

# Assembly and Operating Manual

## LWA 4P

### Powerball lightweight arm



Superior Clamping and Gripping



## Imprint

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### Technical changes:

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

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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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## 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.

Illustrations in this manual are provided for basic understanding and may differ from the actual product design.

In addition to these instructions, the documents listed under [Applicable documents](#) [► 6] are applicable.

#### 1.1.1 Presentation of Warning Labels

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



#### **⚠ DANGER**

##### **Danger 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.

#### **NOTICE**

##### **Material damage!**

Information about avoiding material damage.

### 1.1.2 Applicable documents

- General terms of business\*
- Assembly and operating manuals of the accessories \*

The documents marked with an asterisk (\*) can be downloaded on our homepage **schunk.com**

## 1.2 Warranty

If the product is used as intended, the warranty is valid for 12 months from the ex-works delivery date under the following conditions:

- Intended use in 1-shift operation
- 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

- Powerball lightweight arm LWA 4P in the version ordered
- Operating manual
- EPROM parameters for all rotary modules in list format
- Accessory pack
  - 2 x connection cables LWA4 CAN (ID number 5522658)
  - 1 x connection cable LWA4 RS232 (ID number 5522659)
  - 1 x USB cable (ID number 9959120)
  - 1 x cable fitting M20 (ID number 9960423)
  - 1 x hood 3A-GG-M20 (ID number 9960426)
  - 1 x socket insert HAN4A-BU-S (ID number 9960427)
  - 2 x Cylindrical pin (ID number 9682058)
- Transport container

## 1.4 Accessories

A wide range of accessories are available for this product

| ID number | Designation                              | Note                                       |
|-----------|--|--|
| 9961672   | Brainbox RS485                           | For use with an SVH 5-finger gripping hand |
| 31000871  | FWA115, tool exchange adapter            | Hand exchange flange for adapting a tool   |
| 307913    | PCM 15 USB CAN bus interface (esd v./2)B | CAN/USB converter for connecting a PC      |
| 31001036  | PAE 200 PCAN termination                 | CAN bus termination for master / on the PC |

The following SCHUNK end effectors/grippers are suitable for attachment to the LWA 4P:

| ID number | Designation  |
|-----------|--|
| 0306456   | SVH servo-electric 5-finger gripping hand, right               |
| 0306457   | SVH servo-electric 5-finger gripping hand, left                |
| 0306452   | SDH servo-electric 3-finger gripping hand                      |
| 31001294  | PG-plus 70 servo-electric 2-finger parallel gripper            |
| 31000860  | PG-plus 70 servo-electric 2-finger parallel gripper, dustproof |
| 31001005  | EGP 40 electric 2-finger parallel gripper                      |
| 31000905  | WSG servo-electric 2-finger parallel gripper                   |
| 30064043  | FTM 115 force-torque module                                    |

## 2 Basic safety notes

### 2.1 Intended use

The Powerball lightweight arm LWA 4P is hereinafter referred to as lightweight arm

A SCHUNK gripper is mounted on the lightweight arm. Alternatively, it is possible to install an end effector or measuring device supplied by the customer. The electric and mechanical connection specifications must be observed.

The robot control system - with the exception of the commissioning and demo mode - is provided by the customer. The robot control system must master the required safety functions.

The manufacturer of the machine is responsible for carrying out a risk analysis and for the protective equipment resulting from the analysis.

The safety-related information contained in the "Electrical equipment of machines" standard (DIN EN 60204) must be observed. Commissioning is only permitted in compliance with EMC directives (89/336/EEC).

- The product may only be used within the scope of its technical data, [Technical data](#) [► 18].
- The product is intended for installation in a machine/system. The applicable guidelines must be observed and complied with.
- Appropriate use of the product includes compliance with all instructions in this manual.

Modifications, additions, and conversions that could impair safety may not be made to the lightweight arm without permission from SCHUNK.

Unauthorized changes result in the exclusion from product liability.

### 2.2 Not intended use

- Any utilization that exceeds or differs from the appropriate use is regarded as misuse.
- A use is deemed particularly inappropriate when the lightweight arm is used for one of the following purposes:
  - Use as a guide for machining tools
  - Use as a lifting tool
  - Use as an actuation tool
  - Use as a climbing aid
  - Use without additional protective equipment
  - Use outdoors
  - Use in potentially explosive environments



## 2.3 Constructional changes

### Implementation of structural changes

By conversions, changes, and reworking, e.g. additional threads, holes, or safety devices can impair the functioning or safety of the product or damage it.

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

## 2.4 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 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.

## 2.5 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.

## **2.6 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.

## **2.7 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.

## **2.8 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.

## **2.9 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.

## **2.10 Fundamental dangers**

### **General**

- Observe safety distances.
- Never deactivate safety devices.
- Before commissioning the product, take appropriate protective measures to secure the danger zone.
- Disconnect power sources before installation, modification, maintenance, or calibration. Ensure that no residual energy remains in the system.
- If the energy supply is connected, do not move any parts by hand.
- Do not reach into the open mechanism or movement area of the product during operation.

### **2.10.1 Protection during handling and assembly**

#### **Incorrect handling and assembly**

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

- Have all work carried out by appropriately qualified personnel.
- For all work, secure the product against accidental operation.
- Observe the relevant accident prevention rules.
- Use suitable assembly and transport equipment and take precautions to prevent jamming and crushing.

#### **Incorrect lifting of loads**

Falling loads may cause serious injuries and even death.

- Stand clear of suspended loads and do not step into their swiveling range.
- Never move loads without supervision.
- Do not leave suspended loads unattended.

### **2.10.2 Protection during commissioning and operation**

#### **Falling or violently ejected components**

Falling and violently ejected components can cause serious injuries and even death.

- Take appropriate protective measures to secure the danger zone.
- Never step into the danger zone during operation.

### **2.10.3 Protection against dangerous movements**

#### **Unexpected movements**

Residual energy in the system may cause serious injuries while working with the product.

- Switch off the energy supply, ensure that no residual energy remains and secure against inadvertent reactivation.
- The faulty actuation of connected drives may cause dangerous movements.
- Operating mistakes, faulty parameterization during commissioning or software errors may trigger dangerous movements.
- Never rely solely on the response of the monitoring function to avert danger. Until the installed monitors become effective, it must be assumed that the drive movement is faulty, with its action being dependent on the control unit and the current operating condition of the drive. Perform maintenance work, modifications, and attachments outside the danger zone defined by the movement range.

- To avoid accidents and/or material damage, human access to the movement range of the machine must be restricted. Limit/prevent accidental access for people in this area due through technical safety measures. The protective cover and protective fence must be rigid enough to withstand the maximum possible movement energy. EMERGENCY STOP switches must be easily and quickly accessible. Before starting up the machine or automated system, check that the EMERGENCY STOP system is working. Prevent operation of the machine if this protective equipment does not function correctly.

#### 2.10.4 Protection against electric shock

##### Work on electrical equipment

Touching live parts may result in death.

- Work on the electrical equipment may only be carried out by qualified electricians in accordance with the electrical engineering regulations.
- Lay electrical cables properly, e. g. in a cable duct or a cable bridge. Observe standards.
- Before connecting or disconnecting electrical cables, switch off the power supply and check that the cables are free of voltage. Secure the power supply against being switched on again.
- Before switching on the product, check that the protective earth conductor is correctly attached to all electrical components according to the wiring diagram.
- Check whether covers and protective devices are fitted to prevent contact with live components.
- Do not touch the product's terminals when the power supply is switched on.

##### Possible electrostatic energy

Components or assembly groups may become electrostatically charged. When the electrostatic charge is touched, the discharge may trigger a shock reaction leading to injuries.

- The operator must ensure that all components and assembly groups are included in the local potential equalisation in accordance with the applicable regulations.
- While paying attention to the actual conditions of the working environment, the potential equalisation must be implemented by a specialist electrician according to the applicable regulations.
- The effectiveness of the potential equalisation must be verified by executing regular safety measurements.

### **2.10.5 Protection against magnetic and electromagnetic fields**

#### **Work in areas with magnetic and electromagnetic fields**

Magnetic and electromagnetic fields can lead to serious injuries.

- Persons with pace-makers, metal implants, metal shards, or hearing aids require the consent of a physician before entering areas in which components of the electric drive and control systems are mounted, started up, and operated.
- Persons with pace-makers, metal implants, metal shards, or hearing aids require the consent of a physician before entering areas in which magnetic grippers or motor parts with permanent magnets are stored, repaired, or assembled.
- Do not operate high-frequency or radio devices in the proximity of electric components of the drive system and their feed lines.

If the use of such devices is necessary:

When starting up the electric drive and control system, check the machine or automated system for possible failures when such systems are used at different intervals and in different states of the control system. A special additional EMC test may be necessary if the system has a high risk potential.

## 2.11 Notes on particular risks



### **⚠ DANGER**

#### **Danger from electric voltage!**

Touching live parts may result in death.

- Switch off the power supply before any assembly, adjustment or maintenance work and secure against being switched on again.
- Only qualified electricians may perform electrical installations.
- Check if de-energized, ground it and hot-wire.
- Cover live parts.



### **⚠ DANGER**

#### **Risk of fatal injury from suspended loads!**

Falling loads can cause serious injuries and even death.

- Stand clear of suspended loads and do not step within their swiveling range.
- Never move loads without supervision.
- Do not leave suspended loads unattended.
- Wear suitable protective equipment.



### **⚠ WARNING**

#### **Risk of injury from objects falling and being ejected!**

Falling and ejected objects during operation can lead to serious injury or death.

- Take appropriate protective measures to secure the danger zone.



### **⚠ WARNING**

#### **Risk of injury due to unexpected movements!**

If the power supply is switched on or residual energy remains in the system, components can move unexpectedly and cause serious injuries.

- Before starting any work on the product: Switch off the power supply and secure against restarting.
- Ensure that no residual energy remains in the system.



### **⚠ WARNING**

#### **Risk of injury due to hot surfaces.**

In high ambient temperatures, it is possible for the product to be exposed to excessive heat, causing the surfaces to become hot.

- Wear protective gloves.
- Allow the product to cool to at least 40°C before touching it.



### **⚠ WARNING**

#### **Risk of injury due to sudden movements in case of EMC malfunctions!**

If the EMC directive is not observed when connecting the product, malfunctions in the control units and drives can cause unexpected machine movements.

- Observe the EMC directive when connecting the product.



### **⚠ WARNING**

#### **In case of overload, risk of injury due to sudden movements!**

If the product is overloaded, the integrated brake will no longer function properly. This may result in sudden machine movements.

- Operate the product within the specifications defined at all times.



### **⚠ WARNING**

#### **In case of product malfunction, risk of injury due to sudden movements!**

Electrical devices are not generally protected against failure.

- Therefore, the user is responsible for ensuring that the machine is brought into a safe state in case of product malfunction.



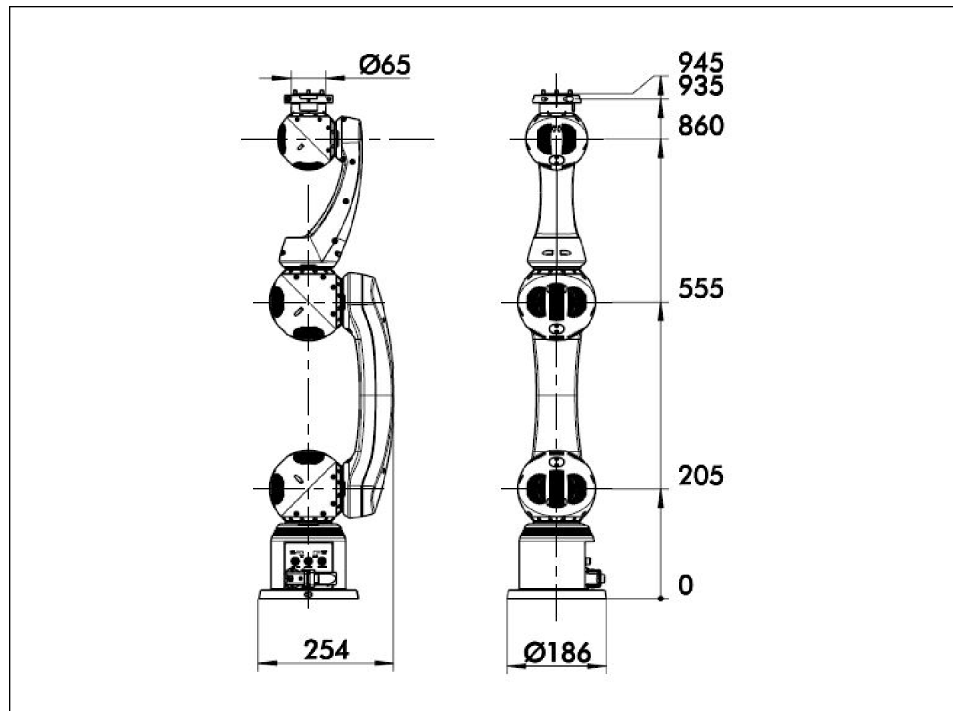
**⚠ WARNING****Risk of injury due to sudden movements in case of electrical malfunctions!**

Electrical malfunctions can lead to sudden movements in the machine.

- During transport and handling, do not bend any of the components or change the insulation clearance.
- To avoid damage due to electrostatic charges, do not touch the electrical components.
- Properly execute all grounding, fastening and cabling work in accordance with applicable regulations.

### 3 Technical data

#### 3.1 Outer dimensions



#### 3.2 Basic data

|  |  |
|--|--|
| Ident number                             | 0306960  |
| Type                                     | 6 DOF lightweight articulated robot  |
| Number of axes                           | 6  |
| Max. load [kg]                           | 3 to 6<br>(depending on deflection)  |
| Weight [kg]<br>without base<br>with base | 12<br>15   |
| Repeatability [mm]                       | ±0.15  |
| Position feedback                        | Pseudo-absolute position measuring   |
| Drives                                   | Brushless servomotors with permanent-magnet brake  |
| Robot control system                     | <ul style="list-style-type: none"> <li>SCHUNK COT, LWA Tool<br/>(only for commissioning and demonstration purposes)</li> <li>Robot Operating System ROS<br/>(Open Source Framework for the development of a robot control system by users themselves with Linux as the basis)</li> </ul> |

*Environmental and operating conditions*

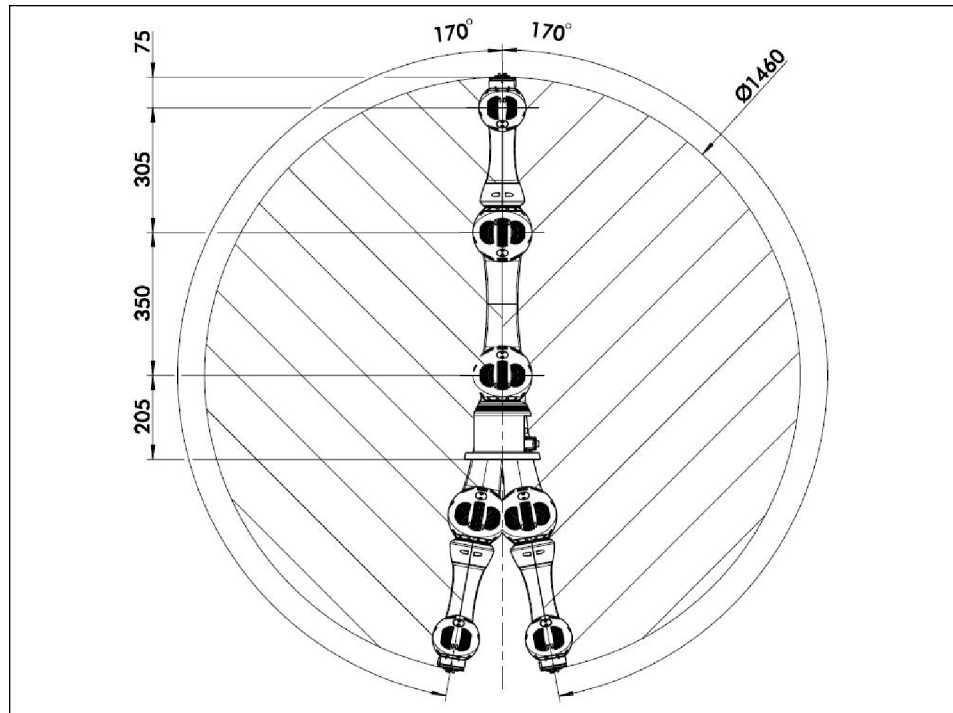
|  |            |
|--|------------|
| Ambient temperature [°C]<br>min.<br>max. | +10<br>+50 |
| IP protection class *                    | 54         |
| Noise emission [dB(A)]                   | ≤ 70       |

| Axis number | Speed with nominal load | Type of rotary module | Range (preset software limit switches) |
|-------------|-------------------------|-----------------------|--|
| 1           | 72°/s                   | ERB 145               | ±170°                                  |
| 2           | 72°/s                   | ERB 145               | ±170°                                  |
| 3           | 72°/s                   | ERB 145               | ±155°                                  |
| 4           | 72°/s                   | ERB 145               | ±170°                                  |
| 5           | 72°/s                   | ERB 115               | ±170°                                  |
| 6           | 72°/s                   | ERB 115               | ±170°                                  |

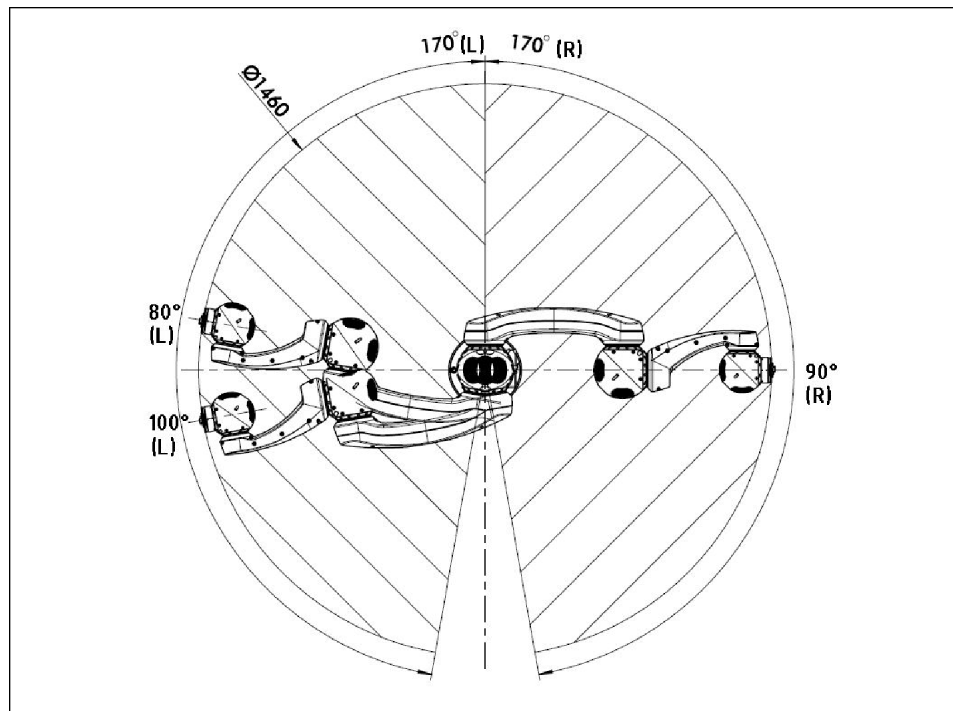
### 3.3 Electrical operating data

|                                |  |
|--------------------------------|--|
| <b>Drive</b>                   |  |
| Nominal voltage [VDC]          | 24.0 ± 5%  |
| Nominal power current [A]      | 5  |
| Max. current [A]               | 14   |
| <b>Electronic control unit</b> |  |
| Power supply [VDC]             | 24.0   |
| Nominal power current [A]      | 1.1  |
| Interface                      | CAN bus (Protocol: CANopen CiA DS402:IEC61800-7-201), two lines are also provided for signals. |

### 3.4 Work area/protected area



*Work area, vertical*



*Work area, horizontal*

Both of the illustrations of the work area show the space in which the lightweight arm is able to move. The geometry of the grippers attached must be added to these areas.

### 3.5 Name plate

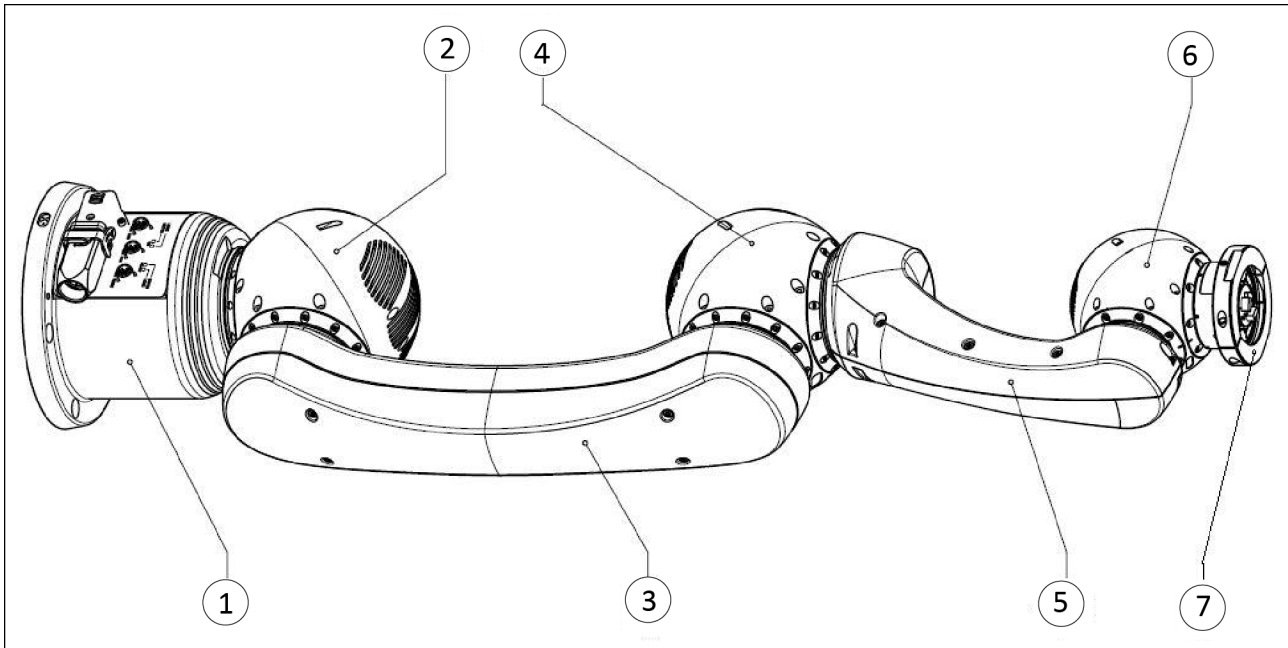


*Name plate*

The name plate is located on the robot base underneath the Harting connector.

## 4 Design and description

### 4.1 Design



Overall view of the lightweight arm

|   |   |   |   |
|---|---|---|---|
| 1 | Robot base (basic flange and electrical connection panel) | 4 | Axis 3 and 4<br>ERB 145 double-axis rotary module |
| 2 | Axis 1 and 2<br>ERB 145 double-axis rotary module         | 5 | Connecting element VBE F145-115-W90               |
| 3 | Connecting element VBE F145-145-P                         | 6 | Axis 5 and 6<br>ERB 115 double-axis rotary module |

## 4.2 Description

The 6-axis lightweight arm is essentially composed of the following components

- Robot base for mechanical mounting. The electrical connections are located at the robot base
- Three double-axis rotary modules in different sizes
- Coupling flange for an end effector/gripper or a sensor
- Connecting elements between the rotary modules

The lightweight arm can be used universally thanks to the 6 axes geometry. The low current input makes it possible to operate the lightweight arm either via a power supply or battery.

The complete control, regulation and power electronics is integrated in each rotary module. In the robot base, there is an additional board with connection sockets and status-LED's for the voltage to be fed (24 V DC).

The coupling flange (SCHUNK Flat Manual Change System) makes it possible to use various grippers from the SCHUNK range [Accessories](#) [► 7].

The lightweight arm is controlled via a CAN bus interface with CANopen protocol. In addition, a second CAN bus interface and an RS232 interface are available. The AUX CAN (CAN\_SDH) and RS232 signals are sent via an internally routed cable up to the last double-axis rotary module. In the double-axis rotary module, the signals are looped through and are available for use on the end effector/gripper/sensor module attached.

The lightweight arm is equipped with separate 24-V connections for the motor voltage and the logic voltage.

This separate voltage supply makes it possible to continue working on the electronic control unit when the drives are switched off, for example due to low battery voltage or after an emergency stop and reset.

Four LEDs on the robot base show the ready status of the lightweight arm.

### Angle of rotation limitation of the axes

The permitted angle of rotation of all the axes of the lightweight arm is limited by adjustable software end positions. These software end positions serve as machine guards and are set so that the lightweight arm cannot drive into the mechanical end stops. The software end positions do not protect against mechanical collisions if multiple axes are moved from their pre-set zero position simultaneously. The software end positions are pre-set by the manufacturer (see EPROM parameter lists attached).

## 5 Assembly and settings

### 5.1 Mechanical connection

#### NOTICE

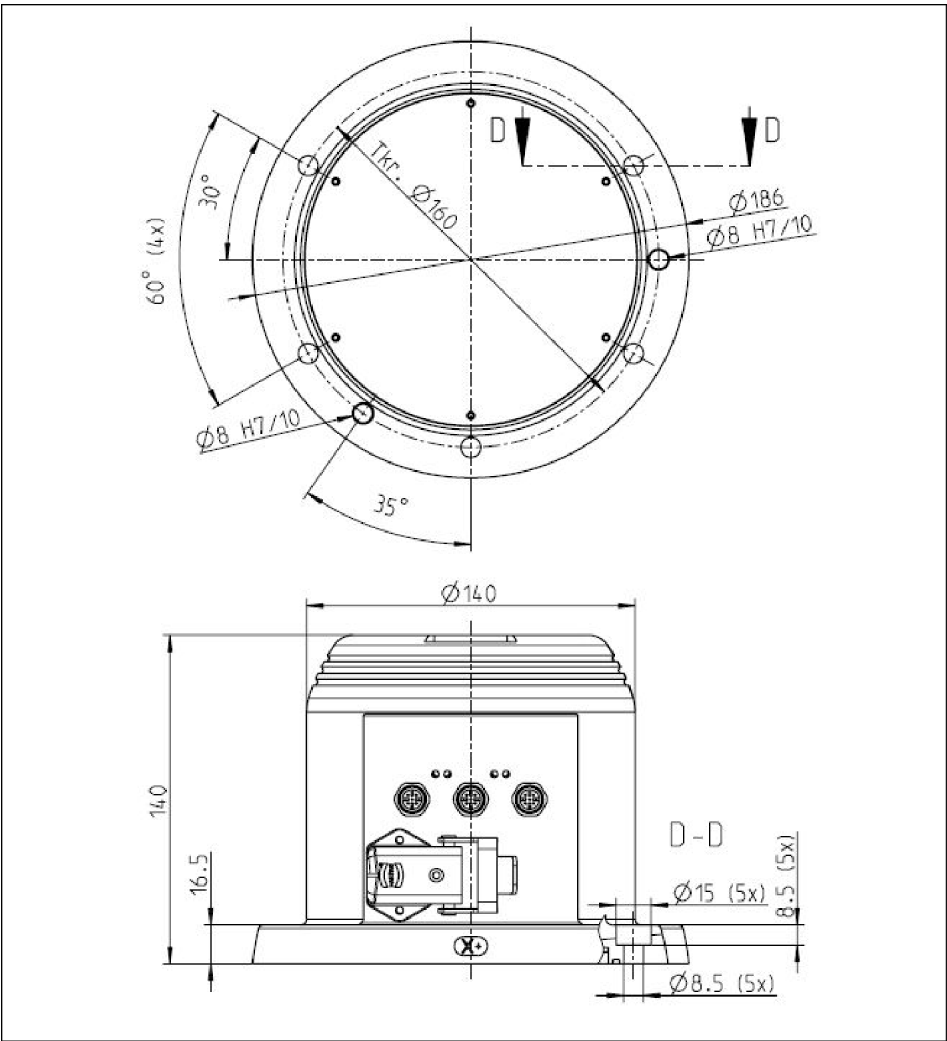
**Risk of damage when using unsuitable connecting elements!**  
Unsuitable components can result in damage to the product.  
SCHUNK recommends using SCHUNK connecting elements.

#### Evenness of the mounting surface

The values apply to the whole mounting surface to which the product is mounted.

*Requirements for evenness of the mounting surface (Dimensions in mm)*

| Edge length | Permissible unevenness |
|-------------|------------------------|
| < 100       | < 0.02                 |
| > 100       | < 0.05                 |



|   |   |
|---|---|
| 1 | 5 x through bores $\varnothing 8.5$ for M8 screws                 |
| 2 | 2 x blind holes (10 mm deep) for centering pin $\varnothing 8$ mm |



Two M10 centering pins are included as mounting aids. The fixing screws must be secured against loosening.

The mounting surface must be designed to carry the load of the lightweight arm and securely hold the fixing screws.

The lightweight arm can be mounted on the ground, on the side of a wall or suspended from the ceiling.

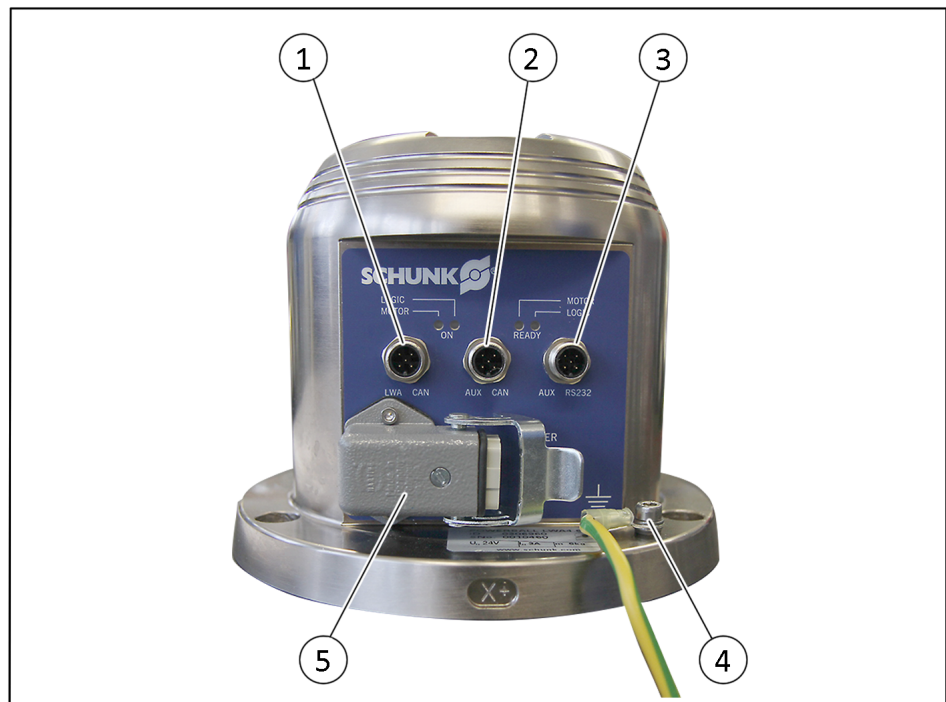
## 5.2 Electrical connection

### NOTICE

**Risk of operational malfunction and damage due to short circuit or incorrect connections! Faulty electrical connections**

Faulty electrical connections may cause malfunction and damage.

- Before connecting, ensure that the electrical lines are deenergized.
- Be sure to distribute the clamps correctly.



Electrical connection

|   |            |           |  |
|---|------------|-----------|--|
| 1 | X11 socket | LWA CAN   | CAN bus communication for LWA rotary modules                         |
| 2 | X12 socket | AUX CAN   | CAN bus communication for optional accessories                       |
| 3 | X13 socket | AUX RS232 | Serial interface for optional accessories                            |
| 4 | Ground     | -         | Screw for connecting the functional ground                           |
| 5 | X3 socket  | POWER LWA | Power supply (motor voltage and logic voltage, 24 V DC respectively) |

The suitable cables for the CAN bus connections is included with the lightweight arm. For the power supply, the lightweight arm includes a plug insert with the necessary accessories for connecting the operator side cables.

#### Pin connection for the sockets on the robot base

| Pin                 | Assignment                              | Recommended cable cross-section [mm <sup>2</sup> ] |
|---------------------|---|--|
| <b>POWER LWA X3</b> |   |  |
| 1                   | +24 VDC Logic voltage                   | 0.5  |
| 2                   | +24 VDC Motor voltage                   | 1.5  |
| 3                   | GND for logic voltage and motor voltage | 1.5  |
| 4                   | Not used                                | -  |
| 5                   | Internal grounding                      | 1.5  |

| Pin                  | Assignment                           |
|----------------------|--------------------------------------|
| <b>LWA CAN X11</b>   |                                      |
| 1                    | Not used                             |
| 2                    | Not used                             |
| 3                    | GND                                  |
| 4                    | CAN High (_H_ERB)                    |
| 5                    | CAN Low (_L_ERB)                     |
| <b>AUX CAN X12</b>   |                                      |
| 1                    | Earth                                |
| 2                    | Not used                             |
| 3                    | GND                                  |
| 4                    | CAN High SDH/FTM (Res 3)             |
| 5                    | CAN Low SDH/FTM (Res 4)              |
| <b>AUX RS232 X13</b> |                                      |
| 1                    | TX SDH /Res 1 (or customer-specific) |
| 2                    | RX SDH /Res 2 (or customer-specific) |
| 3                    | GND                                  |
| 4                    | Not used                             |
| 5                    | Earth                                |

**Pin allocation of the D-sub connecting plug on the CAN Bus cables**

| Pin | Assignment |
|-----|------------|
| 2   | CAN Low    |
| 3   | GND        |
| 7   | CAN High   |

**Pin allocation of the D-sub connecting plug on the RS232 cable**

| Pin | Assignment |
|-----|------------|
| 2   | RX SDH     |
| 3   | TX SDH     |
| 5   | GND        |

**CAN bus termination**

Each CAN bus network must also be terminated on the control side (e.g. PAE 200 PCAN termination, [Accessories](#) [► 7]).

The termination of the LWA CAN is activated by the manufacturer in the ERB115 rotary module (axes 5 and 6). When using a gripper (e.g. PG-plus 70), the LWA CAN is terminated in the gripper by the manufacturer and the termination in the ERB115 must be deactivated.

### 5.3 Installing and connecting



#### **⚠ WARNING**

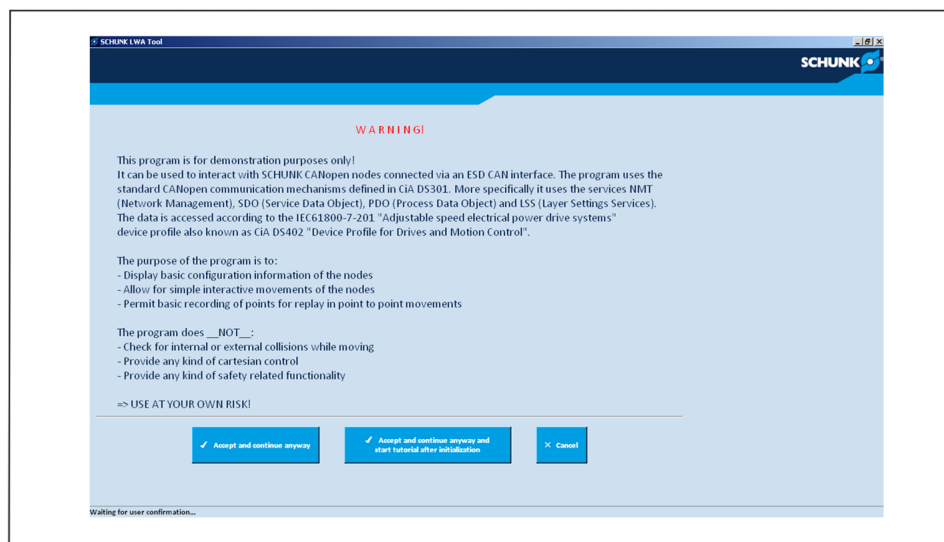
##### **Risk of injury due to unexpected movements!**

If the power supply is switched on or residual energy remains in the system, components can move unexpectedly and cause serious injuries.

- Before starting any work on the product: Switch off the power supply and secure against restarting.
  - Ensure that no residual energy remains in the system.
- 
- Screw the robot base of the lightweight arm onto the mounting surface [Mechanical connection](#) [► 24].
  - Mount the gripper/end effector or sensor module on the lightweight arm (see ERB 115/145 double-axis rotary module documentation).
  - Install operator-side protective devices.
  - Connect the power supply cable to the supplied 5-pin connector assembly and connect to the POWER LWA (X3) socket on the robot base [Electrical connection](#) [► 25].
  - Connect the data cable to the LWA-CAN X111 socket.
  - Depending on the accessories used, connect additional data cables to the AUX CAN or AUX RS232 socket.

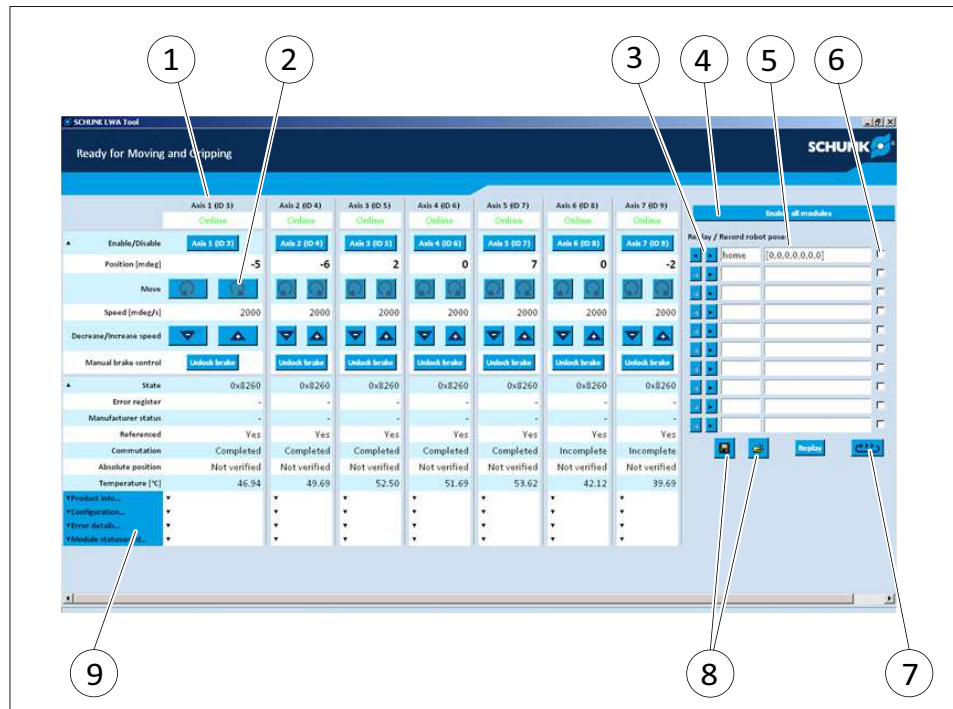
## 6 Commissioning

- Ensure that the lightweight arm is securely mounted mechanically, the protective devices are available and the electrical connections are correctly executed.
- Ensure that the CAN bus lines used are terminated on both sides.
- Switch on the controller (e.g. PC).
- Switch on the power supply for the lightweight arm.
- Download the software for commissioning and demo mode from the Internet or request it from SCHUNK Service:
  - SCHUNK LWA Tool: [robotics@schunk.com](mailto:robotics@schunk.com)
  - Robot Operating System ROS: <http://www.ros.org>
- Start LWA\_Tool.exe. The program automatically searches for the CAN bus devices connected. A message will be displayed explaining that the software may only be used for demonstration purposes. Use of the software is at your own risk. The center button starts a tutorial on program operation.



Message screen

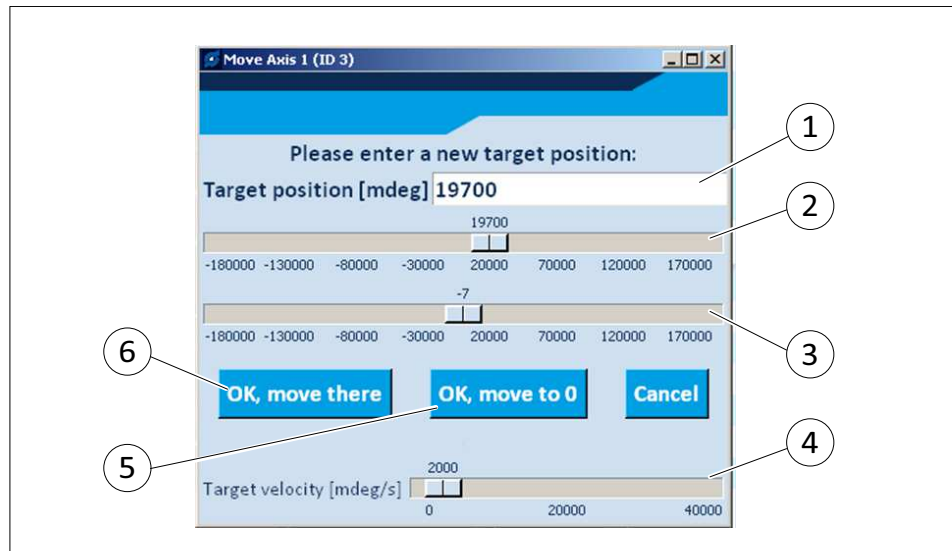
- Press the left or center button. In the following, the start is described without the tutorial (left button). The user interface is displayed.



User interface

|   |  |   |   |
|---|--|---|---|
| 1 | Column for operation and status display for every axis (here: axis 1)  | 6 | Selection field for "active" positions. Marked positions are approached consecutively in the demo start |
| 2 | "Move Axis" button for accessing the dialog window for axis movement   | 7 | Demo start button. The marked positions are approached in an infinite loop                              |
| 3 | Arrow keys for applying the approached position of the lightweight arm to the list of saved positions (and vice versa) | 8 | Save and Open buttons for demo motion sequences   |
| 4 | Release button for all rotary modules  | 9 | Buttons for function selection  |
| 5 | Saved position of the lightweight arm in the form (axis 1, axis 2..., axis 7), values in mdeg                          |   |   |

- Operating example: Press the "Move Axis" button in the axis 1 column. The "Move Axis 1 (ID 3)" dialog window is displayed.



The "Move Axis 1 (ID 3)" dialog window

|   |   |   |  |
|---|---|---|--|
| 1 | Input field for numerical mdeg values that are to be approached | 4 | Slide control for setting movement speed             |
| 2 | Slide control for setting a value to be approached              | 5 | "OK, move to 0" button; moves axis to the 0 position |
| 3 | Display of the axis position                                    | 6 | "OK, move there" button; moves axis to the set value |

- Prepare movement. To do this, enter the numerical value in the input field or adjust the top slide control with the mouse.
- Press the "OK, move there" button. The selected axis moves to the set value.

Additional information on operations can be found in the tutorial. The option of displaying the tutorial can be selected at program startup.

### 6.1 Adjusting rotary modules

The rotary modules are pre-set by the manufacturer (see EPROM parameter lists attached).

Changing the settings at a later point is possible via the CAN bus or the respective service interface.

| Axis | CAN-ID | Rotary module | CAN_ERB | CAN_SDH  | RS232    |
|------|--------|---------------|---------|----------|----------|
| 1    | 3      | ERB 145       | X       | -        | -        |
| 2    | 4      | ERB 145       | X       | -        | -        |
| 3    | 5      | ERB 145       | X       | -        | -        |
| 4    | 6      | ERB 145       | X       | -        | -        |
| 5    | 7      | ERB 115       | X       | -        | -        |
| 6    | 8      | ERB 115       | X       | -        | -        |
| G    | 12     | Option PG+70  | X       | -        | -        |
| -    | -      | End effector  | -       | Optional | Optional |

To adjust the rotary module, see separate document:

- Assembly and Operating Manual servo-electric double-axis rotary module ERB 115/ERB 145

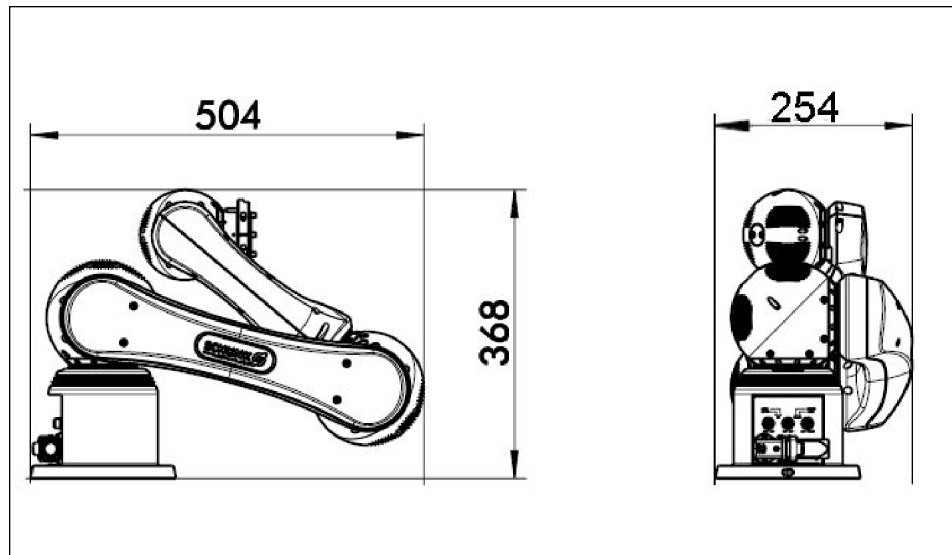


## 6.2 Placing the lightweight arm in transport position

For transporting or shipping, stow the lightweight arm in the original transport container with foam cut-outs.

The end effector/gripper or sensor module installed must be uninstalled.

Place the lightweight arm in the transport position, allowing the lightweight arm to fit into the original transport container.



| Axis | Angular degree | Set point     |
|------|----------------|---------------|
| A2   | -105°          | -105,000 mdeg |
| A3   | -155°          | -155,000 mdeg |
| A5   | +140°          | 140,000 mdeg  |

The A1, A4 and A6 axes should each be in their 0 degrees position.

## **7 Functional description**

The lightweight arm is controlled via the CAN bus interface during operation.

The magnetic holding brakes integrated in the axis modules are automatically released immediately when switching to a movement mode.

If the movement mode is exited or the motor voltage is switched off, the brakes are applied magnetically (after a very short delay).

Before switching off the logic voltage, all brakes must be applied.

This can be achieved, for example, by switching off the motor voltage a few seconds in advance.

## 8 Troubleshooting

### 8.1 Communication interrupted

| Possible cause                | Corrective action  |
|-------------------------------|--|
| Faulty termination of CAN bus | Check whether the termination settings are correct (termination at the beginning and end of the bus)       |
|                               | Perform a measurement between the CAN_H and CAN_L (set value: 60 $\Omega$ )                                |
|                               | On the rotary modules, check whether the microswitch is correctly switched to the position for termination |

### 8.2 Product is not reacting, not moving or stops suddenly

| Possible cause  | Corrective action                                    |
|---|--|
| The power supply for the drive or the electronic control unit has malfunctioned | Check the power supply                               |
| Communication has been connected incorrectly                                    | Check the signal communication lines                 |
| Supply cable is defective   | Check supply cables for damage; replace if necessary |

### 8.3 Unusual noise during operation

| Possible cause    | Corrective action                     |
|-------------------|---------------------------------------|
| Mechanical damage | Send the product to SCHUNK for repair |

## 9 Maintenance, cleaning and repair

### 9.1 Maintenance

This product does not require maintenance.

### 9.2 Cleaning

Clean the surface of the product when necessary.

**The general rule is:**

- Only use solvent-free, water-based cleaning agents.
- The cleaning agent may not be flammable.
- Do not use steam, coolant or high-pressure cleaners.
- Do not allow the cleaning agent to penetrate into electrical or mechanical equipment.

### 9.3 Repair

#### **NOTICE**

##### **Risk of damage due to improper use of the product!**

The mechanics and internal electronics may become damaged when disassembling the product.

- The product may only be disassembled and repaired by SCHUNK.

The components of the product are adapted to each other. Repairs are only possible at the manufacturer.

For repair or replacement, send the product repair order to SCHUNK together with a repair order.

## 10 Translation of the original declaration of incorporation

in terms of the Directive 2006/42/EG, Annex II, Part 1.B of the European Parliament and of the Council on machinery.

|                              |   |
|------------------------------|---|
| Manufacturer/<br>Distributor | SCHUNK GmbH & Co. KG Spann- und Greiftechnik<br>Bahnhofstr. 106 – 134<br>D-74348 Lauffen/Neckar |
|------------------------------|---|

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 directive 2006/42/EC of the European Parliament and of the Council on machinery. The declaration is rendered invalid if modifications are made to the product.

|                     |                                    |
|---------------------|------------------------------------|
| Product designation | Powerball lightweight arm/LWA 4P / |
| ID number           | 0306960                            |

The partly completed machine may not be put into operation until conformity of the machine into which the partly completed machine is to be installed with the provisions of the Machinery Directive (2006/42/EC) is confirmed.

Applied harmonized standards, especially:

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

|                     |  |
|---------------------|--|
| EN ISO 10218-1:2011 | Industrial robots - Safety requirements - Part 1: Robots |
|---------------------|--|

The manufacturer agrees to forward on demand the relevant technical documentation for the partly completed machinery in electronic form to national authorities.

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

Person authorized to compile the technical documentation:  
Robert Leuthner, Address: see manufacturer's address

*Signature: see original declaration*

Lauffen/Neckar, January 2018

Dr. Markus Klaiber,  
Technical Managing Director

## 10.1 Annex to Declaration of Incorporation

according 2006/42/EG, Annex II, No. 1 B

1. Description of the essential health and safety requirements pursuant to 2006/42/EC, Annex I that are applicable and that have been fulfilled with:

|                     |                           |
|---------------------|---------------------------|
| Product designation | Powerball lightweight arm |
| Type designation    | LWA 4P                    |
| ID number           | 0306960                   |

|   |   |
|---|---|
| To be provided by the System Integrator for the overall machine | ↓ |
| Fulfilled for the scope of the partly completed machine         | ↓ |
| Not relevant  | ↓ |

| 1.1   | Essential Requirements                         |  |   |   |
|-------|--|--|---|---|
| 1.1.1 | Definitions                                    |  | X |   |
| 1.1.2 | Principles of safety integration               |  |   | X |
| 1.1.3 | Materials and products                         |  | X |   |
| 1.1.4 | Lighting                                       |  |   | X |
| 1.1.5 | Design of machinery to facilitate its handling |  | X |   |
| 1.1.6 | Ergonomics                                     |  | X |   |
| 1.1.7 | Operating positions                            |  |   | X |
| 1.1.8 | Seating  |  |   | X |

| 1.2     | Control Systems                           |  |   |   |
|---------|---|--|---|---|
| 1.2.1   | Safety and reliability of control systems |  |   | X |
| 1.2.2   | Control devices                           |  | X |   |
| 1.2.3   | Starting                                  |  | X |   |
| 1.2.4   | Stopping                                  |  | X |   |
| 1.2.4.1 | Normal stop                               |  | X |   |
| 1.2.4.2 | Operational stop                          |  | X |   |
| 1.2.4.3 | Emergency stop                            |  | X |   |
| 1.2.4.4 | Assembly of machinery                     |  | X |   |
| 1.2.5   | Selection of control or operating modes   |  |   | X |
| 1.2.6   | Failure of the power supply               |  |   | X |

| 1.3   | Protection against mechanical hazards   |  |   |   |
|-------|---|--|---|---|
| 1.3.1 | Risk of loss of stability               |  |   | X |
| 1.3.2 | Risk of break-up during operation       |  | X |   |
| 1.3.3 | Risks due to falling or ejected objects |  |   | X |
| 1.3.4 | Risks due to surfaces, edges or angles  |  | X |   |
| 1.3.5 | Risks related to combined machinery     |  |   | X |

|            |  |   |   |   |
|------------|--|---|---|---|
| <b>1.3</b> | <b>Protection against mechanical hazards</b>                     |   |   |   |
| 1.3.6      | Risks related to variations in operating conditions              |   |   | X |
| 1.3.7      | Risks related to moving parts                                    |   | X |   |
| 1.3.8      | Choice of protection against risks arising from moving parts     |   |   | X |
| 1.3.8.1    | Moving transmission parts  |   | X |   |
| 1.3.8.2    | Moving parts involved in the process                             |   |   | X |
| 1.3.9      | Risks of uncontrolled movements                                  |   |   | X |
| <b>1.4</b> | <b>Required characteristics of guards and protective devices</b> |   |   |   |
| 1.4.1      | General requirements   |   |   | X |
| 1.4.2      | Special requirements for guards                                  |   |   | X |
| 1.4.2.1    | Fixed guards   |   |   | X |
| 1.4.2.2    | Interlocking movable guards                                      |   |   | X |
| 1.4.2.3    | Adjustable guards restricting access                             |   |   | X |
| 1.4.3      | Special requirements for protective devices                      |   |   | X |
| <b>1.5</b> | <b>Risks due to other hazards</b>                                |   |   |   |
| 1.5.1      | Electricity supply   |   | X |   |
| 1.5.2      | Static electricity   |   | X |   |
| 1.5.3      | Energy supply other than electricity                             |   | X |   |
| 1.5.4      | Errors of fitting  |   | X |   |
| 1.5.5      | Extreme temperatures   |   |   | X |
| 1.5.6      | Fire   |   |   | X |
| 1.5.7      | Explosion  |   |   | X |
| 1.5.8      | Noise  |   |   | X |
| 1.5.9      | Vibrations   |   |   | X |
| 1.5.10     | Radiation  | X |   |   |
| 1.5.11     | External radiation   | X |   |   |
| 1.5.12     | Laser radiation  | X |   |   |
| 1.5.13     | Emissions of hazardous materials and substances                  |   |   | X |
| 1.5.14     | Risk of being trapped in a machine                               |   |   | X |
| 1.5.15     | Risk of slipping, tripping or falling                            |   |   | X |
| 1.5.16     | Lightning  |   |   | X |
| <b>1.6</b> | <b>Maintenance</b>   |   |   |   |
| 1.6.1      | Machinery maintenance  |   | X |   |
| 1.6.2      | Access to operating positions and servicing points               |   |   | X |
| 1.6.3      | Isolation of energy sources                                      |   |   | X |
| 1.6.4      | Operator intervention  |   |   | X |
| 1.6.5      | Cleaning of internal parts                                       |   | X |   |

| 1.7     | Information   |   |   |  |
|---------|---|---|---|--|
| 1.7.1   | Information and warnings on the machinery           |   | X |  |
| 1.7.1.1 | Information and information devices                 |   | X |  |
| 1.7.1.2 | Warning devices                                     |   | X |  |
| 1.7.2   | Warning of residual risks                           |   | X |  |
| 1.7.3   | Marking of machinery                                | X |   |  |
| 1.7.4   | Instructions  |   | X |  |
| 1.7.4.1 | General principles for the drafting of instructions |   | X |  |
| 1.7.4.2 | Contents of the instructions                        |   | X |  |
| 1.7.4.3 | Sales literature                                    |   | X |  |

|       | The classification from Annex 1 is to be supplemented from here forward.   |  |   |   |
|-------|--|--|---|---|
| 2     | Supplementary essential health and safety requirements for certain categories of machinery                                       |  |   | X |
| 2.1   | Foodstuffs machinery and machinery for cosmetics or pharmaceutical products  |  |   | X |
| 2.2   | Portable hand-held and/or guided machinery   |  |   | X |
| 2.2.1 | Portable fixing and other impact machinery   |  |   | X |
| 2.3   | Machinery for working wood and material with similar physical characteristics  |  |   | X |
| 3     | Supplementary essential health and safety requirements to offset hazards due to the mobility of machinery                        |  | X |   |
| 4     | Supplementary essential health and safety requirements to offset hazards due to lifting operations                               |  |   | X |
| 5     | Supplementary essential health and safety requirements for machinery intended for underground work                               |  |   | X |
| 6     | Supplementary essential health and safety requirements for machinery presenting particular hazards due to the lifting of persons |  |   | X |