Mounting and Operating Manual

ZPG Series - Smart Pneumatic Gripping Modules

Hardware Version: 1.00

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www.weiss-robotics.com

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 ZPG series and contains important information on assembly, commissioning, maintenance, and service.

1.1 Product Specification

The ZPG gripping modules are part of the Integration Line by Weiss Robotics. The ZPG gripping modules are electro-pneumatic gripping modules that can be controlled via IO-Link. They have an integrated gripping control with a standardized IO-Link interface, integrated valve technology, and integrated position sensors. Figure 1 shows the connectors and components of a ZPG 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.
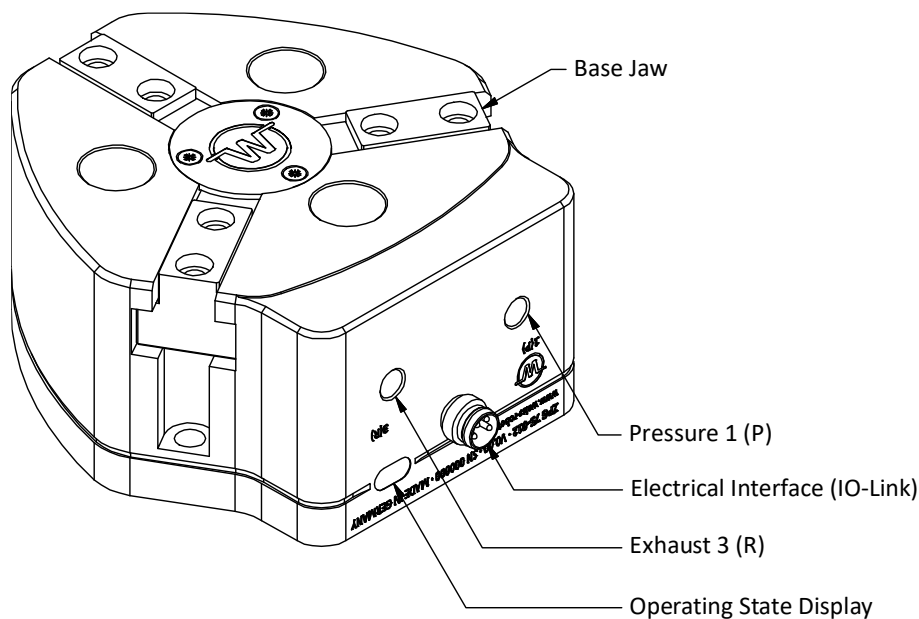
Figure 1: Components and connectors of the gripping module

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/zpg/**:

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

You can find additional information about the warranty in our general terms and conditions, available online at **https://www.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 function 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 to 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 be used only 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. when the gripping module is used as a pressing, cutting, lifting, or punching tool, or when 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 from 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 is state-of-the-art 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, Attachments, or Modifications

Additional bore holes, threads, or attachments not offered by Weiss Robotics as accessories may be mounted only after obtaining the written approval of 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 supply and data lines according to EN 61000-4-4
- HF power input on supply 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 commissioned 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 energy supply is connected.**

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

⚠ **Disconnect the module from the power supply and from the pressurized air supply before performing any maintenance or adjustments at the module.**

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 24 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 25 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 ZPG in the version ordered
- Accessory kit (8 centering sleeves matching the module's diameter)
- Quick guide ZPG series

Module Type	ZPG 75-012
Gripping module	5010013
Accessory kit	5020027
Quick guide	5080006

Table 1: Part numbers 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, the GRIPKIT-PZ1 is available, comprising gripping module, flange adapter, control interface, cables, and mounting material.

☞ **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	ZPG 75-012
Total stroke	mm	12
Nominal gripping force	N	550
Grip rate[1]	Cycles/min	320
Allowable operating pressure	bar	2 … 6
Maximum pressure	bar	7
Operating medium		Pressurized air according to ISO 8573-1:2010 [7:4:4]
Work volume	mm³	8985
Recommended workpiece weight	g	2200
Permitted finger length (L) [2]	mm	80
Permitted mass per finger	g	350
Protection class	IP	54K
Ambient temperature	°C	5 … 50
Air humidity	%	0 … 90 nicht kondensierend
Mechanical repeatability	mm	± 0,01
Resolution of the measuring system	mm	0,1
Working principle of the measuring system		absolut
Weight	g	650
Dimensions (L x B x H)	mm	87 x 82,4 x 42

Table 2: Nominal mechanical data

5.1.1   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

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[1] Gripping cycles per minute when accessed via IO-Link (one cycle consists of completely closing and opening once over the complete stroke); possible delay times due to external process control are excluded.

[2] At nominal force, see measure "L" in Figure 2

found in the nominal mechanical data of the gripping module. When the maximum finger length is exceeded, it is mandatory to reduce the gripping force. Furthermore, the operating life may be reduced.
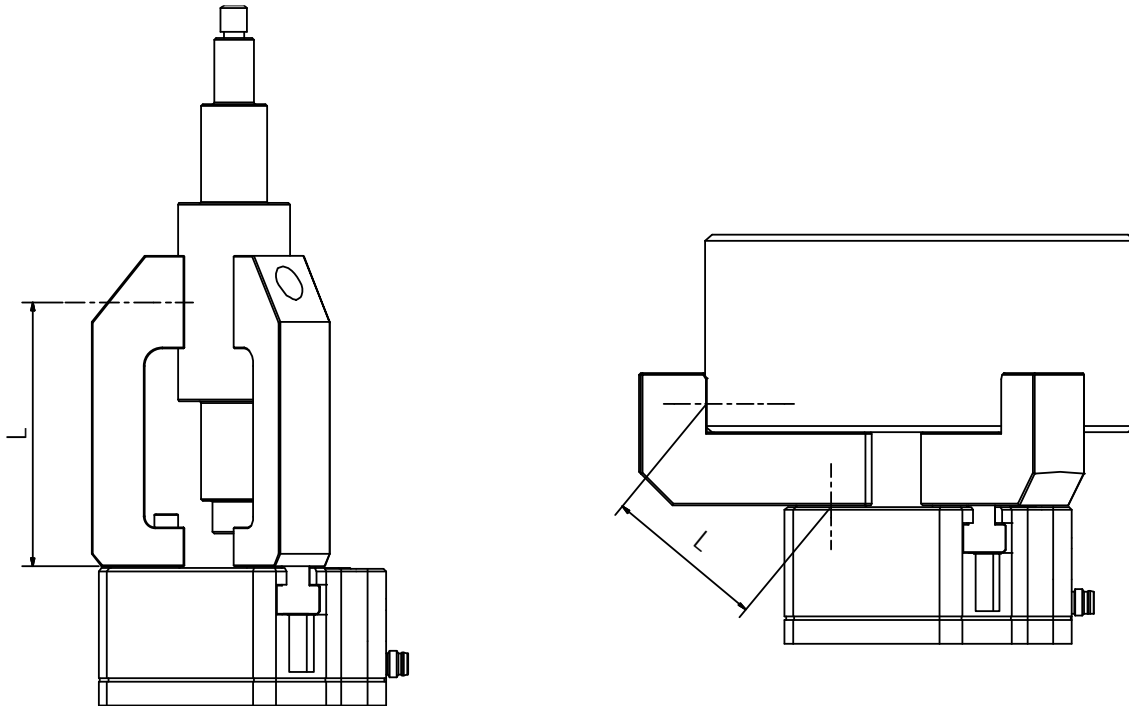
Figure 2: Determination of the finger length "L". Left: straight fingers, right: angled fingers

5.1.2 Gripping Force

The gripping force depends on the finger length. Figure 3 shows this interdependency. The diagram is merely indicative. If in doubt, perform tests.
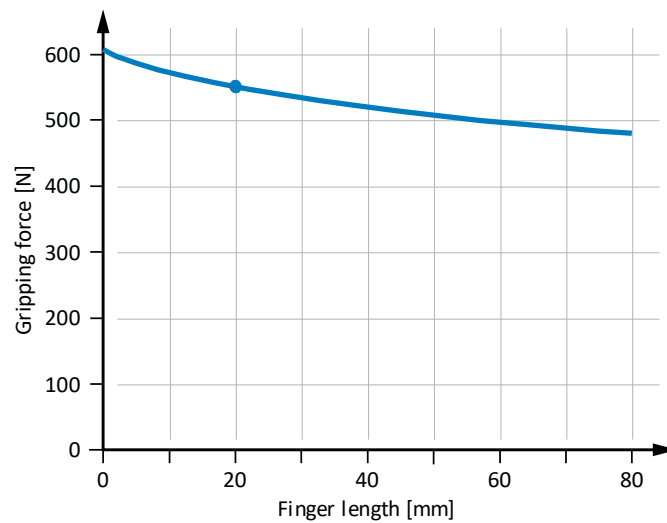
Figure 3: Gripping force diagram with P_{nom} = 6 bar

5.1.3 Cycle Times

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

ℹ️ **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 (firm or elastic), finger weight, gripping height, etc. For an exact assessment of the possible cycle times, tests must be carried out in individual cases.**

5.1.4 Permitted Finger Load

The following table shows the allowable finger loads. The specified forces and moments are static and may work simultaneously and in addition to the gripping force. When the maximum allowable finger length is exceeded, it is imperative to throttle the gripping module so the grip is performed bounce-free. Furthermore, the operating life of the module may be reduced.

Load	Unit	ZPG 75-012
F_Z	N	900
M_X	Nm	35
M_Y	Nm	50
M_Z	Nm	35

Table 3: Allowable finger load
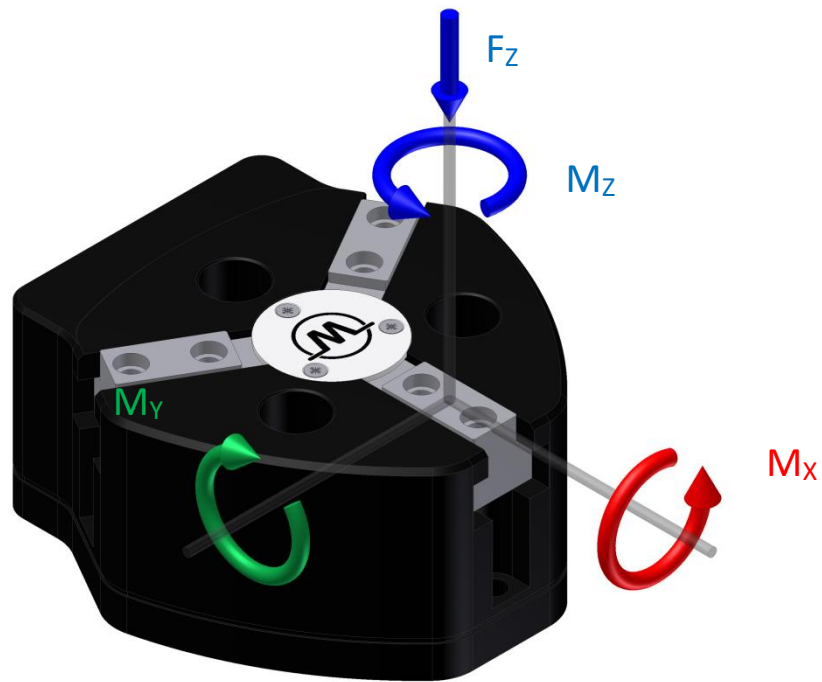
Figure 1: Finger loads

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	ZPG 75-012
Supply voltage (L+) - (L-)	V	18 ... 30
Current drawn	mA	100
C/Q-Pin		
Input voltage range	V	0 ... 30
Threshold "HIGH"	V	13
Threshold "LOW"	V	8
Hysteresis	V	2.2
DQ-Pin		
Output voltage "HIGH" (min)	V	(L+) − 1.5
Output voltage "LOW" (max)	V	(L-) + 1.5
Current carrying capacity (max.)	mA	80

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[3]	ms	280
Max. starting time operational readiness[4]	ms	280

Table 4: 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 **Fehler! Verweisquelle konnte nicht gefunden werden.**).
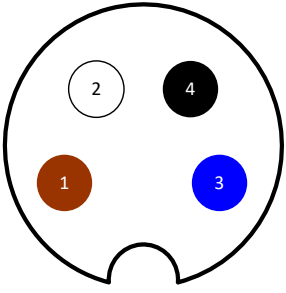
Pin	Wire color	Signal	Function (IO-Link mode)	Function (SIO mode)
1	brown	L+	Power supply +24 V	
2	white	DQ	reserved	Switching output (STATUS)
3	blue	L-	Power supply 0 V	
4	black	C/Q	Communication	Input (GRIPPING)

Figure 4: Pin assignment (view on connector)

According to the operating mode of the gripping module, the two lines DQ and C/Q have different functions. When the gripping module is operated via IO-Link, the C/Q line is used for data communication in both transmission directions (half-duplex). The DQ line is reserved and must not be connected. In the SIO mode (cf. chapter 10), the C/Q line is used as digital input at the gripping module, while the DQ line is used as digital output.

5.3 Name Plate

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

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[3] Time from supply voltage >= 18V until communication readiness via IO-Link

[4] Time from supply voltage >= 18V until operation readiness of the gripping module

Serial Number

Hardware Revision

Module Type

ZPG 75-012 · V1.02 · SN 000001 · MADE IN GERMANY
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IO-Link
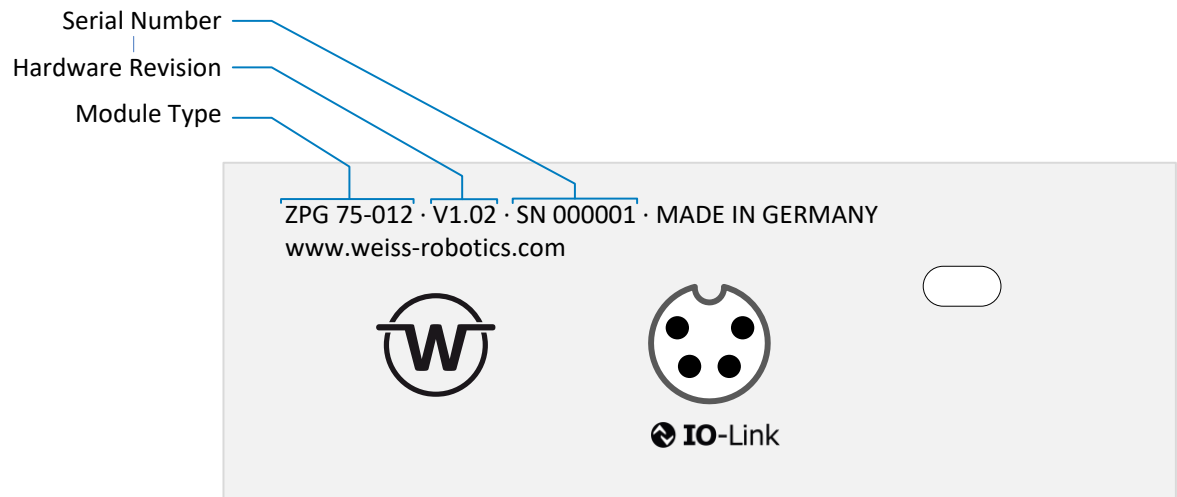
Figure 5: Name plate

6 Installation and Commissioning

⚠️ **Risk of injury due to unexpected movements of the machine. Disconnect the module from the power supply and from the pressurized-air supply during all maintenance work/adjustments and make sure the module is pressure-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 module type. The following maximum torques and minimum screw depths must be observed during assembly:

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

Table 5: Tightening torques for screws (min. strength class 8.8)

The gripping module can be mounted from two sides, see Figure 6. The centering sleeves must be used for mounting. They can be found in the accessory kit of the gripping module.

🛈 **Maximum allowable unevenness of the mounting surface: 0.02 mm**

The recommended screws and centering sleeves are listed in Table 6.

Position	ZPG 075-12
1	Screw ISO 4762 - M4
2	Centering sleeve 6h6 x 5.5 Weiss Robotics part number: 2090046
3	Screw ISO 4762 - M4
4, 7	Screw ISO 4762 - M4

Table 6: Screws and centering sleeves
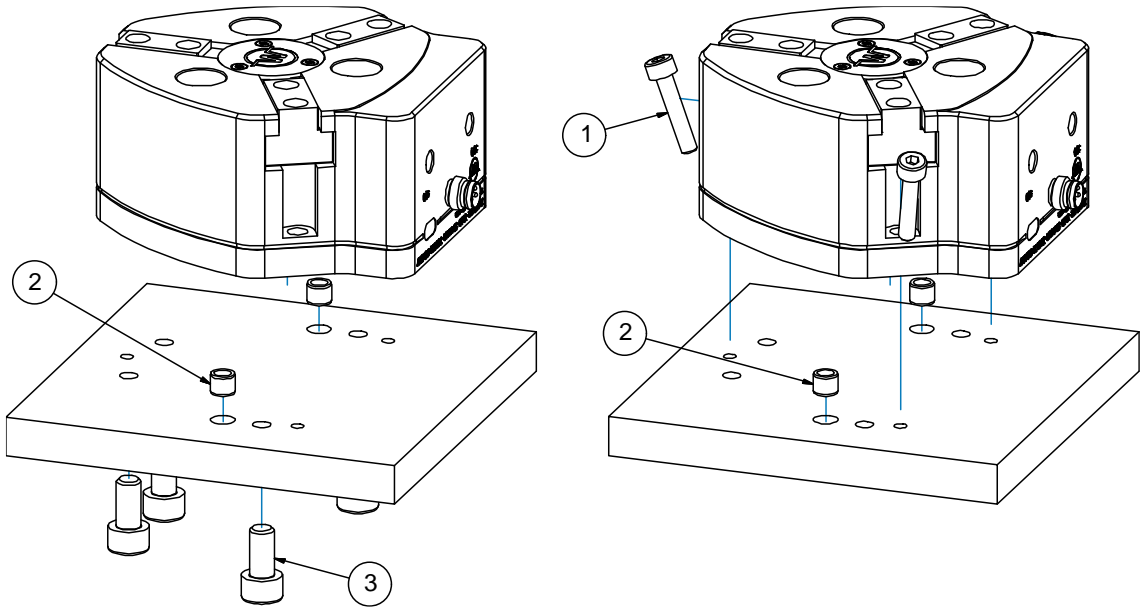
Figure 6: Mounting methods for the gripping module
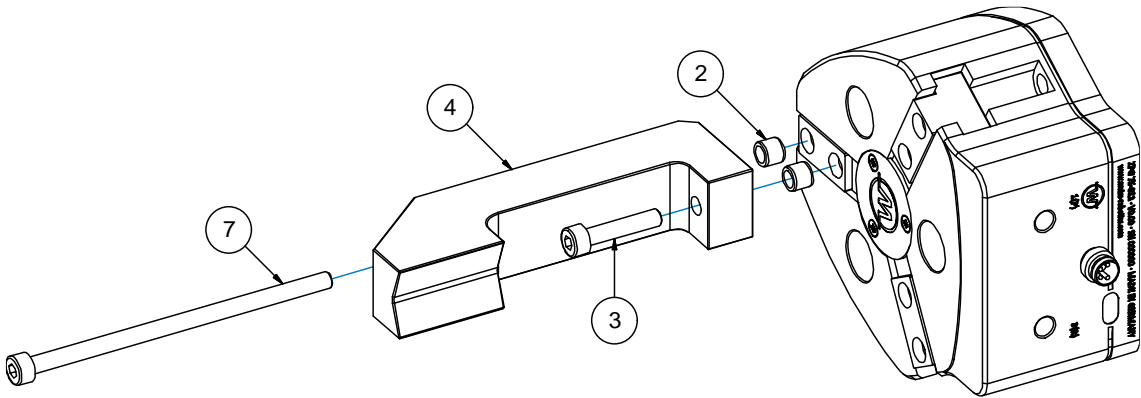
Figure 7: Mounting the fingers

6.2 Connectors

The gripping module has an IO-Link connection for control and one connector each for operating pressure 1 (P) and exhaust air 3 (R). At delivery, the connectors are covered with caps to prevent contamination. The caps must be removed before assembly. Figure 8 shows the electrical and pneumatic contacts of the gripping module. In this picture, a standard field bus coupler is used for the transition between field bus (e.g. Profinet) and IO-Link. If you need assistance in selecting the IO-Link components, please contact our technical support.

It is recommended to use a maintenance unit comprising a 5 µm fine filter and a pressure regulator in the pneumatic path before the gripping module (if necessary, per station/machine) in order to guarantee the recommended pressurized-air class. The depicted throttle is optional and can be used for damping the finger movement. It is required when the fingers move too fast leading to rebound effects during gripping or in the end positions. This especially the case when the fingers are too long or too heavy.
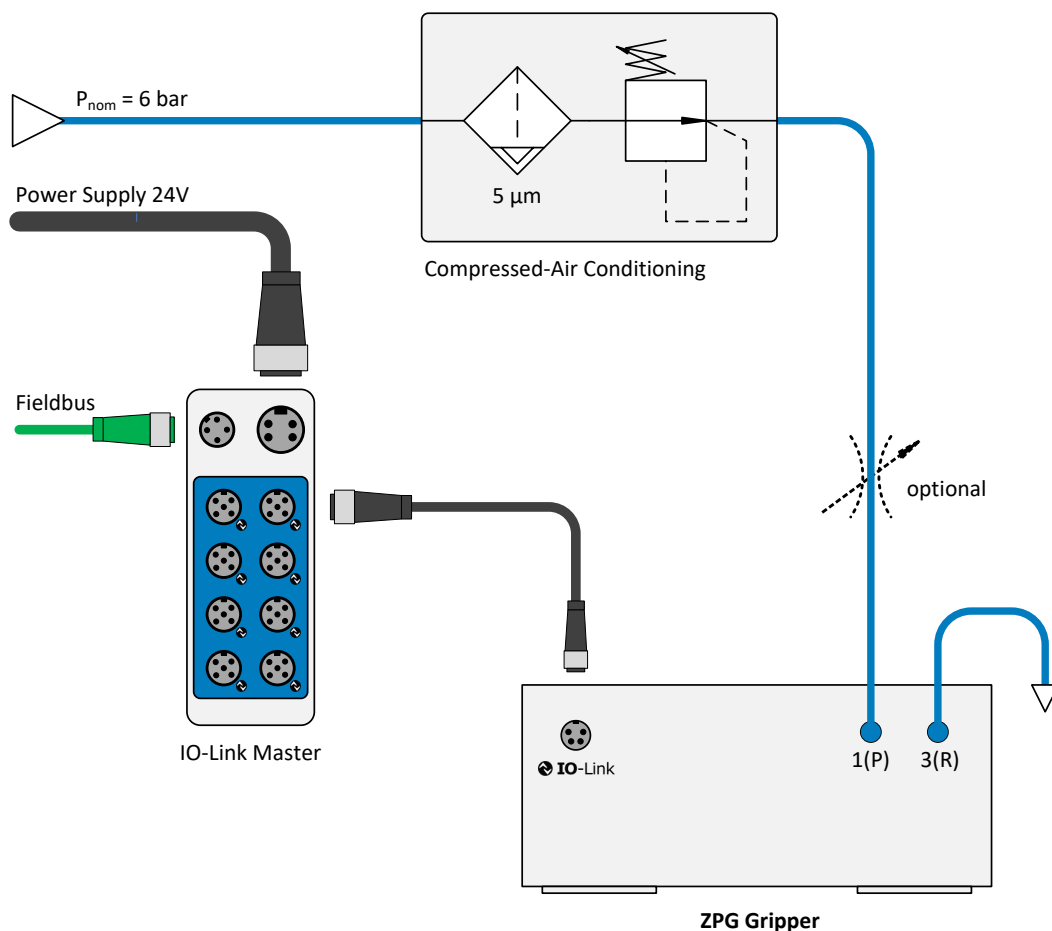
Figure 8: Connecting the gripping module

⚠ **When the allowable mass per finger is exceeded, the gripping module must be throttled.**

⚠ **It is imperative to comply with the requirements for the pressurized-air supply (see chapter 5, "Technical Data"). Particles in the pressurized air may permanently damage the integrated valves.**

7 Functional Principle of the Gripping Module

The gripping modules of the ZPG series are pneumatically powered three-finger centric grippers with integrated valve technology, linear position measurement, and a high-performance gripping control. 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 gripping module.
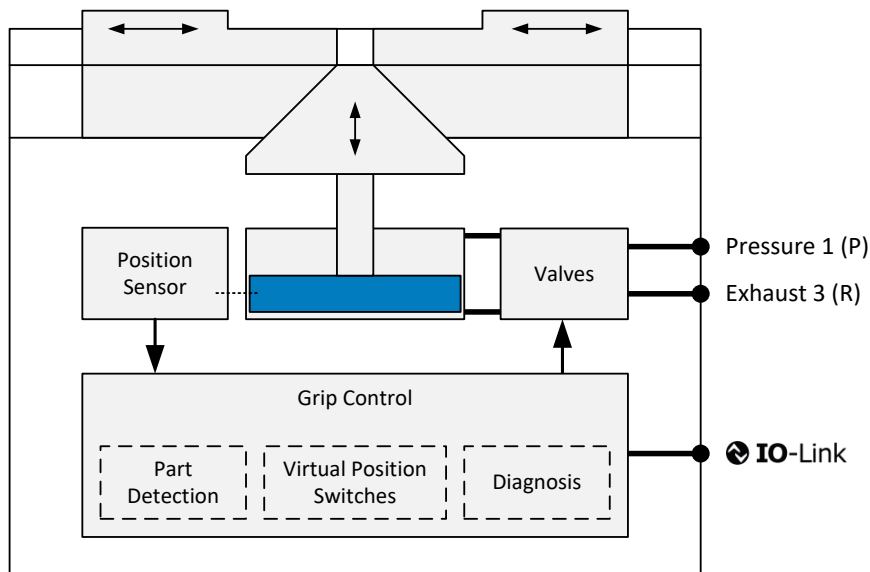

Figure 9: Functional diagram of the ZPG gripping module

The integrated gripping control has a highly optimized gripped-part detection. Up to four different parts can be pre-parameterized via IO-Link and gripped reliably. For each gripped part, a position window is set in which the grip must adjust itself. When the ZPG 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 ZPG monitors all functionally relevant components, such as position sensors and valves, 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 ZPG provides the gripping position and the mean cycle time as parameters - both are important indicators for the process quality during gripping. The ZPG autonomously indicates regular maintenance intervals and lubrication cycles through system events (IO-Link events) so you can better plan maintenance tasks.

The gripping module has a rigid case made of high-strength aluminum. The hardened and precision-ground base jaws are guided in solid T-slot guides.

7.1 Display of the Operating State

The gripping module has a multicolored status display on the side (Figure 10). 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.

Display	Meaning
white	Gripping state IDLE
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 7: 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.

Operating State Display

Figure 10: State display

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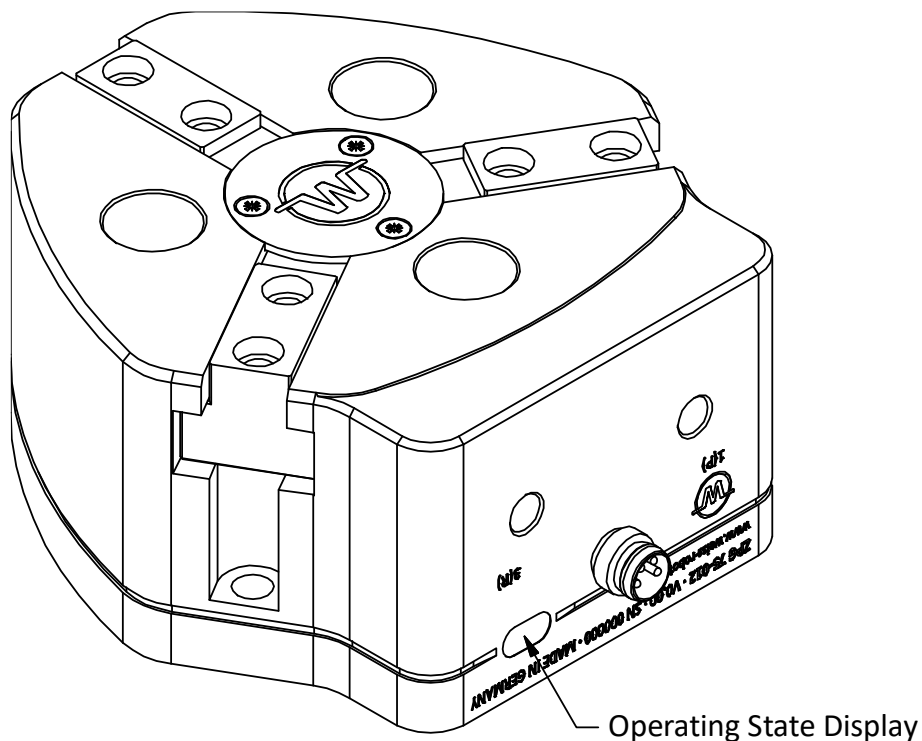
The gripping module has a non-volatile memory in which the following information is stored:

- 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 14).**

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/zpg/** under "Downloads".

8.1 Cyclic Process Data

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

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

Table 8 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						EN	CMD

BYTE 1

7	6	5	4	3	2	1	0
INDEX							

Table 8: Process data word IO-Link master to gripping module

RES – Reserved data bits (bit 15…10)

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.

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 valves of the gripping module are switched to "Venting" 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 9.5 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 9 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	RES			

BYTE 3

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

Table 9: 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.

RES – Reserved data bits (bit 11…8)

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 11.

🛈 **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 55° 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)

When the temperature inside the gripping module exceeds 70° C, this bit is set. 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.

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)

When 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 9.9.**

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 RELEASED Limit and NO PART Limit and do not move any further.

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

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

RELEASED – Part released (bit 1, BooleanT)

When the base jaws of the gripping module reach the parameterized RELEASE Limit, the part is considered released and this bit is set.

IDLE – Gripping module inactive (bit 0, BooleanT)

When 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.**

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 comprise identification, configuration, and diagnosis data, as well as system commands. These data are addressed via index (8 or 16 bit) and subindex (8 bit). 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 parameters 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 10 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, which can be obtained from the IO-Link Community.

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 Oc-tetStringT3	*Detailed device status*

Table 10: 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 13.

8.2.3.1 Grip Parameters

Four grips can be pre-parameterized. The factory settings depend on the module type and are shown in Table 11.

Module Type	NO PART Limit	RELEASE Limit
ZPG 75-012	100 (= 1 mm)	1100 (= 11 mm)

Table 11: 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. 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: Index 0x0060, subindex 0x01

Grip 1: Index 0x0061, subindex 0x01

Grip 2: Index 0x0062, subindex 0x01

Grip 3: Index 0x0063, subindex 0x01

Data Type

IntegerT(16)

Factory Setting

See Table 11.

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. When it is reached, the gripped part is considered released (gripping state RELEASED). The value is indicated in 1/100 mm.

Address

Grip 0: Index 0x0060, subindex 0x02

Grip 1: Index 0x0061, subindex 0x02

Grip 2: Index 0x0062, subindex 0x02

Grip 3: Index 0x0063, subindex 0x02

Data Type

IntegerT(16)

Factory Setting

See Table 11

Example:

A part that has been externally gripped is to be considered released as soon as the base jaws have moved at least 8 mm apart: Set the value 800.

8.2.3.2 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: Index 0x0090, subindex 0x0<t2/>1
Position switch 1: Index 0x0091, subindex 0x01
Position switch 2: Index 0x0092, subindex 0x01
Position switch 3: Index 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: Index 0x0090, subindex 0x02
Position switch 1: Index 0x0091, subindex 0x02
Position switch 2: Index 0x0092, subindex 0x02
Position switch 3: Index 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.

8.2.3.3 Diagnosis 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

Indicates the total count of gripping cycles performed. Since the gripping module only saves the current cycle count remanently after every 1000 cycles, the actual cycle count may differ from the displayed count.

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.

8.2.3.4 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 (max. 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.".

8.2.3.5 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.

Please note that the number of gripping cycles performed by the module is only saved remanently every 1000 cycles. This means that the module might have performed much more gripping cycles when reaching the maintenance interval than indicated by the cycle counter.

Address

Index 0x0140

Data Type

UIntegerT(32)

Factory Setting

10,000,000

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 remanently 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.

Save Configuration Remanently (Code 0xE0).

With this command, you can save the current configuration of the gripping module remanently. In case of power loss, the parameterization is still available.

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

8.3 System Events (IO-Link Events)

Table 12 describes the system events that can be triggered by the gripping module.

☞ **For troubleshooting, see chapter 12.5.**

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 speci-

		fied 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 insufficient operating pressure or a damaged internal valve.
0x4000	Temperature Fault	The temperature inside the gripping module exceeds 70 °C. It is strongly recommended to immediately 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	Valve 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 12: System events (IO-Link events)

9 Controlling the Gripping Module

The gripping module is accessed 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/zpg/

☞ **A configuration example based on SIEMENS TIA Portal can be found in chapter 13.**

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 deactivated, and the cylinder is pressurized. The base jaws move in the direction of choice.

DISABLE

The gripping module is deactivated, and the cylinder is vented. 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.

🛈 **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 cylinder is initially pressureless, and the base jaws are force-free. To move the base jaws, the gripping module must be activated. Once activated, the commands GRIP and RELEASE can be executed.

9.2 Position Sensors

The gripping module has an integrated position measurement system with which the position of the base jaws is detected. The position value corresponds to the spacing of the two base jaws. The inner limit corresponds to the value 0 mm. Figure 11 shows the correlation between the position value and the position of the base jaws using the example of the ZPG 75-012. The current position value is transmitted in the cyclic process data.

❶ **The integrated position sensors are not designed for measurement tasks.**

POS = 0
(Inner Limit)

POS = 1200
(Outer Limit)
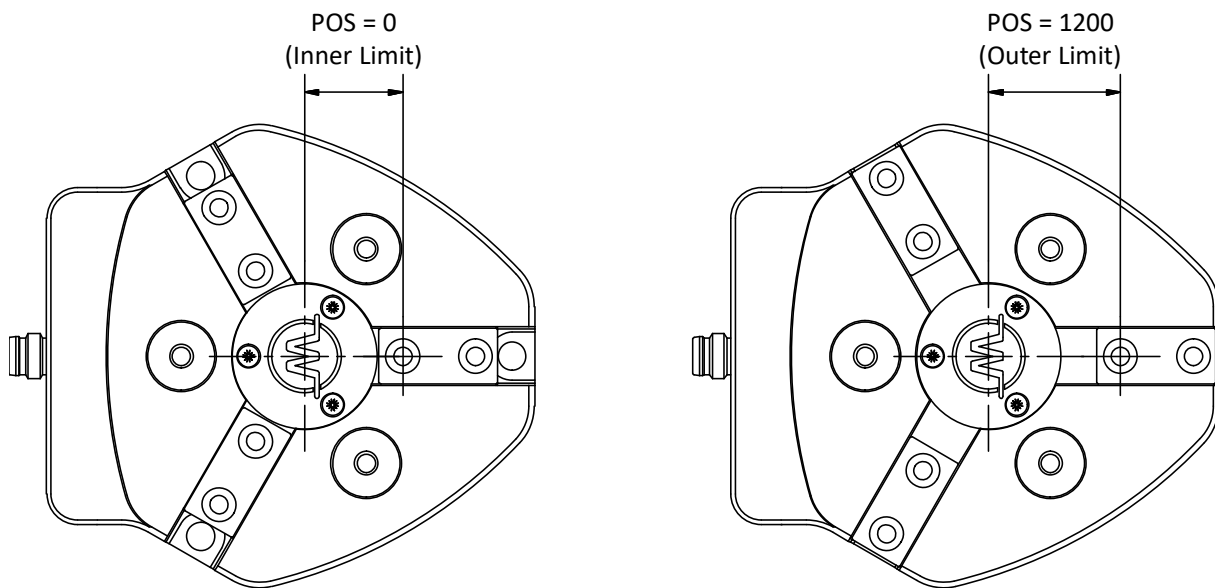
Figure 11: Position value of the ZPG 75-012

9.3 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.

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

9.4 Gripping State

Beside 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 13 lists all possible gripping states.

State	State flag	Description
IDLE	IDLE = 1	**Gripper Is Idle** The gripping module is vented, and the fingers are force-free.
RELEASED	RELEASED = 1	**Part Released** The part has been released, i.e. the parameterized RELEASE Limit has been exceeded.
NO PART	NO PART = 1	**No Part Gripped** No part has been detected during gripping, i.e. the parameterized NO PART Limit has been exceeded.
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 being held; 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 12.5. Additionally, a system event has been triggered, see Table 12.

Table 13: 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 Figure12.

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.
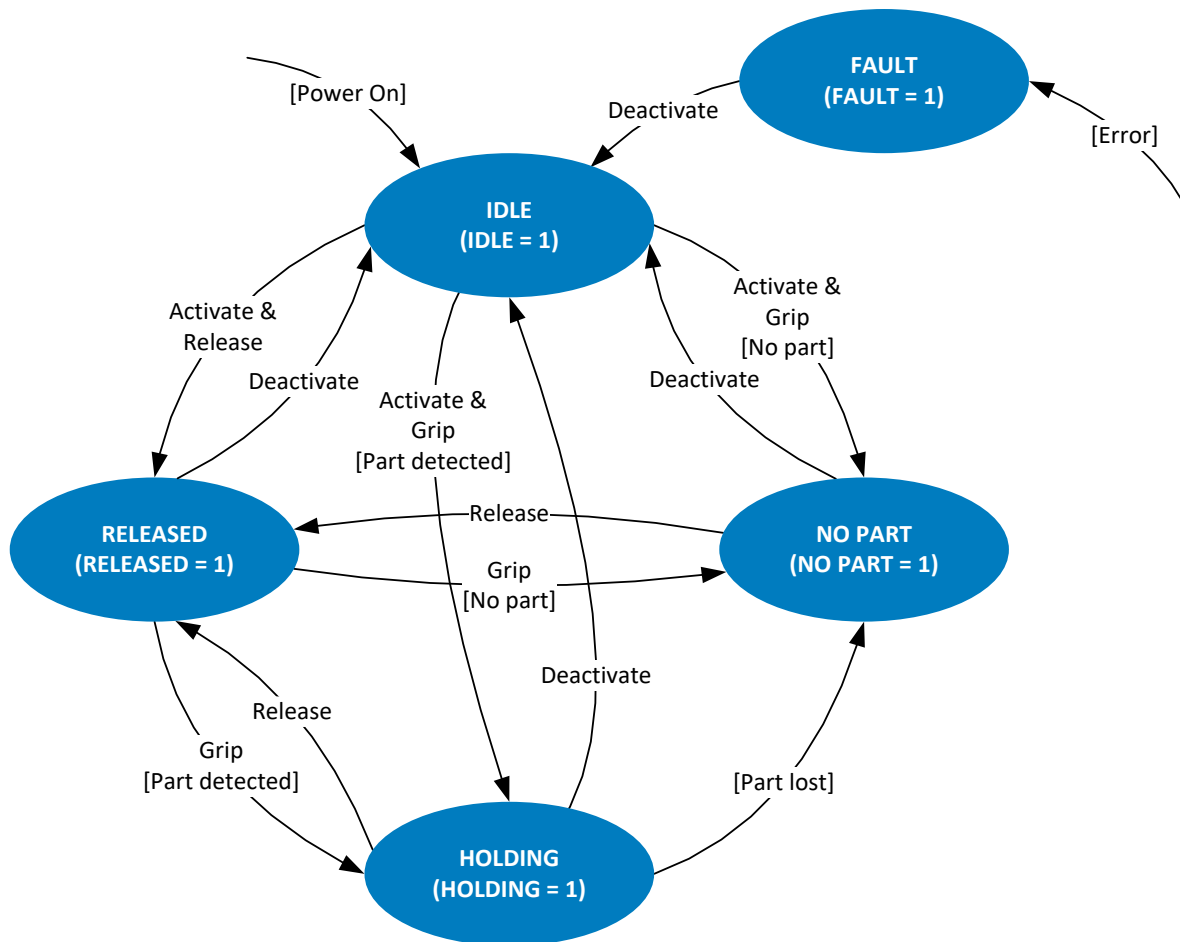
Figure1215: Gripping state

9.5 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 13, for parameterization, a position window must be determined by the RELEASE Limit and the 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. During releasing, the gripping state changes to RELEASED as soon as the RELEASE Limit has been reached. If the RELEASE Limit is not reached, the gripping state changes to FAULT.
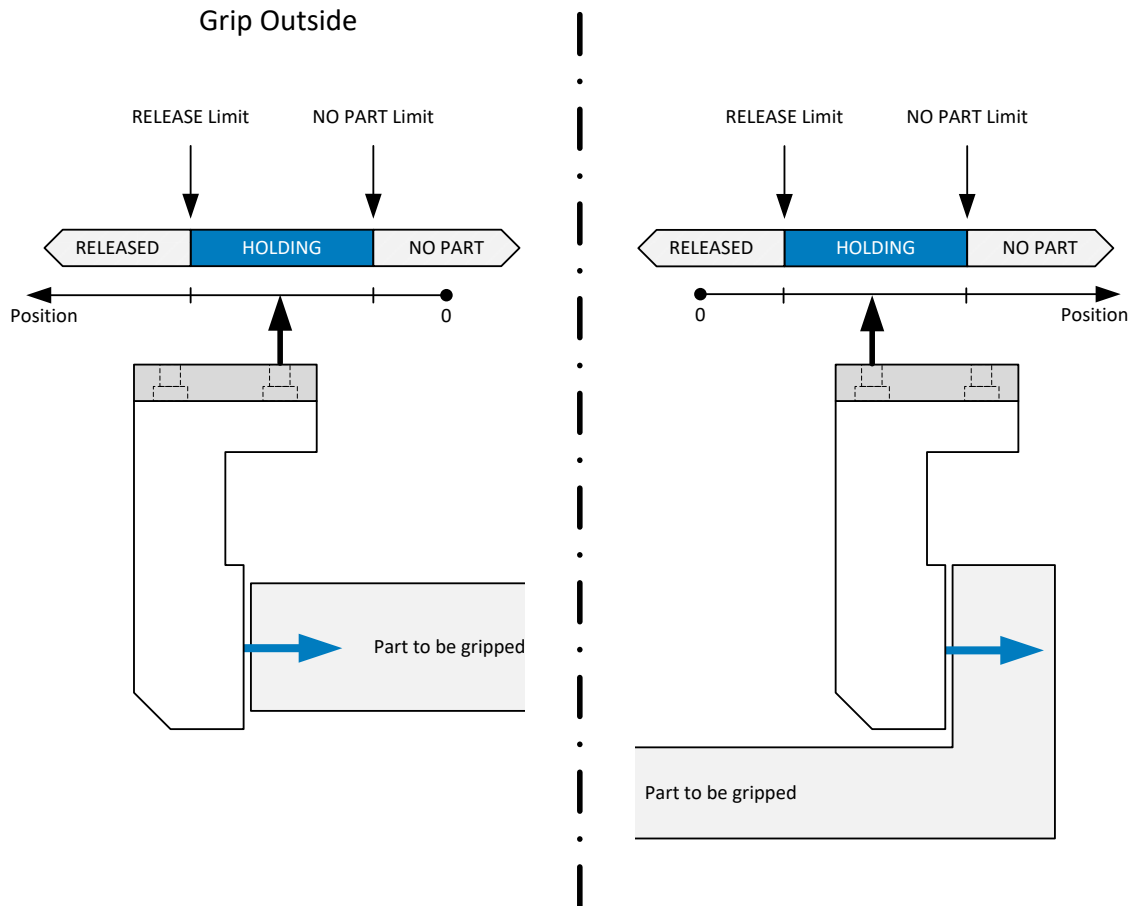
Figure 13: Gripping area and gripping direction

ℹ️ **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 Activating the Gripping Module

After it has been connected to the power supply, the gripping module is in the NOT INITIALIZED state. The fingers are force-free. To activate the gripping module and prepare it for gripping a new part, the control sequence depicted in Figure 14 must be performed.
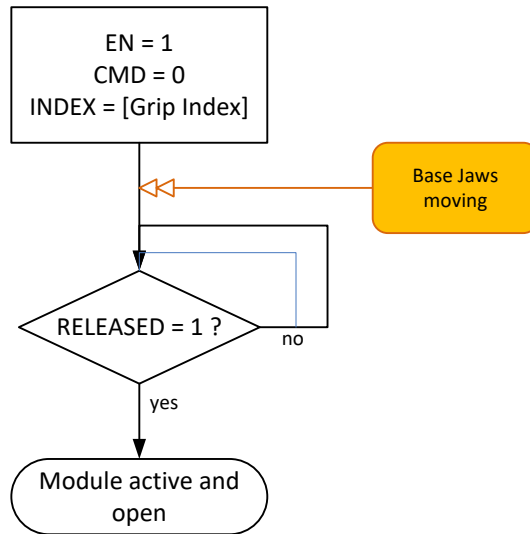
Figure 14: Program sequence activating the gripping module

9.7 Grip Part

The program sequence for gripping a part isFigure 15. The gripping module must be activated before it can perform a grip (see chapter 9.6). The grip is selected via the grip index and initiated by setting the CMD flag. 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 base jaws move beyond the parameterized NO PART Limit, no part has been gripped.

⚠️ **Danger of collision. If the grip has not been parameterized correctly, a part may be held by the gripper although the NO PART state is displayed.**

When an error has occurred during gripping, it must be acknowledged as described in chapter 9.9.
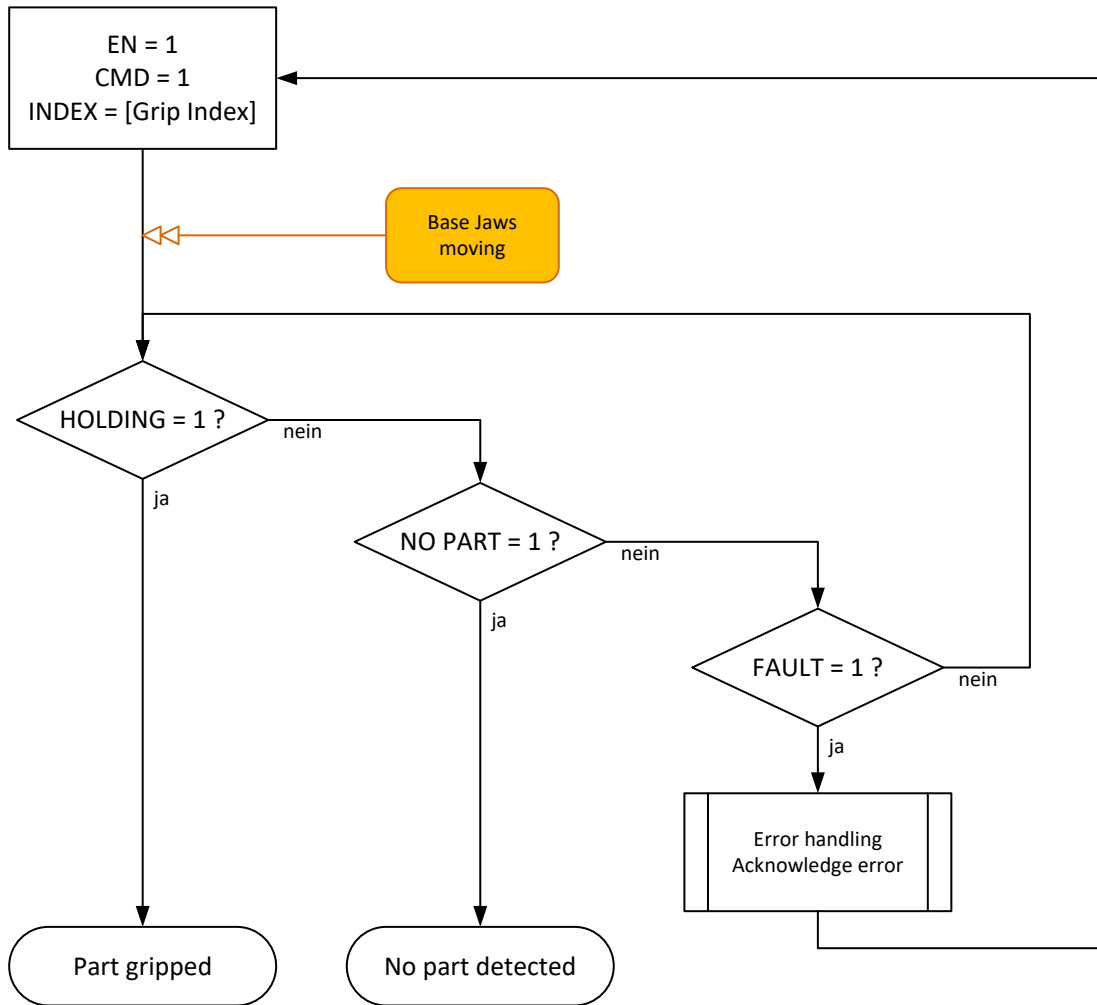
Figure 15: Program sequence gripping

9.8 Release Part

In order to loosen a grip that has been performed before and to release the gripped part, the program sequence depiFigure 16 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 move beyond the RELEASE Limit.
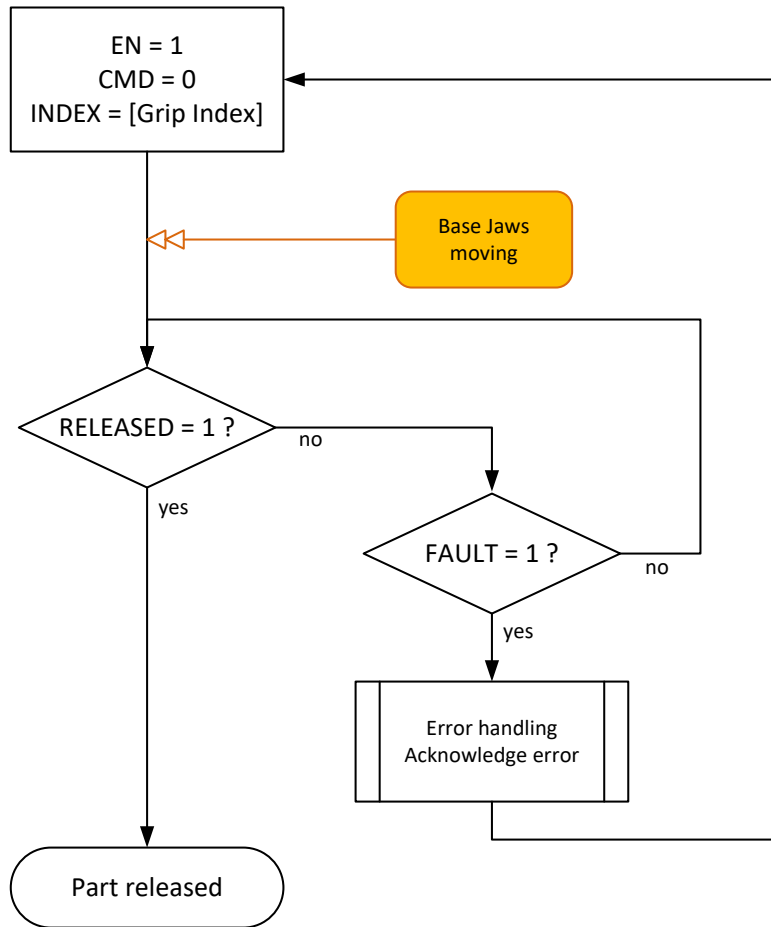
Figure 16: Program sequence release part

9.9 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 12.5. In addition to the FAULT state, a system event that specifies the cause of error is triggered, see Table 12.

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

Figure 17 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.
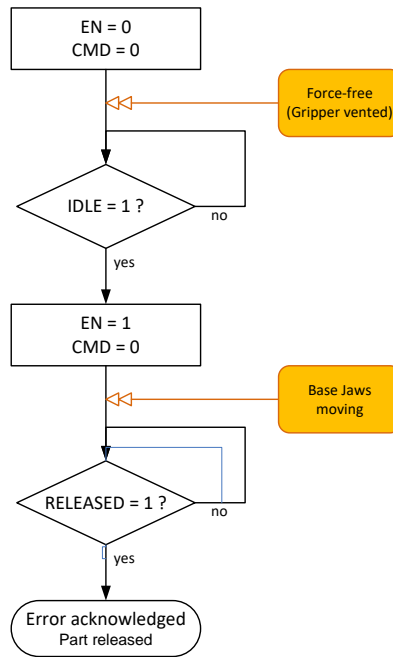
Figure 17: Program sequence acknowledging an error and releasing a part

9.10 Activating and Deactivating the Module (Setup Mode)

Especially while setting up the module, it may be advisable to deactivate the gripping module. The gripping module is vented, and the fingers are 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.

⚠ **Please follow the safety instructions when you work directly at the gripping module.**
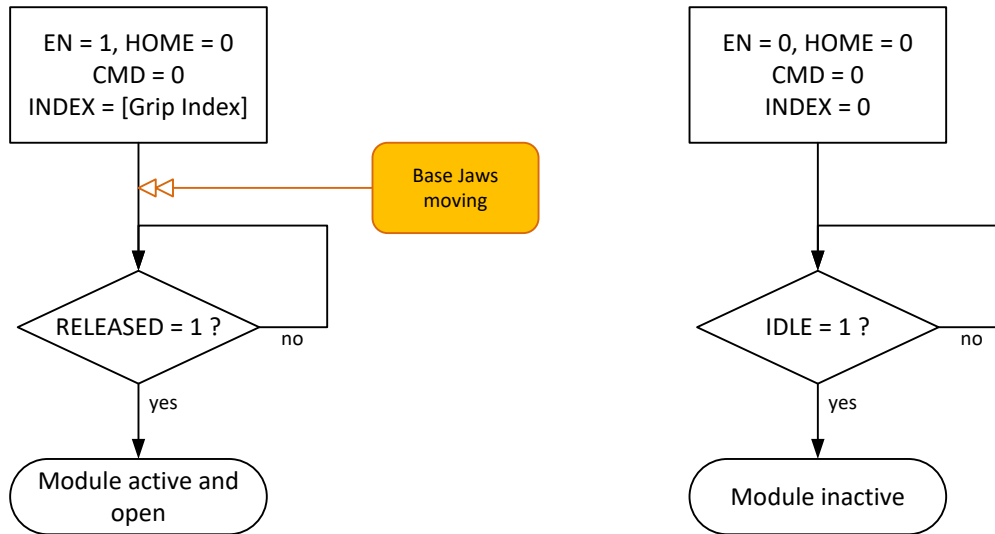
Figure 18: Program sequence activating (left) and deactivating (right) gripping module

9.11 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 RELEASE Limit and the NO PART Limit so a secure grip detection is possible.

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

9.11.1 Application Example External Gripping

Figure 19 shows an example of external gripping with the ZPG 75-012 gripping module. A shaft is to be gripped at its perimeter. The shaft has a nominal diameter in the gripping area of 31.5 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 6 mm (half the total stroke). To ensure the reliability of the gripping process, a position tolerance of ± 2 mm is set.

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):	400	(= 4.00 mm)
RELEASE Limit (index 0x60, subindex 0x02):	800	(= 8.00 mm)

ⓘ 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.
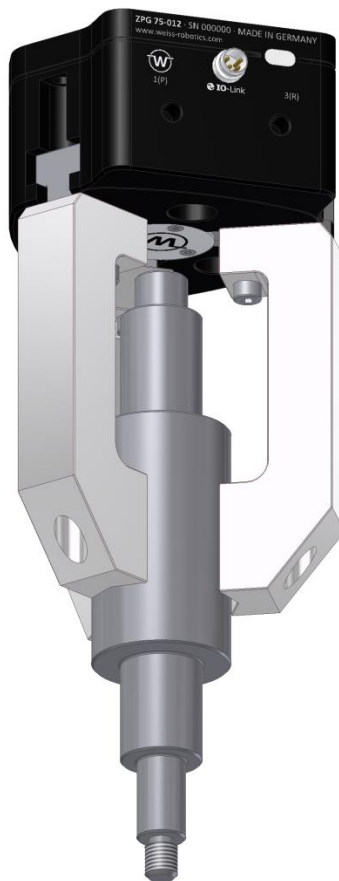
Figure 19: Gripping example external gripping

The gripping process is performed via the program sequences in Figure 15 (grip part) and Figure 16 (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.

9.11.2 Application Example Internal Gripping

In a mounting process, a plain bearing bush is to be picked up and inserted with an ZPG 75-012. Since the bush is to be inserted into a bore hole, it must be gripped from the inside. The gripping application is depictedFigure 20. The fixing at the motion axes and possible compensatory elements are not depicted here. The bush with its inner diameter of 20 mm is gripped and aligned with the help of three hardened pins Figure 20, right view).
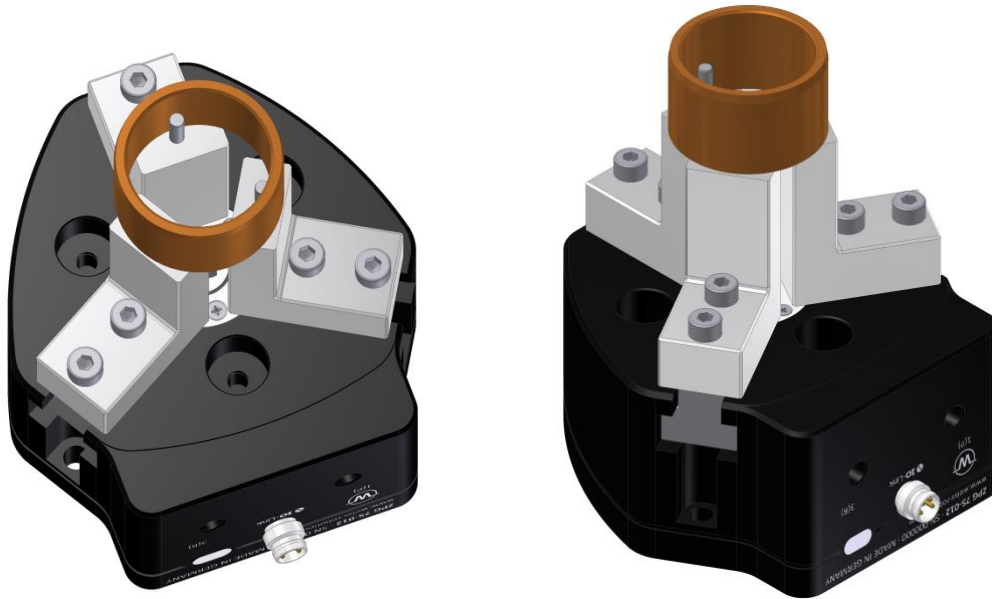
Figure 20: Application example internal gripping

The gripping fingers are designed in such a way that the part is held at a jaw position of 6 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.

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):	750	(= 7.50 mm)
RELEASE Limit (index 0x61, subindex 0x02):	450	(= 4.50 mm)

🛈 **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.**

To grip the part, the control system performs the program sequence depicted in Figure 15. 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 16. Since GRIP 1 has been parameter-

ized 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.

9.12 Function Block for Siemens TIA Portal

For TIA portal, there is a function block available at **https://www.weiss-robotics.com/zpg/** under "Downloads". The documentation of the function block can be found in the downloaded file.

10 Operation in SIO mode (Digital I/O)

As an alternative to being operated via IO-Link, the gripping module can also be operated via classic digital I/O (SIO mode). In this case, there is no data transmission, and the scope of functions of the gripping module is reduced accordingly.

The SIO mode is automatically activated upon startup and is available permanently until communication via IO-Link has been established. It is not necessary to switch manually between the modes. However, as soon as the gripping module detects a connection via IO-Link (i.e. data are correctly received from a connected IO-Link master), the SIO mode is deactivated, and the gripping module can be controlled via IO-Link only. Only after restarting (gripping module powerless or warm start via IO-Link system command) is the SIO mode available again.

🛈 **Mixed operation of SIO mode and IO-Link is not possible.**

10.1 Wiring and Line Seizure in SIO Mode

The electrical interface of the gripping module is described in chapter 5.2.1. In the SIO mode, the C/Q line of the gripping module is used as a digital input that receives a 24 V control signal from the controlling PLC or robot. For the LOW state, the C/Q pin must be connected with L-; for the HIGH state, it must be connected with L+. Common PLCs are either P-sinking output or M-sourcing output, i.e. in switched state, they only put out 0 V (M-sourcing) or 24 V (P-sinking) at their outputs. In unswitched state, the output is not connected. In this case, as depicted in Figure 21 and Figure 22, a resistor is put between the C/Q pin and the supply voltage so the switching state can be identified correctly.

The gripping module itself puts out a 24 V control signal to the superordinate control system via the DQ line. It is MP-sinking and sourcing output. The LOW state corresponds to an output of 0 V; the HIGH state corresponds to an output of 24 V.
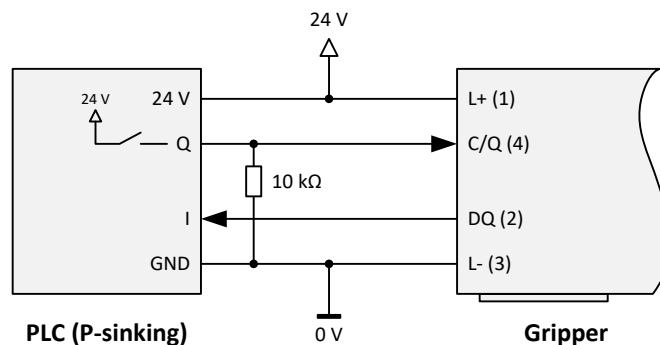
Figure 21: Connection to P-sinking PLC in SIO mode
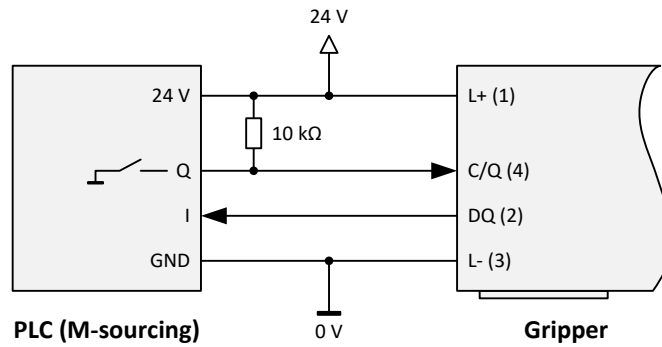
Figure 22: Connection to M-sourcing PLC in SIO mode

10.2 Control in SIO Mode

Signal Input (C/Q)

Only the two functions GRIP and RELEASE are available. the direction of movement depends on the configuration of grip 0. By default, RELEASE corresponds to an outward finger movement. You can find the factory settings in chapter 8.2.3.

☞ **Other configurations are available on demand.**

The gripping commands are transmitted via the signal input (C/Q) of the gripping module. When the superordinate control switches the line to logical HIGH (C/Q = 24 V), a part is gripped. When the superordinate control switches the line to logical LOW (C/Q = 0 V), the part is released. The gripping module has a signal filter to suppress interference pulses. The respective signal level must therefore be applied unchanged for at least 10 ms to be adopted.

🛈 **If the PLC has no push-pull output, a suitable resistor must be added, see chapter** Fehler! Verweisquelle konnte nicht gefunden werden.**.**

Signal Output (DQ)

The gripping state is transmitted to the controlling PLC or robot via the signal output (DQ) of the gripping module. For this, the RELEASE Limit and the NO PART Limit of the gripping module that are configured in grip 0 (cf. chapter 9.5) are relevant. If the base jaws of the gripping module are blocked within the specified borders (gripping state HOLDING), the gripping module puts out logical HIGH (high level, +24 V) In all other cases, logical LOW (low level, 0 V) is put out.

🛈 **The NO PART Limit and the RELEASE Limit can be freely parameterized with the device configurator DC-IOLINK, which is available separately.**

11 Maintenance and Cleaning

Clean the gripping module in regular intervals with a dry cloth to remove all dirt and possible splinters. They typically build up at the guides of the base jaws or at the edges of the casing.

Maintenance interval: every 10 million cycles

Scope of maintenance: Cleaning external parts and relubricating the sliding guides.

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.)

⚠️ **It is not recommended to remove the piston since the position sensors could be misaligned.**

11.1 Relubrication

For relubrication of the sliding guides, open the plate on top of the gripper (**Fehler! Verweisquelle konnte nicht gefunden werden.**) and fill in an adequate supply of lubricant with a syringe. Then have the gripping module run in and remove excess lubricant with a cloth.

🛈 **Please use microGLEIT GP360 lubricant exclusively.**
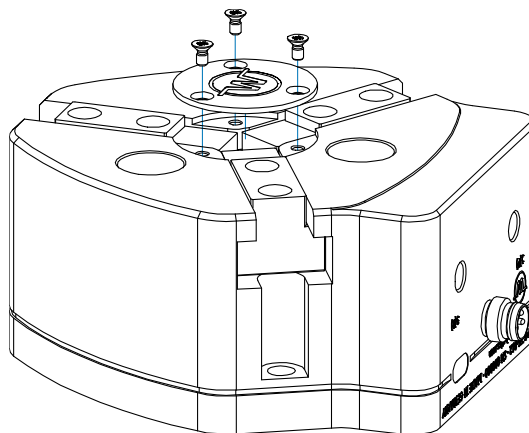
Figure 2: Removing the plate for relubrication

11.2 Needs-based Maintenance

When 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 8.2.3.3).

11.3 Resetting the Maintenance Interval Count

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

12 Troubleshooting

12.1 The Base Jaws Do Not Move

Possible Cause	Remedy
Base jaws jammed in the casing, e.g. mounting surface not sufficiently uneven	• Check the evenness of the mounting surface. • Loosen the mounting screws of the gripping module and actuate the module again.
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.
Insufficient operating voltage/operating pressure	• Check the power supply and pressurized-air 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 the 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 12.5. • Restart the gripping module. If the error occurs again, send the gripping module to Weiss Robotics with a repair order.
Valves defective	• Check the pressurized-air quality. • Send the gripping module to Weiss Robotics with a repair order.

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

Possible Cause	Remedy
Power supply or pressurized-air supply interrupted	• Check the power supply and pressurized-air 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 12.5.
Inadequate lubrication	• Check lubrication. If necessary, deactivate the gripping module and check the mobility by moving the fingers manually.
Uneven mounting surface	• Check the evenness of the mounting surface.

12.3 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.

12.4 Gripping Force Is Getting Lower or Movement Is Getting Slower

Possible Cause	Remedy
Loss of pressurized air	• Check the operating pressure. • Check for leakage.
Pressure below the minimum	• Increase operating pressure.
End of service life of the gripping module reached	• Replace the gripping module.
Inadequate lubrication	• Perform maintenance interval.
Exhaust air cannot escape	• Check the exhaust muffler and, if necessary, the exhaust duct.

12.5 The Gripping Module Reports an Error

The state display's light is permanently red or flashes red. The gripping module has triggered Table 12).

Error code of the gripping module	Remedy
Motion error	It is triggered when the base jaws do not move despite a motion command due to insufficient operating pressure or a damaged internal valve. • Check the operating pressure. • Check for leakage. • Check the exhaust muffler and, if necessary, the exhaust duct.
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 operating conditions. • Reduce external heat input (lightweight robots tend to get hot at the flange). • 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 con-

	tact 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	Valve 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.**

13 APPENDIX A - Device-specific Process Parameters

Table 14 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
0x0060	Grip 0	Read/write	1	IntegerT(16)	*NO PART Limit in 1/100 mm*	See Table 11
			2	IntegerT(16)	*RELEASE Limit in 1/100 mm*	
0x0061	Grip 1	Read/write	1	IntegerT(16)	*NO PART Limit in 1/100 mm*	
			2	IntegerT(16)	*RELEASE Limit in 1/100 mm*	
0x0062	Grip 2	Read/write	1	IntegerT(16)	*NO PART Limit in 1/100 mm*	
			2	IntegerT(16)	*RELEASE Limit in 1/100 mm*	
0x0063	Grip 3	Read/write	1	IntegerT(16)	*NO PART Limit in 1/100 mm*	
			2	IntegerT(16)	*RELEASE Limit in 1/100 mm*	
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
0x0091	Virtual position switch 1	Read/write	1	IntegerT(16)	*Switch position in 1/100 mm*	0
			2	UIntegerT(16)	*Switching width in 1/100 mm*	200
0x0092	Virtual position switch 2	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
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*	-

Index	Function	Access	Subindex	Data Type	Description	Factory Setting
			3	IntegerT(16)	*Current module temperature in 1/10 °C*	-
			4	UIntegerT(32)	*Gripping cycle count*	-
			5	IntegerT(32)	*Cycles Remaining until Next Maintenance*	-
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)"
…						
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)"
0x0140	Maintnance Interval	Read/write	-	UIntegerT(32)	*Number of gripping cycles after which maintenance is signaled*	10,000,000

Table 14: Device-specific process parameters

14 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 S7-PCT 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.

14.1 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.**

14.2 Configuration of the IO-Link Master

You can start the S7-PCT port configurator by right-clicking on the 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.
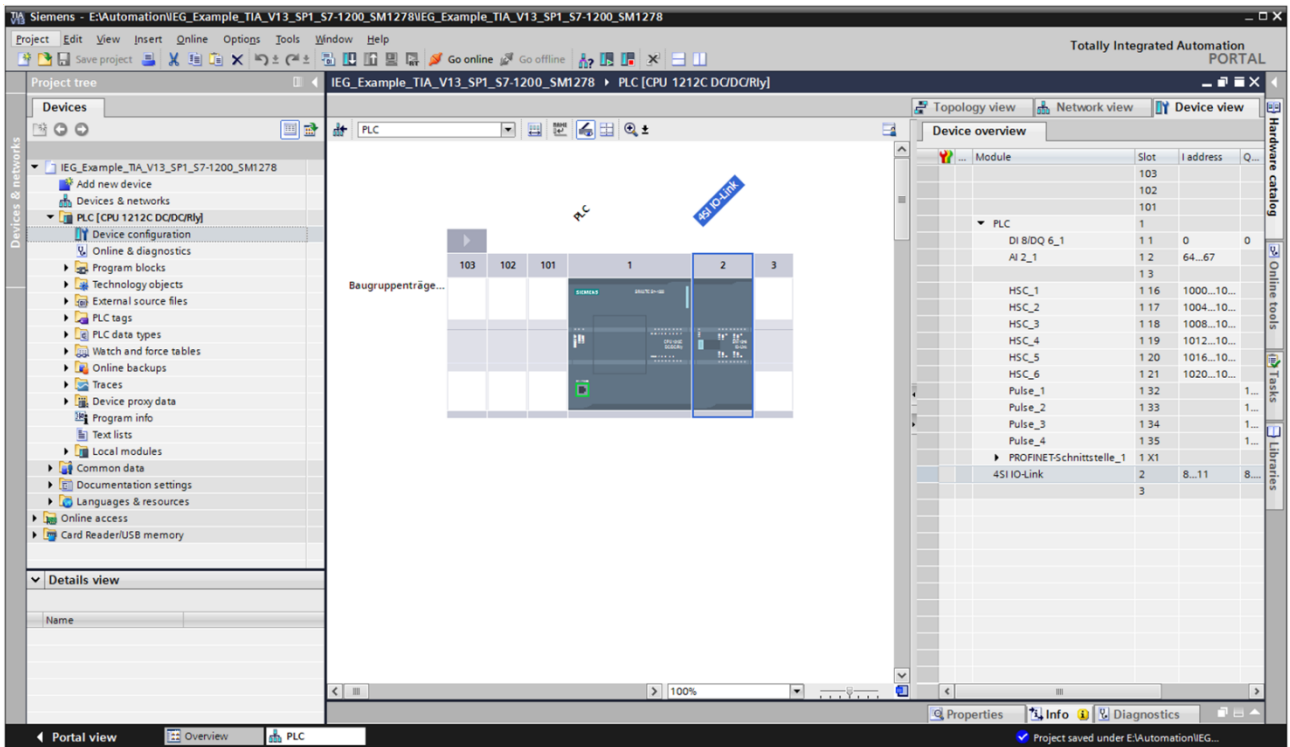
Figure 23: Configuration of the IO-Link master
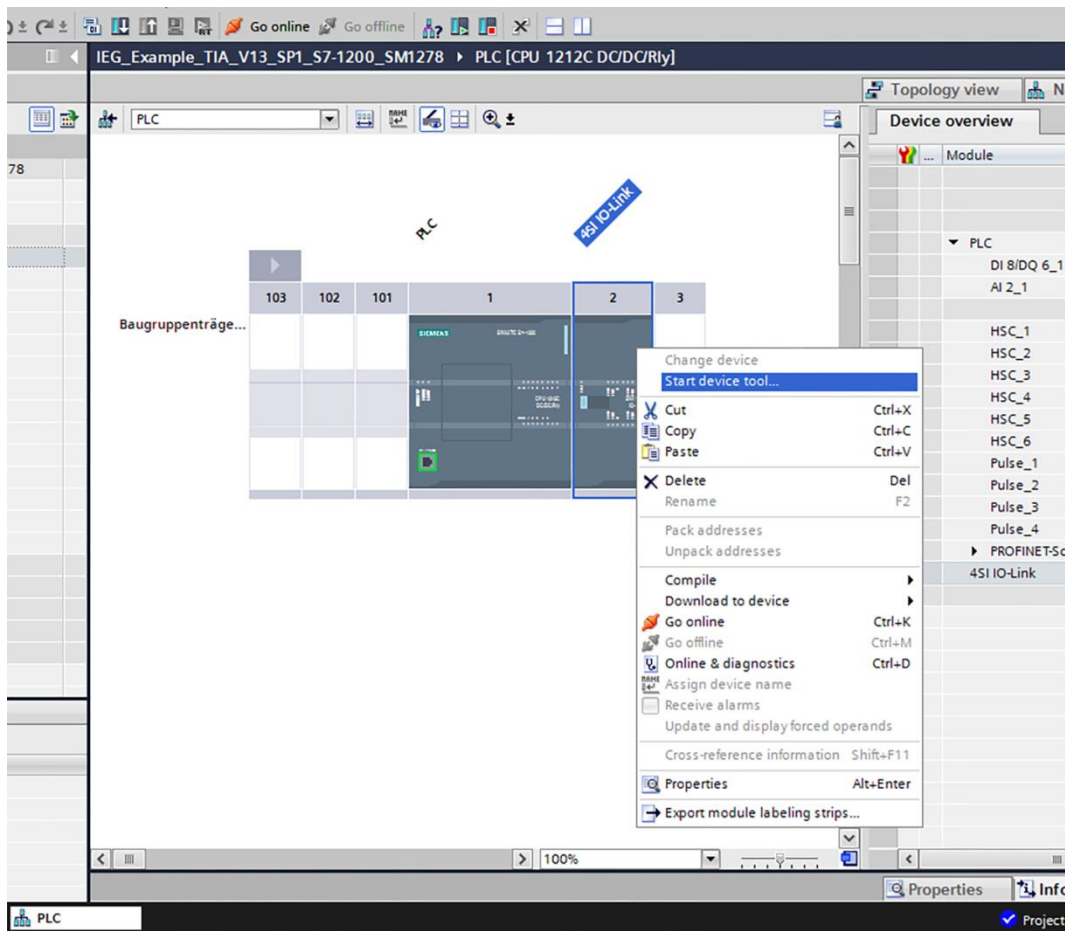
Figure 24: Starting the S7-PCT port configurator (device tool)
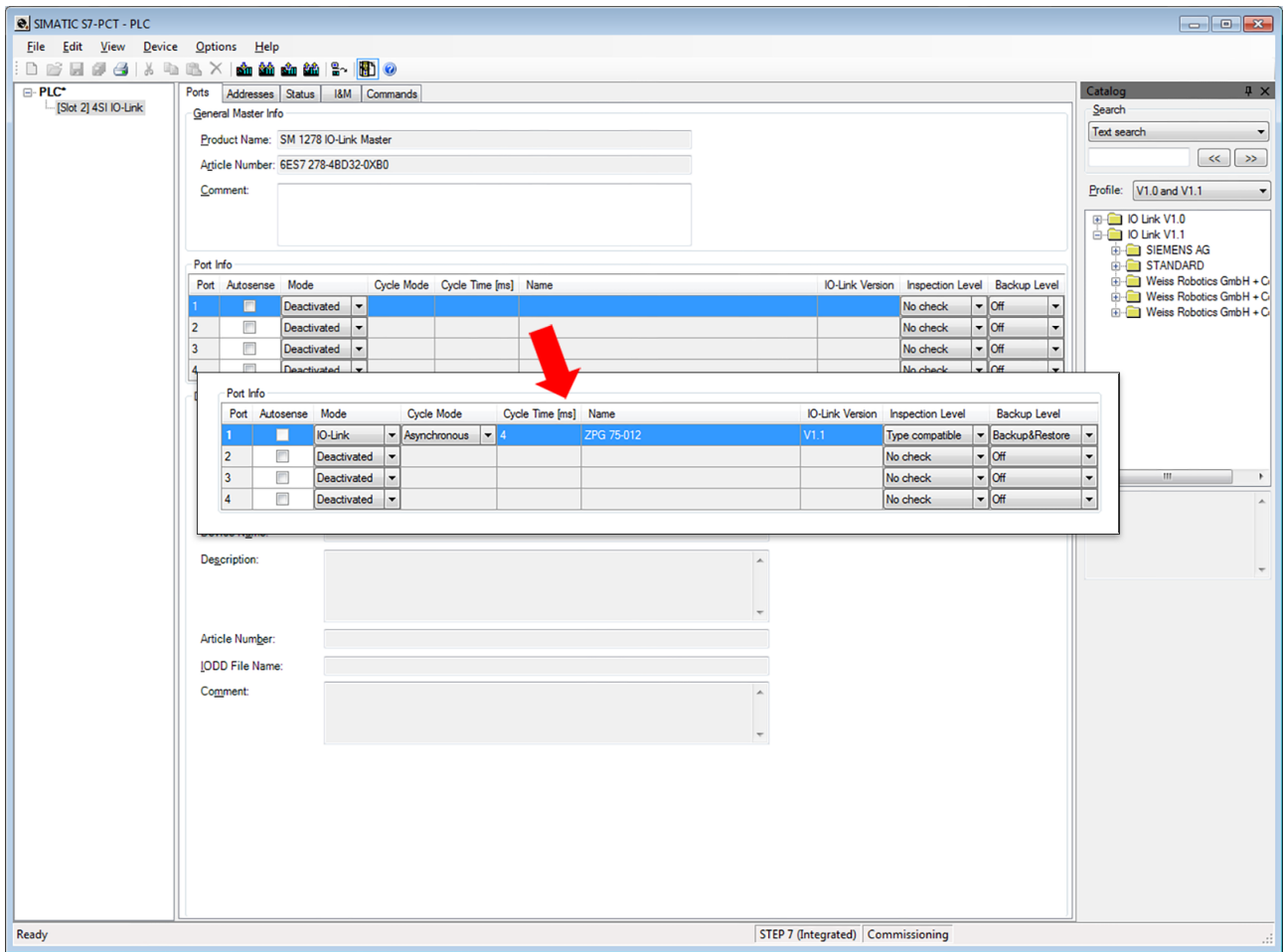
Figure 25: Configuration of the IO-Link port

14.3 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", "Parameters", and "Diagnostics" 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

14.4 Parameterization of the Gripping Module

The "Parameters" 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 per-formed or remanently storing the configuration data in the gripping module.

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

14.5 Diagnosis

The "Diagnostics" 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 "Diagnostics" tab provides information on the current state of the gripping module. Logged events can also be displayed.

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

15 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:	Electro-pneumatic gripping module
Type:	ZPG 75-012
Part numbers	5010013

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, 2016
Details of the signatory:	Weiss Robotics GmbH & Co. KG

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