating temperature | -40°C to +160°C |
| Operating temperature (for oil level measurement) ¹⁾ | - 10°C to + 150°C |
| Reheating temperature | max. 5.700 h at 125°C max. 240 h at 145°C max. 60 h at 160°C |
| Storage temperature | - 40°C to + 150°C |
| Current consumption | 4 mA |
| Max. current consumption during measuring | 50 mA |
| Protocol ²⁾ | PWM |
| Mating connector ³⁾ | 09 44 13 82 |
| Protection class | IP 6K9K |
| Weight | 76 g ± 3 % |
| Viscosities | 1 mm ² /s to 1.300 mm ² /s |

NEW GENERATION OF SENSORS

This sensor has an improved meander structure for optimiSed behaviour under dynamic conditions in oil as well as improved response times.

Tolerance of level measurement

| Oil level | Temperature range | Operating voltage | Tolerance |
|---------------|-------------------|-------------------|-----------|
| 18 to 95.8 mm | -10°C ≤ T <30°C | 9 to 16 V | ±4mm |
| 18 to 95.8 mm | 30°C ≤ T <150°C | 9 to 16 V | + 2 mm |

Tolerance of temperature measurement

| Oil level | Temperature range | Operating voltage | Tolerance |
|-----------|-------------------|-------------------|-----------|
| All | 60°C ≤ T <120°C | 6 to 16 V | ± 4 K |
| All | -40°C ≤ T <60°C | 6 to 16 V | ± 3 K |
| All | 120°C ≤ T <160°C | 6 to 16 V | ± 3 K |
| | | | |

¹⁾ Level output above - 10 °C. At temperatures below - 10 °C, an "empty" signal is sent (18 mm) together with the diagnostic signal "out of tolerance".
²⁾ LIN available on request.
³⁾ This accessory is not included. Can be purchased from Kostal.











Gasket seat free of bur max. permissible circular radius R = 0.3 mm alternatively circular 0.3 mm x 45

DYNAMIC MEASUREMENT OF THE ENGINE OIL





Level sensors Measuring the oil pressure and oil temperature

PRODUCT FEATURES

- → Continuous measurement of the oil pressure
- \rightarrow Continuous measurement of the oil temperature
- → Robust and dependable design

DESIGN AND FUNCTION

The OPS+T bases on a mult-chip module (MCM), consisting of a piezoresistive cell for measuring the absolute pressure and an ASIC for digital evaluation and to further process the information. The oil temperature can also be determined via a diode integrated into the MCM. Both the oil pressure and the oil temperature are transferred via the PWM output signal. The engine control unit (ECU) evaluates the PWM output signal of the sensor. The patented technology guarantees tightness compared to oils.

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 properly control mechanical or electrical oil pumps. This lowers the CO_2 emissions and reduces the fuel consumption. Recording the temperature serves as input information for the engine's thermal management. The evaluation of both signals occurs in superordinate control unit.

The use of the multi-chip module means it can be utilised in tough environments.

EXTERNAL CONVERTER IN THE CONTROL UNIT

A 10k pull-up resistor should be integrated into the ECU of the vehicle to define the idle mode.

In order to optimally read the PWM signal, a capacity of max. $2.2\,\rm nF$ should be integrated to compensate for vibration oscillations.





| VARIANT OVERVIEW | | | | |
|-------------------------|----------------|---|-----------------|----------------|
| Attachment | Supply voltage | Measuring range | Part Number | Page reference |
| Screw sensor, M12 x 1.5 | 4,75-5,25 V | Pressure 0.5 – 10.5 bar, temperature - 40°C to + 160°C | 6PR 010 378-101 | 44-45 |



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

Temperature range Max. Temperature Supply voltage

| 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 |
| Protection level | IP 69K |
| Mating connector ¹⁾ | 872-597-501, 872-597-506, coding A |

TECHNICAL DRAWING

INSTALLATION SPACE

- 40°C to +150°C

160°C (max. 100 h)



TECHNICAL DATA

¹⁾ This accessory is not included. It may be purchased from Hirschmann Automotive.

| RANGE OF TOLERANCE FOR PRESSURE MEASUREMENT | | | |
|---|---------------|---------------|------------------|
| Temperature | 0,50–3,00 bar | 3,00–5,50 bar | 5,50 – 10,50 bar |
| 70 to 160°C | +/- 0,15 bar | +/- 0,20 bar | +/- 0,30 bar |
| 20 to 70°C | +/- 0,15 bar | +/- 0,20 bar | +/- 0,30 bar |
| 0 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 |



| RANGE OF TOLERANCE FOR TEMPERATURE MEASUREMENT | | |
|--|----------|--|
| Temperature | Accuracy | |
| 135 to 160°C | +/- 1 K | |
| 20 to 135°C | +/- 2 K | |
| - 40°C to 20°C | +/- 3 K | |
| | | |

PIN ASSIGNMENT



Pin 1: Supply Pin 2: Logic earth Pin 3: Output

Output signal

A pulse width modulation signal (PWM) is used to communicate the temperature, press and diagnostic information. The entire information is sent every 9.216 μs and receives the temperature, pressure and diagnostic signals. 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 have a suitable sampling frequency and logic for measuring and recording the signals available.

General information on the evaluation of the PWM communication:

Due to the setting accuracy of the oscillator and its temperature dependency, the length of a PWM frame is subject to a maximum tolerance of $\pm 10\%$. Serious hardware errors in the program design of the ASIC lead to an interruption of the PWM communication and are detectable on the control unit by a permanent high level.





T₁: Temperature T₂: Pressure

S1: DIAGNOSTIC SIGNAL



 $\begin{array}{ll} {\sf DC}=0.25 & ({\sf S}_1=256\ \mu{\sf s}\pm25\ \mu{\sf s}) \Rightarrow {\sf OPS}\ functional\ status \\ {\sf DC}=0.375 & ({\sf S}_1=384\ \mu{\sf s}\pm25\ \mu{\sf s}) \Rightarrow {\sf pressure}\ failure \\ {\sf DC}=0.5 & ({\sf S}_1=512\ \mu{\sf s}\pm25\ \mu{\sf s}) \Rightarrow {\sf temperature}\ failure \\ {\sf DC}=0.625 & ({\sf S}_1=640\ \mu{\sf s}\pm25\ \mu{\sf s}) \Rightarrow {\sf hardware}\ failure \end{array}$





96.9% of the PWM block duration T1 (3968 ms) corresponds to the highest measuring point of the measuring range, equal to 160°C. 3.1% of the PWM block duration T1 (128 ms) corresponds to the lowest measuring point of the measuring range, equal to -40°C.

 $T_1|_{\mu s} = 19,2 \frac{\mu s}{C} \cdot \text{Temp} + 896 \ \mu s$

T₂: **PRESSURE EVALUATION (T**₂ **LEVEL) DC** [%] **T**₂ 96,875 3968 μs 3,125 128 μs **0**,5 bar **10**,5 bar **Pressure**

96.9% of the PWM block duration T2 (3968 ms) corresponds to the highest measuring point of the measuring range, equal to 10.5 bar. 3.1% of the PWM block duration T2 (128 ms) corresponds to the lowest measuring point of the measuring range, equal to 0.5 bar.

ECU CALCULATION

| Temperature = | $\left(\begin{array}{c} \frac{4096\mu s}{T_{\rm Pl,isf \mu s}} ~~ \bullet T_{\rm l} _{\mu s} - 128\mu s \right) \bullet \begin{array}{c} \frac{1}{19,2} ~~ \frac{\circ C}{\mu s} ~~ -40^{\circ} C$ |
|---------------|--|
| Pressure = | $\left(\begin{array}{c} \frac{4096\mu s}{T_{\rm PI,isl_{\mu s}}} \bullet T_{\rm 2} _{\mu s} - 128\mu s \right) \bullet \frac{1}{384} \frac{bar}{\mu s} + 0.5bar$ |
| Diagnosis = | $\left(\frac{1024\mu s}{T_{PSI,Isl_{\mu s}}}\cdot S_{I} _{\mu s}\right)$ |



Floor-mounted pedals

PRODUCT FEATURES

- \rightarrow Contact free measuring principle
- \rightarrow Slim and sturdy design
- → Simple mechanical connection
- → Redundant output signal
- → High degree of measuring accuracy, which means no learning process is necessary in the vehicle
- → High interference immunity against electrical and magnetic fields

DESIGN AND FUNCTION

Casing and the pedal plate are made completely of recyclable glass fibre reinforced plastic. The sensor is completely waterproof, enclosed in casing within the overall dimensions of the device. The actuating force is generated by two springs, each of which is sufficient to safely return the pedal to its original position. The electrical output signal is obtained using the CIPOS® measurement principle. For this purpose, a sheet metal cursor is routed from the pedal arm to a guide rod via sensor conductor paths on the measuring board. Two output signals are generated by two galvanically isolated sensors.

APPLICATION

The floor-mounted pedal is suitable for the driver cabins of agricultural and construction vehicles. Thanks to the wear-free measurement principle of HELLA's in-house developed CIPOS ® sensors (see description of the design and function of the angular rotation sensors) and their extremely low level of mechanical wear, this version is particularly suitable for contact-type pedals that effect frequent small movements.

VARIANT OVERVIEW

| Pedal material | Part Number | Page reference |
|----------------|-----------------|----------------|
| Plastic | 6PV 312 010-107 | 48-49 |



Floor-mounted pedals Part number 6PV 312 010-107

TECHNICAL DATA

| Operating voltage | $5 V \pm 6 \%$ |
|---|--|
| Power consumption per channel | max. 10 mA |
| Overvoltage resistance, duration t $\rightarrow \infty$ | 16 V |
| Initial force | 15 N |
| Final force | 25 N |
| Actuation angle | 17° |
| Release | |
| Output signal | 2 x analogue ratiometric, 2nd channel half pitch |
| Linearity | ≤ 1,5 % |
| Synchronisation | ≤ 3 % |
| Idling voltage | 15%/7,5% |
| Full throttle voltage | 80 % / 40 % |
| Load resistance | typ. 10 kΩ to 100 kΩ |
| Load capacity | max. 100 nF |
| Filter constant in the control unit | 1 ms ±5% |
| Signal output current | max. 1 mA |
| Operating temperature | -40°C to +85°C |
| Storage temperature | - 40°C to + 105°C |
| Protection class (electronic) | IP 6K9K |
| Casing material | PBT, PP GF30; PA, GF 40 |
| Mating connector ¹⁾ | 1-967616-1 |
| Weight | ≤ 500 g |
| Vibration resistance | |
| Actuations | min. 3.5 million |
| EMV | CISPR 25, Class 5; electrical and magnetic fields |
| ESD | 4 kV, 8 kV, 15 kV |

¹⁾ This accessory is not included. It may be purchased from TE Connectivity. Gold-plated contacts and the individual wire seal are required.

TECHNICAL DRAWING







RECOMMENDED CONVERTER IN THE CONTROL UNIT

MECHANICAL CHARACTERISTIC CURVE



Pin assignment

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

Component values:

R1, R3 typ. 10 kΩ C1, C3 typ. 100 nF R2*C2; R4*C4 typ. 1ms

ELECTRICAL CHARACTERISTIC CURVE

| RATED VALUES | | |
|--------------|--------|------------|
| R | [mm] | 160,0 |
| F1 | [N] | 15,0 ± 3,5 |
| F2 | [N] | 25 ± 4,5 |
| F4 | [N] | > 4,0 |
| F5 | [N] | > 1,5 |
| al | [Grad] | < 1,5 |
| a2 | [Grad] | 15,5 |
| | | |

Suspended pedals

PRODUCT FEATURES

- \rightarrow Contact free measuring principle
- \rightarrow Slim and sturdy design
- → Simple mechanical connection
- → Redundant output signal
- → High degree of measuring accuracy, which means no learning process is necessary in the vehicle
- → High interference immunity against electrical and magnetic fields

DESIGN AND FUNCTION

Casing and the operating lever are made completely of recyclable glass fibre reinforced plastic. The sensor is completely waterproof, enclosed in casing within the overall dimensions of the device. The actuating force is generated by two springs, each of which is sufficient to safely return the pedal to its original position. The electrical output signal is obtained using the CIPOS® measurement principle. For this purpose, a sheet metal cursor is routed from the pedal arm via sensor conductor paths on the measuring board. Two output signals are generated by two galvanically isolated sensors. Different output signals can be generated depending on the measuring board used. In addition, individual characteristic curves can be programmed on request.

APPLICATION

The floor-mounted pedal is suitable for the driver cabins of agricultural and construction vehicles. Thanks to the wear-free measurement principle of HELLA's in-house developed CIPOS ® sensors (see description of the design and function of the angular rotation sensors) and their extremely low level of mechanical wear, this version is particularly suitable for contact-type pedals that effect frequent small movements.

| VARIANT | OVERVIEW |
|---------|----------|
| | |

| Pedal material | Part Number | Page reference |
|----------------|-----------------|----------------|
| Plastic | 6PV 009 591-011 | 52-53 |

Suspended pedals Part number 6PV 009 591-011

TECHNICAL DRAWING

TECHNICAL DATA

| Operating voltage | 5 V ±6 % |
|---|--|
| Power consumption per channel | max. 10 mA |
| Overvoltage resistance, duration t $\rightarrow \infty$ | 16 V |
| Initial force | 24 N |
| Final force | 42 N |
| Actuation angle | 17° |
| Release | 0,04° |
| Output signal | 2 x analogue ratiometric, 2nd channel half pitch |
| Linearity | ≤ 1,5 % |
| Synchronisation | ≤ 3 % |
| Idling voltage | 10%/5% |
| Full throttle voltage | 90 % / 45 % |
| Load resistance | typ. 10 kΩ to 100 kΩ |
| Load capacity | max. 100 nF |
| Filter constant in the control unit | 1 ms ±5% |
| Signal output current | max. 1 mA |
| Operating temperature | -40°C to +85°C |
| Storage temperature | - 40°C to + 105°C |
| Protection class (electronic) | IP 6K9K |
| Casing material | PA; PBT; GF30 to GF 50 |
| Mating connector ¹⁾ | 7283-1968-30 |
| Weight | ≤ 400 g |
| Vibration resistance | 4,4 g |
| Actuations | min. 3.5 million |
| EMV | CISPR 25, Class 5; electrical and magnetic fields |
| ESD | 4 kV. 8 kV. 15 kV |

(3x)

¹⁾ This accessory is not included. It may be purchased from Yazaki. Gold-plated contacts and the individual wire seal are required.

RECOMMENDED CONVERTER IN THE CONTROL UNIT

Pin assignment Pin 1: Supply 5 V: Sensor 1 Pin 2: Analogue signal: sensor 1 Pin 3: Logic earth: sensor 1 Pin 4: Logic earth: sensor 2 Pin 5: Analogue signal: sensor 2 Pin 6: Supply 5 V: Sensor 2

ELECTRICAL CHARACTERISTIC CURVE

MECHANICAL CHARACTERISTIC CURVE

| RATED VALUES | | |
|--------------|--------|------------|
| R | [mm] | 170,0 |
| F1 | [N] | 24,0 ± 6,0 |
| F2 | [N] | 42,0 ± 8,0 |
| F4 | [N] | > 5,0 |
| F5 | [N] | > 4,0 |
| al | [grad] | < 1,2 |
| a2 | [grad] | 15,5 |
| | | |

Wide Open Throttle Signal for ECU Area of APS P1.2 4 P2 ₽1.1 ▼ **₽**2.1 ¥. 1 +b1+ **≺**T1► b2

| RATED VALUES | | |
|--------------|--------|------------|
| b2 | [grad] | 17,0 ± 1,2 |
| P1.1 | [%] | 10,0 ± 1,0 |
| P2.1 | [%] | 5,0 ± 1,0 |
| P1.max | [%] | < 90,0 |
| P2.max | [%] | < 45,0 |
| P1.2 | [%] | 84,0 |
| P2.2 | [%] | 42,0 |
| T1 | [grad] | < 2,0 |
| b1 | [grad] | < 1,5 |

| COMPONENTS | | EXAMPLES OF VEHICLE APPLICATIONS |
|--|-------------------------|----------------------------------|
| Radio transmitter systems | | |
| Switching on and off or opening and locking. | Remote control | |
| Actuators | | |
| Electrical locking and/or unlocking, tightening of closing and opening mechanisms. | Electromotive actuators | |

COMPONENTS

Provide added convenience with compact solutions in a variety of areas:

These electronic systems are generally invisible little helpers for the various automatic processes within the vehicle.

| COMPONENTS | | EXAMPLES OF VEHICLE APPLICATIONS |
|--|--|----------------------------------|
| Sensors | | |
| Air temperature measurements. | Temperature sensors | |
| Air property measurements. | Air quality sensor | 50 E. E. C. |
| | Rain/light sensor, PC (passenger car) | 6-5° |
| Recording environmental properties. | Rain/light sensor, vehicles with special windshields | 58 De Ea |
| Precise and reliable measurement of angle settings and changes. | Turning angle sensors | 53 Ez 53 |

Radio transmitter systems Switching on and off or opening and locking

PRODUCT FEATURES

Electronic radio transmitter key:

- → Unlocking of cabin doors/flaps
- → Control of lamps/worklights
- → Activating/deactivating an electronic immobilizer via a transponder
- → Robust design

APPLICATION

The radio transmitter system was specially developed under hard operating conditions (agricultural, construction machines, commercial vehicles). The system enables the driver to conveniently unlock the cabin door. The remote control can be equipped with one or two buttons, depending on the customer's requirements. The rugged design has been specially developed for use with agricultural and construction machinery. An additional control unit with up to four output signals also makes it possible to control lights, e.g. worklights or beacons. The HELLA wireless remote system makes it easy to activate the flashers as well as opening and locking of compartments, e.g. the engine compartment and tool containers. The design can be customised on request, e.g. to incorporate customer-specific logos.

DESIGN AND FUNCTION

With regard to the electrical function, the transmitter consists of the transmitter electronics and transponder units. The transponder responsible for the immobiliser function does not depend on the transmitter electronics and can be specified by the customer.

The transmitter is mounted to a double-sided populated PCB. In addition to the actual transmitter electronics, the printed circuit board contains the locking/unlocking button and depending on the variant a further button (additional function). The printed circuit board and the battery are electrically connected by the spring contact elements. By pressing a button, the radio remote control sends data packages provided with a roll code and an up-to-date 128 bit encryption. If the data are positively decoded by the receiving control unit of the radio remote control, this will activate the output signal of the control unit.

The radio control system can be used in every European country and also in North America (USA + Canada) and India without limitations. System radio approvals outside Europe can be carried out in consultation with HELLA.

The radio remote control is equipped with a holder for a mechanical key bit. The radio transmission electronics device does not include the mechanical key bit. The key bit is usually mounted at the customer or manufacturer of the key bit (using a special mounting device).

Two radio transmitter keys are "taught-in" and assigned to the device during production of the radio receiver. Teaching additional radio transmitter keys in the field requires at least one functioning, taught-in key. For radio remote controls with two buttons, up to 7 radio transmitter keys can be taught in. If the maximum number of radio transmitter keys has already been taught in, the last key place is overwritten when teaching in another key. If the radio remote control only has one button, no keys can be subsequently taught in.

FUNCTIONAL DIAGRAM

COMPONENTS

VARIANT OVERVIEW

There are two variants of the reception control unit available. The basic version and the extended variant. Customer-specific output signal characteristics are available on request. If a customer-specific logo is intended, a new article number will be generated for this purpose. Each unit variant included two blind plugs made of hard plastic. This enables the radio transmitter to be operated even without a key bit.

| Variants | Part Number | Page reference |
|--|-----------------|----------------|
| 2 radio transmitters and receiver basic version | on request | 58-59 |
| 2 radio transmitters and receiver extended version | 5FA 012 485-817 | 58-59 |

Other variants and configurations on request.

Details on the basic variant and extended variants can be found on page 56.

Radio transmitter systems Switching on and off or opening and locking Basic variant on request Extended variant 5FA 012 485-817

TECHNICAL SPECIFICATIONS RADIO TRANSMITTER

| Key bit - joining force | max. 350 N |
|--|---|
| Key bit - pull-out force | > 180 N |
| Torque around the axle of the key shaft | 3 Nm |
| Torque around the axle of the key width | 4 Nm |
| Separating the housing parts, joining/ separating force | 110 N (in new condition) |
| Casing cover | PA66+PA6I/X-GF50 and TPU |
| Casing base | PA6-GF30 |
| Contact elements | X10CrNi 18-8 |
| Customer logo | PU-Logo, customised |
| Key panel | Hytrel black |
| Transmission frequency | 434,42 MHz |
| Transmission power | 30 µW ERP |
| Battery type ¹⁾ | CR2032 |
| Battery lifetime | 100,000 key activations (corresponds to approx. 3 years) |
| Max. range ²⁾ | 119 m |
| Min. range ²⁾ | 51 m |
| Average range ²⁾ | 70,5 m |
| Operating temperature | - 20°C to + 60°C |
| Storage temperature | - 20°C to + 60°C |
| Protection level | IP 6K7 and IP X5 |

¹⁾ A battery is included as part of the radio transmitter.

²⁾ Ranges are dependent on installation position and interference factors. The values specified are representative and must be validated for each new application.

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

Blind plug

Receiving control unit

TECHNICAL SPECIFICATIONS RADIO RECEIVER

| Operating voltage | 6-32 V |
|--------------------------------|-------------------------------------|
| Power consumption | 11 mA (signal output not activated) |
| Idling current | < 2 mA |
| Minimum voltage | 6 V |
| Maximum voltage | 58 V for the time of 250 ms |
| Nominal voltage | 12/24V |
| Test voltage | 27,6 ± 0,4 V |
| Overvoltage | 36 V (at 40°C, 1 hour) |
| Casing cover | PC- post consumer material |
| Casing base | PC- post consumer material |
| Male connector housing | PBT-GF20, V0 |
| Operating temperature | -40°C to +80°C |
| Storage temperature | - 40°C to + 90°C |
| Protection level | IP 5K0 |
| Length | |
| Width | 45 mm |
| Height | 21,5 mm |
| Mating connector ¹⁾ | 17848 000 000 |

TECHNICAL DRAWING

Receiving control unit

¹⁾ This accessory is not included. It may be purchased from Lear.

| BASIC VARIANT | | | | |
|-----------------------|----------|---|--|--|
| Pin and configuration | Function | Description | | |
| 1 positive pin | Input | Power supply (+ 12/24 V) | | |
| 2 GND | Input | Power supply (ground) | | |
| 3 door control | Output | Low-active (< 300 mA) signal duration 3.5 s when pressing button 1 | | |
| 4 | | Not assigned | | |
| 5 reserve | Output | High-active (< 300 mA) signal duration 0.5 s when pressing button 2 | | |
| 6 | | Not assigned | | |
| 7 | | Not assigned | | |
| 8 | | Not assigned | | |

| EXTENDED VARIANT | | |
|-----------------------|--------------|--|
| Pin and configuration | Function | Description |
| 1 positive pin | Input | Power supply (+ 12/24 V) |
| 2 GND | Input | Power supply (ground) |
| 3 mode | Input signal | Mode = low or mode = high (high at 70% of the voltage of the vehicle electrics) |
| 4 | | Not assigned |
| 5 door 1 | Output | High-active (< 300 mA) when pressing button 1 mode = low: signal duration 3 s, mode = high: signal duration 0.5 s |
| 6 door 2 | Output | High-active (< 300 mA) when pressing button 2 mode = low: signal duration 3 s, mode = high: signal duration 0.5 s |
| 7 alarm function | Output | High-active (< 300 mA), signal duration 3.5 s |
| 8 reserve | Output | High-active (< 300 mA) signal duration 3 s when pressing button 2 |

COMPONENTS

PRODUCT FEATURES

- → Compact, space-saving design
- → Electrical resetting or automatic resetting (without current)
- \rightarrow Easy to fix in place thanks to snap-fit mounting
- → Spray water protected
- → With or without micro-switch
- → Explosion report for tank modules

APPLICATION

This actuator's extremely compact design makes it particularly suitable for locking and unlocking applications in dry and wet areas (including via remote control, for example) where the available space is tight.

Examples include:

- → Tank modules
- → Service flaps
- → Glove compartments
- \rightarrow Locking of the charging plug (e-mobility)

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

Function

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

Two product variants are available in the product range. The first actuator variant with power locking and unlocking function is particularly well suited to conventional applications in which the locking lever locks a hinge arm connected to the locking system by applying voltage and unlocks it when polarity is reversed. The stability of the open/closed locking positions is achieved after short-circuiting the motor following successful actuation. The position of the locking element can also be defined via an integrated micro-switch.

A return spring and a micro-switch are integrated in the second actuator variant. Lightly move the locking lever e.g. by pressing a service flap to actuate the micro-switch. The actuator is then energized by a control unit. The locking lever is subsequently fully retracted so that the locking system is open and the service flap also opens via a spring action. The actuator is then switched off and the locking lever returns to the locking position de-energized via the integrated return spring. Press the service flap shut to lock it; the hinge arm of the flap then engages in the locking lever of the actuator.

EXAMPLES OF THE MOUNTING INTERFACE

LOCKING INTERFACE (VARIANT -017 and -027)

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

LOCKING INTERFACE (VARIANT -047)

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

VARIANT OVERVIEW

| Function | Voltage | Actuating force | Manual adjustment | Protection level | Part Number | Page reference |
|--|------------|-----------------|-------------------|---------------------|-----------------|----------------|
| Forward and reverse rotation | electrical | | | | | |
| | 12 V | - | Yes | IP 5K4 | 6NW 011 122-017 | 62 |
| With micro-switch | 12 V | - | Yes | IP 5K4 | 6NW 011 122-027 | 64-65 |
| Electrical forward rotation and reverse rotation via return spring, with soft touch button | | | | | | |
| | 12 V | - | Yes | IP 5K4 | 6NW 011 122-047 | 66 |

Electric motor actuators electrical locking/unlocking, space-saving, electrical forward and reverse rotation Part number 6NW 011 122-017

TECHNICAL DRAWING

| TECHNICAL DATA | |
|--|---|
| Function | Forward and reverse rotation electrical |
| Weight | 60 g |
| Rated voltage | 12 V |
| Voltage range | 9–15,5 V |
| Maximum current consumption (blocking current) | 3,2 A |
| Idling current | ≤ 250 mA |
| Locking lever retention force | > 75 N (after design life > 50 N) |
| Locking lever breaking force | ≥ 300 N |
| Functional angle | ≤ 78° |
| Actuating time 78° over functional angle ¹⁾ | max. 200 ms |
| Triggering time | 0,2 s < t < 10 s |
| Thermal overload protection | not available |
| Operating temperature | - 40°C to +85°C |
| Storage temperature | - 40°C to + 90°C |
| Design life ²⁾ | 100,000 cycles |
| Conducted interference | DIN ISO 7637, SAE J1113-42 |
| Interference suppression CISPR 25, SAE J-1113-41 | Intensity level 1 + 10 dB µV |
| Final position stability with motor short circuit | ≤ δ° |
| Protection level | IP 5K4 |
| Salt spray test according to DIN 50 021 SS | 96 h |
| Vibration resistance according to IEC 68-2-64 | 2,7 g |
| Casing material | PP-GF30 |
| Sealing ring | NBR 70 Shore A |
| Locking lever material | PAA GF60 |
| Resistant to | Petrol, diesel, bio-diesel, ozone |
| Pin coating | tin-plated |
| Connector | Hirschmann, 3-pin |
| Mating connector ³⁾ | 3-pin MLK coupler ELA |

ELECTRICAL CONNECTION

| Hirschmann, 3-pin MLK plug | PIN 3 |
|-------------------------------|-------|
| Unlock central locking system | + |
| Lock central locking system | - |

¹⁾ Over the operating voltage and temperature range
²⁾ One switching cycle equals one forward and one reverse rotation
³⁾ This accessory is not included. It may be purchased from Hirschmann Automotive.

Electric motor actuators electrical locking/unlocking, space-saving with microswitch, electrical forward and reverse rotation Part number 6NW 011 122-027

TECHNICAL DATA Forward and reverse rotation Function electrical with micro-switch Weight 60 g Rated voltage 12 V 9-15.5 V Voltage range Maximum current consumption (blocking current) 3,2 A Idling current ≤ 250 mA Locking lever retention force ≥ 75 N Locking lever breaking force ≥ 300 N Functional angle ≤ 78° Actuating time 78° over functional 40 ms < t < 200 ms angle¹⁾ Triggering time 0,2 s < t < 10 s Thermal overload protection not available - 40°C to + 85°C Operating temperature - 40°C to + 90°C Storage temperature Design life2 60,000 cycles Conducted interference Level 2 Interference suppression ≤ 18 mm CISPR 25, SAE J-1113-41 Intensity level 1 + 10 dB µV Micro-switch switching angle 8° to 18° Final position stability with motor ≤ 6° short-circuit Protection level IP 5K4 Salt spray test according to 96 h DIN 50 021 SS Vibration resistance according to IEC 68-2-64 2,7 g Casing material PP-GF30 Sealing ring NBR 70 Shore A black PAA GF60 Locking lever material Petrol, diesel, bio-diesel, ozone Resistant to Pin coating tin-plated Hirschmann, 3-pin Connector 3-pin MLK coupler ELA Mating connector³⁾ 872-858-...KA

OTHER VARIANTS

On request: 6NW 011 122-031 (same as version -021 but without operating and locking elements) On request: 6NW 011 122-051 (without locking element, with operating element)

TECHNICAL DRAWING

 $^{\rm D}$ Over the operating voltage and temperature range $^{\rm 2D}$ One switching cycle equals one forward and one reverse rotation

³⁾ This accessory is not included.

It may be purchased from Hirschmann Automotive.

ELECTRICAL CONNECTION

MICRO-SWITCH TRIGGER

Electromotive actuators Electrical locking/unlocking, space-saving, with micro-switch, electrical forward rotation, reverse rotation via return spring, with soft touch button

Part number 6NW 011 122-047

TECHNICAL DRAWING

TECHNICAL DATA Power open rotation; return rotation via return spring Function Weight 60 g Rated voltage 12 V 9-15.5 V Voltage range Maximum current consumption (blocking current) 5,1 A Idling current ≤ 700 mA Locking lever retention force 75 N Locking lever breaking force 300 N Micro-switch triggering force ≤ 24 N Functional angle ≤ 78° Actuating time 78° over functional max. 4 sec angle¹⁾ 0,3 s <t <4 s Triggering time Thermal overload protection not available - 40°C to + 85°C Operating temperature - 40°C to + 90°C Storage temperature 7,500 cycles Lifetime²⁾ DIN ISO 7637, Conducted interference SAE J1113-42 Interference suppression Intensity level 1 + 10 dB µV CISPR 25, SAE J-1113-41 Micro-switch switching angle 8°-18° Final position stability with motor ≤ 6° short-circuit IP 5K4 Protection level Salt spray test according to DIN 50 021 SS 96 h Vibration resistance according 2,7 g to IEC 68-2-64 PP-GF30 Casing material NBR 70 Shore A Sealing ring PAA GF60 Locking lever material Resistant to Petrol, diesel, bio-diesel, ozone Pin coating CuSn 6 bronze plate Connector Hirschmann, 3-pin 3-pin MLK coupler ELA Mating connector³⁾ 872-858-541

ELECTRICAL CONNECTION

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

¹⁾ Over the operating voltage and temperature range

²⁾ One switching cycle equals one forward and one reverse rotation

³⁾ This accessory is not included.

It may be purchased from Hirschmann Automotive.

SWITCHING OPERATION FUNCTION SEQUENCE

Detection time "OPEN"

Description:

Minimum time that the operator has to hold the operating element depressed for opening.

Explanation:

In order that short pulses do not lead to unintentional opening, the "OPEN" detection time starts with the switch change from [0] to [1]. If the state [1] "Switch active" is detected for longer than the preset value, opening is initiated at the switch change from [1] to [0].

Explanation:

Dead time

Description:

On the electronic side there is a system reaction time comprising the switch debouncing time and the system runtime. This can lead to a delay of up to 70 ms, delaying the nonparameterisable (actual) dead time of the opening operation.

Time between switch change to [0] and

activation of the motor controller [1]

when an opening is initiated.

Description:

operator.

Detection time "CLOSED"

Minimum time that the application has

to be closed before a new opening

operation can be initiated by the

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 not active [0]. The switch change to not active [0] starts the "CLOSED" detection time. Two cases are possible during closing (see case examples).

Case examples

Case 1:

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

Case 2:

The operator presses down to the end stop during closing of the application. The signal first changes from Switch active [1] to Switch not active [0] and the "CLOSED" detection time starts. When pressing down to the end stop, the signal changes again to Switch active [1] and the "CLOSED" detection time that 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.

ACTUATORS

Electromotive actuators Electrical locking/unlocking and closing (medium force)

PRODUCT FEATURES

- \rightarrow High actuating force
- → High-accuracy, laser-welded housing
- → Three versions
- → Dust- and waterproof
- → With or without manual adjustment
- → Thermal overload protection through PTC (PolySwitch)
- → Multifunctional
- → Various connecting elements available

FUNCTION

An electric motor is installed in the two laser-welded polyamide housing halves. Energised by pins 1 and 2, the electric motor moves a spindle gear that extends or retracts a tappet, depending on the direction of rotation. The tappet is extended with plus at pin 1 and minus at pin 2.

The tappet is retracted with minus at pin 1 and plus at pin 2. The stability of the retracted/extended locking positions is achieved by the short-circuited motor following successful actuation. A PolySwitch (PTC) is integrated in the motor for thermal overload protection. It is also possible to equip the actuators with an automatic reset function (retract or extend) by way of a mainspring.

APPLICATION

The motor-driven actuator is used for electrical locking and unlocking or closing of locking and flap systems in vehicles and industrial applications.

Examples of applications in mechanisms include:

- → Electrical locking and unlocking,
- \rightarrow Electrical shutting,
- → Power opening and closing of all doors (locking systems), flaps, roof windows, seats, covers, hoods, glove boxes, etc.

ACCESSORIES

The comprehensive range of accessories for electromotive actuators comprises numerous different joining elements. These allow the straightforward integration of the actuator in the application without additional development expenditure being necessary.

DEPENDENCIES OF ACTUATING FORCE CHARACTERISTIC CURVES

With a controller time of t1, the actuator has an actuating force of F1 <F <F2. The constant actuating force at the ram over the nominal stroke is dependent on the operating voltage and ambient temperature. If the actuator does not have to move a load over the stroke, the actuator force is converted into a higher actuator speed, resulting in the dynamic impact pulses that are a multiple of the constant actuating force.

VARIANT OVERVIEW

| Function | Voltage | Positioning force* | Manual adjustment | Protection level | Part Number | Page reference |
|---------------------------------|--------------------|-----------------------|-------------------|---------------------|-----------------|----------------|
| Electrical retraction and exter | nsion | | | | | |
| | 12 V | 30 – 130 N | Yes | IP 5K0 | 6NW 009 203-401 | 70 |
| | 12 V | 30 – 140 N | No | IP 5K0 | 6NW 009 203-411 | 71 |
| | 12 V | 30 – 130 N | Yes | IP 5K4 | 6NW 009 203-421 | 72 |
| | 12 V | 30 – 140 N | No | IP 5K4 | 6NW 009 203-431 | 73 |
| | 24 V | 30 – 130 N | Yes | IP 5K4 | 6NW 009 203-441 | 74 |
| | 24 V | 30 – 140 N | No | IP 5K4 | 6NW 009 203-451 | 75 |
| | 12 V | 30 – 140 N | No | IP 5K4 | 6NW 009 203-557 | 76 |
| Electrical retraction, extensio | n with clockwork s | pring | | | | |
| | 12 V | 30 – 170 N | No | IP 5K0 | 6NW 009 203-461 | 77 |
| | 12 V | 30 – 170 N | No | IP 5K4 | 6NW 009 203-471 | 78 |
| | 24 V | 30 – 170 N | Yes | IP 5K4 | 6NW 009 203-541 | 79 |
| Electrical extension, retractio | n with clockwork s | pring | | | | |
| | 12 V | 30 –130 N | No | IP 5K0 | 6NW 009 203-491 | 80 |
| | 12 V | 30 –130 N | No | IP 5K4 | 6NW 009 203-501 | 81 |
| | 24 V | 40 – 150 N | No | IP 5K4 | 6NW 009 203-521 | 82 |

* Dependent on the operating voltage and ambient temperature

Electromotive actuators Electrical locking/unlocking and closing (medium force) Electrical retraction and extension Part number 6NW 009 203-401

TECHNICAL DRAWING

| TECHNICAL DATA | |
|---|------------------------------|
| Position on delivery | retracted |
| Mainspring reset | none |
| Weight | 90 g |
| Rated voltage | 12 V |
| Voltage range | 9-15 V |
| Maximum current consumption (blocking current) | 6,7 A |
| Idling current | 350 mA |
| Actuating force for ram stroke over Operating voltage range and operating temperature range | |
| Manual adjustment | ≤ 15 N |
| Actuating time for 18 mm stroke ¹⁾ | max. 400 ms |
| Thermal overload protection | via PolySwitch (PTC) |
| Operating temperature | - 40°C to + 80°C |
| Storage temperature | - 40°C to + 90°C |
| Lifetime | 100,000 switching cycles |
| Conducted interference | < 75 V |
| Interference suppression (in all ranges) | Intensity level 1 + 10 dB µV |
| Functional stroke | ≤ 18 mm |
| Protection level | IP 5K0 |
| Vibration resistance | 2,7 g _{Eff.} |
| Casing material (upper side) | Polyamide 6 GF15 |
| Casing material (bottom side) | Polyamide 6 M25 GF15 |
| Pin coating | Tin |
| Mating connector ²⁾ | 1355390-1 |

 $^{\rm D}$ At the positioning mechanism over the operating voltage and temperature range. $^{\rm 2D}$ This accessory is not included. It may be purchased from TE Connectivity.

Electromotive actuators Electrical locking/unlocking and closing (medium force) Electrical retraction and extension Part number 6NW 009 203-411

TECHNICAL DRAWING

| Position on delivery | retracted |
|---|------------------------------|
| Mainspring reset | none |
| Weight | 90 g |
| Rated voltage | 12 V |
| Voltage range | 9-15 V |
| Maximum current consumption (blocking current) | 6,7 A |
| Idling current | 350 mA |
| Actuating force for ram stroke over Operating voltage range and operating temperature range | |
| Manual adjustment | none |
| Actuating time for 18 mm stroke ¹⁾ | max. 400 ms |
| Thermal overload protection | via PolySwitch (PTC) |
| Operating temperature | - 40°C to + 80°C |
| Storage temperature | - 40°C to + 90°C |
| Lifetime | 100,000 switching cycles |
| Conducted interference | < 75 V |
| Interference suppression (in all ranges) | Intensity level 1 + 10 dB µV |
| Functional stroke | ≤ 18 mm |
| Protection level | IP 5K0 |
| Vibration resistance | 2,7 g _{Eff.} |
| Casing material (upper side) | Polyamide 6 GF15 |
| Casing material (bottom side) | Polyamide 6 M25 GF15 |
| Pin coating | Tin |
| Mating connector ²⁾ | 1355390-1 |

 $^{\scriptscriptstyle 1\!\!\!)}$ At the positioning mechanism over the operating voltage and temperature

²⁾ This accessory is not included. It may be purchased from TE Connectivity.

Electromotive actuators Electrical locking/unlocking and closing (medium force) Electrical retraction and extension Part number 6NW 009 203-421

TECHNICAL DRAWING

| TECHNICAL DATA | |
|---|------------------------------|
| Position on delivery | extended |
| Mainspring reset | none |
| Weight | 90 g |
| Rated voltage | 12 V |
| Voltage range | 9-15 V |
| Maximum current consumption (blocking current) | 6,7 A |
| Idling current | 350 mA |
| Actuating force for ram stroke over Operating voltage range and operating temperature range | |
| Manual adjustment | ≤ 15 N |
| Actuating time for 18 mm stroke ¹⁾ | max. 400 ms |
| Thermal overload protection | via PolySwitch (PTC) |
| Operating temperature | - 40°C to + 80°C |
| Storage temperature | - 40°C to + 90°C |
| Lifetime | 100,000 switching cycles |
| Conducted interference | < 75 V |
| Interference suppression (in all ranges) | Intensity level 1 + 10 dB µV |
| Functional stroke | ≤ 18 mm |
| Protection level | IP 5K4 |
| Vibration resistance | 2,7 g _{Eff.} |
| Casing material (upper side) | Polyamide 6 GF15 |
| Casing material (bottom side) | Polyamide 6 M25 GF15 |
| Pin coating | Tin |
| Mating connector ²⁾ | 282080-1 |

28.6±0.3 59.6±0.8 38±0.15 4.2±0.2 44.9±0.6 8.1±0.3 **O** τ 07. 33.5 ±0.15 11.5 ±0.15 4.8+0.1 (\mathbf{O}) 4.9.0 Functional stroke ≤ 18 30.25±0.8 Nominal stroke 19 ± 1

 $^{\rm D}$ At the positioning mechanism over the operating voltage and temperature range. $^{\rm 2D}$ This accessory is not included. It may be purchased from TE Connectivity.


Electromotive actuators Electrical locking/unlocking and closing (medium force) Electrical retraction and extension Part number 6NW 009 203-431

TECHNICAL DRAWING

| TECHNICAE DATA | |
|---|-----------------------------------|
| Position on delivery | extended |
| Mainspring reset | none |
| Weight | 90 g |
| Rated voltage | 12 V |
| Voltage range | 9–15 V |
| Maximum current consumption (blocking current) | 6,7 A |
| Idling current | 350 mA |
| Actuating force for ram stroke over Operating voltage range and operating temperature range | 30 – 140 N |
| Manual adjustment | none |
| Actuating time for 18 mm stroke ¹⁾ | max. 400 ms |
| Thermal overload protection | via PolySwitch (PTC) |
| Operating temperature | - 40°C to +80°C |
| Storage temperature | - 40°C to + 90°C |
| Lifetime | 100,000 switching cycles |
| Conducted interference | < 75 V |
| Interference suppression (in all ranges) | Intensity level 1 + 10 dB μ V |
| Functional stroke | ≤ 18 mm |
| Protection level | IP 5K4 |
| Vibration resistance | 2,7 g _{Eff.} |
| Casing material (upper side) | Polyamide 6 GF15 |
| Casing material (bottom side) | Polyamide 6 M25 GF15 |
| Pin coating | Tin |
| Mating connector ²⁾ | 282080-1 |

 $^{\scriptscriptstyle 1\!\!\!)}$ At the positioning mechanism over the operating voltage and temperature

²⁾ This accessory is not included. It may be purchased from TE Connectivity.





Electromotive actuators Electrical locking/unlocking and closing (medium force) Electrical retraction and extension Part number 6NW 009 203-441

| TECHNICAE DATA | |
|---|------------------------------|
| Position on delivery | extended |
| Mainspring reset | none |
| Weight | 90 g |
| Rated voltage | 24 V |
| Voltage range | 18-30 V |
| Maximum current consumption (blocking current) | 4,2 A |
| Idling current | |
| Actuating force for ram stroke over Operating voltage range and operating temperature range | |
| Manual adjustment | ≤ 15 N |
| Actuating time for 18 mm stroke ¹⁾ | max. 400 ms |
| Thermal overload protection | via PolySwitch (PTC) |
| Operating temperature | - 40°C to + 80°C |
| Storage temperature | - 40°C to + 90°C |
| Lifetime | 50,000 switching cycles |
| Conducted interference | < 75 V |
| Interference suppression (in all ranges) | Intensity level 1 + 10 dB µV |
| Functional stroke | ≤18 mm |
| Protection level | IP 5K4 |
| Vibration resistance | 2,7 g _{Eff.} |
| Casing material (upper side) | Polyamide 6 GF15 |
| Casing material (bottom side) | Polyamide 6 M25 GF15 |
| Pin coating | Tin |
| Mating connector ²⁾ | 282080-1 |

 $^{\rm D}$ At the positioning mechanism over the operating voltage and temperature range. $^{\rm 2D}$ This accessory is not included. It may be purchased from TE Connectivity.





Electromotive actuators Electrical locking/unlocking and closing (medium force) Electrical retraction and extension Part number 6NW 009 203-451

TECHNICAL DRAWING

| TECHNICAE DATA | |
|---|------------------------------|
| Position on delivery | extended |
| Mainspring reset | none |
| Weight | 90 g |
| Rated voltage | 24 V |
| Voltage range | 18-30 V |
| Maximum current consumption (blocking current) | 4,2 A |
| Idling current | 185 mA |
| Actuating force for ram stroke over Operating voltage range and operating temperature range | 40 – 140 N |
| Manual adjustment | none |
| Actuating time for 18 mm stroke ¹⁾ | max. 400 ms |
| Thermal overload protection | via PolySwitch (PTC) |
| Operating temperature | - 40°C to + 80°C |
| Storage temperature | - 40°C to + 90°C |
| Lifetime | 20,000 switching cycles |
| Conducted interference | < 75 V |
| Interference suppression (in all ranges) | Intensity level 1 + 10 dB µV |
| Functional stroke | ≤ 18 mm |
| Protection level | IP 5K4 |
| Vibration resistance | 2,7 g _{Eff.} |
| Casing material (upper side) | Polyamide 6 GF15 |
| Casing material (bottom side) | Polyamide 6 M25 GF15 |
| Pin coating | Tin |
| Mating connector ²⁾ | 282080-1 |

 $^{\scriptscriptstyle 1\!\!\!)}$ At the positioning mechanism over the operating voltage and temperature

²⁾ This accessory is not included. It may be purchased from TE Connectivity.



TECHNICAL DATA

Rated voltage

Voltage range

(blocking current) Idling current

temperature range Manual adjustment

Maximum current consumption

Actuating force for ram stroke over Operating voltage range and operating

Actuating time for 18 mm stroke¹⁾

Interference suppression (in all ranges)

Thermal overload protection

Operating temperature

Conducted interference

Functional stroke

Vibration resistance Casing material (upper side)

Mating connector²⁾

Casing material (bottom side)

Protection level

Pin coating

Storage temperature

Lifetime



Electromotive actuators Electrical locking/unlocking and closing (medium force) Electrical retraction and extension With cable Part number 6NW 009 203-557

Position on delivery Mainspring reset Weight

TECHNICAL DRAWING

extended

none

12 V 9–15 V

6,7 A

≤ 18 mm IP 5K4

2,7 g_{Eff.}

Tin

282080-1

Polyamide 6 GF15 Polyamide 6 M25 GF15





| ¹⁾ At the positioning mechanism over the operating voltage and temperat | ure range. |
|--|------------|
| ²⁾ This accessory is not included | |

It may be purchased from TE Connectivity.



Electromotive actuators Electrical locking/unlocking and closing (medium force) Electrical retraction, extension with clockwork spring Part number 6NW 009 203-461

TECHNICAL DRAWING

| TECHNICAL DATA | |
|---|------------------------------|
| Position on delivery | extended |
| Mainspring reset | extend |
| Weight | 90 g |
| Rated voltage | 12 V |
| Voltage range | 9-15 V |
| Maximum current consumption (blocking current) | 10,5 A |
| Idling current | 545 mA |
| Actuating force for ram stroke over Operating voltage range and operating temperature range | 30 – 170 N |
| Manual adjustment | none |
| Actuating time for 18 mm stroke ¹⁾ | max. 400 ms |
| Thermal overload protection | via PolySwitch (PTC) |
| Operating temperature | -40°C to +80°C |
| Storage temperature | - 40°C to + 90°C |
| Lifetime | 50,000 switching cycles |
| Conducted interference | < 75 V |
| Interference suppression (in all ranges) | Intensity level 1 + 10 dB µV |
| Functional stroke | ≤ 18 mm |
| Protection level | IP 5K0 |
| Vibration resistance | 2,7 g _{Eff.} |
| Casing material (upper side) | Polyamide 6 GF15 |
| Casing material (bottom side) | Polyamide 6 M25 GF15 |
| Pin coating | Tin |
| Mating connector ²⁾ | 1355390-1 |

 $^{\mbox{\tiny I}\mbox{\tiny }}$ At the positioning mechanism over the operating voltage and temperature

²⁾ This accessory is not included. It may be purchased from TE Connectivity.

PIN 2 28.6 ± 0.3 IA PIN 1



TECHNICAL DATA



Electromotive actuators Electrical locking/unlocking and closing (medium force) Electrical retraction, extension with clockwork spring Part number 6NW 009 203-471

TECHNICAL DRAWING

| Position on delivery | extended |
|---|------------------------------|
| Mainspring reset | extend |
| Weight | 90 g |
| Rated voltage | 12 V |
| Voltage range | 9–15 V |
| Maximum current consumption (blocking current) | 10,5 A |
| Idling current | 545 mA |
| Actuating force for ram stroke over Operating voltage range and operating temperature range | 30 – 170 N |
| Manual adjustment | none |
| Actuating time for 18 mm stroke ¹⁾ | max. 400 ms |
| Thermal overload protection | via PolySwitch (PTC) |
| Operating temperature | - 40°C to + 80°C |
| Storage temperature | - 40°C to + 90°C |
| Lifetime | 50,000 switching cycles |
| Conducted interference | < 75 V |
| Interference suppression (in all ranges) | Intensity level 1 + 10 dB µV |
| Functional stroke | ≤ 18 mm |
| Protection level | IP 5K4 |
| Vibration resistance | 2,7 g _{Eff.} |
| Casing material (upper side) | Polyamide 6 GF15 |
| Casing material (bottom side) | Polyamide 6 M25 GF15 |
| Pin coating | Tin |
| Mating connector ²⁾ | 282080-1 |

 $^{\rm D}$ At the positioning mechanism over the operating voltage and temperature range. $^{\rm 2D}$ This accessory is not included. It may be purchased from TE Connectivity.





Electromotive actuators Electrical locking/unlocking and closing (medium force) Electrical retraction, extension with clockwork spring Part number 6NW 009 203-541

TECHNICAL DRAWING

| TECHNICAL DATA | |
|---|------------------------------|
| Position on delivery | extended |
| Mainspring reset | extend |
| Weight | 90 g |
| Rated voltage | 24 V |
| Voltage range | 18-30 V |
| Maximum current consumption (blocking current) | 4,2 A |
| Idling current | 185 mA |
| Actuating force for ram stroke over Operating voltage range and operating temperature range | |
| Manual adjustment | < 35 N |
| Actuating time for 18 mm stroke ¹⁾ | max. 400 ms |
| Thermal overload protection | via PolySwitch (PTC) |
| Operating temperature | - 40°C to + 80°C |
| Storage temperature | - 40°C to + 90°C |
| Lifetime | 50,000 switching cycles |
| Conducted interference | < 75 V |
| Interference suppression (in all ranges) | Intensity level 1 + 10 dB µV |
| Functional stroke | ≤ 18 mm |
| Protection level | IP 5K4 |
| Vibration resistance | 2,7 g _{Eff.} |
| Casing material (upper side) | Polyamide 6 GF15 |
| Casing material (bottom side) | Polyamide 6 M25 GF15 |
| Pin coating | Tin |
| Mating connector ²⁾ | 282080-1 |

 $^{\mbox{\tiny I}\mbox{\tiny }}$ At the positioning mechanism over the operating voltage and temperature

²⁾ This accessory is not included. It may be purchased from TE Connectivity.



TECHNICAL DATA



Electromotive actuators Electrical locking/unlocking and closing (medium force) Electrical extension, retraction with clockwork spring Part number 6NW 009 203-491

TECHNICAL DRAWING

| Position on delivery | retracted |
|---|-----------------------------------|
| Mainspring reset | retract |
| Weight | 90 g |
| Rated voltage | 12 V |
| Voltage range | 9-15 V |
| Maximum current consumption (blocking current) | 10,5 A |
| Idling current | 577 mA |
| Actuating force for ram stroke over Operating voltage range and operating temperature range | 30 – 120 N |
| Manual adjustment | none |
| Actuating time for 18 mm stroke ¹⁾ | max. 400 ms |
| Thermal overload protection | via PolySwitch (PTC) |
| Operating temperature | -40°C to +80°C |
| Storage temperature | - 40°C to + 90°C |
| Lifetime | 50,000 switching cycles |
| Conducted interference | < 75 V |
| Interference suppression (in all ranges) | Intensity level 1 + 10 dB μ V |
| Functional stroke | ≤ 18 mm |
| Protection level | IP 5K0 |
| Vibration resistance | 2,7 g _{eff.} |
| Casing material (upper side) | Polyamide 6 GF15 |
| Casing material (bottom side) | Polyamide 6 M25 GF15 |
| Pin coating | Tin |
| Mating connector ²⁾ | 1355390-1 |



 $^{\rm D}$ At the positioning mechanism over the operating voltage and temperature range. $^{\rm 2D}$ This accessory is not included. It may be purchased from TE Connectivity.



Electromotive actuators Electrical locking/unlocking and closing (medium force) Electrical extension, retraction with clockwork spring Part number 6NW 009 203-501

TECHNICAL DRAWING

| TECHNICAE DATA | |
|---|-----------------------------------|
| Position on delivery | retracted |
| Mainspring reset | retract |
| Weight | 90 g |
| Rated voltage | 12 V |
| Voltage range | 9–15 V |
| Maximum current consumption (blocking current) | 10,5 A |
| Idling current | 577 mA |
| Actuating force for ram stroke over Operating voltage range and operating temperature range | |
| Manual adjustment | none |
| Actuating time for 18 mm stroke ¹⁾ | max. 400 ms |
| Thermal overload protection | via PolySwitch (PTC) |
| Operating temperature | -40°C to +80°C |
| Storage temperature | - 40°C to + 90°C |
| Lifetime | 50,000 switching cycles |
| Conducted interference | < 75 V |
| Interference suppression (in all ranges) | Intensity level 1 + 10 dB μV |
| Functional stroke | ≤ 18 mm |
| Protection level | IP 5K4 |
| Vibration resistance | 2,7 g _{Eff.} |
| Casing material (upper side) | Polyamide 6 GF15 |
| Casing material (bottom side) | Polyamide 6 M25 GF15 |
| Pin coating | Tin |
| Mating connector ²⁾ | 282080-1 |

 $^{\scriptscriptstyle 1\!\!\!)}$ At the positioning mechanism over the operating voltage and temperature

²⁾ This accessory is not included. It may be purchased from TE Connectivity.





Electromotive actuators Electrical locking/unlocking and closing (medium force) Electrical extension, retraction with clockwork spring Part number 6NW 009 203-521

TECHNICAL DRAWING

| TECHNICAL DATA | |
|---|-----------------------------------|
| Position on delivery | retracted |
| Mainspring reset | retract |
| Weight | 90 g |
| Rated voltage | 24 V |
| Voltage range | 18-30 V |
| Maximum current consumption (blocking current) | 4,2 A |
| Idling current | 185 mA |
| Actuating force for ram stroke over Operating voltage range and operating temperature range | 40 – 150 N |
| Manual adjustment | none |
| Actuating time for 18 mm stroke ¹⁾ | max. 400 ms |
| Thermal overload protection | via PolySwitch (PTC) |
| Operating temperature | - 40°C to +80°C |
| Storage temperature | - 40°C to + 90°C |
| Lifetime | 50,000 switching cycles |
| Conducted interference | < 75 V |
| Interference suppression (in all ranges) | Intensity level 1 + 10 dB μ V |
| Functional stroke | ≤ 18 mm |
| Protection level | IP 5K4 |
| Vibration resistance | 2,7 g _{eff.} |
| Casing material (upper side) | Polyamide 6 GF15 |
| Casing material (bottom side) | Polyamide 6 M25 GF15 |
| Pin coating | Tin |
| Mating connector ²⁾ | 282080-1 |

 $^{\rm D}$ At the positioning mechanism over the operating voltage and temperature range. $^{\rm 2D}$ This accessory is not included. It may be purchased from TE Connectivity.





2

Electromotive actuators Electrical locking/unlocking and closing (medium force) Connecting element for retraction and extension actuator function

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

1 Part number 9XD 860 912-001





TECHNICAL DRAWING



2 Part number 9XD 862 354-001







Electromotive actuators Electrical locking/unlocking and closing (medium force) Connecting element for retraction and extension actuator function

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

TECHNICAL DRAWING





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

TECHNICAL DRAWING





2 Part number 9XD 861 450-001





COMPONENTS

85



Electromotive actuators Electrical locking/unlocking and closing (medium force) Connecting element for retraction and extension actuator function with rod

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





TECHNICAL DRAWING









2 Part number 9XD 862 516-001







Electromotive actuators Electrical locking/unlocking and closing (medium force) Connecting element for retraction and extension actuator function with rod

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









PRODUCT FEATURES

- \rightarrow Very high positioning forces
- → Sturdy and compact design
- → Interference suppression class 3
- → Universal interface for Bowden cable
- \rightarrow For universal use.

Electromotive actuators Electrical locking/unlocking and pull/push (high force)

Function

- This electromotive actuator is an actuator with rotary output driven by a DC motor. The actuator is operated by applying a voltage via a two-pin plug with contacts "+" and "ground". The return action is carried out by simply reversing the polarity or automatically via a spring. The direction of rotation and runtime are defined by the control unit. The actuator can be attached to three connecting points.

APPLICATION REQUIREMENTS:

No mechanical restriction or limitation of the actuator by the application is permitted. The high impact pulse (approx. 7 to 8 Nm) can damage the application, bracket or bowden cable.

The customer application must ensure that in the rest position (end position following ccw rotation), no load is acting on the actuator to avoid damaging the internal limit stop.

A motor short circuit is necessary during mainspring return (only 6CSA 009 424-781). This short circuit takes place using an 1N 4005 diode during the service life test. The short-circuited motor has a braking effect that protects the internal limit stop. Without this, the dynamism in the system can damage the limit stop during the return action, which can cause the device to become blocked.

APPLICATION

The actuator is particularly suitable for locking and pull/push applications for which 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 through the Bowden cable sleeve and can be embedded in foam for noise insulation.

VARIANT OVERVIEW

| Function | Voltage | Torque | Manual adjustment | Protection level | Part Number | Page reference |
|--|---------|---------|-------------------|------------------|-----------------|----------------|
| Retraction with spring, electrical extension | 12 V | 150 Ncm | No | IP 5K0 | 6NW 009 424-781 | 90 |
| Electrical retraction and extension | 12 V | 300 Ncm | No | IP 5K0 | 6NW 009 424-791 | 91 |



Electromotive actuators Electrical locking/unlocking and pull/push (high force) Electrical rotation left, reset per spring right Part number 6NW 009 424-781

TECHNICAL DATA

| Mainspring reset | Available |
|---|------------------------|
| Weight | 181 g |
| Rated voltage | 12 V |
| Voltage range | 9–16 V |
| Maximum current consumption (blocking current) | 7 A |
| Idling current | 150 mA |
| Nominal torque | 150 Ncm |
| Functional angle | 0° to 198° |
| Tensile path | approx. 45 mm |
| Rated torque (at rated load and room temperature) | 32 min -1 |
| Manual adjustment | none |
| Thermal overload protection | Available |
| Operating temperature | - 40°C to + 85°C |
| Lifetime | 8,000 switching cycles |
| Conducted interference | < - 75 V |
| Interference suppression (in all ranges) | Level 3 |
| Protection level | IP 5K0 |
| Vibration resistance (IEC 68-2-64) | 3 g _{Eff.} |
| Casing material (upper side) | PP-GF30 |
| Casing material (bottom side) | PP-GF30 |
| Pin coating | Tin |
| Mating connector ¹⁾ | 1355390-1 |

¹⁾ This accessory is not included. It may be purchased from TE Connectivity.

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TECHNICAL DRAWING



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Electromotive actuators Electrical locking/unlocking and pull/push (high force) Electrical rotation to right and left Part number 6NW 009 424-791

TECHNICAL DRAWING

| TECHNICAL DATA | |
|---|-------------------------------------|
| Mainspring reset | none |
| Weight | |
| Rated voltage | 12 V |
| Voltage range | 9–16 V |
| Maximum current consumption (blocking current) | 6 A |
| Idling current | 150 mA |
| Nominal torque | 300 Ncm |
| Functional angle | 0° to 198° |
| Tensile path | approx. 45 mm |
| Rated torque (at rated load and room temperature) | 15 min ⁻¹ at RT and 13 V |
| Manual adjustment | none |
| Thermal overload protection | not available |
| Operating temperature | - 40°C to + 85°C |
| Lifetime | 50,000 switching cycles |
| Conducted interference | < - 75 V |
| Interference suppression (in all ranges) | Level 3 |
| Protection level | IP 5K0 |
| Vibration resistance (IEC 68-2-64) | 3 g _{eff.} |
| Casing material (upper side) | PP-GF30 |
| Casing material (bottom side) | PP-GF30 |
| Pin coating | Tin |
| Mating connector ¹⁾ | 1355390-1 |







¹⁾ This accessory is not included. It may be purchased from TE Connectivity.



Electromotive actuators Electrical locking/unlocking and closing

Part number 6NW 011 303-701

PRODUCT FEATURES

- → Flexible operating angle range
- → Fast response time
- → Precise position control
- → CIPOS position sensor integrated directly at driven gear
- → "True power on" function for angular ranges < 180°
- → Controlled motion up to limit stop
- → Self-blocking gearbox; low current consumption (< 25 mA) for holding the position</p>
- → Internal fault memory

Function

- The URA monitors the position of the output gear wheel and the integrated electronics continually calculate the position using an ASIC (Application Specific Integrated Circuit). The actuator offers the "true power on" function for angles under 180°; i.e. it enables commissioning without calibration. In operation, the actuator carries out controlled movement to the programmable "soft stops". The self-locking transmission minimises current consumption (< 25 mA), which is required to maintain a defined position.

APPLICATION

The URA can be used in a broad range of applications involving harsh environmental conditions, and can perform precise and reliable positionings. The insensitivity to magnetic fields and the high level of temperature stability, in particular, are the characteristic qualities of the CIPOS technology employed in the URA. Angles are measured inductively using a contact-free and hence wear-free method, thus guaranteeing a high measuring precision over the whole service life. An error memory records errors and the actuator is able to react differently to different errors.

APPLICATION EXAMPLES

- → Seed metering/singling
- \rightarrow Delivery air/exhaust air flaps

PWM INTERFACE – INPUT SIGNAL

A PWM signal can be used as input signal for the communication of the actuator with the controller. This PWM signal must be supplied by the external controller as a lowside driver (open collector). The PWM input signal is defined by the periods and the cyclic duration factor. The period duration starts (and ends) with a rising flank. The cyclic duration factor is defined as the ratio between the time with high signal and the total period duration.

PWM FEEDBACK AND PWM GROUNDING

In order to transmit errors by PWM grounding, the PWM input signal is set to Low for a defined time and then set to High again. The time for which the PWM signal is set to Low depends on the error group.

LIN INTERFACE / LIN BUS SPECIFICATIONS:

A LIN signal can be used by the controller as input/output signal for the communication with the actuator. The URA functions here as a LIN slave. The URA operates with the LIN 2.0 protocol without diagnostic function (diagnostic function and 2.1 or 2.2 are 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



VARIANT OVERVIEW

| Function | Voltage | Torque | Manual adjustment | Protection level | Part Number | Page reference |
|---|---------|---------------|-------------------|--|-----------------|----------------|
| Power locking/unlocking & closing,power rotational movement to right and left,with position feedback via CIPOS technology | 12 V | up to 300 Ncm | No | IP 6K9K oder IP 6K7 ¹ (¹ depends on the connector classification) | 6NW 011 303-701 | 94 |



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

Part number 6NW 011 303-701

TECHNICAL DATA 106 g Weight 13.5 V Rated voltage 9 - 16 V Voltage range Rated current 0,5 A Maximum current consumption 3,7 A (stall current) <100 µA (type 20 µA) No-load current in idle mode Nominal torque (at 13.5 V and RT) 60 Ncm Max. torque (at 13.5 V and RT) 300 Ncm Working angle > 360° (< 180° true power on) Actuating time 0°-90° < 2 s (no load; 13.5 V and RT) Thermal overload protection Self-protection by self-diagnosis Operating temperature -40 °C to +85 °C Storage temperature -40 °C to +105 °C Typ. 250,000 cycles (1 cycle = angle of 90° open - closed -Lifetime open) EMV CISPR25 class 5* Protocol LIN 2.0 and PWM IP 6K9K; IP 6K71 Protection level (1 depends on the connector classification) Vibration resistance 9,6 g PPA-GF40 Casing material Pin coating Tin Manual adjustment No TE Connectivity 1-1456426-1, Mating connector Coding A

* Limit values can be exceeded in the frequency range of 3 – 4 MHz.

PIN ASSIGNMENT



Pin 1: U _{bat} Pin 2: PWM input Pin 3: LIN / PWM output Pin 4: Ground













Temperature sensors Measurement of air temperatures

PRODUCT FEATURES

- \rightarrow Various designs
- → EMC stable
- → Quick response times

DESIGN AND FUNCTION

The basic set-up of this sensor version consists of an NTC resistor. NTC resistors have a negative temperature coefficient and their conductivity increases as temperature increases. Some of the versions available in the product range have an open NTC element covered by a protective glass layer. These sensor versions have particularly fast response times of up to six seconds (τ in accordance with DIN EN 60539). Encased sensor versions have longer response times, but provide better protection of the NTC elements against external environmental conditions.

The basic circuit diagram consists of a sensor and a constant resistor connected in series. The resistance of the NTC temperature sensor can be calculated from the voltage drop at the resistor or the sensor using the voltage divider rule. A temperature can be assigned to the resistance of the NTC sensor using the resistance curve.

Variant

The fourth version (part no.: 6PT 009 522-011) has been designed as an outdoor temperature sensor and is protected against splashing water. The temperature curve is linearised using a resistor connected in parallel. A parallel capacitor improves the electromagnetic compatibility of this version.

APPLICATION

The air temperature sensors measure temperatures in the air flow of the air conditioning system. Furthermore, other corresponding versions for measuring outside and inside temperature can be implemented, keeping in mind their respective response times and protection classes in different industrial areas

Examples include air-conditioning systems in

- → Vehicles
- → Heating/sanitary
- → Refrigeration
- → Buildings

SCHEMATIC SENSOR DESIGN (NOT ENCASED), FIRST VERSION





SCHEMATIC SENSOR DESIGN (ENCASED), SECOND VERSION

EQUIVALENT CIRCUIT DIAGRAM



VARIANT OVERVIEW

| Temperature range | Areas of use | Time constant | Mating connector | Encased | Protection level | Part Number | Page reference |
|-------------------|-------------------------------|----------------------------------|------------------|---------|---------------------|-----------------|----------------|
| - 40°C to + 65°C | Outdoor temperature sensor | < 35 s (water / alcohol bath) | 2-1437712-5 | Yes | IP 67 | 6PT 009 522-011 | 98 |

COMPONENTS



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

| TECHNICAL DATA | |
|-------------------------------------|--|
| Nominal voltage | 5 V |
| Temperature measurement range | - 40°C to + 65°C |
| Time constant | < 35 s (in water / alcohol bath) |
| Vibration resistance | 1 g, frequency cycle 10 Hz to 100 Hz up to 10 Hz, change in frequency 1 Hz/s, test time of 94 hours pro direction (flat), in three test directions |
| Storage temperature | - 40°C to + 90°C |
| Protection level | IP 67 |
| Corrosion tested in accordance with | ASTM 13117, 96 h |
| Lifetime | 15 years |
| Casing material | PA6 GF30 |
| Contact pin | Sheet metal EN 1652-CuSn6-R420-03 |
| Pin coating | NiAu and NiSn, solderable |
| Mating connector ¹⁾ | 2-1437712-5 |
| Weight | 5.9 a |





¹⁾ This accessory is not included. It may be purchased from TE Connectivity.

| HARACTERISTIC RESISTANCE VALUES | | | | |
|---------------------------------|---------------------|-----------------------------|--|--|
| Temperature | Resistance (R nom.) | Percentage deviation (±) | | |
| - 40°C | 9,820 kΩ | 1,5% | | |
| - 20°C | 7,931 kΩ | 1,5% | | |
| 0°C | 5,179 kΩ | 0,5 % | | |
| +4°C | 4,632 kΩ | 0,5 % | | |
| +25°C | 2,354 kΩ | 1,0 % | | |
| +65°C | 0,588 kΩ | 1,0% | | |

CIRCUIT DIAGRAM





Air quality sensor Air property measurements **on request**

PRODUCT FEATURES

- → Greater driving comfort due to continual optimisation of the interior air quality in the inside of the vehicle
- → The intelligent software automatically provides preprocessed information for the air conditioning system while taking into account the respective environmental conditions (e.g. city traffic, overland, motorway)

DESIGN AND FUNCTION

During the trip the AQM air quality monitor from HELLA records all occurrences that could have an effect on the air quality in the inside of the vehicle (e.g. driving through a tunnel or driving past vehicles with high exhaust emissions).

The AQM is located on the vehicle to enable the air quality outside the vehicle to be recorded quickly in all driving situations. A possible installation location could, for example be the water tank.

The AQM activates the air conditioning system which regulates its air circulation automatically according to the outside air quality. If there is a high exhaust concentration in the external environment of the vehicle, it switches automatically to air circulation mode. This prevents exhaust fumes getting into the vehicle.

APPLICATION

The air quality is assessed on the basis of the recorded changes in concentration of CO and NO_2 and divided into levels from 0 to 4. In order to give consideration to the environmental conditions, as they are present e.g. in the city compared to country areas, the air quality monitor has an autonomous sensitivity adjustment for different gas concentrations and occurrences.

Example: With an increasing number of gas occurrences (air quality level \geq 2) recorded, the sensitivity of the device is lowered to reach an average rate of 0.25 event recordings per minute.

PIN ASSIGNMENT



| TECHNICAE DATA | |
|-----------------------------------|---|
| Rated voltage | 9-16 V |
| Recorded gases | CO, NO ₂ |
| Min. concentrated change recorded | CO: 7ppm, NO ₂ : 75ppb |
| Response time | CO: 5s, NO ₂ : 10s |
| Chemical resistance | Typical vehicle media |
| Operating temperature | - 40°C to +85°C |
| Storage temperature | - 40°C to + 95°C |
| Protection rating | IP 26 (with sealed plug: IP 5K9K) |
| Lifetime | 241,350 km (150,000 miles), 10 years |
| Material | Casing: PA 66 GF25, membrane: Teflon |
| Contact pin material | C19010 |
| Contact pin coating | Ni 1–2 µm, zinc-plated pin, matt final coating 5 ±2,5 µm Sn to Ni |
| El. plug | EWCAP Nr. 064-S-003-1-Z01 (Option A) |
| Mechanical interface | Receptacle with Delphi clip |
| Alignment at installation | Plug and air inlet point downwards |
| Weight | 21 g |

| PWM DUTY CYCLE | | | | |
|----------------|------|-----------|------|-----------------------------|
| Unit | Min. | Typically | Max. | Signal content/comment |
| % | 0 | - | 5 | Not in operation, not ready |
| % | 7 | 12,5 | 18 | Not in use |
| % | 22 | 27,5 | 33 | Air quality level 4 |
| % | 37 | 42,5 | 48 | Air quality level 3 |
| % | 52 | 57,5 | 63 | Air quality level 2 |
| % | 67 | 72,5 | 78 | Air quality level 1 |
| % | 82 | 87,5 | 93 | Air quality level 0 |
| % | 95 | - | 100 | Not in operation, not ready |





Rain/light sensors Recording environmental properties

PRODUCT FEATURES

- → Fourth generation of the long-established rain sensors by HELLA
- → Five functions in one product: rain, light solar and humidity measurement and adjustment of the light intensity of the head-up display
- → Optimised design especially compact package space

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 situations in the sensor range and activates the front windshield wiper accordingly. Thus, manual intervention by the driver is now more or less unnecessary.

Light sensor

As a light sensor, it activates the switching on and off of the dimmed headlights in different light conditions or in special situations e.g. tunnels.

Head-Up-Display

If used for the head-up display, the sensor records the brightness immediately in front of the vehicle and adjusts the light intensity of the display depending on the current light conditions.

Solar sensor

As a solar sensor, it measures insolation and thus supports air conditioning control.

Humidity measurement

The humidity measurement is used to control the air conditioning control unit for the air conditioning in the vehicle interior, such as automatic ventilation of the windshield.

APPLICATION

The rain/light sensor can be used in its full functional range (five functions: rain sensor, light sensor, solar sensor, humidity measurement and head-up display) only for passenger car applications. This sensor can only be used to a limited extent for vehicles with special windshields (thickness, angle, transmission).

The optics of the second sensor are specially designed for vehicles with steep windshields and combines the rain and light recognition functions (environment and tunnel recognition).

FUNCTIONAL DIAGRAM



 $^{\scriptscriptstyle 1)}$ Function can only be used in conjunction with the car sensor

VARIANT OVERVIEW

The sensors must be specially applied for each vehicle. For that reason all part numbers are customer-specific provided.

| Areas of use | Permissible glass thickness | Permissible glass tilt | Part Number | Page reference |
|-----------------------------------|-----------------------------|------------------------|-------------|----------------|
| Car | 4–6 mm | 22°-32° | on request | 106-107 |
| Vehicles with special windshields | 6–9 mm | 80° – 90° | on request | 108-111 |



Rain/light sensors Recording environmental properties on request

TECHNICAL DATA

| Operating temperature | -40 to +85°C |
|--|------------------------|
| Storage temperature | - 40°C to +100°C |
| Protection level | IP 50 |
| Protection level (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 ¹⁾ | 114 18063-18, coding D |
| Requirements of the windshield | |
| Spectral working range | 400–1.050 nm |
| Permissible transmission of the windshield | 20-80% (at 950 nm) |
| Permissible glass thickness | 4–6 mm |
| Permissible glass tilt | 22°-32° |
| Permissible radius in the sensor range | R => 1.400 mm |
| Diameter of the black print section | 28 +/-0,2 mm |

TECHNICAL DRAWING





ILLUSTRATION OF INSTALLATION ON THE WINDSHIELD

(14)





¹⁾ This accessory is not included. It may be purchased from TE Connectivity.



Rain/light sensors Brackets

Accessories

| Part number | |
|-----------------|--|
| on request | For fixing with 3 m adhesive tape Plastic |
| 9XD 420 747-502 | For fixing with PUR liquid adhesive Plastic |



15,9±0,15 37,3



Accessories

| Part number | |
|-----------------|---|
| 9XD 420 747-007 | For fixing with 3 m adhesive tape Sintered metal |
| on request | For fixing with PUR liquid adhesive Sintered metal |







Rain/light sensors for vehicles with high-angled windshields Recording environmental properties on request

TECHNICAL DATA

| Operating temperature | - 40 to +85°C |
|--|--------------------------|
| Storage temperature | - 40°C to +100°C |
| Protection level | IP 50 |
| Operating voltage | 9–16 V |
| Rated voltage | 12 V |
| Overvoltage | 24 V |
| Rated current consumption | < 50 mA |
| Communication interface | LIN 2.1 |
| Weight | ≤ 42 g |
| Mating connector ¹⁾ | 114 18063-18, coding A |
| Requirements of the windshield ²⁾ | |
| Spectral working range | 400–1.050 nm |
| Permissible transmission of the windshield | 23-80% (at 800-1.100 nm) |
| Permissible glass thickness | 6–9 mm |
| Permissible glass tilt | 80° – 90° |
| Permissible radius in the sensor range | R => 1.400 mm |
| Diameter of the black print section | 40 +/-0.2 mm |

TECHNICAL DRAWING







| Pin assignmen | t |
|---------------|------|
| Pin 1 | 12 V |
| Pin 2 | LIN |
| Pin 3 | GND |

ILLUSTRATION OF INSTALLATION ON THE WINDSHIELD

¹⁾ This accessory is not included.
It may be purchased from TE Connectivity.
²⁾ Other windshield configurations available on request.




Rain/light sensors Brackets

TECHNICAL DRAWING

Accessories

| Part number | |
|-----------------|---|
| 9XD 420 696-101 | For fixing with PUR liquid adhesive Sintered metal |







TECHNICAL DRAWING

Accessories

| Part number | |
|-------------|---|
| on request | For fixing with 3 m adhesive tape Sintered metal |





0,3 x 45° 7,7±0,8

2,9±0

3,8±0,5



Rain/light sensors Brackets

Accessories

| Part number | |
|-----------------|---|
| 9XD 748 921-017 | For fixing with PUR liquid adhesive Sintered metal |
| | |



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



Accessories

| Part number | | TECHNICAL DRAWING |
|-----------------|--------------|-------------------|
| 9HB 748 851-107 | Design cover | |
| | | |







Angle of rotation sensors Single and double sensors

PRODUCT FEATURES

- → Single or redundant sensors
- → High precision due to internal 14 bit resolution
- → High thermal stability and linearity
- → High degree of insensitivity to magnetic fields
- → Zero position can be individually programmed
- → Various connecting elements available

Function



Inside the laser-welded polyamide housing PA 66, the rotation of the lever arm is transferred to the rotor and measured by induction. An ASIC (Application Specific Integrated Circuit) accurately calculates the rotor position. Various mounting positions are possible thanks to the repeating characteristic curve of the output signal (depending on the sensor structure used). This increases the flexible options for use of the sensor.

APPLICATION

These CIPOS [®] angular position sensors (contactless inductive position sensors) can be used in many different applications to return accurate and reliable angular measurements even in tough environments. In particular, insensitivity to magnetic fields and a high degree of thermal stability are characteristic of the CIPOS [®] technology used in all these angular position sensors. Angles are measured inductively using a contact-free and hence wear-free method. This guarantees a high degree of precision throughout the entire life of the sensor. The redundant sensors (double sensors) are especially designed for failure detection, thus improving the reliability of the overall system.

ANALOGUE OUTPUT

At a supply voltage of 5 V DC, the angle measured is rendered as the ratio of the output voltage (U_{out}) and operating voltage (U_s) (ratiometric to power supply). This signal is output by a high-side driver (HSD). At a supply voltage between 9 V and 32 V (multivoltage), the angle measured is rendered as a voltage between 0.5 V and 4.5 V.

PWM OUTPUT (DIGITAL)



When the PWM signal is used, the actual position of the angular position sensor is equivalent to the ratio of the low time of the PWM signal (T_{low}) and the period (T_{period}). The absolute duration of the high or low level is not indicative of the angle. The PWM signal is output by a low-side driver (LSD). You can of course also choose to evaluate the ratio between high time (T_{high}) and period (T_{period}). This will invert the course with reference to the analogue signal.

VARIANT OVERVIEW

| Mechanical connection | Angle range | Supply voltage | Output signal | Zero position | Lever arm | Part Number | Page reference |
|-----------------------|----------------|----------------|--------------------------------------|---------------|-----------|-----------------|----------------|
| Single sensors | | | - | | | | |
| Socket | - 30° to + 30° | 5 V | 0.5–4.5 V ratiometric and PWM | 0°/120°/240° | 50 mm | 6PM 008 161-241 | 116 |
| Socket | - 51° to + 51° | 5 V | 0.5–4.5 V ratiometric and PWM | 0°/120°/240° | 50 mm | 6PM 008 161-251 | 117 |
| Socket | - 54° to + 54° | 5 V | 0.25 - 4.75 V ratiometric and PWM | 0°/120°/240° | 70 mm | 6PM 008 161-121 | 118 |
| Socket | -54° to +54° | 5 V | 0.25 - 4.75 V ratiometric and PWM | 60°/180°/300° | 70 mm | 6PM 008 161-131 | 119 |
| Socket | -54° to +54° | 5 V | 0.25 - 4.75 V ratiometric and PWM | 30°/150°/270° | 50 mm | 6PM 008 161-141 | 120 |
| Socket | - 54° to + 54° | 5 V | 0.25 - 4.75 V ratiometric and PWM | 90°/210°/330° | 50 mm | 6PM 008 161-151 | 121 |
| Basic sensors - Co | ompact design | | | | | | |
| Ball, top | - 54° to + 54° | 5 V | 0.5–4.5 V ratiometric | 0°/120°/240° | 39 mm | 6PM 010 200-501 | 122 |
| Ball, bottom | - 54° to + 54° | 5 V | 0.5–4.5 V ratiometric | 0°/120°/240° | 39 mm | 6PM 010 200-511 | 123 |
| Ball, bottom | - 54° to + 54° | 5 V | 0.5–4.5 V ratiometric | 0°/120°/240° | 51 mm | 6PM 010 200-521 | 124 |
| Ball, top | - 54° to + 54° | 5 V | 0.5–4.5 V ratiometric | 0°/120°/240° | 64 mm | 6PM 010 200-531 | 125 |
| Double sensors | | | | | | | |
| Socket | - 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 | 126-127 |
| Socket | -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 | 128-129 |
| Socket | - 54 to + 54° | 5 V | 0.5-4.5 V ratiometric | 0°/120°/240° | 70 mm | 6PD 009 580-017 | 130-131 |
| 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 | 132-133 |







Housing variant A

Housing variant B

Housing variant C

TECHNICAL DRAWING OF HOUSING TYPE A



TECHNICAL DRAWING, HOUSING VARIANT B





TECHNICAL DRAWING, HOUSING VARIANT C





| ENVIRONMENTAL TEST | |
|---------------------------------------|---|
| Humidity / heat | DIN EN 60068-2-38,-Z/AD $T_0 = + 65^{\circ}C \pm 2^{\circ}C$, $TU = -10^{\circ}C \pm 2^{\circ}C$ $F_{rel} = 93\% \pm 3\%$, number of cycles: 10 |
| Salt spray | IEC 60068-2-11 Ka, duration of test: 168 h |
| Vibration resistance | $\begin{array}{l} Broadband noise with reference to\\ ISO 16750-3, section 4.1.3.2.3, DIN\\ EN 60068-2-64, temperature\\ overlapping DIN EN 60068-2-14 Nb,\\ test period per axis: 8 h, T_{min}=-40^\circ C,\\ T_{max}=+85^\circ C \end{array}$ |
| Shock resistance | ISO 16750-3, section 4.2.2, DIN EN 60068-2-29, test method: semi-sine Acceleration 500 m/s ² , duration 6 ms Number of shocks 10 in every direction |
| Conducted interference | according to IEC-CISPR 25, Class 5 |
| Radiated electromagnetic interference | according to IEC-CISPR 25, Class 5 |
| Other EMC tests | ISO 7637-2, 3 / ISO 11452-2,-5 / ISO TR 10605 |
| Protection level | DIN 40050, Part 9 IP6K5 and IP6K9K |
| Salt spray | according to IEC 60068-2-11 Ka and duration 168 h |
| Surge voltage withstand capability | ISO 16750-2, section 4.2 (where applicable) |
| Short-circuit resistance | ISO 16750-2, section 4.8.2 (where applicable) |
| Insulation resistance | $ \begin{array}{l} \mbox{With reference to ISO 16750-2,} \\ \mbox{section 4.10} \\ \mbox{T}_{amb} = 35^{\circ}\mbox{C} \pm 5^{\circ}\mbox{C}, F_{rel} = 50\% \pm 5\% \\ \mbox{U} = 500 \mbox{ V DC, duration} = 60 s \pm 6 s \end{array} $ |
| Breakdown strength | $\begin{array}{c} \mbox{With reference to ISO 16750-2,} \\ \mbox{section 4.9} \\ \mbox{T}_{amb} = 35^{\circ} C \pm 5^{\circ} C, F_{rel} = 50\% \pm 5\% \\ \mbox{U} = 500 \ V_{eff.} \ AC, \ f = 50 \ to \ 60 \ Hz \\ \mbox{Duration 60 s} \end{array}$ |

Sensor

WIRING FOR RATIOMETRIC (10% to 90%) OR FIXED-VOLTAGE OUTPUT (0.5 V - 4.5 V)

This version requires an external pull-down resistor. If 5 V are supplied, e.g. select 2.7 k Ω to 10 k Ω . The max. output current of the analogue output should not exceed 2 mA. The output voltage is relative to the supply voltage, because the high-side driver (HSD) is used as the analogue output.



WIRING FOR PWM OUTPUT AT THE LOW-SIDE DRIVER (LSD)

The maximum current through the pull-up resistor is set by the external ECU, because an LSD is used as the PWM output. HELLA recommends using 10 k Ω to keep the output current as low as possible. The pull-up resistor also limits the current output of the sensor, which should not exceed 5 mA. The voltage and transients at the pull-up resistor must not exceed 25 V.



| TECHNICAL DATA | |
|---|----------------------------------|
| Angle range | - 30° to + 30° |
| Mechanical angle range | unlimited (full 360° circle) |
| Supply voltage | $U_s 5 V \pm 10 \%$ |
| Output signal 1 | 0.5-4.5 V ratiometric |
| Output signal 2 | PWM |
| Release | 0,12° |
| Linearity error including temperature drift | ±0,6° |
| Current consumption | < 15 mA |
| Max. current (analogue output) | < 2 mA |
| Max. current (PWM output) | < 5 mA |
| PWM frequency | 200 Hz |
| Casing type | A |
| Zero position | 0°/120°/240° |
| Lever arm | 50 mm |
| Protection level | IP 6K5, IP 6K9K |
| Operating temperature | - 40°C to +125°C |
| Lifetime | 5 million cycles |
| Polarity reversal protection | none, mechanical protection only |
| Mating connector ¹⁾ | 1-967616-1 |
| Pin coating | Sn |

¹⁾ This accessory is not included.

It may be purchased from TE Connectivity.

This special variant outputs two different signals, i.e. a voltage indicating the angle measured (analogue) and a PWM signal (pulse width modulated digital signal), ensuring this angular position sensor can be used universally.

PIN ASSIGNMENT FOR CASING TYPE A



| Pin 1: | Logic earth |
|--------|---------------------------------------|
| Pin 4: | Output signal 0.5 - 4.5 V ratiometric |
| Pin 5: | Supply 5 V DC |
| Pin 6: | PWM output |



CHARACTERISTIC CURVE OF THE ROTATION ANGLE SENSOR

The characteristic curve of the rotation angle sensor repeats every 120°. The sensor does not therefore have to be installed in the mounting position shown, but can be installed at any offset angle that is a multiple of 120°. This will not affect the behaviour of the connected system in any way. The measuring angle range is 60°. If the signal continues to fall or rise up to 82.5° in the positive direction of rotation or 7.5° in the negative direction of rotation, the output signal remains at the limit value of the measuring range. If exceeded further, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions are shown on the graph. The segments of the circle shown in grey represent the angles that cannot be measured.



| TECHNICAL DATA | |
|---|----------------------------------|
| Angle range | -51° to +51° |
| Mechanical angle range | unlimited (full 360° circle) |
| Supply voltage | $U_s 5 V \pm 10 \%$ |
| Output signal 1 | 0.5–4.5 V ratiometric |
| Output signal 2 | PWM |
| Release | 0,12° |
| Linearity error including temperature drift | ±0,6° |
| Current consumption | < 15 mA |
| Max. current (analogue output) | < 2 mA |
| Max. current (PWM output) | < 5 mA |
| PWM frequency | 200 Hz |
| Casing type | A |
| Zero position | 0°/120°/240° |
| Lever arm | |
| Protection level | IP 6K5, IP 6K9K |
| Operating temperature | - 40°C to + 125°C |
| Lifetime | 5 million cycles |
| Polarity reversal protection | none, mechanical protection only |
| Mating connector ¹⁾ | 1-967616-1 |
| Pin coating | Sn |

¹⁾ This accessory is not included.

It may be purchased from TE Connectivity.

This special variant outputs two different signals, i.e. a voltage indicating the angle measured (analogue) and a PWM signal (pulse width modulated digital signal), ensuring this angular position sensor can be used universally.

PIN ASSIGNMENT FOR CASING TYPE A



| Pin 1: | Logic earth |
|--------|---------------------------------------|
| Pin 4: | Output signal 0.5 - 4.5 V ratiometric |
| Pin 5: | Supply 5 V DC |
| Pin 6: | PWM output |



CHARACTERISTIC CURVE OF THE ROTATION ANGLE SENSOR

The characteristic curve of the rotation angle sensor repeats every 120°. The sensor does not therefore have to be installed in the mounting position shown, but can be installed at any offset angle that is a multiple of 120°. This will not affect the behaviour of the connected system in any way. The measuring angle range is 102°. If the signal continues to fall or rise up to 5.25° in the positive direction of rotation or 12.75° in the negative direction of rotation, the output signal remains at the limit value of the measuring range. If exceeded further, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions are shown on the graph. The segments of the circle shown in grey represent the angles that cannot be measured.



| TECHNICAL DATA | |
|---|----------------------------------|
| Angle range | - 54° to + 54° |
| Mechanical angle range | unlimited (full 360° circle) |
| Supply voltage | $U_s 5 V \pm 10 \%$ |
| Output signal 1 | 0.25-4.75 V ratiometric |
| Output signal 2 | PWM |
| Release | 0,12° |
| Linearity error including temperature drift | ±0,6° |
| Current consumption | < 15 mA |
| Max. current (analogue output) | < 2 mA |
| Max. current (PWM output) | < 5 mA |
| PWM frequency | 200 Hz |
| Casing type | A |
| Zero position | 0°/120°/240° |
| Lever arm | 70 mm |
| Protection level | IP 6K5, IP 6K9K |
| Operating temperature | - 40°C to +125°C |
| Lifetime | 5 million cycles |
| Polarity reversal protection | none, mechanical protection only |
| Mating connector ¹⁾ | 1-967616-1 |
| Pin coating | Sn |

¹⁾ This accessory is not included.

It may be purchased from TE Connectivity.

This special variant outputs two different signals, i.e. a voltage indicating the angle measured (analogue) and a PWM signal (pulse width modulated digital signal), ensuring this angular position sensor can be used universally.

PIN ASSIGNMENT FOR CASING TYPE A



| Pin 1: | Logic earth |
|--------|---------------------------------------|
| Pin 4: | Output signal 0.25–4.75 V ratiometric |
| Pin 5: | Supply 5 V DC |
| Pin 6: | PWM output |





CHARACTERISTIC CURVE OF THE ROTATION ANGLE SENSOR



| TECHNICAL DATA | |
|---|----------------------------------|
| Angle range | - 54° to + 54° |
| Mechanical angle range | unlimited (full 360° circle) |
| Supply voltage | $U_{s}~5~V~\pm10~\%$ |
| Output signal 1 | 0.25–4.75 V ratiometric |
| Output signal 2 | PWM |
| Release | 0,12° |
| Linearity error including temperature drift | ±0,6° |
| Current consumption | < 15 mA |
| Max. current (analogue output) | < 2 mA |
| Max. current (PWM output) | < 5 mA |
| PWM frequency | 200 Hz |
| Casing type | А |
| Zero position | 60°/180°/300° |
| Lever arm | 70 mm |
| Protection level | IP 6K5, IP 6K9K |
| Operating temperature | - 40°C to +125°C |
| Lifetime | 5 million cycles |
| Polarity reversal protection | none, mechanical protection only |
| Mating connector ¹⁾ | 1-967616-1 |
| Pin coating | Sn |

¹⁾ This accessory is not included.

It may be purchased from TE Connectivity.

This special variant outputs two different signals, i.e. a voltage indicating the angle measured (analogue) and a PWM signal (pulse width modulated digital signal), ensuring this angular position sensor can be used universally.

PIN ASSIGNMENT FOR CASING TYPE A



| Logic earth |
|---------------------------------------|
| Output signal 0.25–4.75 V ratiometric |
| Supply 5 V DC |
| PWM output |
| |



— U_{out 1}/U_s[%]



CHARACTERISTIC CURVE OF THE ROTATION ANGLE SENSOR



| TECHNICAL DATA | |
|---|----------------------------------|
| Angle range | - 54° to + 54° |
| Mechanical angle range | unlimited (full 360° circle) |
| Supply voltage | $U_{s} 5 V \pm 10 \%$ |
| Output signal 1 | 0.25–4.75 V ratiometric |
| Output signal 2 | PWM |
| Release | 0,12° |
| Linearity error including temperature drift | ±0,6° |
| Current consumption | < 15 mA |
| Max. current (analogue output) | < 2 mA |
| Max. current (PWM output) | < 5 mA |
| PWM frequency | 200 Hz |
| Casing type | A |
| Zero position | 30° / 150° / 270° |
| Lever arm | 50 mm |
| Protection level | IP 6K5, IP 6K9K |
| Operating temperature | - 40°C to + 125°C |
| Lifetime | 5 million cycles |
| Polarity reversal protection | none, mechanical protection only |
| Mating connector ¹⁾ | 1-967616-1 |
| Pin coating | Sn |

¹⁾ This accessory is not included.

It may be purchased from TE Connectivity.

This special variant outputs two different signals, i.e. a voltage indicating the angle measured (analogue) and a PWM signal (pulse width modulated digital signal), ensuring this angular position sensor can be used universally.

PIN ASSIGNMENT FOR CASING TYPE A



| Pin 1: | Logic earth |
|--------|---------------------------------------|
| Pin 4: | Output signal 0.25–4.75 V ratiometric |
| Pin 5: | Supply 5 V DC |
| Pin 6: | PWM output |





CHARACTERISTIC CURVE OF THE ROTATION ANGLE SENSOR



| TECHNICAL DATA | |
|---|----------------------------------|
| Angle range | - 54° to + 54° |
| Mechanical angle range | unlimited (full 360° circle) |
| Supply voltage | $U_s 5 V \pm 10 \%$ |
| Output signal 1 | 0.25–4.75 V ratiometric |
| Output signal 2 | PWM |
| Release | 0,12° |
| Linearity error including temperature drift | ±0,6° |
| Current consumption | < 15 mA |
| Max. current (analogue output) | < 2 mA |
| Max. current (PWM output) | < 5 mA |
| PWM frequency | 200 Hz |
| Casing type | A |
| Zero position | 90°/210°/330° |
| Lever arm | 50 mm |
| Protection level | IP 6K5, IP 6K9K |
| Operating temperature | - 40°C to + 125°C |
| Lifetime | 5 million cycles |
| Polarity reversal protection | none, mechanical protection only |
| Mating connector ¹⁾ | 1-967616-1 |
| Pin coating | Sn |

¹⁾ This accessory is not included.

It may be purchased from TE Connectivity.

This special variant outputs two different signals, i.e. a voltage indicating the angle measured (analogue) and a PWM signal (pulse width modulated digital signal), ensuring this angular position sensor can be used universally.

PIN ASSIGNMENT FOR CASING TYPE A



| Pin 1: | Logic earth |
|--------|---------------------------------------|
| Pin 4: | Output signal 0.25–4.75 V ratiometric |
| Pin 5: | Supply 5 V DC |
| Pin 6: | PWM output |
| | |



— U_{out 1}/U_s[%]



CHARACTERISTIC CURVE OF THE ROTATION ANGLE SENSOR



TECHNICAL DATA

| Angle range | -54° to +54° |
|---|--------------------------------|
| Mechanical angle range | unlimited (full 360° circle) |
| Supply voltage | $U_{s} 5 V \pm 0.5 V$ |
| Output signal | 0.5–4.5 V ratiometric |
| Release | 12 bit |
| Linearity error including temperature drift | 1 % of the supply voltage |
| Current consumption | 10 mA |
| PWM frequency | 1.000 Hz ±20 % |
| Zero position | 0°/120°/240° |
| Lever arm | 50 mm |
| Protection level | IP 6K9K according to DIN 40050 |
| Operating temperature | - 40°C to + 125°C |
| Lifetime | 6.75 million cycles |
| Polarity reversal protection | mechanical only |
| Mating connector ¹⁾ | Sigma 2 |
| Pin coating | CuNiSi, Au |

¹⁾ This accessory is not included.

It may be purchased from Sigma.

PIN ASSIGNMENT FOR SINGLE SENSORS 2ND GENERATION



| Pin 1: | Logic earth |
|--------|---------------------------------------|
| Pin 2: | Output signal 0.5 - 4.5 V ratiometric |
| Pin 3: | Supply 5 V DC |





CHARACTERISTIC CURVE OF THE ROTATION ANGLE SENSOR



TECHNICAL DATA

| Angle range | - 54° to + 54° |
|---|--------------------------------|
| Mechanical angle range | unlimited (full 360° circle) |
| Supply voltage | $U_{s} 5 V \pm 0.5 V$ |
| Output signal | 0.5–4.5 V ratiometric |
| Release | 12 bit |
| Linearity error including temperature drift | 1 % of the supply voltage |
| Current consumption | 10 mA |
| PWM frequency | 1.000 Hz ±20 % |
| Zero position | 0°/120°/240° |
| Lever arm | 50 mm |
| Protection level | IP 6K9K according to DIN 40050 |
| Operating temperature | - 40°C to + 125°C |
| Lifetime | 6.75 million cycles |
| Polarity reversal protection | mechanical only |
| Mating connector ¹⁾ | Sigma 2 |
| Pin coating | CuNiSi, Au |

¹⁾ This accessory is not included.

It may be purchased from Sigma.

PIN ASSIGNMENT FOR SINGLE SENSORS 2ND GENERATION



| Pin 1: | Logic earth |
|--------|---------------------------------------|
| Pin 2: | Output signal 0.5 - 4.5 V ratiometric |
| Pin 3: | Supply 5 V DC |





CHARACTERISTIC CURVE OF THE ROTATION ANGLE SENSOR



| TECHNICAL DATA | |
|---|--------------------------------|
| Angle range | - 54° to + 54° |
| Mechanical angle range | unlimited (full 360° circle) |
| Supply voltage | $U_s 5 V \pm 0.5 V$ |
| Output signal | 0.5–4.5 V ratiometric |
| Release | 12 bit |
| Linearity error including temperature drift | 1 % of the supply voltage |
| Current consumption | 10 mA |
| PWM frequency | 1.000 Hz ±20 % |
| Zero position | 0°/120°/240° |
| Lever arm | 70 mm |
| Protection level | IP 6K9K according to DIN 40050 |
| Operating temperature | - 40°C to + 125°C |
| Lifetime | 6.75 million cycles |
| Polarity reversal protection | mechanical only |
| Mating connector ¹⁾ | Sigma 2 |
| Pin coating | CuNiSi, Au |

¹⁾ This accessory is not included.

It may be purchased from Sigma.

PIN ASSIGNMENT FOR SINGLE SENSORS 2ND GENERATION



| Pin 1: | Logic earth |
|--------|---------------------------------------|
| Pin 2: | Output signal 0.5 - 4.5 V ratiometric |
| Pin 3: | Supply 5 V DC |





CHARACTERISTIC CURVE OF THE ROTATION ANGLE SENSOR



| TECHNICAL DATA | |
|---|--------------------------------|
| Angle range | -54° to +54° |
| Mechanical angle range | unlimited (full 360° circle) |
| Supply voltage | U _s 5 V ±0,5 V |
| Output signal | 0.5–4.5 V ratiometric |
| Release | 12 bit |
| Linearity error including temperature drift | 1 % of the supply voltage |
| Current consumption | 10 mA |
| PWM frequency | 1.000 Hz ± 20 % |
| Zero position | 0°/120°/240° |
| Lever arm | 90 mm |
| Protection level | IP 6K9K according to DIN 40050 |
| Operating temperature | - 40°C to +125°C |
| Lifetime | 6.75 million cycles |
| Polarity reversal protection | mechanical only |
| Mating connector ¹⁾ | Sigma 2 |
| Pin coating | CuNiSi, Au |

¹⁾ This accessory is not included.

It may be purchased from Sigma.

PIN ASSIGNMENT FOR SINGLE SENSORS 2ND GENERATION



| Pin 1: | Logic earth |
|--------|---------------------------------------|
| Pin 2: | Output signal 0.5 - 4.5 V ratiometric |
| Pin 3: | Supply 5 V DC |





CHARACTERISTIC CURVE OF THE ROTATION ANGLE SENSOR



Angle of rotation sensors Double sensors (redundant angle measurement for system-critical applications) Part number 6PD 009 583-001

TECHNICAL DATA - 30° to + 30° Angle range unlimited (full 360° circle) Mechanical angle range $5~V\pm10~\%$ or 9-32~VSupply voltage "Crossed Scale" output signal Power Supply U_s 5 V Output U_{out 1} 0.5 – 4.5 V ratiometric Output U_{out 2} 4.5-0.5 V ratiometric Power Supply U_s 9-32 V Output U_{out 1} 0.5 – 4.5 V Output U_{out 2} 4.5 – 0.5 V Release 0,06° Linearity error including temperature $\pm 0,3^{\circ}$ drift Current consumption < 15 mA Max. current (analogue output) < 2 mA Casing type В Zero position 0°/120°/240° Lever arm 50 mm Protection level IP 6K9K Operating temperature - 40°C to +85°C Lifetime 5 million cycles Polarity reversal protection none, mechanical protection only 1394416-1

PIN ASSIGNMENT FOR CASING TYPE B



Voltage supply with 5 V DC²⁾

| Pin 1: | 5 V DC Sensor 2 |
|--------|---|
| Pin 2: | Output U _{out 1} 0.5-4.5 V ratiometric |
| Pin 3: | Not assigned |
| Pin 4: | 5 V DC Sensor 1 |
| Pin 5: | Output U _{out 2} 4.5–0.5 V ratiometric |
| Pin 6: | Not assigned |
| Pin 7: | Logic earth sensor 2 |
| Pin 8: | Logic earth sensor 1 |

 $^{\scriptscriptstyle 2)}$ The power supply lines (pin 1 and pin 4) and the ground supply lines (pin 7 and pin 8) can be bridged externally (e.g. in the mating connector) to reduce the number of wires.

Power supply with 9-32 V DC³⁾

Sn

| Pin 1: | Bridge to pin 4 (external) |
|--------|---------------------------------------|
| Pin 2: | Output U _{out 1} 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 _{out 2} 4.5 – 0.5 V |
| Pin 6: | Not assigned |
| Pin 7: | Logic earth sensor 2 |
| Pin 8: | Logic earth sensor 1 |

³⁾ Pin 1 and pin 4 must be bridged externally (e.g. in the mating connector). 2) The power supply (pin 7 and pin 8) can be bridged externally (e.g. in the mating connector) to reduce the number of cables.

¹⁾ This accessory is not included.

Mating connector¹⁾

Pin coating

It may be purchased from TE Connectivity.

CHARACTERISTIC CURVE OF THE ROTATION ANGLE SENSOR

The characteristic curve of the angular position sensor repeats every 120°. The sensor does not therefore have to be installed in the mounting position shown, but can be installed at any offset angle that is 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 at the limit value of the measuring range. If exceeded further, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions are shown on the graph. The segments of the circle shown in grey represent the angles that cannot be measured.







Output signal $U_{out 2} = 100\% - U_{out 1}/U_{s}$ [%] (opposite curve)

Absolute output signal $U_{out 1}$ with power supply 9–32 V



Output signal $U_{out 2} = 5 V - U_{out 1} [V]$ (opposite curve)



Angle of rotation sensors Double sensors (redundant angle measurement for system-critical applications) Part number 6PD 009 583-011

TECHNICAL DATA - 54° to + 54° Angle range unlimited (full 360° circle) Mechanical angle range $U_{s}\,5$ V $\pm\,10$ % or 9–32 V Supply voltage "Crossed Scale" output signal Power Supply U_s 5 V Output U_{out 1} 0.5 – 4.5 V ratiometric Output U_{out 2} 4.5-0.5 V ratiometric Power Supply U_s 9-32 V Output U_{out 1} 0.5 – 4.5 V Output U_{out 2} 4.5 – 0.5 V Release 0,06° Linearity error including temperature $\pm 0,3^{\circ}$ drift Current consumption < 15 mA Max. current (analogue output) < 2 mA Casing type В Zero position 0°/120°/240° Lever arm 50 mm Protection level IP 6K9K Operating temperature - 40°C to +85°C Lifetime 5 million cycles Polarity reversal protection none, mechanical protection only 1394416-1 Mating connector¹⁾

PIN ASSIGNMENT FOR CASING TYPE B



Voltage supply with 5 V $DC^{2)}$

| Pin 1: | 5 V DC Sensor 2 |
|--------|---|
| Pin 2: | Output U _{out 1} 0.5-4.5 V ratiometric |
| Pin 3: | Not assigned |
| Pin 4: | 5 V DC Sensor 1 |
| Pin 5: | Output U _{out 2} 4.5–0.5 V ratiometric |
| Pin 6: | Not assigned |
| Pin 7: | Logic earth sensor 2 |
| Pin 8: | Logic earth sensor 1 |

²⁾ The power supply lines (pin 1 and pin 4) and the ground supply lines (pin 7 and pin 8) can be bridged externally (e.g. in the mating connector) to reduce the number of wires.

Power supply with 9-32 V DC³⁾

Sn

| Pin 1: | Bridge to pin 4 (external) |
|--------|---------------------------------------|
| Pin 2: | Output U _{out 1} 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 _{out 2} 4.5 – 0.5 V |
| Pin 6: | Not assigned |
| Pin 7: | Logic earth sensor 2 |
| Pin 8: | Logic earth sensor 1 |

³⁾ Pin 1 and pin 4 must be bridged externally (e.g. in the mating connector). 2) The power supply (pin 7 and pin 8) can be bridged externally (e.g. in the mating connector) to reduce the number of cables.

¹⁾ This accessory is not included.

Pin coating

It may be purchased from TE Connectivity.

CHARACTERISTIC CURVE OF THE ROTATION ANGLE SENSOR

The characteristic curve of the angular position sensor repeats every 120°. The sensor does not therefore have to be installed in the mounting position shown, but can be installed at any offset angle that is 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 at the limit value of the measuring range. If exceeded further, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions are shown on the graph. The segments of the circle shown in grey represent the angles that cannot be measured.



```
Ratiometric output signal U<sub>out 1</sub> with power supply 5 V
```



Output signal $U_{out 2} = 100\% - U_{out 1}/U_{s}$ [%] (opposite curve)

Absolute output signal $U_{out 1}$ with power supply 9–32 V



Output signal $U_{out 2} = 5 V - U_{out 1} [V]$ (opposite curve)

TECHNICAL DATA



For illustrative purposes only

Angle of rotation sensors Double sensors (redundant angle measurement for system-critical applications) Part number 6PD 009 580-017

PIN ASSIGNMENT FOR CASING TYPE B

| Angle range | - 54° to + 54° |
|---|---|
| Mechanical angle range | unlimited (full 360° circle) |
| Supply voltage | $U_{s}5V \pm 10\%$ |
| "Crossed Scale" output signal | |
| Power Supply | U _s 5 V |
| | Output U _{out 1} 0.5–4.5 V ratiometric |
| | Output $U_{out 2}$ 4.5–0.5 V ratiometric |
| Release | 0,06° |
| Linearity error including temperature drift | ±0,3° |
| Current consumption | < 15 mA |
| Max. current (analogue output) | < 2 mA |
| Casing type | В |
| Zero position | 0°/120°/240° |
| Lever arm | 70 mm |
| Protection level | IP 6K9K |
| Operating temperature | - 40°C to +85°C |
| Lifetime | 5 million cycles |
| Polarity reversal protection | none, mechanical protection only |
| Mating connector ¹⁾ | 1394416-1 |
| Pin coating | Sn |

| 1357 HONOROK HONOROK 24468 | |
|-------------------------------------|--|

Voltage supply with 5 V $DC^{2)}$

| Pin 1: | 5 V DC Sensor 2 |
|--------|---|
| Pin 2: | Output U _{out 1} 0.5-4.5 V ratiometric |
| Pin 3: | Not assigned |
| Pin 4: | 5 V DC Sensor 1 |
| Pin 5: | Output U _{out 2} 4.5 – 0.5 V ratiometric |
| Pin 6: | Not assigned |
| Pin 7: | Logic earth sensor 2 |
| Pin 8: | Logic earth sensor 1 |

²⁾ The power supply lines (pin 1 and pin 4) and the ground supply lines (pin 7 and pin 8) can be bridged externally (e.g. in the mating connector) to reduce the number of wires.

¹⁾ This accessory is not included.

It may be purchased from TE Connectivity.

CHARACTERISTIC CURVE OF THE ROTATION ANGLE SENSOR

The characteristic curve of the angular position sensor repeats every 120°. The sensor does not therefore have to be installed in the mounting position shown, but can be installed at any offset angle that is 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 at the limit value of the measuring range. If exceeded further, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions are shown on the graph. The segments of the circle shown in grey represent the angles that cannot be measured.



```
Ratiometric output signal U<sub>out 1</sub> with power supply 5 V
```



Output signal $U_{out 2} = 100\% - U_{out 1}/Us$ [%] (opposite curve)



Angle of rotation 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° circle) |
| Supply voltage | U _s 5 V ± 10 % or 9 – 32 V |
| "Crossed Scale" output signal | |
| Power Supply | U _s 5 V |
| | Output Uout 1 0.5–4.5 V ratiometric |
| | Output $U_{out 2}$ 4.5–0.5 V ratiometric |
| Power Supply | U _s 9–32 V |
| | Output U _{out 1} 0.5-4.5 V |
| | Output U _{out 2} 4.5-0.5 V |
| Release | |
| Linearity error including temperature drift | ±0,3° |
| Current consumption | < 15 mA |
| Max. current (analogue output) | < 2 mA |
| Casing type | B |
| Zero position | |
| Lever arm | 90 mm |
| Protection level | IP 6K9K |
| Operating temperature | - 40°C to +85°C |
| Lifetime | 5 million cycles |
| Polarity reversal protection | none, mechanical protection only |
| Mating connector ¹⁾ | 1394416-1 |
| Pin coating | Sn |

PIN ASSIGNMENT FOR CASING TYPE B



Voltage supply with 5 V DC²⁾

| • • • • | |
|---------|---|
| Pin 1: | 5 V DC Sensor 2 |
| Pin 2: | Output U _{out 1} 0.5–4.5 V ratiometric |
| Pin 3: | Not assigned |
| Pin 4: | 5 V DC Sensor 1 |
| Pin 5: | Output U _{out 2} 4.5 – 0.5 V ratiometric |
| Pin 6: | Not assigned |
| Pin 7: | Logic earth sensor 2 |
| Pin 8: | Logic earth sensor 1 |

 $^{\scriptscriptstyle 2)}$ The power supply lines (pin 1 and pin 4) and the ground supply lines (pin 7 and pin 8) can be bridged externally (e.g. in the mating connector) to reduce the number of wires.

¹⁾ This accessory is not included.

It may be purchased from TE Connectivity.

Power supply with 9-32 V DC³⁾

| Pin 1: | Bridge to pin 4 (external) |
|--------|---------------------------------------|
| Pin 2: | Output U _{out 1} 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 _{out 2} 4.5 – 0.5 V |
| Pin 6: | Not assigned |
| Pin 7: | Logic earth sensor 2 |
| Pin 8: | Logic earth sensor 1 |

³⁾ Pin 1 and pin 4 must be bridged externally (e.g. in the mating connector). 2) The power supply (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 ROTATION ANGLE SENSOR

The characteristic curve of the angular position sensor repeats every 120°. The sensor does not therefore have to be installed in the mounting position shown, but can be installed at any offset angle that is 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 at the limit value of the measuring range. If exceeded further, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions are shown on the graph. The segments of the circle shown in grey represent the angles that cannot be measured.



```
Ratiometric output signal U_{out 1} with power supply 5 V
```



Output signal $U_{out 2} = 100\% - U_{out 1}/U_{s}$ [%] (opposite curve)

Absolute output signal $U_{out 1}$ with power supply 9–32 V





Angle of rotation sensors Connecting elements

CONNECTING ELEMENT WITH TWO BALL HEAD SCREW



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







CONNECTING ELEMENT WITH COVER CAP AND ONE BALL HEAD SCREW







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



Head section, left Type A – ball head screw



Head section, right Type A – ball head screw

Head section, right Type B – cover cap

VARIANT OVERVIEW

Head section, left

Type B – cover cap

| Head section – left | Rotation | Length of connection element | Head section – right | Part number |
|---------------------|----------|------------------------------|----------------------|-----------------|
| А | 0° | 56 mm | А | 9XB 732 588-207 |
| А | 0° | 78.2 mm | А | 9XB 732 588-197 |
| А | 0° | 90 mm | A | 9XB 732 588-167 |
| В | 0° | 120 mm | A | 9XB 732 588-237 |
| В | 180° | 56 mm | А | 9XX 732 603-167 |
| А | 180° | 70 mm | А | 9XX 732 603-107 |
| А | 180° | 90 mm | В | 9XX 732 603-117 |

Part no. 9NS 740 413-317

| TECHNICAL DATA | |
|----------------|--------------|
| Length (total) | 29.5 mm ±0.6 |
| Length (screw) | 14 mm ± 0.3 |
| Placement | M6 |

TECHNICAL DRAWING





| LIGHTING ELECTRONICS | EXAMPLES OF VEHICLE APPLICATIONS | | | |
|--|----------------------------------|--|--|--|
| LED lighting failure control and electrical connection | | | | |
| LED flasher unit towing vehicle | | | | |
| LED lamp control unit | | | | |
| Control unit for flashing side marker lights | | | | |
| Control unit for current monitoring | | | | |
| Simulation device for cold checking | | | | |





LIGHTING ELECTRONICS

The focus here is on the control of the lighting function.

These electronic products offer solutions for "communication" between the LED lamps and the vehicle and for monitoring the function. They ensure that the lighting electronics or the flasher unit can be matched to the connected lighting.



LED lighting Failure control and electrical connection

LED LIGHT FAILURE MONITOR

A defined standard such as for bulbs cannot be used for the monitoring of LED lamps. Every LED lamp is different in its technical design and its energy consumption:

- \rightarrow Due to the number of LEDs,
- \rightarrow the intensity with which they are driven,
- \rightarrow and also due to the electronic ballast necessary for their operation.

Monitoring of the lamp failure is therefore no longer as simple as it once was with bulbs. HELLA has various approaches as solutions to this problem that are summarised here under the heading "Lighting Electronics".

FUNCTIONAL DIAGRAM



WHAT IS DEMANDED BY LAW?

ECE R48 defines that flashers as direction indicators have to be monitored and that their failure has to be signaled optically or visually.

THERE ARE TWO POSSIBILITIES:

→ The LED lamp either has to be able to "communicate" with the vehicle or it is monitored via its energy consumption.

→ The "communication" is the better approach here, but is not always possible, e.g. between towing vehicle and trailer.

SOLUTIONS:

The optimum solution is to match the lighting electronics or the flasher unit to the connected lighting. This is only possible in the most seldom of cases, however, as either a towing vehicle or trailer is involved or the vehicle electronics have already been dictated by third parties.

Flasher units

ISO 13207-conformant LED flashers can "communicate" with the flasher unit. The flasher unit checks for a defined energy consumption at a defined point in time: Exactly 21 W for 100-130 ms after each switching on of the direction indicator. The energy consumption or "pulse" corresponds here to that of a bulb, so that the flasher unit notices no difference between a bulb and an ISO 13207-conformant LED lamp.

If the intelligent ISO 13207-conformant LED lamp detects a defect or only a partial defect, this "pulse" is switched off and the flasher unit can interpret this as a failure. ISO 13207-conformant LED lamps and ISO 13207-conformant flasher units are required for this method.

Advantage:

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

LED lamp control units for use with third-party electronics

If the vehicle electronics have already been dictated by third parties, HELLA offers LED control units that on the one hand monitor the LED lamps, and on the other hand simulate to the vehicle that bulbs are connected. This allows LED lamps to be used without any problems.

Monitoring of the current

Another possibility is to measure the average energy consumption of the headlight or the LED lamp.

Disadvantage:

In most cases, however, partial defects cannot be detected in this way: With very efficient LED lamps it is possible that their energy consumption is so low that they are detected as defective even when functioning correctly. Or in the worst case: The electronic ballast of the LED lamp requires so much energy that a failure cannot be detected even if all the LEDs are defective.



LED lighting Failure check and electrical connection LED flasher unit: towing vehicle

ISO 13207-conformant LED flashers can "communicate" with the flasher unit. The flasher unit checks for a defined energy consumption at a defined point in time: Exactly 21 W for 100-130 ms after each switching on of the direction indicator. The energy consumption or "pulse" corresponds here to that of a bulb, so that the flasher unit notices no difference between a bulb and an ISO 13207-conformant LED lamp.

Benefit: Bulbs and ISO LED lamps can be operated in any combination on an ISO 13207-conformant flasher unit. This is relevant both for vehicles that are frequently operated with different trailers and for manufacturers who wish to offer several variants of the lighting system without having to modify the underlying electronics.

24 V

Operating voltage

Functional voltage

Protection level

Operating temperature

| 12 V | |
|-----------------------|-----------------------------|
| Operating voltage | 10–15 V |
| Functional voltage | 11 – 14 V |
| Operating temperature | -40 to +85°C |
| Protection level | IP 53 (contacts underneath) |



| 12 V, LED flasher unit 3+1 | |
|--|--|
| 3 direction indicators on the vehicle/tractor vehicle 1 direction indicator on optional trailer | |
| Minimum switching power 18 W | |
| Maximum switching power 171 W | |
| Error threshold towing vehicle 58 W | |
| Error threshold towing vehicle + trailer 77 W | |

| 24 V, LED flasher unit 3+1 | | |
|--|-------|--|
| 3 direction indicators on the vehicle/tractor vehicle 1 direction indicator on optional trailer | | |
| Minimum switching power | 18 W | |
| Maximum switching power | 171 W | |
| Error threshold towing vehicle | 59 W | |
| Error threshold towing vehicle + trailer | 82 W | |
| 4DW 009 492-011 | | |

18–32 V

20 – 28 V

-40 to +85°C

IP 53 (contacts underneath)

4DW 009 492-111





| 24 V, LED flasher unit 2+1 | |
|---|-------|
| 2 indicators on the vehicle / traction vehicle 1 direction indicator on optional trailer | |
| Minimum switching power | 18 W |
| Maximum switching power | 129 W |
| Error threshold towing vehicle | 33 W |
| Error threshold towing vehicle + trailer | 59 W |

4DM 009 492-001

4DN 009 492-101



System representation: Basic

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

LED lighting Failure check and electrical connection LED lamp control unit

System representation: Premium

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





| BASIC CONTROL UNIT | |
|--------------------|-----------------|
| 12 V basic | 5DS 227 488-001 |
| 24 V basic | 5DS 227 488-101 |

| PREMIUM CONTROL UNIT | |
|---|-----------------|
| 12 V Premium (1 stop light channel) | 5DS 227 489-001 |
| 12 V Premium (2 stop light channels) | 5DS 227 489-011 |
| 24 V Premium (1 stop light channel) | 5DS 227 489-101 |



LED lighting Control unit for flashing side marker lights

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

Variant 1:

This control unit has been specially developed for CAT 5 side marker lights with integrated direction indicators and functions only in combination with these.

Variant 2:

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





| Control unit for flashing side marker li | ghts |
|--|------------|
| ECE-R48 category 5, 24 V | on request |

| Control unit for flashing side marker lights | | |
|--|------------|--|
| ECE-R48 category 6, 24 V | on request | |



LED lighting Failure check and electrical connection **Control unit for current monitoring**

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

| Variant | Voltage | THRESHOLD |
|-----------------|---------|-----------|
| 5DS 011 630-001 | 12 V | 500 mA |
| 5DS 011 630-011 | 24 V | 500 mA |
| 5DS 011 630-211 | 24 V | 350 mA |







| Variant | Voltage |
|-----------------|---------|
| 5DS 011 630-101 | 12 V |
| 5DS 011 630-111 | 24 V |

Control unit for current monitoring Integrated measurement over time **Example K-LED 2.0 beacon**





LIGHTING ELECTRONICS

Average threshold

CIRCUIT DIAGRAM



LED lighting Failure check and electrical connection **Simulation device for cold checking**

If the existing vehicle electrical system is programmed to monitor the lighting even when it is not in operation, we speak of a cold check. During a cold check, a small test pulse is transmitted to the lamp while 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" to ensure operation.

| 12 V | | 24 V | |
|-----------------------|---------------------------|-----------------------|---------------------------|
| Operating voltage | 9 – 16 V | Operating voltage | 18 – 32 V |
| Rated current | 1,5 A | Rated current | 1,5 A |
| Operating temperature | -40 to +85°C | Operating temperature | -40 to +85°C |
| Protection level | IP 54 (contacts below) | Protection level | IP 54 (contacts below) |
| Part Number | 5DS 009 602-011 | Part Number | 5DS 009 602-001 |
| Notes | |
|-------|--|
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