WEISS ROBOTICS

Operating Manual

IEG PLUS SERIES

Smart Servo Grippers with IO-Link

March 2025

Contents

1 Introduction

This manual is an integral part of the gripping module and describes the safe and proper handling during all operational phases. It is valid solely for gripping modules of the IEG series and contains important information on assembly, commissioning, maintenance, and service.

1.1 Product Specification

The gripping modules of the IEG PLUS series are ultracompact servo-electrical gripping modules with innovative gripping force regulation and integrated IO-Link technology. Figure 1 shows the connectors and components of an IEG PLUS gripping module. The gripping module can be configured via the configuration software of the IO-Link master or via the DC-IOLINK device configurator, which is available separately.

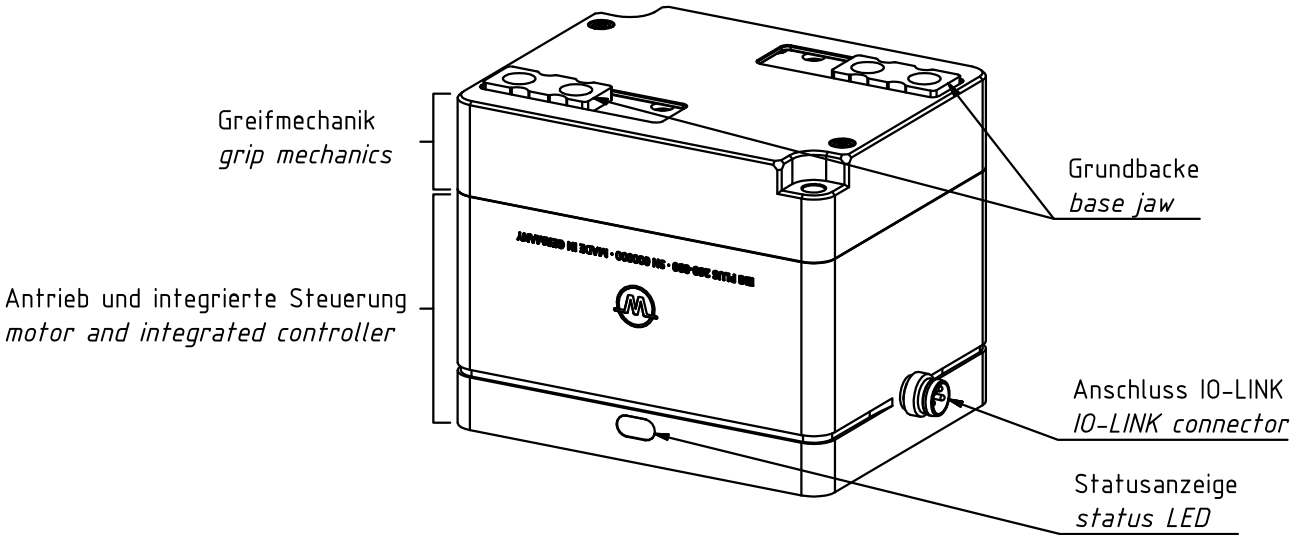


Figure 1: Components and connectors of the gripping module

1.2 Applicable Documents

For more detailed information on operating this module, please consult the following documents, which are available for download on our website at **https://www.weiss-robotics.com//ieg-plus/**:

- Technical drawing
- 3D model (STEP)
- IO-Link device description file (IODD)
- Function block for Siemens TIA portal

Please find additional information about the warranty in our general terms and conditions, available online at **https://weiss-robotics.com/gtc/** .

1.3 Target Audience

These instructions are targeted at plant manufacturers and operators, who should make this and other documents permanently available for the personnel and should also ask the personnel to read and observe particularly the safety instructions and warnings.
In addition, this manual is targeted at professionals and technicians, who should read this manual and should particularly observe the safety and warning notes at all times.

1.4 Notation and Symbols

For better clarity, the following symbols are used in this manual:

Functional or safety-related information. Failure to comply may jeopardize the safety of personnel and equipment, damage the device, or impair the functionality of the device.

Additional information for a better understanding of the facts described.

Reference to further information.

2 Basic Safety Notes

2.1 Intended Use

The module was designed to grip and temporarily and securely hold work pieces and objects. The module is intended for installation in a machine/system. The requirements of the applicable guidelines as well as the mounting and operating notes in this manual must be observed and complied with. The gripping module may only be used in the context of its defined application parameters and only in industrial applications.
Any other use or use exceeding the intended use is deemed improper, e.g. if the gripping module is used as a pressing, cutting, lifting, or punching tool, or if it is used as a clamping device or guide for other tools. The manufacturer is not liable for any damage resulting from such use.

2.2 Environmental and Operating Conditions

The module may only be used within its defined application parameters. It must be ensured that the module and the fingers are sufficiently dimensioned for the intended application, and that the environment is clean and the ambient temperature meets the requirements specified in the data sheet. Please observe the maintenance instructions (see chapter 10). Furthermore, it must be ensured that the environment is free of

splash water and vapors as well as from abrasion or process dust. Excepted are modules that are specifically designed for dirty environments.

2.3 Product Safety

The gripping module uses state-of-the-art technology and complies with the recognized safety rules and regulations at the time of delivery. However, dangers may arise from the module if e.g.:

- the gripping module is not used in accordance with its intended purpose.
- the gripping module is installed, modified, or maintained improperly.
- operators do not comply with the EC Machinery Directive, the VDE guidelines, the local safety and accident prevention regulations, or with the safety and installation notes.

2.3.1 Protective Equipment

⚠ **Provide protective equipment according to the EC Machinery Directive.**

2.3.2 Constructional Changes, Extensions or Modifications

Additional bore holes, threads or attachments not offered by Weiss Robotics as accessories may be mounted only after obtaining the written approval by Weiss Robotics.

2.3.3 Special Standards

The following standards are met:

- RFI voltage, interference field strength and emission according to EN 61000-6-3
- Fast transients on signal and data lines according to EN 61000-4-4
- HF power input on signal and data lines according to EN 61000-4-6
- HF radiation according to EN 61000-4-3
- Emissions according to EN 61000-6-4 Class A
- Power frequency magnetic field according to EN 61000-4-8
- Static electrical discharge according to EN 61000-4-2
- IO-Link communication standard according to IEC 61131-9

2.4 Personnel Qualification

The assembly, initial commissioning, maintenance, and repair of the module may be performed only by trained specialist personnel.

Every person assigned by the operator to work on the module must have read and understood the complete mounting and operating manual, especially chapter 2 “Basic safety notes”. This also applies to personnel that is only employed occasionally, e.g. maintenance personnel.

2.5 Safety Considerations

Observe the safety and accident prevention regulations that are applicable at the operation site.

⚠ **Do not move parts by hand when the module is connected to the power supply.**

⚠ **Do not reach into the open mechanical parts or the movement range of the gripping module.**

⚠ **Disconnect the power supply of the module before any installation, modification, maintenance, or adjustment work.**

2.6 Notes on Particular Risks

⚠ **Risk of injury from objects falling and being ejected. Take appropriate safety measures to prevent the falling or ejection of objects, e.g. processed parts, tools, shavings, fragments, waste.**

⚠ **Risk of injury due to unexpected movements of the machine.**

3 Warranty

The warranty is valid for 12 months from the delivery date to the production facility if the module is operated in one-shift operation mode and according to the specified maintenance and lubricating intervals, or up to 10 million gripping cycles, respectively. Parts touching the work piece and wear parts are not part of the warranty. Please also note the general terms and conditions.
The gripping module is considered defective if its basic function “gripping” cannot be performed anymore.

4 Scope of Delivery and Accessories

The scope of delivery comprises:

- Gripping module IEG PLUS in the version ordered
- Accessory kit (centering sleeves or dowel pins matching the module's diameter)
- Quick Start Guide IEG PLUS series

Item	IEG PLUS 40-020	IEG PLUS 40-050	IEG PLUS 260-030	IEG PLUS 260-080
Gripping module	5120016	5120023	5120017	5120024
Accessory kit	5020081	5020081	5020080	5020080
Quick guide	5080033	5080033	5080033	5080033

Table 1: Part numbers scope of delivery

The included accessory kit contains the following parts:

Item	IEG PLUS 40-020	IEG PLUS 40-050	IEG PLUS 260-030	IEG PLUS 260-080
Dowel pin ISO 2338 - 1,5m6 x 5	4		-	
Screw ISO 4762 - M3 x 45	2		-	
Dowel pin ISO 2338 - 3m6 x 8	2		-	
Centering sleeve 6h6 x 4.2 x 5.35	-		4	
Screw ISO 4762 - M4 x 65	-		2	
Dowel pin ISO 2338 - 4m6 x 10	-		2	

Table 2: Supplementary pack Scope of delivery

For the gripping module, the following accessories are available separately:

- Flange adapter for robots with ISO standard flange
- Device configurator for gripping modules of the Integration Line, DC-IOLINK, part number 5020009
- Power supply cables

Complete solution for Universal Robots

For Universal Robots arms, there is a kit comprising gripping module, flange adapter, control interface, cables, and mounting material available.

☞ **Please order accessories separately.**
More accessories can be found on our website at https://www.weiss-robotics.com.

5 Technical Data

5.1 Nominal Mechanical Data

⚠ **Exceeding the specified nominal data may damage the module. If in doubt, please discuss your application with our technical sales department.**

Mechanical operating data	Unit	IEG PLUS 40-020	IEG PLUS 40-050	IEG PLUS 260-030	IEG PLUS 260-080
Total stroke	mm	20	50	30	80
Nominal gripping force (100%)	N	40		260	
Recommended minimum gripping force (25%)	N	10		30	
Max. relative finger speed	mm/s	250		180	
Min. relative finger speed	mm/s	5		5	
Recommended workpiece weight	g	200		1300	
Max. permitted finger length (L)[1]	mm	80		120	
Max. permitted mass per finger	g	150		400	
Protection class	IP	54			
Ambient temperature	°C	5 ... 50			
Air humidity	%	0 ... 90 non-condensing			
Mechanical repeatability	mm	± 0,005			
Resolution of the measuring system	mm	0,01			
Working principle of the measuring system		relativ			
Weight	g	295	335	825	990

Table 3: Nominal mechanical data

5.1.1 Max. Permitted Finger Length

The maximum finger length *L* corresponds to the distance between the mounting surface of the base jaw and the point where the gripping force is effectively applied, see Figure 2. The maximum values for *L* can be found in the nominal mechanical data of the respective gripping module. When the maximum finger length is exceeded, it is mandatory to reduce the gripping force. Furthermore, the operating life may be reduced.

[1] At nominal force, see measure “L” in Figure 2

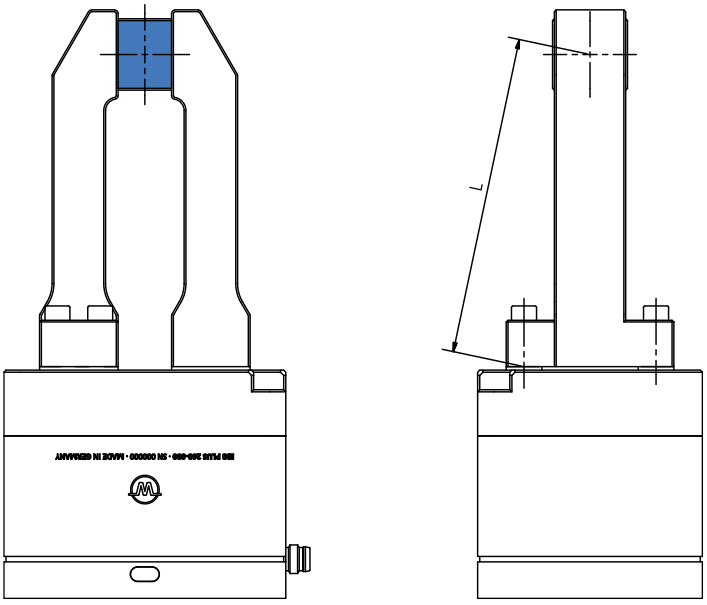


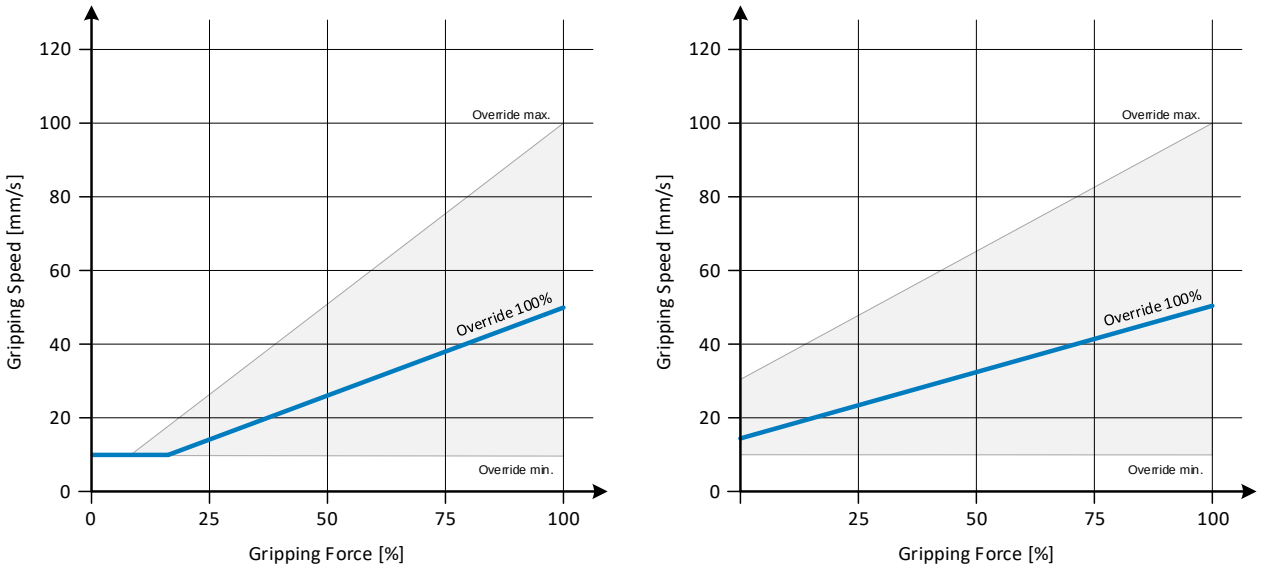
Figure 2: Determination of the finger length “L”

5.1.2 Gripping Force and Finger Speed

The gripping force can be set as a percentage of the nominal gripping force. Always select a gripping force that is adapted to the respective gripping situation. If the gripping force is set too high, this results in higher 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. Take into account both static and dynamic forces acting on the gripping part during design, for example during movement by a robot.

The specified minimum gripping force of the gripping module indicates at which minimum gripping force a reliable function of the gripping module is ensured even over batches. The minimum gripping force of the respective size is given in Table 3. If the value set as a percentage falls below the specified minimum gripping force, the module grips with the minimum gripping force.

The gripping module sets the finger speed depending on the parameterized gripping force, see Figure 3. This minimizes the gripping impulse and rebound effects during undamped gripping. The gripping speed can be increased or decreased manually (and thus adjusted to the part that is being gripped) via the central override parameter (gray area; see also chapter 8.2.3.1). To ensure proper movement of the fingers, the minimum possible gripping speed is limited to 10 mm/s.



IEG PLUS 40-020 and IEG PLUS 40-050

IEG PLUS 260-030 and IEG PLUS 260-080

Figure 3: Gripping speed depending on the parameterized gripping force

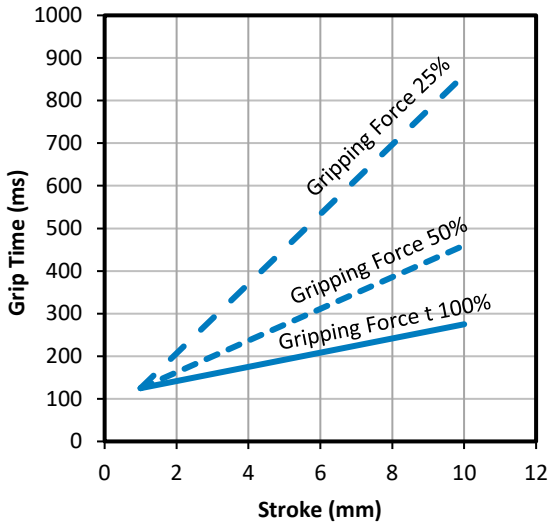
Gripping speeds exceeding 100% (override) lead to an increased gripping impulse that can damage the workpiece and the gripping mechanics.

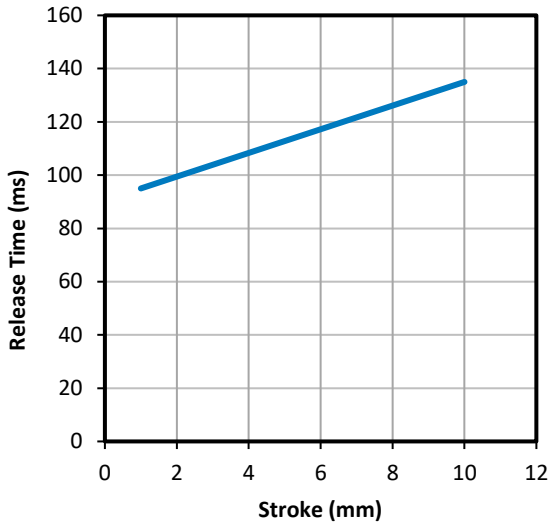
5.1.3 Cycle Times

The following diagrams show the typical progression of gripping time and release time for different gripping force settings.

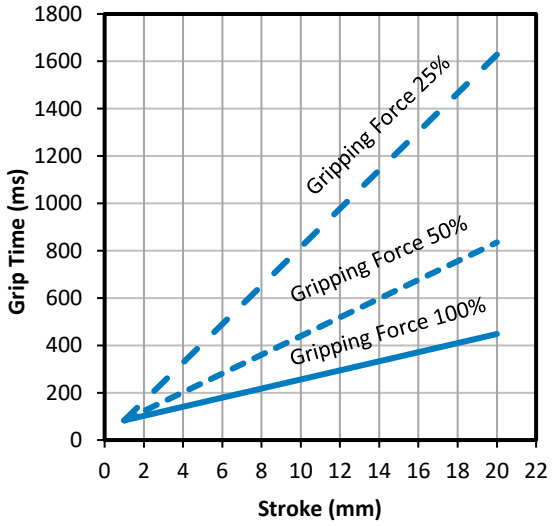
The displayed values show the typical time from the processing of the command at the gripping module to the change of the gripping state. The actual time varies depending on the part that is being gripped (rigid or elastic), finger weight, gripping width, etc. For an exact assessment of the possible cycle times, tests must be carried out in individual cases.

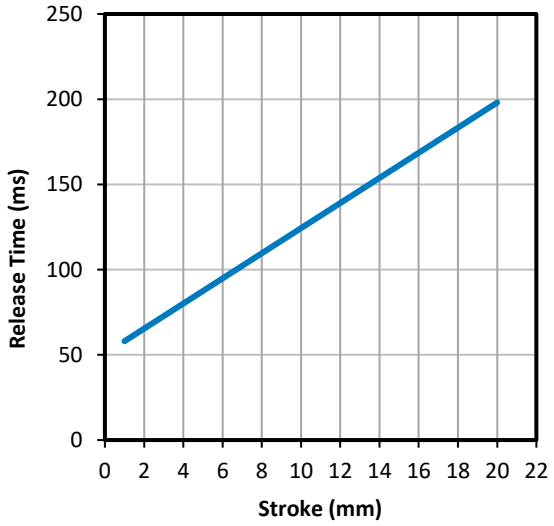
IEG PLUS 40-020



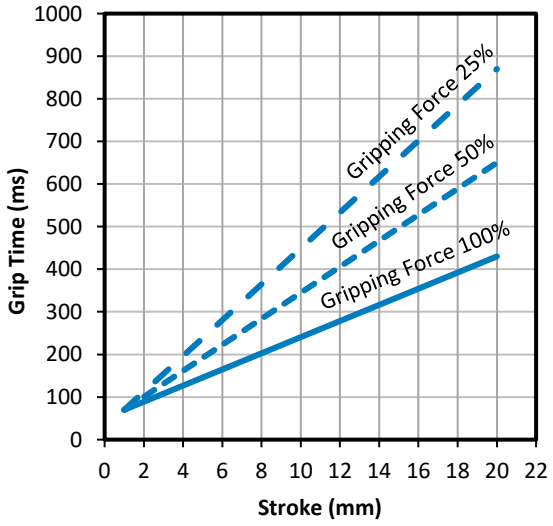


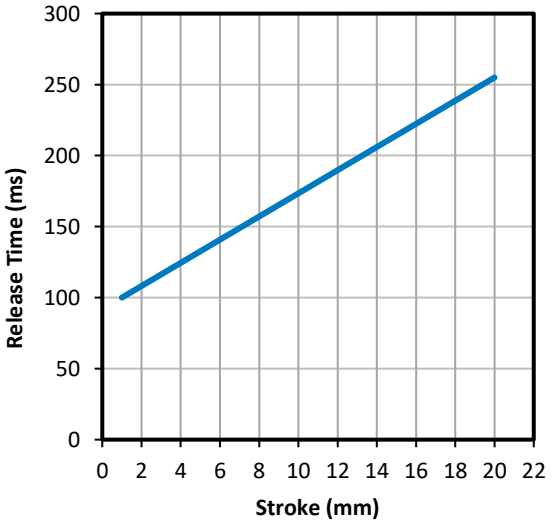
IEG PLUS 40-050



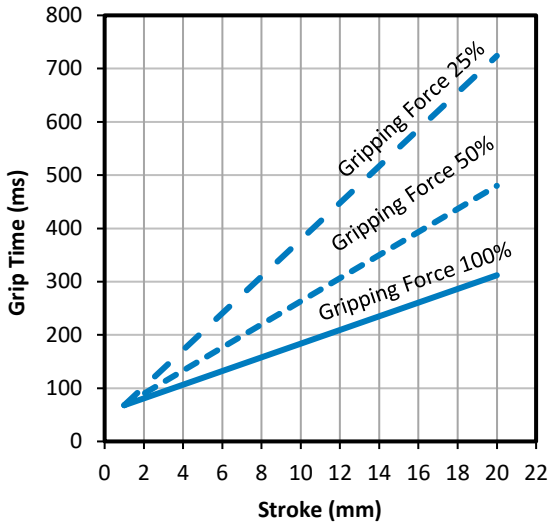


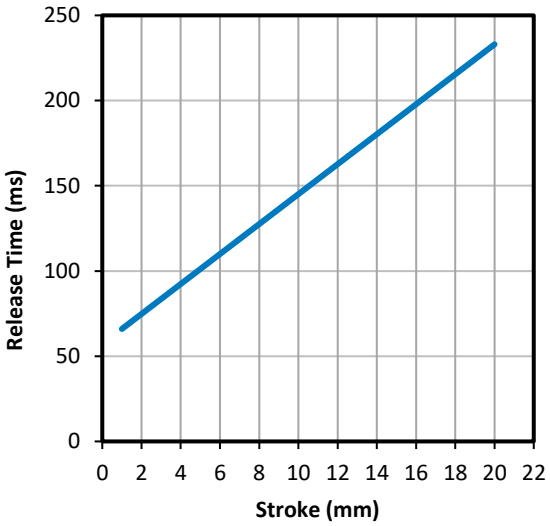
IEG PLUS 260-030





IEG PLUS 260-080





5.1.4 Max. Permitted Finger Load

The following table shows the maximum permitted static loads on the base jaw guide:

Load	Unit	IEG PLUS 40-020	IEG PLUS 40-050	IEG PLUS 260-030	IEG PLUS 260-080
C_0	N	841		1890	
T_X	Nm	2,2		6,9	
T_Y	Nm	8,0		26,0	
T_Z	Nm	7,2		23,6	

Table 4: Static guide loads

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

$$\frac{M_x}{T_x} + \frac{M_y}{T_y} + \frac{M_z}{T_z} + \frac{F_z}{C_0} \leq 1.0$$

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

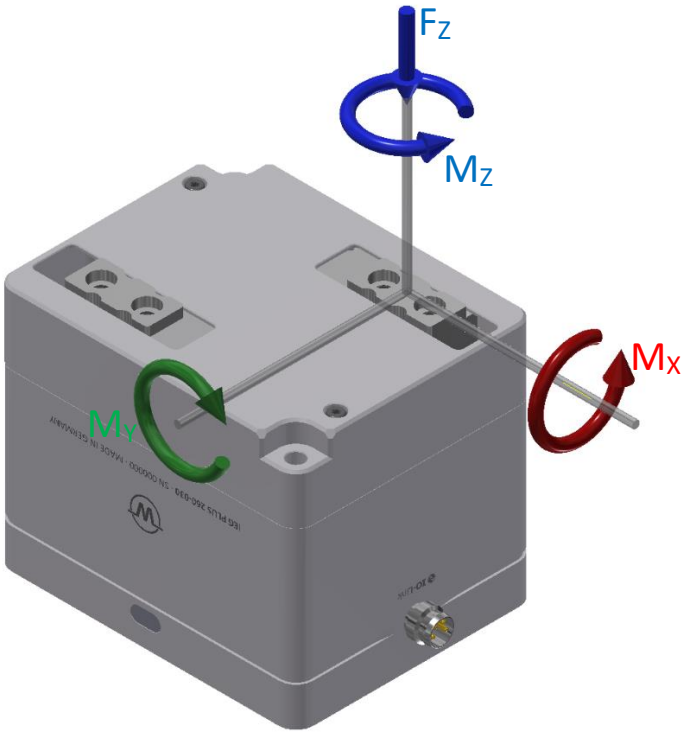


Figure 4: Finger loads

5.2 Nominal Electrical Data

⚠ **Exceeding the specified nominal data may damage the module. If in doubt, please discuss your application with our technical sales department.**

Electrical operating data	Unit	IEG PLUS 40-020	IEG PLUS 40-050	IEG PLUS 260-030	IEG PLUS 260-080
Supply voltage	V	18 ... 30			
Typ. current drawn (state IDLE)	mA	40		40	
Typ. current drawn (holding, gripping force 100%)	mA	150		310	
Max. current drawn (moving, peak current)	mA	600		1700	
C/Q pin					
Input voltage range	V	0 ... 30			
Threshold "HIGH"	V	13			
Threshold "LOW"	V	8			
Hysteresis	V	2.2			

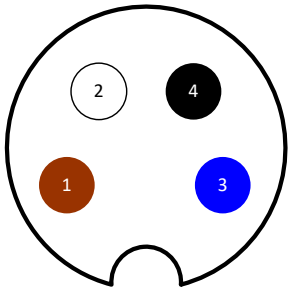
Communication	Unit	Value
Standard		IO-Link V1.1
Transmission rate	bit/s	38,400 (COM2)
Min. cycle time	ms	4.0
Max. starting time IO-Link[2]	ms	280
Max. starting time operational readiness[3]	ms	750

Table 5: Electrical nominal data

5.2.1 Electrical Interface

The gripping module has an M8 connector for electrical contact. The connector has the same pin assignment as the IO-Link standard class A connector (see Figure 5).

⚠ **Depending on the build size, the gripping module may draw more current than the 200 mA specified by the IO-Link 1.1 standard. It is therefore imperative to check whether the IO-Link master can permanently provide the nominal current specified in Table 5.**



Pin	Wire color	Signal	Function
1	brown	L+	Power supply +24 V
2	white	RES	Reserved, do not connect.
3	blue	L-	Power supply 0 V
4	black	C/Q	IO-Link communication

Figure 5: Pin assignment (view of device connector)

5.3 Name Plate

The name plate is on the transverse side of the gripping module and contains the serial number, the hardware version, and the exact type designation.

[2] Time from supply voltage ≥ 18V until communication readiness via IO-Link

[3] Time from supply voltage ≥ 18V until operation readiness of the gripping module (without referencing)

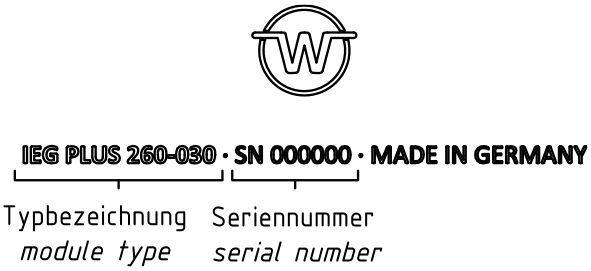


Figure 6: Name plate

6 Installation and Commissioning

Risk of injury due to unexpected movements of the machine. Disconnect the module from the power supply during all maintenance work/adjustments and make sure the module is force-free.

6.1 Installation

You can find the dimensions of the threads and centering holes that can be used to mount the module in the technical drawing of the respective build size. The following maximum torques and minimum screw depths must be observed during assembly:

Thread	M3	M4	M6
Casing (aluminum)	0.7 Nm	1.3 Nm	3 Nm
Base jaw (stainless steel)	1.3 Nm	3 Nm	10 Nm
Minimum screw depth	3 mm	4 mm	6 mm

Table 6: Tightening torques for screws (min. strength class 8.8)

The gripping module can be mounted from two sides, see Figure 7.

Maximum allowable unevenness of the mounting surface: 0.02 mm

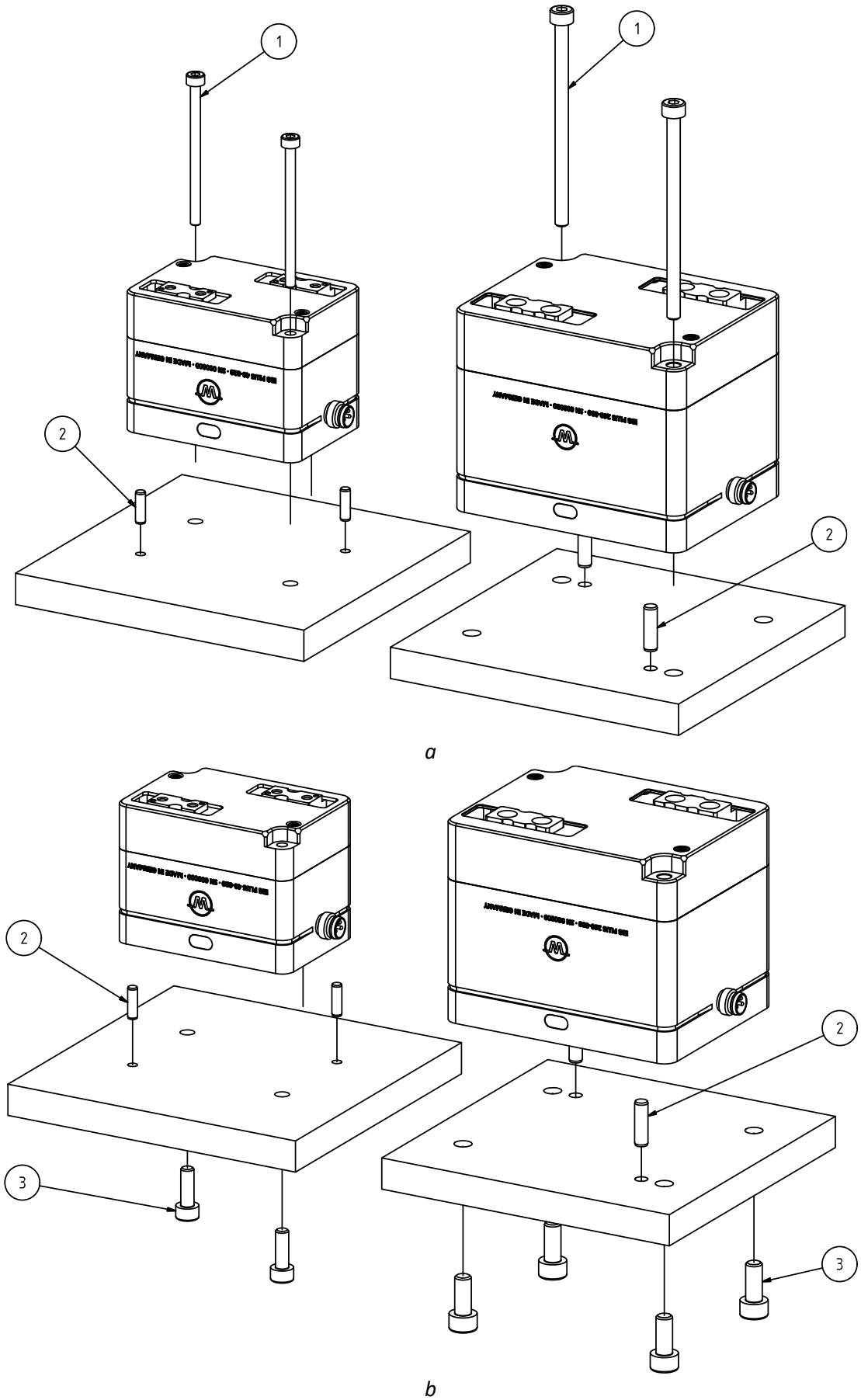


Figure 7: Mounting methods for the gripping module from above (a) and from below (b)

Figure 8 shows the mounting of the fingers. The centering sleeves (IEG PLUS 260-030) and pins (for IEG PLUS 40-020) must be used for mounting. They can be found in the accessory kit of the gripping module.

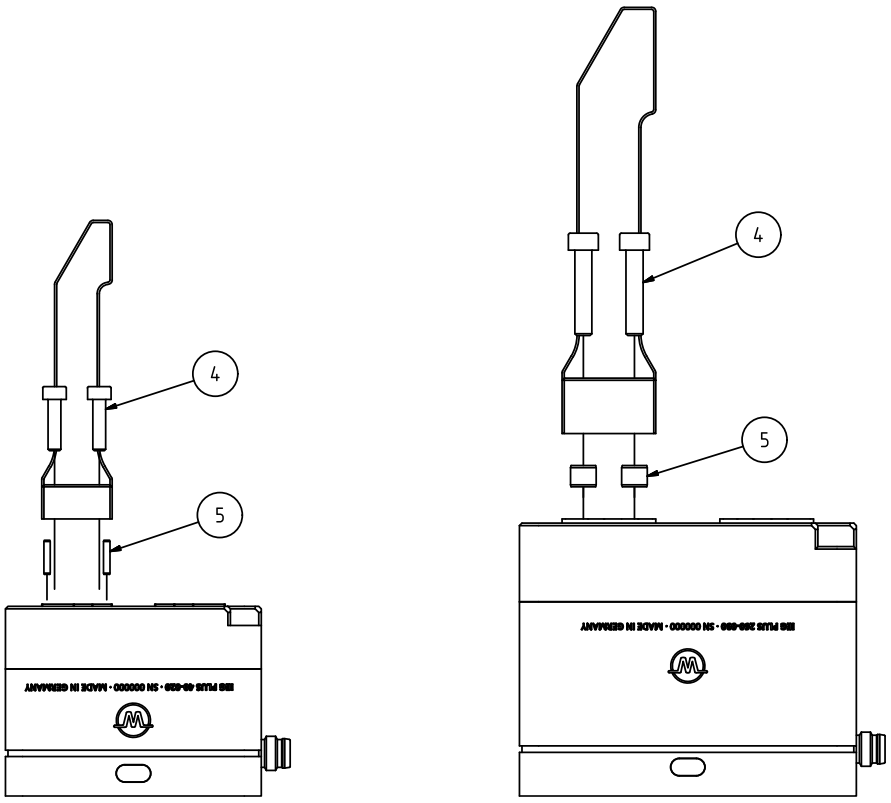


Figure 8: Mounting the fingers

The recommended screws and centering sleeves are listed in in Table 7.

Position	IEG PLUS 40-020	IEG PLUS 40-050	IEG PLUS 260-030	IEG PLUS 260-080
1	2 pieces Screw, e.g., ISO 4762 - M3 x 45		2 pieces Screw, e.g., ISO 4762 - M4 x 65	
2	2 pieces Dowel pin, e.g., ISO 2338 - 3 m6		2 pieces Dowel pin, e.g., ISO 2338 - 4 m6	
3	2 pieces Screw - M4		4 pieces Screw - M5	
4	2 pieces Screw - M3		2 pieces Screw - M4	
5	2 pieces Dowel pin, e.g., ISO 2338 - 1.5 m6		2 pieces Centering sleeve 6h6 x 5.5 Weiss Robotics part number: 2090046	

Table 7: Screws and centering sleeves

7 Functional Principle of the Gripping Module

The gripping modules of the IEG PLUS series are servo-electrical two-finger parallel grippers with integrated gripping control, a high-performance brushless drive, and a high-resolution position measuring system. Tooth belt kinematics move and synchronize the base jaws, which are guided by rolling bearings. Due to the pre-positioning capability of the gripping fingers and the innovative gripping force control, the gripping modules of the IEG series can be used for a multitude of applications in modern automation. The module is supplied with power and connected to the process control directly via the integrated IO-Link interface. Figure 9 shows the functional diagram of the IEG PLUS gripping modules.

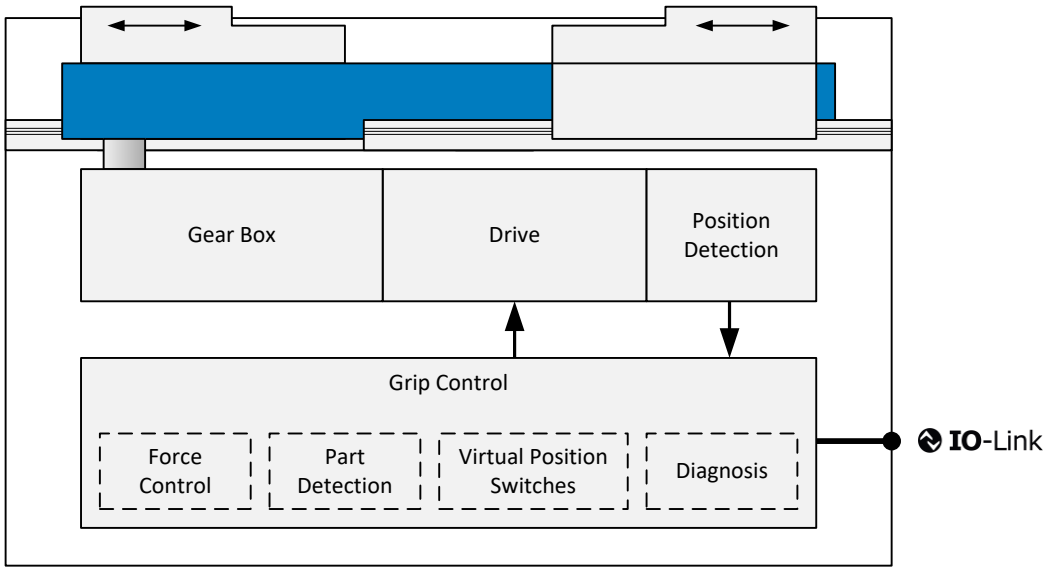


Figure 9: Functional diagram of the IEG PLUS gripping module

The integrated gripping control has a highly optimized workpiece detection. Up to four different parameter sets can be configured via IO-Link to reliably grip multiple workpieces. For each workpiece, a position window is set in which the grip must adjust itself. When the IEG grips in this area, its state changes from RELEASED to HOLDING, which signals a successful grip to the process control. As an alternative to the gripped-part detection, the position of the base jaws can also be detected via freely parameterizable virtual position switches.

To detect malfunctions, the IEG monitors all functionally relevant components, such as position sensors and drive, continuously and provides detailed diagnostic information via IO-Link during operation. Providing usage data via IO-Link makes needs-based maintenance possible. For this purpose, the IEG autonomously indicates regular maintenance intervals and lubrication cycles through system events (IO-Link events). The cycles remaining until the next maintenance interval can be queried from the gripping module for better planning efficiency.

The gripping module has a rigid case made of high-strength aluminum, which can be mounted from two directions. The base jaws are guided by double roller bearings and have a ground finger flange.

7.1 Typical Application

Figure 10 shows a typical control-side setup with IEG PLUS series gripping modules that are accessed via PLC and a decentralized IO-Link field bus master. If you need assistance in selecting the IO-Link components, please contact our technical support.

⚠ **Damage to the IO-Link master possible. Make sure that the IO-Link master can permanently provide the required operating current of the gripping module.**

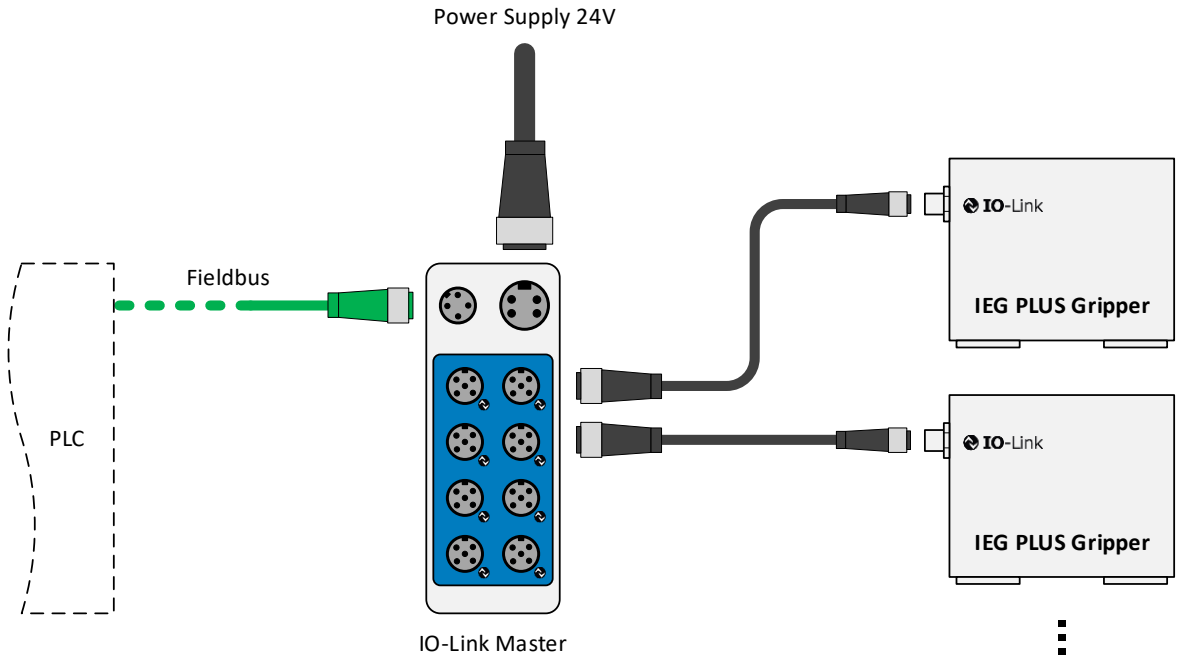


Figure 10: Typical application

7.2 Display of the Operating State

The gripping module has a multicolored status display on the side. The current operational status is indicated through the color of the display light, while the IO-Link connection status is indicated through flashing or steady light (see Table 8).

Display	Meaning
white	Gripping state IDLE or INITIALIZING
blue	Gripping state RELEASED or NO PART
green	Gripping state HOLDING
red	ERROR
Flashing display	No IO-Link communication
Steadily lighted display	Cyclic data exchange via IO-Link

Table 8: Display color and IO-Link status

Example

Display flashes red: An error has occurred, and there is no IO-Link connection.

Steady red light: An error has occurred, and the IO-link connection has been established.

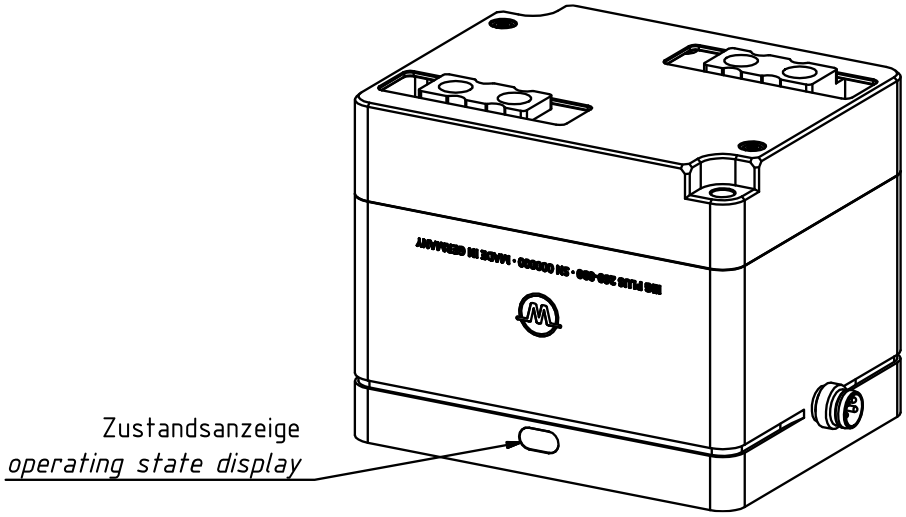


Figure 11: Operating State Display

7.3 Non-volatile Memory

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

- Device-specific factory settings
- Parameterization of the gripping module
- Protocol memory (event log) of the last ten events
- Data for needs-based maintenance (gripping cycle count)

The protocol memory can be read out via IO-Link (parameter index 0x100 to 0x109, cf. Table 15).

8 Interface Description IO-Link

The interface description of the IO-Link interface is defined in the IO-Link Device Description (IODD) file that belongs to the gripping module. The IODD file that is needed for the configuration of the gripping module can be found on our website at **https://www.weiss-robotics.com/ieg-plus/** under “Downloads”.

8.1 Cyclic Process Data

Please pay attention to the byte order. According to the IO-Link standard, data is transmitted in big-endian format.

8.1.1 Output Data (IO-Link Master to Gripping Module)

Table 9 describes the cyclic process data (2 byte) that the gripping module expects from the IO-Link master.

BYTE 0

15	14	13	12	11	10	9	8
RES					HOME	EN	CMD

BYTE 1

7	6	5	4	3	2	1	0
INDEX							

Table 9: Process data word IO-Link master to gripping module

RES – Reserved data bits (bit 15…11)

These data bits are reserved and are currently not evaluated by the gripping module. Their value should always be set to 0 by the master.

HOME - Reference gripping module (bit 10, BooleanT)

If this bit is set and the gripping module is activated (EN = 1), a reference run is performed. In normal operation, this bit must be reset to 0. The reference run is described in chapter 9.3.

EN - Activate gripping module (bit 9, BooleanT)

This bit must be set so that movement commands can be executed. If the bit is not set, the drive is de-activated and the fingers are force-free.

CMD - Gripping command (bit 8, BooleanT)

With this bit, the gripping and releasing of parts is controlled. If the bit is set, the gripping module grips with the grip that has been selected via INDEX; otherwise the module releases a gripped part.

The actual direction of movement of the base jaws during GRIPPING and RELEASING is determined by the parameters RELEASE LIMIT and NO PART LIMIT, which are stored in the acyclic process parameters of the gripping module (cf. chapter 8.2.3).

INDEX - Grip index (bit 7…0, UIntegerT)

The grip index identifies one of four pre-parameterized grips (cf. chapter 9.6 and chapter 8.2.3), which is used for executing the next gripping command.

8.1.2 Input Data (Gripping Module to IO-Link Master)

Table 10 describes the cyclic process data word (4 bytes), which is transmitted from the gripping module to the IO-Link master.

BYTE 0

31	30	29	28	27	26	25	24
POS							

BYTE 1

23	22	21	20	19	18	17	16
POS							

BYTE 2

15	14	13	12	11	10	9	8
SW3	SW2	SW1	SW0	PARTLOST	RES		

BYTE 3

7	6	5	4	3	2	1	0
MAINT	TEMPWARN	TEMPFAULT	FAULT	HOLDING	CLOSED	OPEN	IDLE

Table 10: Process data word gripping module to IO-Link master

POS – Current position (bit 31…16, IntegerT)

Returns the current position of the base jaws in 1/100 mm.

SW0, SW1, SW2, SW3 - Virtual positions switches 0 to 3 (bit 15…12, BooleanT)

If the respective bit is set, the base jaws are within the parameterized position range of the respective virtual position switch.

PARTLOST – Lost workpiece detected (bit 11, BooleanT)

Indicates if a workpiece has been lost while holding (corresponds to a state transition from *HOLDING* to *NO PART*). Will be reset automatically when issuing a *RELEASE* command.

RES – Reserved data bits (bit 10…9)

These data bits are reserved and are currently not used by the gripping module. Their value should be ignored by the master.

MAINT – Maintenance required (bit 7, BooleanT)

Shows whether the maintenance interval of the gripping module has been reached. You can find information on maintenance in chapter 10.

If maintenance has been performed, the MAINT bit must be acknowledged via a system command (cf. chapter 8.2.4). The maintenance counter is also reset.

TEMPWARN – Temperature warning (bit 6, BooleanT)

This bit is set when the temperature inside the gripping module falls below 0 °C or exceeds 60 °C. If the module exceeds the temperature regularly, you should check the heat dissipation of the gripping module and the ambient conditions.

The bit is automatically reset when the temperature is within the allowable range again (hysteresis: 2 °C).

TEMPFAULT – Temperature fault (bit 5, BooleanT)

If the temperature inside the gripping module exceeds 70 °C, this bit is set. It is recommended to stop the gripping module immediately and only start it again after it has significantly cooled down. If necessary, the heat dissipation of the gripping module should be checked.

The bit is automatically reset when the temperature falls below 68 °C.

Temperatures exceeding 70° C may lead to malfunctions and to permanent damage of the gripping module.

FAULT – Device fault (bit 4, BooleanT)

If this bit is set, the gripping module is in error state. Information on the cause of the fault can be obtained by checking the active system events (cf. chapter 8.3) or by evaluating the event log.

For troubleshooting, see chapter 9.10.

HOLDING – Holding (bit 3, BooleanT)

Shows whether a part has been gripped. This is the case when the base jaws of the gripping module are blocked within the specified gripping range, i.e. between the parameterized RELEASE Limit and NO PART Limit, and the gripping force has been built up.

NO PART – No part found (bit 2, BooleanT)

If the base jaws of the gripping module reach the parameterized NO PART Limit or are moved beyond it, no part has been detected and this bit is set.

RELEASED – Part released (bit 1, BooleanT)

If the base jaws of the gripping module reach the parameterized RELEASE Limit or are moved beyond it, the part is considered released and this bit is set.

IDLE – Gripping module inactive (bit 0, BooleanT)

If this bit is set, the gripping module is inactive and force-free. No gripping commands can be executed.

☞ **For information on activating the gripping module, see chapter 9.6.1.**

8.2 Acyclic Process Parameters and System Commands

For the operation of the gripping module, several acyclic process parameters can be set and queried. These process parameters include identification, configuration, and diagnostic data, as well as system commands. These data are addressed via index (8 or 16 bit value) and subindex (8 bit value). Some of the parameters are specified by the IO-Link standard; other parameters are device-specific or determined by the manufacturer. All parameters are defined in the IO-Link Device Description (IODD) file.
The acyclic process parameters can be set and read out during configuration with a suitable configuration software. This configuration software is available from the manufacturer of your IO-Link master or field bus coupler. Altering parameters and issuing system commands during operation is possible on many PLC systems with the respective function blocks (e.g. function block IO_LINK_CALL by Siemens). For further information, please contact the manufacturer of your IO-Link master, your PLC or your field bus coupler.

8.2.1 Remanent Storage of Acyclic Process Parameters

Remanent Storage in the IO-Link Master

The gripping module supports remanent storage of acyclic process parameters in the IO-Link master (“Data Storage”, “Parameter Server”). If your IO-Link master also supports this function, the parameters set during configuration can be permanently stored in the IO-Link master. When the gripping module is activated, the stored parameter set is then automatically transferred from the IO-Link master to the gripping module. If the gripping module is exchanged, the stored parameter set can automatically be transferred to the new gripping module. It is then not necessary to configure the new module separately since the parameter set of the old module is automatically taken over.
For further information on the storage capabilities of your IO-Link master, please contact the manufacturer.

Remanent Storage in the Gripping Module

If your IO-Link master or your field bus coupler do not support permanent storage of acyclic process parameters, the parameters can also be stored remanently in the gripping module via a system command (cf. chapter 8.2.4). When the gripping module is disconnected from the power supply, the acyclic process pa-

rameters are preserved and are still available after reconnecting. However, if the gripping module is exchanged, the new module must be configured anew.

⚠ **If you want to store the configuration remanently only in the gripping module, it could be necessary to deactivate the function "Data Storage" or "Parameter Server" on your IO-Link master. Otherwise the configuration stored in the gripping module will be overwritten by the IO-Link master at startup.**

8.2.2 Standardized Acyclic Process Parameters

Table 11 lists the acyclic process parameters defined in the IO-Link standard that are supported by the gripping module. You can find more information on the meaning and use of the individual parameters in the IO-Link System Description[4], which can be obtained from the IO-Link Community[5].

Index	Function	Access	Data type	Description
0x02	System Command	Write only	UIntegerT(8)	*Execution of system commands*
0x0C	Device Access Locks	Read/write	RecordT	*Standardized device protection function*
0x10	Vendor Name	Read only	StringT	*Manufacturer name*
0x11	Vendor Text	Read only	StringT	*Manufacturer text*
0x12	Product Name	Read only	StringT	*Product name*
0x13	Product ID	Read only	StringT	*Product ID*
0x14	Product Text	Read only	StringT	*Product text*
0x15	Serial Number	Read only	StringT	*Serial number*
0x16	Hardware Revision	Read only	StringT	*Hardware revision*
0x17	Firmware Revision	Read only	StringT	*Firmware revision*
0x20	Error Count	Read only	UIntegerT(16)	*Number of errors since the start or reset of the gripping module*
0x24	Device Status	Read only	UIntegerT(8)	*Device status*
0x25	Detailed Device Status	Read only	ArrayT of OctetStringT3	*Detailed device status*

Table 11: Standardized process parameters

8.2.3 Device-specific Acyclic Process Parameters

Configuration and diagnosis of the gripping module are performed via device-specific acyclic process parameters. You can find an overview on the parameters in chapter 12.

[4] IO-Link Interface and System Specification, appendix B

[5] http://www.io-link.com

8.2.3.1 Motion Parameters

Override Gripping Speed in Percent

Decreases or increases the gripping speed, which has been automatically calculated from the specified gripping force. The necessary gripping speed is automatically determined by the gripping module and is optimized for a hard grip (steel on steel), see chapter 5.1.2. This predefined value is equivalent to 100%. The set value is valid for all grips.

⚠ **Damage to the gripping module and to the gripped part possible. Excessive gripping speed can lead to rebound effects and heightened force peaks (gripping impulse) during gripping.**

Uneven movement (“clattering”) possible when gripping speed is insufficient.

Address

Index 0x0040, Subindex 0x01

Data Type

UIntegerT(8) - Value range: 10 to 200

Factory Setting

100

Example:

Gripping with 100% of the calculated gripping speed: Set the value 100.

Gripping with double the calculated gripping speed: Set the value 200.

Override Release Speed in Percent

Limits the finger speed during releasing of the grip. By default, the grip is released with maximum speed. The set value is valid for all grips.

Address

Index 0x0040, Subindex 0x02

Data Type

UIntegerT(8) - Value range: 10 to 100

Factory Setting

100

Example:

Releasing with 10% of the maximum speed: Set the value 10.

Releasing with the maximum speed: Set the value 100.

Reverse Reference Run Direction

By default, the gripping module performs its reference run (chapter 9.3) outwards. By setting this value to “TRUE”, the direction of the reference run can be reversed so the gripping module references inwards.

Address

Index 0x0040, Subindex 0x03

Data Type

BooleanT

Factory Setting

FALSE

Example:

Reference run inwards: Set the value “TRUE”.

8.2.3.2 Grip Parameters

The IEG PLUS series support eight pre-configurable grips that can be used to grip either single parts (inside/outside grip) or a group of similar parts each. A human-readable tag can be set for each grip to further improve the documentation of the machine. The factory settings of the grips depend on the build module type and are shown in Table 12.

Module Type	NO PART Limit	RELEASE Limit	Gripping force	Tag
IEG PLUS 40-020	50 (0.5 mm)	1950 (19.5 mm)	100%	“Preset n” (n=0-7)
IEG PLUS 40-050	50 (0.5 mm)	4950 (49.5 mm)	100%	„Preset n“ (n=0-7)
IEG PLUS 260-030	50 (0.5 mm)	2950 (29.5 mm)	100%	„Preset n“ (n=0-7)
IEG PLUS 260-080	50 (0.5 mm)	7950 (79.5 mm)	100%	„Preset n“ (n=0-7)

Table 12: Factory settings of the grip parameters depending on module type

All grips have the same scope of functions and have the following parameters:

NO PART Limit

Indicates the NO PART Limit for the respective grip. When performing a grip, the gripping module tries to position the base jaws on this target position. If the base jaws block due to a gripped part before the NO PART Limit is reached, the part is considered gripped (gripping state HOLDING). When the NO PART Limit is reached, the part is considered not gripped (gripping state NO PART). The position is indicated in 1/100 mm.

Address

Grip 0 to 7: Index 0x0060 to 0x0067, subindex 0x01

Data Type

IntegerT(16)

Factory Setting

See Table 12

Example:

The nominal gripping position during external gripping of a part is 7 mm; the tolerance is set to 2 mm. The NO PART Limit must therefore be set to 5 mm, and the parameter must be set to 500.

RELEASE Limit

Indicates the RELEASE Limit for the respective grip (prepositioning). This is the target position for releasing the grip. When it is reached, the gripped part is considered released (gripping state RELEASED). The position is indicated in 1/100 mm.

Address

Grip 0 to 7: Index 0x0060 to 0x0067, subindex 0x02

Data Type

IntegerT(16)

Factory Setting

See Table 12

Example:

The RELEASE Limit for external gripping of a part is at 10 mm: Set the value 1000.

Gripping Force

Determines the required gripping force as a percentage of the nominal gripping force. The gripping speed is also determined via the gripping force, see chapter 5.1.2.

The gripping force is specified as a percentage of the nominal gripping force. If a gripping force is set that is lower than the minimum gripping force specified in the technical data, gripping is always performed with the minimum gripping force. Observe batch variations!

Address

Grip 0 to 7: Index 0x0060 to 0x0067, subindex 0x03

Data Type

UIntegerT(8)

Factory Setting

See Table 12.

Example:

Gripping with nominal gripping force: Set the value to 100.

Gripping with 25% of the nominal gripping force: Set the value to 25.

Identifier/Tag

Give a human-readable name tag to the parameter set for later identification.

Address

Grip 0 to 7: Index 0x0060 to 0x0067, subindex 0x04

Data Type

StringT(32)

Factory Setting

See Table 12.

8.2.3.3 Virtual Position Switches

The gripping module has four virtual position switches. All position switches have the same scope of functions and can be set up via following parameters:

Switch Position

Indicates the center position of the switching range in 1/100 mm.

Address

Position switch 0 to 3: Index 0x0090 to 0x0093, subindex 0x01

Data Type

IntegerT(16)

Factory Setting

0 (0 mm)

Example:

The center position of the virtual position switch is 5 mm: Set the value 500.

Width of the Switching Range

Indicates the width of the switching range in 1/100 mm. The switching range is arranged symmetrically to the switch position.

Address

Position switch 0 to 3: Index 0x0090 to 0x0093, subindex 0x02

Data Type

UIntegerT(16)

Factory Setting

200 (2 mm)

Example:

The width of the switching range is 1 mm: Set the value to 100.

8.2.3.4 Diagnostic Parameters

Duration of the Last Successful Gripping Operation

Indicates the duration of the last successful gripping operation in milliseconds.

Address

Index 0x00A0, subindex 0x01

Data Type

UIntegerT(16)

Factory Setting

(not available)

Example:

The last gripping operation took 42 ms. Reading out the parameter gives the result 42.

Duration of the Last Successful Releasing Operation

Indicates the duration of the last successful releasing operation in milliseconds.

Address

Index 0x00A0, subindex 0x02

Data Type

UIntegerT(16)

Factory Setting

(not available)

Example:

The last releasing operation took 116 ms. Reading out the parameter gives the result 116.

Current Module Temperature

Indicates the current temperature inside the gripping module in 1/10 °C.

Address

Index 0x00A0, subindex 0x03

Data Type

IntegerT(16)

Factory Setting
(not available)

Example:
A read-out value of 451 means a temperature of 45.1 °C.

Cycle Count

Returns the total number of gripping cycles executed by the gripping module. The number of gripping cycles executed by the gripping module is stored retentively every 100 cycles or once per minute. The number of gripping cycles actually executed may therefore differ slightly from the number reported.

Address
Index 0x00A0, subindex 0x04

Factory Setting
(not available)

Data Type
UIntegerT(32)

Cycles Remaining until Next Maintenance

Indicates the remaining gripping cycles until the next maintenance of the module. Negative values indicate that the maintenance interval has been exceeded.

Address
Index 0x00A0, Subindex 0x05

Data Type
IntegerT(32)

Factory Setting
(not available)

Example:
A read-out value of 200281 indicates that there are approximately 200281 cycles left until the next maintenance of the gripping module.
A read-out value of -50112 means that the maintenance interval has been exceeded by 50112 gripping cycles.

8.2.3.5 Protocol Memory

The protocol memory comprises ten entries, which can be read out via the device-specific acyclic process parameters. All entries are identical and are structured as follows:

Time Stamp

System time when the event occurs, measured in seconds since the boot-up of the module.

Address

Index 0x0100 (oldest entry) to 0x0109 (newest entry), subindex 0x01

Data Type

UIntegerT(32)

Factory Setting

0 (0 s)

Example:

A read-out value of 110678 indicates that the logged event occurred 110678 seconds or approximately 31 hours after the start.

Message Text

Returns the message text of the protocol entry. This text has a maximum of 140 characters. If there is no event logged at the queried index of the protocol, reading out the parameter returns the character string “(not set)”.

Address

Index 0x0100 (oldest entry) to 0x0109 (newest entry), subindex 0x02

Data Type

StringT(140)

Factory Setting

“(not set)”

Example:

A temperature error event returns the message text “Temperature Error. Please check device.”.

Severity

Returns the severity of the protocol entry:

0: Info

1: Warning

2: Error

Address

Index 0x0100 (oldest entry) to 0x0109 (newest entry), subindex 0x03

Data Type

UIntegerT(8)

Factory Setting

0

Example:

A temperature fault event returns the severity 2 (“Error“).

Session ID

Returns a consecutive session ID that is incremented by one each time the gripping module is restarted. If the highest session ID is reached (255), it overflows to 0 at the next start. The session ID can be used to group the log entries by a specific session.

Address

Index 0x0100 (oldest entry) to 0x0109 (newest entry), subindex 0x04

Data Type

UIntegerT(8)

Factory Setting

0

Example:

The log contains four messages. Two messages have session ID = 24, the other two have session ID = 25. Thus, the messages with ID = 25 belong to the current session, the other two messages to the session before the last system start.

8.2.3.6 Extended Configuration Parameters

Maintenance Interval

Sets the number of gripping cycles for the maintenance interval.

This value is preconfigured by the manufacturer and doesn’t need to be changed for normal operation. For certain applications, however, it might be useful to adjust the maintenance interval according to the environmental conditions of the gripping process.

Address

Index 0x0140, subindex 0x00

Data Type

UIntegerT(32)

Factory Setting

20,000,000

Device state (Conditional Monitoring)

Returns the current device condition as a standardized value between 0 and 100, which can be used to monitor the reliable function of the gripping module. The value 0 corresponds to "poor" and the value 100 to "optimum".

In normal operation, the device state is 100. If the value is lower, measures should be taken (i.e. check module temperature and maintenance interval).

Address

Index 0x00A1, subindex 0x00

Data Type

UIntegerT(8)

Factory Setting

(not available)

Example:

Device state is 100: Gripper module is working properly.

Device state is 50: Maintenance interval exceeded, perform maintenance.

Device state is < 30: Increased module temperature detected, check application.

8.2.4 System Commands

System commands are issued by writing the respective code (1 byte) at index 0x02 of the standardized process parameters (cf. chapter 8.2.2). If necessary, the system commands can be issued directly via the configuration software of the IO-Link master. The following commands are available:

Restarting the Gripping Module (Code 0x80)

With this command, you can restart the module without having to disconnect it from the power supply (warm start).

Process parameters that are not stored remanent are lost during a warm start.

Reset to Factory Settings (Code 0x82)

With this command, the configuration of the gripping module can be reset to the factory settings.

All altered process parameters are overwritten with the standard setting.

Acknowledge Maintenance (Code 0xB0)

With this command, you can confirm that the device has undergone maintenance. When the module signals that maintenance is necessary (in the cyclic process data word, cf. chapter 8.1.2, or via system event, cf. chapter 8.3), this command must be executed after maintenance has been performed. The maintenance count is then reset, and with it the system event and the respective bit in the cyclic process data word.

Store Configuration (Code 0xE0).

With this command, you can save the current configuration of the gripping module in its non-volatile memory. In case of power loss, the parameterization is still available.

☞ **For more information on storing the configuration, see chapter 8.2.1.**

8.3 System Events (IO-Link Events)

Table 13 describes the system events that can be triggered by the gripping module.

☞ **For troubleshooting, see chapter 11.4.**

Code	Event	Description
0x0000	No Malfunction	No more malfunction. Previous faults were resolved.
0x1000	General Malfunction	Triggered when there is a general malfunction that cannot be specified further, e.g. in the event of a restart after watchdog reset. Further information can be found in the event log, if applicable.
0x1800	Motion Fault	Triggered when the base jaws do not move despite a motion command due to a blocked or defective drive.
0x4000	Temperature Fault	The temperature inside the gripping module exceeds 70 °C. It is recommended to stop the gripping module and only start it again after it has significantly cooled down. If necessary, the heat dissipation of the gripping module should be checked. ⚠ **Continuing operation despite a temperature fault may lead to malfunctions and to permanent damage of the gripping module.**
0x4210	Device Temperature Overrun	The temperature inside the gripping module exceeds 55 °C. The heat dissipation of the gripping module should be checked.
0x4220	Device Temperature Underrun	The temperature inside the gripping module falls below 0 °C.
0x5010	Component Malfunction	Triggered when there is a malfunction during startup or operation of the gripping module.
0x5011	Non-Volatile Memory Loss	*Memory error in the configuration memory* Triggered when a memory error in the configuration memory is detected during the startup of the gripping module.
0x8C00	Technology Specific Application Fault	Motor current out of the allowable range or measured values of the position sensor invalid.
0x8C41	Maintenance Required	The gripping module has reached or exceeded the cycle count upon which the next maintenance is required. Maintenance must be carried out.

Table 13: System events (IO-Link events)

9 Control of the Gripping Module

The gripping module is controlled via a standardized data format in accordance with IO-Link specification V1.1 (IEC 61131-9). This is a powerful point-to-point communication protocol in which the process data are cyclically exchanged between the IO-Link master and the gripping module.
The gripping module is also parameterized via IO-Link. This can be performed with the configuration software of the IO-Link master or with the DC-IOLINK device configurator by Weiss Robotics, which is available separately.

☞ **The IO-Link Device Description (IODD) file that is needed for the configuration of the gripping module can be found on our website at** https://www.weiss-robotics.com/ieg-plus/

☞ **A configuration example based on SIEMENS TIA Portal can be found in chapter 12.**

9.1 Gripping Commands

The movement of the base jaws is controlled via the command bits of the cyclic process data. The following commands are available:

ENABLE

The gripping module is activated, and the drive is switched on. The selected command GRIP, RELEASE, or REFERENCE is executed.

DISABLE

The gripping module is deactivated, and the drive is switched off. The base jaws are force-free.

RELEASE

The jaws are opened, and the gripped part is released.

GRIP

The jaws are closed, and the part is gripped.

HOME

A reference run is performed for the gripping module.

The direction of movement of the base jaws during GRIPPING and RELEASING is determined by the parameterization of the grip.

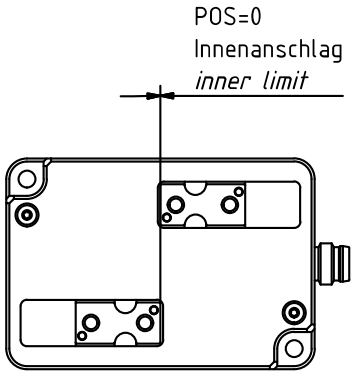
After the start of the gripping module, the drive is initially deactivated, and the base jaws are force-free. To move the base jaws, the gripping module must be activated and referenced. Only then can the commands GRIP and RELEASE be executed.

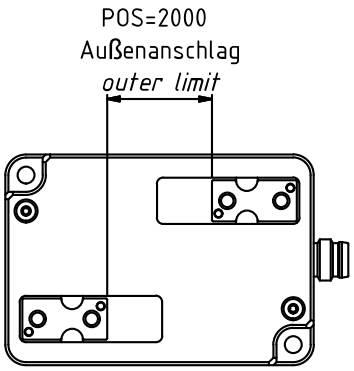
9.2 Position Sensors

The gripping module has an integrated position measurement system with which the position of the base jaws is measured relatively. The position value corresponds to the spacing of the two base jaws. The inner limit corresponds to the value 0 mm.

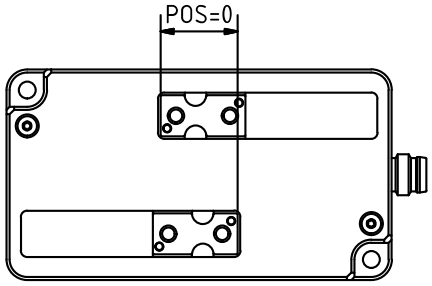
Figure 12 shows the correlation between the position value and the position of the base jaws. The current position value is transmitted in the cyclic process data.

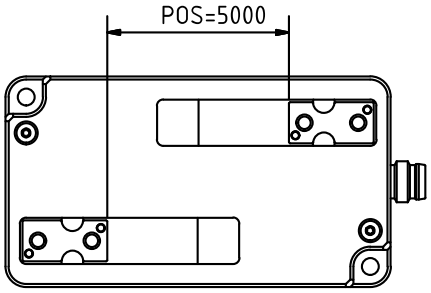
IEG PLUS 40-020



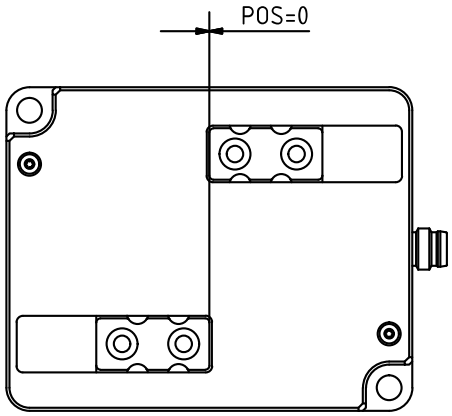


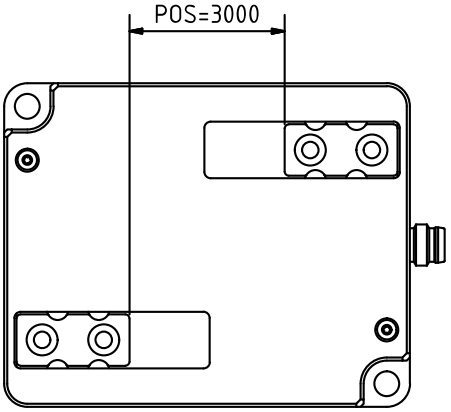
IEG PLUS 40-050





IEG PLUS 260-030





IEG PLUS 260-080

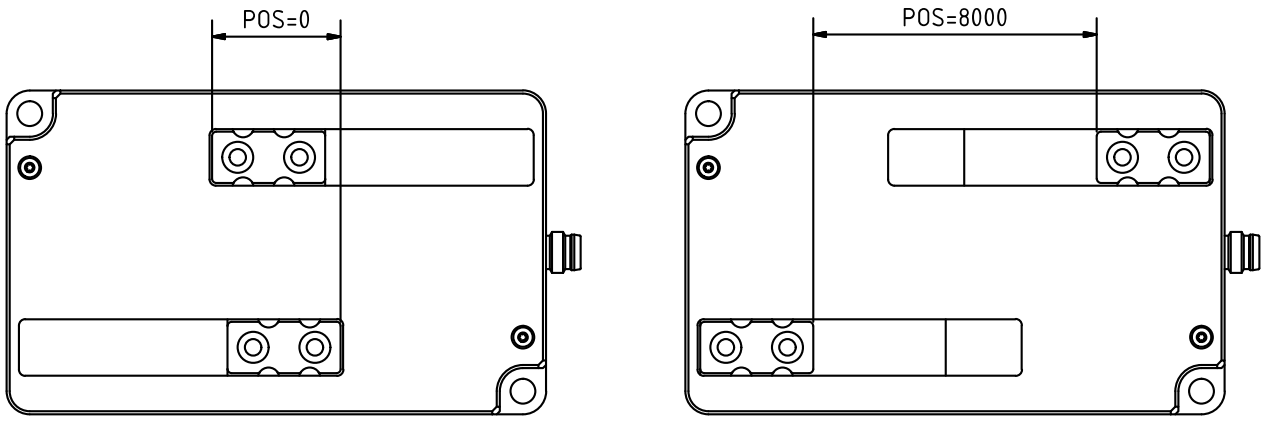


Figure 12: Position value

9.3 Homing sequence

Due to the relative position measurement system, the finger position is yet unknown when the gripping module is activated. The module must be referenced before it can execute movement commands. For this purpose, the module moves the base jaws with defined force and speed to the outer limit and uses this position as a reference value.

⚠ **Keep the traversing range of the fingers free during the reference run to avoid collisions and faulty referencing.**

If an individual application makes an outwards reference run impossible, e.g. if it would lead to a collision with a part or with the environment, the direction of the reference run can be reversed and the inner limit can be used (see chapter 8.2.3.1).

9.4 Virtual Position Switches

To detect different end positions, up to four virtual position switches can be parameterized. These position switches are realized in the control software of the gripping module (“virtually”). Their switching status is transmitted via the cyclic process data of the gripping module.
You can determine the center position and the width of the detection range for each position switch. The position switches do not save their status but provide a momentary signal. To detect an end position reliably, it must be ensured mechanically that the fingers block in the position that is to be detected, e.g. by a mechanical end stop or by the gripped part.

Merely traversing a position switch cannot be detected reliably due to the time-discrete sampling.

9.5 Gripping State

Besides detecting end positions via virtual position switches (cf. chapter 9.3), the gripping module also provides the “gripping state”. The gripping state is generated by the integrated gripped-part detection and is transmitted to the cyclic process control via the cyclic process data. It can be used for the sequence control of the handling process. Table 14 lists all possible gripping states. After startup, the module is in a special “NOT INITIALIZED” state. The gripping module remains in this state until a reference run has been initiated.

State	State flag	Description
NOT INITIALIZED	**all flags = 0**	**Initial State** The gripping module has been activated and is waiting for the command to perform a reference run.
IDLE	**IDLE = 1**	**Gripper Is Idle** The gripping module is inactive, and the fingers are force-free.
RELEASED	**RELEASED = 1**	**Part Released** The part has been released, i.e. the parameterized RELEASE Limit has been reached. The base jaws remain position-controlled in this position with reduced force.
NO PART	**NO PART = 1**	**No Part Gripped** No part has been detected while gripping, i.e. the parameterized NO PART Limit has been reached. The base jaws remain position-controlled in this position with reduced force.
HOLDING	**HOLDING = 1**	**Part is being held.** The gripping module has been blocked between the parameterized RELEASE Limit and NO PART Limit, and the base jaws do not move. The part is held with the specified force; gripped-part monitoring is activated.
ERROR	**FAULT = 1**	**An Error Has Occurred** An internal error that prevents the module from functioning correctly has occurred. For information on error causes, see chapter 11.4. Additionally, a system event has been triggered, see Table 13.

Table 14: Gripping states

In regular operation, depending on the command executed last and the current position of the base jaws, one of four gripping states can be reached: IDLE, RELEASED, NO PART, or HOLDING. The FAULT state indicates a device error. The possible transitions between the states are depicted in Figure 13.
A change of state is initiated by the gripping commands GRIP/RELEASE and ENABLE/DISABLE, which are set by the master via the cyclic process data. When the gripping module receives a new command, the command is executed and the gripping state changes accordingly. Every command leads to a change of state so the completion of a command can be identified by waiting for a change of state.
Thus, the gripping state provides a simple opportunity to monitor the gripping process in the controlling PLC or robot control. After a new gripping command has been issued, you must just wait for the change of the gripping state to identify the correct or incorrect execution of the command and take the next process step accordingly.

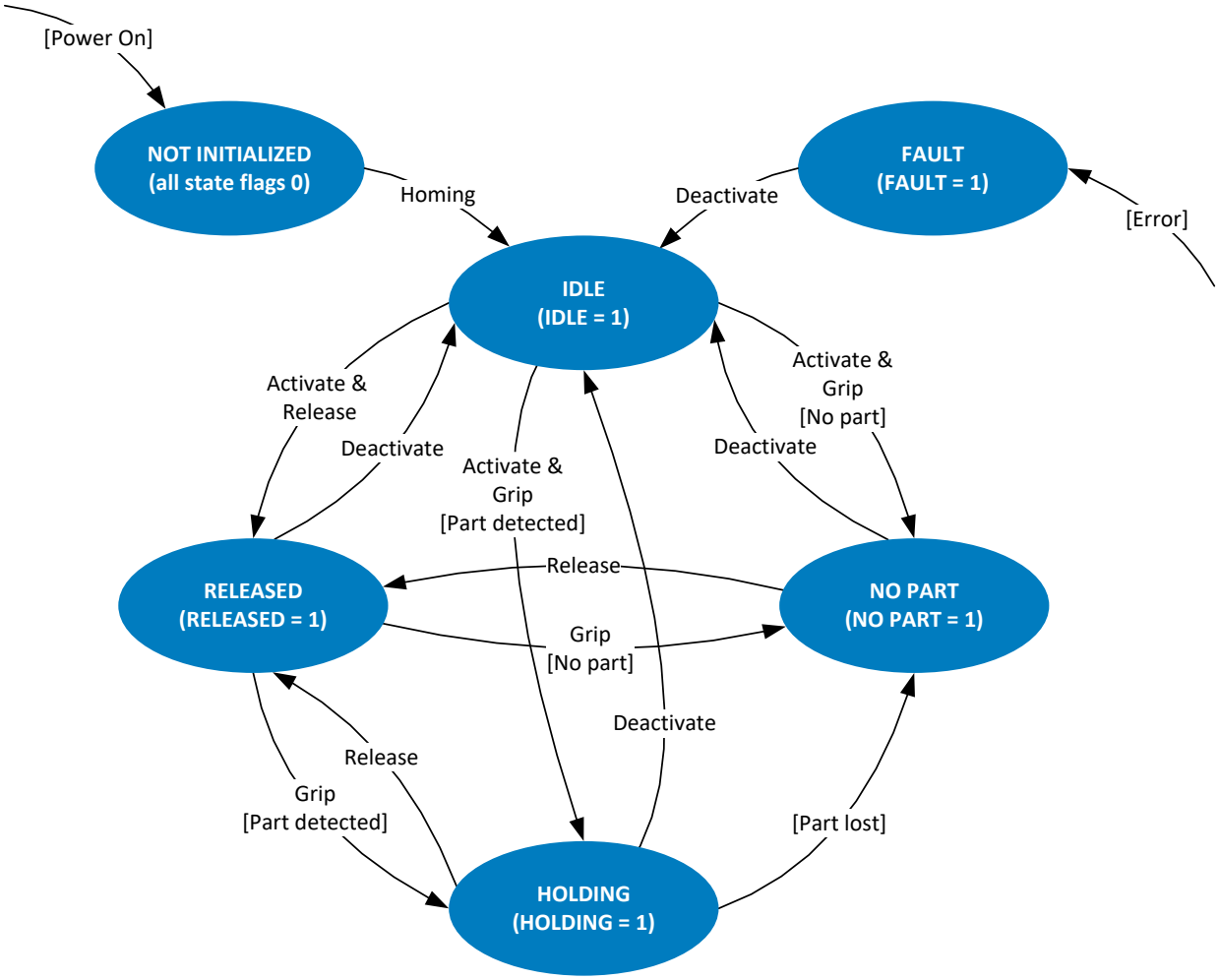


Figure 13: Gripping state

9.6 Parameterizable Grips

Four different grips can be parameterized for the gripping of different parts. The grip is selected via the grip index, which is transmitted by the cyclic process data, and is performed with the gripping commands GRIP or RELEASE.

As depicted in Figure 14, for parameterization, a position window must be determined by the RELEASE Limit and NO PART Limit for each grip. The part to be gripped must be within this window. When the base jaws are blocked within this window during GRIPPING, the gripping module detects a valid grip and changes to the gripping state HOLDING. When the base jaws reach the specified NO PART Limit, the gripping state changes to NO PART to signal that no part has been gripped.

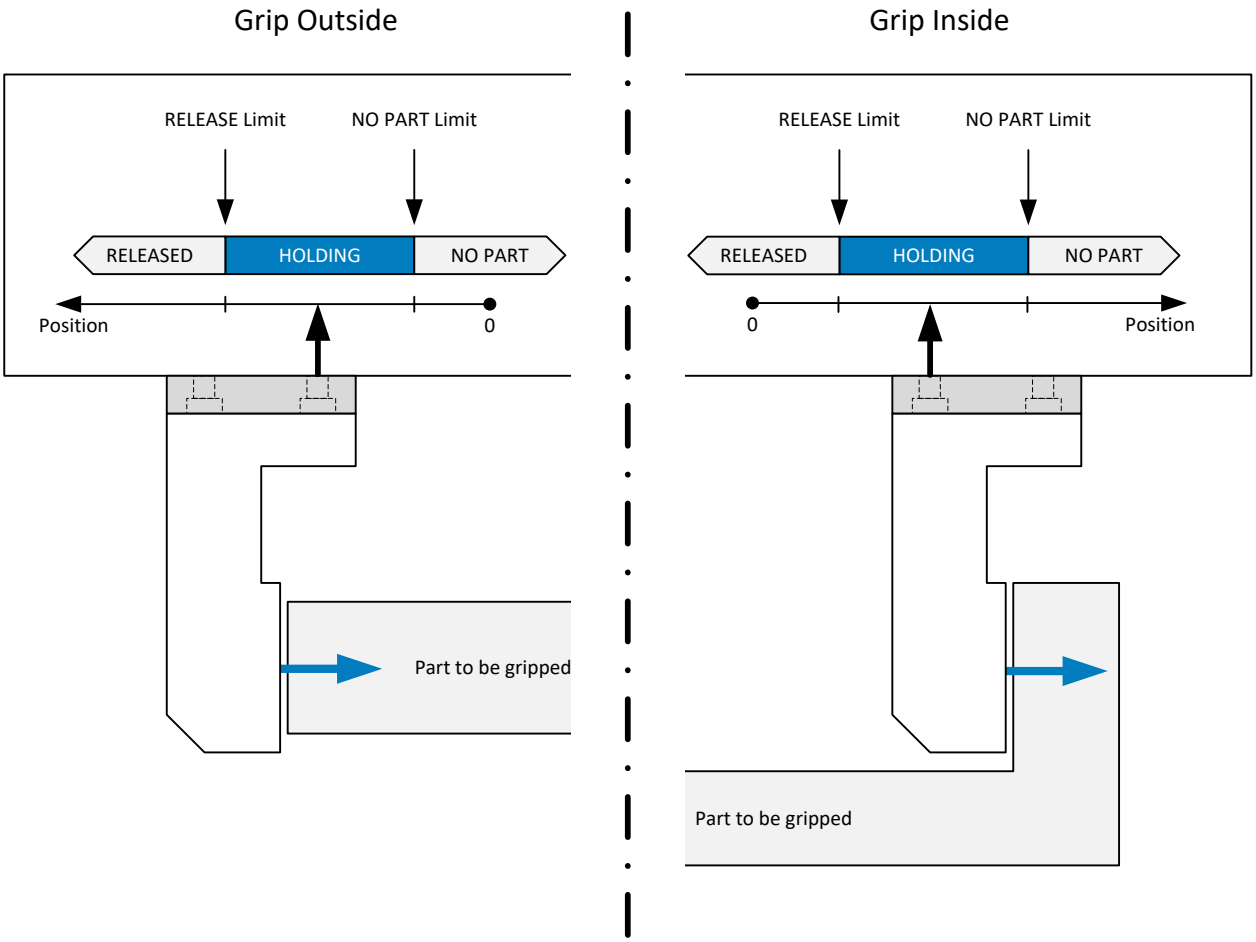


Figure 14: Gripping area and gripping direction

If the base jaws are blocked outside the position window, e. g. at the end stop of the movement, the gripped part is considered released or no part has been detected, depending on the direction of movement.

Danger of collision. If the gripping area is not sufficiently large, parts that are too small or too large may be gripped, although the gripping state is NO PART or RELEASED. If in doubt, please check the current jaw position.

9.6.1 Gripping Direction

The gripping direction is determined by the RELEASE Limit and NO PART Limit. When the position for the NO PART Limit is smaller than that for the RELEASE Limit, the gripping module performs an inward grip (Figure 14, “Gripping Outside”). If the position for the NO PART Limit is larger than that for the RELEASE Limit, the gripping module performs an outward grip (Figure 14, “Gripping Inside”).

9.7 Initializing the Module and Performing a Reference Run

After it has been connected to the power supply, the gripping module is in the NOT INITIALIZED state. The fingers are force-free, and the gripping module is waiting for the command for the initial reference run. The reference run is performed according to Figure 15.

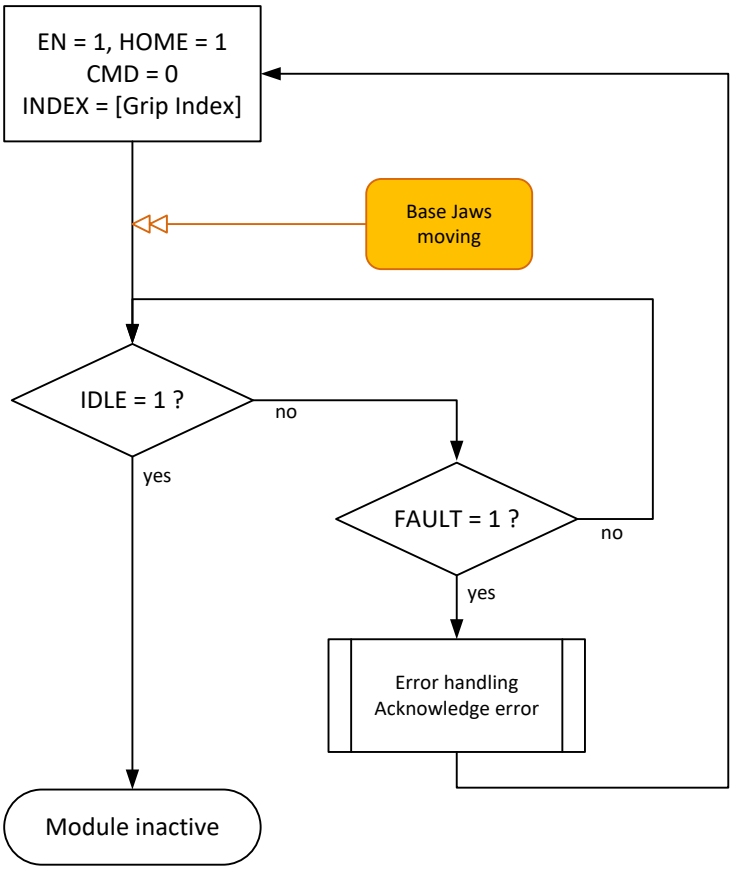


Figure 15: Initializing the gripping module

The reference run can be interrupted at any time by resetting the EN bit. The gripping module then remains in the NOT INITIALIZED state. When the reference run has been completed successfully, the gripping module changes to the IDLE state. After resetting the HOME bit, the command that has been selected with the CMD bit is executed.

If an error occurs during the reference run, the FAULT state is set. The state can be acknowledged by resetting the module with EN = 0 and HOME = 0. The gripping module then changes back to the NOT INITIALIZED state (all status flags are reset). Once this state has been reached, the reference run can be initiated again.

The reference run can also be performed during regular operation by setting the HOME bit. In this case, the gripping state will be set to NOT INITIALIZED during the reference run.

9.8 Grip Part

The program sequence for gripping a part is shown in Figure 16. The gripping module must be initialized and activated before it can perform a grip (see chapter 9.6.1). The gripping direction depends on the parameterization of the respective grip. The module detects the end of the gripping process or an error by continuously monitoring the gripping state. When the parameterized NO PART Limit has been reached, no part has been gripped and the base jaws remain at this position.
When an error has occurred during gripping, it must be acknowledged as described in chapter 9.10.

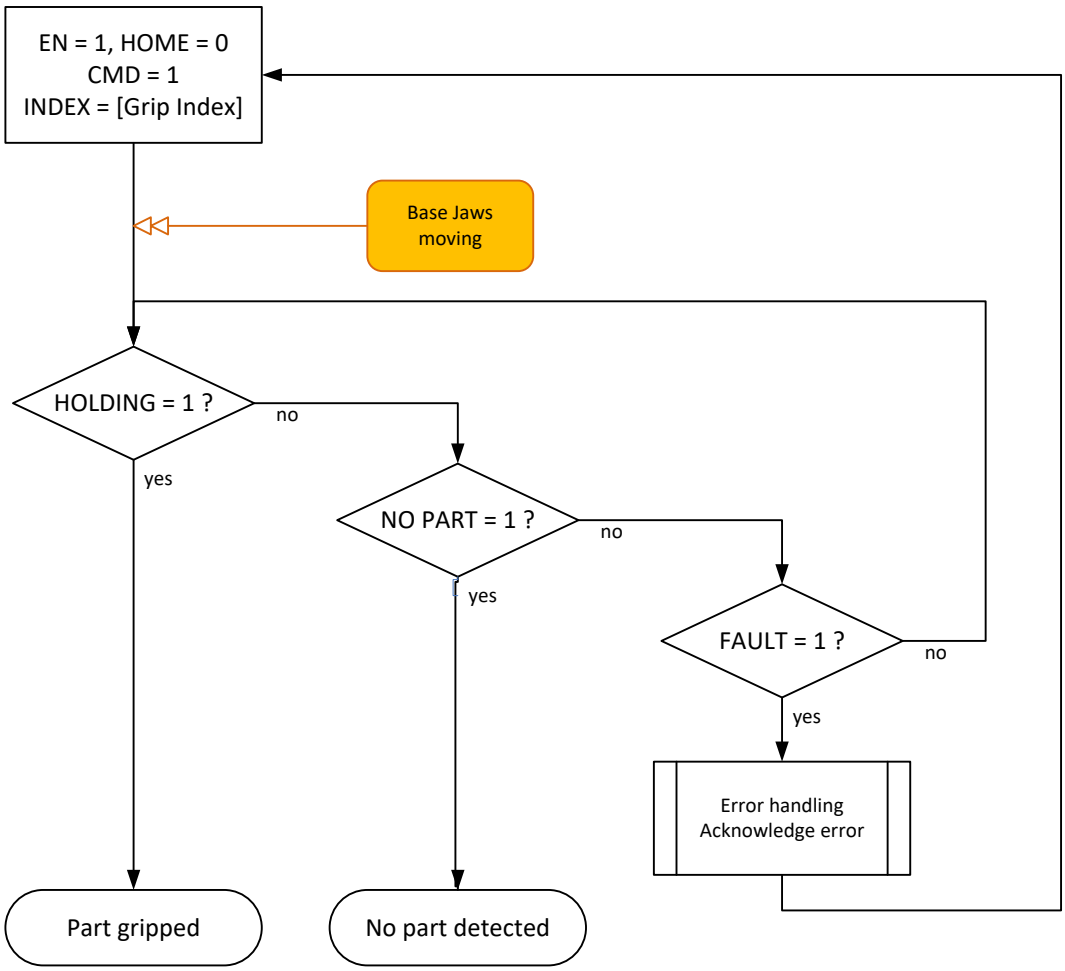


Figure 16: Program sequence gripping

9.9 Release Part

In order to loosen a grip that has been performed before and to release the gripped part, the program sequence in Figure 17 must be executed. Releasing the part is initiated by resetting the CMD flag. The direction of movement depends on the selected grip, which should not be changed during holding (grip index during releasing = grip index during gripping).

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

The gripped part is considered released (change from HOLDING state to RELEASED state) as soon as the base jaws have reached the RELEASE Limit. There they remain position-controlled, but with reduced force.

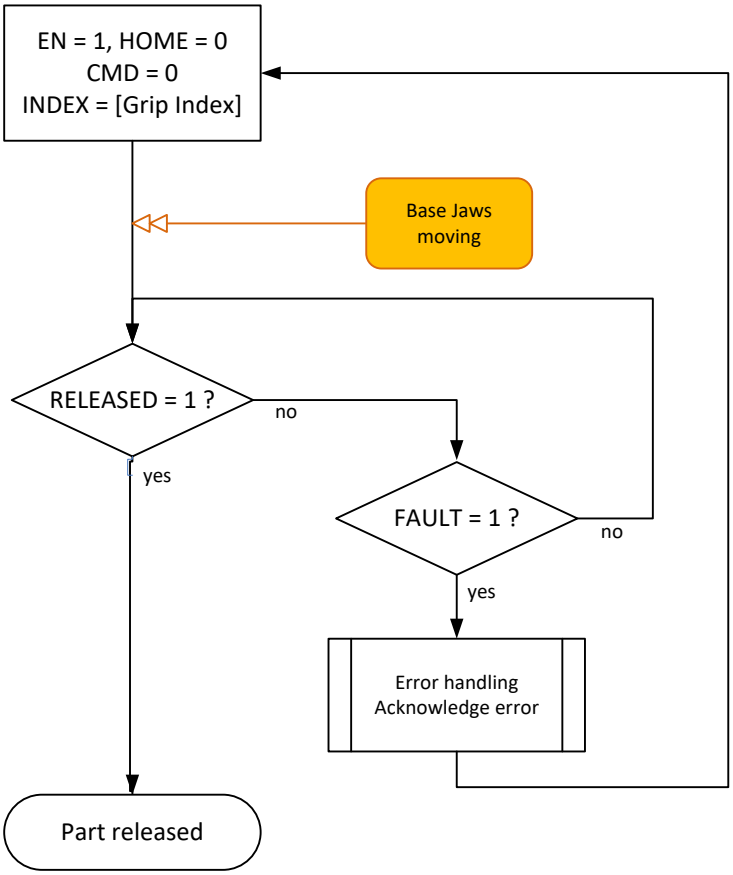


Figure 17: Program sequence release part

9.10 Troubleshooting

When the gripping module is in the FAULT state during regular operation, an internal error has occurred that prevents the module from functioning correctly. Possible causes for errors are described in chapter 11.4. In addition to the FAULT state, a system event that specifies the cause of error is triggered, see Table 13.

To acknowledge an error, the module must be deactivated and reactivated.

Figure 18 shows the program sequence that is required to acknowledge an error. If the error cannot be acknowledged, try to restart the gripping module by temporarily disconnecting it from the power supply. If the error persists, please contact the technical support of Weiss Robotics. The gripping module may be defective.

Possible loss of parts. Move the module into a safe position before acknowledging the error.

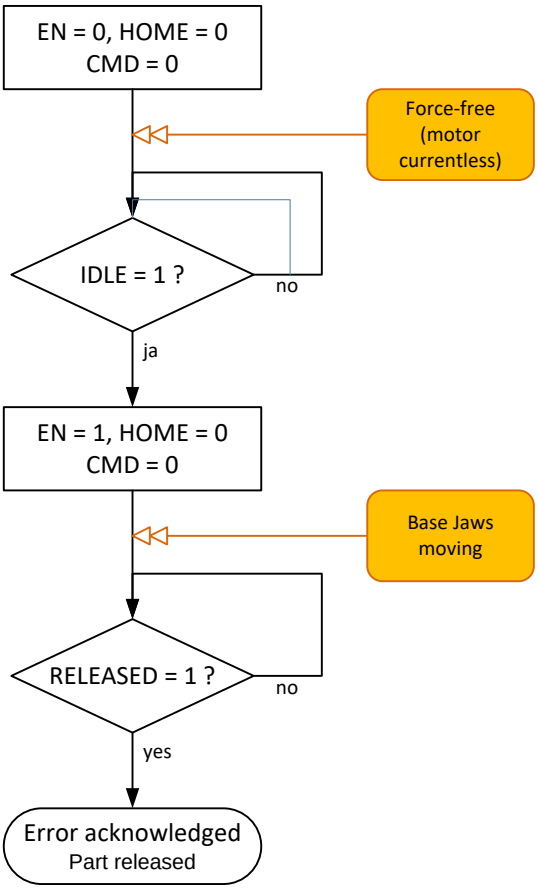


Figure 18: Program sequence acknowledging an error and releasing a part

9.11 Activating and Deactivating the Module (Setup Mode)

Especially when setting up the gripping process, it may be advisable to deactivate the gripping module. The fingers are then force-free, but the logic of the gripping module and the position detection are still active. Thus, e. g. gripping positions can be taught in manually, or parts can be extracted manually. The control sequences for both states are depicted in Figure 19.

⚠ **Please follow the safety instructions when you work directly at the gripping module.**

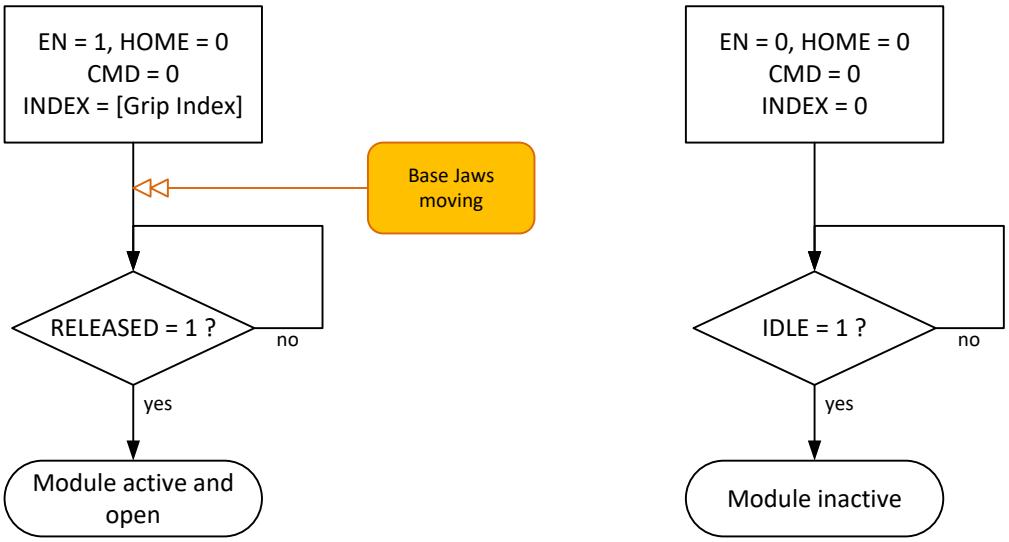


Figure 19: Program sequence to activate (left) and deactivate (right) gripping module

9.12 Design of the Gripping Process

The design of the gripping process determines the reliability of the production process. The following points have been proved to be helpful:

- Put the gripping point in the center of the stroke range of the base jaws by constructively designing the fingers if the process allows this.
- If possible, secure the position of the part by establishing a form-fit connection between the contact area of the finger and the contact area of the part to be gripped.
- Avoid inaccuracies in the contact with the part by constructing the contact areas accordingly.
- Use a compensatory element if traverse forces can occur at the gripping module due to gripping or positioning tolerances. That is the case, e.g., when a clamped part is to be picked up by a gripping module that has been positioned by a robot.
- Choose a large enough gripping range (recommended distance between RELEASE Limit and NO PART Limit ≥ 2 mm) to maximize the reliability of the gripping process.
- Always keep a distance to the stroke stop with the positions for the RELEASE Limit and the NO PART Limit so a secure grip detection is possible and the gripping module does not grip itself.
- During holding, the continuous application of the gripping force creates heat that must be dissipated from the gripping module. Make sure that the mounting surface has sufficient heat dissipation. Avoid permanent holding and do not block the fingers beyond the actual gripping process (e.g. by setting the RELEASE Limit outside the stroke range) in order not to heat up the module unnecessarily.
- Perform some idle strokes traversing the whole movement range every 1000 gripping cycles to ensure an even distribution of the lubricant in the linear guides.

The following application examples describe the realization of simple handling tasks and how to parameterize and use the gripping module via IO-Link accordingly.

9.12.1 Application Example External Gripping

Figure 20 shows an example of external gripping with the IEG PLUS 40-020 gripping module. An electrolytic capacitor is to be gripped at the casing and dropped into a fixture. The capacitor has a nominal diameter in the gripping area of 15 mm. The gripping fingers have been configured in such a way that the nominal diameter corresponds to a jaw spacing at the gripping module of 10 mm (half the total stroke). To ensure the reliability of the gripping process, a position tolerance of ± 1 mm is set. Due to the low weight of the part, the gripping force is set to 20 N. For the IEG PLUS 40, this means the gripping force is set to 50%. The part is parameterized as GRIP 0 of the gripping module. For this purpose, the following parameters are set via the configuration software of the IO-Link master or via the Weiss Robotics DC-IOLINK device configurator, which is available separately:

GRIP 0:

NO PART Limit (index 0x60, subindex 0x01):	900	(= 9.00 mm)
RELEASE Limit (index 0x60, subindex 0x02):	1100	(= 11.00 mm)
Gripping force (index 0x60, subindex 0x03):	50	(= 50%, corresponding to 20 N)

If the module is parameterized via DC-IOLINK, the parameterized values must be stored remanently in the gripping module before it is deactivated, see chapter 8.2.1.

Figure 20: Gripping example external gripping

If the gripping module has been restarted, it must first perform a reference run. In this example, it makes sense to perform an outward reference run (factory setting). The gripping module is initialized by the program sequence depicted in Figure 15. The gripping process is performed via the program sequences in Figure 16 (grip part) and Figure 17 (release part). Since GRIP 0 has been parameterized, the grip index 0 must be used in the program sequence. The gripping state is also visualized via the state display at the gripping module: In the released state, the state display's light is blue; if the part has been gripped correctly, the light changes to green.

9.12.2 Application Example Internal Gripping

In a mounting process, a plain bearing bush is to be picked up and inserted with an IEG PLUS 40-020. Since the bush is to be inserted into a bore hole, it must be gripped from the inside. The gripping application is shown in Figure 21. The fixing at the motion axes and possible compensatory elements are not depicted here. The bush with its inner diameter of 22 mm is gripped and aligned with the help of hardened pins (Figure 21, right view).

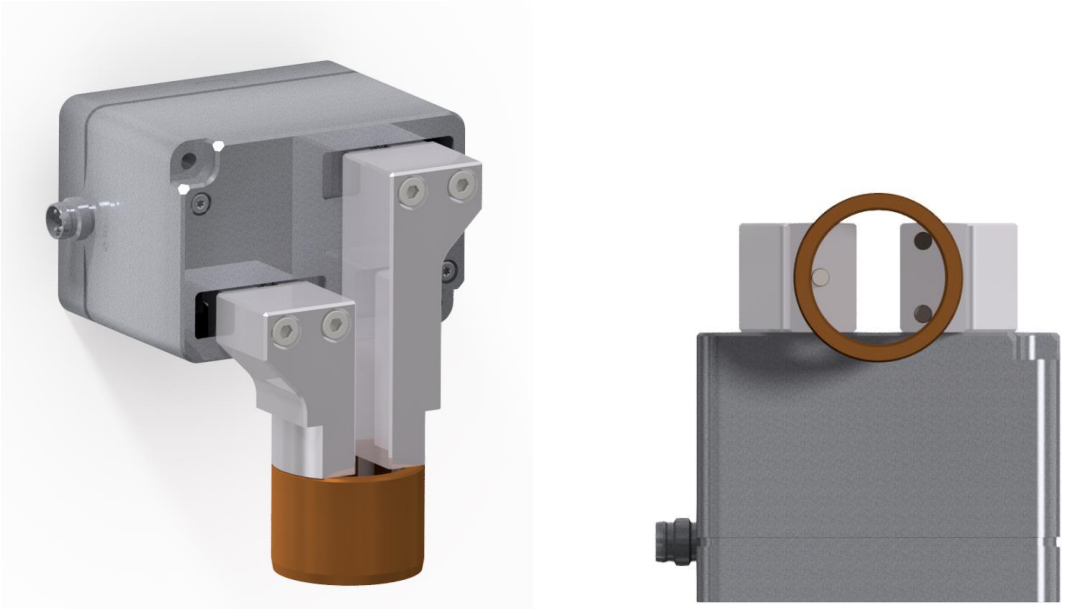


Figure 21: Application example internal gripping

The gripping fingers are designed in such a way that the part is held at a jaw position of 10 mm (half the total stroke of the gripping module). To ensure the reliability of the gripping process, a position tolerance of ± 1.5 mm is set. The gripping force should be the nominal gripping force.
Since GRIP 0 is already in use, the part is parameterized as GRIP 1 of the gripping module. For this purpose, the following parameters are set via the configuration software of the IO-Link master or via the Weiss Robotics DC-IOLINK device configurator, which is available separately:

GRIP 1:

NO PART Limit (index 0x61, subindex 0x01): 1150 (= 11.50 mm)

RELEASE Limit (index 0x61, subindex 0x02):	850	(= 8.50 mm)
Gripping force (index 0x61, subindex 0x03):	100	(= 100%, corresponding to 40 N)

If the module is parameterized via DC-IOLINK, the parameterized values must be stored remanently in the gripping module before it is deactivated, see chapter 8.2.1.

If the gripping module has been restarted, it must first perform a reference run. In this example, it makes sense to perform an outward reference run (factory setting) since the fingers project slightly beyond the inner edge of the base jaws. Thus, an inward reference run would be performed on the mounted gripping fingers and the position value would have an offset. The gripping module is initialized by the program sequence depicted in Figure 15. To grip the part, the control system performs the program sequence depicted in Figure 16. When the GRIP command is issued, the fingers move apart since the NO PART Limit is higher than the RELEASE Limit. To release the part, perform the program sequence depicted in Figure 17. Since GRIP 1 has been parameterized in this example, the grip index 1 must also be used for performing the program sequences mentioned above. The gripping state is visualized via the state display: In the released state (fingers together), the state display's light is blue; when the part has been gripped correctly, the light changes to green.

9.13 Function Block for Siemens TIA Portal

For TIA portal, there is a function block available at **https://weiss-robotics.com/servo-electric/ieg-plus-series/product/ieg-plus-series-523/** under “Downloads”. The documentation of the function block can be found in the downloaded file.

10 Maintenance and Cleaning

Maintenance interval: Every 2 million cycles
Scope of maintenance: Cleaning the motion system and checking the gripping module

Clean the gripping module in regular intervals with a dry cloth to remove all dirt and possible splinters. They typically build up below the belt cover. Remove the cover as shown in Figure 22 to clean the module with a brush.

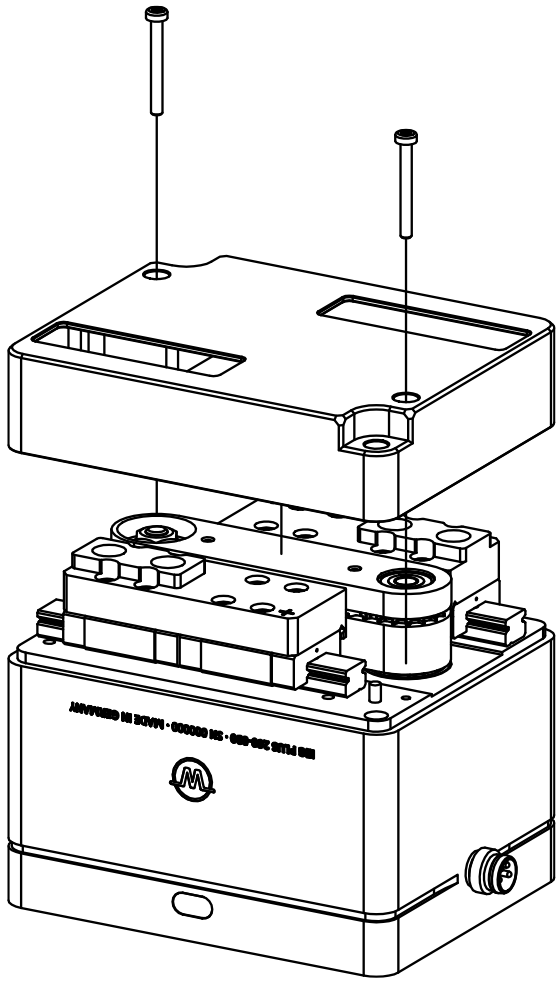


Figure 22: Removing the belt cover

⚠ **The gripping module is factory-adjusted. Do not remove the base jaws and the belt.**

The maintenance intervals must be adjusted to the surface and operating conditions. The following factors should be taken into account:

- Increased operating temperatures
- Condensation and perspiration water effects
- High vibration stress

- Use in a vacuum
- High-dynamics operation
- Effects from foreign substances (e.g. vapors, acids, etc.)

The guides are lubricated for life. Only in individual cases, it might be necessary to relubricate them. Contact our support if you need advice.

10.1 Maintenance according to Requirements

If the maintenance function is activated, the gripping module triggers a system event when the maintenance interval has been reached. In addition, the MAINT flag is set in the cyclic process data. The remaining cycles until the maintenance interval is reached can be queried via the acyclic process parameters (see chapter 8.2.3.4).

10.2 Resetting the Maintenance Interval Count

After successful maintenance, the interval count must be reset by acknowledging the maintenance (see chapter 8.2.4).

11 Troubleshooting

11.1 The Base Jaws Do Not Move

Possible Cause	Remedy
The operating voltage is too low, or the power supply is insufficient.	• Check the power supply. • Check the requirements of the power supply.
Communication with the module is not possible (the state display at the gripping module flashes).	• Check the connections and communications cables. • Check compatibility with the IO-Link master (the gripping module only supports V1.1 masters).
Error message in the system	• Check the module's operating state. • The gripping module reports an error -> chapter 11.4. • Restart the gripping module. If the error occurs again, send the gripping module to Weiss Robotics with a repair order.
Failure of a component, e.g. through overload	• Send the gripping module to Weiss Robotics with a repair order. • Make sure the gripping module is only used according to the defined operating parameters.

11.2 Gripping Module Stops Abruptly or Does Not Complete the Entire Stroke

Possible Cause	Remedy
Wrong parameterization	• Check the parameterization.
Power supply interrupted	• Check the power supply.
No communication with the gripping module possible	• Check the connections and communications cables.
Error message in the system (the state display's light is red)	• Check the module's operating state. • The gripping module reports an error -> chapter 11.4.
Foreign objects in the motion system or module contaminated	• Deactivate the gripping module and check the mobility by moving the fingers manually. • Remove foreign parts. • Perform cleaning and maintenance.
Uneven mounting surface	• Check the evenness of the mounting surface.

11.3 No Communication with the Gripping Module

Possible Cause	Remedy
Power supply interrupted	• Check the power supply.
The IO-Link connection cannot be established.	• Check the connections and communications cables. • Check the compatibility with the IO-Link master (the gripping module only supports V1.1 masters).

Flashing state display indicates no IO-Link communication with the master.	• Check settings of the master/configuration.

11.4 The Gripping Module Reports an Error

The state display's light is permanently red or flashes red. The gripping module has triggered a system event (IO-Link event according to Table 13).

Error code of the gripping module	Remedy
Motion error	This error occurs when the base jaws do not move despite a movement command. If this error occurs repeatedly, the drive is defective. Send the gripping module to Weiss Robotics with a repair order.
Temperature fault	The temperature inside the gripping module exceeds 70 °C. **It is strongly recommended to stop the gripping module and only start it again after it has significantly cooled down.** • Check the ambient conditions. • Improve the heat dissipation. • Shorten the holding cycles or reduce the gripping force. • Make sure that there is a distance between the base jaws and the end stop in the RELEASED state. • Reduce the heat input from outside. The error is automatically reset when the gripping module has cooled down. The gripping module remains operational, but it is not recommended to continue operation.
Memory error in the configuration memory	The content of the configuration memory is inconsistent. • Restart the gripping module. If the error persists, please contact our technical support.
Component malfunction	At least one control component required for operation could not be initialized. • Restart the gripping module. If the error persists, send the gripping module to Weiss Robotics with a repair order.
General error	Restart by watchdog reset. • Acknowledge the error. If the error occurs regularly, please contact our technical support.
Technology-specific application error	Motor current out of the allowable range or measured values of the position sensor invalid. • Restart the gripping module. If the error persists, send the gripping module to Weiss Robotics with a repair order.

☞ **For troubleshooting, see chapter 9.6.1.**

12 APPENDIX A - Device-specific Process Parameters

Table 15 lists the device-specific process parameters of the gripping module. A detailed description can be found in chapter 8.2.3.

Index	Function	Access	Subindex	Data type	Description	Factory setting
0x0040	Motion parameter	Read/write	1	UIntegerT(8)	*Override gripping speed in percent*	100
		Read/write	2	UIntegerT(8)	*Override release speed in percent*	100
		Read/write	3	BooleanT(8)	*Reverse reference run direction*	false
0x0060	Grip 0	Read/write	1	IntegerT(16)	*NO PART Limit in 1/100 mm*	see Table 12
			2	IntegerT(16)	*RELEASE Limit in 1/100 mm*	
			3	UIntegerT(8)	*Gripping force in percent*	
			4	StringT(32)	*Identifier Tag (text)*	
0x0061	Grip 1	Read/write	1	IntegerT(16)	*NO PART Limit in 1/100 mm*	
			2	IntegerT(16)	*RELEASE Limit in 1/100 mm*	
			3	UIntegerT(8)	*Gripping force in percent*	
			4	StringT(32)	*Identifier Tag (text)*	
…						
0x0067	Grip 7	Read/write	1	IntegerT(16)	*NO PART Limit in 1/100 mm*	
			2	IntegerT(16)	*RELEASE Limit in 1/100 mm*	
			3	UIntegerT(8)	*Gripping force in percent*	
			4	StringT(32)	*Identifier Tag (text)*	
0x0090	Virtual position switch 0	Read/write	1	IntegerT(16)	*Switch position in 1/100 mm*	0
			2	UIntegerT(16)	*Switching width in 1/100 mm*	200
…						
0x0093	Virtual position switch 3	Read/write	1	IntegerT(16)	*Switch position in 1/100 mm*	0
			2	UIntegerT(16)	*Switching width in 1/100 mm*	200

Index	Function	Access	Subindex	Data type	Description	Factory setting
0x00A0	Diagnosis	Read only	1	UIntegerT(16)	*Duration of the last successful gripping operation in milliseconds*	-
			2	UIntegerT(16)	*Duration of the last successful releasing operation in milliseconds*	-
			3	IntegerT(16)	*Current module temperature in 1/10 °C*	-
			4	UIntegerT(32)	*Gripping cycle count*	-
			5	IntegerT(32)	*Cycles remaining until next maintenance*	-
0x00A1	Condition monitoring	Read only	0	UIntegerT(8)	*Current device condition (0…100)*	-
0x0100	Protocol Entry 0	Read only	1	UIntegerT(32)	*Time stamp measured in seconds since activation*	0
			2	StringT(140)	*Message text (max. 140 characters)*	"(not set)"
			3	UIntegerT(8)	*Severity (0…2)*	0
			4	UIntegerT(8)	*Session ID*	0
…						
0x0109	Protocol Entry 9	Read only	1	UIntegerT(32)	*Time stamp measured in seconds since activation*	0
			2	StringT(140)	*Message text (max. 140 characters)*	"(not set)"
			3	UIntegerT(8)	*Severity (0…2)*	0
			4	UIntegerT(8)	*Session ID*	0
0x0140	Maintenance Interval	Read/write	-	UIntegerT(32)	*Number of gripping cycles after which maintenance is signaled*	20,000,000

Table 15: Device-specific process parameters

13 APPENDIX B - Configuration Example

Below the configuration of Integration Line gripping modules via IO-Link with a suitable IO-Link master at a PLC is described.

Control Elements Used

- SPS SIEMENS Simatic S7-1200 1212C DC/DC/Rly version 4, article number 6ES7 212-1HE40-0XB0
- IO-Link master SIEMENS SM 1278, article number 6ES7 278-4BD32-0XB0
- Configuration software SIEMENS TIA-Portal / STEP 7 Basic V13 SP1
- Port configurator SIEMENS S7-PCT 3.3 HF2

Prerequisites

The prerequisite for this example is that the PLC has been commissioned and configured in such a way that it can be accessed via the TIA portal. The configuration software and the port configurator must be installed. The operator should know the basic functionality of the TIA portal. Furthermore, it is assumed that the gripping module is properly wired to the IO-Link master. You can find information on the pin assignment in chapter 5.2.1.

13.1 Preparation

Create a new project in the TIA portal and configure the PLC. Set the IP address of the PLC
in such a way that you can access the PLC via PROFINET. Then configure the IO-Link master SM 1278 (cf. Figure 23).

The IO-Link master maps the cyclic process data of the gripping module into the I/O address space of the PLC. The address range is automatically assigned during project engineering and is stored in the device configuration.

13.2 Configuration of the IO-Link Master

You can start the S7-PCT port configurator by right-clicking on the respective IO-Link master (Figure 24).
You must first import the IO-Link Device Description (IODD) file of the gripping module in S7-PCT (menu item “Extras” -> “Import IODD”). The gripping module then appears in the device catalog on the right. Per “drag & drop”, the suitable gripping module can then be dragged from the catalog to the IO-Link port of the master that you want to use (Figure 25).
By clicking on “Load” in the tool bar of S7-PCT, the port configuration is transferred to the IO-Link master. The IO-Link master now establishes a connection with the gripping module. The respective LEDs at the IO-Link master change to green, and the LED at the gripping module changes from white flashing to permanent white light.

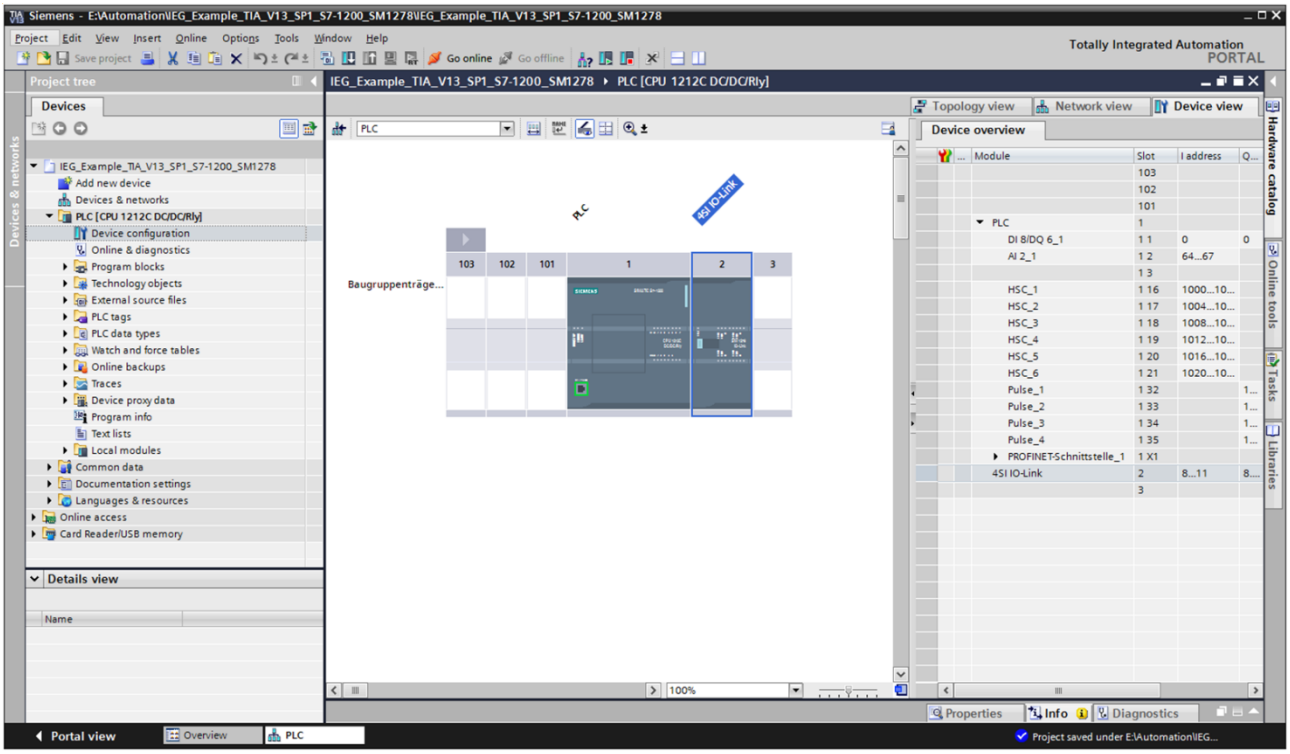


Figure 23: Configuration of the IO-Link master

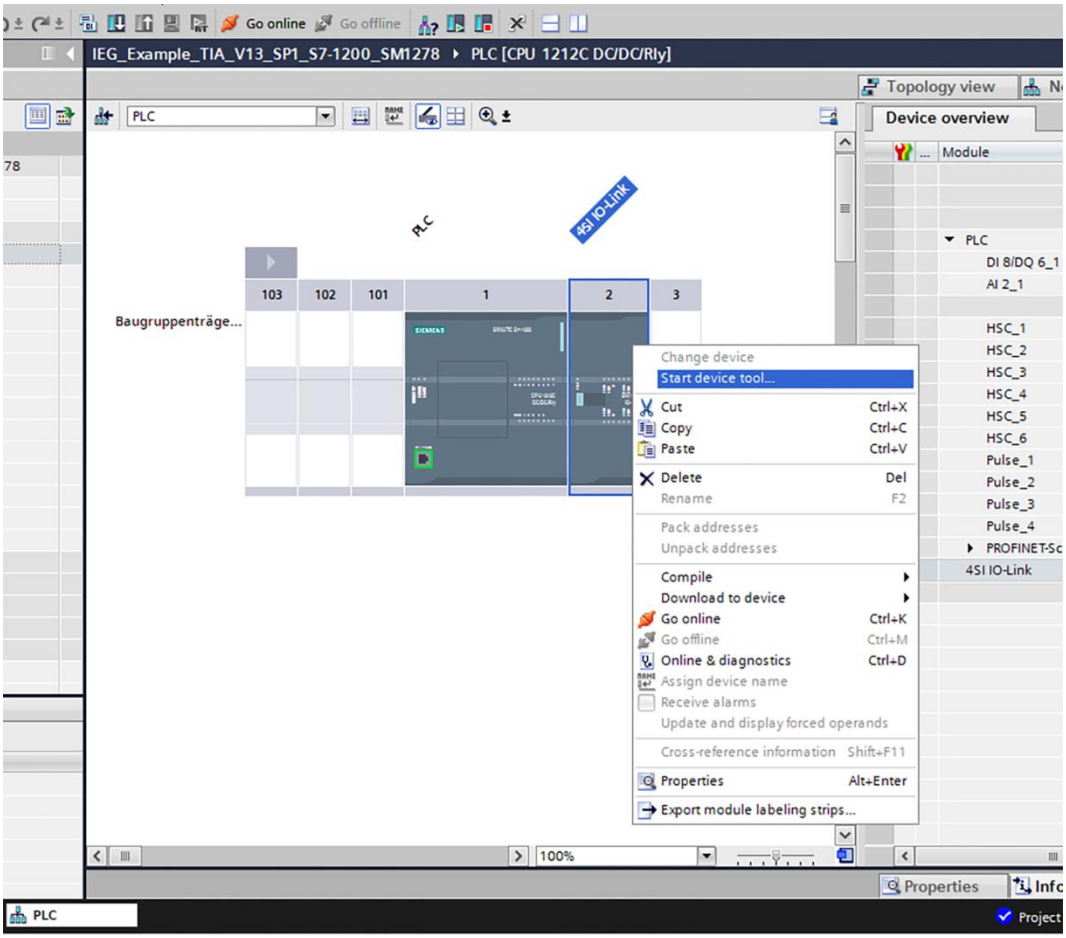


Figure 24: Starting the S7-PCT port configurator (device tool)

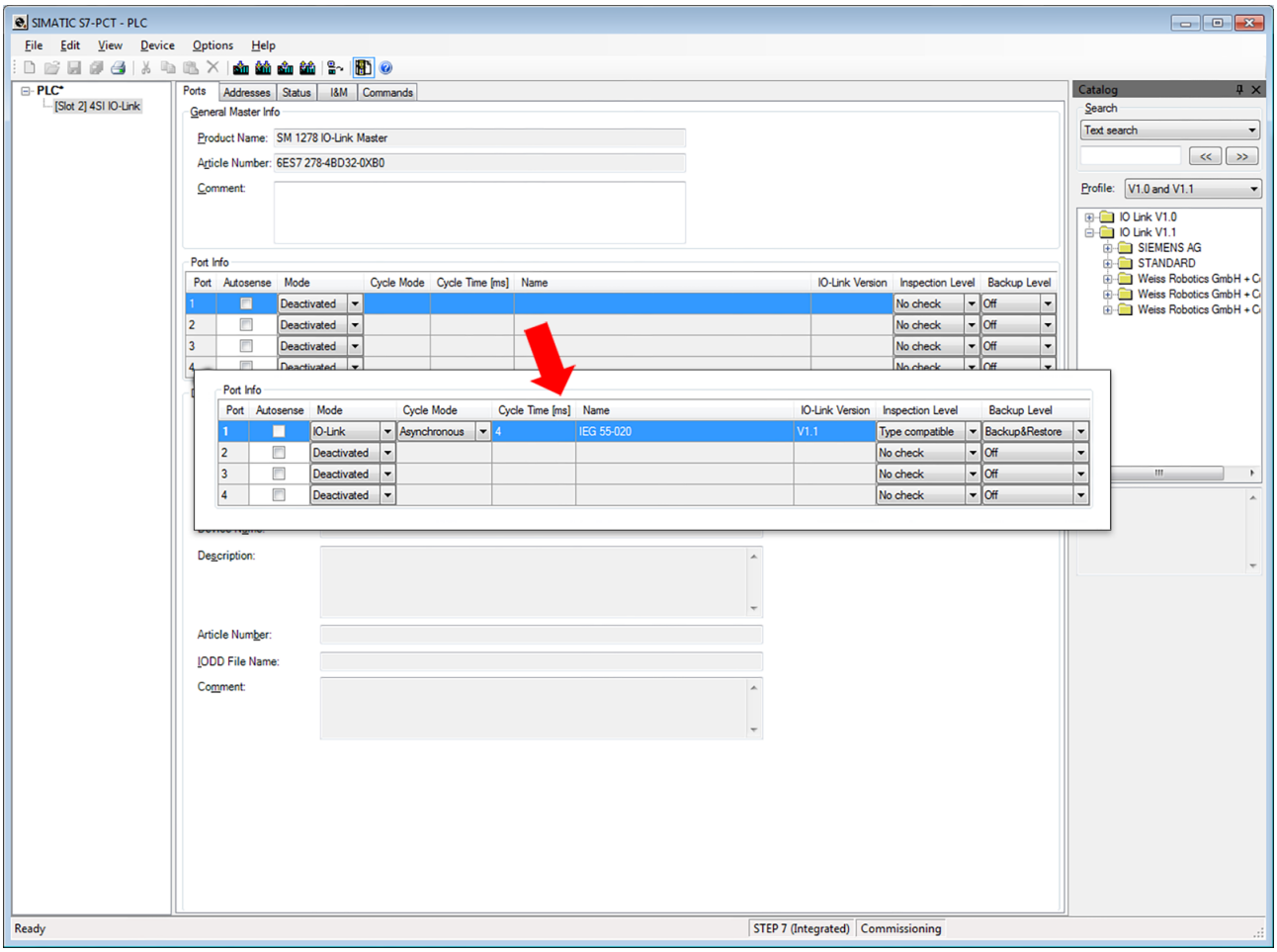


Figure 25: Configuration of the IO-Link port

13.3 Configuration of the Gripping Module

The gripping module can now be parameterized via the S7-PCT port configurator. By clicking on “Online” (IO-Link port selected in the selection tree on the left), the port configurator establishes a connection to the IO-Link master. By selecting the gripping module in the selection tree on the left, the parameterization of the gripping module is loaded. The tabs “Identification”, “Parameter”, and “Diagnosis” appear.

The “Identification” tab (Figure 26) shows the manufacturer, the type description, the firmware version, etc. of the gripping module. This information can be read only.

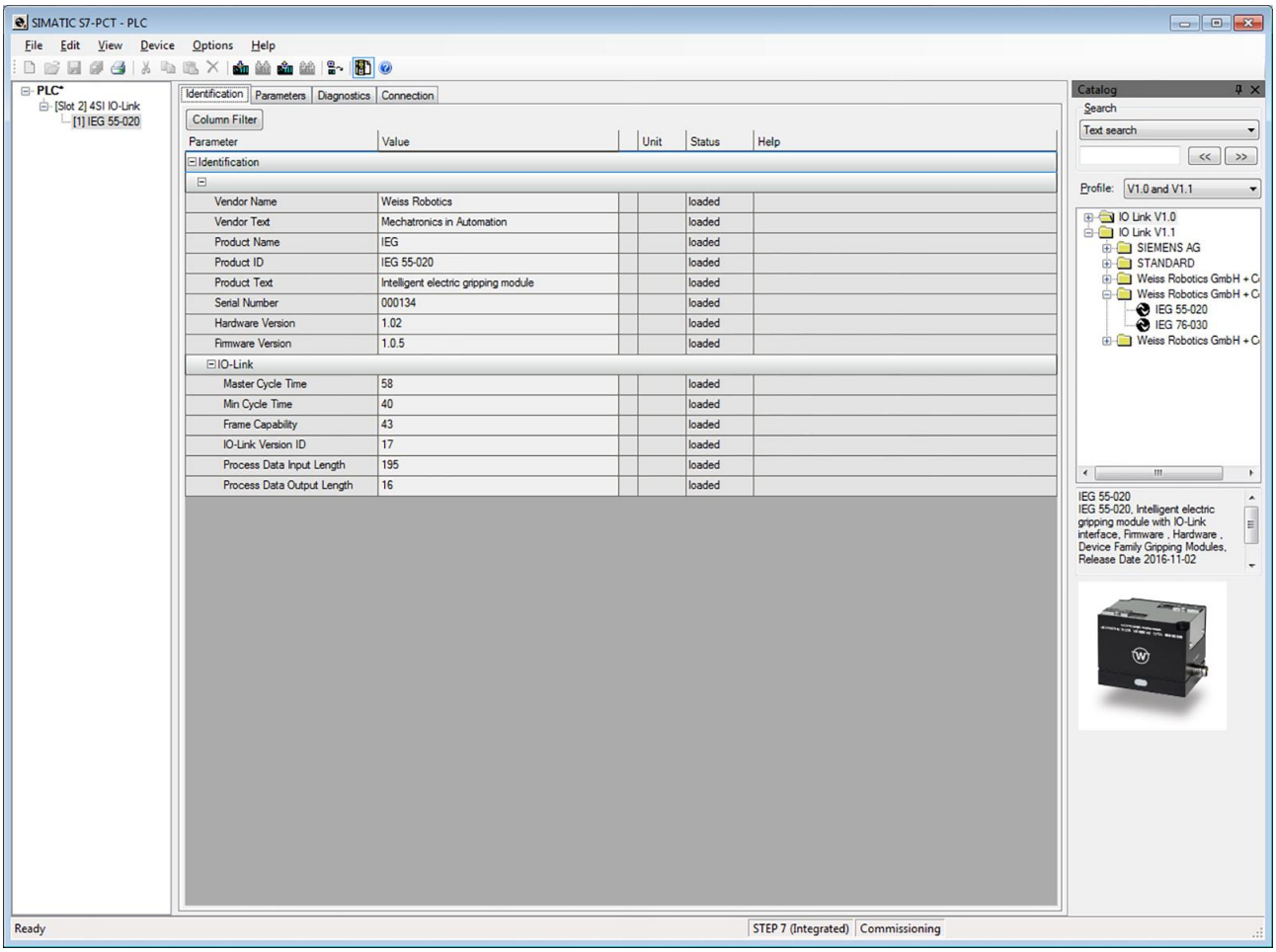


Figure 26: Identification of the gripping module in S7-PCT

13.4 Parameterization of the Gripping Module

The “Parameter” tab (Figure 27) shows the gripping parameters of the four available grips as well as the settings of the four virtual position switches. These values can be adjusted to your individual application.
The system commands can be issued via buttons, e.g. acknowledging that maintenance has been performed or remanently storing the configuration data in the gripping module.

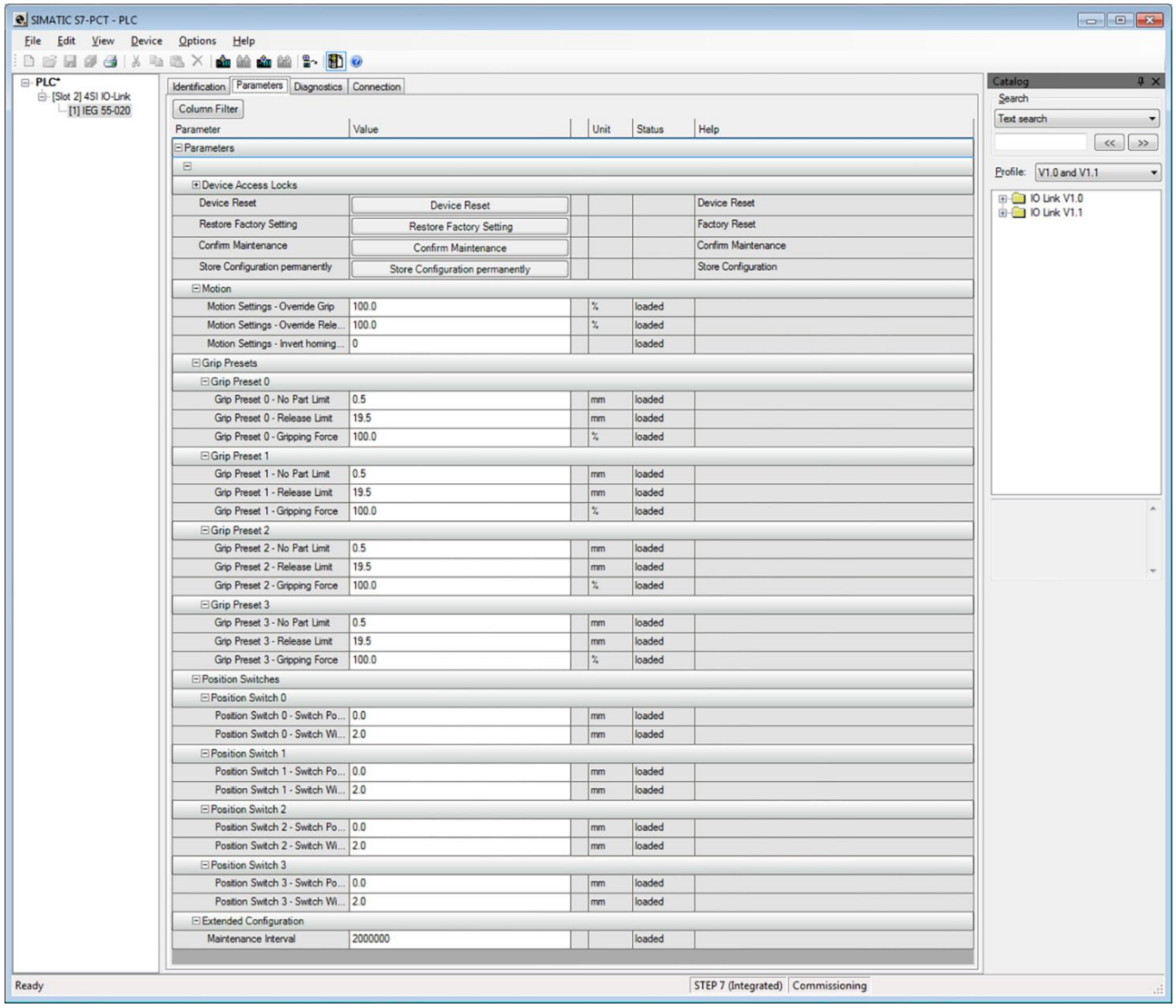


Figure 27: Parameters of the gripping module in S7-PCT

13.5 Diagnostics

The “Diagnosis” tab (Figure 28) shows various diagnosis data as well as the event log memory of the gripping module. This information can be read only. The “Diagnosis” tab provides information on the current state of the gripping module. Logged events can also be displayed.

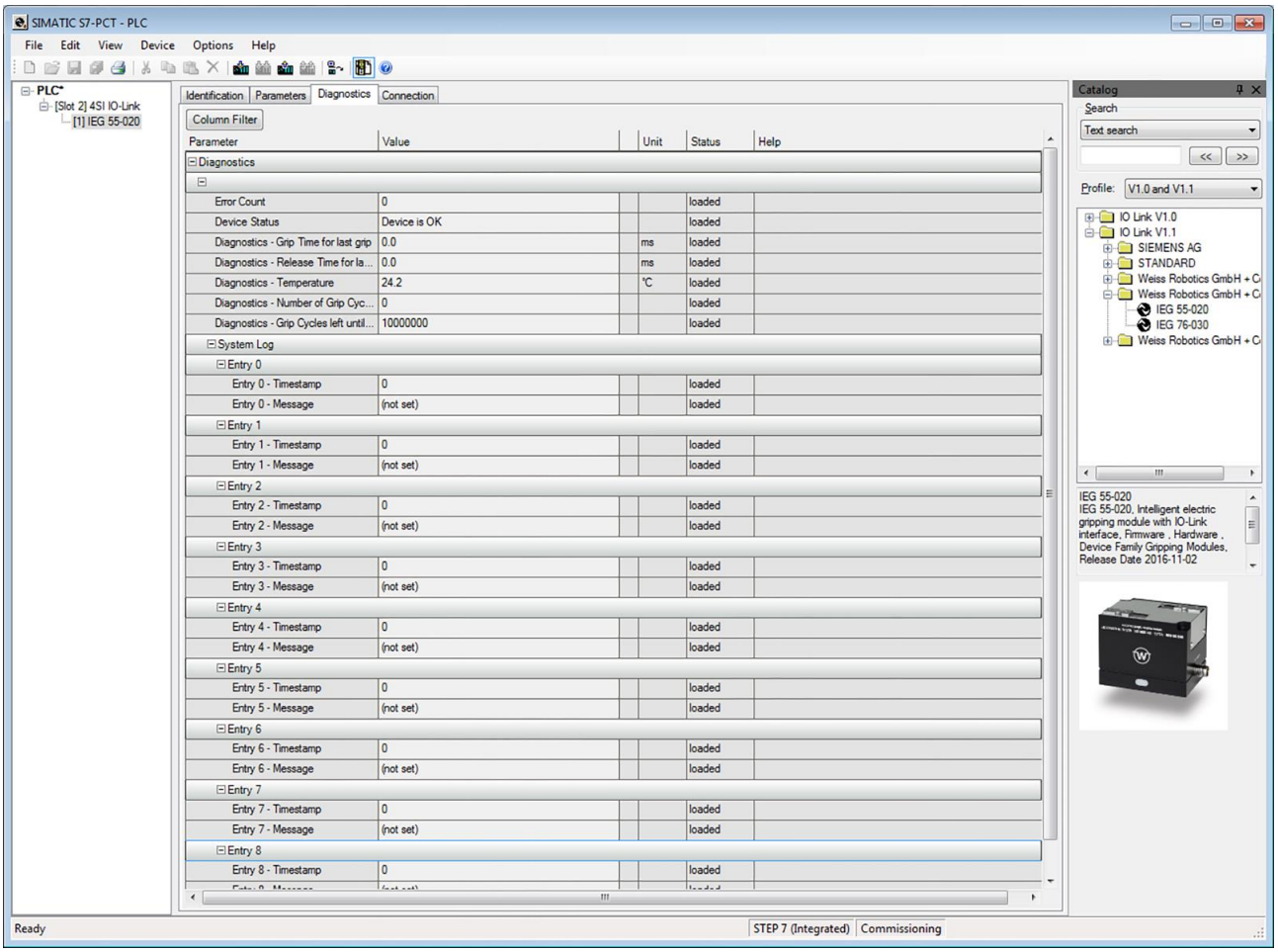


Figure 28: Diagnostics data of the gripping module in S7-PCT

14 EC Declaration of Incorporation

According to EC Machinery Directive 2006/42/EG, appendix 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 designation:	Servo-electrical gripping module
Type:	IEG PLUS
Part numbers	5010016 (IEG PLUS 40-020), 5010017 (IEG PLUS 260-030) 5010023 (IEG PLUS 40-050), 5010024 (IEG PLUS 260-080)

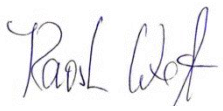
meets the applicable basic requirements of the **Machinery Directive (2006/42/EC)**.
The incomplete machine may not be put into operation until it is confirmed that the machine into which the incomplete machine is to be installed meets the provisions of the Machinery Directive (2006/42/EC).
Applied harmonized standards, especially:

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

The manufacturer agrees to forward the special technical documents for the incomplete machine to state offices on demand. The special technical documents according to Annex VII, Part B, belonging to the incomplete machine have been created.

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

Location, Date/Signature: Ludwigsburg, July 1, 2024



Details of the signatory: Weiss Robotics GmbH & Co. KG

www.weiss-robotics.com