



# Assembly and Operating Instructions



MAXOLUTION® System Solution  
**Parallel Arm Kinematics Kit**  
MAXO-RPS--R...-...-...-...



## Table of contents

<b>1</b>	<b>General information</b> .....	<b>5</b>
1.1	About this documentation .....	5
1.2	Applicable documentation.....	5
1.3	Structure of the safety notes.....	5
1.4	Decimal separator in numerical values .....	6
1.5	Rights to claim under limited warranty .....	6
1.6	Product names and trademarks.....	7
1.7	Copyright notice.....	7
<b>2</b>	<b>Safety notes</b> .....	<b>8</b>
2.1	Preliminary information .....	8
2.2	Duties of the user.....	8
2.3	Target group .....	8
2.4	Designated use.....	9
2.5	Risk assessment and risk reduction .....	10
2.6	Verification .....	10
2.7	Transport.....	10
2.8	Setup and installation.....	10
2.9	Electrical installation .....	11
2.10	Protective separation .....	11
2.11	Startup and operation .....	12
2.12	Inspection and maintenance .....	13
<b>3</b>	<b>Device structure</b> .....	<b>14</b>
3.1	Description .....	14
3.2	Type designation.....	15
3.3	Configuration.....	16
3.4	Scope of delivery .....	18
3.5	Control and visualization.....	19
3.6	Mechanical components .....	20
<b>4</b>	<b>Installation</b> .....	<b>27</b>
4.1	General information .....	27
4.2	Mechanical installation.....	27
4.3	Electrical installation .....	28
4.4	Sequence.....	30
<b>5</b>	<b>Startup</b> .....	<b>31</b>
5.1	General information .....	31
5.2	Sequence.....	31
5.3	MOVIKIT® Robotics .....	31
5.4	Referencing.....	32
<b>6</b>	<b>Operation</b> .....	<b>37</b>
<b>7</b>	<b>Service</b> .....	<b>38</b>
7.1	Inspection and maintenance .....	38
7.2	Electronics Service by SEW-EURODRIVE.....	38

## Table of contents

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7.3	Waste disposal.....	38
8	<b>Technical data</b> .....	<b>40</b>
9	<b>MAXOLUTION® Competence Center</b> .....	<b>41</b>

# 1 General information

## 1.1 About this documentation

**The current version of the documentation is the original.**

This documentation is an integral part of the product. The documentation is intended for all employees who perform work on the product.

Make sure this documentation is accessible and legible. Ensure that persons responsible for the systems and their operation as well as persons who work on the product independently have read through the documentation carefully and understood it. If you are unclear about any of the information in this documentation, or if you require further information, contact SEW-EURODRIVE.

## 1.2 Applicable documentation

Observe the following other applicable documentation:

- Documentation of the robot mechanics
- "CMP40 – CMP112, CMPZ71 – CMPZ100 Synchronous Servomotors" operating instructions
- "MOVIDRIVE® system Application Inverters" operating instructions
- "MOVIDRIVE® modular Application Inverters" operating instructions
- "MOVIDRIVE® modular – Power Supply Module with External DC Link Supply" addendum to the operating instructions
- "MOVI-C® CONTROLLER power UHX85A and power eco UHX84A" manual
- "MOVI-C® CONTROLLER progressive UHX65A" manual
- "MOVI-C® CONTROLLER power with PROFINET IO Interface" manual
- "MOVIKIT® Robotics" manual
- "MAXOLUTION® parallel arm kinematics kit calculation sheet" document (22675833/1218)

Always use the latest edition of the documentation and the software.

The SEW-EURODRIVE website ([www.sew-eurodrive.com](http://www.sew-eurodrive.com)) provides a wide selection of documents for download in various languages. If required, you can also order printed and bound copies of the documentation from SEW-EURODRIVE.

## 1.3 Structure of the safety notes

### 1.3.1 Meaning of signal words

The following table shows the grading and meaning of the signal words for safety notes.

Signal word	Meaning	Consequences if disregarded
<b>▲ DANGER</b>	Imminent hazard	Severe or fatal injuries
<b>▲ WARNING</b>	Possible dangerous situation	Severe or fatal injuries
<b>▲ CAUTION</b>	Possible dangerous situation	Minor injuries
<b>NOTICE</b>	Possible damage to property	Damage to the product or its environment

Signal word	Meaning	Consequences if disregarded
INFORMATION	Useful information or tip: Simplifies handling of the product.	

### 1.3.2 Structure of section-related safety notes

Section-related safety notes do not apply to a specific action but to several actions pertaining to one subject. The hazard symbols used either indicate a general hazard or a specific hazard.

This is the formal structure of a safety note for a specific section:



#### SIGNAL WORD


Type and source of hazard.

Possible consequence(s) if disregarded.

- Measure(s) to prevent the hazard.

### Meaning of the hazard symbols

The hazard symbols in the safety notes have the following meaning:

Hazard symbol	Meaning
	General hazard

### 1.3.3 Structure of embedded safety notes

Embedded safety notes are directly integrated into the instructions just before the description of the dangerous action.

This is the formal structure of an embedded safety note:

**⚠ SIGNAL WORD** Type and source of hazard. Possible consequence(s) if disregarded. Measure(s) to prevent the hazard.

## 1.4 Decimal separator in numerical values

In this document, a period is used to indicate the decimal separator.

Example: 30.5 kg

## 1.5 Rights to claim under limited warranty

Read the information in this documentation. This is essential for fault-free operation and fulfillment of any rights to claim under limited warranty. Read the documentation before you start working with the product.

## **1.6 Product names and trademarks**

The brands and product names in this documentation are trademarks or registered trademarks of their respective titleholders.

## **1.7 Copyright notice**

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## 2 Safety notes

### 2.1 Preliminary information

The following general safety notes serve the purpose of preventing injury to persons and damage to property. They primarily apply to the use of products described in this documentation. If you use additional components, also observe the relevant warning and safety notes.

### 2.2 Duties of the user

As the user, you must ensure that the basic safety notes are observed and complied with. Make sure that persons responsible for the machinery and its operation as well as persons who work on the device independently have read through the documentation carefully and understood it.

As the user, you must ensure that all of the work listed in the following is carried out only by qualified specialists:

- Setup and installation
- Installation and connection
- Startup
- Maintenance and repairs
- Shutdown
- Disassembly

Ensure that the persons who work on the product pay attention to the following regulations, conditions, documentation, and information:

- National and regional safety and accident prevention regulations
- Warning and safety signs on the product
- All other relevant project planning documents, installation and startup instructions, and wiring diagrams
- Do not assemble, install or operate damaged products
- All system-specific specifications and conditions

Ensure that systems in which the product is installed are equipped with additional monitoring and protection devices. Observe the applicable safety regulations and legislation governing technical work equipment and accident prevention regulations.

### 2.3 Target group

Planning and design

Any work related to planning and design which is necessary for the correct integration of the drive solution into the machine/system may only be performed by adequately qualified personnel. Qualified personnel in the context of this documentation are persons familiar with the mechanical or electromechanical design, integration of the drive solution into the plant/machine and the corresponding processes (e.g. hazard analysis and risk assessment) and who have the following qualifications:

- Qualification in the electrotechnical area in accordance with the national regulations
- Qualification in the mechanical area in accordance with the national regulations
- Knowledge of this documentation and other applicable documentation

Specialist for mechanical work	<p>Any mechanical work may be performed only by adequately qualified specialists. Specialists in the context of this documentation are persons who are familiar with the design, mechanical installation, troubleshooting, and maintenance of the product who possess the following qualifications:</p> <ul style="list-style-type: none"> <li>• Qualification in the mechanical area in accordance with the national regulations</li> <li>• Familiarity with this documentation</li> </ul>
Specialist for electrotechnical work	<p>Any electrotechnical work may be performed only by electrically skilled persons with a suitable education. Electrically skilled persons in the context of this documentation are persons who are familiar with electrical installation, startup, troubleshooting, and maintenance of the product who possess the following qualifications:</p> <ul style="list-style-type: none"> <li>• Qualification in the electrotechnical area in accordance with the national regulations</li> <li>• Familiarity with this documentation</li> </ul>
Software specialist	<p>Any work with the software used may be performed only by a trained specialist. A specialist in this context is someone who has the following qualifications:</p> <ul style="list-style-type: none"> <li>• Appropriate instruction (such as participation at a training)</li> <li>• Knowledge of this documentation and the documentations referenced in it</li> </ul>
Additional qualification	<p>In addition to that, these persons must be familiar with the valid safety regulations and laws, as well as with the requirements of the standards, directives, and laws specified in this documentation.</p> <p>The persons must have the express authorization of the company to operate, program, parameterize, label, and ground devices, systems, and circuits in accordance with the standards of safety technology.</p>
Instructed persons	<p>All work in the areas of transportation, storage, operation and waste disposal must be carried out by persons who are trained appropriately. The purpose of the instruction is to give persons the ability to perform the required tasks and work steps in a safe and correct manner.</p>

## 2.4 Designated use

The product is intended for installation in electrical plants or machines.

In case of installation in electrical systems or machines, startup of the product is prohibited until it is determined that the machine meets the requirements stipulated in the local laws and directives. For Europe, Machinery Directive 2006/42/EC as well as the EMC Directive 2014/30/EU apply. Observe EN 60204-1 (Safety of machinery - electrical equipment of machines). The product meets the requirements stipulated in the Low Voltage Directive 2014/35/EU.

The standards given in the declaration of conformity apply to the product.

Technical data and information on the connection conditions are provided on the nameplate and in the chapter "Technical data" in the documentation. Always comply with the data and conditions.

Unintended or improper use of the product may result in severe injury to persons and damage to property.

## 2.5 Risk assessment and risk reduction

The plant/machine must be assessed and evaluated with respect to its limits, hazards, and risks. For all risks that cannot be adequately reduced, you must implement additional structural measures to minimize the likelihood of any danger. If this is not possible, you may be able to reduce risk by implementing protective technical measures and consulting the relevant user information.

At the end of the process, it must be checked that the selected measures are effective in reducing risk and do not generate additional hazards.

The technical solutions described in this document can help to reduce risk by providing additional safety measures. The risk assessment and the selected measures for risk reduction must be developed and performed in accordance with the applicable national regulations for machine and plant manufacturing (e.g. ISO 12100, ISO 13849, etc.).

The machine/plant manufacturer, supplier or operator must make sure that it is evaluated whether the risk reduction measures listed in this document achieve their purpose and do not create new hazards.

## 2.6 Verification

Check to make sure that the actual risk classes of the drive solution comply with the required risk classes of the various safety functions.

Verify that all parameters, program components, etc. comply with the applicable requirements. Use the applicable standards (e.g. ISO 13849-1) and their respective tools for this purpose.

## 2.7 Transport

Inspect the shipment for damage as soon as you receive the delivery. Inform the shipping company immediately about any damage. If the product is damaged, it must not be assembled, installed or started up.

Observe the following notes when transporting the device:

- Ensure that the product is not subject to mechanical impact.

If necessary, use suitable, sufficiently dimensioned handling equipment.

Observe the information on climatic conditions in the chapter "Technical data" of the documentation.

## 2.8 Setup and installation

Ensure that the products are installed and cooled according to the regulations in the related documentation.

Protect the products from excessive strain. Ensure that elements are not deformed and/or insulation spaces are maintained, particularly during transportation. Products must not be damaged or destroyed.

Observe the following notes on installation and assembly:

- In chapter "Mechanical installation" in the respective documentation of the SEW-EURODRIVE components.
- In the documentation supplied by the manufacturer if third-party components are installed in the system solution.

## 2.9 Electrical installation

Ensure that all of the required covers are correctly attached after carrying out the electrical installation.

Make sure that preventive measures and protection devices comply with the applicable regulations (e.g. EN 60204-1 or EN 61800-5-1).

### 2.9.1 Carrying out electric work safely

Observe the following information to carry out electric work safely during installation and maintenance:

- Electric work may only be carried out by electrically skilled persons.
- Always adhere to the 5 safety rules for working on electrical components:
  - Disconnect
  - Secure the drive against restart
  - Check that no voltage is applied
  - Ground and short-circuit it
  - Cover or safeguard neighboring live parts
- When the device is switched on, dangerous voltages are present at all power connections as well as at any connected cables and terminals. This also applies even when the product is inhibited and the motor is at standstill.

### 2.9.2 Required preventive measure

Make sure that the product is correctly attached to the ground connection.

### 2.9.3 Stationary application

Necessary preventive measure for the product is:

Type of energy transfer	Preventive measure
Direct power supply	• Ground connection

## 2.10 Protective separation

The product meets all requirements for protective separation of power and electronics connections in accordance with EN 61800-5-1. To ensure protective separation, all connected circuits must also meet the requirements for protective separation.

## 2.11 Startup and operation

Damaged products	Never install damaged products. Submit any complaint to the shipping company immediately in the event of transportation damage. Do not start up damaged products.
Ejection of objects	Take suitable protective measures to prevent objects from being ejected. A protected work envelope must be created by constructive measures. Make sure that there is no direct intervention in the robot's work envelope. Check the effectiveness of the measures prior to startup of the product.
Monitoring and protection devices	<p>Do not deactivate monitoring and protection devices even for a test run. When in doubt, switch off the product whenever changes occur in relation to normal operation (e.g. increased temperatures, noise, oscillation). Determine the cause. It may be necessary to contact SEW-EURODRIVE.</p> <p>The machine or system manufacturer must equip machines/systems in which this product is installed with additional monitoring and protection devices in accordance with the respective applicable safety regulations (e.g. the law governing technical equipment, accident prevention regulations).</p> <p>Additional preventive measures may be required for applications with increased hazard potential. Be sure to check the effectiveness of the protection devices after every modification.</p> <p>Cover unused connections with the supplied protection caps during operation.</p> <p>According to the degree of protection, the product has:</p> <ul style="list-style-type: none"> <li>• Live parts</li> <li>• Bare parts</li> <li>• Moving and/or rotating parts</li> <li>• Hot surfaces</li> </ul> <p>Removing covers without authorization, improper use, or incorrect installation and operation may result in severe injuries to persons or damage to machinery.</p>
Live product parts	<p>Do not touch live parts of the product or power connections immediately after disconnecting the product from the voltage supply because some capacitors may still be charged. Discharge present energy storage units until the voltage has fallen below the protective extra-low voltage.</p> <p>When the device is switched on, dangerous voltages are present at all power connections as well as at any connected cables and motor terminals. This also applies even when the product is inhibited and the motor is in an idle state. The fact that the operation LED and other display elements are no longer illuminated does not indicate that the product has been disconnected from the power supply and no longer carries any voltage.</p> <p>Observe the corresponding information signs on the product.</p>
Automatic restart	<p>Faulty mechanical blocking or internal safety functions of the device can cause a motor standstill. Removing the source of the malfunction or performing a restart can result in an automatic restart of the drive.</p> <p>If an automatic restart is not permitted for safety reasons, proceed as follows:</p> <ol style="list-style-type: none"> <li>1. Disconnect the product from the power supply and, if present, from the energy storage unit.</li> <li>2. Start troubleshooting.</li> </ol>
Hot surfaces	<p>The surfaces of components (e.g. heat sink, braking resistance, drives) can be very hot during operation. Observe the following information to avoid risk of burns:</p> <ul style="list-style-type: none"> <li>• Do not touch the components during operation.</li> </ul>

	<ul style="list-style-type: none"> <li>• Let the components cool down before you start working on the components.</li> <li>• Observe the hazard symbols on the product.</li> </ul>
Tilting of the robot	<p>If the load leads to a center of gravity of the robot that is too high or one-sided, the robot may tilt over.</p> <ul style="list-style-type: none"> <li>• The robot must be set up on a solid platform.</li> <li>• Always adhere to the maximum permitted weight of the transported goods.</li> </ul>
Rotating parts	<p>The product contains rotating parts. Body parts (e.g. hands or fingers) may be caught or trapped. Observe the following information to avoid risk of injury:</p> <ul style="list-style-type: none"> <li>• Wear tight clothing in the hazard zone.</li> </ul>
Breakage of parts	<p>Adhere to the technical specifications.</p>

## 2.12 Inspection and maintenance

Carry out maintenance and repair work only on a secured and de-energized machine/system. Ensure a de-energized state of the machine/system before you start working on it. Ensure a de-energized state for the entire time you work on the system.

Avoid unintentional startup of the drives:

- Switch off all required switches.
- Secure the main switch against restarting.

### 3 Device structure

#### 3.1 Description

##### 3.1.1 Areas of application

The assembly kit for kinematic models with 2 – 5 axes is designed for applications with simple motion sequences with high repeat accuracy and high speed.

Typical areas of application include fast pick and place applications.

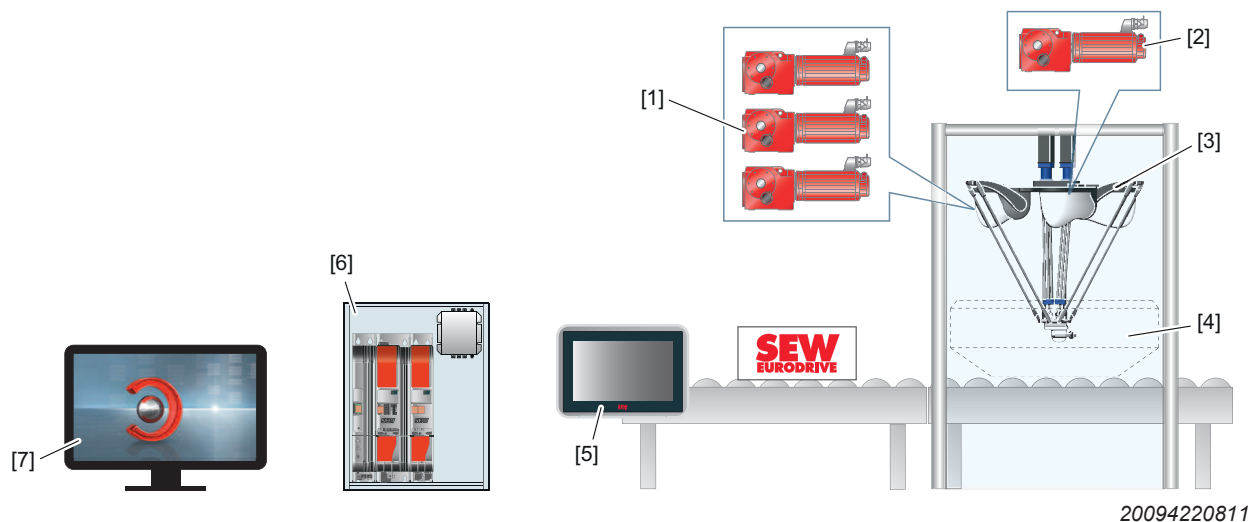
##### 3.1.2 Short designation

The following short designations are used in this documentation:

Component	Short designation
MAXOLUTION® System Solution Parallel Arm Kinematics Kit	Robot

##### 3.1.3 Structure

The robot consists of robot arms, a tool mounted to the arms, drives and a controller.



- [1] Drives robot arms
- [2] Drive rotation/inclination axis
- [3] Robot mechanics
- [4] Work envelope robot
- [5] Visualization
- [6] Control cabinet with power supply module, line filter, controller and inverters
- [7] Software

The robot arms and drives are mounted in a base frame. The joint axes are driven by motors, enabling the arms to move. The arms can reach very high speeds and dynamics.

The tool mounted to the arms (e.g. gripper) handles the workpieces. The movement of the tool in XZ or XYZ direction as well as rotation or inclination (optional) are performed via the coordinated control of all motors.

Due to the visualization of the robot on a monitor, it is easier to have direct control and to work with the robot.

After programming, the robot can perform a workflow autonomously or vary the performance of the task within certain limits, depending on sensor information.

### 3.1.4 Designs

#### Stand-alone

With stand-alone robots, the energy supply and the controller are installed in a control cabinet at a suitable location near the robot.

#### Integrated

With integrated robots, the energy supply and the controller are installed in the control cabinet of the system. These components can also be used for other system parts (e.g. conveyor line).

### 3.1.5 Features

- Stiff mechanics, precision
- Scalable work envelope
- Individual dimensioning of the drive technology
- Free programming of three-dimensional movement
- Visualization on a monitor or keypad
- Automatic mode, manual mode and jog mode
- Configuration with teach mode

## 3.2 Type designation

<b>MAXO</b>	MAXOLUTION® system solution	
-		
<b>R</b>	Robot	
<b>PS</b>	Function: Production system	
-		
.	Kinematic model:	
	D	Delta
	T	Tripod
-		
<b>R...</b>	Joint axes:	
	R	Rotary axis
	0	No axis
-		
...	Model type, design:	
	10	Standard
	20	Hygienic design
	30	Heavy

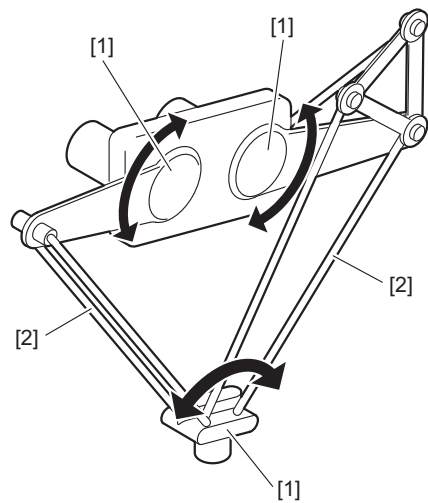
-	
...	Work envelope in mm, e.g. 0800
-	
<b>00</b>	Version

### 3.3 Configuration

Each robot can be designed according to the requirements.

#### 3.3.1 Number of arms and axes

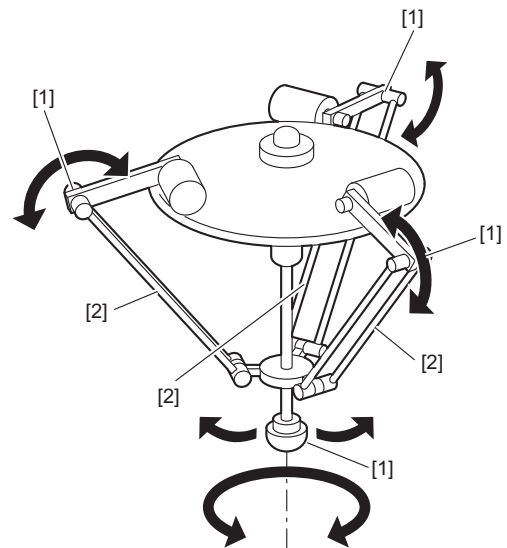
##### Delta kinematics 2 arms (2 – 3 axes)



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[1] Axis  
[2] Arm

##### Tripod kinematics 3 arms (3 – 5 axes)



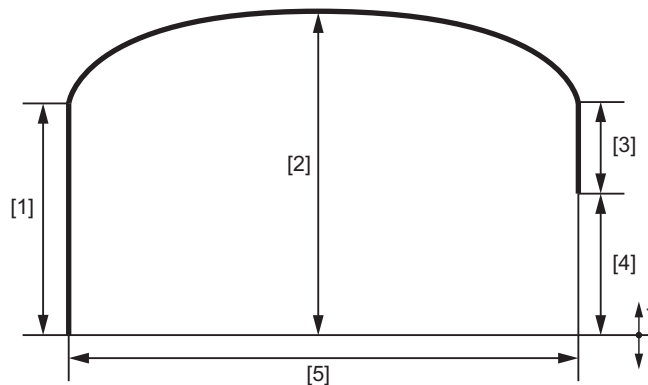
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#### 3.3.2 Movement dimensions

Axes	Work envelope
2 (+ 1 optional axis)	XZ (level) (optional inclination)
3 (+ 1 optional axis)	XYZ (space) (optional rotation)
3 (+ 2 optional axes)	VWXYZ (rotation and inclination of the tool)

### 3.3.3 Dimensioning of the mechanical components

The following data is relevant for the dimensioning of the mechanical components:



20413051915

- [1] Minimum vertical output length
- [2] Minimum Z-height
- [3] Minimum vertical final length (unloading)
- [4] Height difference between loading and unloading position
- [5] Travel length

In addition, the following data is important:

- Robot type: 2 arms or 3 arms
- Duration of loading and unloading of the product
- Required cycle time (loading, unloading and back to loading)
- Loading position of the product
- Mass of the product and loading tool
- Optional: Rotation and/or inclination with specification of the number of degrees
  - Inertia of the product
  - Inertia of the loading tool

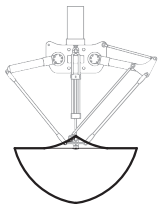
Each mechanical component is available in hygienic design.

Refer to the document "MAXOLUTION® parallel arm kinematics kit calculation sheet" for further information (22675833/1218).

### 3.3.4 Dimensioning

The table shows the respective maximum values. Only one feature can reach the maximum value for the features work envelope, payload and cycles. The remaining values are calculated from this.

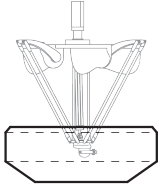
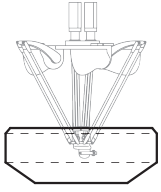
There are further possible variants.

Number of arms	Rotary axis	Inclination axis	Work envelope <sup>1)2)</sup>		Load capacity	Cycles per minute
2	Optional	–	1000 × 342 mm		30 kg	50
			1500 × 347 mm		35 kg	45

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# 3 Device structure

## Scope of delivery

Number of arms	Rotary axis	Inclination axis	Work envelope <sup>1)2)</sup>		Load capacity	Cycles per minute
3	Optional	–	500 × 200 mm		2 kg	200
			800 × 250 mm		3 kg	200
			1100 × 250 mm		3 kg	180
			1300 × 250 mm		3 kg	150
			1600 × 350 mm		12 kg	100
3	Standard	Standard	800 × 250 mm		1.5 kg	130
			1300 × 250 mm		1.5 kg	120

1) 2 arms: Width × height

2) 3 arms: Diameter × height

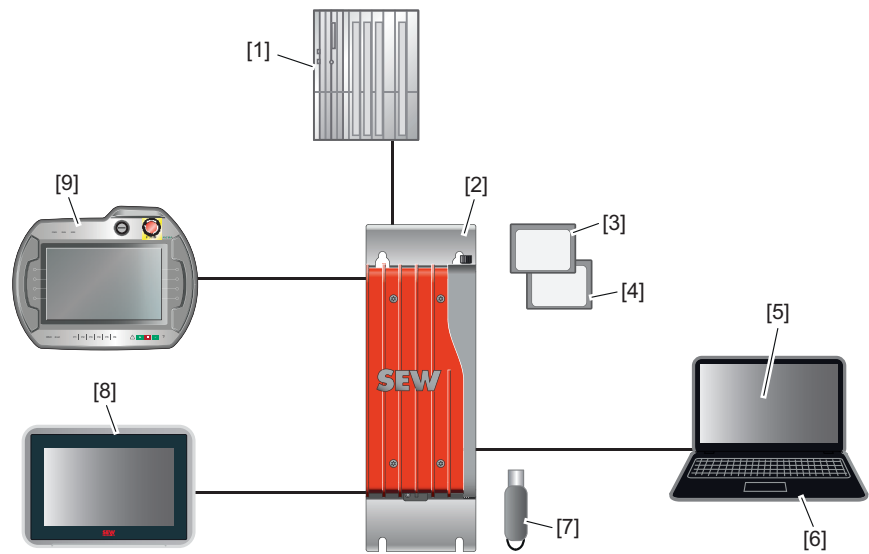
### 3.4 Scope of delivery

The scope of delivery depends on the configuration:

1. Controller package
  - MOVI-C® CONTROLLER
  - Software
  - Visualization
2. Robot axis package
  - MOVIDRIVE® axis modules
  - Line filter
  - Drives
  - Required cables
3. Robot mechanics package
  - Robot mechanics
  - Gear unit

### 3.5 Control and visualization

#### 3.5.1 Technical diagram



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No.	Component	Part number
[1]	Higher-level controller (PLC) (optional)	–
[2]	Control cabinet controller e.g. MOVI-C® CONTROLLER power UHX85A-R (PROFINET)	Configured
[3]	Windows memory card OMW72A (optional)	28208331
[4]	CFast memory card OMH85A	Configured
[5]	Software	–
[6]	Laptop	–
[7]	Runtime license dongle ORV71C. USB dongle or li- cense code for optional visualization software	17974305
[8]	Monitor or keypads (optional)	Configurable

#### 3.5.2 Functional principle

The MOVI-C® CONTROLLER control cabinet controller coordinates the axes and thus the movements of the robot.

The data of the application is visualized on a monitor.

#### Components

The used components depend on the design of the robot:

- Stand-alone: A MOVI-C® CONTROLLER control cabinet controller controls several MOVIDRIVE® system drive inverters.
- Integrated: A MOVI-C® CONTROLLER control cabinet controller controls one or several MOVIDRIVE® modular application inverters.

The control cabinet controller can control up to 32 interpolating axes and 32 auxiliary axes. The parameterization and startup of the devices are performed in the MOVISUITE® software.

- Operating systems    The following operating systems run parallel on the control cabinet controller:
- A real-time operating system for the communication with the higher-level controller and the coordination of the axes. The real-time operating system allows for short response times with connection to the higher-level controller via system buses.
  - A Windows-based operating system for visualization tasks.

With the CFast memory card OMH85A, the control cabinet controller can be programmed as required with programming languages according to standard IEC 61131-3.

The Windows memory card OMW72B extends the control cabinet controller by a Windows platform and can be used for plant visualization.

- Communication        The communication with the higher-level controller is based on PROFINET, Ethernet IP or Modbus TCP. You can connect up to 64 devices to the EtherCAT® interface, e.g. MOVIDRIVE® modular/system application inverters, MOVI-PLC® I/O system C and third-party components with ETG configuration file.

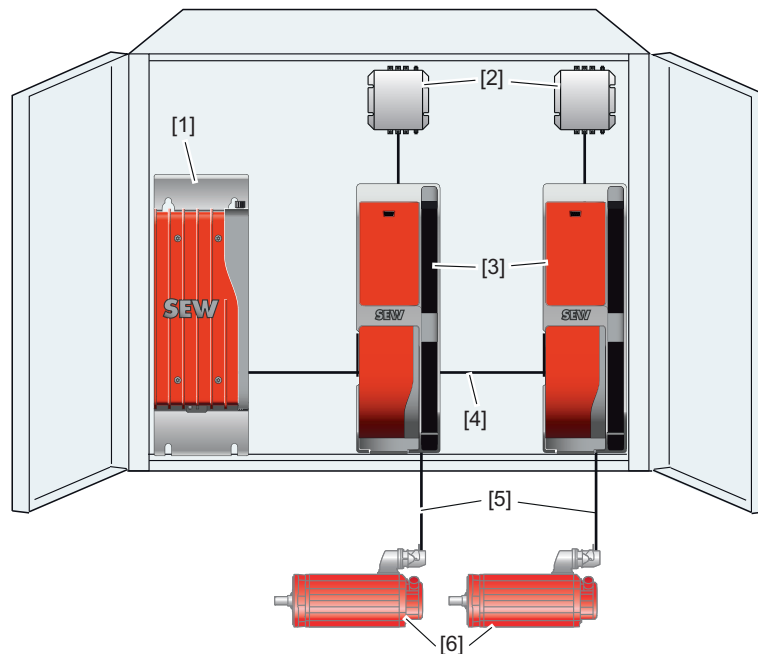
## 3.6 Mechanical components

### 3.6.1 Drives of the arms

#### 2 arms

##### Stand-alone

The drives of the arms are controlled by 2 MOVIDRIVE® system inverters and coordinated by a MOVI-C® CONTROLLER control cabinet controller. The following figure shows an example of the components:



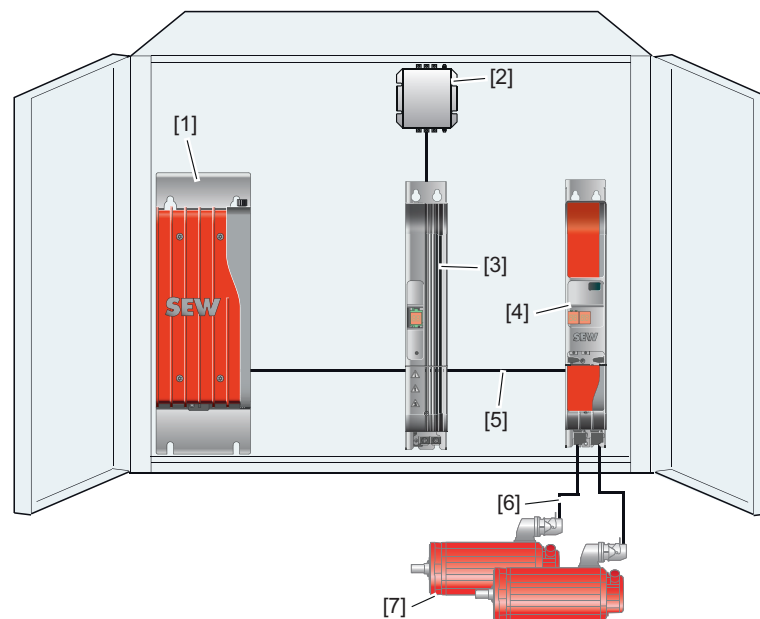
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No.	Component	Part number
[1]	MOVI-C® CONTROLLER power control cabinet controller	Configured
[2]	Line filter NF0120-503	17984270

No.	Component	Part number
[3]	MOVIDRIVE® MDX90A-0070-5E3-4-S00 drive inverter with braking resistor BW047-010-T	Configured
[4]	System bus cable 4-pole Length: 0.75 m	18167039
[5]	Servo brake motor cable with SB11 (M23) connector for a fixed installation Length: configurable	13354345
	encoder cable Length: configurable	13324535
[6]	Synchronous servomotor CMP63M/BP/PT/AK0H/SB1	Configured

*Integrated*

The drives of the arms are controlled by a power supply module with MOVIDRIVE® modular inverters and coordinated by a MOVI-C® CONTROLLER control cabinet controller. The following figure shows an example of the components:



20363750155

No.	Component	Part number
[1]	MOVI-C® CONTROLLER power control cabinet controller	Configured
[2]	Line filter NF0420-513	17983789
[3]	Power supply module MDP90A-0100-503-4-C00 optional with braking resistor	Configured
[4]	MOVIDRIVE® MDD90A-0080-503-X-S00 drive inverter	Configured
[5]	System bus cable 4-pole Length: 0.75 m	18167039

# 3

## Device structure

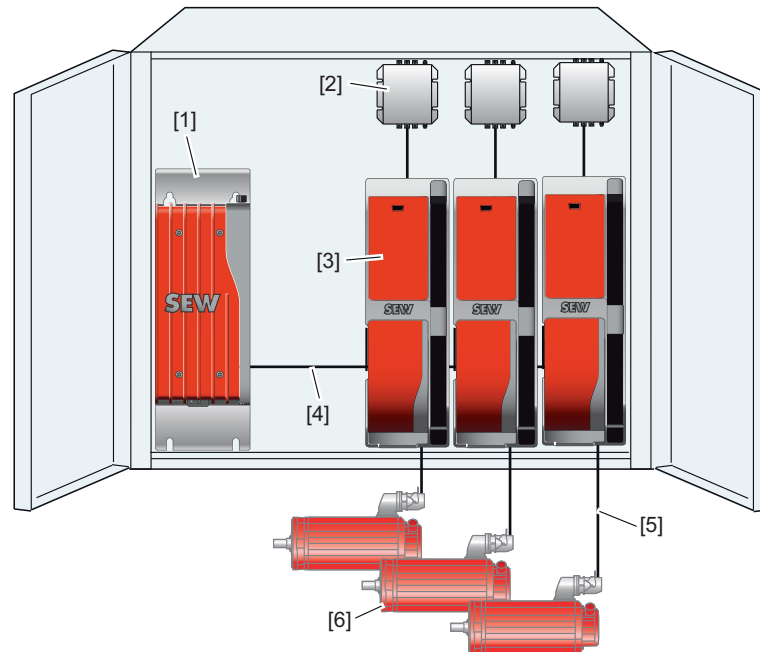
### Mechanical components

No.	Component	Part number
[6]	Servo brake motor cable with SB11 (M23) connector for a fixed installation Length: configurable	13354345
	encoder cable Length: configurable	13324535
[7]	Synchronous servomotor CMP63M/BP/PT/AK0H/SB1	Configured

### 3 arms

#### Stand-alone

The drives of the arms are controlled by 3 MOVIDRIVE® system inverters and coordinated by a MOVI-C® CONTROLLER control cabinet controller. The following figure shows an example of the components:



20364033291

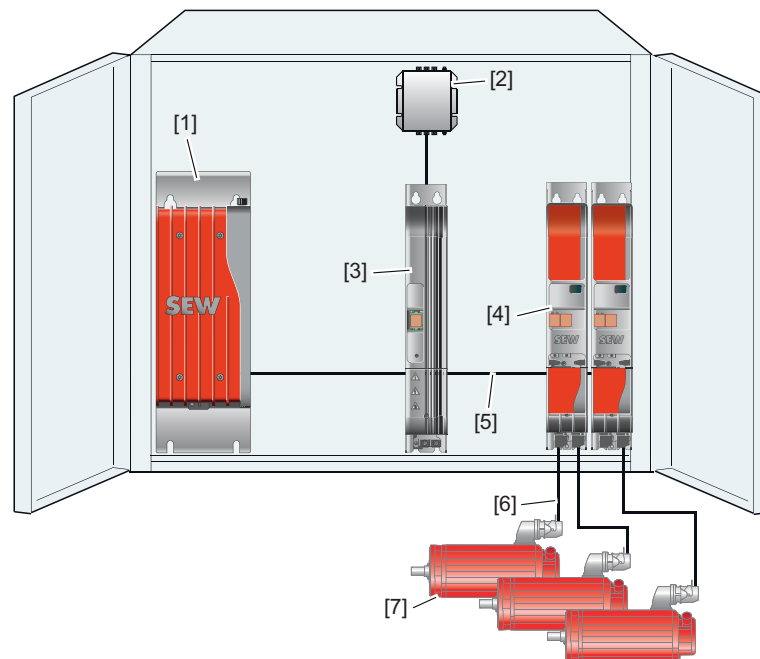
No.	Component	Part number
[1]	MOVI-C® CONTROLLER power control cabinet controller	Configured
[2]	Line filter NF0120-503	17984270
[3]	MOVIDRIVE® MDX90A-0070-5E3-4-S00 drive inverter with braking resistor BW047-010-T	Configured
[4]	System bus cable 4-pole Length: 0.75 m	18167039

29115051/EN – 09/2019

No.	Component	Part number
[5]	Servo brake motor cable with SB11 (M23) connector for a fixed installation Length: configurable	13354345
	encoder cable Length: configurable	13324535
[6]	Synchronous servomotor CMP63M/BP/PT/AK0H/SB1	Configured

*Integrated*

The drives of the arms are controlled by a power supply module with MOVIDRIVE® modular inverters and coordinated by a MOVI-C® CONTROLLER control cabinet controller. The following figure shows an example of the components:



20366696459

No.	Component	Part number
[1]	MOVI-C® CONTROLLER power control cabinet controller	Configured
[2]	Line filter NF0420-513	17983789
[3]	Power supply module MDP90A-0100-503-4-C00 optional with braking resistor	Configured
[4]	MOVIDRIVE® MDD90A-0080-503-X-S00 drive inverter	Configured
[5]	System bus cable 4-pole Length: 0.75 m	18167039

No.	Component	Part number
[6]	Servo brake motor cable with SB11 (M23) connector for a fixed installation Length: configurable	13354345
	encoder cable Length: configurable	13324535
[7]	Synchronous servomotor CMP63M/BP/PT/AK0H/SB1	Configured

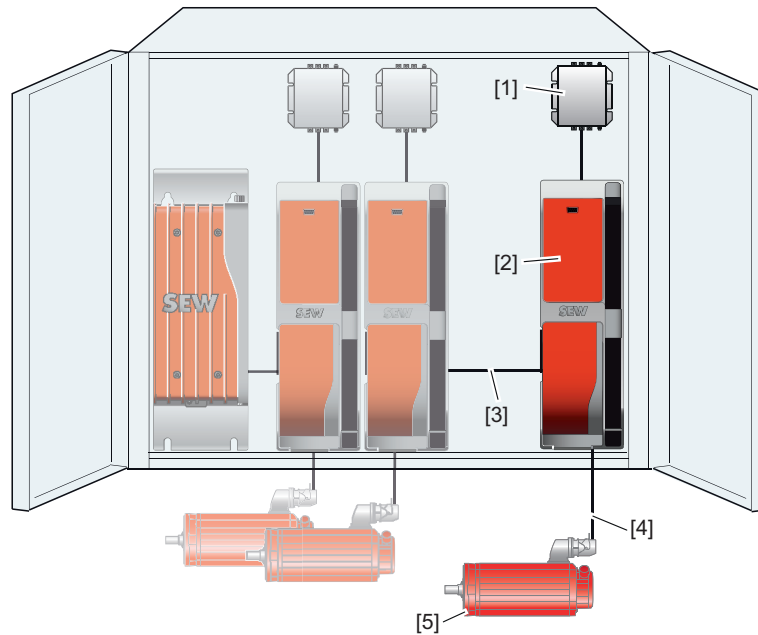
### 3.6.2 Drives of the tools (optional)

Several tools can be mounted to the robot for handling the workpieces. Optionally, a motor at the tool axis can generate rotary motions with up to  $6000 \text{ min}^{-1}$  for 2- and 3-axis variants.

In addition to the rotary motion, a drive for tilting of the tool is provided for 4-axis variants.

#### Stand-alone

The drives of the tools are controlled by MOVIDRIVE® system inverters. The following figure shows an example of the components:



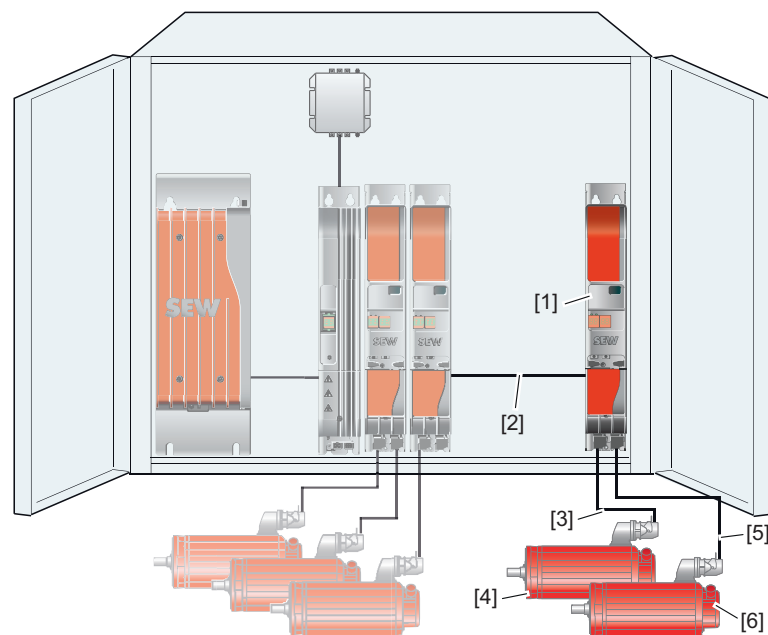
20367461643

No.	Component	Part number
[1]	Line filter NF0055-503	17984319
[2]	MOVIDRIVE® MDX90A-0020-5E3-4-S00 drive inverter	Configured
[3]	System bus cable 4-pole Length: 0.75 m	18167039

No.	Component	Part number
[4]	Servo motor cable with SB11 (M23) connector for a fixed installation Length: configurable	05904544
	encoder cable Length: configurable	13324535
[5]	Synchronous servomotor CMP40M/PT/AK0H/SM1	Configured

### Integrated

The drives of the tools are controlled by MOVIDRIVE® modular inverters. The following figure shows an example of the components:



20367468811

No.	Component	Part number
[1]	MOVIDRIVE® MDD90A-0020-503-X-S00 drive inverter	Configured
[2]	System bus cable 4-pole Length: 0.75 m	18167039
[3]	Servo motor cable with SM11 (M23) connector for a fixed installation Length: configurable	05904544
	encoder cable Length: configurable	13324535
[4]	Synchronous servomotor CMP40M/PT/AK0H/SM1	Configured

# 3

## Device structure

### Mechanical components

No.	Component	Part number
[5]	Only for 4 axes: Servo brake motor cable with SB11 (M23) connector for a fixed installation Length: configurable	13354345
	Only for 4 axes: encoder cable Length: configurable	13324535
[6]	Only for 4 axes: Synchronous servomotor CMP63M/PT/AK0H/SB1	Configured

## 4 Installation

### 4.1 General information

Observe the following:

- The guidelines and instructions provided by the system manufacturer.
- All information about permitted conditions at the place of installation.
- The safety notes for the respective devices.
- The assembly and installation instructions of the respective devices.

### 4.2 Mechanical installation

#### 4.2.1 Clearance

When installing the mechanical components, observe the minimum clearance:

- For the connection of cables and plug connectors
- For the handling of any display elements, diagnostics elements and actuator elements
- For the heat convection

Observe the documentation for the devices used.

#### 4.2.2 Cooling

Observe the following rules:

- Ensure that excessive heat can be dissipated to the environment by means of free convection.
- Observe the specified minimum clearance below the cooling fins.
- Ensure that excessive heat in the control cabinet can be dissipated by fans.

Observe the documentation for the devices used.

#### 4.2.3 Assembly

Observe the following rules:

- When selecting and dimensioning the mounting and safety elements, observe the applicable standards, the technical data of the device, as well as local circumstances.
- Only use mounting and locking elements that fit into the existing bores, threads and countersinks.
- Observe the relevant minimum distances and clearances.
- Ensure that there is no risk of collision with other components or construction elements along the travel path after installation.
- Ensure that all display and diagnostic elements (such as LEDs, displays and diagnostic interfaces) are visible and accessible after installation.

**Drive**

Observe the following rules:

- The specifications on the nameplate of the drive must correspond to the supply system or the output voltage of the frequency inverter.
- The drive is undamaged (no damage caused by transportation or storage).
- The following provisions are met:
  - Ambient temperature between -20°C and +40°C
  - No oils, acids, gases, vapors, radiation, etc. in the environment
  - Installation altitude max. 1000 m above sea level
  - The limitations for encoders are observed
  - Special versions: Drive configured in accordance with ambient conditions.

**INFORMATION**

The mounting position for installation must correspond with the specifications on the nameplate.

**4.3 Electrical installation**

Prefabricated cables are provided to connect the majority of components. You can order these cables from SEW-EURODRIVE.

If you require additional cables, the team at SEW-EURODRIVE will be happy to assist you in selecting them.

**4.3.1 Preventive measures**

Observe the following rules:

- Observe the permitted EMC limit value ranges for the devices.  
For detailed information about EMC-compliant installation, refer to the publication "Electromagnetic Compatibility in Drive Engineering" from SEW-EURODRIVE.
- Connect only ohmic/inductive loads, such as motors, to motor connection. Never connect capacitive loads.
- Implement the prescribed preventive measures for preventing electrical hazards (ground connection or protective separation/equipotential bonding and ESD protection).
- Use the shortest possible low-impedance, HF-compatible cables, with the stipulated minimum cross sections and colors.

**4.3.2 Using prefabricated cables**

SEW-EURODRIVE uses prefabricated cables for certifications, type tests and approval of the devices. The cables provided by SEW-EURODRIVE fulfill all requirements necessary to ensure that the device and all connected components function properly. The devices under consideration are always the basic devices including all connected components and corresponding connection cables.

This is why SEW-EURODRIVE recommends to use only the prefabricated cables specified in the documentation.

In accordance with EN ISO 13849, when using devices with integrated safety functions, you must also adhere to all of the conditions and requirements for the installation and routing of cables described in the corresponding device's functional safety documentation.

### Use of third-party cables

If third-party cables are used – even if these cables are technically equivalent – SEW-EURODRIVE will not accept any liability and cannot guarantee compliance with device properties or that the device will function correctly.

When using third-party cables to connect the device and/or device components, make sure to comply with all applicable national regulations. Note that the technical features of the device or system of devices might be affected inadvertently when using non-SEW cables. This concerns in particular the following properties:

- Mechanical properties (such as IP protection class, cable carrier suitability)
- Chemical properties (such as the absence of silicone and halogen, resistance against substances)
- Thermal properties (e.g. temperature stability, heating of the device, flammability class)
- EMC behavior (such as interference emission limit values, compliance with interference immunity values stipulated in standards)
- Functional safety (approvals according to EN ISO 13849-1)

Non-SEW cables not explicitly recommended by SEW-EURODRIVE must meet at least the requirements of the following standards and have been permitted according to these standards:

- IEC 60309
- IEC 61984
- IEC 60204

#### 4.3.3 Cable routing

Observe the following rules:

- To connect the power supply and the communication, use suitable cables.
- Route power cables and signal cables in separate cable ducts.
- Choose the greatest possible distance between power cables and signal cables.
- Avoid using long cables running parallel to one another.




#### 4.3.4 Shielding

Observe the following rules:

- The power signals and electronics signals (motor and control leads) are installed in shielded cables.
- The shield against capacitive coupling is applied to at least one end.
- A shield end is applied using a capacitor to avoid excessive loop currents.
- For cables with single shielding, the shield to the connector housing is applied on both ends over a wide area.
- For cables with double shielding (e.g. hybrid cables), the outer shielding is applied to the unit side and the inner shielding to the other side (e.g. on the motor).
- For external buses, the bus-specific installation instructions apply.

## 4.4 Sequence

Install the components in the following order:

Component	Required documentation
Robot mechanics	Documentation of the robot mechanics
	
Drives robot arms Drive tool/gripper	"CMP40 – CMP112, CMPZ71 – CMPZ100 Synchronous Servomotors" operating instructions Chapter "Installation"
	
MOVIDRIVE® Drive Inverters	<ul style="list-style-type: none"> <li>Stand-alone: "MOVIDRIVE® system application inverter" operating instructions Chapter "Installation"</li> <li>Integrated: "MOVIDRIVE® modular application inverter" operating instructions Chapter "Installation"</li> </ul>
	
MOVI-C® CONTROLLER control cabinet controller	"MOVI-C® CONTROLLER power UHX85A and power eco UHX84A" operating instructions Chapter "Installation notes"

## 5 Startup

### 5.1 General information

Observe the following:

- The guidelines and instructions provided by the system manufacturer.
- All information about permitted conditions at the place of installation.
- The safety notes for the respective devices.
- The startup notes and instructions for the relevant devices.

### 5.2 Sequence

Put the components into operation in the following order:

Component	Required documentation
Drives robot arms Drive tool/gripper	"CMP40 – CMP112, CMPZ71 – CMPZ100 Synchronous Servomotors" operating instructions Section "Startup"
↓	
MOVIDRIVE® Drive Inverters	<ul style="list-style-type: none"> <li>• Stand-alone: "MOVIDRIVE® system application inverter" operating instructions Section "Startup"</li> <li>• Integrated: "MOVIDRIVE® modular application inverter" operating instructions Section "Startup"</li> </ul>
↓	
MOVI-C® CONTROLLER power control cabinet controller	<ul style="list-style-type: none"> <li>• "MOVI-C® CONTROLLER power UHX85A and power eco UHX84A" operating instructions</li> <li>• Operating instructions "MOVI-C® CONTROLLER progressive UHX65A"</li> </ul> Chapter "Project planning and startup with Windows 7 Embedded"
↓	
MOVIKIT® robotics control cabinet controller	<ul style="list-style-type: none"> <li>• "MOVIKIT® Robotics" manual</li> </ul>

### 5.3 MOVIKIT® Robotics

#### 5.3.1 Operating principle

**Process controller** The MOVIKIT® Robotics is controlled by a process controller. This controller can be implemented in the MOVI-C® CONTROLLER or in a higher-level controller (fieldbus).  
In terms of MOVIKIT®, the process controller determines which paths are to be travelled with which motion parameters by starting and parameterizing robot programs.

Robot monitor	The motion path is parameterized in the robot monitor. The path points and further process signals can be determined or can be altered by the process controller during runtime.
Troubleshooting	Error handling with transmission of an error message to the process controller is integrated. Several diagnostics tools are available for a detailed fault analysis and startup, e.g. the 3D simulation that is integrated in the robot monitor.
Safety	To fulfill the safety standard DIN EN ISO 10218-1 for robots, the MOVIKIT® Robotics supports the operating mode selection, several brake ramps and reduced speed.

### 5.3.2 Kinematic model DELTA

DELTA is a kinematic model where 2 kinematic partial chains are connected in parallel between kinematic base and tool flange in a triangular structure.

### 5.3.3 Kinematic model TRIPOD

TRIPOD is a kinematic model characterized by a tripod and consisting of 3 parallel kinematic partial chains between kinematic base and tool flange.

## 5.4 Referencing

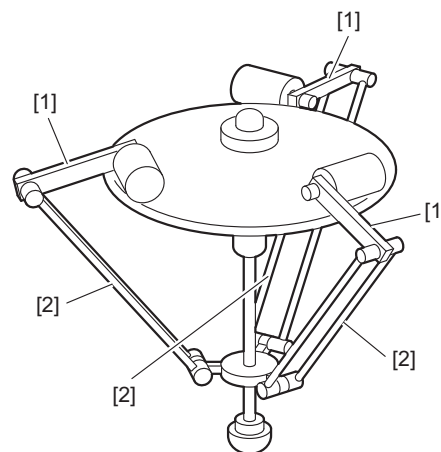
### 5.4.1 Tools required

- Referencing tool for arms
- Referencing tool for the rotary and inclination axis

### 5.4.2 Referencing arms

Proceed as follows:

1. Dismount all secondary arms.

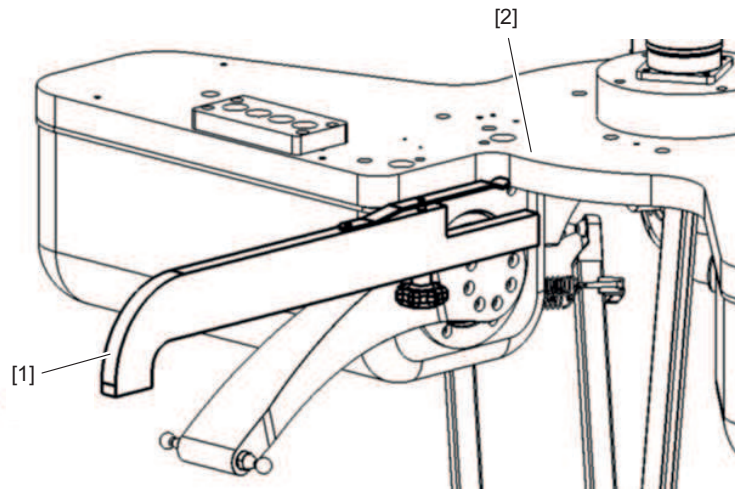


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- [1] Primary arms
- [2] Secondary arms

2. Release the brakes of the motors for the primary arms.
3. Turn the primary arms downwards in order to mount the referencing tool.

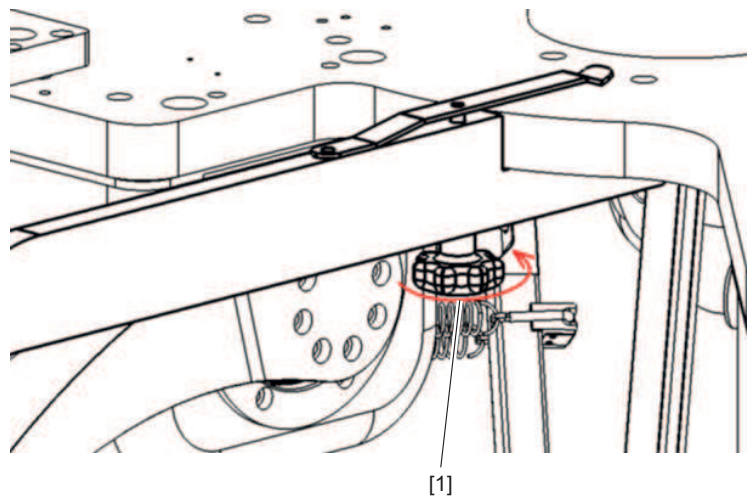
- Slide the referencing tool onto the base plate.



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- [1] Referencing tool
- [2] Base plate

- Tighten the star grip nut until the referencing tool has been fixed.

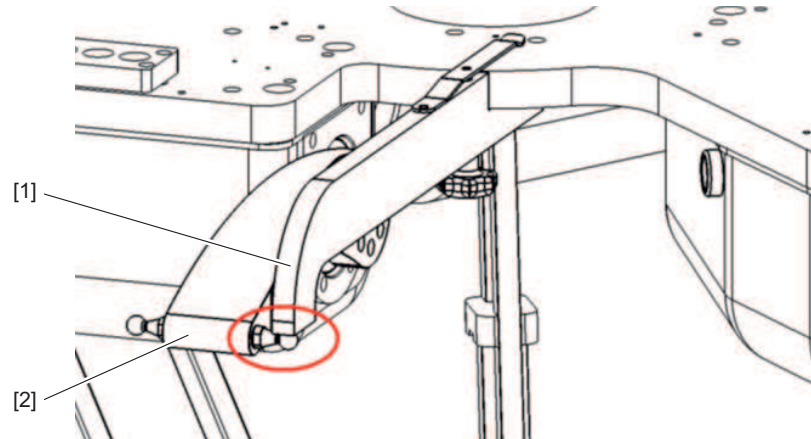


21373481867

- [1] Star grip nut

- Open the MOVISUITE® software and release the motor brake of the required arm in manual mode.

- Push the upper arm with its ball joint against the referencing tool.



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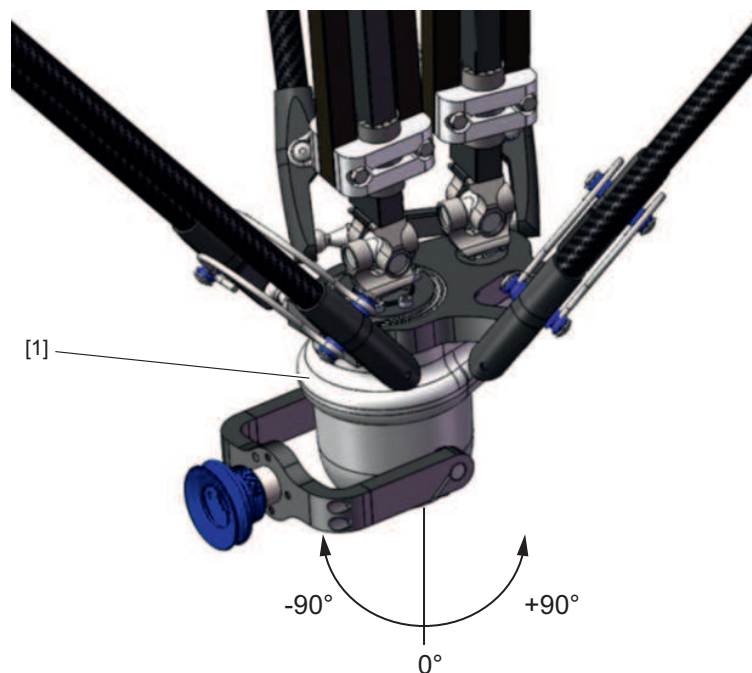
- [1] Referencing tool
- [2] Primary arm

- Apply the motor brake to the arm.
- Reference the drive with MOVISUITE® in manual mode.
- Perform referencing for the other primary arms (steps 6 – 9).
- Ensure that the angle between motors and arms measures  $0^\circ (\pm 0.1^\circ)$ . Check the value in MOVISUITE®.
- Remove the referencing tool.

### 5.4.3 Referencing rotary and inclination axis

Proceed as follows:

- Set the inclination axis to  $-90^\circ$ .

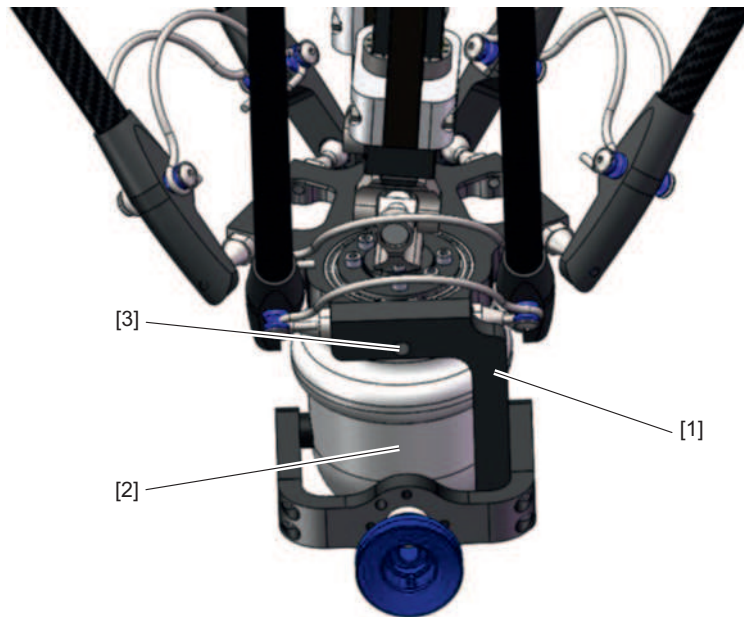


21373609483

- [1] Internal gear unit

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2. **NOTICE!** Mechanical damage at the internal gear unit. Always use a referencing tool for aligning the inclination axis.  
The alignment of the inclination axis depends on the position of the internal gear unit. The gear unit can have 2 positions with mounted referencing tool (rotated by 180° from each other). The position of the gear unit cannot be determined by a visual check. Determine the position by moving the inclination axis when the robot is completely installed. With new referencing, the position of the gear unit must be determined again.
3. Fasten the referencing tool at the tool center point.

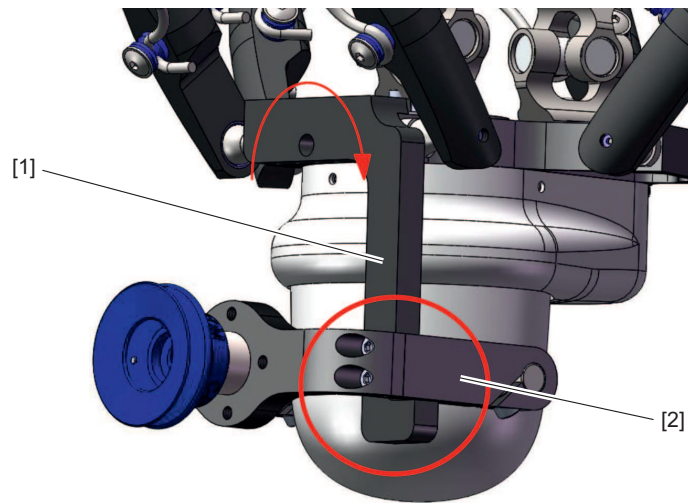


21380817931

- [1] Referencing tool
- [2] Tool operating point
- [3] Star grip nut

4. Tighten the star grip nut until the referencing tool has been fixed.
5. Open the MOVISUITE® software and release the motor brake of the rotary and inclination axis in manual mode.

6. Push the arm of the inclination axis against the referencing tool.




21382078475

- [1] Referencing tool
- [2] Arm of the inclination axis

7. Apply the motor brake.
8. Reference the drives with MOVISUITE® in manual mode.
9. Ensure that the angle of the rotation axis is  $0^\circ (\pm 0.1^\circ)$  and that of the inclination axis is  $-90^\circ (\pm 0.1^\circ)$ . Check the value in MOVISUITE®.
10. Remove the referencing tool.

## 6 Operation

The operation is described in detail in the "MOVIKIT® robotics" manual, see chapter "Applicable documentation" (→  5).

## 7 Service

### 7.1 Inspection and maintenance

During inspection and maintenance, observe the documentation of the used components.

### 7.2 Electronics Service by SEW-EURODRIVE

If you are unable to rectify a fault, contact SEW-EURODRIVE Service. For the addresses, refer to [www.sew-eurodrive.com](http://www.sew-eurodrive.com).

When contacting SEW-EURODRIVE Service, always specify the following information so that our service personnel can assist you more effectively:

- Information on the device type on the nameplate (e.g. type designation, serial number, part number, product key, purchase order number)
- Brief description of the application
- Fault message on the status display
- Nature of the fault
- Accompanying circumstances
- Any unusual events preceding the problem

### 7.3 Waste disposal

Dispose of the product and all parts separately in accordance with their material structure and the national regulations. Put the product through a recycling process or contact a specialist waste disposal company. If possible, divide the product into the following categories:

- Iron, steel or cast iron
- Stainless steel
- Magnets
- Aluminum
- Copper
- Electronic parts
- Plastics

The following materials are hazardous to health and the environment. These materials must be collected and disposed of separately.

- Oil and grease

Collect used oil and grease separately according to type. Ensure that the used oil is not mixed with solvent. Dispose of used oil and grease correctly.

- Screens
- Capacitors
- Rechargeable batteries
- Batteries



**Waste disposal according to the Battery Directive 2006/66/EC**

This product contains batteries or accumulators. Dispose this product and the batteries or accumulators separately from the municipal waste according to the national regulations.

## 8 Technical data

Note the technical data in the documentation for the components.

## 9 MAXOLUTION® Competence Center

### Germany

Bruchsal	SEW-EURODRIVE GmbH & Co KG Ernst-Blickle-Straße 42 76646 Bruchsal	Tel. +49 7251 75-0 Fax +49 7251 75-1970 <a href="http://www.sew-eurodrive.de">http://www.sew-eurodrive.de</a> <a href="mailto:maxolution@sew-eurodrive.de">maxolution@sew-eurodrive.de</a>
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### France

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### India

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### Italy

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### Poland

Tychy	SEW-EURODRIVE Polska Sp.z.o.o. ul. Strzelecka 66 43-109 Tychy	Tel. +48 32 32 32 610 Fax +48 32 32 32 648
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### South Africa

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**South Korea**

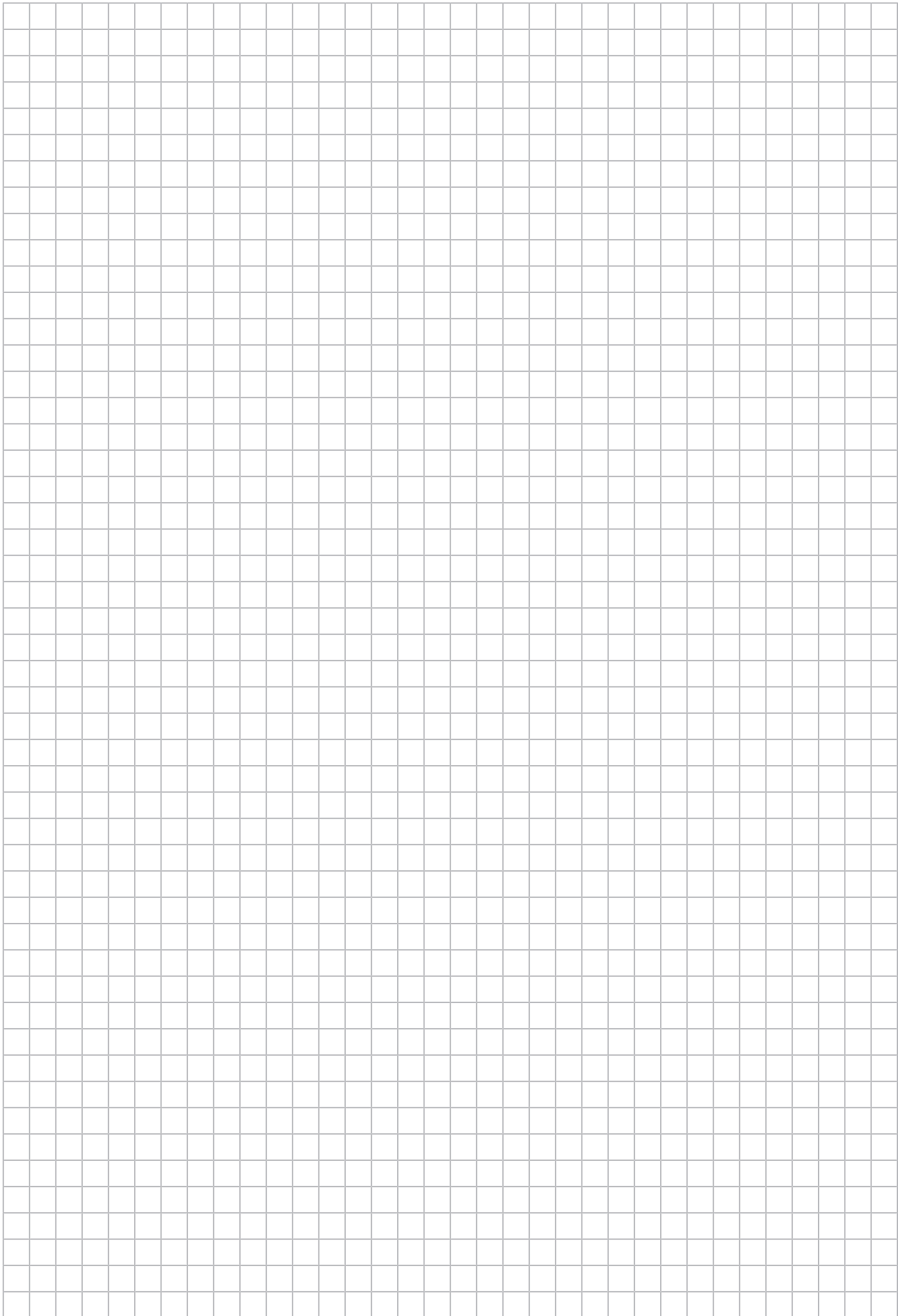
Ansan	SEW-EURODRIVE KOREA CO., LTD. 7, Dangjaengi-ro, Danwon-gu, Ansan-si, Gyeonggi-do, Zip 425-839	Tel. +82 31 492-8051 Fax +82 31 492-8056 <a href="http://www.sew-eurodrive.kr">http://www.sew-eurodrive.kr</a> <a href="mailto:master.korea@sew-eurodrive.com">master.korea@sew-eurodrive.com</a>
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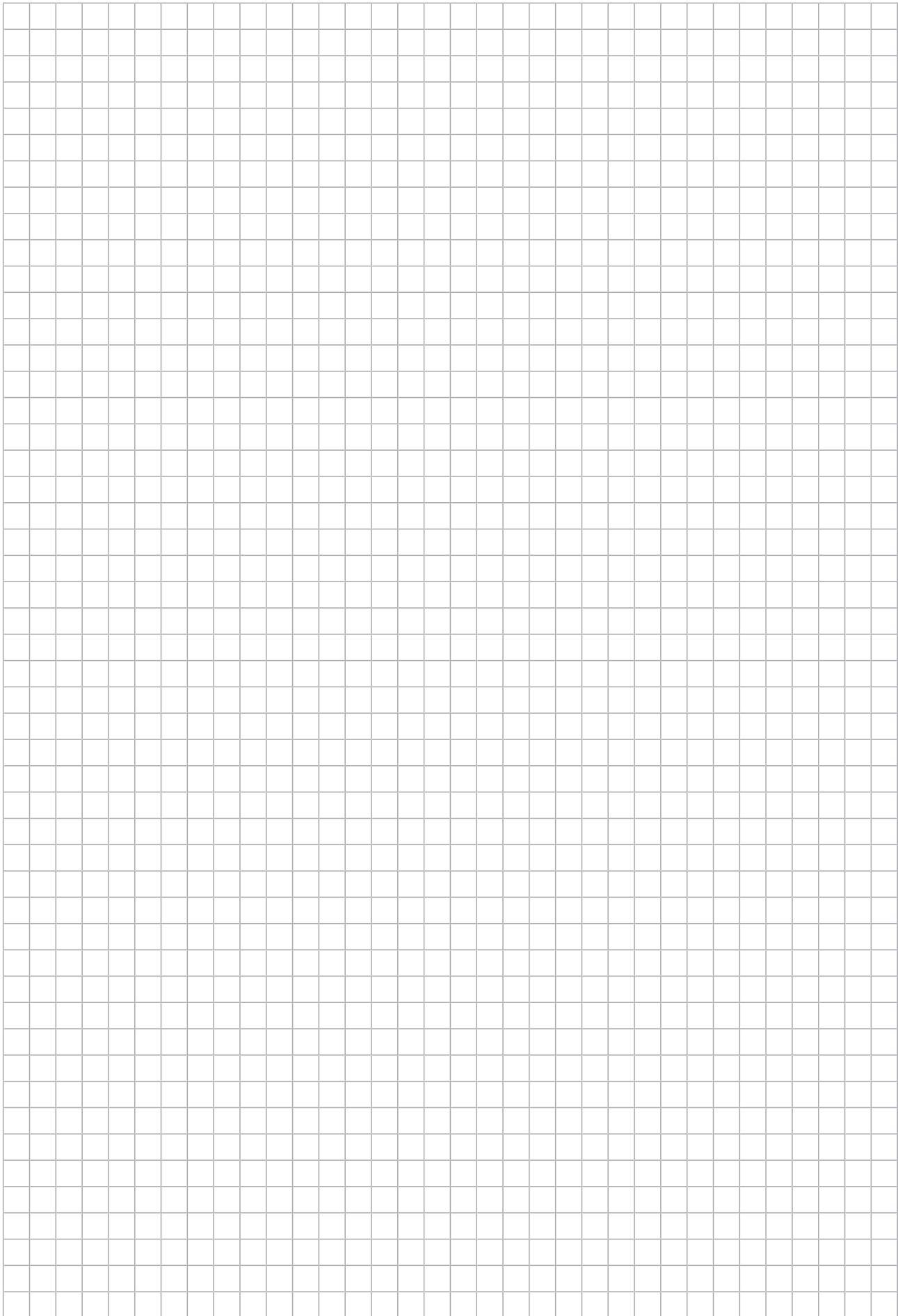
**Sweden**

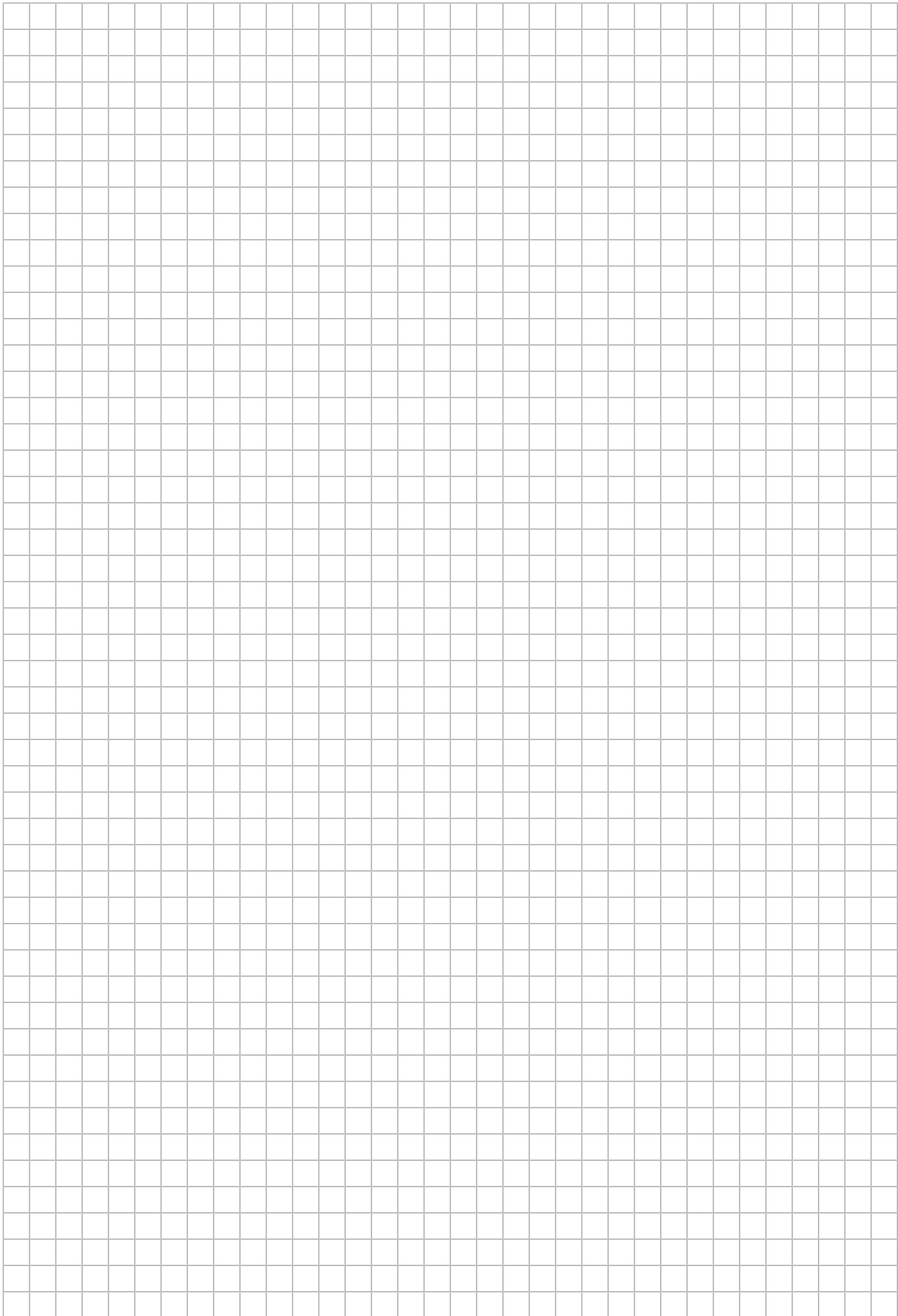
Jönköping	SEW-EURODRIVE AB Gnejsvägen 6-8 553 03 Jönköping Box 3100 S-550 03 Jönköping	Tel. +46 36 34 42 00 Fax +46 36 34 42 80 <a href="http://www.sew-eurodrive.se">http://www.sew-eurodrive.se</a> <a href="mailto:jonkoping@sew.se">jonkoping@sew.se</a>
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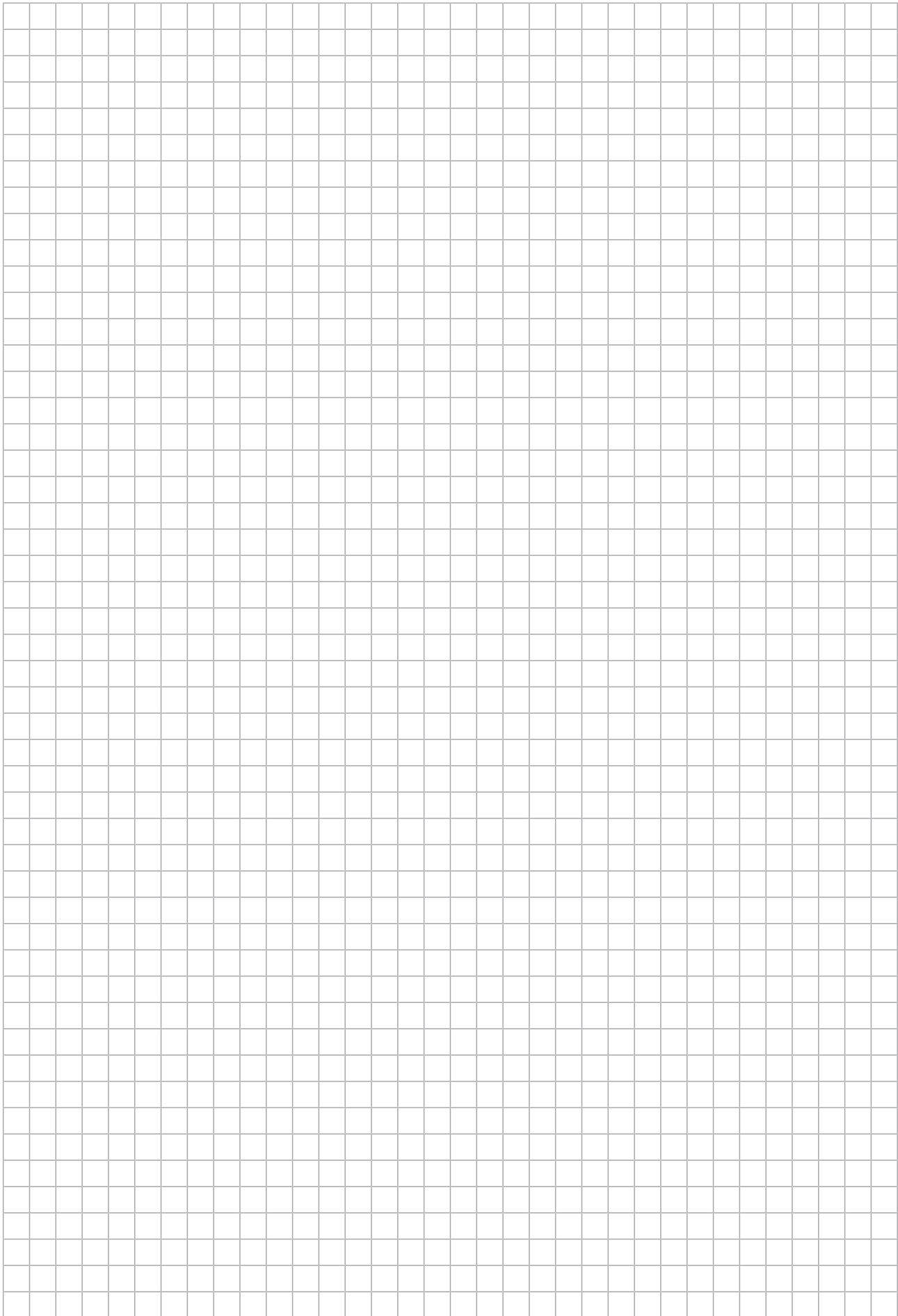
**USA**

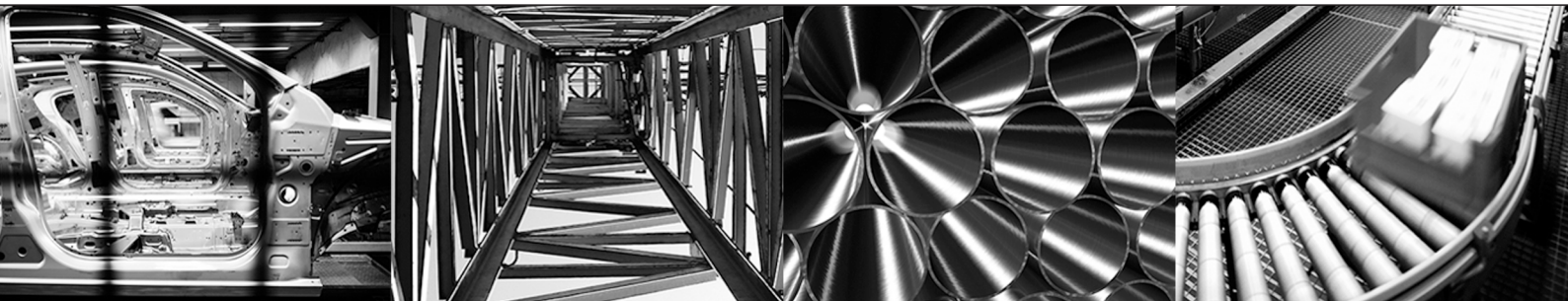
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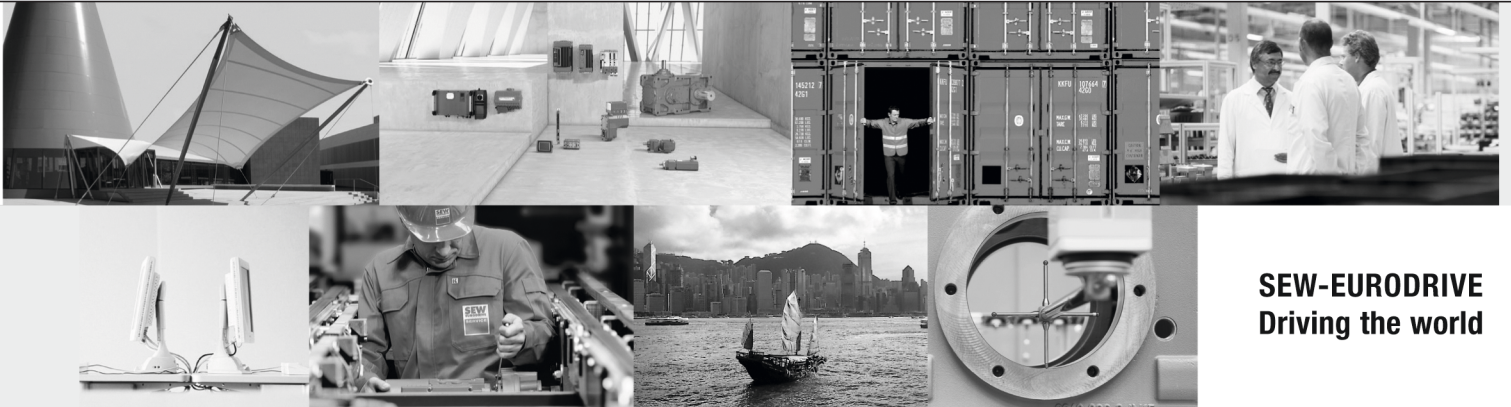












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