Assembly and operating manual

OPR 061-221

Collision and Overload Protection Sensor

Original operating manual

Hand in hand for tomorrow

Imprint

Technical changes:
We reserve the right to make alterations for the purpose of technical improvement.

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Dear Customer,

Thank you for trusting our products and our family-owned company, the leading technology supplier of robots and production machines.

Our team is always available to answer any questions on this product and other solutions. Ask us questions and challenge us. We will find a solution!

Best regards,

Your SCHUNK team

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Please read the operating manual in full and keep it close to the product.

Table of Contents

1 General

1.1 About this manual

This manual contains important information for a safe and appropriate use of the product.

This manual is an integral part of the product and must be kept accessible for the personnel at all times.

Before starting work, the personnel must have read and understood this operating manual. Prerequisite for safe working is the observance of all safety instructions in this manual.

In addition to these instructions, the documents listed under ▸ 1.1.2 [🗋 6] are applicable.

NOTE: The illustrations in this manual are intended to provide a basic understanding and may deviate from the actual version.

1.1.1 Presentation of Warning Labels

To make risks clear, the following signal words and symbols are used for safety notes.

⚠ DANGER

Dangers for persons!

Non-observance will inevitably cause irreversible injury or death.

⚠ WARNING

Dangers for persons!

Non-observance can lead to irreversible injury and even death.

⚠ CAUTION

Dangers for persons!

Non-observance can cause minor injuries.

CAUTION

Material damage!

Information about avoiding material damage.

1.1.2 Applicable documents

- General terms of business *
- Catalog data sheet of the purchased product *

The documents labeled with an asterisk (*) can be downloaded from **schunk.com/downloads**.

1.2 Warranty

If the product is used as intended, the warranty is valid for 24 months from the ex-works delivery date under the following conditions:

- Observe the specified maintenance and lubrication intervals
- Observe the ambient conditions and operating conditions

Parts touching the workpiece and wear parts are not included in the warranty.

1.3 Scope of delivery

The scope of delivery includes:

- Collision and Overload Protection Sensor OPR
- Accessory pack (electrical connection: connection cable 5 m, straight connector, open wire strands)
- Safety information (product-specific instructions available online)

2 Basic safety notes

2.1 Intended use

The OPR was designed as a device to protect industrial components and machinery from damage resulting from collisions and impacts.

The OPR has not been designed for, nor should it be used in, situations involving the safety of humans or animals. In all situations the user is responsible for insuring that applicable safety practices are followed as outlined by the manufacturer of the equipment on which the OPR will be used.

The module is intended for installation in a machine/system. The requirements of the applicable guidelines must be observed and complied with.

The module may be used only in the context of its defined application parameters ▶ 3 [🗋 12].

Any other use or use exceeding that specified is an infringement of use for intended purpose. The manufacturer bears no liability for damage resulting from such use.

2.2 Not intended use

It is not intended use if the product is used, for example, as a pressing tool, stamping tool, lifting gear, guide for tools, cutting tool, clamping device or a drilling tool.

- Any utilization that exceeds or differs from the appropriate use is regarded as misuse.

2.3 Constructional changes

Implementation of structural changes

Modifications, changes or reworking, e.g. additional threads, holes, or safety devices, can damage the product or impair its functionality or safety.

- Structural changes should only be made with the written approval of SCHUNK.

2.4 Spare parts

Use of unauthorized spare parts

Using unauthorized spare parts can endanger personnel and damage the product or cause it to malfunction.

- Use only original spare parts or spares authorized by SCHUNK.

2.5 Ambient conditions and operating conditions

Required ambient conditions and operating conditions

Incorrect ambient and operating conditions can make the product unsafe, leading to the risk of serious injuries, considerable material damage and/or a significant reduction to the product's life span.

- Make sure that the product is used only in the context of its defined application parameters, ▸ 3 [🗋 12].
- Make sure that the product is a sufficient size for the application.
- Make sure that the environment is free from splash water and vapors as well as from abrasion or processing dust. Exceptions are products that are designed especially for contaminated environments.

2.6 Personnel qualification

Inadequate qualifications of the personnel

If the personnel working with the product is not sufficiently qualified, the result may be serious injuries and significant property damage.

- All work may only be performed by qualified personnel.
- Before working with the product, the personnel must have read and understood the complete assembly and operating manual.
- Observe the national safety regulations and rules and general safety instructions.

The following personal qualifications are necessary for the various activities related to the product:

Trained electrician

Due to their technical training, knowledge and experience, trained electricians are able to work on electrical systems, recognize and avoid possible dangers and know the relevant standards and regulations.

Qualified personnel

Due to its technical training, knowledge and experience, qualified personnel is able to perform the delegated tasks, recognize and avoid possible dangers and knows the relevant standards and regulations.

Instructed person

Instructed persons were instructed by the operator about the delegated tasks and possible dangers due to improper behaviour.

Service personnel of the manufacturer

Due to its technical training, knowledge and experience, service personnel of the manufacturer is able to perform the delegated tasks and to recognize and avoid possible dangers.

2.7 Personal protective equipment

Use of personal protective equipment

Personal protective equipment serves to protect staff against danger which may interfere with their health or safety at work.

- When working on and with the product, observe the occupational health and safety regulations and wear the required personal protective equipment.
- Observe the valid safety and accident prevention regulations.
- Wear protective gloves to guard against sharp edges and corners or rough surfaces.
- Wear heat-resistant protective gloves when handling hot surfaces.
- Wear protective gloves and safety goggles when handling hazardous substances.
- Wear close-fitting protective clothing and also wear long hair in a hairnet when dealing with moving components.

2.8 Notes on safe operation

Incorrect handling of the personnel

Incorrect handling and assembly may impair the product's safety and cause serious injuries and considerable material damage.

- Avoid any manner of working that may interfere with the function and operational safety of the product.
- Use the product as intended.
- Observe the safety notes and assembly instructions.
- Do not expose the product to any corrosive media. This does not apply to products that are designed for special environments.
- Eliminate any malfunction immediately.
- Observe the care and maintenance instructions.

- Observe the current safety, accident prevention and environmental protection regulations regarding the product's application field.

2.9 Transport

Handling during transport

Incorrect handling during transport may impair the product's safety and cause serious injuries and considerable material damage.

- When handling heavy weights, use lifting equipment to lift the product and transport it by appropriate means.
- Secure the product against falling during transportation and handling.
- Stand clear of suspended loads.

2.10 Malfunctions

Behavior in case of malfunctions

- Immediately remove the product from operation and report the malfunction to the responsible departments/persons.
- Order appropriately trained personnel to rectify the malfunction.
- Do not recommission the product until the malfunction has been rectified.
- Test the product after a malfunction to establish whether it still functions properly and no increased risks have arisen.

2.11 Disposal

Handling of disposal

The incorrect handling of disposal may impair the product's safety and cause serious injuries as well as considerable material and environmental harm.

- Follow local regulations on dispatching product components for recycling or proper disposal.

2.12 Notes on particular risks

⚠ WARNING

Risk of injury from falling of the unit during transport, assembly and operation!

- Secure gripper unit during transport and assembly with adequately sized straps.
- Ensure careful cultivation of the collision and overload system to the machine.

⚠ WARNING

Risk of injury from crushing fingers during deflection process!

⚠ WARNING

Risk of injury from overload signal of the sensor (eg electrical short circuit) and in case of failure and reducing the supply of compressed air! The function of the electrical signal transmission is no longer guaranteed.

3 Technical data

Standard for quality of the compressed air		clean, dry, non-lubricated compressed air from a **self-relieving** regulator
Pressure range min./max. [bar]		OPR-...-P00: 1.4 / 6.2 OPR-...-P05: 1.4 / 5.9 OPR-...-P10: 1.4 / 5.5 OPR-...-P15: 1.4 / 5.2
Ambient temperature [°C]		5 to +50
IP rating	splashing water protection	65
Connector Type Switch Rating	OPR 061	M8-3-pin male threaded connector 100 mA 10-30 VDC
	OPR 081-221	3-pole Nano Connector 125 mA 28 V~/=
Optional auxiliary springs		available corresponding to 0.3, 0.7, 1 bar
Noise emission [dB(A)]		≤ 70

More technical data is included in the catalog data sheet. Whichever is the latest version.

4 Design and description

4.1 Introduction

The OPR is a pneumatically pressurized device offering protection to industrial robots and tooling in the event of accidental impacts and unanticipated loads. The unit works by "breaking away" from its working geometry in the event of excessive torsional, moment, or compressive axial forces, or any combination of these.

The OPR cannot respond to pure axial tension, which is an unlikely mode of loading. Removal of the upsetting force or moment allows the OPR to return to its initial position.

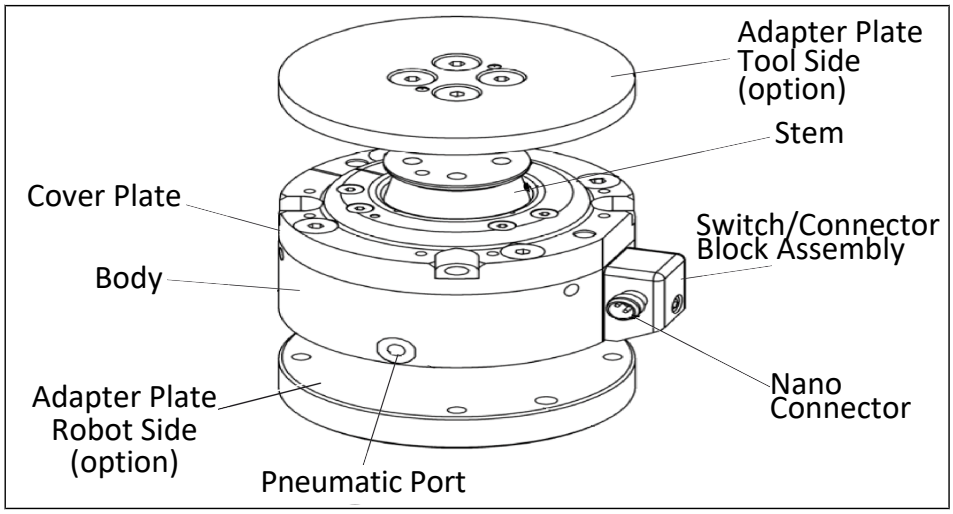
As a collision occurs, internal motion of the OPR components cause a switch to change state (OPR-061: Change to an open circuit / OPR-081-221: Cause a normally closed switch to open).

As a collision occurs, internal motion of the Protector components cause a switch to change state to an open circuit.

The switch circuit may be monitored by robotic controllers to stop operations before damage to the robot or tooling occurs. The load threshold at which the OPR breaks away is adjustable by controlling the air pressure supplied to the unit. The amount of compliance (travel) provided by the OPR before the switch circuit opens is adjustable by turning a switch adjustment screw.

All OPR devices provide axial (compression only), torsional, and moment compliance.

4.2 Description



The OPR consists of a piston housing (body) closed with a cover plate assembly. A stem assembly protrudes through the cover plate assembly. The cover plate assembly incorporates a cam to accurately and repeatably position the stem assembly. The stem assembly is forced into position against the cam by a piston. The piston is supported by user supplied compressed air and an optional assist spring. The stem provides a mounting surface for customized interface plates. Tapped and through holes on the back surface of the body allow direct bolting of the body to user tooling. All load bearing components and those with wear surfaces are made of hard-coat anodized aluminium, hardened bearing steel, or hardened tool steel.

A Collision Sensing Switch is positioned in the side of the body. A connector block assembly containing a M8, 3-pin male threaded connector is mounted on the side of the OPR body. The user connects to the switch using the M8 connector for which a variety of cables are available. The user must also supply the OPR with dry, regulated, compressed air through a port on the side of the OPR body. The size and location of these connections are shown in the drawing provided at the end of this manual.

5 Assembly

Protect electrical cables and compressed air lines as much as possible against tensile strain, kinking, breakage etc. when laying.

CAUTION

Prior to establishing or branching the compressed air line to the OPR, ensure that the compressed air supply is switched off and that enclosed compressed air has been discharged.

CAUTION

The level of desired or required air pressure will vary according to the weight, loading, and motion of the user's tooling.

When the pneumatically-supplied force is sufficient to re-seat the OPR, the tooling will move to its working position.

- Exercise caution while increasing the air pressure supplied to the OPR.

5.1 Mechanical connection

The OPR is usually installed with the housing facing the robot and the broach facing the insert tool, yet users can decide this for themselves.

The OPR can be attached directly to a robot or insert tool with the help of the alignment pin and through-hole / thread bores. Where this is not possible, please use an adapter plate.

CAUTION

The surface to which the OPR body is mounted must be flat and smooth and provide support for the entire surface of the body.

A second interface plate is often required for mounting to the OPR stem. Such adapterplates may be ordered from SCHUNK as blank plates or machined as necessary for specific applications. Another option is for the user to fabricate their own interface plates. Once any required machining of the adapter plates is complete, mount the OPR using hardware appropriately sized for the application. Connect an appropriately sized air line and fitting to the OPR.

Do not supply air pressure at this time.

All mounting hardware should be tightened. The use of an industrial thread-locking compound is recommended for all fasteners.

⚠ CAUTION

unexpected movement of the OPR

Personal injury or damage to equipment is possible

- Before connecting or uncoupling the air supply to the OPR, ensure that the air supply is turned off and that all trapped air has been vented

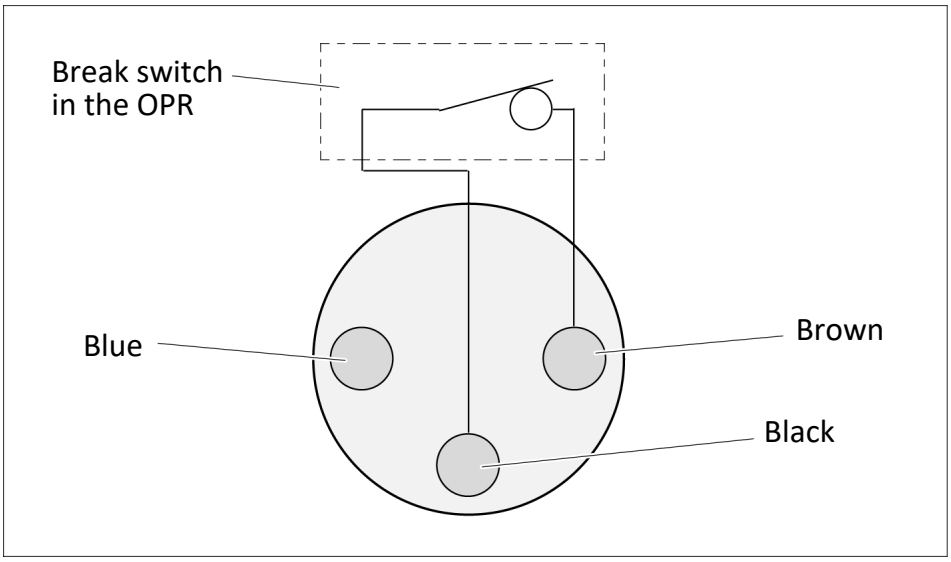
Type	Screw [mm]	Tightening torque [Nm]
OPR-061	M4 - 40 mm	4.4 - 5.1 Nm
OPR-081	M5 - 45 mm	5.0 - 6.8 Nm
OPR-101	M5 - 50 mm	5.0 - 6.8 Nm
OPR-131	M6 - 69 mm	9.0 - 11.9 Nm
OPR-176	M8 - 80 mm	21.5 - 28.2 Nm
OPR-221	M10 - 100 mm	44.0 - 58.8 Nm

Tab.: Fastener Torque Specifications

5.2 Electrical connection

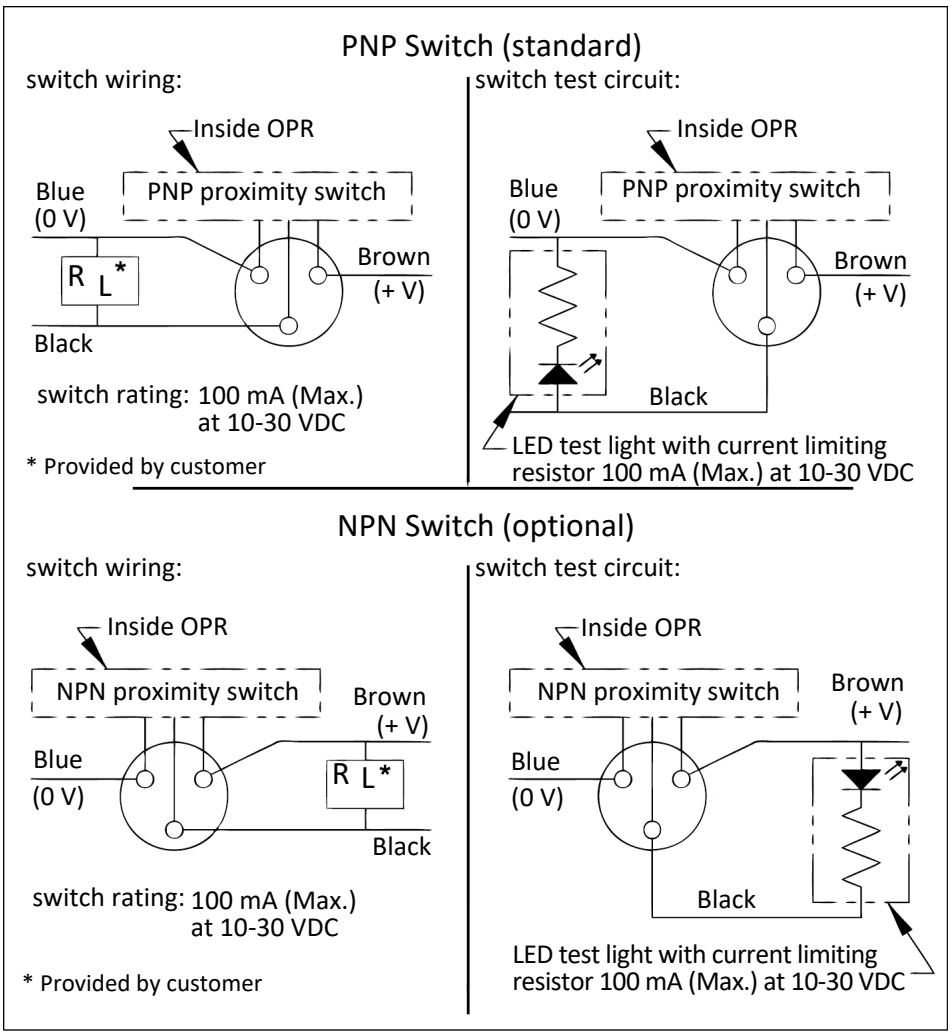
For connection to the user's controls, the OPR is equipped with a collision sensing switch. When the OPR is in the collision mode or the electrical cable to the switch is disconnected an open circuit is generated.

Following you can find the connections between the internal switch and the pins in the Connector Block Assembly. Optional mating cables, available from SCHUNK ▸ 5.1 [🗋 15], utilize the brown-black-blue color code indicated.



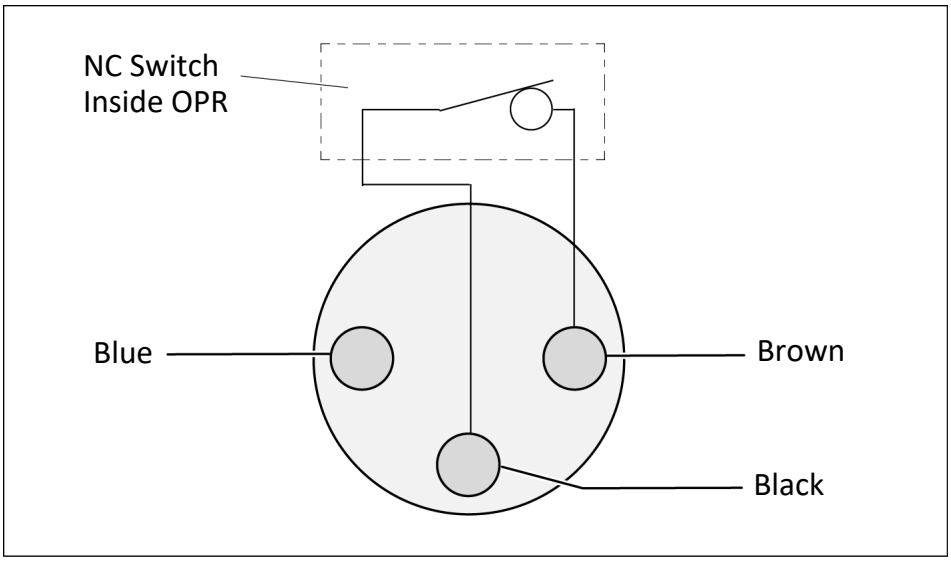
Switch wiring as a normaly-closed , dry contact switch

OPR-061



Switch wiring as a normaly-open PNP or NPN proximity switch

OPR-081-221



Switch wiring as a normaly-closed , dry contact switch

NOTE

The user is responsible for connecting the OPR to their controls and providing an "electrical load" in series with the collision sensing switch.

- The switches of type OPR 81 – 221 are suitable for electrical signals of max. 125 mA, 28 V AC or DC.
- The switch of the type OPR 61 is suitable for electrical signals of max. 100 mA at 10 – 30 VDC.
- The desired or required pressure of the compressed air depends on the weight, load and movement of the attached tools. Resetting the compressed air of the OPR moves the tool to its working position.

Once the OPR has been installed and connected as described in the preceding paragraphs proper electrical operation of the unit may be confirmed.

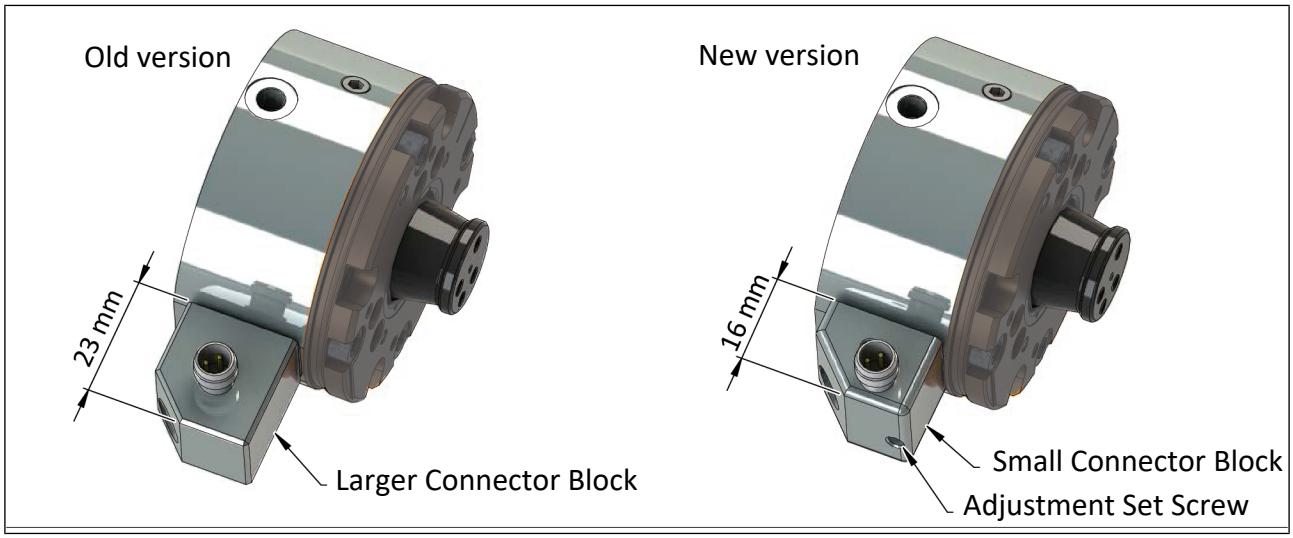
1. Supply the OPR with approximately 1 bar and ensure that the unit is electrically connected to the user's control circuit or to a test box.
   ⇨ The switch should appear closed.
2. Manually push the OPR to simulate a collision while observing the switch output. .
   ⇨ When the collision occurs the switch will open and the test light will turn off
3. Release the OPR and it will return to its working position.
   ⇨ The test light will illuminate

5.2.1 Switch Adjustment

OPR 061: ▶ 5.2.1.1 [🗋 19]

OPR 081 – 221: ▶ 5.2.1.2 [🗋 23]

5.2.1.1 Switch Adjustment for OPR 061



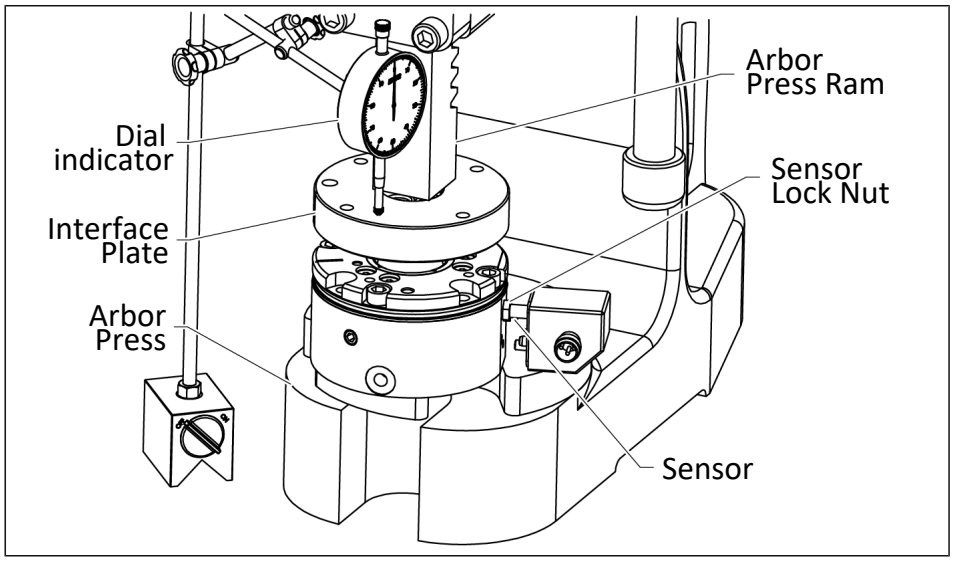
There are two styles of connector block assemblies. The Old version has a larger connector body than the New version. The New version has an adjustment set screw in the side of the connector body.

Switch adjustment of Old version

NOTE

The switch is factory adjusted to open after the stem has traveled 0.5 mm in the axial direction. Adjustments should only be made if replacing the switch.

1. De-energize all electrical and pneumatic power supplied to the OPR. Drain all stored air and electric power in compliance with standard (OSHA) safety practices and standards.
2. Disconnect the air lines and signal wires connected to the OPR.
3. Remove the user-installed mounting hardware from the OPR and remove the unit. Take the unit to a test bench equipped with a clean working surface and compressed air.
4. Ensure that the OPR returns to its Reset or Working position with the stem fully extended and the alignment mark on the stem in line with the alignment mark on the cover plate. (Temporarily supply approx. 4 bar to the unit.)



5. Loosen and remove the screw holding the connector block in place.
6. Taking care not to break the wires, pull the connector block away from the body. Loosen the locknut on the proximity switch.
7. Connect a test box ▶ 5.2 [🗋 16].
8. Attach an interface plate to the stem of the OPR.
9. Center the OPR under the press ram.
10. Set a dial indicator in contact with the interface plate and adjust it so that the probe is vertical. Set the dial indicator height so that it can read at least 1.5mm stroke. Set the dial ring to zero.
11. Push on the press handle until the switch circuit opens and check the distance traveled on the dial indicator.
12. If the distance traveled is greater than desired turn the proximity switch counterclockwise. If the distance traveled is less turn the proximity switch clockwise.
13. Repeat the two previous steps as necessary to obtain the desired switch setting.
14. Tighten the locknut on the proximity sensor.
15. Slide the connector block over the proximity sensor carefully routing the wires into the slotted area under the proximity sensor. Line up the dowel pin with the hole in the body and the screw hole with the threaded hole in the body.
16. Apply Loctite® 222MS to the M3 mounting screw and thread it into the body. Tighten the screw securely.

17. Re-install the OPR using the user-installed mounting hardware.

CAUTION

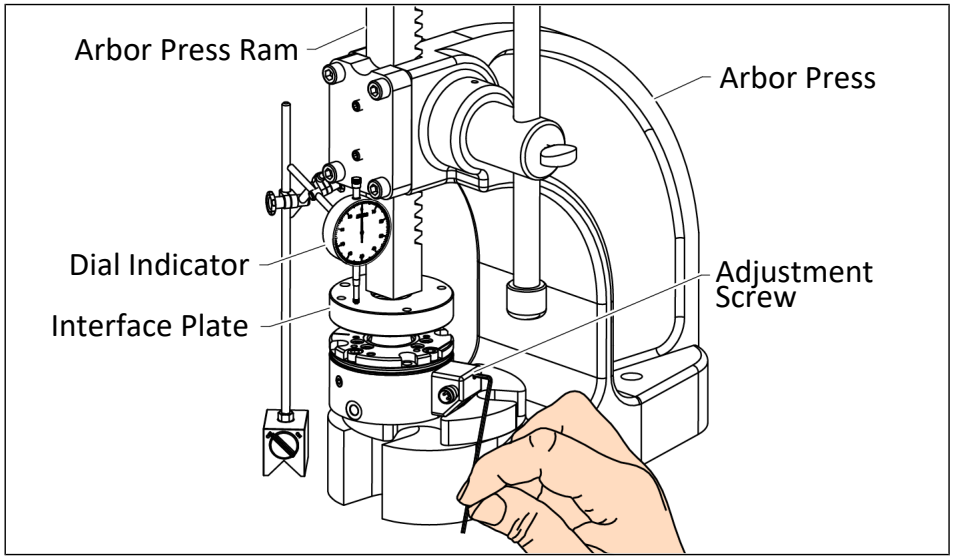
Before putting the OPR back into operation, confirm that the switch is functioning properly▶ 5.2 [🗋 16].

Switch adjustment of New version

NOTE

The switch is factory adjusted to open after the stem has traveled 0.5 mm in the axial direction. Adjustments should only be made if replacing the switch.

1. De-energize all electrical and pneumatic power supplied to the OPR. Drain all stored air and electric power in compliance with standard (OSHA) safety practices and standards.
2. Disconnect the air lines and signal wires connected to the OPR.
3. Remove the user-installed mounting hardware from the OPR and remove the unit. Take the unit to a test bench equipped with a clean working surface and compressed air.
4. Ensure that the OPR returns to its Reset or Working position with the stem fully extended and the alignment mark on the stem in line with the alignment mark on the cover plate. (Temporarily supply approx. 4 bar to the unit.



5. Connect a test box ▶ 5.2 [🗋 16].
6. Attach an interface plate to the stem of the OPR.
7. Center the OPR under the press ram.

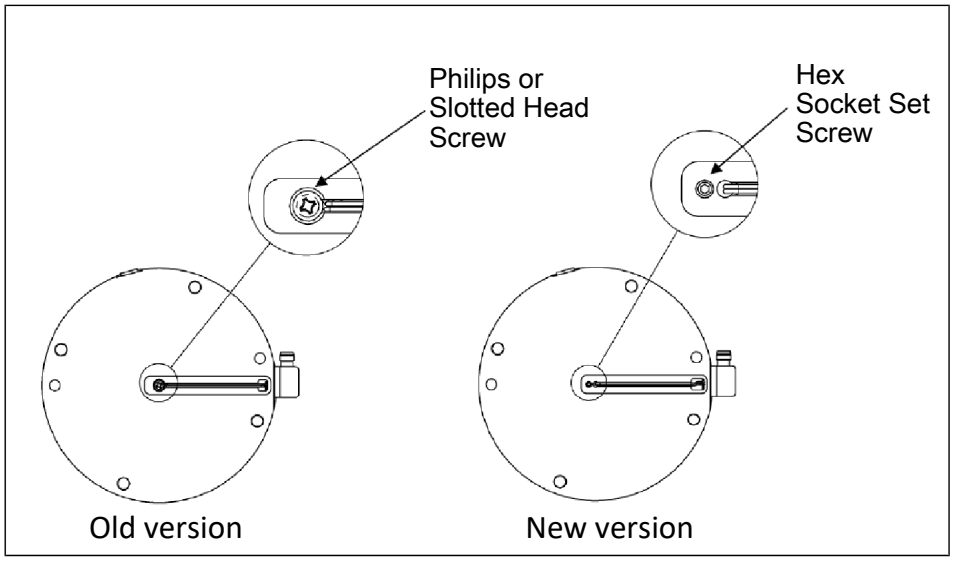
8. Set a dial indicator in contact with the interface plate and adjust it so that the probe is vertical. Set the dial indicator height so that it can read at least 1.5mm stroke. Set the dial ring to zero.
9. Push on the press handle until the switch circuit opens and check the distance traveled on the dial indicator.
10. If the distance traveled is greater than desired turn the proximity switch counterclockwise. If the distance traveled is less turn the proximity switch clockwise.
11. Repeat the two previous steps as necessary to obtain the desired switch setting.
12. Re-install the OPR using the user-installed mounting hardware.

CAUTION

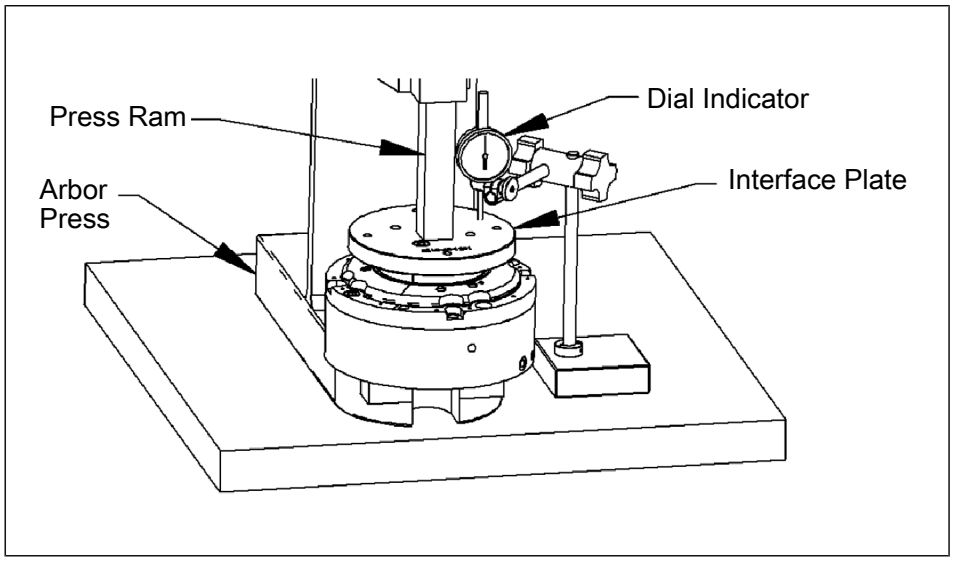
Before putting the OPR back into operation, confirm that the switch is functioning properly▸ 5.2 [🗋 16].

5.2.1.2 Switch Adjustment for OPR 081 – 221

1. The switch is factory adjusted to open after the stem has traveled 0.02" (0.5 mm) in the axial direction. Adjustments should only be made after it has been determined that the OPR should open sooner or later after the start of a collision. Adjusting the switch to open sooner may result in nuisance signals.
2. De-energize all electrical and pneumatic power supplied to the OPR. Drain all stored air and electric power in compliance with standard safety practices and standards.
3. Disconnect the air lines and signal wires connected to the OPR.
4. Remove the user-installed mounting hardware from the OPR and remove the unit. Take the unit to a test bench equipped with a clean working surface and compressed air.
5. Ensure that the OPR returns to its Reset or Working position with the stem fully extended and the alignment mark on the stem in line with the alignment mark on the cover plate.
6. Set a volt-ohm meter to ohms or continuity and connect it between the black and brown wires of the cord (see wiring diagrams on previous page) connected to the Nano connector on the switch housing.



7. Peel back the gasket at the bottom center of the OPR body and locate the switch adjustment screw. Determine which switch version the unit contains (The adjustment procedure differs slightly depending on the version.).
8. Attach an interface plate to the stem of the OPR.



9. Center the OPR under the press ram of an arbor press
10. Set a dial indicator in contact with the interface plate and adjust it so that the probe is vertical. Set the dial indicator height so that it can read at least 1.5 mm stroke. Set the dial ring to zero.
11. Push on the press handle until the switch circuit opens and check the distance traveled on the dial indicator.
12. Check whether the screw is a Phillips screw (1) or a hexagon socket screw (2). (The setting varies with the type of screw.) **IMPORTANT! Adjusting the switch to the limits of its travel on a OPR-81 or OPR-101 may cause the switch to short to ground. Check for continuity between each leg of the circuit and ground after adjusting the switch on a OPR-81 or OPR-101.**
13. **Phillips screw:**
    If the distance traveled before the switch turns off is
    - ⇨ greater than desired: Turn the set counter-clockwise.
    - ⇨ less than desired: Turn the set screw clockwise.
      WARNING The newer style switch can be adjusted to open between 0.3 mm and 1.3 mm of axial stem displacement. Setting the switch to open beyond the maximum value of 1.3 mm may result in failure of the switch to detect a crash condition. Setting the switch to open under the minimum value of 0.3 mm may result in damage to the switch and eventual failure of the switch to detect a crash condition.
14. **Hexagon socket screw:**
    Use a 1.5 mm hexagon socket screw if the distance traveled before the switch turns off is
    - ⇨ greater than desired: Turn the set screw clockwise.

⇨ less than desired: Turn the set screw counter-clockwise.

15. After turning the adjusting screw, confirm that the switch is functioning properly by pushing down on the interface plate until the switch circuit opens. Verify that the switch setting is within the adjustment range of 0.3 mm to 1.3 mm.
16. Re-install the OPR using the user-installed mounting hardware.

CAUTION

Prior to restarting the OPR, check that the switch contact is working flawlessly ▶ 5.2 [🗋 16].

6 Operation

With the OPR mounted and connected pneumatically and electrically the unit may be placed into operation.

Commissioning

1. If possible for safety and convenience, position the OPR and the tooling vertically so that the load is suspended below the OPR.
2. Apply low-pressure air (1 bar) to the unit.
3. Gradually increase the air pressure until the desired working pressure is applied.

In operation the OPR should be supplied with the minimum air pressure necessary to allow continuous, uninterrupted operation of the unit.

Nuisance collision detections caused by high accelerations and unanticipated loads will occur if the air pressure is too low.

The magnitude of overhung loads, robot accelerations, and applied loads prevent SCHUNK from recommending air pressure settings.

Where high robots accelerations are anticipated the user may wish to supply the OPR with electronically variable or multiple, switchable air supplies.

Alternatively, where working loads are small the OPR may be outfitted with auxiliary springs and supplied with high-pressure air only during robot moves. Using these techniques, the OPR may be supplied with higher air pressure when higher loads or accelerations are anticipated.

7 Troubleshooting

The OPR will offer exceptional performance in normal operation. However, the OPR is not a compliance device and frequent collisions should be avoided to maximize performance and life.

The OPR is designed to automatically return to its working position once the disturbing force is removed. Should this fail to happen the following examinations should be performed to verify proper operation of the unit.

- **Check the supply air pressure.**
  Insure that the supply air pressure is sufficient to support the loads placed upon the unit. If the supply pressure is too low the OPR will experience excessive nuisance collision sensings and fail to reset.

  SCHUNK recommend: After collision, move to a vertical hanging position and apply max. air pressure.
- Once proper air supply pressure has been verified, check the **self-relieving function of the pressure regulator**. Do so by deflecting the tooling while listening for the regulator to exhaust air in response to compression of the air trapped within the OPR. If the regulator does not properly relieve the air pressure, it may need to be cleaned or replaced.
- **Check the control wiring.** Disconnect the cable from the OPR and use a volt-ohm meter on the Nano connector to confirm that the switch is closed when the OPR is in the working position. (The scribe lines on the OPR cover plate and stem must be aligned and the mounting surfaces of the body and stem must be parallel. Remove tooling or increase air pressure if necessary to allow the unit to move to its working position.) If the switch does not close adjustment or replacement may be necessary Switch Adjustment. If the switch is closed under this condition examine the system for control wiring and logic problems.
- **Check for mechanical obstructions.** The OPR will not be free to rotate back to its working position if obstructions prevent its free motion. Insure that there are no obstructions either on or around the tooling or the stem of the OPR. Pay particular attention to cables and tubing that may become trapped or snagged.

If the OPR still fails to reset or if the switch fails to close after adjustment when the unloaded unit is in its working condition, contact SCHUNK.

8 Maintenance

⚠ WARNING

Danger when changes to the set screws in the wall of the body are made!

Doing so may result in personal injury and/or damage to the unit.

- Do not adjust or remove any of the three set screws installed in the wall of the Body.

8.1 General

The OPR is a reliable device fabricated using heavy-duty components. In normal operation the unit requires no maintenance if proper air quality and pressures are maintained.

Service kits are available in the event that the Nano connector or collision sensing switch become damaged or worn.

Proper collision sensing should be verified on a regular basis. This can be scheduled twice a year or as a part of any robot or work cell preventative maintenance activities.

In applications where a high number of collisions occur on a regular basis, the life of the OPR can be extended with periodic maintenance.

CAUTION

Never disassemble OPR Versions with integrated springs.

The OPR could be damaged

- Send the OPR for maintenance to SCHUNK

- Partial disassembly allows the unit to be cleaned, re-greased, and reassembled without special tools or adjustment procedures. Such maintenance work should be conducted every 5.000 or fewer collisions.
- Check the control wiring for shorts.
- If necessary, readjust the switiching point.

⚠ WARNING

Danger from unexpected movements

Damage to equipment or personnel injury is possible

- In all instances where the OPR is to be examined, installed, or removed from service, ensure that air pressure has been vented from the unit, that electrical current is not supplied to the OPR's signal circuit, and that the robot is in a safe, locked-out, condition consistent with local and national safety standards.

8.2 OPR with the Spring Assist Option

⚠ WARNING

personal injury and/or damage to the unit

OPR equipped with the spring assist option contain a significant amount of stored energy and present an increased level of hazard if not handled properly.

- Do not attempt to disassemble or repair these units beyond what is described in this manual.
- All additional repair work requires the use of special tools and procedures necessary to prevent personal injury and/or damage to the unit.

8.3 Cable Replacement

If the cable attached to your OPR becomes broken or worn, replacement cables may be purchased as follows:

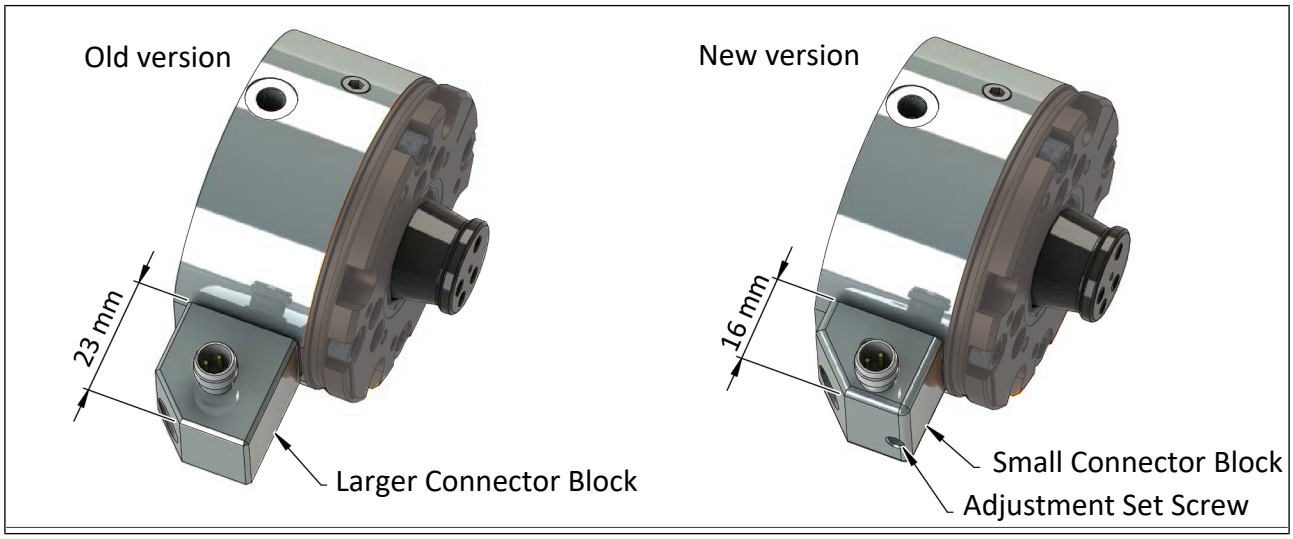
OPR Model Number/0301623 KA BG08-L 3P-0500-PNP, 5m.

8.4 Replacement of connector block assembly

OPR 061: ▸ 8.4.1 [🗋 30]

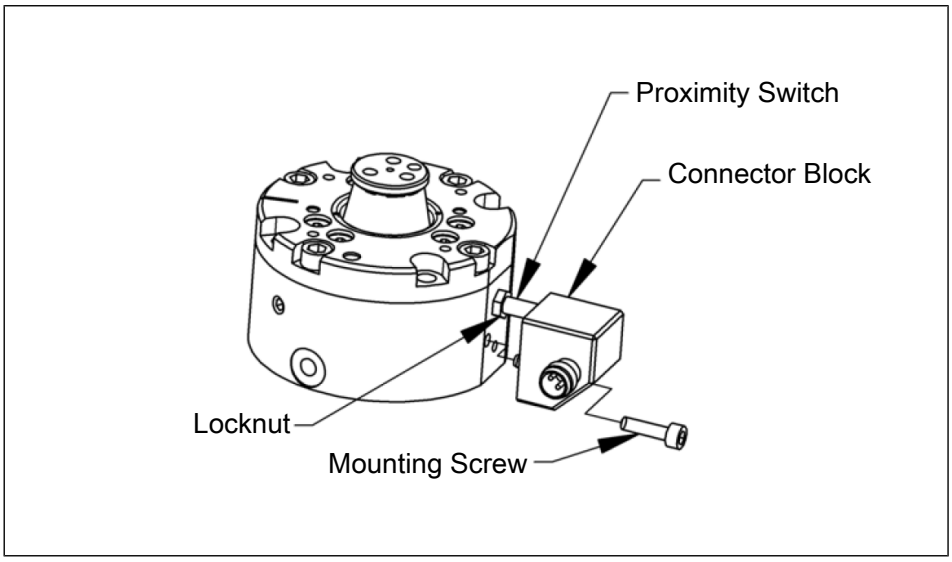
OPR 081 – 221: ▸ 8.4.2 [🗋 33]

8.4.1 Replacement of connector block assembly for OPR 061

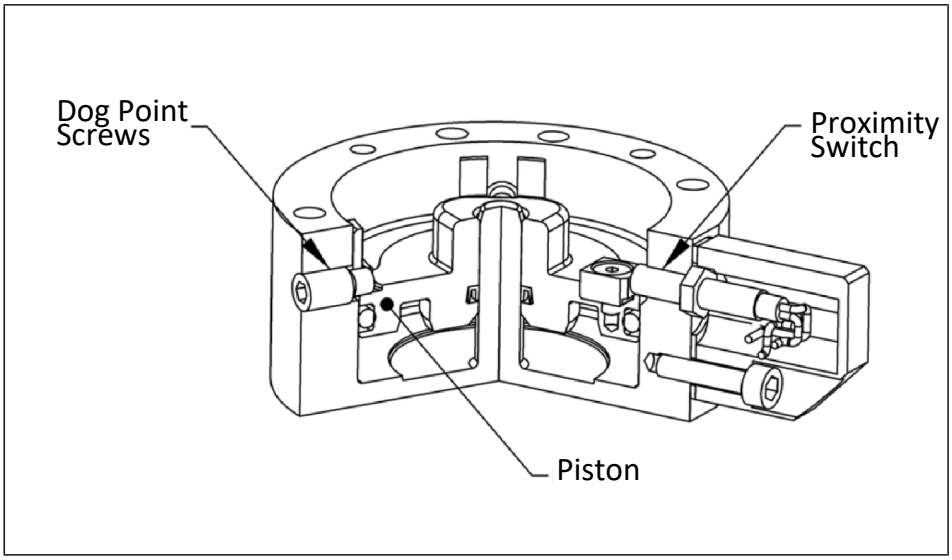


There are two styles of connector block assemblies. The Old version has a larger connector body than the New version. The New version has an adjustment set screw in the side of the connector body.

Replacement of Old Version



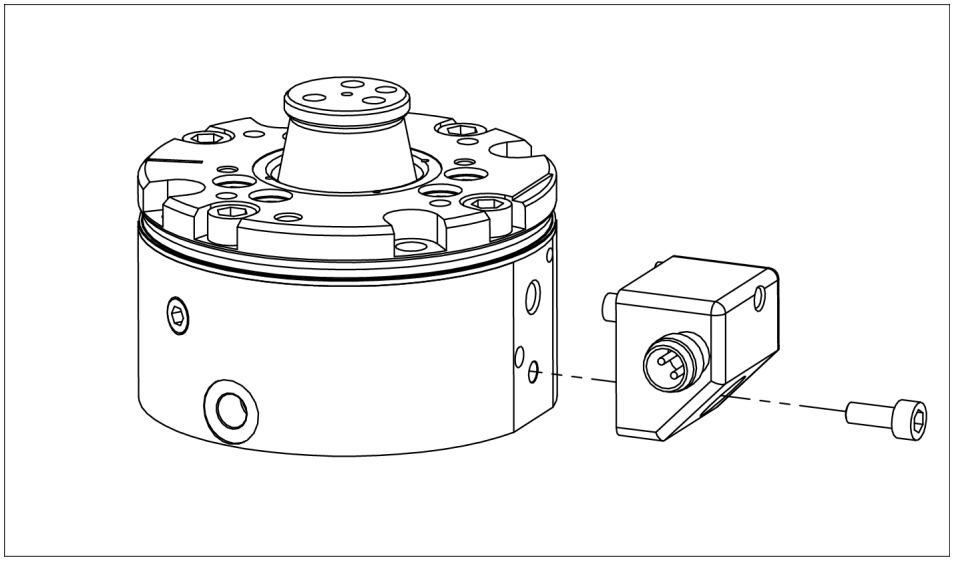
1. Remove the mounting screw using a 2.5 mm hex key
2. Pull the Connector Block away from the OPR being careful not to strain the wires inside.
3. Loosen the locknut on the proximity switch.
4. Screw the proximity switch out of the body.
5. Discard the entire assembly.



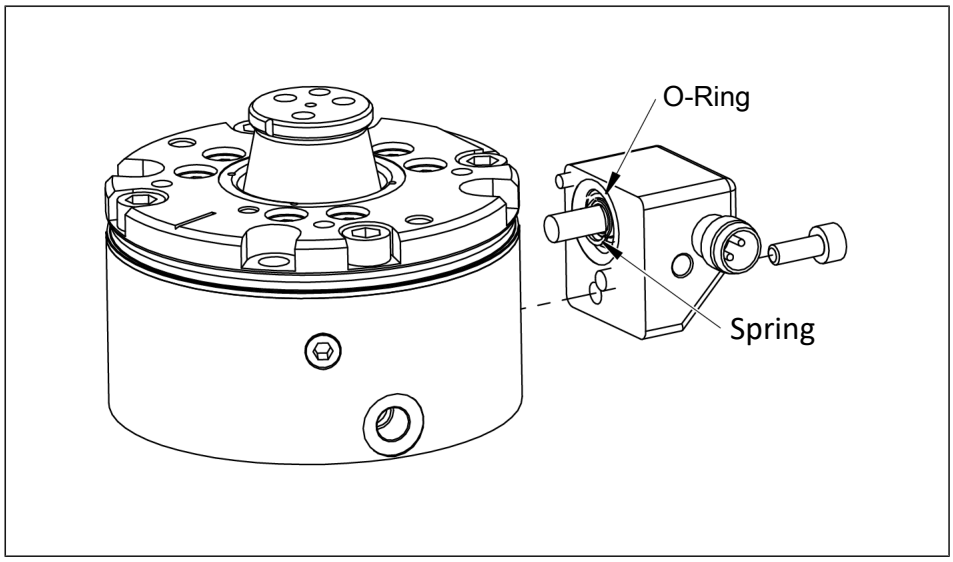
6. **IMPORTANT! If the piston is not up against the dog point screws while screwing in the proximity switch, applying air to the unit could damage the proximity switch. Make sure the Stem is locked into position indicating the piston is against the dog point screws.** Provide 0.3 to 1 bar of air to the unit at the port marked "P" (unless the unit is equipped with preload springs).
7. Screw the new proximity switch clockwise into the hole on the side of the body until it bottoms.

8. Rotate the connector block along with the proximity switch to prevent damage to the wires.
9. Screw the proximity switch out 1 turn (counterclockwise).
10. Perform switch adjustment ▸ 5.2.1.1 [🗋 19]
11. Press the Connector Block Assembly firmly against the body of the OPR while tightening the screw. When tightened securely, the Connector Block Assembly should rest parallel to its mounting surface.

Replacement of New version



1. Remove the mounting screw using a 2.5 mm hex key
2. Pull the Connector Block away from the OPR.
3. Discard the entire assembly.



4. Provide 0.3 to 1 bar of air to the unit at the port marked "P" (unless the unit is equipped with preload springs).

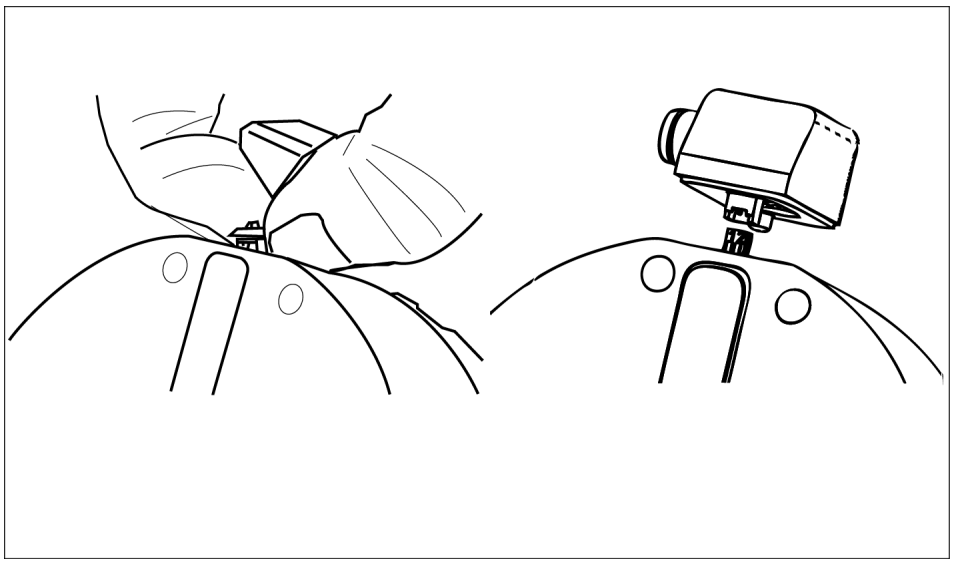
5. Make sure the Spring is on the sensor and the O-ring is seated in the Connector Block. Press the Connector Block Assembly firmly against the body of the OPR while tightening the screw to 0.45 Nm. When tightened securely, the Connector Block Assembly should rest parallel to its mounting surface.
6. Perform switch adjustment ▸ 5.2.1.1 [🗋 19]

8.4.2 Replacement of connector block assembly for OPR 081 – 221

There are two styles of connector block assemblies. Older version have wires to connect the Connector Board to the OPR. Newer versions have the Connector Boards attached to the Connector Block

Removal

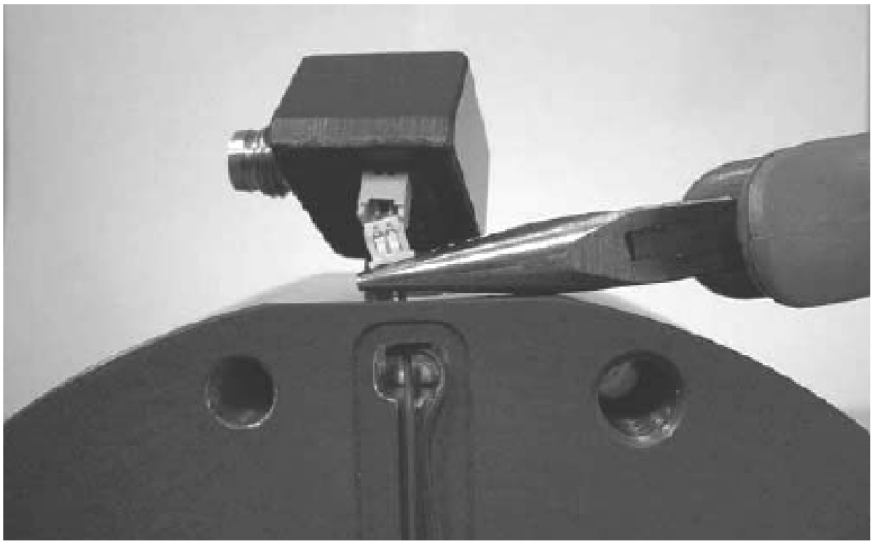
1. Remove the mounting screw using a 2.5 mm Allen wrench.
2. Pull the Connector Block Assembly away from the OPR just enough to ensure that the gasket is free from the body (Older version: Be careful not to strain the wires inside).
3. If the Connector Board pulls away from the Connector Block perform the next step. Otherwise perform afternext step.



Removement of connector block assembly

4. Pivot the connector block up and away from the OPR and firmly grasp the circuit board on either side of the PCB Header. Pull the circuit board away from the OPR, bringing the connector block along with it.
   ⇨ This will unplug the PCB Header from its mate in the body of the OPR.
5. Unplug the PCB Header from its mate in the body of the OPR. (Newer versions have the Connector Boards attached to the Connector Block.)

Replacement



Connector block assembly replacement

1. Hold the Micro Header Socket protruding from the Body with needle nose pliers while plugging it into the PCB Header of the Connector Block Assembly. Position the Connector Block Assembly so that the dowel pin in the Connector Block Assembly is aligned with its mating hole in the Body.
2. Carefully push the Connector Block Assembly into position. Check to see that the connector parts have properly mated by letting the Connector Block Assembly fall away from the OPR body.
3. Re-position the Connector Block Assembly for final attachment and check that the 3 wire loops are not pinched between the Connector Block Assembly and the body of the OPR. (Newer versions do not contain wire loops.)
4. Slide the plastic flat washer onto the mounting screw and apply a drop of Loctite® 222MS to the end of the threads.
5. Install the mounting screw and plastic flat washer.
6. Press the Connector Block Assembly firmly against the body of the OPR while tightening the screw. When tightened securely, the Connector Block Assembly should rest parallel to its mounting surface.
7. Confirm the integrity of the circuit between the 3-pole Nano connector and the internal switch ▸ 5.2 [🗋 16]

8.5 Re-lubrication

Disassembly

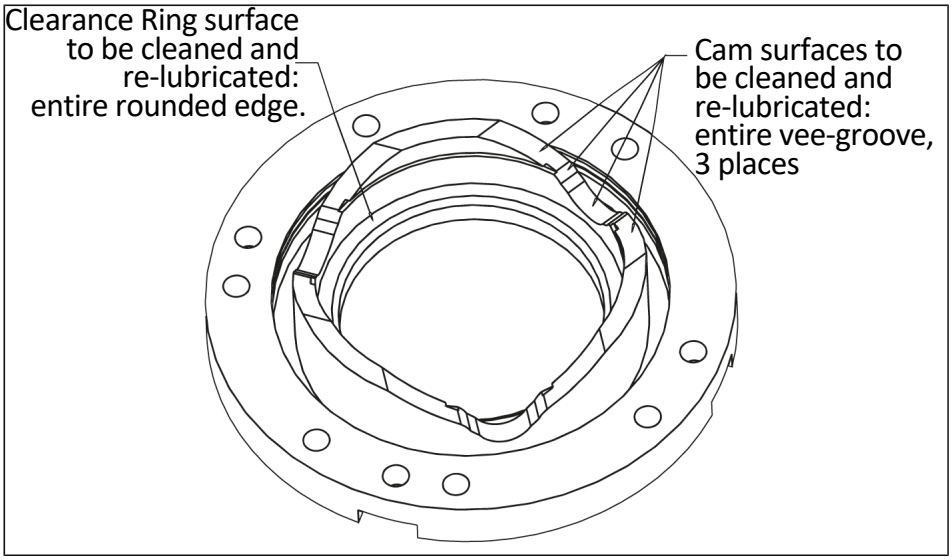
NOTE

Cleaning may be accomplished with a clean, dry rag. For more thorough cleaning, use isopropyl alcohol.

1. Remove the four socket head cap screws securing the Cover Plate assembly to the Body.
   IMPORTANT! During factory assembly, Loctite is applied to the screws to prevent them from coming loose in operation. As a result, it may be necessary to use a hot air gun to individually heat the screws (and the immediate areas of the Body) in order to soften the Loctite and allow the screws to be removed.

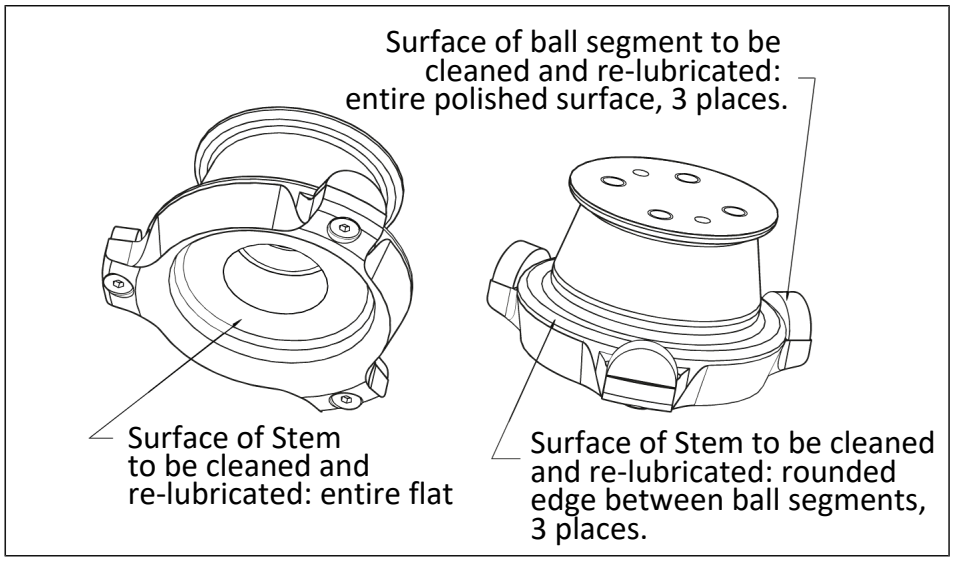
CAUTION

- Do not attempt to pry or wedge the Cover Plate assembly and Body apart. Doing so can damage the mating surfaces and may render the parts unusable.
- The Cover Plate assemblies and Stem assemblies are factory-assembled as matched parts. Do not allow either of these assemblies to be mixed with those from other units.



Cleaning and Relubricating the Cover Plate Assembly

2. Remove the Cover Plate assembly by carefully pulling it straight up and off of the Body. This may be difficult due to the close fit of the dowel pins used to align the parts. It may be necessary to hold the unit up by the Cover Plate and lightly tap on the Stem with a rubber or plastic mallet.
   IMPORTANT! The dowel pins are pressed into the Cover Plate and are a slip fit into the Body.

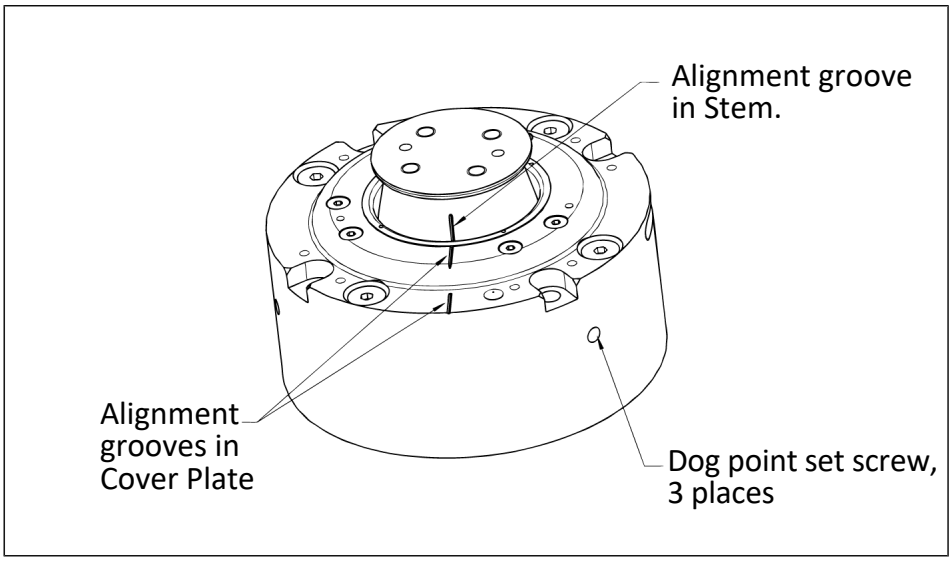


Cleaning and Re-lubricating the Stem

3. Clean the lubricant from the working surfaces of the Cam and the Clearance Ring. Set the Cover Plate assembly aside for later re-use.
4. Remove the Stem assembly and clean the lubricant from the working surfaces of the ball segments and the Stem. Set the Stem assembly aside for later re-use.
5. Clean the lubricant from the working surfaces of the Piston Cap. Push the Piston assembly to the bottom of the Body.

Re-assembly

1. Apply a generous coating of CRC Extreme Pressure Moly C.V. Joint Grease (Moly Grease) to the top of the Piston Cap and to the rounded edges.
2. Apply a generous coat of Moly Grease to each of the three ball segments on the Stem Assembly and to the rounded edge of the shoulders between the ball segments. Apply a layer of Moly Grease to the flat underneath surface of the Stem (see Figure "Cleaning and Re-lubricating the Stem").
3. Apply a generous coat of Moly Grease to each of the three v-grooves in the Cam and to the rounded edge of the Clearance Ring (see Figure "Cleaning and Relubricating the Cover Plate Assembly").
4. (This step applies only to OPR-131s, OPR-176s, and OPR-221s) Apply Magnalube® to the Cover Seal and assemble to the groove in the Cover Plate.



5. With the Stem assembly upright, set the Cover Plate assembly onto it. Make certain that the alignment grooves are lined up.
6. Place the Stem and Cover Plate together onto the Body. Make certain that the dowel pins in the Plate and the Stem are still lined up.
7. Press the Cover Plate down onto the Body.
8. Apply Loctite 222MS to the four socket head cap screws and thread them into the Body. (Note: On units with the Spring Assist Option it is necessary to use two opposing screws to evenly pull the Cover Plate down against the Body.) Tighten the screws per the following table

Size OPR	Screw	Recommended Torque
061	–	–
081 / 101	M5 x 20 Socket Flat Heard Cap Screw	6.2 Nm
131	M6 x 25 Socket Flat Heard Cap Screw	7.9 Nm
176	M8 x 40 Socket Flat Heard Cap Screw	19.7
221	M10 x 30 Socket Heard Cap Screw	47.4

Tab.: Recommended Tightening Torques for Cover Screws

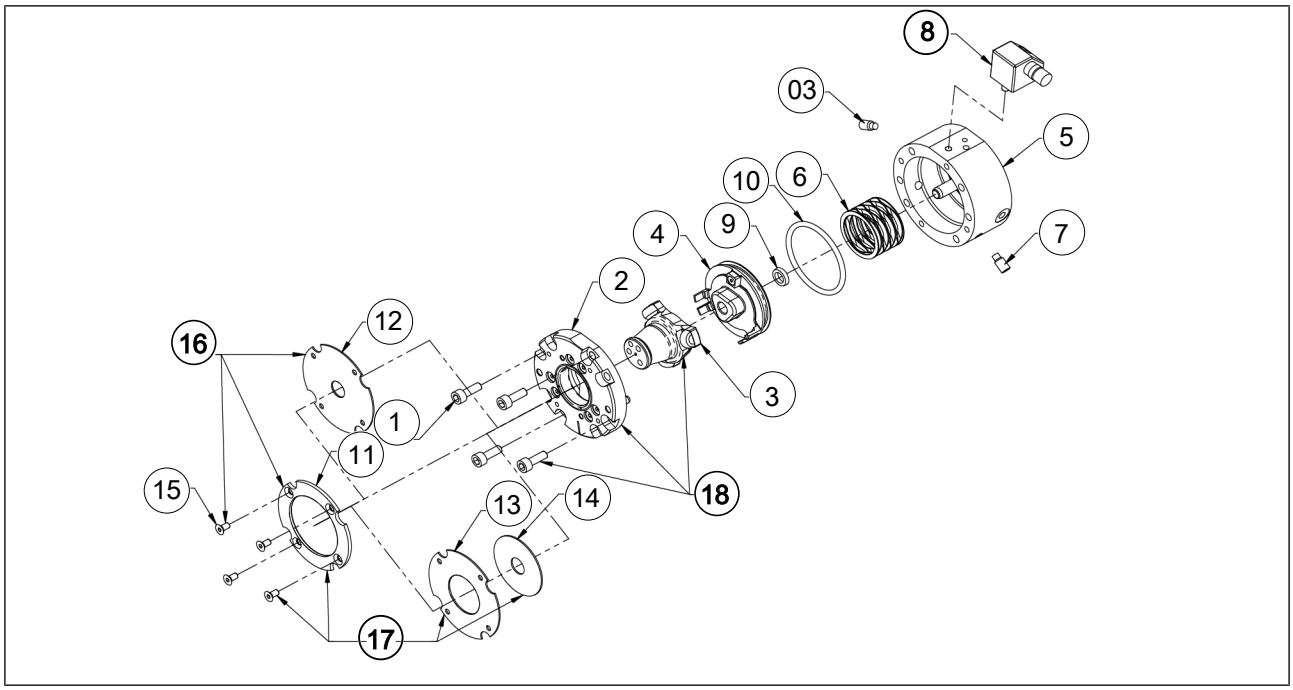
CAUTION

Before putting the Protector back into operation, confirm that the switch is functioning properly ▶ 5.2 [🗋 16]

9 Drawings

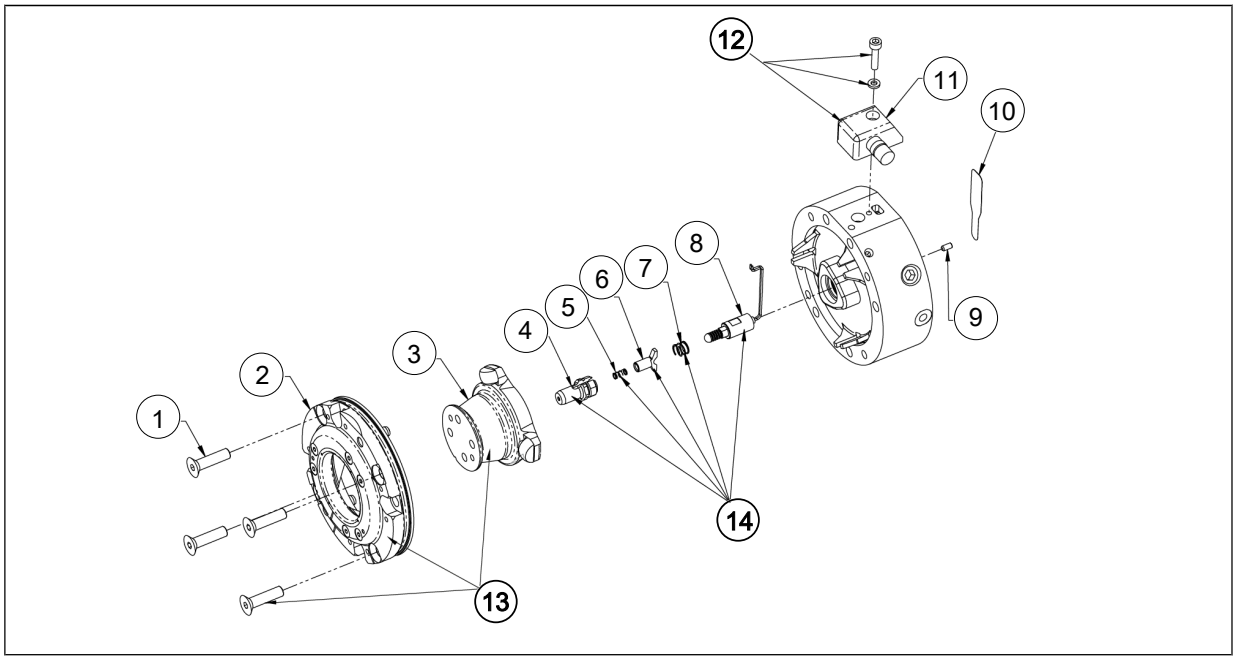
The following figures are example images.
They serve for illustration and assignment of the spare parts.
Variations are possible depending on size and variant.

9.1 OPR 61



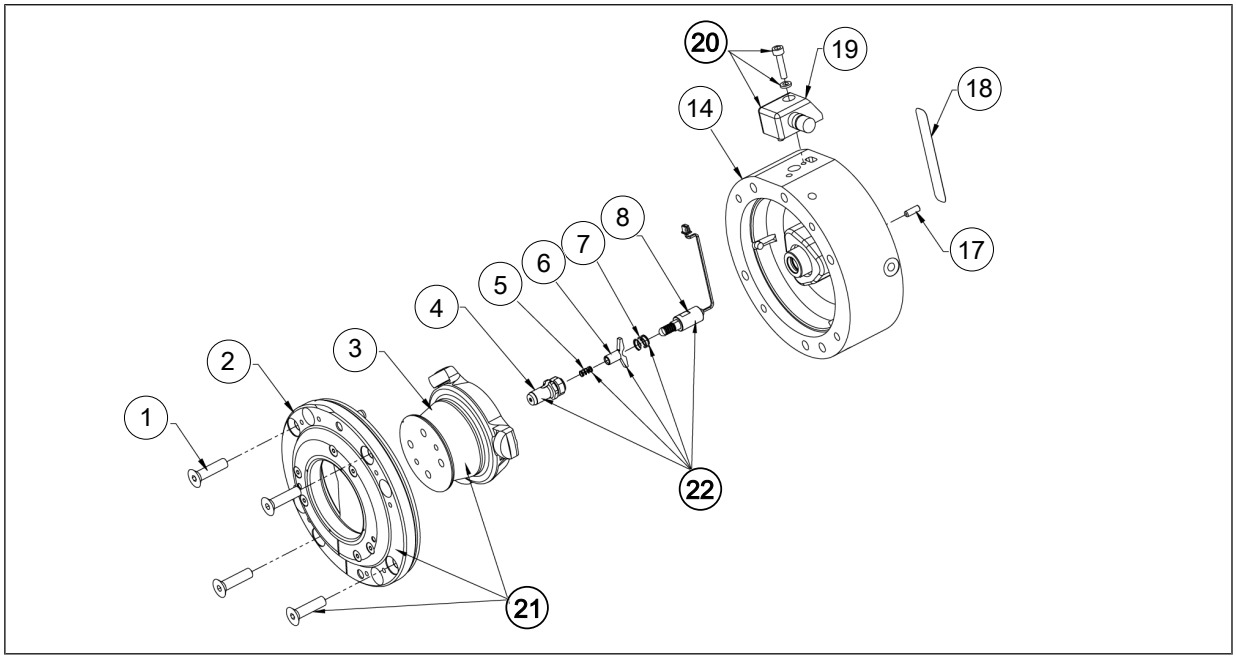
Item	Designation	ID number
8	Connector plug	9965112
16	Dust and spray cover	9954890
17	Welding sparks cover	9958058
18	Deflection mechanism	9952010

9.2 OPR 081



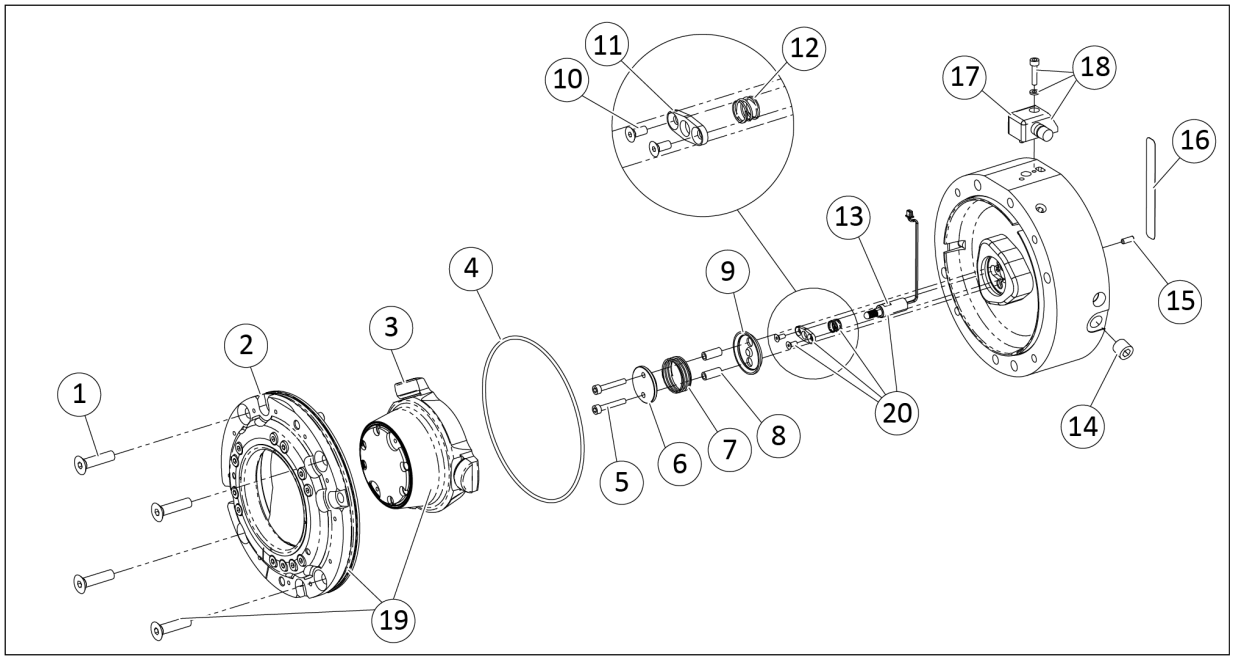
Item	Designation	ID number
12	Connector plug	9939134
13	Deflection mechanism	0321391
14	Sensor kit	9957437

9.3 OPR 101



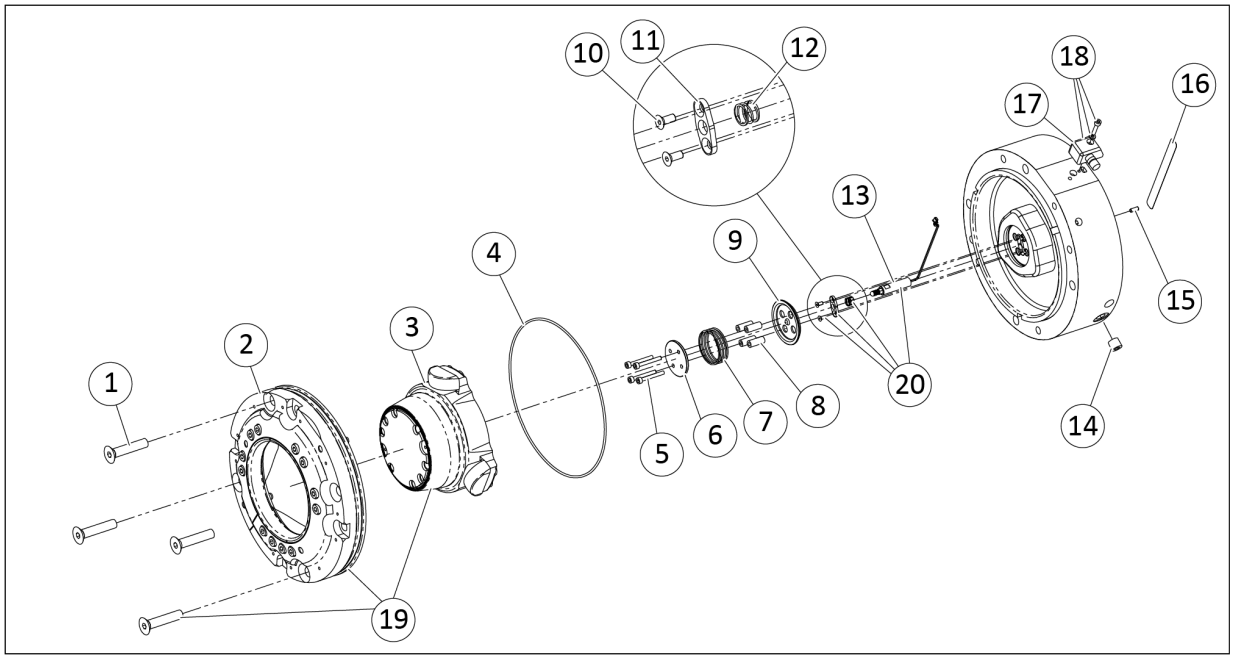
Item	Designation	ID number
20	Connector plug	9939134
21	Deflection mechanism	0321421
22	Sensor kit	9939550

9.4 OPR 131



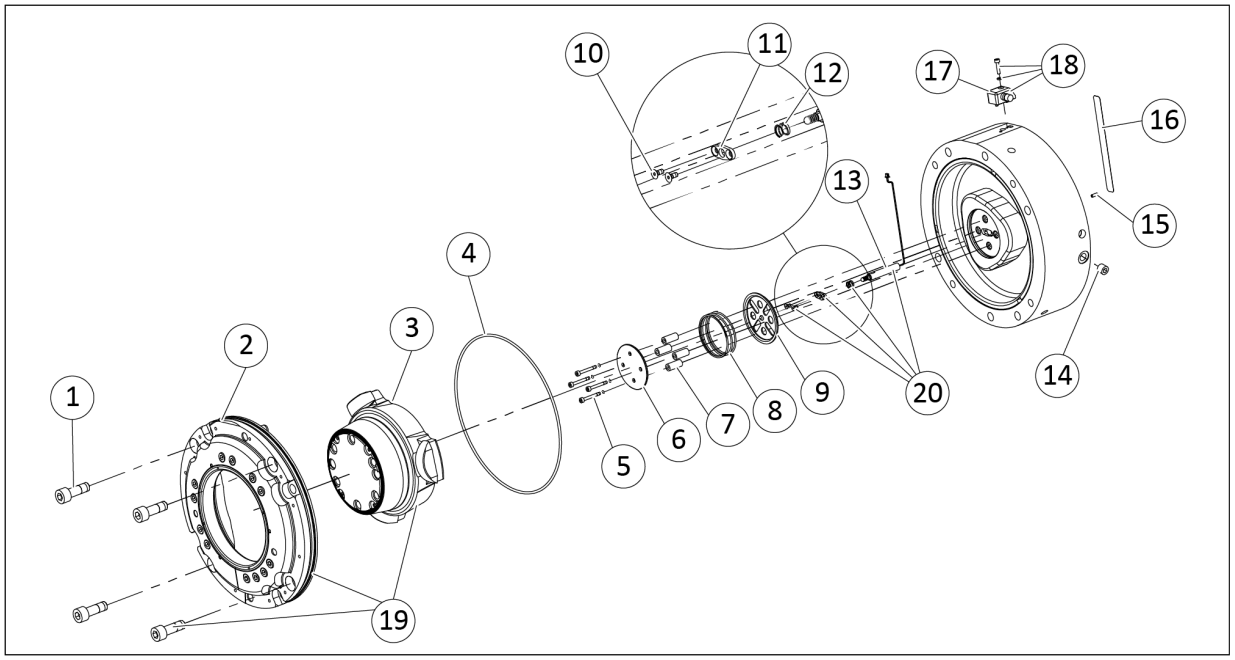
Item	Designation	ID number
18	Connector plug	9939134
19	Deflection mechanism	0321451
20	Sensor kit	9952600

9.5 OPR 176



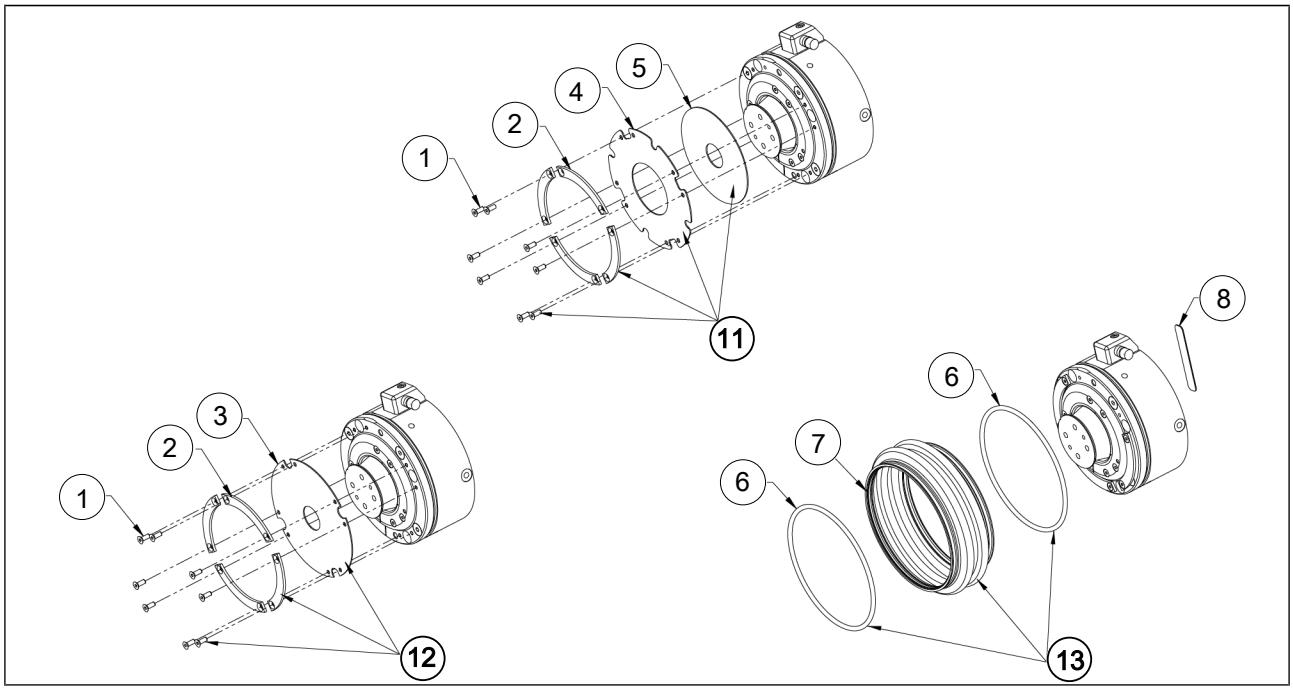
Item	Designation	ID number
18	Connector plug	9939134
19	Deflection mechanism	0321491
20	Sensor kit	9900038

9.6 OPR 221



Item	Designation	ID number
18	Connector plug	9939134
19	Deflection mechanism	0321541
20	Sensor kit	9939587

9.7 Dust and splashing water protection



Item	Designation	OPR					
		061	081	101	131	176	221
11	OPR welding splatter	9958058	9955588	9960517	9960518	9960519	9960520
12	OPR – S-kit splashing water protection (IP65)	–	0321390	0321420	0321450	0321490	0321540
13	OPR – flexboot splash-ing water protection (IP65)	0321376	0321195	0321416	0321447	0321492	0321535

10 Translation of the original declaration of incorporation

in terms of the Directive 2006/42/EG, Annex II, Part 1 Section B.

Manufacturer/ Distributor	SCHUNK SE & Co. KG Spanntechnik | Greiftechnik | Automatisierungstechnik Bahnhofstr. 106 – 134 D–74348 Lauffen/Neckar

We hereby declare that the partly completed machine described below

Product designation:	Collision and Overload Protection Sensor / OPR 061–221/pneumatic
ID number	0321361, 0321362, 0321363, 0321364, 0321881, 0321882, 0321883, 0321884, 0321401, 0321402, 0321403, 0321404, 0321431, 0321432, 0321433, 0321476, 0321477, 0321478, 0321479, 0321521, 0321522, 0321523, 0321524

meets the following basic occupational health and safety of the Machinery Directive 2006/42/EC:

No. 1.1.1, No. 1.1.2, No. 1.1.3, No. 1.1.5, No. 1.3.2, No. 1.5.3, No. 1.5.4, No. 1.5.6, No. 1.5.8, No. 1.5.10, No. 1.5.11, No. 1.5.13

The partly completed machinery may not be put into operation until it has been confirmed that the machine into which the partly completed machinery is to be installed complies with the provisions of the Machinery Directive (2006/42/EC). The declaration shall be rendered invalid if modifications are made to the product.

Applied harmonized standards, especially:

EN ISO 12100:2010	Safety of machinery – General principles for design – Risk assessment and risk reduction

The special technical documentation according to Annex VII, Part B, belonging to the partly completed machine, has been created.

Person authorized to compile the technical documentation:
Stefanie Walter, Address: see manufacturer's address

Signature: see original declaration

Lauffen/Neckar, October 2024

Dr.–Ing. Manuel Baumeister,
Head of Systems Engineering,
Technology & Innovation

11 UKCA declaration of incorporation

in accordance with the Supply of Machinery (Safety) Regulations 2008.

Manufacturer/ Distributor	SCHUNK Intec Limited Clamping and gripping technology 3 Drakes Mews, Crownhill MK8 0ER Milton Keynes

We hereby declare that on the date of the declaration the following partly completed machine complied with all basic safety and health regulations found in the
"Supply of Machinery (Safety) Regulations 2008".
The declaration shall be rendered invalid if modifications are made to the product.

Product designation:	Collision and Overload Protection Sensor / OPR 061-221 / pneumatic
ID number	0321361, 0321362, 0321363, 0321364, 0321881, 0321882, 0321883, 0321884, 0321401, 0321402, 0321403, 0321404, 0321431, 0321432, 0321433, 0321476, 0321477, 0321478, 0321479, 0321521, 0321522, 0321523, 0321524

The partly completed machine may not be put into operation until it has been confirmed that the machine into which the partly completed machine is to be installed complies with the provisions of the "Supply of Machinery (Safety) Regulations 2008".

Applied harmonized standards, especially:

EN ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction

The special technical documentation according to Annex VII, Part B, belonging to the partly completed machine, has been created.

Person authorized to compile the technical documentation:
Marcel Machado, address: refer to manufacturer's address

Lauffen/Neckar, October 2024

Dr.-Ing. Manuel Baumeister,
Head of Systems Engineering,
Technology & Innovation

12 Information on the RoHS Directive, REACH Regulation and Substances of Very High Concern (SVHC)

RoHS Directive

SCHUNK products are classified as "large-scale stationary installations" or as "large-scale stationary industrial tools" within the meaning of Directive 2011/65/EU and its extension 2015/863/EU "on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)", or fulfill their intended function only as part of one. Therefore products from SCHUNK do not fall within the scope of the directive at this time.

REACH Regulation

Products from SCHUNK fully comply with the regulations of Regulation (EC) No. 1907/2006 "concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)" and its amendment 2022/477. SCHUNK attaches great importance to completely avoiding chemicals of concern to humans and the environment wherever possible.

Only in rare exceptional cases do SCHUNK products contain SVHC substances on the candidate list with a mass content above 0.1%. In accordance with Article. 33 (1) of Regulation (EC) No. 1907/2006, SCHUNK complies with its duty to "communicate information on substances in articles" and lists the components concerned and the substances used in an overview that can be viewed at **schunk.com\SVHC**.

Signature: see original declaration

Lauffen/Neckar, October 2024

Dr.-Ing. Manuel Baumeister,
Head of Systems Engineering,
Technology & Innovation

SCHUNK SE & Co. KG
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