

Operating instructions

WPG Series - Universal servo-electric Gripping Modules with Ethernet Interface

May 2023



Content

1	Introduction	5
1.1	Product description	5
1.2	Related documents.....	5
1.3	Target audience.....	6
1.4	Notation and symbols.....	6
2	Basic safety instructions.....	6
2.1	Intended use	6
2.2	Ambient and operating conditions	6
2.3	Product safety	7
2.3.1	Protective devices	7
2.3.2	Structural changes, additions or conversions	7
2.3.3	Special standards.....	7
2.4	Personnel qualification	8
2.5	Safety conscious work	8
2.6	Notes on special hazards.....	8
3	Warranty	8
4	Scope of delivery and accessories.....	9
5	Technical data.....	10
5.1	Mechanical nominal data.....	10
5.1.1	Permissible finger length.....	11
5.1.2	Gripping force, finger speed and acceleration	11
5.1.3	Permissible finger loads.....	12
5.2	Electrical nominal data	14
5.2.1	Power supply connection	15
5.2.2	Ethernet connection	17
6	Assembly and commissioning.....	17
6.1	Assembly of the gripping module	17
7	Function of the gripping module	20
7.1	Non-volatile memory.....	21
7.2	SD memory card	21
7.2.1	Removing and reinserting the SD memory card	21
7.2.2	SD memory card content.....	22

8	Configuration and monitoring via the web interface	23
8.1	Status overview	23
8.2	User management	24
8.3	Grip parameter configuration	25
8.3.1	Permissible value range.....	25
8.3.2	Editor	26
8.3.3	Teach Wizard	27
8.4	LED presets configuration	28
8.4.1	Editor	29
8.5	Manual Control	30
8.6	Settings	31
8.7	GRIP SCOPE	32
8.8	Setting up a proxy network.....	34
8.9	Licenses.....	35
8.10	Firmware update	35
9	Interface description GRIPLINK protocol.....	36
10	Control of the gripping module	36
10.1	Gripper state	36
10.2	Position sensor technology	37
10.3	Reference run.....	38
10.4	Enable and disable.....	39
10.5	Configurable grip presets	41
10.5.1	Gripping direction.....	42
10.6	Grip workpiece	43
10.7	Release workpiece.....	44
10.8	Error handling	45
10.9	Design of the gripping process	45
10.9.1	Application example gripping outside.....	46
10.9.2	Application example gripping inside	47
11	Maintenance	48
12	Troubleshooting	49
12.1	Base jaws do not move	49
12.2	Gripping module stops abruptly or does not travel the entire stroke.....	49
12.3	The gripping module reports an error.....	50
13	Decommissioning, dismantling and disposal.....	51
13.1	Decommissioning and disassembly	51

13.2 Disposal 51

14 EC Declaration of Incorporation 52

1 Introduction

These instructions are part of the gripping module and describe the safe and proper use in all operating phases. It is only valid for gripping modules of type WPG 300-120 and WPG 60-090 and contains important information on installation, commissioning, maintenance, and service.

1.1 Product description

The gripping modules of type WPG 300-120 and WPG 60-090 are universal servo-electric gripping modules with innovative gripping force control and Ethernet interface for use in robotic applications. Figure 1 shows the connections and components of a WPG 300-120 gripping module. The gripping module is configured via the integrated web interface.

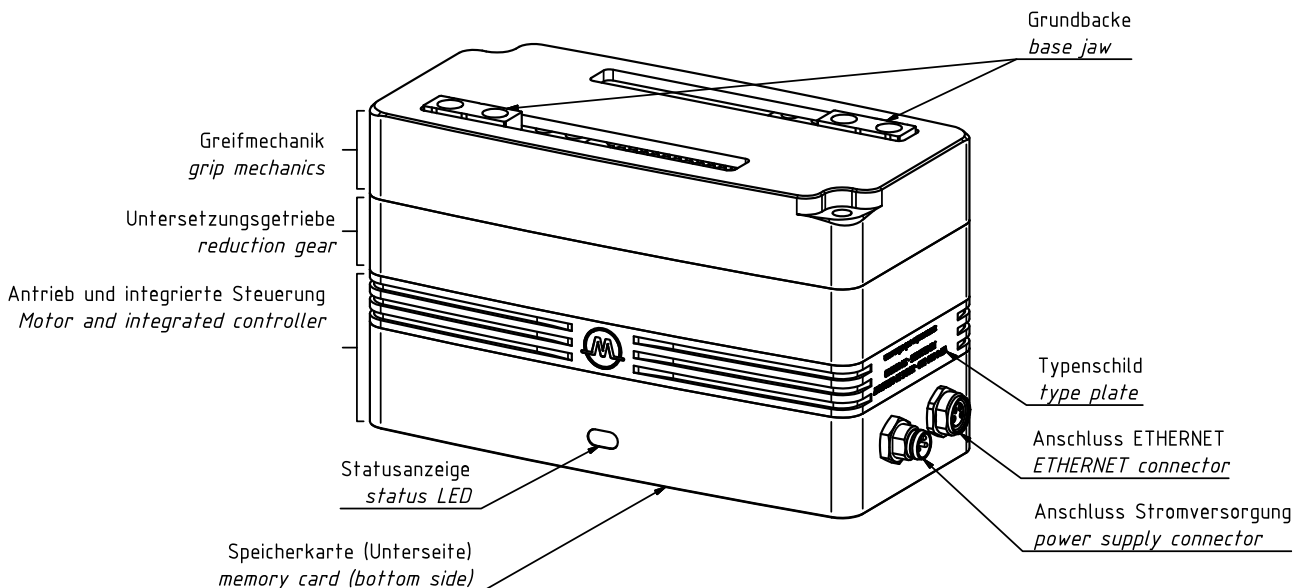


Figure 1: Components and connections of the gripping module

1.2 Related documents

The following additional documents for the operation of the gripping module are part of the documentation package:

- Technical drawing
- 3D model (STEP)
- Contents of the SD card in delivery state
- Interface description of the GRIPLINK protocol

For additional warranty information, please refer to our General Terms and Conditions, available at www.weiss-robotics.com/agb.

1.3 Target audience

The target audience for these instructions are plant manufacturers and operators who should keep this, and other documents always supplied accessible to personnel and, in addition, encourage them to read and observe the safety and warning instructions in particular.

It is also intended for qualified personnel and installers who should read these instructions and always observe and comply with the safety and warning instructions.

1.4 Notation and symbols

For a better overview, the following symbols are used in these instructions.



Function or safety-relevant note. Non-observance may endanger the safety of personnel and plant, damage the device, or impair the function of the device.



Additional information for a better understanding of the described facts.



Reference to further information.

2 Basic safety instructions

2.1 Intended use

The gripping module is designed for gripping and reliably holding workpieces or objects and is intended for installation in a machine. The requirements of the applicable directives as well as the assembly and operating instructions in this manual must be observed and complied with. The gripping module may only be used within the scope of its defined application parameters and only in industrial applications.

Any other use or use beyond this is considered improper, e. g. if the gripping module is used as a pressing, cutting, lifting or punching tool or as a clamping device or guiding aid for tools. The manufacturer is not liable for any damage resulting from this.

2.2 Ambient and operating conditions

The gripping module may only be used within its defined application parameters. It must be ensured that the gripping module and the fingers are sufficiently dimensioned according to the application, and that the environment is clean and the ambient temperature corresponds to the specifications in the data sheet. Observe the maintenance instructions (see chapter 11). Furthermore, it must be ensured that the environment is free

of splash water and vapors as well as abrasion or process dusts. This does not apply to modules that are specially designed for dirty environments.



Cleaning agents must be checked for compatibility with the outer materials of the gripping module!

2.3 Product safety

The gripping module corresponds to the state of the art and the recognized safety rules at the time of delivery. However, hazards may emanate from it if, for example:

- the gripping module is not used as intended
- the gripping module is improperly mounted, modified or incorrectly maintained
- the EC Machinery Directive, the VDE Directives, the safety and accident prevention regulations applicable at the place of use or the safety and assembly instructions are not observed

2.3.1 Protective devices



In order to be able to dispense with protective devices in accordance with the EC Machinery Directive, a risk assessment in accordance with the applicable directives/standards is necessary.

2.3.2 Structural changes, additions or conversions

Additional holes, threads or attachments that are not offered as accessories by WEISS ROBOTICS may only be attached after written approval by WEISS ROBOTICS.

2.3.3 Special standards

The gripping module complies with the following standards:

- Radio interference voltage, interference field strength and radiation according to EN 61000-6-3
- Fast transients on signal and data lines according to EN 61000-4-4
- HF current injection on signal and data lines according to EN 61000-4-6
- RF irradiation according to EN 61000-4-3
- Interference emission according to EN 61000-6-4 Class A
- Magnetic field with power frequency according to EN 61000-4-8
- Discharge of static electricity according to EN 61000-4-2

2.4 Personnel qualification

Installation, initial startup, maintenance and repair of the gripping module may only be performed by trained specialists.

Any person assigned by the operator to work on the gripping module must read the complete operating manual. In particular, chapter 2 "Basic safety instructions" must be read and understood. This also applies to personnel who are only occasionally assigned, for example maintenance personnel.

2.5 Safety conscious work

The safety and accident prevention regulations valid at the place of use must be observed.



Avoid moving parts by hand when the power supply is connected.



Do not reach into the open mechanics. Avoid reaching into the movement range of the gripping module.



Disconnect the power supply of the gripping module before carrying out any work.

2.6 Notes on special hazards



Risk of injury from falling and ejected objects! Provide protective devices to prevent objects from falling or being thrown out, e.g. machined workpieces, tools, chips, fragments, waste.



Risk of injury due to unexpected movements of the machine/plant! Perform risk assessment and take countermeasures.

3 Warranty

The warranty period is 12 months from the date of delivery to the factory, provided the machine is used for its intended purpose in single-shift operation and the prescribed maintenance and lubrication intervals or 10 million gripping cycles are observed. Parts that come into contact with the workpiece and wear parts (seals, wipers) are not covered by the warranty.

Please also refer to the General Terms and Conditions (GTC).

The gripping module is considered defective if its basic function, gripping, is no longer available.

4 Scope of delivery and accessories

The scope of delivery includes:

- WPG 300-120 or WPG 60-090 gripping module in the version ordered
- Accessories (material according to the list)
- Documentation package in electronic form

Size	WPG 60-090	WPG 300-120
Gripper module with built-in SD card	5120022	5120015
Accessory kit	5020079	5020076

Table 1: Part numbers Scope of delivery

The included accessory kit contains the following parts:

Size	WPG 60-090	WPG 300-120
Dowel pin ISO 8734 – 1.5m6 x 5	4	-
Screw ISO 4762 - M4 x 70	2	-
Dowel pin ISO 8734 - 4 m6 x 10	2	-
Centering sleeve 6h6 x 4.2 x 5.35	-	4
Screw ISO 4762 - M4 x 80	-	2
Dowel pin ISO 2338 - 4 h8 x10	-	2

Table 2: Supplementary pack Scope of delivery

The following accessories are available separately for the gripping module:

- Data cable Ethernet, M8 4-pin angled to RJ 45, 5m (Part No. 5070023)
- Connection cable, M8 4-pin angled to free LE, 5m (Part No. 5070006)
- Further variants of the data and connection cables on request
- Integration solutions for the integration of the gripping module into a robot controller



Order accessories separately.

Additional accessories can be found on our website at www.weiss-robotics.com.

5 Technical data

5.1 Mechanical nominal data



If the specified nominal data are exceeded, the gripping module may be damaged.

If in doubt, clarify your application with our technical sales department.

Mechanical operating data	Unit	WPG 60-090	WPG 300-120
Total stroke	mm	90	120
Nominal gripping force	N	60	300
Minimum gripping force	N	12	30
Max. relative finger speed	mm/s	Grip: 150 Release: 300	Grip: 150 Release: 300
Min. relative finger speed	mm/s	Grip: 5 Release: 5	Grip: 5 Release: 5
Max. relative finger acceleration	mm/s ²	Grip: 2500 Release: 5000	Grip: 2500 Release: 5000
Min. relative finger acceleration	mm/s ²	Grip: 500 Release: 500	Grip: 500 Release: 500
Recommended workpiece weight	g	1000	4000
Permissible finger length (L) ¹	mm	100	100
Permissible mass of the finger	g	300	300
Protection class gripping mechanism	IP	24	24
Protection class control	IP	64	64
Ambient temperature	°C	0 ... 50	0 ... 50
Humidity	%	0 ... 100	0 ... 100
Mechanical repeatability	mm	± 0,03	± 0,03
Displacement encoder		Relative	Relative
Resolution of the displacement encoder	mm	0,001	0,001
Accuracy of the displacement encoder	mm	± 0,01	± 0,01
Dead weight	g	950	1360

Table 3: Mechanical nominal data

¹ For nominal force, see dimension "L" in Figure 2

5.1.1 Permissible finger length

The permissible finger length L corresponds to the distance between the screw-on surface of the base jaw and the effective gripping force application point, see Figure 2. Maximum values for L can be found in the mechanical nominal data of the respective gripping module. If the maximum finger length is exceeded, it is mandatory to reduce the gripping force. In addition, the service life may be reduced.

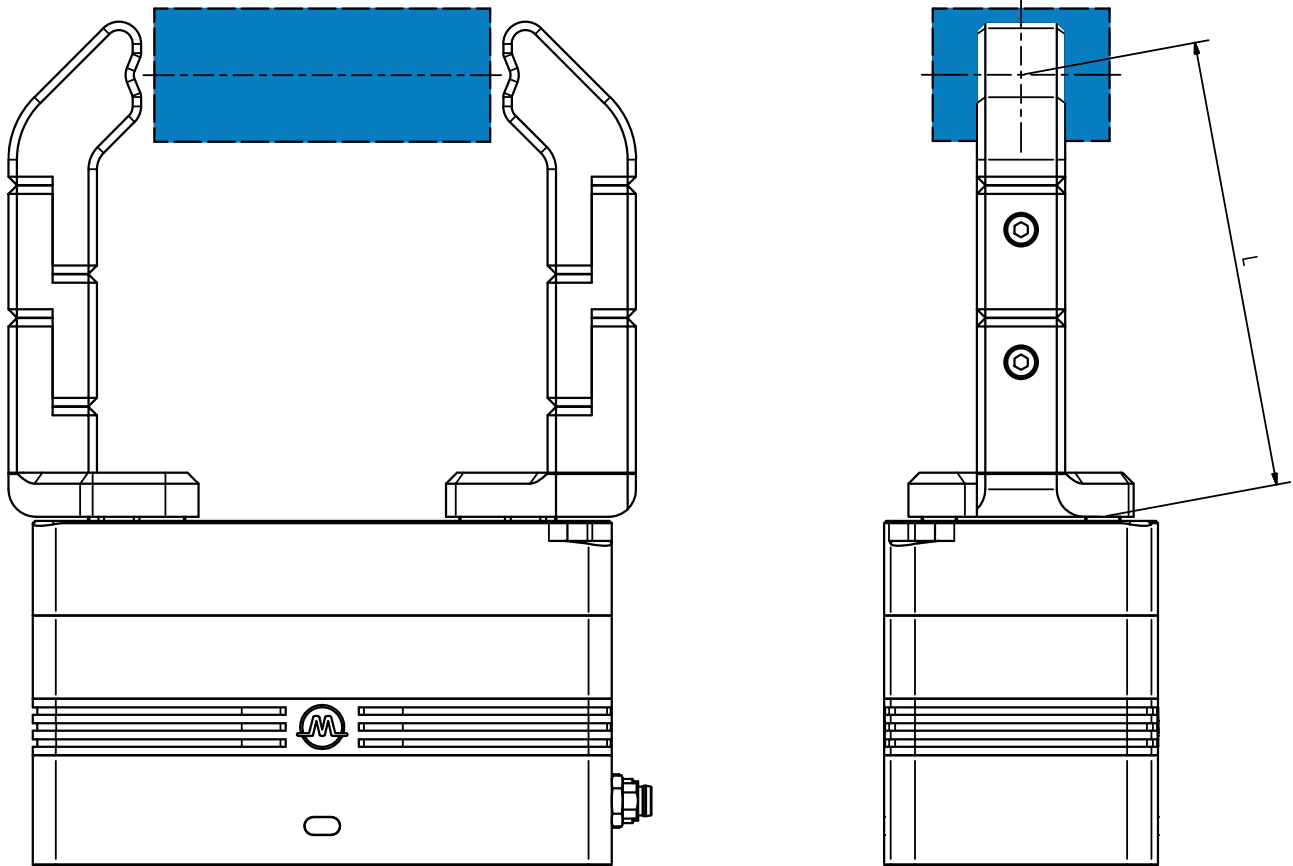


Figure 2: Determination of the finger length "L".

5.1.2 Gripping force, finger speed and acceleration

The gripping force can be set in newtons or as a percentage of the nominal gripping force. A gripping force adapted to the respective gripping situation should always be selected. If the gripping force is set too high, this will lead to increased wear of the gripping mechanism and unnecessary heat generation. A gripping force that is selected too low will, in the worst case, result in the loss of parts. When designing the gripping process, take into account both static and dynamic forces acting on the workpiece, for example during movement by a robot.

The specified minimum gripping force of the gripping module indicates the gripping force at which reliable workpiece detection is guaranteed, even across batches. It is technically possible to set lower gripping forces on the gripping module. In this case, however, preliminary tests are absolutely necessary and possible batch variations must be taken into account. Lower gripping forces than the specified minimum gripping force can cause the finger movement to falter during gripping and the gripped part can no longer be reliably detected.

Finger speed and acceleration can be set via the gripping parameters. The web interface provides a parameter editor (see chapter 8.3), with which these values are optimally calculated depending on the selected gripping force. This minimizes gripping impulse and rebound effects during undamped gripping.



Gripping forces below the specified minimum gripping force can lead to unexpected behavior. Take batch variations into account.



Excessive gripping speeds/accelerations that are not adapted to the workpiece may lead to an increased gripping impulse that can damage the workpiece and the gripping mechanism.

5.1.3 Permissible finger loads

The following table shows the permissible static loads on the base jaw guide.

Last	Unit	WPG 60-090	WPG 300-120
C ₀	N	1090	1890
T _x	Nm	2,9	6,9
T _y	Nm	11,8	26,0
T _z	Nm	10,8	23,6

Table 4: Static guide loads

In the case of superimposed forces and moments, the load carrying capacity of the guide must be recalculated according to the following equation:

$$\frac{M_x}{T_x} + \frac{M_y}{T_y} + \frac{M_z}{T_z} + \frac{F_z}{C_0} \leq 1,0$$

Here, C_0 and T are the permissible guide loads according to Table 4 and M is the sum of all moments occurring per base jaw (gripping, weight, inertia and process forces) in the application.

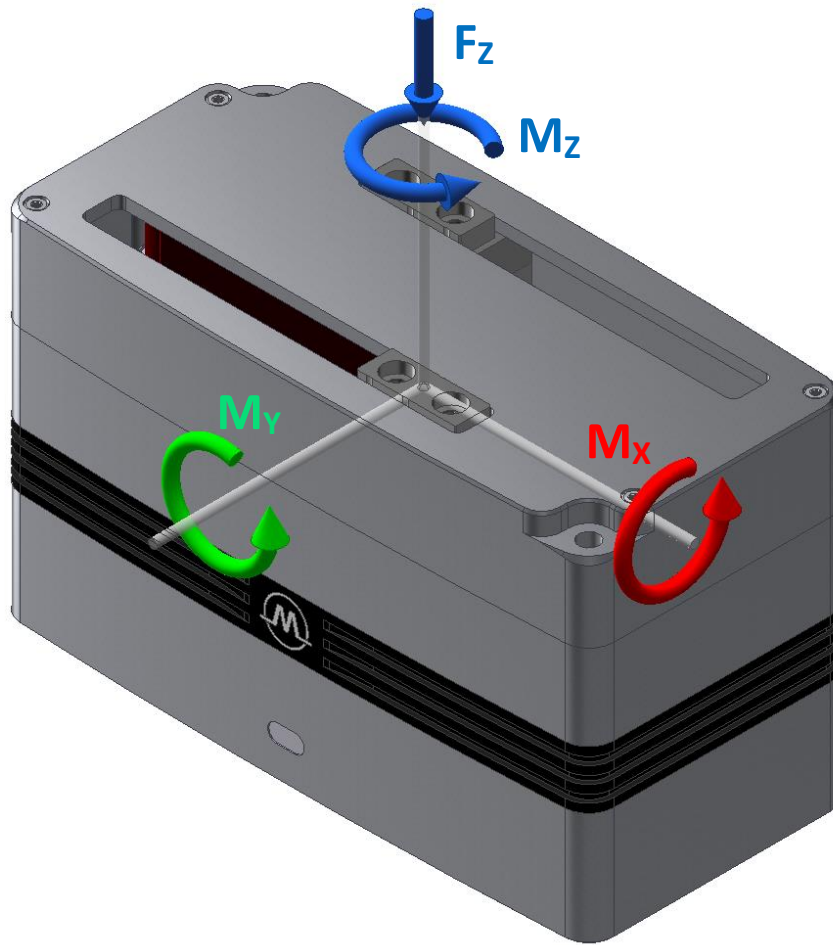


Figure 3: Finger loads

5.2 Electrical nominal data



*If the specified nominal data are exceeded, the gripping module may be damaged.
If in doubt, check your application with our technical sales department.*



Safety extra-low voltage (SELV) is recommended for operating the gripping module.

Electrical operating data	Unit	WPG 60-090	WPG 300-120
Supply voltage	V	24 ± 10%	
Max. residual ripple of the supply voltage	mV _{SS}	150	
Typ. current consumption (IDLE state)	A	0,1	
Typ. current consumption (holding at nominal gripping force)	A	TBD	0,35
Max. current consumption (peak current while moving)	A	TBD	2
Recommended min. rated output current of the power supply unit	A	5	

Monitoring	Unit	WPG 60-090	WPG 300-120
Undertemperature warning level	°C	0	
Overtemperature warning level	°C	55	
Overtemperature error level	°C	75	

Communication	Unit	WPG 60-090	WPG 300-120
Standard	-	IEEE 802.3	
Transmission speed	MBit/s	10, 100	
Protocol	-	Ethernet TCP/IP	

Table 5: Electrical nominal data

5.2.1 Power supply connection

Power is supplied via a four-pin M8 connector (plug) on the housing of the module (see Figure 1). The pin assignment is shown in Figure 4.

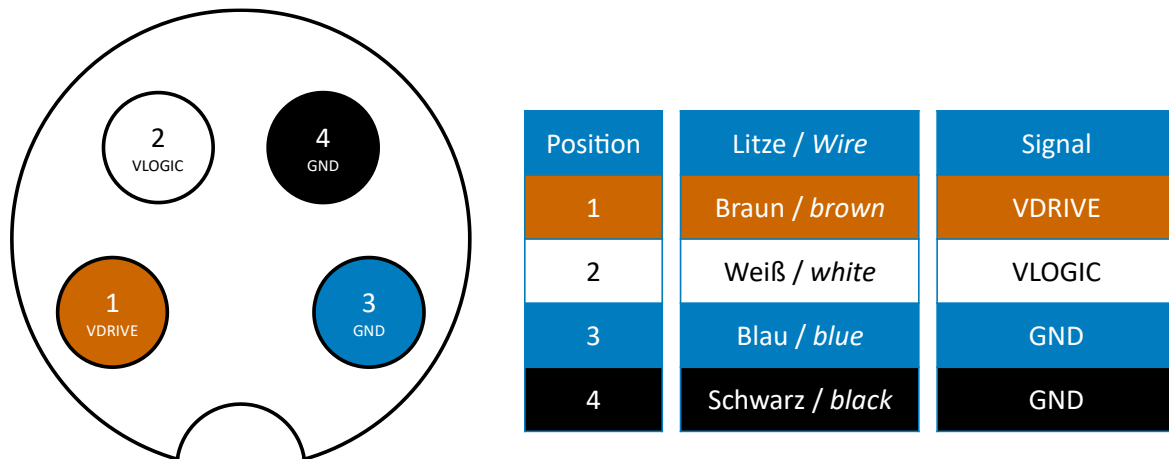


Figure 4: Power supply terminal (view of connector)



The maximum cable length of 10 m must not be exceeded. In environments with high electro-magnetic interference, e. g. in the vicinity of large electrical drives, this length may have to be reduced further and shielded cables may have to be used. If in doubt, carry out tests!

Safe Torque Off (STO)

Both the power and logic sections of the integrated gripper control are supplied via the M8 connector (see equivalent circuit diagram in Figure 5).

Power and logic section can be powered together (see Figure 6). If the application requires a separate power supply for the power and logic sections, for example to implement safe torque off (STO) with an external safety relay, the power and logic sections can also be supplied with power separately. This is shown in Figure 7. Power and logic supply are not galvanically isolated and must therefore be supplied via the same power supply unit.



In case of separate operation, always connect load and logic at the same supply! Damage to the gripping module possible.

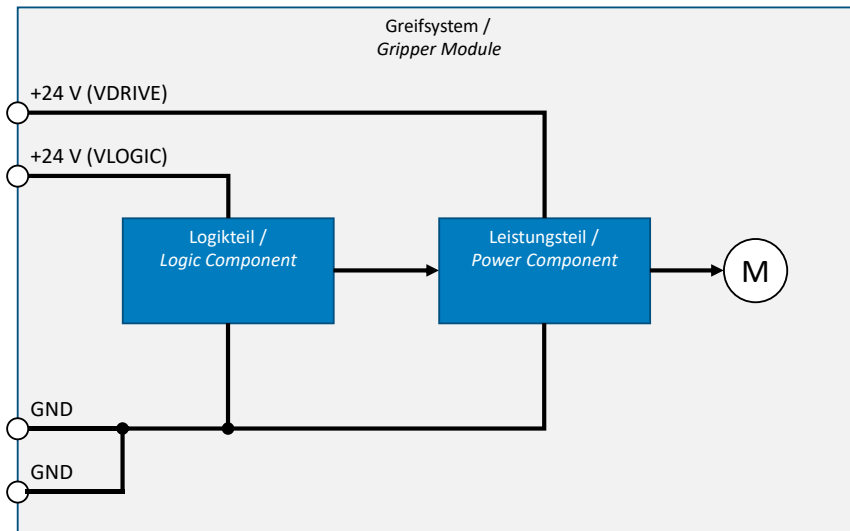


Figure 5: Internal structure of the power supply

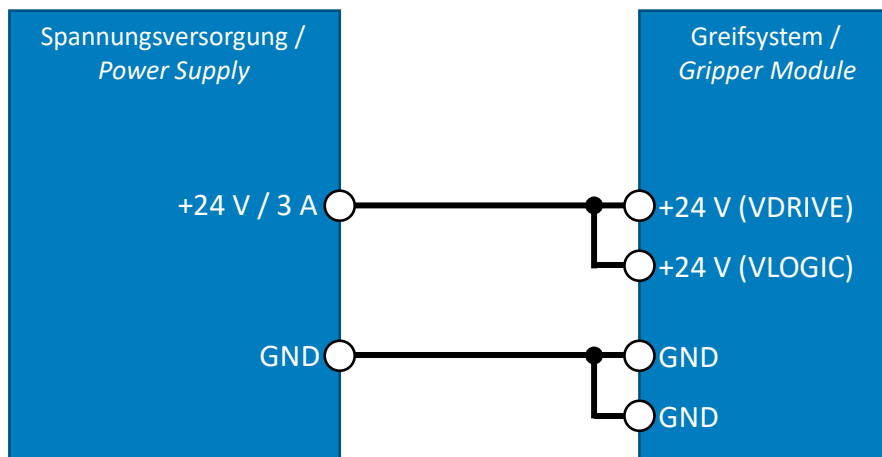


Figure 6: Common power supply for logic and power section

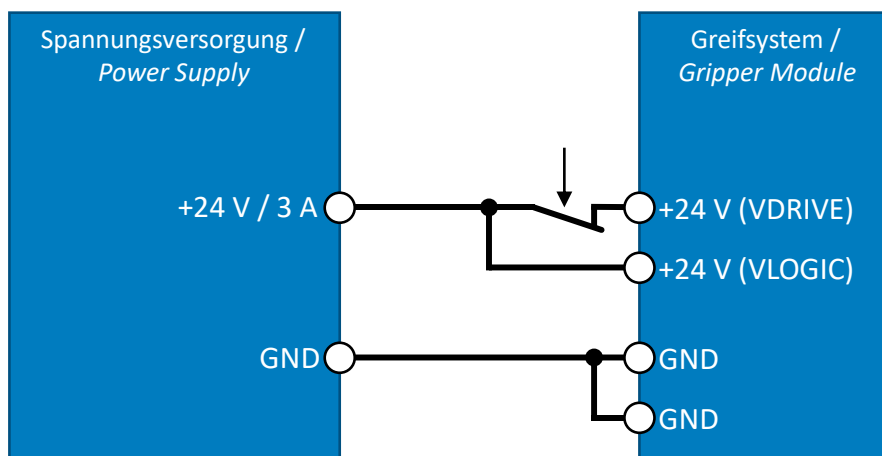


Figure 7: Separate power supply for logic and power section with STO function

5.2.2 Ethernet connection

The connection to an Ethernet network is also made via a four-pin M8 connector (socket) on the housing of the module (see Figure 1). The pin assignment is shown in Figure 8 and corresponds to the EtherCAT standard.

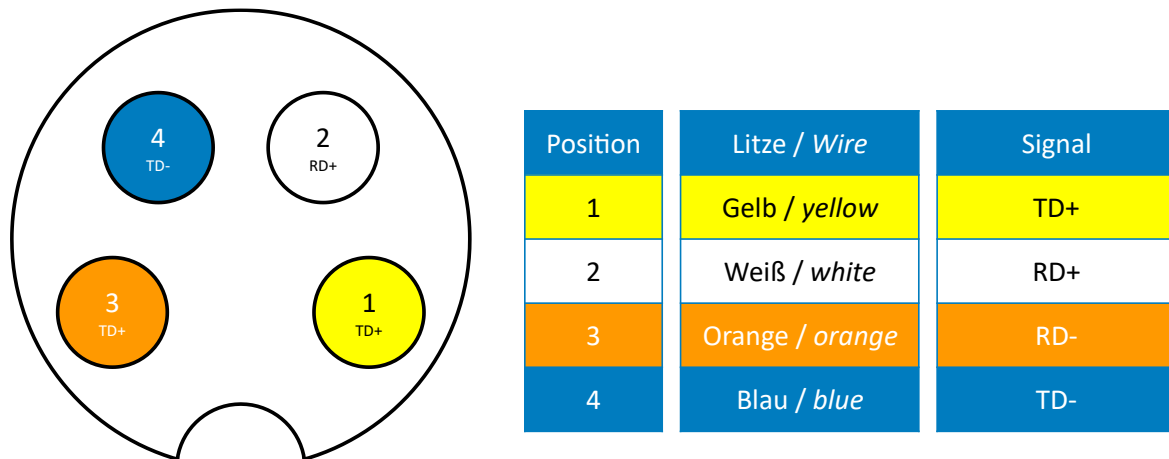


Figure 8: Ethernet connection terminal (view on socket)

6 Assembly and commissioning



Risk of injury in case of unexpected movements of the machine/system. Therefore, switch off the power supply and ensure that there is no force exerted on the gripping module during all work!



Risk of injury from falling objects. Wear personal protective equipment!

6.1 Assembly of the gripping module

For the dimensions of the threads and centering holes that can be used for mounting the gripping module, refer to the technical drawing of the respective size.

The gripping module can be mounted against a surface from below as well as from above. Figure 9 shows the two variants.

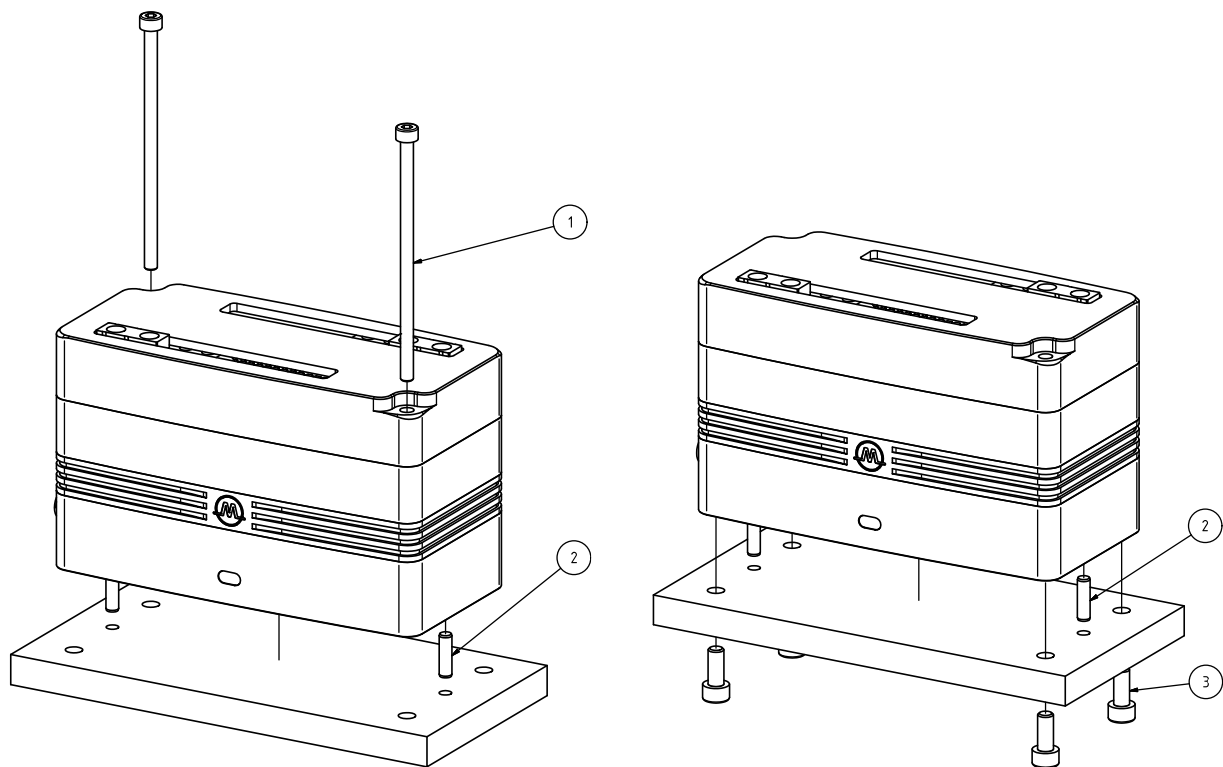


Figure 9: Mounting the gripping module from above (left) and from below (right)

The mounting of the fingers is shown in Figure 10. The centering sleeves (for WPG 300-120) and dowel pins (for WPG 60-090) must be used for mounting and are included in the accessory kit that comes with the gripping module.

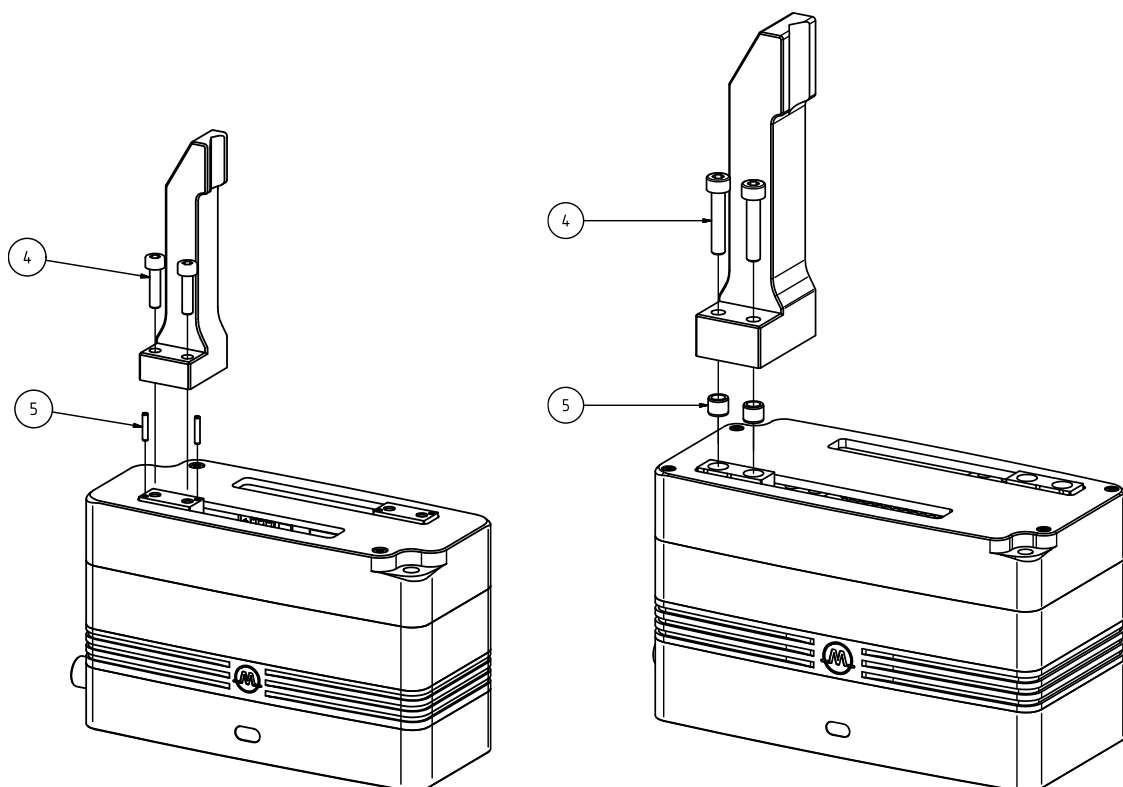


Figure 10: Mounting the WPG 60-090 (left) and WPG 300-120 (right) fingers

The following table lists all screws, centering pins and centering sleeves recommended for mounting.

Position	WPG 60-090	WPG 300-120
1	2 pieces Screw, cylinder head (e. g. ISO 4762), M4 x 70 (min. 6 mm screw-in depth)	2 pieces Screw, cylinder head (e. g. ISO 4762), M4 x 80 (min. 6 mm screw-in depth)
2	2 pieces Dowel pin ISO 8734 - 4 m6	2 pieces Dowel pin ISO 2338 - 4 h8
3	4 pieces Screw, cylinder head (e. g. ISO 4762), M5 (min. 6 mm screw-in depth)	4 pieces Screw, cylinder head (e. g. ISO 4762), M5 (min. 6 mm screw-in depth)
4	4 pieces Screw (e. g. ISO 4762) M3 (min. 4 mm screw-in depth)	4 pieces Screw (e. g. ISO 4762) M4 (min. 6 mm screw-in depth)
5	2 pieces Dowel pin ISO 8734 - 1.5 m6	4 pieces Centering sleeve 6 h6 x 5.5 Weiss Robotics part no. 2090046

Table 6: Screws, centering pins and centering sleeves for mounting.

7 Function of the gripping module

This gripping module is a servo-electrically driven two-finger parallel gripper with an integrated gripping control, a particularly power-dense brushless drive and a high-resolution position measuring system. The movement and synchronization of the base jaws, which are guided by roller bearings, are effected via toothed belt kinematics. The pre-positioning capability of the gripper fingers as well as the innovative gripping force control allow the use in a wide range of different handling applications in various fields of industrial automation. Power supply and connection to the process control system are provided via two plug connectors (see section 5.2).

The integrated gripping control features highly optimized workpiece detection. Up to eight different workpieces can be parameterized and reliably gripped via the web interface or dynamically via the command interface. A position window is defined for each workpiece in which the grip must adjust itself. If the gripping module grips within this range, it changes from state RELEASED to HOLDING, which is the signal for a successful grip for the process control.

The gripping module continuously monitors the function-relevant components such as position sensors and drive and provides detailed diagnostic information via the command interface during operation. This serves to detect malfunctions.

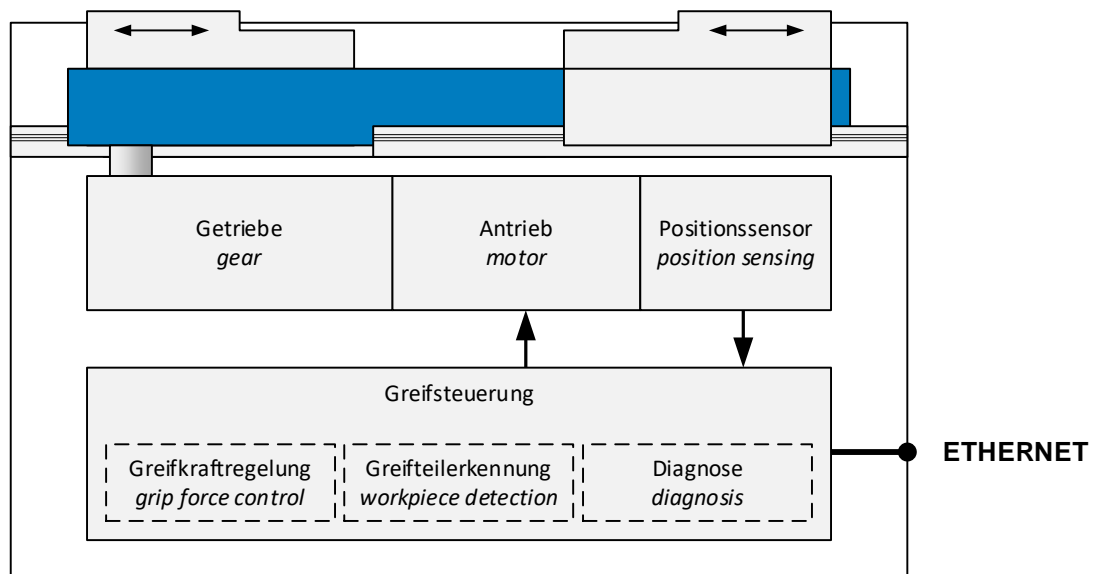


Figure 11: Functional diagram of the gripping module

Two status LEDs show the status of the gripping module and whether communication is in progress via the network interface. The position of the LEDs is shown in Figure 12: Status display via LEDs.

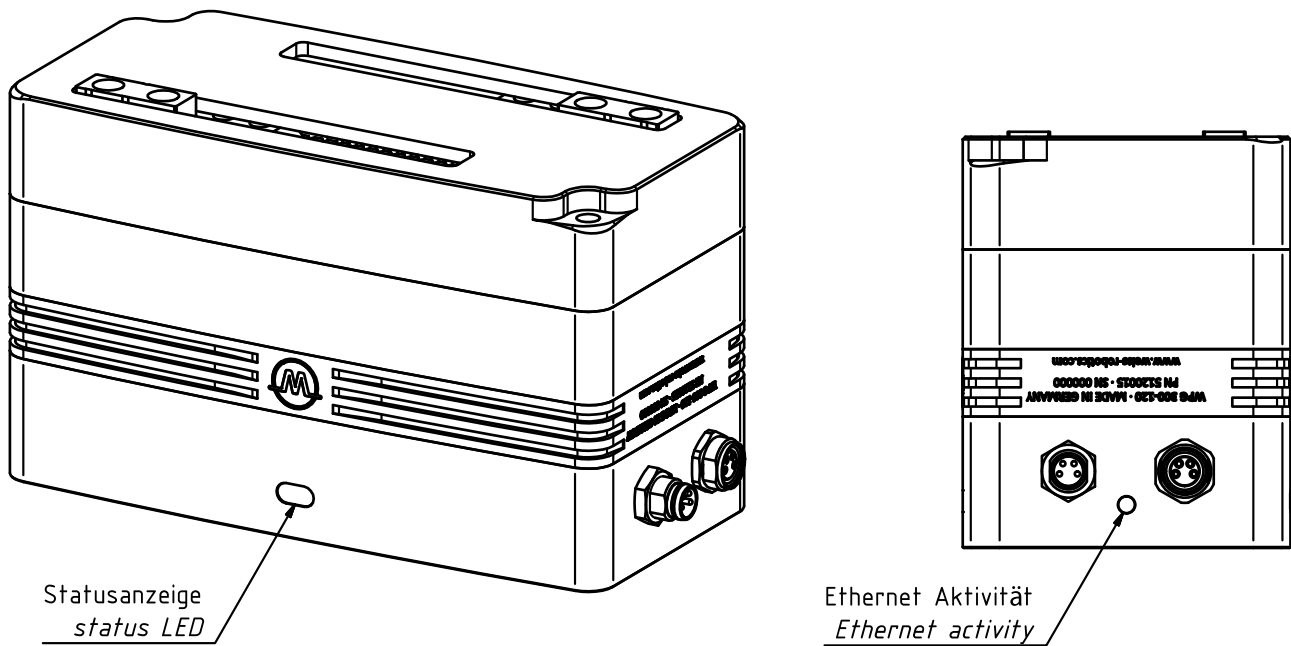


Figure 12: Status display via LEDs

7.1 Non-volatile memory

The gripping module has a non-volatile memory in which the following information is stored:

- Device-specific factory adjustment
- Parameterization of the gripping module
- Log memory

7.2 SD memory card

To save adjustable configuration data, the SD memory card located on the bottom of the gripping module is used.

7.2.1 Removing and reinserting the SD memory card

The SD memory card is covered by a cover plate, which can be removed by releasing two screws (Figure 13). By pulling the SD card holder slightly backward, the lock opens and the holder can be flipped upward. This allows the SD memory card to be pulled out and inserted again.

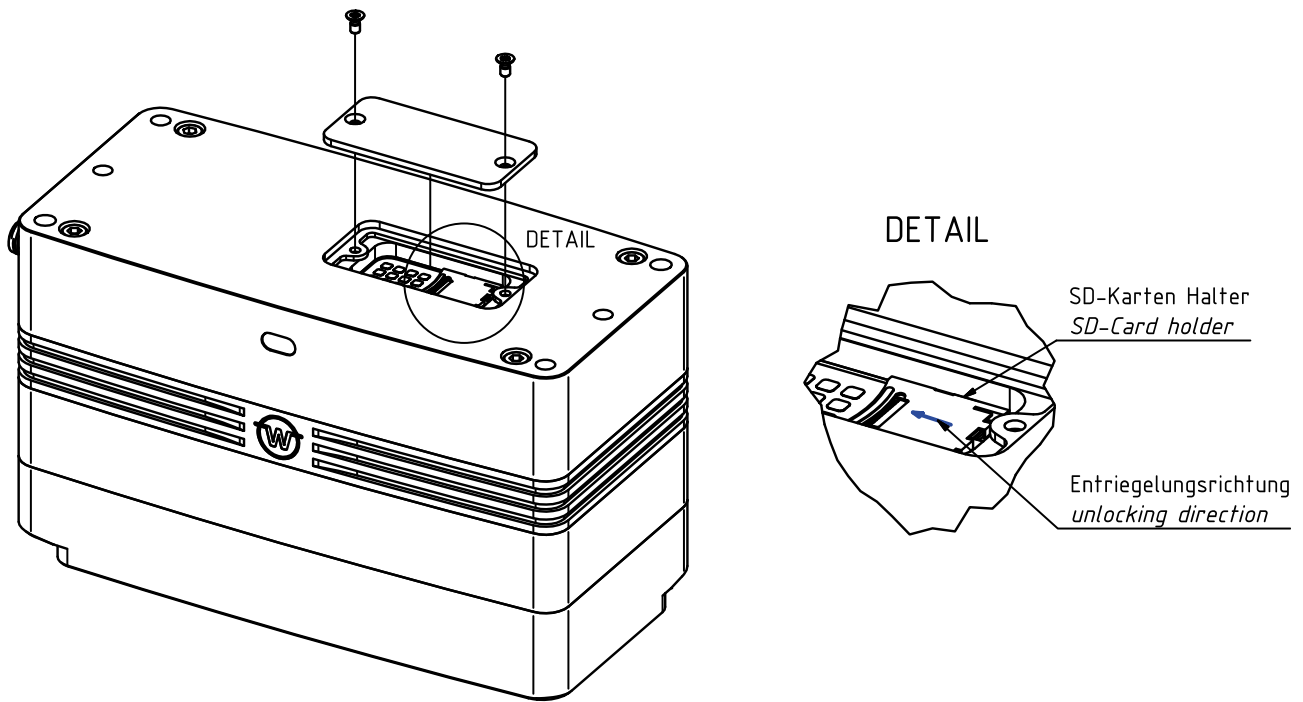


Figure 13: Changing the SD card



When opening the SD card holder, proceed with caution to avoid damage!



Operating the gripping module without SD memory card is not permitted and may lead to malfunctions!

7.2.2 SD memory card content

The file structure of the SD memory card is as follows:

```

SD-Karte
|
+- ./config          DIR: Verstecktes Verzeichnis für Einstellungen
|
| +- ./gripper       DIR: Verzeichnis für greiferspezifische Einstellungen
| |
| | +- gripper.yaml  F: Konfigurationsdatei für greiferspezifische Einstellungen
| | +- griplink.yaml F: Konfigurationsdatei für Proxy-Einstellungen
| |
| +- interfaces      F: Konfigurationsdatei für Netzeinstellungen

```

Figure 14: Contents of the SD memory card at delivery

8 Configuration and monitoring via the web interface

The web interface can be opened with a PC, tablet or similar via a web browser. To do this, enter the IP address or the mDNS URL of the gripping module in the browser's address bar.



Not all browsers (e.g. Internet Explorer) are supported. We recommend using Google Chrome or Mozilla Firefox.



The mDNS URL of a gripping module consists of the type code and its six-digit serial number (leading zeros).

Example for S/N 123: <http://wpg-000123.local/>

8.1 Status overview

The status overview shows the most important parameters of the gripping system for monitoring. These include gripping state, opening width of the base jaws, device temperature and supply voltage. Via the blue tab at the top of the window, the control panel can be unfolded (see chapter 8.4).

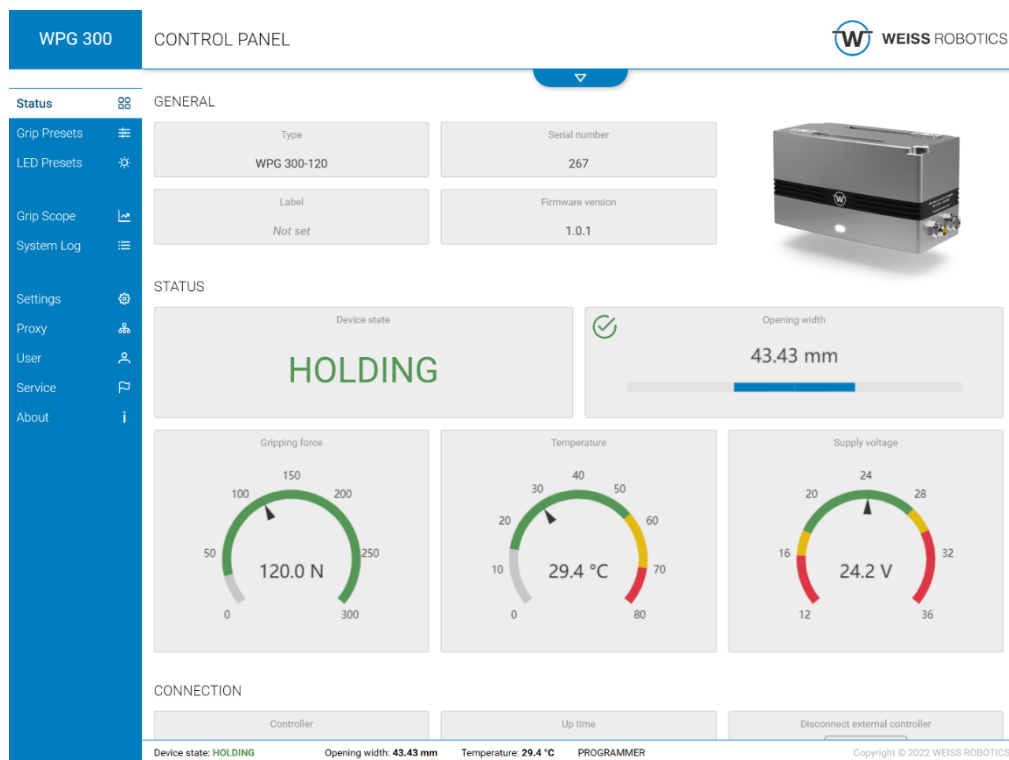


Figure 15: Status overview

8.2 User management

The web interface distinguishes between different user roles, which are listed in Table 7. The permissions of a role include the permissions of the roles above.

User	Permissions	Default password
Worker	Execute grip commands Grip scope control Setting the UI language Reading out the motion controller and command log	No password required
Programmer	Configuration of Grip and LED presets incl. Teach Wizard Configuration of the network interface Reading the command log Adding/Deleting Licenses Performing a firmware update Changing the programmer password	wpg_prog
Supervisor	Extended access rights	-

Table 7: User roles on the web interface



The “Supervisor” user is not required for normal operation or configuration. It is only accessible for Weiss Robotics!

Via the user menu, the corresponding user can log in with the resp. password.

Figure 16: User selection (left) and logged in user Programmer (right).

8.3 Grip parameter configuration

Up to eight grip presets can be configured in the "Grip Presets" menu. These are displayed in table form.

Status	GRIP PRESETS
Grip Presets	
LED Presets	
Grip Scope	
System Log	
Settings	
Proxy	
User	
Service	
About	

INDEX	LABEL	NO PART LIMIT	RELEASE LIMIT	FORCE	
0	Not set	1.00 mm	119.00 mm	300.00 N	
1	Not set	1.00 mm	119.00 mm	300.00 N	
2	Not set	1.00 mm	119.00 mm	300.00 N	
3	Not set	1.00 mm	119.00 mm	300.00 N	
4	Not set	1.00 mm	119.00 mm	300.00 N	
5	Not set	1.00 mm	119.00 mm	300.00 N	
6	Not set	1.00 mm	119.00 mm	300.00 N	
7	Not set	1.00 mm	119.00 mm	300.00 N	

STORE RELOAD

Figure 17 Overview of the handle presets

8.3.1 Permissible value range

Parameter	WPG 60-090		WPG 300-120	
	Minimum value	Maximum value	Minimum value	Maximum value
No Part limit	-60	60	-300	300
Release limit	-60	60	-300	300
Gripping force	12	60	30	300
Gripping speed	5	150	5	150
Gripping acceleration	500	2500	500	2500
Release speed	5	300	5	300
Release acceleration	500	3000	500	5000

Table 8: Permissible value range of the grip preset parameters

8.3.2 Editor

The button at the right end of each line can be used to open the editor to change the default settings.



The editor can be opened only by the "Programmer" user.



To save the set values non-volatile on the gripping module, click the "Save" button below the preset table.

GRIP PRESET 6

Label	10 50 120	
No part limit	10	mm
Release limit	50	mm
Force	120	N

Force-dependent motion parameters

Select the checkbox to calculate optimum motion parameters when changing the force value.

☒ Calculate optimum force-based motion settings

Grip Velocity	53	mm/s
Grip Acceleration	1167	mm/s ²
Release Velocity	103	mm/s
Release Acceleration	2000	mm/s ²

☆ WIZARD

OK

CANCEL

Figure 18: Grip preset editor

8.3.3 Teach Wizard

A wizard can be called up via the grip editor, with which workpieces can be taught in quickly and safely.

The first step is to ensure that the gripping module is referenced.



The gripping module is deactivated. Make sure that the gripping module does not hold any workpiece at this time and observe the displayed warning messages!

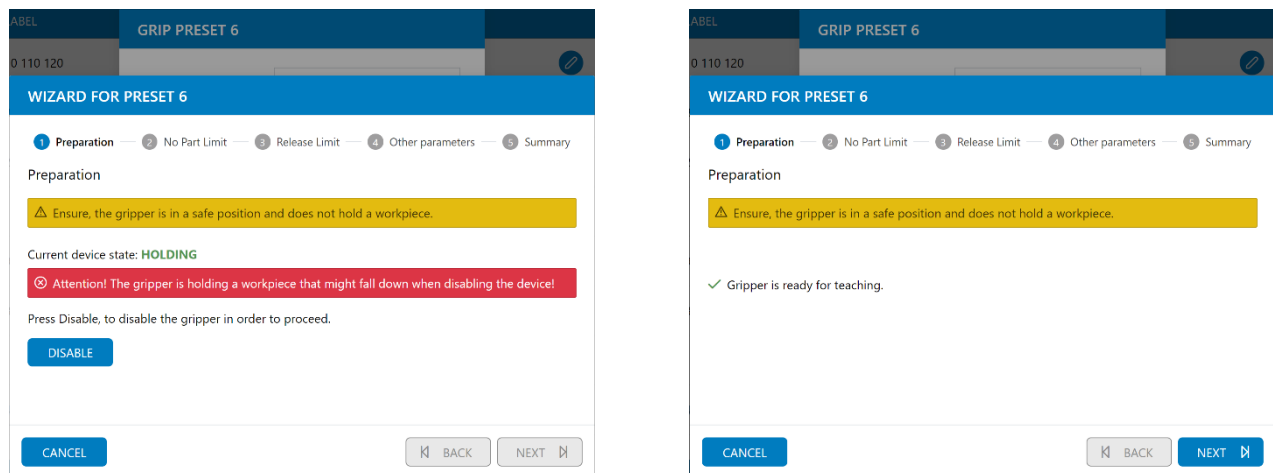


Figure 19: Gripping module is not ready for teach-in (left), gripping module is ready for teach-in (right)

The user then places the workpiece between the fingers of the gripping module so that the gripper touches the workpiece at the gripping points. Then the fingers are moved by the user so that the gripper releases the gripped part. These steps are independent of whether the component is gripped from the outside or the inside.

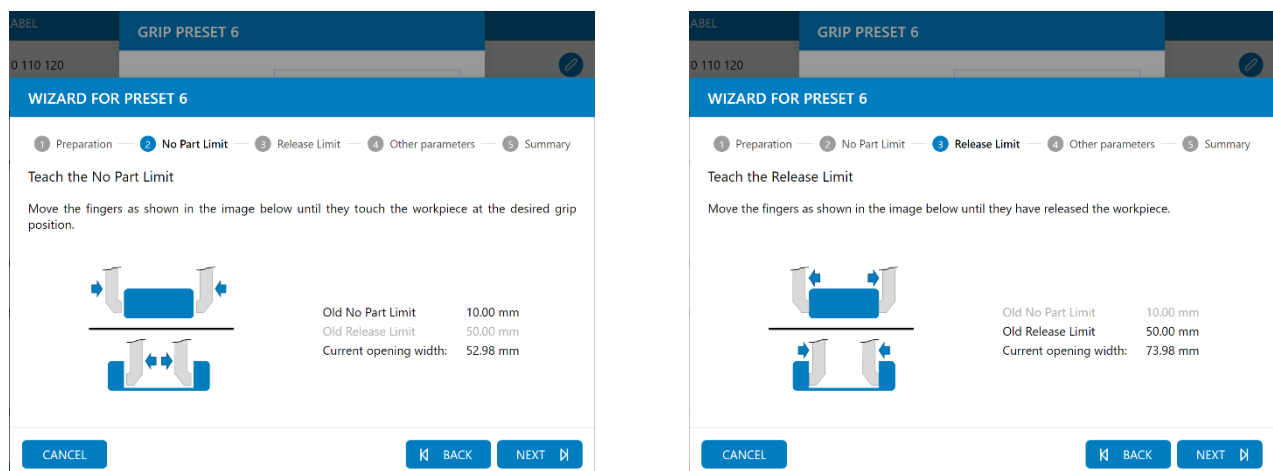


Figure 20: Teaching the NO PART limit (left) and RELEASE limit (right).

Finally, further parameters can be adjusted according to the workpiece properties. The info buttons can be used to display further information on the parameters and their optimized settings. Pressing the "Done" button takes you back to the preset editor, where you can confirm or fine-tune the taught-in values.

WIZARD FOR PRESET 6

1 Preparation — 2 No Part Limit — 3 Release Limit — 4 Other parameters — 5 Summary

Gripping force
120 N

The Part Width Tolerance can be used to compensate charge tolerances or flexibility of the work piece.
1 mm

If the checkbox is selected, force-based optimum motion parameters are calculated based on the taught values.
☒ Automatically calculate optimum motion parameters

WIZARD FOR PRESET 6

1 Preparation — 2 No Part Limit — 3 Release Limit — 4 Other parameters — 5 Summary

Preset comparison

No Part Limit:	10.00 mm →	51.98 mm
Release Limit:	50.00 mm →	73.98 mm
Gripping force:	120.00 N →	120.00 N

Motion parameters

⚠ Use optimum motion parameters.

Grip Velocity	53 mm/s	Grip Acceleration	1167 mm/s ²
Release Velocity	103 mm/s	Release Acceleration	2000 mm/s ²

Figure 21: Further settings (left) and summary (right)



The taught-in values are not written to the gripping module until they are confirmed in the preset editor. For a non-volatile storage of the parameters, observe the notes in chapter 8.3.1.

8.4 LED presets configuration

Up to eight LED presets can be configured in the "LED Presets" menu. These are displayed in a table.

Status	☰	LED PRESETS			
Grip Presets	☰				
LED Presets	☰				
Grip Scope	☰				
System Log	☰				
Settings	⚙️				
Proxy	👤				
User	👤				
Service	🔧				
About	ℹ️				

INDEX	MODE	COLOR	SPEED	
0	GRIPSTATE	—	—	
1	ON	GREEN	—	
2	BLINK	GREEN	NORMAL	
3	ON	RED	—	
4	BLINK	RED	FASTEST	
5	ON	YELLOW	—	
6	BLINK	YELLOW	FAST	
7	RAINBOW	—	—	

STORE
 RELOAD

Figure 22: Overview of the LED presets

8.4.1 Editor

The button at the right end of each line can be used to open the editor to change the default settings.

LED PRESET 2

Mode

Blink

▼

Color

Green

▼

Speed

Normal

▼

OK

CANCEL

Figure 23: LED preset editor



The editor can be opened only by the "Programmer" user.



To save the set values non-volatile on the gripping module, click the "Save" button below the preset table.

8.5 Manual Control

A tab appears at the top of the web application. If this is clicked, a window opens with which the gripper can be controlled.

The "Gripping" tab provides inputs to perform grip and release actions with the configured grip presets.

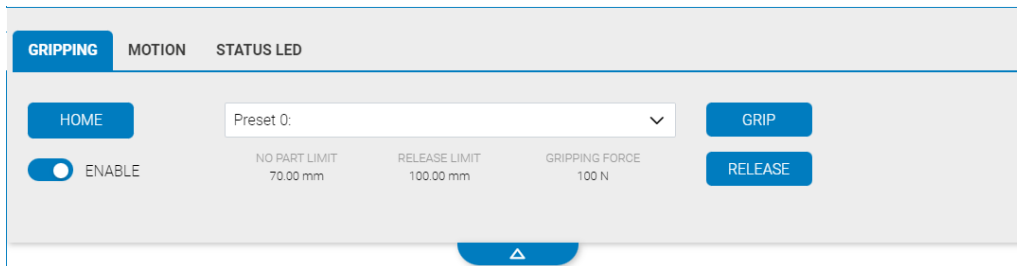


Figure 24: Control panel tab "Gripping"

The "Motion" tab allows moving the fingers to a specified position. The movement speed can also be set.

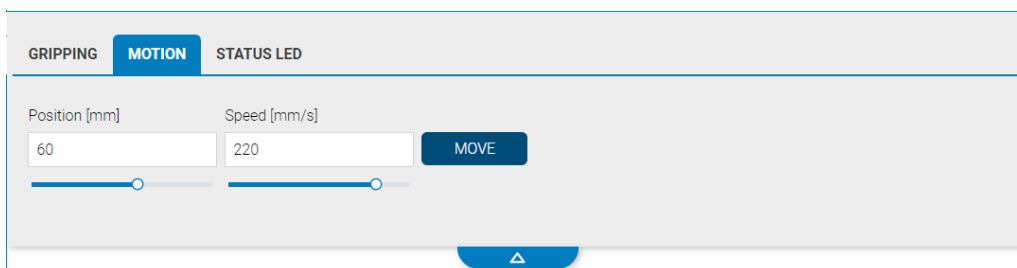


Figure 25: Control panel tab "Motion"

In the tab "Status LED" the presets of the LED can be controlled.

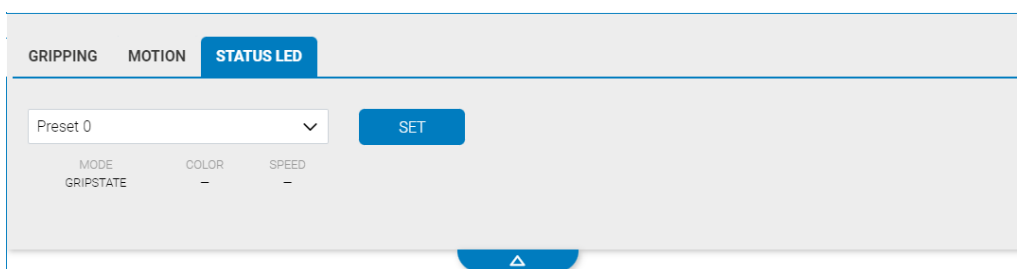


Figure 26: Control panel tab "Status LED"



The Control Panel is not available on all pages.

8.6 Settings

Basic settings of the gripping system can be made in the "Settings" menu.

WPG 300 CONTROL PANEL		WEISS ROBOTICS	
Status Grip Presets LED Presets Grip Scope System Log Settings Proxy User Service About	GENERAL SETTINGS		GRIPPER SETTINGS
	Label Not set		Homing direction normal Normal
			STORE
	NETWORK SETTINGS		USER INTERFACE
	IP address 192.168.1.50		Language English
	Sub-net mask 255.255.255.0		
	Gateway 192.168.1.1		
	DNS		
	MAC address 00:0C:C6:88:4E:CD		

Figure 27: Settings for gripper parameters, network and UI



Some settings cannot be changed by the "Worker" user. Log in as "Programmer".



When changing the device-specific settings, values are only saved remanently when the "Save" button is pressed. Before that, the values are only transferred to the gripper volatile.

8.7 GRIP SCOPE

With the optionally available extension GRIP SCOPE (OPT-WPG-SCOPE), the exclusive visualization module for gripping processes from Weiss Robotics, the most important gripping parameters can be monitored and graphically displayed during operation. GRIP SCOPE can be accessed via the web interface of the gripping module.



The GRIP SCOPE function is only available with an activated license (OPT-WPG-SCOPE). Contact our sales department at sales@weiss-robotics.com for more information.

Similar to an oscilloscope, a distinction is made between AUTO mode and SINGLE mode. The AUTO mode starts a time unlimited measurement starting from the first trigger. In SINGLE mode, a single recording is started as soon as a trigger is detected.

The trigger can be set via the corresponding button. The dialog shown below opens.

Figure 28: Settings of the GRIP SCOPE trigger

A recording has a predefined length, adjustable via the "Recording duration" slider. It is possible to include data before the trigger condition in the recording. This is set via the "Start offset" slider.

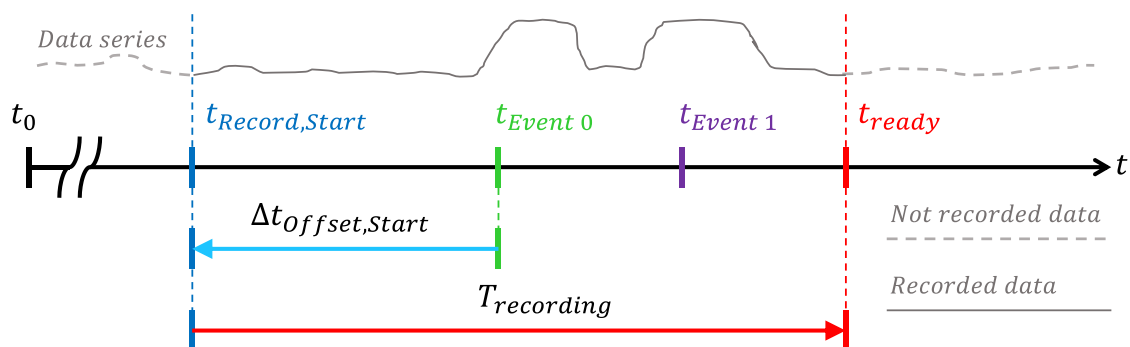


Figure 29: Time response of the Grip Scope recording

Various data series are displayed on the graphical interface. The current image of the Grip Scope can be exported as a graph by pressing a button. The corresponding button can be found in the upper right corner of the graph area.



Figure 30: Example of a running recording in AUTO mode

8.8 Setting up a proxy network

In applications where more than one WPG gripping module is to be used, the optionally available proxy license (OPT-WPG-PROXY) can be used to set up a network of several WPG gripping modules, one of which acts as a master and forwards incoming commands from the higher-level controller to up to seven WPG slaves. The master remains the only contact for the robot controller, which greatly simplifies implementation in an existing system.

In combination with a GRIPLINK controller (e.g. GRIPLINK-ET4, part no. 5020069), these gripping modules can also be linked to IO-Link-capable automation components and operated in the same application.



See also Application Note *an_griplink_proxy_en.pdf* (available as download on our website at www.griplink.de)



The proxy functionality is only available with the license activated on the master device (OPT-WPG-PROXY). Contact our sales department at sales@weiss-robotics.com for more information.

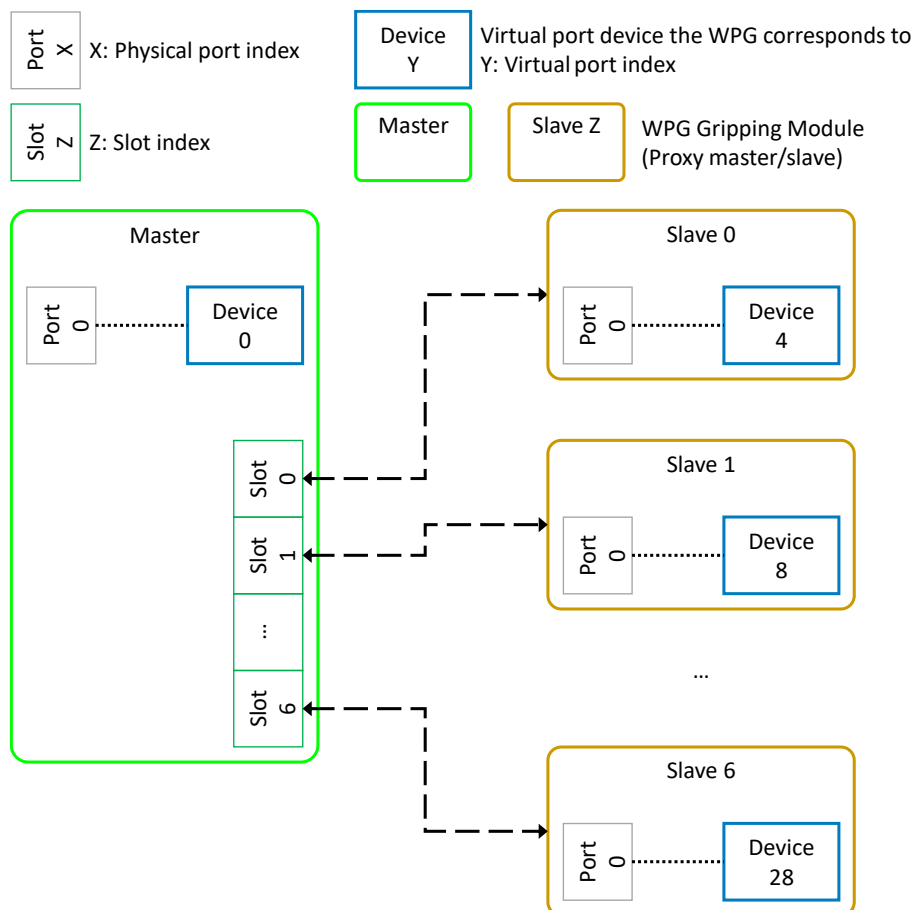


Figure 31: Simple proxy network of several WPG gripping modules

8.9 Licenses

Licenses can be activated or deactivated in the Service menu. Via the "Add" button, the license key can be entered in the dialog that opens.



LICENSING		
Current licenses		
FEATURE	STATE	ACTIONS
OPT-WPG-DEV	Activated	
OPT-WPG-PROXY	Not activated	
<div>+ ADD</div>		

Figure 32: Available license options and their state



Licenses can be edited only by the "Programmer" user.



After a valid license key has been entered, a restart of the gripping module is necessary before the full functionality of the linked feature is available.



To obtain licensable options, please contact Technical Sales at sales@weiss-robotics.com.

8.10 Firmware update

The firmware can be updated directly via the web interface.



Update the firmware of the gripping module only after prior consultation with Weiss Robotics technical support!

9 Interface description GRIPLINK protocol

The interface description for the GRIPLINK protocol can be found in the documentation package WPG.

10 Control of the gripping module

10.1 Gripper state

The gripping module is always in a defined gripping state. This state is generated by the integrated workpiece detection. It can be used to control the handling process. Table 9 lists the possible gripping states.

State	Description
IDLE	Gripper in idle mode The gripping module is inactive and the fingers are switched powerless.
ENABLED	Gripper in active mode The gripping module is active and holds the current position of the base jaws without a grip or release command being executed. The base jaws remain in this position.
RELEASED	Part released The workpiece is released, i.e. the RELEASE limit of the selected grip has been reached. The base jaws remain in this position under position control.
NO PART	No part gripped No workpiece was detected during gripping, i.e. the selected NO PART limit was reached. The base jaws remain in this position under position control.
HOLDING	Part is held The gripping module has blocked between the selected NO PART and RELEASE limits and the base jaws do not move. The workpiece is held with the set force, the workpiece monitoring is active.
FAULT	An error has occurred An internal error has occurred that prevents the gripping module from functioning correctly.

Table 9: Gripper states

The possible transitions between the states are shown in Figure 33.

A change of state is initiated by the gripping commands GRIP/RELEASE and ENABLE/DISABLE. If the gripping module receives a new command, it is executed and then, depending on the result, the gripper state is updated accordingly. During the process, each of these commands leads to a change of state, so that the completion of a command can be recognized by waiting for a change of state.

The gripper state thus provides a simple way of mapping the gripping process into the higher-level controller. After a new gripping command has been triggered, it is only necessary to wait for the gripping state to change in order to detect whether the command has been executed correctly or not and to execute the next process step depending on this transition.



The HOME command (reference travel) does not lead to a change of state. The command is blocking and the higher-level controller receives a feedback as soon as the reference run has been completed or aborted in case of an error.

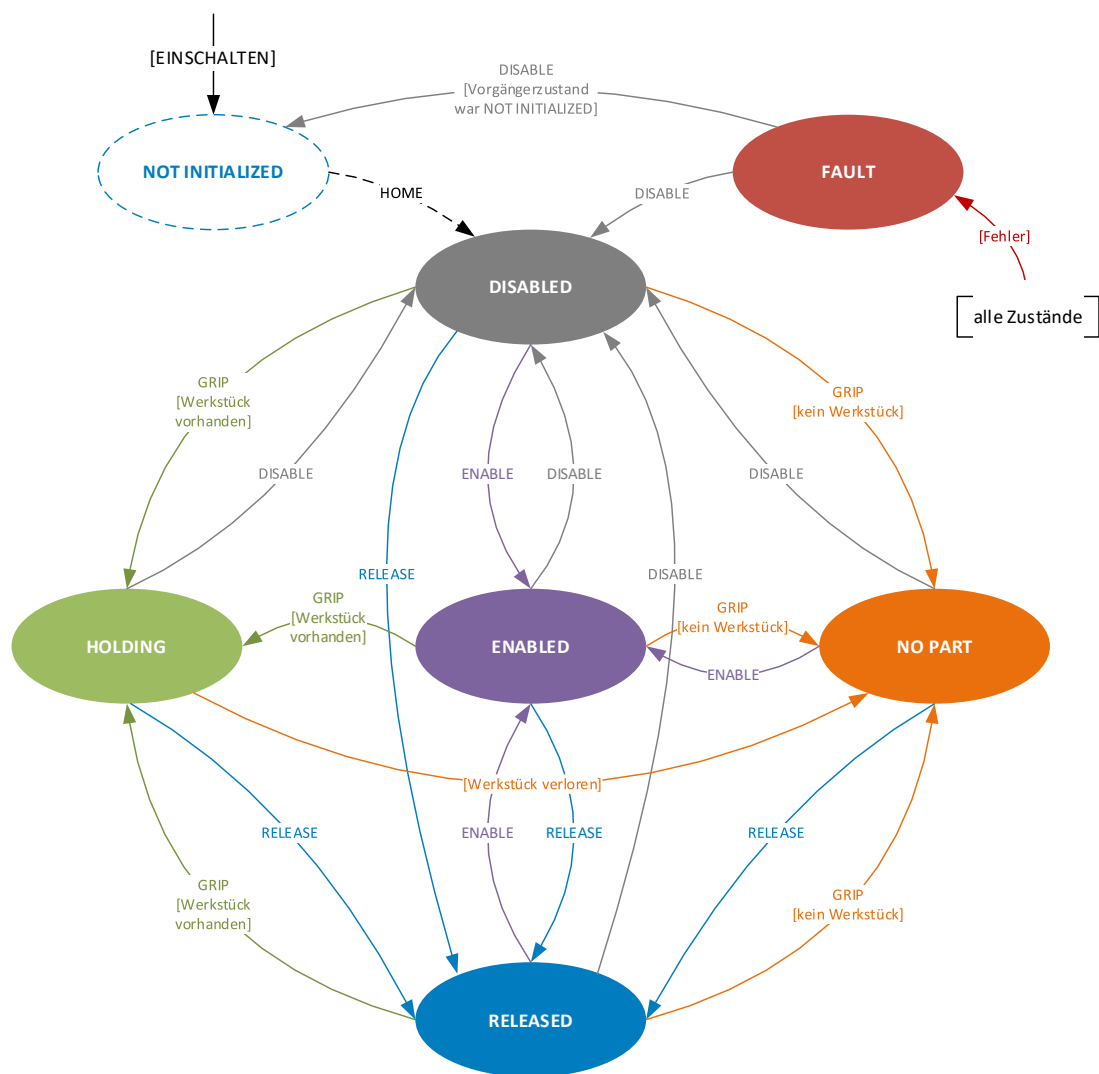


Figure 33: State transitions

10.2 Position sensor technology

The gripping module has an integrated position measuring system with which the position of the base jaws is recorded with high precision. The position value represents to the distance between the two base jaws,

with the inner stop corresponding to the value 0 mm. Figure 34 shows the relationship between the position value and the position of the base jaws.

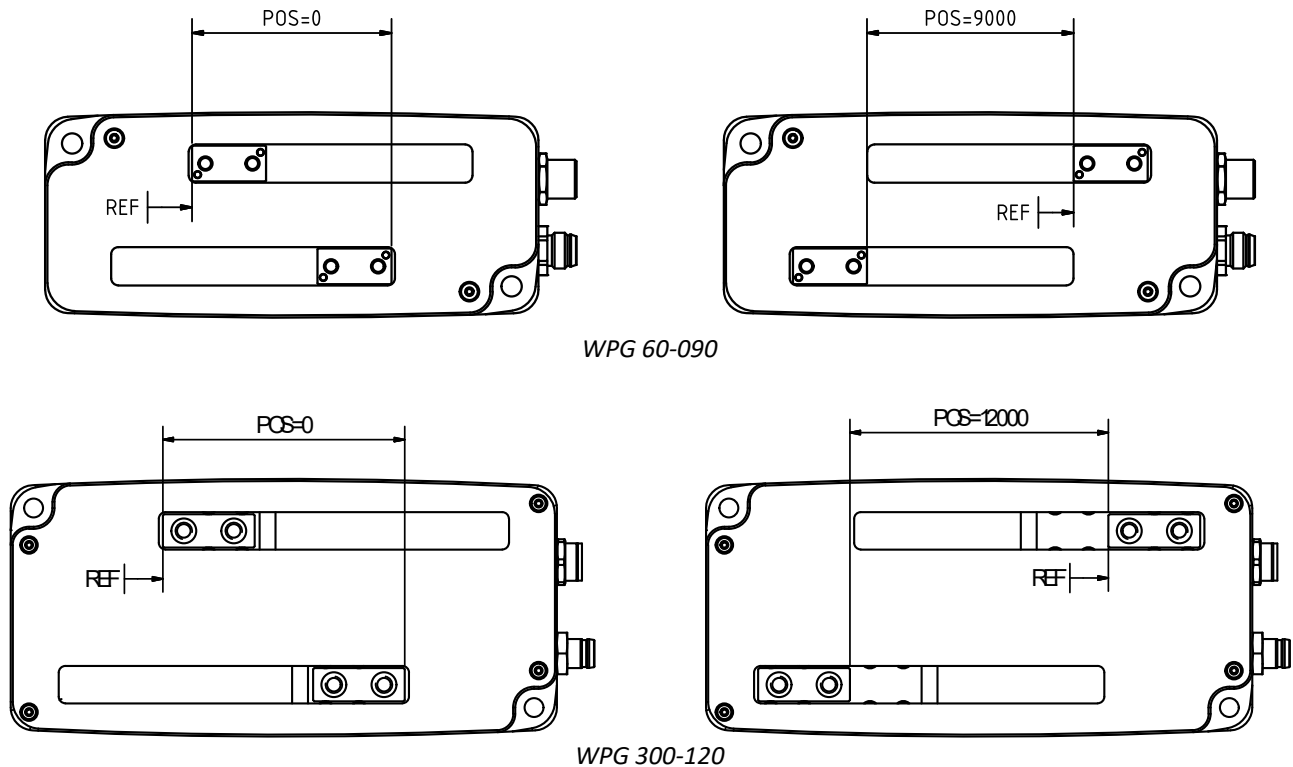


Figure 34: Position values

10.3 Reference run

When the gripping module is switched on, the finger position is initially unknown due to the relative position measuring system used. Before the gripping module can execute movement commands, it must be referenced. To do this, the gripping module moves the base jaws to the outer stop with a defined force and speed and uses this position as a reference value. The program sequence is shown in Figure 35



Keep the traversing range of the fingers free during the reference run to avoid collision and incorrect referencing.

If referencing to the outside is not possible due to the application, e. g. because a collision with the workpiece or the environment would occur, the homing direction can be configured via the web interface (see section 8.6).

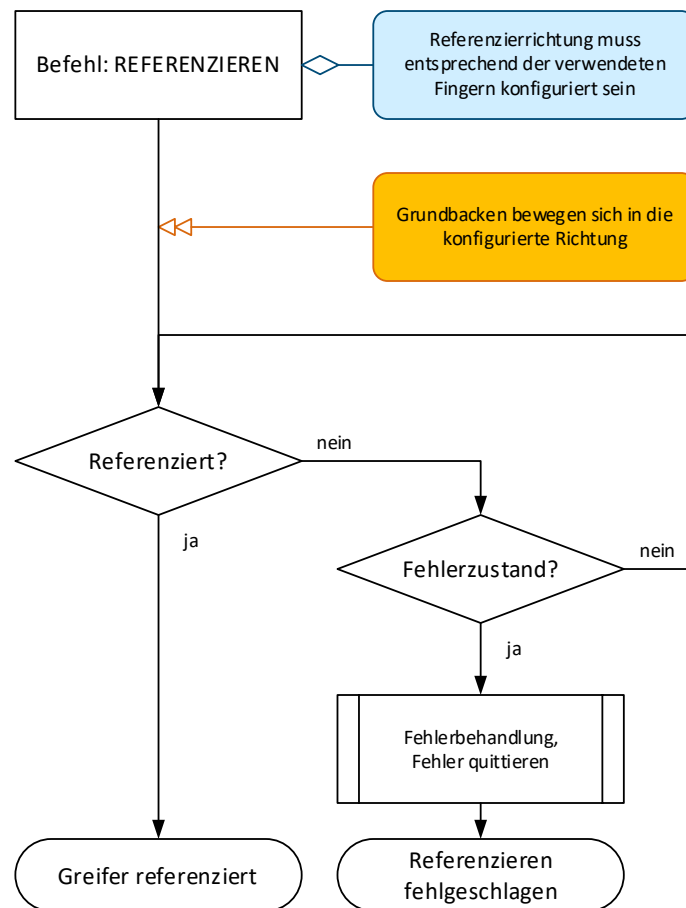


Figure 35 Referencing program flow

10.4 Enable and disable

The gripping module can be activated and deactivated. There is no movement of the base jaws.

If the gripping module is deactivated, the drive is de-energized and the base jaws can be moved by hand.



Loss of workpiece possible! Never deactivate the gripping module when a workpiece has been gripped!



Move the base jaws as close as possible to the gripping module and not at the end of the mounted fingers. Damage to the gripping module possible!

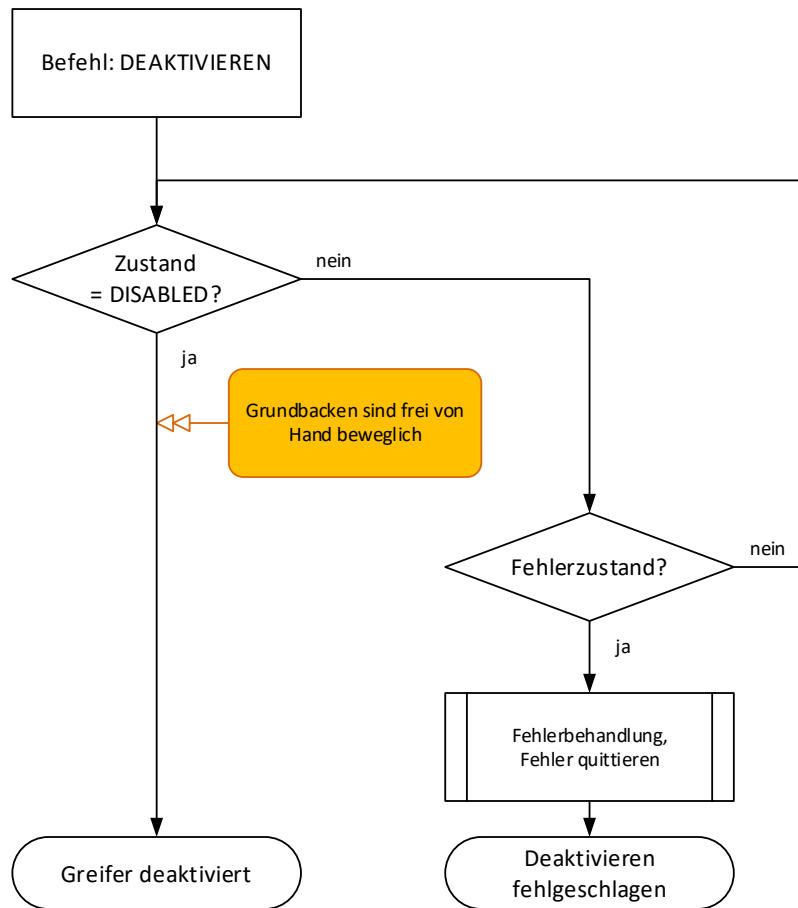


Figure 36: Deactivate program sequence

If the gripping module is activated and no grip or release command has been executed, the drive is energized. The base jaws hold the current position and cannot be moved by hand.

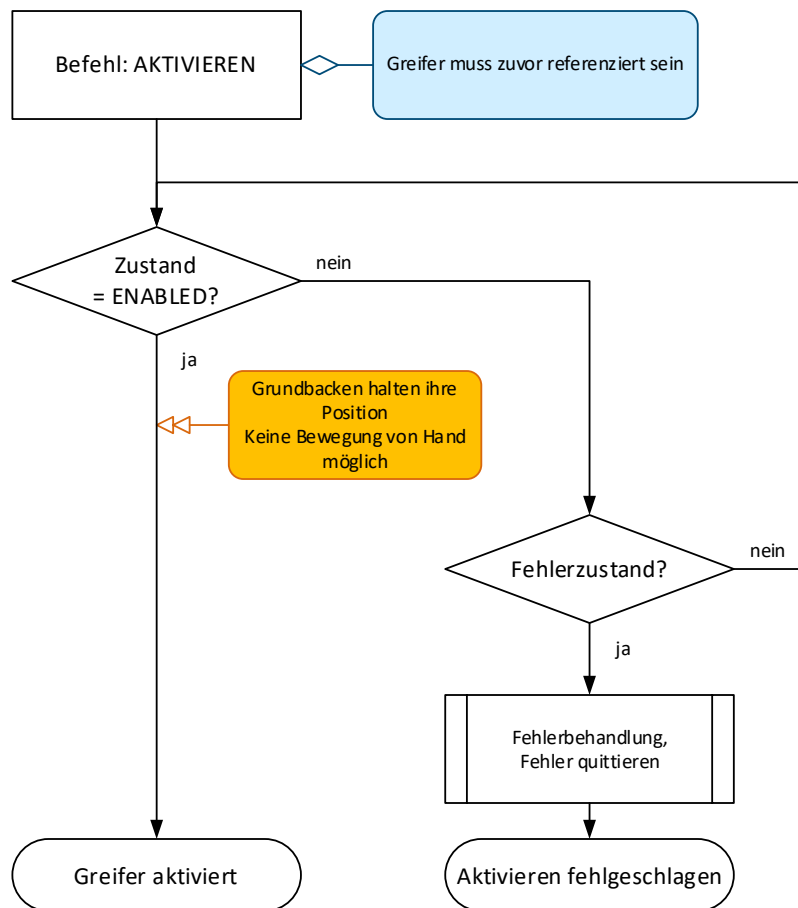


Figure 37: Activate program sequence

10.5 Configurable grip presets

A total of eight different grip presets can be parameterized for gripping different parts. The grip preset is selected in the corresponding commands via the transmitted grip index and executed with the gripping commands GRIP or RELEASE.

For parameterization, proceed as shown in Figure 38. A position window is specified for each grip by the values RELEASE limit and NO PART limit, in which the workpiece must be located. If the base jaws block within this window while gripping, the gripping module detects a valid grip and changes to the gripper state HOLDING. If, on the other hand, the base jaws reach the NO PART limit, the gripping state changes to NO PART to indicate that no part has been gripped. During RELEASE, the gripper state changes to RELEASED as soon as the base jaws reach the position of the RELEASE limit. If the RELEASE limit is not reached, the gripper state changes to FAULT.

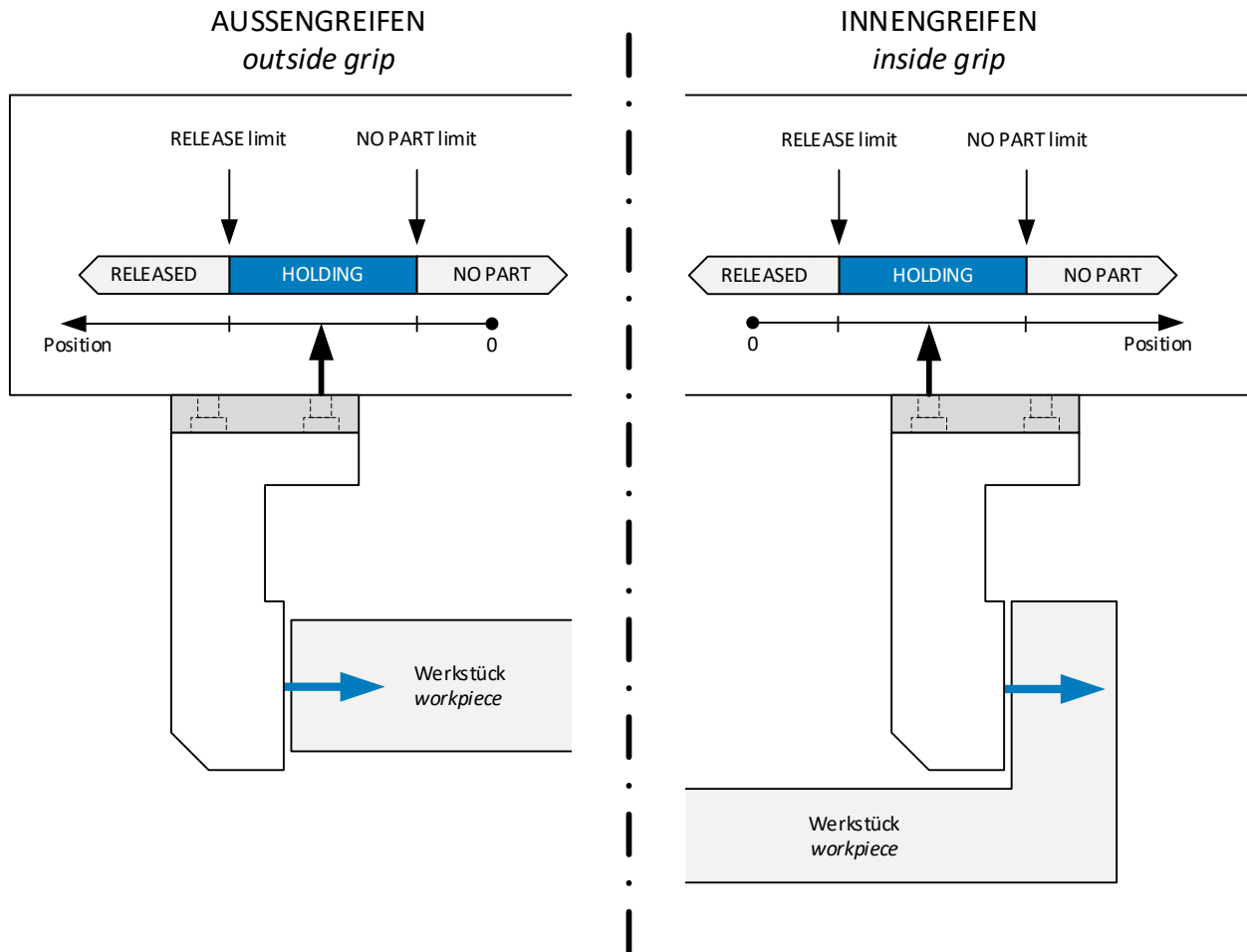


Figure 38: Gripping range and direction of grip



If the base jaws block outside the position window, e.g. at the end stop of the movement, the workpiece is considered released or no part was detected, depending on the direction of movement.



Attention Danger of collision! If the selected gripping range is not large enough, gripped parts that are too small or too large may be gripped, although the gripping state is NO PART or RELEASED. In case of doubt, evaluate the position value!

10.5.1 Gripping direction

The gripping direction is specified by the two limit values NO PART limit and RELEASE limit: if the position for the NO PART limit is smaller than that for the RELEASE limit, the gripping module grips inward (Figure 38"Outside gripping"). Conversely, the gripping module grips to the outside (Figure 38"Inside gripping"), if the position for the NO PART limit is greater than that for the RELEASE limit.

10.6 Grip workpiece

The program flow for gripping a workpiece is shown in Figure 39. The gripping module must be initialized prior to gripping. The gripping process can be started via the grip command of the command set. The index of the desired grip preset is given as a parameter. The gripping direction depends on the parameterization of the selected grip preset.

The WSTR command is used to determine the end of the gripping process or any error that may have occurred. If the parameterizable NO PART limit is reached, no part was gripped and the base jaws remain in this position.

If an error has occurred during gripping (gripping module is in FAULT state), this must be acknowledged. This is done by deactivating the gripping module (see section 0).

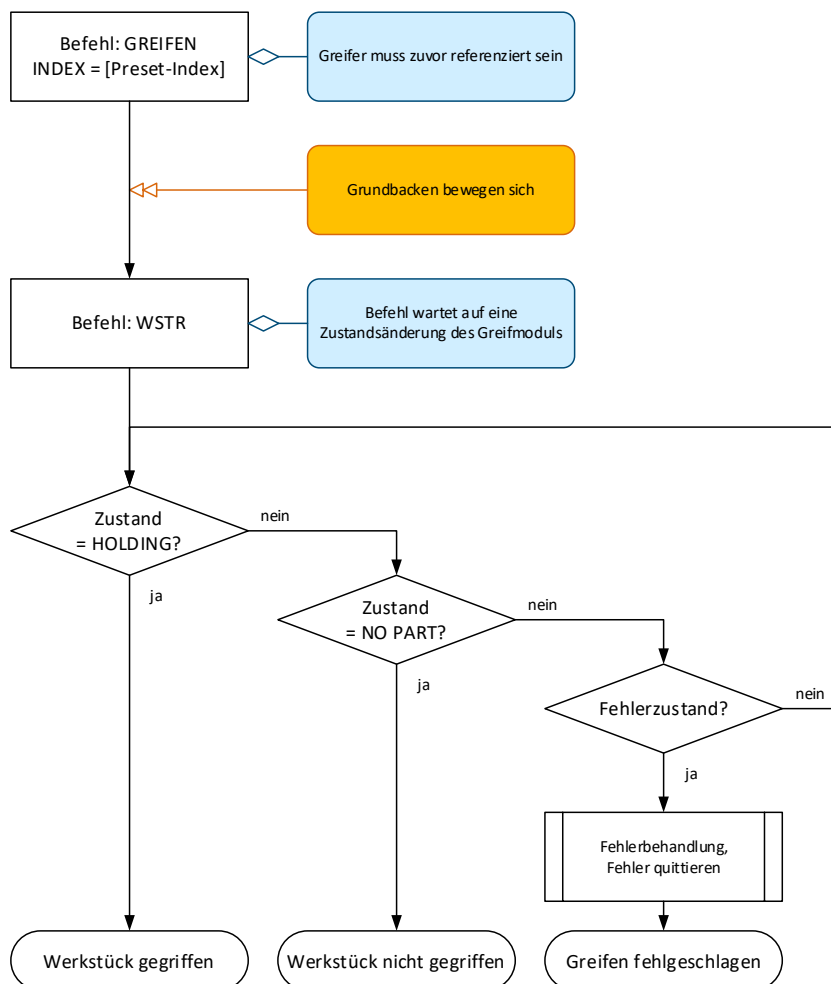


Figure 39: Grasping program sequence

10.7 Release workpiece

To release a previously gripped workpiece, the program sequence in Figure 40 must be executed. The release process can be started via the release command as described in the command set. The index of the desired grip preset is given as a parameter.

The WSTR command is used to determine the end of the gripping process or any error that may have occurred. If the parameterized RELEASE limit is reached, the base jaws are at the release position and remain there position-controlled, but with reduced force.

Any errors that occur must be acknowledged in the same way as for the gripping process (see section 0).



To change between grip presets, first release the part and then change the grip index.

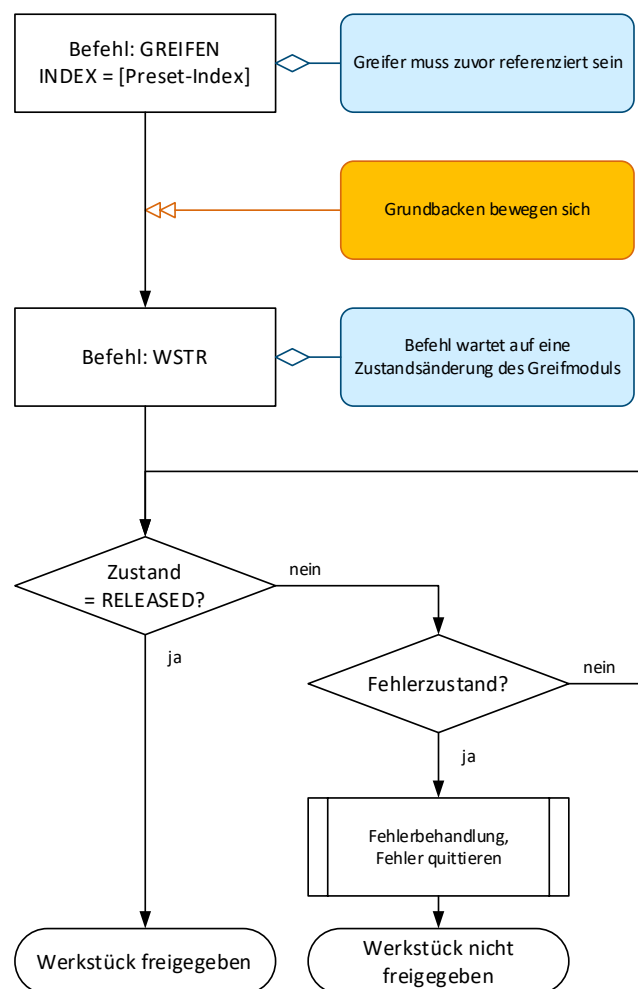


Figure 40 Program sequence: Enable part

10.8 Error handling



Error handling in FAULT state is required to prevent damage to the gripping module or the system, as well as injuries!

If the gripping module is in FAULT state, an internal error has occurred that prevents the correct function of the gripping module.



To acknowledge an error, the gripping module must be deactivated.

To acknowledge an error, deactivate the gripping module (see section 10.4). If the error cannot be acknowledged, try to restart the gripping module by interrupting the power supply. If the error persists, contact WEISS ROBOTICS technical support. There may be a defect in the gripping module.



Loss of parts possible! Move to a safe position before acknowledging the error.

10.9 Design of the gripping process

The design of the gripping process is decisive for the reliability of the production process. The following points have proven to be helpful:

- Place the gripping point in the center of the stroke range of the base jaws by constructive design of the fingers, if the process allows this.
- If possible, secure the workpiece position with a form fit between the contact surface on the finger and the gripping surface on the workpiece.
- Avoid overdetermination when contacting the workpiece by appropriate design of the contact surfaces.
- Use a compensation element if transverse forces can occur on the gripping module due to gripping or positioning tolerances. This is the case, for example, if a clamped workpiece is to be picked up by a gripping module positioned by a robot.
- Select a sufficiently large gripping area (recommended distance between the RELEASE limit and the NO PART limit ≥ 2 mm) to maximize the reliability of the gripping process.
- Always keep a distance to the end stop with the positions for the RELEASE limit and the NO PART limit so that a safe detection of the grip is possible and the gripping module does not grip itself.
- Select a sufficiently large gripping force. Please note that excessive gripping forces may damage the workpiece!
- During holding, the continuous application of the gripping force generates increased heat that must be dissipated by the gripping module. Therefore, provide for sufficient heat dissipation via the mounting surface. Avoid continuous holding and do not block the fingers outside the actual gripping (e. g. by

setting the RELEASE limit outside the stroke range) to avoid unnecessary heating of the gripping module.

The following application examples describe the implementation of simple handling tasks and the associated parameterization and use of the gripping module.

10.9.1 Application example gripping outside

Figure 41 shows an example of gripping a workpiece from the outside. An electrolytic capacitor is to be gripped by the housing and placed in a fixture. The capacitor has a nominal diameter in the gripping area of 15 mm. To ensure the reliability of the gripping process, a position tolerance of ± 1 mm is specified. A gripping force of 40 N is specified, with gripping speed and acceleration reduced to prevent damage. The workpiece is parameterized as GRIP 0 of the gripping module. The parameters of the grip can now be set either via the web interface or by using the corresponding command via command interface.

Grip parameters:

<i>NO PART limit</i>	<i>14 mm</i>	<i>Gripping speed</i>	<i>100 mm/s</i>
<i>RELEASE limit</i>	<i>18 mm</i>	<i>Gripping acceleration</i>	<i>2000 mm/s²</i>
<i>Gripping force</i>	<i>40 N</i>	<i>Release speed</i>	<i>300 mm/s</i>
		<i>Release acceleration</i>	<i>5000 mm/s²</i>

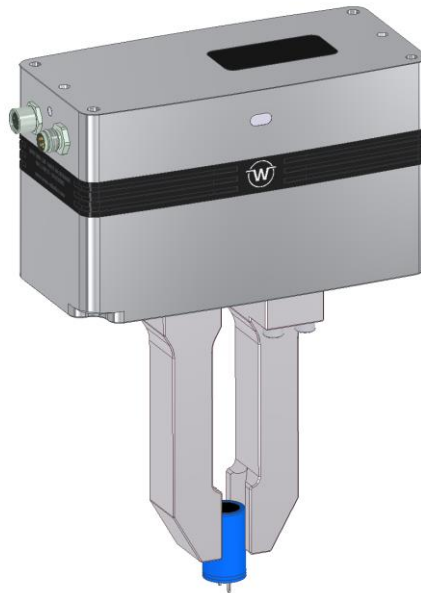


Figure 41: Application example external gripping

The grip parameters can be set via the web interface of the gripping module.

The gripping process is controlled via the program sequences in Figure 39 (grip workpiece) and Figure 40 (release workpiece) or, if GRIPLINK technology is used, directly via the GRIPLINK plug-in on the robot controller. Since GRIP 0 has been parameterized, grip index 0 must be used in the program sequence.

10.9.2 Application example gripping inside

In an assembly process, a plain bearing bushing is to be picked up and inserted with the gripping module. Since the bushing is to be inserted into a bore, it must be gripped on the inner surface. The gripping application is shown in Figure 42. The illustration of the fastening to the movement axes and any compensating elements has been omitted here. The bushing with an inner diameter of 22 mm is gripped and aligned by means of three hardened pins.

Due to the three-point grip, it must be taken into account that the distance between the fingers does not correspond to the inner diameter when the part is gripped. This must be taken into account when designing the NO PART limit.

Handle parameters:

<i>NO PART limit</i>	23 mm	<i>Gripping speed</i>	150 mm/s
<i>RELEASE limit</i>	20 mm	<i>Gripping acceleration</i>	2500 mm/s ²
<i>Gripping force</i>	40 N	<i>Release speed</i>	300 mm/s
		<i>Release acceleration</i>	5000 mm/s ²

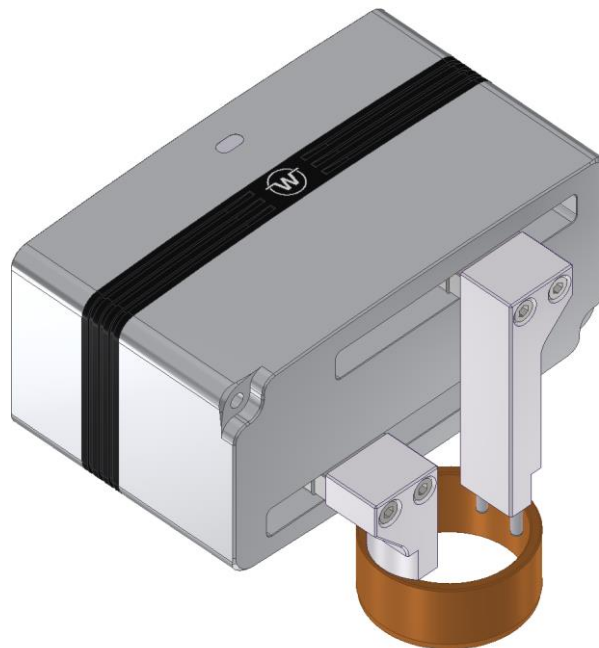


Figure 42: Application example internal gripping

11 Maintenance

The installed gripping mechanism is maintenance-free and does not require any special maintenance during normal operation. Nevertheless, clean the gripping module at regular intervals with a dry cloth to remove all dirt and any chips. These typically accumulate underneath the belt cover. Remove the cover as shown in Figure 43 to clean the module with a brush.

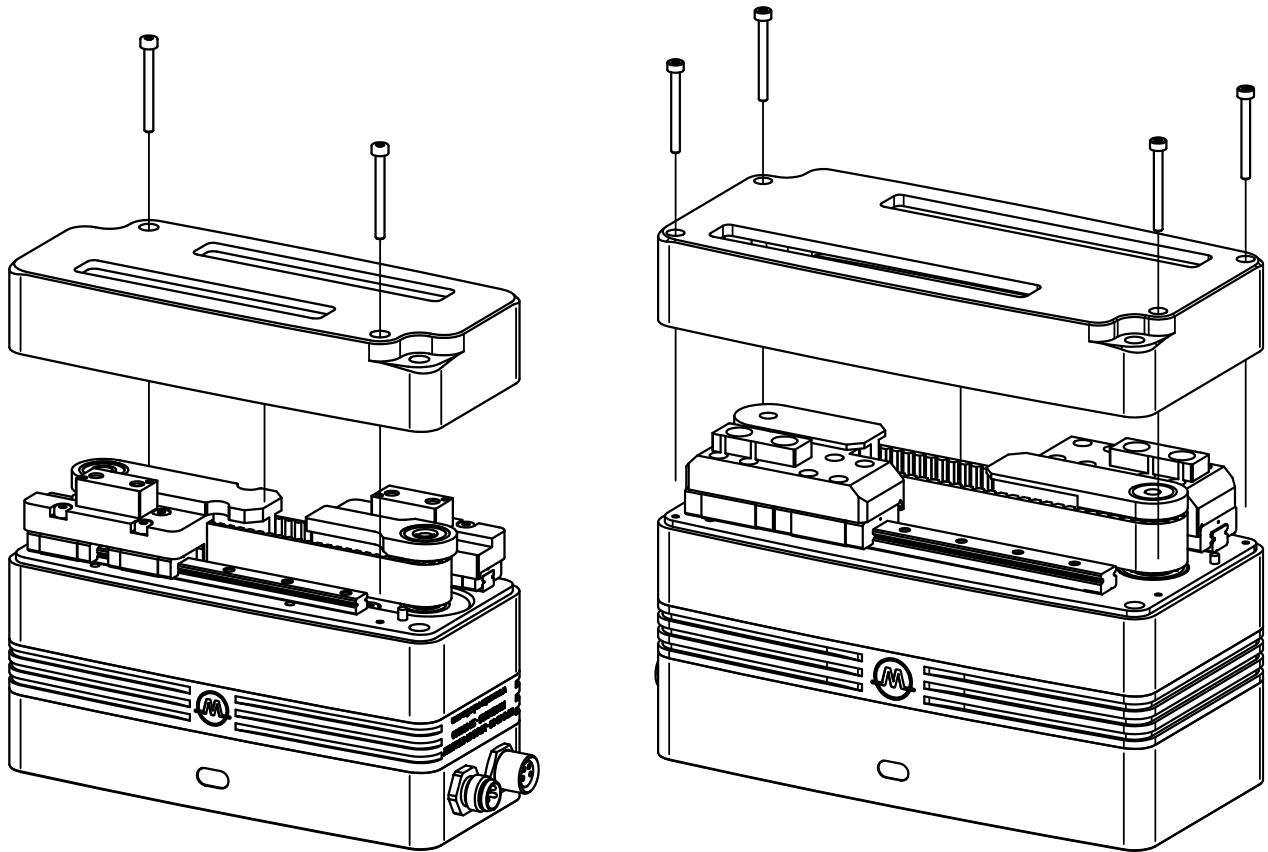


Figure 43 Removing the belt cover WPG 60-090 (left) and WPG 300-120 (right)

The maintenance intervals must be adapted to the ambient conditions and operating conditions. The following factors must be taken into account:

- Increased operating temperatures
- Influence of foreign substances, especially abrasive or chemically active substances
- High vibration stress
- Use in vacuum
- Highly dynamic operation



The gripping module is calibrated at the factory. Do not disassemble the belt drive!

12 Troubleshooting

12.1 Base jaws do not move

Possible cause	Remedy
Operating voltage too low or power supply insufficient	<ul style="list-style-type: none">• Check power supply• Check power supply requirements
No communication with the gripping module possible.	<ul style="list-style-type: none">• Check communication cable and connections• Checking the network settings of robot/computer• Testing of built-in network components such as switches
Error message in the system	<ul style="list-style-type: none">• Check the operating status of the gripping module• Restart the gripping module, in case of repeated error, send the gripping module with a repair order to WEISS ROBOTICS for repair.
Failure of a component, e.g. due to overload	<ul style="list-style-type: none">• Send the gripping module with a repair order to WEISS ROBOTICS.• Ensure that the gripping module is only used within the scope of its defined application parameters.

12.2 Gripping module stops abruptly or does not travel the entire stroke

Possible cause	Remedy
Parameterization incorrect	<ul style="list-style-type: none">• Check parameterization
Power supply interrupted	<ul style="list-style-type: none">• Check power supply
No communication with the gripping module possible	<ul style="list-style-type: none">• Check communication cable and connections• Checking the network settings of robot/computer• Testing of built-in network components such as switches
Gripping module set to FAULT state	<ul style="list-style-type: none">• Read out system log via web interface
Foreign parts in the motion system or module dirty	<ul style="list-style-type: none">• With the gripping module switched off, check the freedom of movement by moving the fingers by hand.• Remove foreign body• Perform cleaning and maintenance
Uneven screw-on surface	<ul style="list-style-type: none">• Check the evenness of the screw mounting surface

12.3 The gripping module reports an error

The gripping module is in the FAULT state.

Error code from gripping module	Remedy
Movement error	The base jaws do not move despite movement command. If this error occurs repeatedly, there is a defect in the drive. Send the gripping module with a repair order to WEISS ROBOTICS for repair.
Temperature error	The temperature inside the gripping module is above the maximum permissible temperature range. It is strongly recommended to stop the gripping module and to continue operating only after it has cooled down. <ul style="list-style-type: none">• Check environmental conditions• Improve heat dissipation• Shorten holding cycles or reduce gripping force• Make sure that the base jaws are at a distance from the end stop in the RELEASED state.• Reduce heat input from outside. The error is automatically reset when the gripping module has cooled down. The gripping module remains ready for operation, even if further operation is not recommended.
General error	Restart by device restart



Error handling see chapter 10.5.1.

13 Decommissioning, dismantling and disposal

13.1 Decommissioning and disassembly

For disassembly, the assembly instructions in chapter 6 must be worked through backwards.



Disconnect the power supply of the gripping module before carrying out any work.

13.2 Disposal

Gripper modules that are no longer usable must be freed from biological or chemical contamination. They are not to be returned as a whole unit, but broken down into their component parts in accordance with local regulations for recycling or proper disposal. We will gladly take care of the disposal for you - contact us!



Disconnect the power supply of the gripping module before carrying out any work.



National and international laws and regulations must be observed during disposal.

14 EC Declaration of Incorporation

In the sense of the EC Machinery Directive 2006/42/EC, Annex II B

Manufacturer WEISS ROBOTICS GmbH & Co KG
 Karl-Heinrich-Käferle-Str. 8
 D-71640 Ludwigsburg

Distributor WEISS ROBOTICS GmbH & Co KG
 Karl-Heinrich-Käferle-Str. 8
 D-71640 Ludwigsburg

We hereby declare that the following product:

Product Name: Servo-electric gripping modules WPG
Type designation: WPG 300-120
Part numbers: 5120015

complies with the applicable essential requirements of the **Machinery Directive (2006/42/EC)**.

The partly completed machinery must not be put into service until it has been established that the machine into which the partly completed machinery is to be incorporated complies with the provisions of the Machinery Directive (2006/42/EC).

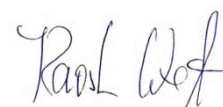
Applied harmonized standards, in particular:

EN ISO 12100-1 Safety of machinery - Basic concepts, general principles for design, Part 1:
 Basic terminology, methodology
EN ISO 12100-2 Safety of machinery - Basic concepts, general principles for design, Part 2:
 Technical principles and specifications

The manufacturer undertakes to submit the special technical documents relating to the partly completed machinery to national authorities on request. The special technical documents belonging to the partly completed machinery according to Annex VII Part B have been prepared.

Responsible for documentation: Dr.-Ing. Karsten Weiß, Tel.: +49(0)7141/94702-0

Place, Date/Signature: Ludwigsburg, October 12, 2022



Signatory details WEISS ROBOTICS GmbH & Co KG



www.weiss-robotics.com

© 2022 WEISS ROBOTICS GmbH & Co. KG. All rights reserved.

Specifications given in this document are subject to change without notice for the purpose of product improvement. Trademarks are the property of their respective owners. Our products are not intended for use in life support systems or systems where failure could result in personal injury.