

# **Commissioning instructions, Firmware 6.1.2**

## **EGP40-IL-GKS with IO-Link interface**

### **Electric miniature parallel gripper**

Translation of original commissioning  
instructions

**Hand in hand for tomorrow**

## Imprint

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**Please read the operating manual in full and keep it close to the product.**

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# 1 General

## 1.1 About this document

This manual describes the commissioning as well as the operating and parameterization options for an electric gripper EGP40-IL-GKS with IO-Link (IL) interface:

### Validity

This version of the manual describes the functions of firmware versions that have the main version number 6.1.2.

The firmware version can be read out. Information on the corresponding parameter can be found in section ► 4.2 [ 63].

### Conventions

The following conventions apply to this guide:

- The gripper is hereinafter referred to as the "module".
- Actions initiated by the user that the module is to perform are hereafter referred to as a "control commands".
- Identification of parameters: <parameter>
- Identification of events: WARNING
- Page number in references: [ ► 4]

**NOTE:** The illustrations in this manual are intended to provide a basic understanding and may deviate from the actual version.

### Abbreviations

The following abbreviations are used:

- GPE: Gripping force and position maintenance

### Applicable documents

- General terms of business \*
- Assembly and Operating Manual of the module \*

The documents labeled with an asterisk (\*) can be downloaded from [schunk.com/downloads](https://schunk.com/downloads).

## 1.2 Definitions

### 1.2.1 Minimum and maximum position

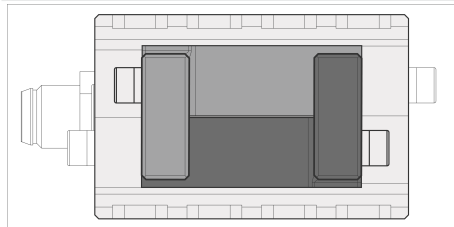
The parameters <min\_pos> and <max\_pos> define the position limits within which movements are permitted.

The value of the parameter <min\_pos> corresponds to the *smallest* position value that can be approached.

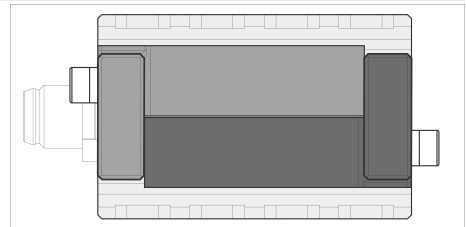
The value of the parameter <max\_pos> corresponds to the *largest* position value that can be approached.

In the delivery state, the position values of the parameters <min\_pos> and <max\_pos> correspond to the positions of the base jaws shown below.

**Minimum position**



**Maximum position**

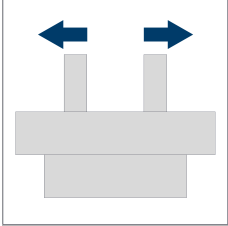
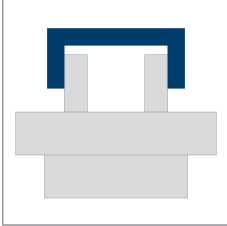
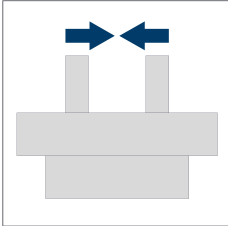
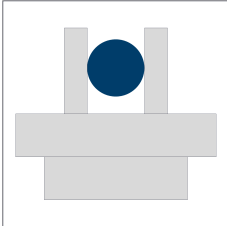


In the delivery state, this position corresponds to the **zero point** of the module.

---

## 1.2.2 Directions of movement and gripping

Directions of movement and gripping are shown below.

| Directions of movement                                                                                                                                                                                      | Directions of gripping                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>outward</b><br>The movement from the minimum to the maximum position value corresponds to the <i>outward</i> movement.  | <b>I.D. gripping</b><br>By moving outward, a workpiece can be gripped from the <i>inside</i> , hence the name <i>I.D. gripping</i> .    |
| <b>inward</b><br>The movement from the maximum to the minimum position value corresponds to the <i>inward</i> movement.  | <b>O.D. gripping</b><br>By moving inward, a workpiece can be gripped from the <i>outside</i> , hence the name <i>O.D. gripping</i> .  |

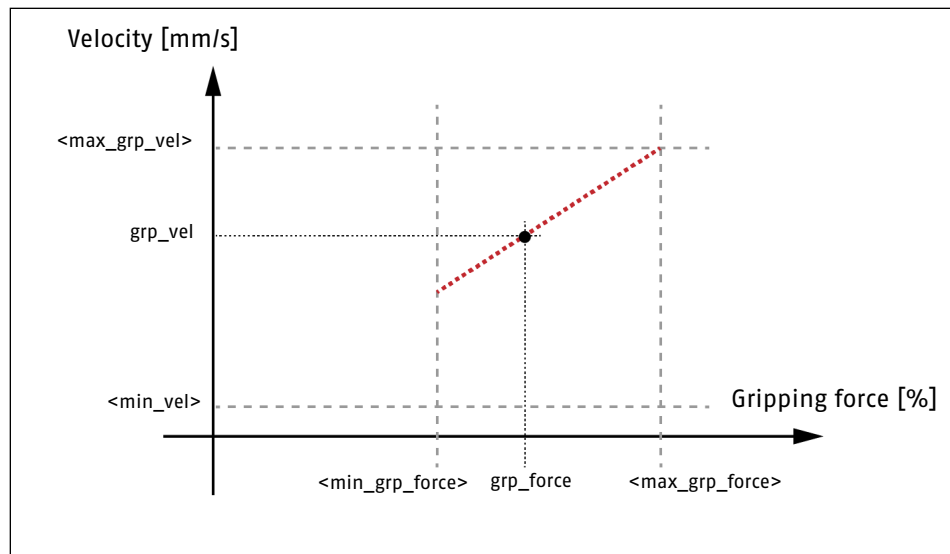
### 1.2.3 Gripping modes

The module provides different gripping modes for gripping workpieces:

- BasicGrip
- SoftGrip

#### BasicGrip

BasicGrip is the default gripping mode for the module. The module calculates the gripping velocity with which the workpiece is gripped, depending on the gripping force transferred. This reduces the force pulse generated when gripping the workpiece.



*Gripping velocity as a function of gripping force*

#### Calculation of the gripping velocity in BasicGrip mode

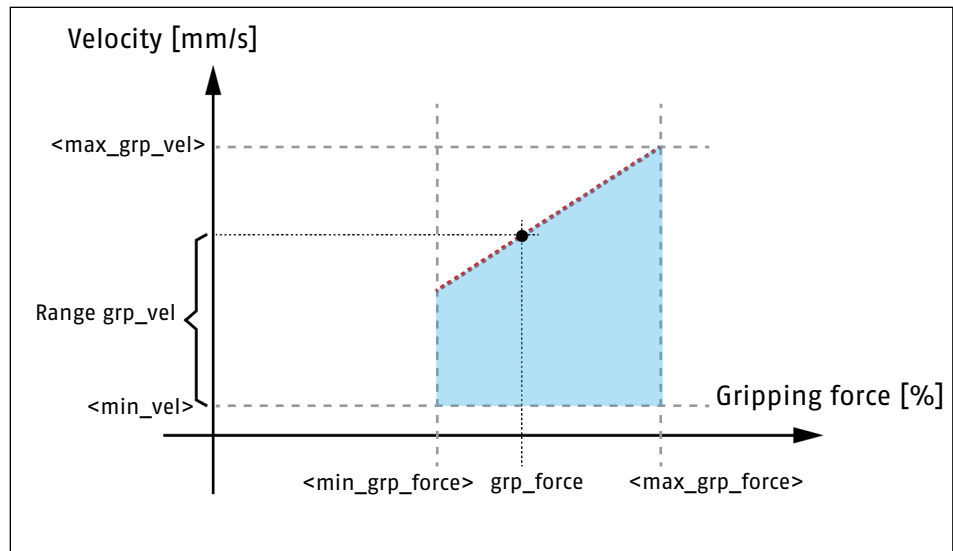
Gripping velocity = gripping force [%] \* <max\_grp\_vel> [mm/s]

#### SoftGrip

The SoftGrip mode can be used to gently grip delicate, fragile or fracture-sensitive workpieces, e.g. electronics, glass, ceramics.

To influence the force pulse at SoftGrip, a gripping velocity value must be transferred. This gripping velocity value must be between the minimum gripping velocity <min\_vel> and the calculated gripping velocity used in BasicGrip with the same gripping force.

The following graphic shows the range of valid velocity values for the SoftGrip mode.



*Gripping velocity as a function of gripping force*

### Example: Determining speed limits for SoftGrip

- Application:
  - A fragile workpiece is to be gripped with 75% gripping force.
- Example of parameterization:
  - $\text{min\_vel} = 5 \text{ mm/s}$
  - $\text{max\_grp\_vel} = 20 \text{ mm/s}$
- Limit determination:
  - Minimum possible gripping velocity is equal to the parameter value  $\text{<min\_vel>}$ , ► 4.2 [□ 57]
    - $\rightarrow \text{min\_vel} = \mathbf{5 \text{ mm/s}}$
  - Maximum possible gripping velocity is equal to gripping force [%] multiplied by the parameter value  $\text{<max\_grp\_vel>}$ , ► 4.2 [□ 58]
    - $\rightarrow 75\% * 20 \text{ mm/s} = \mathbf{15 \text{ mm/s}}$

#### 1.2.4 Gripping force and position maintenance (GPE)

Workpieces and positions are held by the module's drive control as standard. This module has gripping force and position maintenance (GPE). When sending control commands, you can specify whether workpieces and positions are to be held by the drive control *or* by the GPE.

Selecting the type of workpieces and positions to be held is done via the control bit "Activate grip force and position maintenance", ► 7.2 [📄 93].

#### 1.2.5 Zero point

The zero point of the module corresponds to a position of the gripper fingers at which the position value 0 mm is output. The zero point can be individually adapted to the conditions within an application, ► 3.4.2 [📄 45].

## 2 Communication

### 2.1 Data exchange

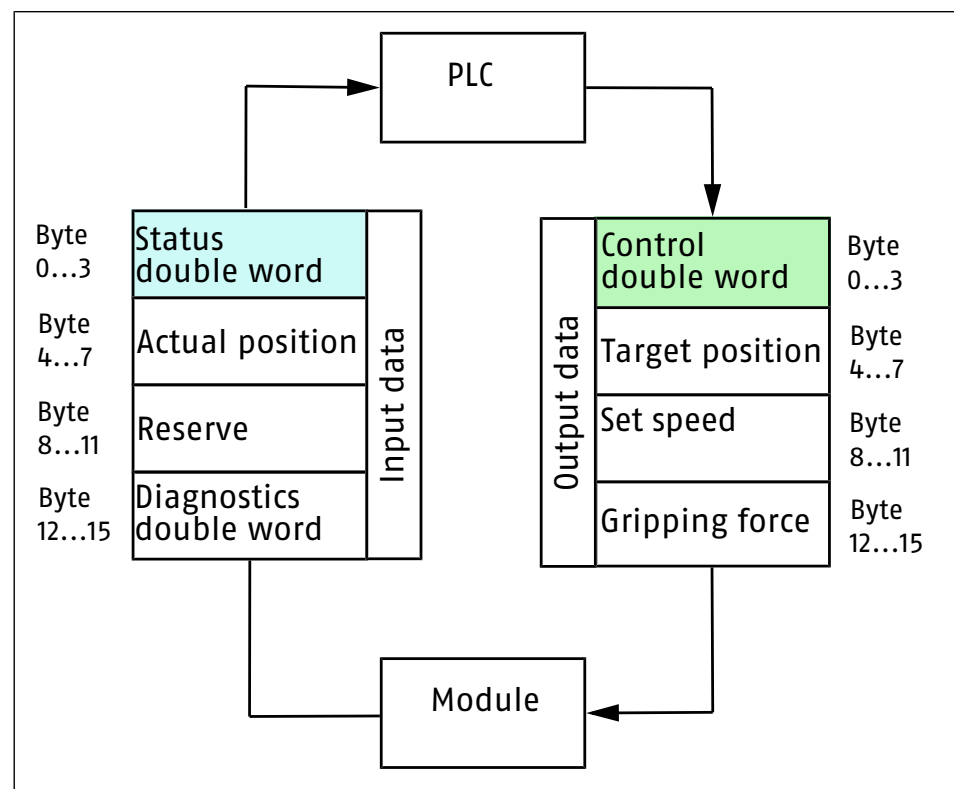
Integrated IO-Link interfaces can be used to exchange data cyclically and acyclically between the module and the controller.

#### NOTE

If communication between the module and the controller is interrupted, e.g. by a cable break or by changing the controller to the "Stop" status, the module performs a quick stop. The diagnostic event ERR\_COMM\_LOST is also reported back.

#### 2.1.1 Cyclical data exchange

For cyclical data exchange, a fixed data frame for input and output data is defined. The data frame is based on the use of double word data and is set to a data length of four double words.



*Cyclical data exchange*

For further information on data transmission and interpretation, see the following sections.

2.1.1.1 Cyclical output data

The cyclical output data is transmitted from the PLC to the module, thereby sending control commands to the module. For practical application examples, see chapter ▶ 7.1 [ 81].

Execution of the control commands

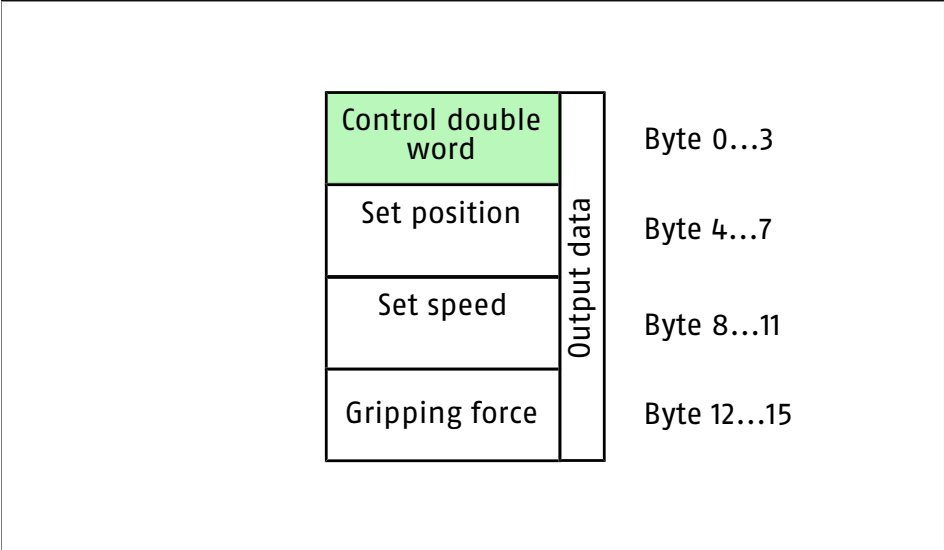
Control commands sent to the module may be permissible or impermissible.

- Permissible control commands are executed by the module.
- Impermissible control commands are not executed. The PLC is displayed by setting the status bit "not feasible".

Furthermore, the warning WRN\_NOT\_FEASIBLE including additional code is transmitted via the diagnostics double word, ▶ 6.1 [ 75].

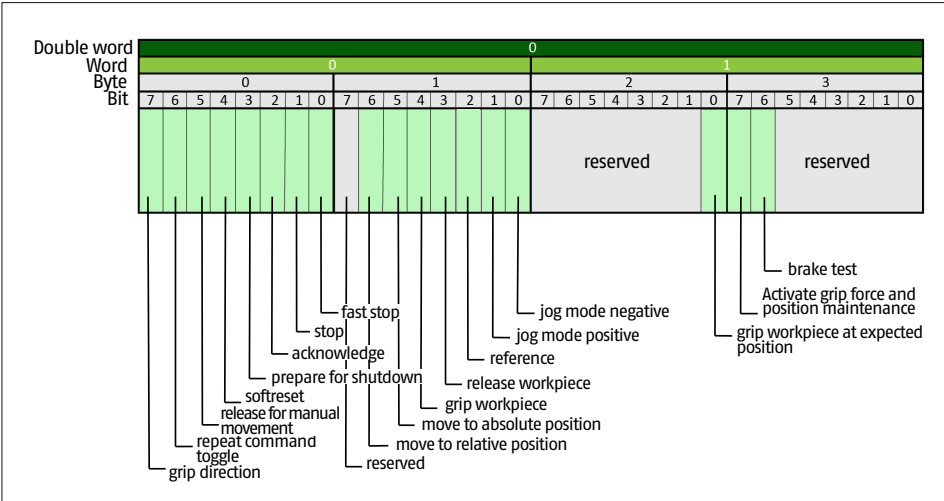
Data frame

The data frame of cyclical output data is composed of the control double word and movement parameters.



Data frame of cyclical output data

Control double word



Bit sequence control double word

In bytes 0 – 3 of the cyclical output data, the control double word is transmitted. The structure of the control double word is shown in the following table. For a detailed description of the control double word, see chapter ▶ 7.2 [ 90].

### NOTE

In the following table, the descriptions of the status bits are shown in the "Cyclical output data" column as follows:

- Long English designation
- Short English designation
- Short German designation

⇒ The long designation increases comprehensibility when reading this manual.

### Overview of control double word

| Word | Byte | Bit | Cyclical output data                                                                                          |
|------|------|-----|---------------------------------------------------------------------------------------------------------------|
| 0    | 0    | 0   | ▶ fast stop [ 90]<br>EN – short: fast stop<br>DE – short: Schnellstopp                                        |
|      |      | 1   | ▶ stop [ 90]<br>EN – short: stop<br>DE – short: Stopp                                                         |
|      |      | 2   | ▶ acknowledge [ 90]<br>EN – short: ack<br>DE – short: Quittieren                                              |
|      |      | 3   | ▶ prepare for shutdown [ 90]<br>EN – short: prep shutdown<br>DE – short: Herunterfahren vorbereiten           |
|      |      | 4   | ▶ softreset [ 90]<br>EN – short: softreset<br>DE – short: Neustart                                            |
|      |      | 5   | ▶ release for manual movement [ 90]<br>EN – short: release manual movement<br>DE – short: Man. Bwg. freigeben |
|      |      | 6   | ▶ repeat command toggle [ 91]<br>EN – short: rpt cmd tgl<br>DE – short: Kdo. wiederh.                         |
|      |      | 7   | ▶ grip direction [ 91]<br>EN – short: grip dir<br>DE – short: Greifrichtung                                   |

| Word | Byte | Bit | Cyclical output data                                                                                                 |
|------|------|-----|----------------------------------------------------------------------------------------------------------------------|
| 0    | 1    | 8   | ▶ jog mode negative [ 91]<br>EN – short: jog –<br>DE – short: Tipp –                                                 |
|      |      | 9   | ▶ jog mode positive [ 91]<br>EN – short: jog +<br>DE – short: Tipp +                                                 |
|      |      | 10  | ▶ reference [ 92]<br>EN – short: reference<br>DE – short: Referenzieren                                              |
|      |      | 11  | ▶ release workpiece [ 92]<br>EN – short: release wp<br>DE – short: Werkst. freigeben                                 |
|      |      | 12  | ▶ grip workpiece [ 92]<br>EN – short: grp wp<br>DE – short: Werkst. greifen                                          |
|      |      | 13  | ▶ move to absolute position [ 92]<br>EN – short: pos absolute<br>DE – short: Pos. absolut                            |
|      |      | 14  | ▶ move to relative position [ 92]<br>EN – short: pos relative<br>DE – short: Pos. relativ                            |
|      |      | 15  | reserved                                                                                                             |
| 1    | 2    | 16  | ▶ grip workpiece at expected position [ 93]<br>EN – short: grp wp at pos<br>DE – short: Werkst. greifen an erw. Pos. |
|      |      | 17  | reserved                                                                                                             |
|      |      | 18  | reserved                                                                                                             |
|      |      | 19  | reserved                                                                                                             |
|      |      | 20  | reserved                                                                                                             |
|      |      | 21  | reserved                                                                                                             |
|      |      | 22  | reserved                                                                                                             |
|      |      | 23  | reserved                                                                                                             |
| 1    | 3    | 24  | reserved                                                                                                             |
|      |      | 25  | reserved                                                                                                             |
|      |      | 26  | reserved                                                                                                             |
|      |      | 27  | reserved                                                                                                             |
|      |      | 28  | reserved                                                                                                             |
|      |      | 29  | reserved                                                                                                             |

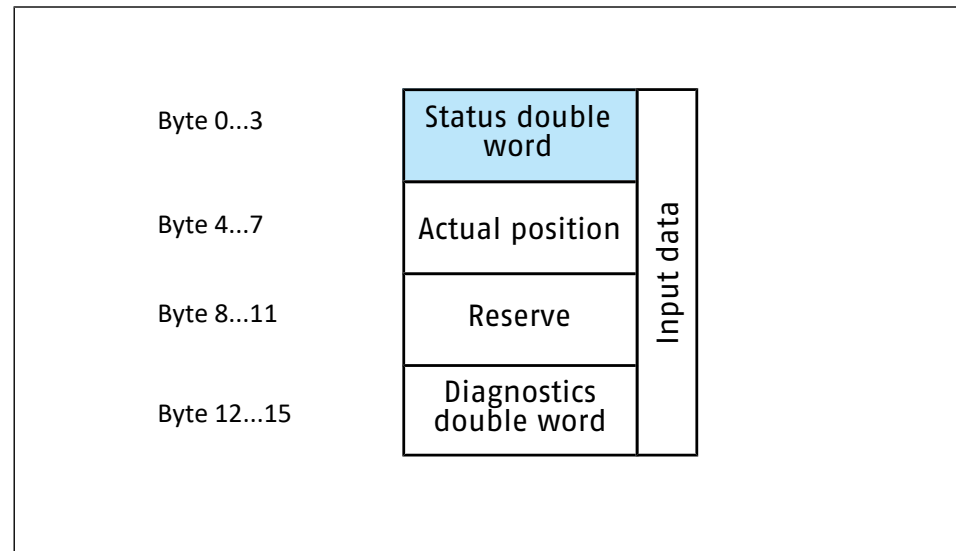
| Word                   | Byte | Bit | Cyclical output data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------|------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        |      | 30  | <ul style="list-style-type: none"> <li>▶ brake test [ 93]</li> <li>EN – short: brake test</li> <li>DE – short: Bremsentest</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                        |
|                        |      | 31  | <ul style="list-style-type: none"> <li>▶ Activate grip force and position maintenance [ 93]</li> <li>EN – short: activate GPE</li> <li>DE – short: GPE aktivieren</li> </ul>                                                                                                                                                                                                                                                                                                                                                 |
| <b>Target position</b> |      |     | <ul style="list-style-type: none"> <li>In bytes 4 – 7 of the cyclical output data, data is transmitted that is used for positioning purposes, ▶ 4.2 [ 51].</li> <li>The data format of the parameter is <i>signed 32 bits</i> and represents a value in micrometers [<math>\mu\text{m}</math>]. (<math>1000 \mu\text{m} \triangleq 1 \text{ mm}</math>)</li> </ul>                                                                                                                                                           |
| <b>Target speed</b>    |      |     | <ul style="list-style-type: none"> <li>In bytes 8 – 11 of the cyclical output data, the value of the set speed of a movement is transmitted, ▶ 4.2 [ 51].</li> <li>The data format of the parameter is <i>signed 32 bits</i> and represents a value in micrometers per second [<math>\mu\text{m/s}</math>]. (<math>1000 \mu\text{m/s} \triangleq 1 \text{ mm/s}</math>)</li> </ul>                                                                                                                                           |
| <b>Gripping force</b>  |      |     | <ul style="list-style-type: none"> <li>In bytes 12 – 15 of the cyclical output data, the gripping force with which a workpiece is to be gripped is transmitted, ▶ 3.3.1 [ 30].</li> <li>The data format of the parameter is <i>signed 32 bits</i> and represents a value in percent [%]. The percentage value refers to the parameter &lt;max_grp_force&gt;, ▶ 4.2 [ 58].<br/>If an invalid gripping force is set, an entry is created in the diagnostic memory which also refers to the force limits in newtons.</li> </ul> |

### 2.1.1.2 Cyclical input data

The cyclical input data is transmitted from the module to the control. This gives the PLC feedback from the module, allowing an appropriate reaction to then take place.

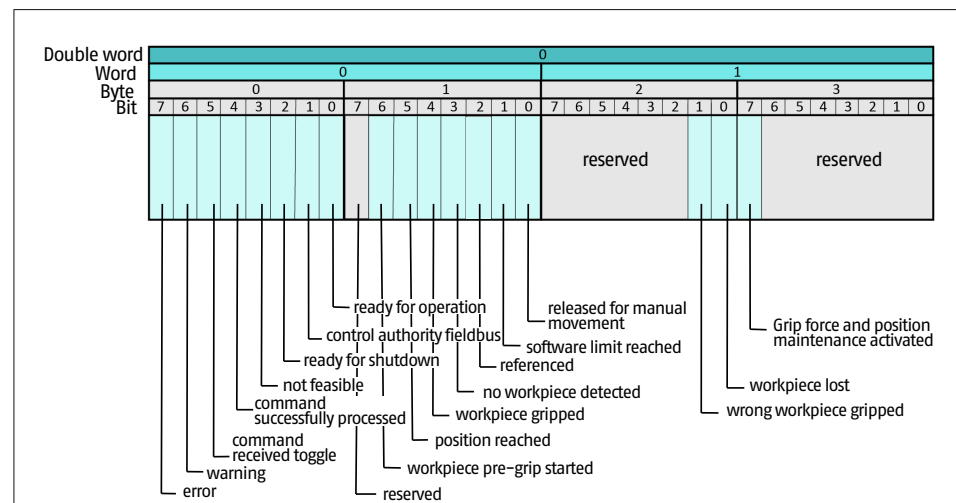
## Data frame

The data frame of cyclical input data is composed of the status double word and module feedback signals.



*Data frame of cyclical input data*

## Status double word



*Bit sequence status double word*

In bytes 0 – 3 of the cyclical input data, the status double word is transmitted. In the following table, the structure of the status double word is shown. For a detailed description of the status double word, see chapter ► 7.3 [93].

**NOTE**

In the following table, the descriptions of the status bits are shown in the "Cyclical input data" column as follows:

- Long English designation
- Short English designation
- Short German designation

⇒ The long designation increases comprehensibility when reading this manual.

**Overview of status  
double word**

| Word | Byte | Bit | Cyclical input data                                                                               |
|------|------|-----|---------------------------------------------------------------------------------------------------|
| 0    | 0    | 0   | ▶ ready for operation [ 93]<br>EN – short: ready for op<br>DE – short: Betriebsbereit             |
|      |      | 1   | ▶ control authority fieldbus [ 93]<br>EN – short: ctrl authority fb<br>DE – short: Feldbus        |
|      |      | 2   | ▶ ready for shutdown [ 94]<br>EN – short: ready for sd<br>DE – short: Abschaltbereit              |
|      |      | 3   | ▶ not feasible [ 94]<br>EN – short: not feasible<br>DE – short: Nicht durchführb.                 |
|      |      | 4   | ▶ command successfully processed [ 94]<br>EN – short: cmd success<br>DE – short: Kdo. erfolgreich |
|      |      | 5   | ▶ command received toggle [ 94]<br>EN – short: cmd rcvd tgl<br>DE – short: Kommandowechsel        |
|      |      | 6   | ▶ warning [ 94]<br>EN – short: warning<br>DE – short: Warnung                                     |
|      |      | 7   | ▶ error [ 95]<br>EN – short: error<br>DE – short: Fehler                                          |

| Word | Byte | Bit | Cyclical input data                                                                                               |
|------|------|-----|-------------------------------------------------------------------------------------------------------------------|
| 0    | 1    | 8   | ▶ released for manual movement [ 95]<br>EN – short: manual movement released<br>DE – short: Man. Bwg. freigegeben |
|      |      | 9   | ▶ software limit reached [ 95]<br>EN – short: softlimit reached<br>DE – short: Softlimit                          |
|      |      | 10  | ▶ referenced [ 95]<br>EN – short: referenced<br>DE – short: Referenziert                                          |
|      |      | 11  | ▶ no workpiece detected [ 95]<br>EN – short: no wp detected<br>DE – short: Kein Werkstück                         |
|      |      | 12  | ▶ workpiece gripped [ 95]<br>EN – short: wp gripped<br>DE – short: Gegriffen                                      |
|      |      | 13  | ▶ position reached [ 95]<br>EN – short: pos reached<br>DE – short: Positioniert                                   |
|      |      | 14  | ▶ workpiece pre-grip started [ 95]<br>EN – short: wp pre-grip started<br>DE – short: Nachgreifen                  |
|      |      | 15  | reserved                                                                                                          |
| 1    | 2    | 16  | ▶ workpiece lost [ 96]<br>EN – short: wp lost<br>DE – short: Werkst. verloren                                     |
|      |      | 17  | ▶ wrong workpiece gripped [ 96]<br>EN – short: wrong wp gripped<br>DE – short: Falsches Werkst.                   |
|      |      | 18  | reserved                                                                                                          |
|      |      | 19  | reserved                                                                                                          |
|      |      | 20  | reserved                                                                                                          |
|      |      | 21  | reserved                                                                                                          |
|      |      | 22  | reserved                                                                                                          |
|      |      | 23  | reserved                                                                                                          |

| Word | Byte | Bit | Cyclical input data                                                                                                            |
|------|------|-----|--------------------------------------------------------------------------------------------------------------------------------|
| 1    | 3    | 24  | reserved                                                                                                                       |
|      |      | 25  | reserved                                                                                                                       |
|      |      | 26  | reserved                                                                                                                       |
|      |      | 27  | reserved                                                                                                                       |
|      |      | 28  | reserved                                                                                                                       |
|      |      | 29  | reserved                                                                                                                       |
|      |      | 30  | reserved                                                                                                                       |
|      |      | 31  | <p>► Grip force and position maintenance activated [ 96]</p> <p>EN – short: GPE activated</p> <p>DE – short: GPE aktiviert</p> |

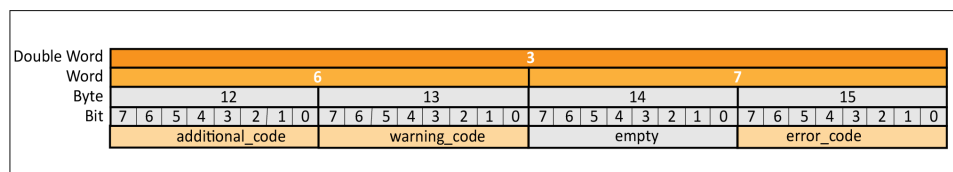
### Actual position

- In bytes 4 – 7 of the cyclical input data, the current actual position of the module is transmitted, ► 4 [ 51].
- The data format of the parameter is *signed 32 bits* and represents a value in micrometers [ $\mu\text{m}$ ] ( $1000 \mu\text{m} \triangleq 1 \text{ mm}$ ).

### Reserve

- In bytes 8 – 11 of the cyclic input data no user data is currently transmitted.

### Diagnostics double word



#### Code sequence diagnostics double word

- The diagnostics double word is transmitted in bytes 12 – 15 of the cyclical input data.
- Confusion between warning and error codes is eliminated since each code is assigned only once.

### NOTE

If the warning is output via byte 13

WRN\_NOT\_FEASIBLE, ► 6.1 [ 75], the cause for the non-feasibility can be read via byte 12 (additional\_code). The list of causes can be found in the attachment to this document, ► 7.4 [ 96].

### 2.1.2 Acyclical data exchange IO-Link

Execution of the acyclical data exchange complies with the specifications of the IO-Link Community (c/o Profibus User Organization, [www.io-link.com](http://www.io-link.com)). For all the required information pertaining to acyclical data exchange, see chapter ► 4 [ 51].

## 3 Module functions

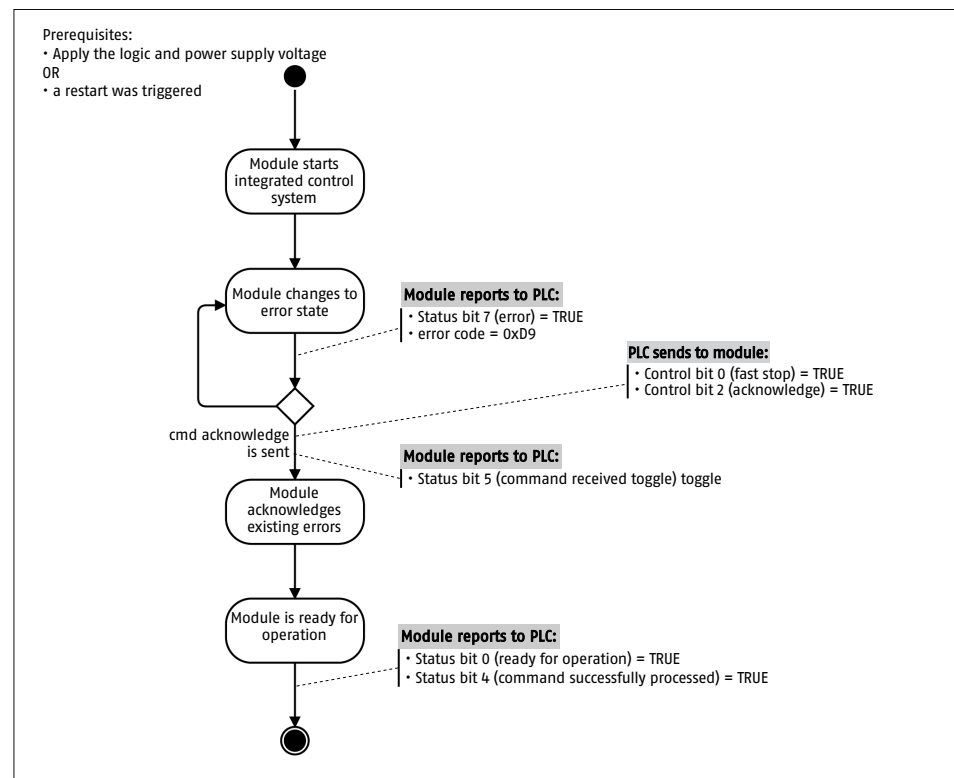
### 3.1 Booting, shutting down and restarting

#### 3.1.1 Booting and establishing operational readiness

##### Short description

When booting, the internal hardware and the connected communication interfaces are checked after the electronics have booted up. The module is in error state after booting. From this state, operational readiness can be established by acknowledgment.

The following example shows the sequence for establishing operational readiness:



*Booting the module and establishing operational readiness*

#### NOTE

The time required to establish communication after the supply voltage is applied may be longer than 300 ms.

##### Trigger

Booting can be triggered on the hardware side by applying the logic supply voltage, or triggered on the software side by a restart, ▶ 3.1.3 [23].

If the module is in the error state after booting, establishing operational readiness is triggered by setting the control bit "acknowledge" (bit 2), ▶ 7.2 [90].

**NOTE**

- To prevent any unexpected behavior of the module, all control bits equal to 0 should be cyclically transmitted to the module during booting.
- The module sets all control bits internally to status 1 during booting. This prevents unwanted requests from being triggered by the external controller during the ongoing cyclical transmission of the control word. Only the status bit "command received toggle" reflects the inverted value of the control bit "fast stop" initially received.  
Background: If the controller transmits a 0 into the control bit "fast stop" during or after booting, this 1 → 0 transition is interpreted as a request for a "fast stop" and accordingly "command received toggle" is set from the start value 0 to 1.

**Module feedback**

- The receipt of the control command is displayed by an immediate status change of the status bit "command received toggle". This confirmation occurs regardless of whether the control command is subsequently completed successfully or if it can be processed at all.
- If establishing operational readiness was *successful*, this is displayed by setting the status bit "ready for operation". The status bit "error" and the displayed diagnostic code are reset.
- If establishing operational readiness was *not successful*, the module remains in the error state. The status bit "error" and a corresponding diagnostic code are still displayed. In this case, contact SCHUNK Service.

**3.1.2 Shutting down****Short description**

When the module is switched off in a controlled manner, data required for operation is stored permanently. If the module reports back that it is ready for shutdown, the logic supply voltage can be disconnected or a software restart can be triggered.

**NOTE**

As soon as the module indicates that it is ready for shutdown, no further functions can be triggered except for the restart (► 3.1.3 [□ 23]). Furthermore, no changes to parameter values are accepted.

**Trigger**

A controlled shutdown is only permitted from within a defined system status and is triggered by setting the control bit "prepare for shutdown", (Bit 3), ► 7.2 [□ 90].

## System status

To trigger preparation for shutdown, the module must be in one of the following states:

- Position maintenance
- Workpiece holding
- Error state

---

### NOTE

- If the shutdown is triggered from the workpiece holding on modules *with* GPE, the module stores this information. After the restart, the corresponding status bit "workpiece gripped" or "wrong workpiece gripped" is displayed again.
  - If the shutdown is triggered from the workpiece holding on modules *without* GPE, the module does not store any information about a gripped workpiece.
- 

## Module feedback

- The receipt of the control command is displayed by an immediate status change of the status bit "command received toggle". This confirmation occurs regardless of whether the control command is subsequently completed successfully or if it can be processed at all.
- If preparations to shut down the module are *successful*, this is displayed by setting the status bit "ready for shutdown".
- If preparations to shut down the module are *not successful*, this is displayed by setting the status bit "error" and the corresponding diagnostic code. In this case, contact SCHUNK Service.

### 3.1.3 Restart

#### Short description

When the module is restarted, data required for operation is permanently saved and then booting is initiated, see chapter ▶ 3.1.1 [□ 20].

#### Trigger

Restarting the module is only permitted from within a defined system status and is triggered by setting the control bit "softreset", (Bit 4), ▶ 7.2 [□ 90].

The restart of the module can still be triggered by the IO-Link system command "Restart" (Device Reset).

Execution of the "Restore factory setting" IO-Link system command is triggered by acyclic writing of a value to an IO-Link parameter.

| Index  | Sub index | Value |
|--------|-----------|-------|
| 0x0002 | 0x0       | 0x80  |

#### System status

To trigger the restart, the module must be in one of the following states:

- Ready to switch off
- Position maintenance
- Workpiece holding
- Error state

#### NOTE

- If the shutdown is triggered from the workpiece holding on modules *with* GPE, the module stores this information. After the restart, the corresponding status bit "workpiece gripped" or "wrong workpiece gripped" is displayed again.
- If the shutdown is triggered from the workpiece holding on modules *without* GPE, the module does not store any information about a gripped workpiece.

## 3.2 Movement functions

### 3.2.1 Tip mode

#### Short description

In jog mode, an outward or inward movement is executed as long as one of the corresponding control bits is set. If the movement reaches the minimum or maximum position, the movement ends automatically.

---

#### NOTE

The jog mode is exclusively a function for commissioning the module. Do not use this function during automated operation!

---

#### Trigger

- Outward jog mode is triggered by setting the control bit "jog mode positive", (Bit 9) ▶ 7.2 [91].
- Inward jog mode is triggered by setting the control bit "jog mode negative", (Bit 8) ▶ 7.2 [91].

#### Movement parameter

The following movement parameters must be transmitted cyclically to the module:

- $\text{<min\_vel>} \leq \text{Velocity of movement } [\mu\text{m/s}] \leq \text{<max\_grp\_vel>}$
- Application GPE
  - Module with GPE: Use of the GPE is indicated by the state of the control bit "Activate grip force and position maintenance" (Bit 31), ▶ 7.2 [93].
  - Module without GPE: Control bit "Activate grip force and position maintenance" must be equal to 0.

#### Finish

Jog mode is terminated by the following events:

- Resetting the control bit "jog mode positive" or "jog mode negative"

- When reaching the minimum or maximum position

#### Module feedback

- The receipt of the control command is displayed by an immediate status change of the status bit "command received toggle". This confirmation occurs regardless of whether the control command is subsequently completed successfully or if it can be processed at all.
- Termination of jog mode by *resetting one of the control bits* is indicated by setting the status bits "position reached" and "command received toggle". The status bit "command received toggle" also changes the state.
- Termination of jog mode by *reaching the minimum or maximum position* is displayed by setting the status bit "position reached" and "command successfully processed". Furthermore the module returns the diagnostic code WRN\_POS\_LIMIT.

**Possible diagnostic events**

Events leading to warnings and/or errors are detected by the diagnostics. Below is a list of all possible diagnostic events.

| Diagnostic event                          | Diagnostic code *                  |
|-------------------------------------------|------------------------------------|
| Lower software limit is reached.          | ERR_SOFT_LOW                       |
| Upper software limit is reached.          | ERR_SOFT_HIGH                      |
| Drive blocked during movement.            | ERR_MOVE_BLOCKED                   |
| Sending an impermissible control command. | WRN_NOT_FEASIBLE + additional code |
| Module is not referenced.                 | ERR_NO_REF                         |
| Movement terminated by user.              | ERR_FAST_STOP                      |

\* For further information, see chapter ▶ 6 [ 74].

**3.2.2 Absolute positioning movement****Short description**

During absolute positioning, the module moves to the cyclically transferred position value. This position value refers to the parameterized zero point of the module. A practical application example is described in chapter ▶ 7.1 [ 82], example 1.

**NOTE**

Using a positioning movement for gripping workpieces represents a misuse, which will result in a module error.

**Trigger**

Absolute positioning is triggered by setting the control bit "move to absolute position" (Bit 13), ▶ 7.2 [ 92].

If the control bit "move to absolute position" is set, new absolute positioning can be triggered by changing the control bit "repeat command toggle", (Bit 6), ▶ 7.2 [ 91].

- Movement parameter** The following movement parameters must be transmitted cyclically to the module:
- $\langle \text{min\_pos} \rangle \leq \text{absolute position } [\mu\text{m}] \leq \langle \text{max\_pos} \rangle$
  - $\langle \text{min\_vel} \rangle \leq \text{Velocity of movement } [\mu\text{m/s}] \leq \langle \text{max\_vel} \rangle$
  - Application GPE
    - Module with GPE: Use of the GPE is indicated by the state of the control bit "Activate grip force and position maintenance" (Bit 31), ▶ 7.2 [93].
    - Module without GPE: Control bit "Activate grip force and position maintenance" must be equal to 0.

**Finish** Absolute positioning is terminated by the following events:

- Target position reached
- Setting the control bit "stop"
- The receipt of the control command is displayed by an immediate status change of the status bit "command received toggle". This confirmation occurs regardless of whether the control command is subsequently completed successfully or if it can be processed at all.
- Once the target position has been reached, it is displayed by setting the status bit "position reached" and "command successfully processed".

**Possible diagnostic events** Events leading to warnings and/or errors are detected by the diagnostics. Below is a list of all possible diagnostic events.

| Diagnostic event                                   | Diagnostic code *                  |
|----------------------------------------------------|------------------------------------|
| Positioning is taking too long.                    | ERR_MOV_ABORT_TO                   |
| Lower software limit is reached.                   | ERR_SOFT_LOW                       |
| Upper software limit is reached.                   | ERR_SOFT_HIGH                      |
| Drive is already blocked at the start of movement. | ERR_MOVE_BLOCKED                   |
| Drive blocked during movement.                     | ERR_MOVE_BLOCKED                   |
| Sending an impermissible control command.          | WRN_NOT_FEASIBLE + additional code |
| Module is not referenced.                          | ERR_NO_REF                         |
| Movement terminated by user.                       | ERR_FAST_STOP                      |

\* For further information, see chapter ▶ 6 [74].

### 3.2.3 Relative positioning movement

#### Short description

With relative positioning, the module moves from the current position by the cyclically transferred and signed position value. A practical application example of this is described in chapter ▶ 7.1 [□ 83], Example 2.

---

#### NOTE

Using a positioning movement for gripping workpieces represents a misuse, which will result in a module error.

---

#### Trigger

Relative positioning is triggered by setting the control bit "move to relative position" (Bit 14), ▶ 7.2 [□ 92].

If the control bit "move to relative position" is set, new relative positioning can be triggered by changing the control bit "repeat command toggle" (Bit 6), ▶ 7.2 [□ 91].

#### Movement parameter

The following movement parameters must be transmitted cyclically to the module:

- signed relative position [ $\mu\text{m}$ ]
- $\langle \text{min\_vel} \rangle \leq \text{Velocity of movement } [\mu\text{m/s}] \leq \langle \text{max\_vel} \rangle$
- Application GPE
  - Module with GPE: Use of the GPE is indicated by the state of the control bit "Activate grip force and position maintenance" (Bit 31), ▶ 7.2 [□ 93].
  - Module without GPE: Control bit "Activate grip force and position maintenance" must be equal to 0.

---

#### NOTE

- The transmitted signed relative position must be selected so that the permissible range of movement from  $\langle \text{min\_pos} \rangle$  to  $\langle \text{max\_pos} \rangle$  is not exceeded.
  - If the position is not within the permissible movement range, the module will set the status bit "not feasible" and report back the diagnostics code WRN\_NOT\_FEASIBLE including additional code.
- 

#### Finish

Relative positioning is terminated by the following events:

- Target position reached
- Setting the control bit "stop"

**Module feedback**

- The receipt of the control command is displayed by an immediate status change of the status bit "command received toggle". This confirmation occurs regardless of whether the control command is subsequently completed successfully or if it can be processed at all.
- Once the target position has been reached, it is displayed by setting the status bit "position reached" and "command successfully processed".

**Possible diagnostic events**

Events leading to warnings and/or errors are detected by the diagnostics. Below is a list of all possible diagnostic events.

| Diagnostic event                                   | Diagnostic code *                  |
|----------------------------------------------------|------------------------------------|
| Positioning is taking too long.                    | ERR_MOV_ABORT_TO                   |
| Lower software limit is reached.                   | ERR_SOFT_LOW                       |
| Upper software limit is reached.                   | ERR_SOFT_HIGH                      |
| Drive is already blocked at the start of movement. | ERR_MOVE_BLOCKED                   |
| Drive blocked during movement.                     | ERR_MOVE_BLOCKED                   |
| Sending an impermissible control command.          | WRN_NOT_FEASIBLE + additional code |
| Module is not referenced.                          | ERR_NO_REF                         |
| Movement terminated by user.                       | ERR_FAST_STOP                      |

\* For further information, see chapter ▶ 6 [74].

### 3.2.4 Controlled stop

|                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Short description</b>          | During controlled stops, the current movement is decelerated as quickly as possible until it comes to a standstill.                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Trigger</b>                    | Controlled stops are triggered by setting the control bit "stop", (Bit 1), ▶ 7.2 [90].                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Movement parameter</b>         | <p>The following movement parameters must be transmitted cyclically to the module:</p> <ul style="list-style-type: none"> <li>• Application GPE           <ul style="list-style-type: none"> <li>– Module with GPE: Use of the GPE is indicated by the state of the control bit "Activate grip force and position maintenance" (Bit 31), ▶ 7.2 [93].</li> <li>– Module without GPE: Control bit "Activate grip force and position maintenance" must be equal to 0.</li> </ul> </li> </ul> |
| <b>Finish</b>                     | The controlled stop is terminated automatically when a standstill has been reached.                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Module feedback</b>            | <ul style="list-style-type: none"> <li>• The receipt of the control command is displayed by an immediate status change of the status bit "command received toggle". This confirmation occurs regardless of whether the control command is subsequently completed successfully or if it can be processed at all.</li> <li>• The controlled stop of an active movement is displayed by setting the status bit "position reached" and "command successfully processed".</li> </ul>           |
| <b>Possible diagnostic events</b> | Events leading to warnings and/or errors are detected by the diagnostics. Below is a list of all possible diagnostic events.                                                                                                                                                                                                                                                                                                                                                              |

| Diagnostic event                          | Diagnostic code *                  |
|-------------------------------------------|------------------------------------|
| The controlled stop is taking too long    | ERR_MOV_ABORT_TO                   |
| Sending an impermissible control command. | WRN_NOT_FEASIBLE + additional code |
| Movement terminated by user.              | ERR_FAST_STOP                      |

\* For further information, see chapter ▶ 6 [74].

### 3.2.5 Terminating a movement

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Short description</b> | If the movement is terminated, the current movement is forced to a standstill.                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Trigger</b>           | Since the control bit "fast stop" is executed in a fail-safe and thus "low-active" manner, the termination of an active movement is triggered by resetting the control bit "fast stop" (1 → 0), ▶ 7.2 [□ 90].                                                                                                                                                                                                                                                   |
| <b>Module feedback</b>   | <ul style="list-style-type: none"> <li>The receipt of the control command is displayed by an immediate status change of the status bit "command received toggle". This confirmation occurs regardless of whether the control command is subsequently completed successfully or if it can be processed at all.</li> <li>The movement termination is displayed by setting the status bit "error" in connection with the diagnostic code ERR_FAST_STOP.</li> </ul> |

## 3.3 Handling a workpiece

### 3.3.1 Workpiece gripping (simple gripping movement)

|                          |                                                                                                                                                                                                                              |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Short description</b> | In workpiece gripping, a workpiece is gripped with the specified gripping force value <b>without</b> specifying the workpiece position. A practical application example is described in chapter ▶ 7.1 [□ 84], example 3 – 5. |
| <b>Trigger</b>           | Workpiece gripping is triggered by setting the control bit "grip workpiece", (Bit 12), ▶ 7.2 [□ 92].                                                                                                                         |

---

#### NOTE

As long as a workpiece is held, it is permissible to trigger workpiece gripping with changed movement parameters.

---

|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Movement parameter for BasicGrip</b> | <p>In order to grip in the BasicGrip mode, the following movement parameters and information must be transmitted cyclically to the module:</p> <ul style="list-style-type: none"> <li><math>25 \leq \text{Gripping force [\%]} \leq 75</math></li> <li>Gripping direction is indicated by the control bit "grip direction" (Bit 7), ▶ 7.2 [□ 91].</li> <li>Application GPE           <ul style="list-style-type: none"> <li>Module with GPE: Use of the GPE is indicated by the state of the control bit "Activate grip force and position maintenance" (Bit 31), ▶ 7.2 [□ 93].</li> <li>Module without GPE: Control bit "Activate grip force and position maintenance" must be equal to 0.</li> </ul> </li> </ul> |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Movement parameter for SoftGrip**

In order to grip in the SoftGrip mode, the following movement parameters and information must be transmitted cyclically to the module:

- $25 \leq \text{Gripping force [\%]} \leq 75$
- smallest possible gripping velocity  $\leq \text{gripping velocity } [\mu\text{m/s}] \leq$  largest possible gripping velocity, ▶ 1.2.3 [8].
- Gripping direction is indicated by the control bit "grip direction" (Bit 7), ▶ 7.2 [91].
- Application GPE
  - Module with GPE: Use of the GPE is indicated by the state of the control bit "Activate grip force and position maintenance" (Bit 31), ▶ 7.2 [93].
  - Module without GPE: Control bit "Activate grip force and position maintenance" must be equal to 0.

**Finish**

Workpiece gripping is terminated by the following options:

- Workpiece was gripped successfully, the module automatically switches to workpiece holding.
- Workpiece was detected successfully and must be re-gripped, the module automatically switches to workpiece re-gripping.
- Automatic when reaching the minimum or maximum position
- Setting the control bit "stop"

**Module feedback**

- The receipt of the control command is displayed by an immediate status change of the status bit "command received toggle". This confirmation occurs regardless of whether the control command is subsequently completed successfully or if it can be processed at all.
- Successful gripping of a workpiece is displayed by setting the status bit "workpiece gripped" and "command successfully processed".
- The change to workpiece re-gripping is displayed by setting the status bit "workpiece pre-grip started".
- Reaching the minimum or maximum position is displayed by setting the status bit "no workpiece detected".

## Possible diagnostic events

Events leading to warnings and/or errors are detected by the diagnostics. Below is a list of all possible diagnostic events.

| Diagnostic event                          | Diagnostic code *                  |
|-------------------------------------------|------------------------------------|
| Sending an impermissible control command. | WRN_NOT_FEASIBLE + additional code |
| Module is not referenced.                 | ERR_NO_REF                         |
| Movement terminated by user.              | ERR_FAST_STOP                      |

\* For further information, see chapter ▶ 6 [74].

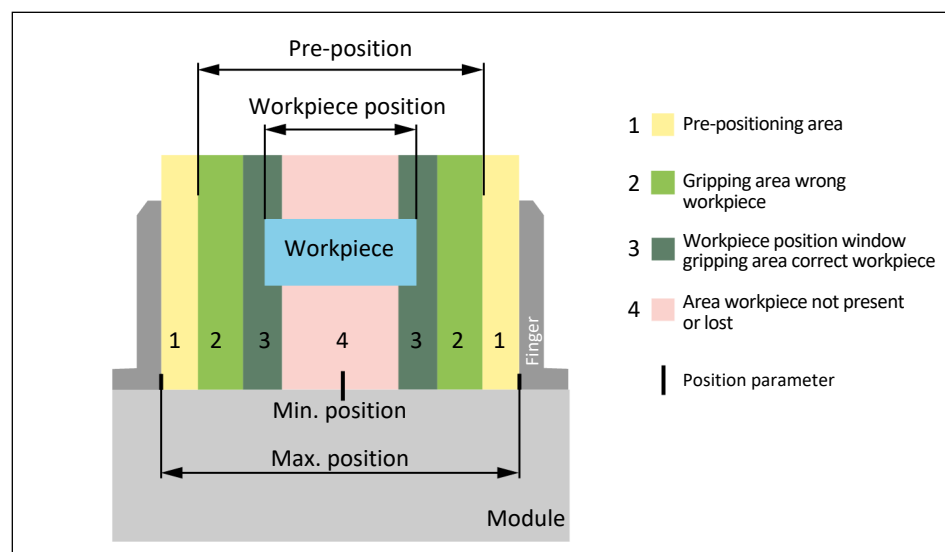
### 3.3.2 Workpiece gripping at expected position (combined gripping movement)

#### Short description

In workpiece gripping at an expected position, a workpiece is gripped at the specified workpiece position with the specified gripping force value using a combined gripping movement. A practical application example is described in chapter ▶ 7.1 [87], example 6 – 8.

#### NOTE

The following example illustrated shows the O.D. gripping mode; the statements made also apply to the I.D. gripping mode.



*Gripping workpiece at expected position, example of O.D. gripping*

The combination consists of an optional pre-positioning (Fig.: yellow area 1) and the gripping movement (Fig.: light and dark green areas 2 and 3).

The decision as to whether the correct or wrong workpiece has been gripped is made on the basis of the gripping position detected:

- The *correct* workpiece is gripped within the workpiece position window (Fig.: dark green area 3).

- The *wrong* workpiece is gripped between the pre-position and the workpiece position window (Fig.: light green area 2).

The workpiece position window is a "virtual window" that is clamped around the expected workpiece position. If the workpiece position window is exceeded (Fig. light red area 4), then no workpiece has been detected or the workpiece was lost during re-gripping.

---

### NOTE

- The pre-position and the workpiece position window are calculated from the cyclically transferred workpiece position and the parameterization of the module.
  - Pre-positioning is performed at the maximum positioning speed.
  - If the start position lies between the pre-position and the gripping position when the gripping movement is triggered, the pre-positioning is dispensed with and the gripping movement is carried out immediately.
  - Depending on the parameterization, the module changes after a successful combined gripping process to the ► [workpiece re-gripping](#) [ 38] or workpiece holding status.
- 

### Trigger

The combined gripping movement is triggered by setting the control bit "grip workpiece at expected position" (Bit 16), ► [7.2](#) [ 93].

---

### NOTE

As long as a workpiece is held, it is permissible to trigger workpiece gripping with changed movement parameters.

---

**Movement parameter for BasicGrip**

In order to grip in the BasicGrip mode, the following movement parameters and information must be transmitted cyclically to the module:

- $25 \leq \text{Gripping force [\%]} \leq 75$
- $\text{<min\_pos>} \leq \text{Workpiece position } [\mu\text{m}] \leq \text{<max\_pos>}$
- Gripping direction is indicated by the control bit "grip direction" (Bit 7), ▶ 7.2 [□ 91].
- Application GPE
  - Module with GPE: Use of the GPE is indicated by the state of the control bit "Activate grip force and position maintenance" (Bit 31), ▶ 7.2 [□ 93].
  - Module without GPE: Control bit "Activate grip force and position maintenance" must be equal to 0.

**Movement parameter for SoftGrip**

In order to grip in the SoftGrip mode, the following movement parameters and information must be transmitted cyclically to the module:

- $25 \leq \text{Gripping force [\%]} \leq 75$
- $\text{smallest possible gripping velocity} \leq \text{gripping velocity } [\mu\text{m/s}] \leq \text{largest possible gripping velocity}$ , ▶ 1.2.3 [□ 8].
- $\text{<min\_pos>} \leq \text{Workpiece position } [\mu\text{m}] \leq \text{<max\_pos>}$
- Gripping direction is indicated by the control bit "grip direction" (Bit 7), ▶ 7.2 [□ 91].
- Application GPE
  - Module with GPE: Use of the GPE is indicated by the state of the control bit "Activate grip force and position maintenance" (Bit 31), ▶ 7.2 [□ 93].
  - Module without GPE: Control bit "Activate grip force and position maintenance" must be equal to 0.

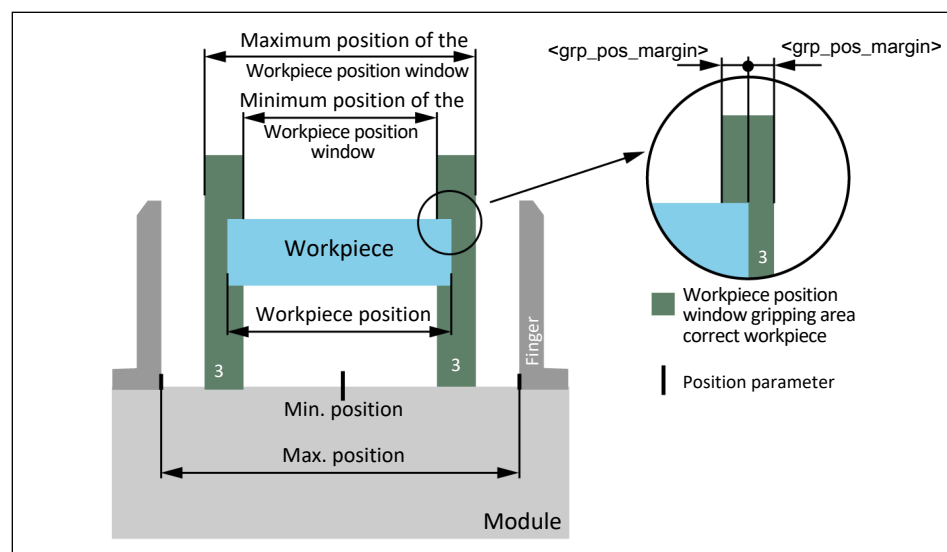
## Parameterization

### 1. Workpiece position window

The parameter `<grp_pos_margin>` (► 4.2 [55]) can be used to parameterize the value from which the minimum and maximum positions of the workpiece position window are calculated.

#### NOTE

- The minimum position of the workpiece position window is calculated according to: *workpiece position* - `<grp_pos_margin>`.
- The maximum position of the workpiece position window is calculated according to: *workpiece position* + `<grp_pos_margin>`.



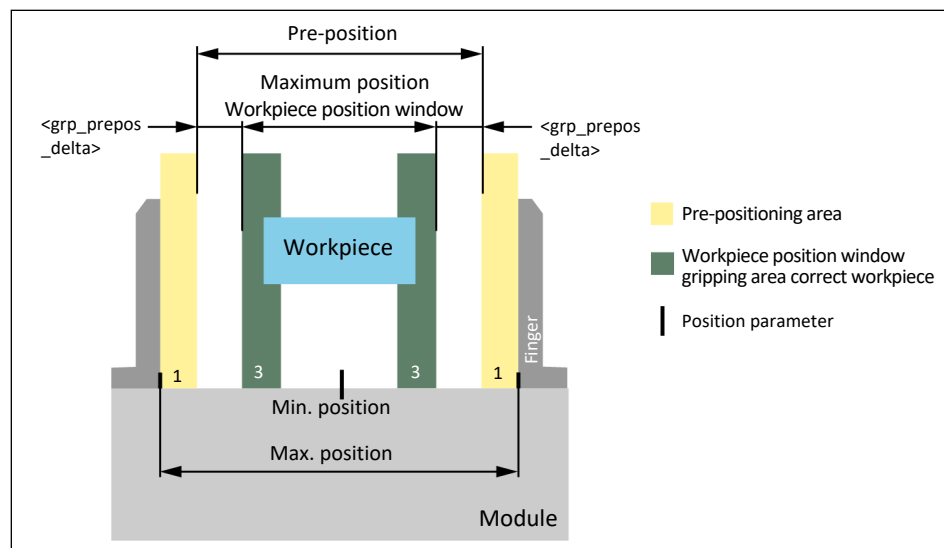
Minimum and maximum position of the workpiece position window

## 2. Pre-position

The parameter `<grp_prepos_delta>` ([▶ 4.2 \[56\]](#)) can be used to parameterize the difference in position between the workpiece position window and the pre-position.

### NOTE

- The pre-position is calculated from the minimum or maximum position of the workpiece position window depending on the direction from which a workpiece is gripped.
- The pre-position during I.D. gripping is calculated according to: minimum position workpiece position window - `<grp_prepos_delta>`.
- The pre-position during O.D. gripping is calculated according to: maximum position workpiece position window + `<grp_prepos_delta>`



*Pre-positioning area for O.D. gripping*

### Finish

Workpiece gripping at an expected position is terminated by the following options:

- Expected workpiece was gripped
- Unexpected workpiece was gripped
- Automatic switchover to re-gripping
- Gripping position was exceeded
- Automatic when reaching the minimum or maximum position
- Setting the control bit "stop"

**Module feedback**

- The receipt of the control command is displayed by an immediate status change of the status bit "command received toggle". This confirmation occurs regardless of whether the control command is subsequently completed successfully or if it can be processed at all.
- Gripping of the expected workpiece is displayed by setting the status bit "workpiece gripped" and "command successfully processed".
- Gripping of an unexpected workpiece is displayed by setting the status bit "wrong workpiece gripped" and "command successfully processed".
- The automated change to re-gripping is displayed by setting the status bit "workpiece pre-grip started".
- Exceeding the workpiece position window is displayed by setting the status bit "no workpiece detected".

**Possible diagnostic events**

Events leading to warnings and/or errors are detected by the diagnostics. Below is a list of all possible diagnostic events.

| Diagnostic event                             | Diagnostic code *                  |
|----------------------------------------------|------------------------------------|
| Sending an impermissible control command.    | WRN_NOT_FEASIBLE + additional code |
| Module is not referenced.                    | ERR_NO_REF                         |
| Movement terminated by user.                 | ERR_FAST_STOP                      |
| The drive is blocked during pre-positioning. | ERR_MOVE_BLOCKED                   |

\* For further information, see chapter ▶ 6 [74].

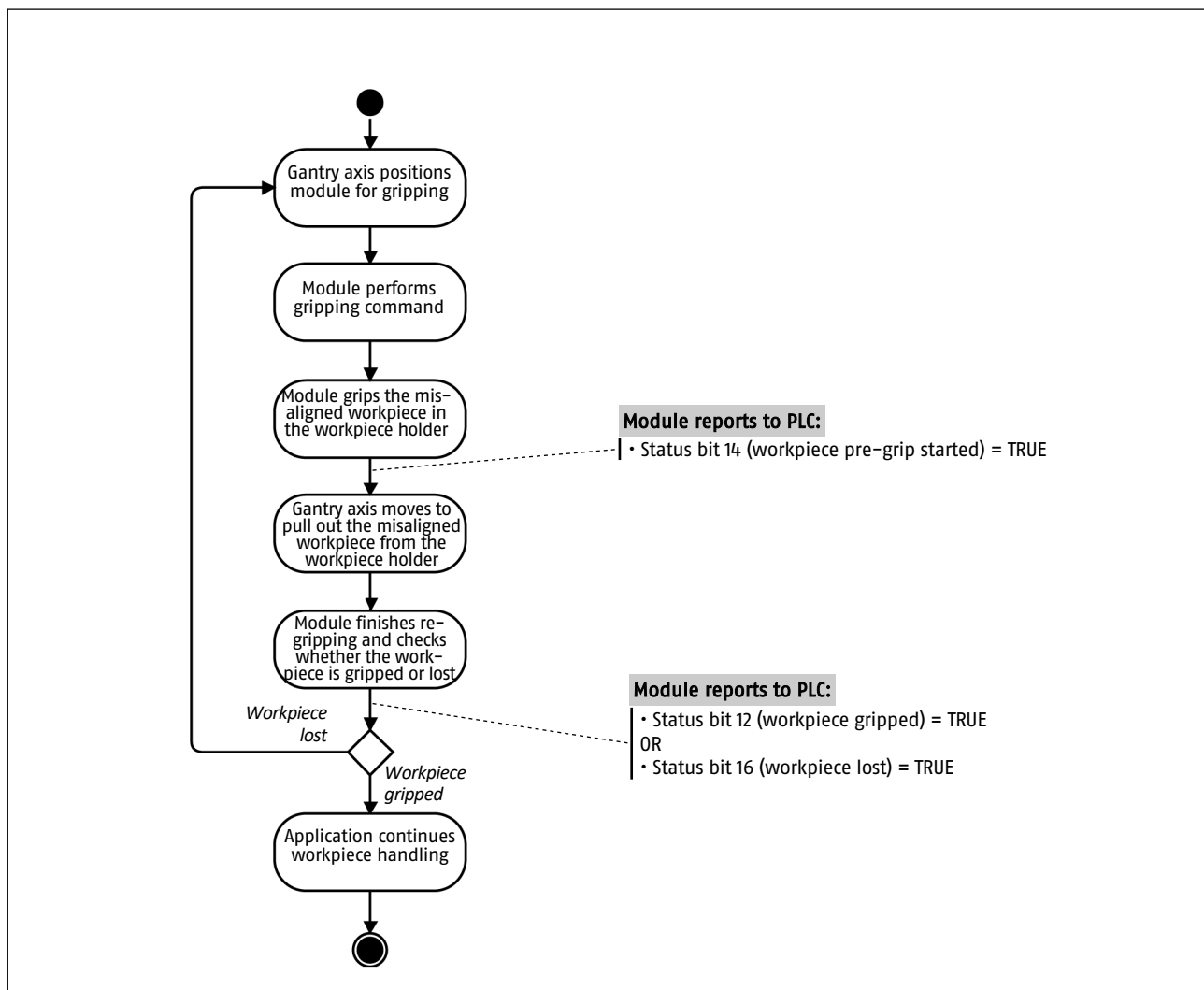
### 3.3.3 Workpiece re-gripping

#### Short description

Workpiece re-gripping is an optional extension for the gripping modes (► 1.2.3 [8]) of the module. This allows the module to grip workpieces that align with a delay during the gripping movement. The module detects the first contact with a workpiece and then starts the re-gripping. At the end of the re-gripping process, the module reports back to the user whether the workpiece was gripped or lost. Practical application examples are described in chapter ► 7.1 [81].

#### EXAMPLE

#### Workpiece re-gripping in a linear gantry application



Workpiece re-gripping in a linear gantry application

---

**NOTE**

In the application example shown above, it can be seen that starting the re-gripping can serve as a trigger for an action of another application component (PLC reads status bit 14 = TRUE). The feedback from the module as to whether the workpiece has been gripped or lost can in turn be used as a trigger for distinguishing further cases in the application.

---

**Trigger**

The re-gripping behavior is determined by the parameter <grp\_prehold\_time>. If a re-gripping time is set in the parameter, re-gripping with the set time takes place for all executed gripping commands.

**Parameterization**

The parameter <grp\_prehold\_time> (► 4.2 [53]) can be used to parameterize the time span of the re-gripping. The maximum time span for re-gripping is 5000 ms (5 Sekunden).

---

**NOTE**

If a time of 0 ms is stored in this parameter (factory setting), re-gripping is *not* carried out when carrying out a gripping movement.

---

**Finish**

The re-gripping of workpieces is terminated by the following options:

- Time span of the re-gripping has expired
  - Setting the control bit "stop"
  - Setting the control bit "release workpiece"
  - Setting the control bit "move to absolute position"
  - Setting the control bit "move to relative position"
- 

**NOTE**

If re-gripping is interrupted by setting the control bit "stop", workpiece loss is to be assumed as the re-gripping was not successfully completed. This is displayed by setting the status bit "workpiece lost". Furthermore, the status bit "workpiece pre-grip started" is reset.

---

**Module feedback**

- The start of re-gripping is displayed by setting the status bit "workpiece pre-grip started".

**Feedback after previous workpiece gripping:**

- Gripping of a workpiece is displayed by setting the status bit "workpiece gripped" and "command successfully processed".
- Unsuccessful re-gripping is displayed by setting the status bit "workpiece lost".

**Feedback after previous workpiece gripping at an expected position:**

- Gripping of the expected workpiece is displayed by setting the status bit "workpiece gripped" and "command successfully processed".
- Gripping of an unexpected workpiece is displayed by setting the status bit "wrong workpiece gripped".
- Exceeding the workpiece position window is displayed by setting the status bit "workpiece lost".

**Possible diagnostic events**

Events leading to warnings and/or errors are detected by the diagnostics. Below is a list of all possible diagnostic events.

| Diagnostic event                          | Diagnostic code *                  |
|-------------------------------------------|------------------------------------|
| Sending an impermissible control command. | WRN_NOT_FEASIBLE + additional code |
| Movement terminated by user.              | ERR_FAST_STOP                      |

\* For further information, see chapter ▶ 6 [74].

### 3.3.4 Workpiece loss detection

|                          |                                                                                                                                                                                                                                                                                                                            |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Short description</b> | <p>The module can detect loss of the workpiece. Due to a workpiece loss, the module performs a movement. As soon as this movement results in a position change greater than a parameterizable distance, the workpiece is recognized as lost.</p>                                                                           |
|                          | <hr/> <p><b>NOTE</b></p> <p>If GPE is activated, workpiece loss detection is not possible for technical reasons.</p> <hr/>                                                                                                                                                                                                 |
| <b>Trigger</b>           | <p>The workpiece loss detection does not have to be triggered. It is automatically activated as soon as a workpiece is held.</p>                                                                                                                                                                                           |
| <b>Parameterization</b>  | <p>The parameter &lt;wp_lost_dst&gt; (► 4.2 [54]) can be used to parameterize the distance that the gripper fingers are allowed to travel after the workpiece is lost before a workpiece loss is detected.</p>                                                                                                             |
| <b>Module feedback</b>   | <ul style="list-style-type: none"> <li>• A workpiece loss is displayed by setting the status bit "workpiece lost".</li> <li>• A set status bit "workpiece pre-grip started" is reset.</li> <li>• A set status bit "workpiece gripped" is reset.</li> <li>• A set status bit "wrong workpiece gripped" is reset.</li> </ul> |

### 3.3.5 Workpiece release

#### Short description

During workpiece release, the module executes a relative positioning movement. Starting from the current position, a defined distance of the parameter <wp\_release\_delta> is moved in the opposite direction to the gripping direction of the last gripping movement.

---

#### NOTE

- Since all necessary movement parameters are calculated internally during workpiece release, a maximum of two control bits (bit 11, optional bit 31) must be changed.
  - Workpieces can also be released by triggering an absolute or relative positioning movement.
- 

#### Trigger

Releasing workpieces is only permitted from workpiece holding and is triggered by setting the control bit "release workpiece" (Bit 11), ▶ 7.2 [□ 92].

#### Movement parameter

The following movement parameters must be transmitted cyclically to the module:

- Application GPE:
  - Module with GPE: Use of the GPE is indicated by the state of the control bit "Activate grip force and position maintenance", ▶ 7.2 [□ 93].
  - Module without GPE: Control bit "Activate grip force and position maintenance" must be equal to 0.

#### Parameterization

The parameter <wp\_release\_delta> (▶ 4.2 [□ 54]) can be used to parameterize the distance which the module moves relatively during release.

#### Finish

Workpiece release is terminated by the following options:

- Calculated release position was reached
- Setting the control bit "stop"

#### Module feedback

- The receipt of the control command is displayed by an immediate status change of the status bit "command received toggle". This confirmation occurs regardless of whether the control command is subsequently completed successfully or if it can be processed at all.
- The release of workpieces is displayed by setting the status bit "position reached" and "command successfully processed".
- A set status bit "workpiece pre-grip started" is reset.
- A set status bit "workpiece gripped" is reset.
- A set status bit "wrong workpiece gripped" is reset.

**Possible diagnostic events**

Events leading to warnings and/or errors are detected by the diagnostics. Below is a list of all possible diagnostic events.

| Diagnostic event                                   | Diagnostic code *                  |
|----------------------------------------------------|------------------------------------|
| The release is taking too long.                    | ERR_MOV_ABORT_TO                   |
| Drive is already blocked at the start of movement. | ERR_MOVE_BLOCKED                   |
| Drive blocked during movement.                     | ERR_MOVE_BLOCKED                   |
| Sending an impermissible control command.          | WRN_NOT_FEASIBLE + additional code |
| Module is not referenced.                          | ERR_NO_REF                         |
| Movement terminated by user.                       | ERR_FAST_STOP                      |

\* For further information, see chapter ▶ 6 [ 74].

**3.3.6 Remove workpiece manually****Short description**

If the module is in the **error state**, the GPE of the module can be deactivated. The user can manually remove a gripped workpiece.

**NOTE**

Because the user works directly on the module, the manual **removal** of workpieces **is only permitted in an emergency**. To ensure that the module does not perform any unexpected movements, it is only possible to trigger this function in the error state of the module!

**Trigger**

The manual removal of workpieces is triggered by setting the control bit "release for manual movement", (Bit 5), ▶ 7.2 [ 90].

If the module is **not** in the error state, proceed as follows:

- Resetting the control bit "fast stop" (bit 0)
- Setting the control bit "fast stop" (bit 0)
- Setting the control bit "release for manual movement" (bit 5)

**Movement parameter**

No movement parameters need to be transmitted to perform the manual release of workpieces.

**Finish**

The manual gripping of workpieces is terminated by the following events:

- Resetting the control bit "fast stop" to 0
- Automatically after 30 minutes
- The receipt of the control command is displayed by an immediate status change of the status bit "command received toggle". This confirmation occurs regardless of whether the control command is subsequently completed successfully or if it can be processed at all.

**Module feedback**

- The release for manual workpiece removal is displayed by setting the status bit "released for manual movement".

### 3.4 Additional functions

#### 3.4.1 Referencing

##### Short description

The module executes the parameterized referencing routine. Once the routine is complete, the current position value is updated.

---

##### NOTE

If the module is properly switched off (► 3.1.2 [□ 21]) and the base jaws are not moved when switched off, the module can restore the reference after a restart.

---

##### Trigger

Referencing is triggered by setting the "reference" control bit, ► 7.3 [□ 95]–Bit 10.

##### Movement parameter

The following movement parameters must be transmitted cyclically to the module:

- Application GPE:
  - Module with GPE: Use of the GPE is indicated by the state of the control bit "Activate grip force and position maintenance", ► 7.2 [□ 93].
  - Module without GPE: Control bit "Activate grip force and position maintenance" must be equal to 0.

##### Parameterization

The parameter <ref\_type> (► 4.2 [□ 55]) can be used to parameterize the type of referencing routine.

**Finish**

Referencing is terminated by the following events:

- Referencing routine is successfully completed
- Setting the control bit "stop"
- The receipt of the control command is displayed by an immediate status change of the status bit "command received toggle". This confirmation occurs regardless of whether the control command is subsequently completed successfully or if it can be processed at all.
- Successful referencing is displayed by setting the status bit "referenced" and command successfully processed.

**Module feedback****Possible diagnostic events**

Events leading to warnings and/or errors are detected by the diagnostics. Below is a list of all possible diagnostic events.

| Diagnostic event                          | Diagnostic code *                  |
|-------------------------------------------|------------------------------------|
| Referencing is taking too long.           | ERR_REF_ABORT_TO                   |
| Sending an impermissible control command. | WRN_NOT_FEASIBLE + additional code |
| Movement terminated by user.              | ERR_FAST_STOP                      |

\* For further information, see chapter ▶ 6 [ 74].

**3.4.2 Zero point offset**

When using application-specific gripper fingers, the zero point can be "shifted" so that the displayed position values match the geometry of the gripper fingers. Moving the zero point automatically changes the values of the parameters <actual\_pos>, <min\_pos> and <max\_pos>.

**NOTE**

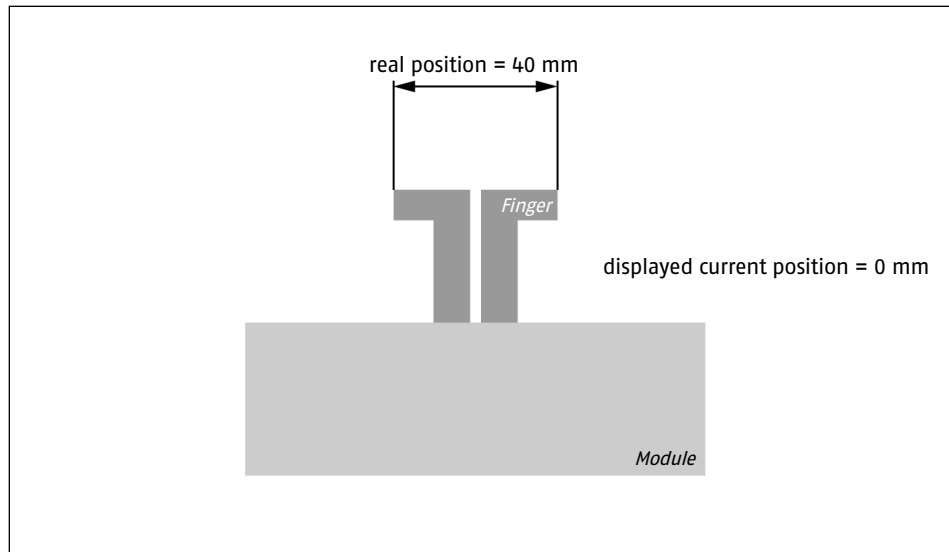
In the delivery state, the zero point corresponds to the minimum position of the base jaws, see ▶ 1.2.1 [ 6].

**Parameterization**

With the parameter <zero\_pos\_ofs> (▶ 4.2 [ 57]) the distance by which the zero point is shifted can be parameterized with a sign.

### Example: Zero point offset EGP40-IL-GKS

- Application:
  - Values of actual, minimum and maximum position **before** displacement.
    - actual\_pos = 0 mm
    - min\_pos = 0 mm
    - max\_pos = 13 mm
- The module is to be used for I.D. gripping with the gripper fingers shown.



Zero point offset

- Shifting of the zero point:
  - Write the value +40 mm in the parameter <zero\_pos\_ofs>.
  - Values of actual, minimum and maximum position **after** displacement.
    - actual\_pos = 40 mm
    - min\_pos = 40 mm
    - max\_pos = 53 mm

### 3.4.3 Handshake

#### Short description

If the module detects the input of a control command, it reports the input back to the control system.

#### Module feedback

The receipt of the control command is displayed by an immediate status change of the status bit "command received toggle".

### 3.4.4 Brake test

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Short description</b> | During the brake test, the module checks the holding force of the brake by applying a defined moment alternately in both directions against the applied brake.                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Trigger</b>           | <ul style="list-style-type: none"> <li>• The brake test is triggered by setting the control bit "brake test" (bit 30), ▶ 7.2 [93].</li> <li>• The module must be at a standstill and not holding any workpiece.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Module feedback</b>   | <ul style="list-style-type: none"> <li>• The receipt of the control command is displayed by an immediate status change of the status bit "command received toggle". This confirmation occurs regardless of whether the control command is subsequently completed successfully or if it can be processed at all.</li> <li>• A successfully performed brake test is displayed by setting the status bit "command successfully processed".</li> <li>• An unsuccessful brake test is indicated by setting the status bit "error" in conjunction with the diagnostic code ERR_BT_FAILED, ▶ 6.2 [77].</li> </ul> |

### 3.4.5 LifeSign

|                          |                                                                                                                                                                                                                                                                                                                |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Short description</b> | The acknowledge feature can be used to check communication between the control system and module. As soon as the command is triggered, the module reports the arrival of the control command back to the control system. If no feedback is received, it is assumed that there is a fault in the communication. |
| <b>Trigger</b>           | Acknowledgment is triggered by setting the control bit "acknowledge" (Bit 2), ▶ 7.2 [90].                                                                                                                                                                                                                      |
| <b>Module feedback</b>   | The receipt of the control command is displayed by an immediate status change of the status bit "command received toggle".                                                                                                                                                                                     |

### 3.4.6 Repeat control command with optimized time

#### Short description

This function makes it possible to send consecutive identical control commands to the module in a time-optimized manner.

#### NOTE

By default, control commands are sent to the module by 0 → 1 edges of individual control bits. If the same function is to be executed again, the corresponding control bit must first be reset and then set again.

#### Trigger

If the control bit is set, the time-optimized transmission of identical control commands is triggered by toggling the control bit "repeat command toggle".

### 3.4.7 Factory settings

#### Short description

The module can be reset from the error state to the factory settings using the software. This restores the default parameterization to that when the module was delivered. In addition, the diagnostic memory is deleted.

#### Trigger

Resetting to factory settings is initiated via the Mechatronic grippers (► 5.3 [67]) app.

The module must be restarted so that the parameterization is correctly adopted after the factory settings are established.

#### Module feedback

Successful resetting to factory settings is displayed by setting the status bit "'ready for shutdown'".

#### NOTE

It is mandatory to wait for this bit to be set before restarting or switching off the module.

#### Possible diagnostic events

Events leading to warnings and/or errors are detected by the diagnostics. Below is a list of all possible diagnostic events.

| Diagnostic event                              | Diagnostic code *                  |
|-----------------------------------------------|------------------------------------|
| Resetting to factory settings is not possible | WRN_NOT_FEASIBLE + additional code |

#### NOTICE

#### Material damage due to faulty usage!

After resetting to factory settings, application-specific parameters must be adjusted again. Failure to do so may result in damage to the module itself or to adjacent machine parts.

### 3.4.8 IO-Link system command "Application Reset"

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Short description</b> | <p>The module can execute the "Application Reset" IO-Link system command from the error state.</p> <ul style="list-style-type: none"> <li>• The parameterization of the delivery state is restored in the module and on the master.</li> <li>• The diagnostic memory is <i>not</i> deleted.</li> <li>• The following device-specific identification parameters remain unchanged: <ul style="list-style-type: none"> <li>– application-specific tag, ▶ 4.2 [ 64]</li> <li>– location tag, ▶ 4.2 [ 64]</li> <li>– function tag, ▶ 4.2 [ 64]</li> </ul> </li> </ul> |
| <b>Trigger</b>           | The "Application Reset" system command is triggered by acyclic writing of a value to an IO-Link parameter.                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

| Index  | Sub index | Value |
|--------|-----------|-------|
| 0x0002 | 0x0       | 0x81  |

|                                   |                                                                                                      |
|-----------------------------------|------------------------------------------------------------------------------------------------------|
| <b>Module feedback</b>            | The successful execution of the "Application Reset" command is displayed depending on the tool used. |
| <b>Possible diagnostic events</b> | Events that lead to warnings and/or errors are displayed depending on the tool used.                 |

### 3.4.9 IO-Link system command "Restore Factory Setting"

|                          |                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Short description</b> | <p>The module can execute the "Restore Factory Setting" IO-Link system command from the error state.</p> <ul style="list-style-type: none"> <li>• The parameterization of the delivery state is restored in the module.</li> <li>• The diagnostic memory is deleted.</li> <li>• Device-specific identification parameters are reset.</li> </ul> |
| <b>Trigger</b>           | The "Restore Factory Setting" system command is triggered by acyclic writing of a value to an IO-Link parameter.                                                                                                                                                                                                                                |

| Index  | Sub index | Value |
|--------|-----------|-------|
| 0x0002 | 0x0       | 0x82  |

|                                   |                                                                                                            |
|-----------------------------------|------------------------------------------------------------------------------------------------------------|
| <b>Module feedback</b>            | The successful execution of the "Restore Factory Setting" command is displayed depending on the tool used. |
| <b>Possible diagnostic events</b> | Events that lead to warnings and/or errors are displayed depending on the tool used.                       |

### 3.4.10 IO-Link system command "Back-to-Box"

#### Short description

The module can execute the "Back-to-Box" IO-Link system command from the error state.

- The parameterization of the delivery state is restored in the module.
- The diagnostic memory is deleted.
- Device-specific identification parameters are reset.
- The communication between module and master is terminated.

Then the module can be removed from the application.

#### Trigger

Execution of the "Back-to-Box" command is triggered by acyclic writing of a value to an IO-Link parameter.

| Index  | Sub index | Value |
|--------|-----------|-------|
| 0x0002 | 0x0       | 0x83  |

#### Module feedback

The successful execution of the "Back-to-Box" command is indicated by the termination of the IO-Link communication between the module and the master.

#### NOTE

It is possible to put the module back into operation by restarting it.

#### Possible diagnostic events

Events that lead to warnings and/or errors are displayed depending on the tool used.

## 4 System parameters

### 4.1 Value ranges

#### Value ranges

The following internal data types are used:

| Data type | Threshold  | Numerical values |
|-----------|------------|------------------|
| BOOL      | MIN_BOOL   | 0                |
|           | MAX_BOOL   | 1                |
| UINT8     | MIN_UINT8  | 0                |
|           | MAX_UINT8  | 255              |
| UINT16    | MIN_UINT16 | 0                |
|           | MAX_UINT16 | 65535            |
| UINT32    | MIN_UINT32 | 0                |
|           | MAX_UINT32 | 4294968295       |
| INT32     | MIN_INT32  | -2147483648      |
|           | MAX_INT32  | 2147483647       |
| FLOAT     | MIN_FLOAT  | -3.402823E+38    |
|           | MAX_FLOAT  | 3.402823E+38     |
| CHAR      | MIN_CHAR   | 0                |
|           | MAX_CHAR   | 255              |
| ENUM      | MIN_ENUM   | 0                |
|           | MAX_ENUM   | 255              |

### 4.2 Parameter list

In the following, all system-relevant parameters are listed according to the diagram "HEX-Code/DEC-Code <Parametername>"

#### NOTE

The parameter list refers to parameters that can be read out or written acyclically.

Some of the parameters listed here as "read only" can be changed in principle, but the user does not have the right to change these parameters.

All parameters that do not appear in this list are internal or reserved parameters.

#### Parameter configuration

All system parameters whereby the user has write permissions can be configured via acyclical data exchange.

**HEX 0x0118**  
**DEC 280**

#### **<err\_code>**

Short description: The existing error code can be read out with this parameter.

Parameter name: Error Code

Access rights: Read

Data type: ENUM

Enumeration: see chapter ► 6.2 [77]

**HEX 0x0120**  
**DEC 288**

#### **<wrn\_code>**

Short description: The existing warning code can be read out with this parameter.

Parameter name: Warning Code

Access rights: Read

Data type: ENUM

Enumeration: see chapter ► 6.1 [74]

**HEX 0x0128**  
**DEC 296**

#### **<sys\_msg\_req>**

Short description: With this parameter, an entry in the diagnostic memory can be selected for reading out via <sys\_msg\_buffer> by writing an index

Parameter name: Request system message

Access rights: Read and write

Data type: UINT16

---

#### **NOTE**

The 32 (index 0 – 31) most recent diagnostic events are stored in the diagnostic memory.

---

**HEX 0x0130**  
**DEC 304**

#### **<sys\_msg\_buffer>**

Short description: The requested diagnostic memory entry can be read out via this parameter.

Parameter name: System message buffer

Access rights: Read

Data type: CHAR[214]

Format: ASCII-String

**HEX 0x0230**  
**DEC 560**

#### **<actual\_pos>**

Short description: This parameter can be used to read out the current actual position.

Parameter name: Position

Access rights: Read

Data type: FLOAT

Unit: Millimeter [mm]

**HEX 0x0238**  
**DEC 568**

#### **<actual\_vel>**

Short description: This parameter can be used to read out the current actual speed.

Parameter name: Velocity

Access rights: Read

Data type: FLOAT

Unit: Millimeter per second [mm/s]

**HEX 0x0380**  
**DEC 896**

#### **<grp\_prehold\_time>**

Short description: This parameter can be used to read and write the time span for the re-gripping.

Parameter name: Grip prehold time

Access rights: Read and write

Data type: UINT16

Unit: Millisecond [ms]

Min; Max; Default 0; 5000; 0

**HEX 0x03A8**  
**DEC 936**

#### **<dead\_load\_kg>**

Short description: The mass of the module can be read out and written with this parameter.

Parameter name: Net mass of the gripper

Access rights: Read

Data type: FLOAT

Unit: Kilogram [kg]

**HEX 0x03B0**  
**DEC 944**

#### **<tool\_cent\_point>**

Short description: The tool center point (TCP) of the module can be read out and written with this parameter.

Parameter name: Tool center point 6D-frame

Access rights: Read

Data type: 6x FLOAT (24 byte)

Unit: x [mm], y [mm], z [mm], a [°], b [°], c [°]

**HEX 0x03B8**  
**DEC 952**

**<cent\_of\_mass>**

Short description: The center of mass and the mass moments of inertia of the module can be read out and written with this parameter.

Parameter name: Center of mass- 6D-frame

Access rights: Read

Data type: 6x FLOAT (24 byte)

Unit: x [mm], y [mm], z [mm], a [kg\*m<sup>2</sup>], b [kg\*m<sup>2</sup>], c [kg\*m<sup>2</sup>]

**HEX 0x0500**  
**DEC 1280**

**<module\_type>**

Short description: The module type can be read out with this parameter.

Parameter name: Modul type

Access rights: Read

Data type: ENUM

Enumeration: The enumeration value matching the module is read out.

**HEX 0x0528**  
**DEC 1320**

**<wp\_lost\_dst>**

Short description: This parameter can be used to set the traverse path from which a workpiece loss is detected.

Parameter name: Max. distance after workpiece lost

Access rights: Read and write

Data type: FLOAT

Unit: Millimeter [mm]

Min; Max; Default 0; 13; 0.5

**HEX 0x0540**  
**DEC 1344**

**<wp\_release\_delta>**

Short description: With this parameter the relative position delta between the gripping position and release position can be read out and written.

Parameter name: Workpiece release delta positione

Access rights: Read and write

Data type: FLOAT

Unit: Millimeter [mm]

Min; Max; Default 0.5; 13 ; 3

HEX 0x0580  
DEC 1408

#### <grp\_pos\_margin>

Short description: With this parameter the tolerance value of the workpiece position window can be read and written.

Parameter name: Margin for workpiece detection

Access rights: Read and write

Data type: FLOAT

Unit: Millimeter [mm]

Min; Max; Default 0.5; 13 ; 1

HEX 0x0588  
DEC 1416

#### <max\_phys\_stroke>

Short description: With this parameter the maximum physical stroke of the module without fingers can be read.

Parameter name: Max. physical stroke

Access rights: Read

Data type: FLOAT

Unit: Millimeter [mm]

---

#### NOTE

Maximum stroke: 13 mm

---

HEX 0x0590  
DEC 1424

#### <ref\_type>

Short description: With this parameter, the type of referencing routine can be configured.

Parameter name: Referencing type

Access rights: Read and write

Data type: ENUM

Enumeration: 0 = inward

1 = outward

---

#### NOTE

- *to inside:*  
Base jaws move inwards. Current position value after referencing = 0 mm.
  - *Out:*  
Base jaws are moved outwards. Current position value after referencing = 13 mm.
- ⇒ Any parameterized zero offset is taken into account at this point.
-

**HEX 0x05A8**  
**DEC 1448**

#### **<grp\_prepos\_delta>**

Short description: With this parameter the relative position delta between the pre-position and gripping position can be read out and written.

Parameter name: Gripping pre-position delta

Access rights: Read and write

Data type: FLOAT

Unit: Millimeter [mm]

Min; Max; Default 0.1; 13 ; 2

**HEX 0x0600**  
**DEC 1536**

#### **<min\_pos>**

Short description: The smallest position value that can be approached by the module can be read out and written with this parameter.

Parameter name: Min. absolut position

Access rights: Read and write

Data type: FLOAT

Unit: Millimeter [mm]

---

#### **NOTE**

- Values within the following limits can be written to this parameter:  

$$\text{<zero\_pos\_ofs>} \leq \text{Value} < \text{<max\_phys\_stroke>} + \text{<zero\_pos\_ofs>}$$
  - Furthermore, the value must be smaller than the value of the parameter <max\_pos>.
-

**HEX 0x0608**  
**DEC 1544**

### <max\_pos>

Short description: The largest position value that can be approached by the module can be read out and written with this parameter.

Parameter name: Max. absolut position

Access rights: Read and write

Data type: FLOAT

Unit: Millimeter [mm]

---

### NOTE

- Values within the following limits can be written to this parameter:  
 $\text{<zero\_pos\_ofs>} < Value \leq \text{<max\_phys\_stroke>} + \text{<zero\_pos\_ofs>}$
  - Furthermore, the value must be larger than the value of the parameter <min\_pos>.
- 

**HEX 0x0610**  
**DEC 1552**

### <zero\_pos\_ofs>

Short description: The zero point can be adapted to the application with this parameter.

Parameter name: Zero position Offset

Access rights: Read and write

Data type: FLOAT

Unit: Millimeter [mm]

Min; Max; Default -10000; 10000; 0

**HEX 0x0628**  
**DEC 1576**

### <min\_vel>

Short description: The minimum movement/gripping velocity with which the module can be moved can be read out with this parameter.

Parameter name: Min. velocity

Access rights: Read

Data type: FLOAT

Unit: Millimeter per second [mm/s]

---

### NOTE

The minimum movement/gripping speed is 15 mm/s.

---

**HEX 0x0630**  
**DEC 1584**

#### <max\_vel>

Short description: The maximum positioning speed with which the module can be moved can be read out with this parameter.

Parameter name: Max. velocity  
Access rights: Read  
Data type: FLOAT  
Unit: Millimeter per second [mm/s]

#### NOTE

- The minimum movement/gripping speed is 90 mm/s.

**HEX 0x0650**  
**DEC 1616**

#### <max\_grp\_vel>

Short description: The maximum gripping velocity with which the module can be moved can be read out with this parameter.

Parameter name: Max. grip velocity  
Access rights: Read  
Data type: FLOAT  
Unit: Millimeter per second [mm/s]

#### NOTE

- The minimum gripping speed is 82 mm/s.
- For more information on gripping speed, see the chapter [1.2.3 \[8\]](#).

**HEX 0x0658**  
**DEC 1624**

#### <min\_grp\_force>

Short description: The minimum gripping force can be read out with this parameter.

Parameter name: Min. grip force  
Access rights: Read  
Data type: FLOAT  
Unit: Newton [N]

**HEX 0x0660**  
**DEC 1632**

#### <max\_grp\_force>

Short description: The maximum gripping force can be read out with this parameter.

Parameter name: Max. grip force  
Access rights: Read  
Data type: FLOAT  
Unit: Newton [N]

**HEX 0x0800**  
**DEC 2048**

**<min\_err\_mot\_volt>**

Short description: With this parameter the lower exact error limit of the supply voltage of the motor can be read out.

Parameter name: Min. error motor voltage

Access rights: Read

Data type: FLOAT

Unit: Volt [V]

**HEX 0x0808**  
**DEC 2056**

**<max\_err\_mot\_volt>**

Short description: With this parameter the upper exact error limit of the supply voltage of the motor can be read out.

Parameter name: Max. error motor voltage

Access rights: Read

Data type: FLOAT

Unit: Volt [V]

**HEX 0x0810**  
**DEC 2064**

**<min\_err\_lgc\_volt>**

Short description: With this parameter the lower exact error limit of the supply voltage of the logic part can be read out.

Parameter name: Min. error logic voltage

Access rights: Read

Data type: FLOAT

Unit: Volt [V]

**HEX 0x0818**  
**DEC 2072**

**<max\_err\_lgc\_volt>**

Short description: With this parameter the upper exact error limit of the supply voltage of the logic part can be read out.

Parameter name: Max. error logic voltage

Access rights: Read

Data type: FLOAT

Unit: Volt [V]

**HEX 0x0820**  
**DEC 2080**

**<min\_err\_lgc\_temp>**

Short description: With this parameter the lower exact error limit of the temperature of the logic part can be read out.

Parameter name: Min. error logic voltage

Access rights: Read

Data type: FLOAT

Unit: Degrees Celsius [°C]

**HEX 0x0828**  
**DEC 2088**

**<max\_err\_lgc\_temp>**

Short description: With this parameter the upper exact error limit of the temperature of the logic part can be read out.

Parameter name: Max. error logic temperature

Access rights: Read

Data type: FLOAT

Unit: Degrees Celsius [°C]

**HEX 0x0840**  
**DEC 2112**

**<meas\_lgc\_temp>**

Short description: With this parameter the current measured temperature of the logic part can be read out.

Parameter name: Measured logic temperature

Access rights: Read

Data type: FLOAT

Unit: Degrees Celsius [°C]

**HEX 0x0870**  
**DEC 2160**

**<meas\_lgc\_volt>**

Short description: With this parameter the current measured supply voltage of the logic part can be read out.

Parameter name: Measured logic voltage

Access rights: Read

Data type: FLOAT

Unit: Volt [V]

**HEX 0x0878**  
**DEC 2168**

#### **<meas\_mot\_volt>**

Short description: With this parameter the current measured supply voltage of the motor can be read out.

Parameter name: Measured motor voltage

Access rights: Read

Data type: FLOAT

Unit: Volt [V]

**HEX 0x0880**  
**DEC 2176**

#### **<min\_wrn\_mot\_volt>**

Short description: With this parameter the lower exact warning limit of the supply voltage of the motor can be read out and written.

Parameter name: Min. warning motor voltage

Access rights: Read and write

Data type: FLOAT

Unit: Volt [V]

**HEX 0x0888**  
**DEC 2184**

#### **<max\_wrn\_mot\_volt>**

Short description: With this parameter the upper exact warning limit of the supply voltage of the motor can be read out and written.

Parameter name: Max. warning motor voltage

Access rights: Read and write

Data type: FLOAT

Unit: Volt [V]

**HEX 0x0890**  
**DEC 2192**

#### **<min\_wrn\_lgc\_volt>**

Short description: The lower warning limit of the supply voltage of the logic part can be read out and written with this parameter.

Parameter name: Min. warning logic voltage

Access rights: Read and write

Data type: FLOAT

Unit: Volt [V]

**HEX 0x0898**  
**DEC 2200**

#### **<max\_wrn\_lgc\_volt>**

Short description: The upper warning limit of the supply voltage of the logic part can be read out and written with this parameter.

Parameter name: Max. warning logic voltage

Access rights: Read and write

Data type: FLOAT

Unit: Volt [V]

**HEX 0x08A0**  
**DEC 2208**

**<min\_wrn\_lgc\_temp>**

Short description: The lower warning limit of the temperature of the logic part can be read out and written with this parameter.

Parameter name: Min. warning logic logic temperaturure

Access rights: Read

Data type: FLOAT

Unit: Degrees Celsius [°C]

**HEX 0x08A8**  
**DEC 2216**

**<max\_wrn\_lgc\_temp>**

Short description: The upper warning limit of the temperature of the logic part can be read out and written with this parameter.

Parameter name: Max. warning logic logic temperaturure

Access rights: Read

Data type: FLOAT

Unit: Degrees Celsius [°C]

**HEX 0x1000**  
**DEC 4096**

**<serial\_no\_txt>**

Short description: The serial number of the module can be read out with this parameter.

Parameter name: Device serial number

Access rights: Read

Data type: CHAR[16]

Format: ASCII-String

**HEX 0x1008**  
**DEC 4104**

**<order\_no\_txt>**

Short description: The order number of the module can be read out with this parameter.

Parameter name: Order number

Access rights: Read

Data type: CHAR[16]

Format: ASCII-String

**HEX 0x1020**  
**DEC 4128**

**<serial\_no\_num>**

Short description: The serial number of the module can be read out numerically with this parameter.

Parameter name: Device serial number encoded

Access rights: Read

Data type: UINT32

**HEX 0x1100**  
**DEC 4352**

**<fw\_app\_date>**

Short description: The creation date of the firmware version can be read out with this parameter.

Parameter name: Applikation firmware creation date

Access rights: Read

Data type: CHAR[12]

Format: ASCII-String

**HEX 0x1108**  
**DEC 4360**

**<fw\_app\_time>**

Short description: The creation time of the firmware version can be read out with this parameter.

Parameter name: Application firmware creation time

Access rights: Read

Data type: CHAR[9]

Format: ASCII-String

**HEX 0x1110**  
**DEC 4368**

**<fw\_app\_ver\_num>**

Short description: The version of the software can be read out as a number with this parameter.

Parameter name: Application firmware version short

Access rights: Read

Data type: UINT16

**HEX 0x1118**  
**DEC 4376**

**<fw\_app\_ver\_txt>**

Short description: The version of the software can be read out as a text with this parameter.

Parameter name: Application firmware version

Access rights: Read

Data type: CHAR[22]

Format: ASCII-String

**HEX 0x1138**  
**DEC 4408**

**<mac\_addr>**

Short description: The MAC address of the module can be read out with this parameter.

Parameter name: MAC adress

Access rights: Read

Data type: UINT8

Format: MAC

**HEX 0x1140**  
**DEC 4416**

**<iol\_product\_txt>**

Short description: The IO-Link product designation of the module can be read out with this parameter.

Parameter name: IO-Link product text

Access rights: Read

Data type: CHAR [64]

Format: ASCII-String

**HEX 0x1148**  
**DEC 4424**

**<iol\_app\_specific>**

Short description: The IO-Link user-specific name of the module can be read out and written with this parameter.

Parameter name: IO-Link application specific name

Access rights: Read and write

Data type: CHAR [32]

Format: ASCII-String

**HEX 0x1150**  
**DEC 4432**

**<iol\_function\_tag>**

Short description: The IO-Link function description of the module can be read out and written with this parameter.

Parameter name: IO-Link function tag

Access rights: Read and write

Data type: CHAR [32]

Format: ASCII-String

**HEX 0x1158**  
**DEC 4440**

**<iol\_location\_tag>**

Short description: The IO-Link location description of the module can be read out and written with this parameter.

Parameter name: IO-Link location tag

Access rights: Read and write

Data type: CHAR [32]

Format: ASCII-String

**HEX 0x1180**  
**DEC 4480**

**<fw\_bld\_ver\_txt>**

Short description: This parameter can be used to read out the version of the bootloader as text.

Parameter name: Bootloader firmware version

Access rights: Read

Data type: CHAR[22]

Format: ASCII-String

**HEX 0x1330**  
**DEC 4912**

**<enable\_softreset>**

Short description: The "Restart" function can be enabled with this parameter.

Parameter name: Enable software reboot

Access rights: Read and write

Data type: BOOL

Values: 0 = function switched off  
1 = function switched on

**HEX 0x1400**  
**DEC 5120**

**<system\_uptime>**

Short description: The operating time that has elapsed since the last (re)start of the module can be read out with this parameter.

Parameter name: System uptime

Access rights: Read

Data type: UINT32

Unit: Seconds [s]

**HEX 0x1460**  
**DEC 5216**

**<grip\_cmd\_count>**

Short description: The total number of triggered gripping commands can be read out with this parameter.

Parameter name: Counter of triggered gripping commands

Access rights: Read

Data type: UINT32

Unit: -

## 5 Start-up

### 5.1 Safety

Commissioning of the module may only be carried out by qualified personnel with programming and interface knowledge!



#### **⚠ WARNING**

##### **Risk of injury from crushing and impacts!**

Serious injury could occur during movement of the base jaw, due to breakage or loosening of the gripper fingers or if the workpiece is lost.

- Wear suitable protective equipment.
- Do not reach into the open mechanism or the movement area of the product.



#### **⚠ CAUTION**

##### **Risk of injury due to electromagnetic interference!**

Electromagnetic interference can cause malfunctions and lead to unexpected movements.

- Use electrical components, e.g. sensors, controllers, etc. according to EN 61000-5-7.

### 5.2 System integration

The communication protocol "SCHUNK Flexible Protocol" is available for operation within the plant.

For further information on communication, module functions and parameters, see the corresponding sections in this manual.

#### Overview

- The module is mounted and electrically connected. For more information, see Assembly and Operating Manual, ► 1.1 [5].
- 1. Activate logic and power supply.
  - ⇒ LED LOG and PWR light up green.
- 2. Connect the cables for communication.
  - ⇒ Communication is reported back by LED status indicator, Link LED.
- 3. Configure controller and module, ► 5.4 [69].
- 4. Determine the program sequence.

### 5.3 SCHUNK Control Center – Mechatronic Grippers app

The *Mechatronic grippers* application can be started via the SCHUNK Control Center. This app enables fast commissioning and parameterization of the module.

The software can be downloaded from [schunk.com/downloads-software](https://schunk.com/downloads-software).

#### Range of functions of the *Mechatronic grippers* app

- Configuration and commissioning:
  - Display of status information
  - Execution of gripping and movement commands
  - Changing the IP address
  - Display and save error messages
  - Executing firmware updates
  - Saving and reading configuration files
- Automatic and manual search for modules in the network
- Optical display of the connected module
- Configuration and control via computer possible
- Resetting to factory settings

#### Start software

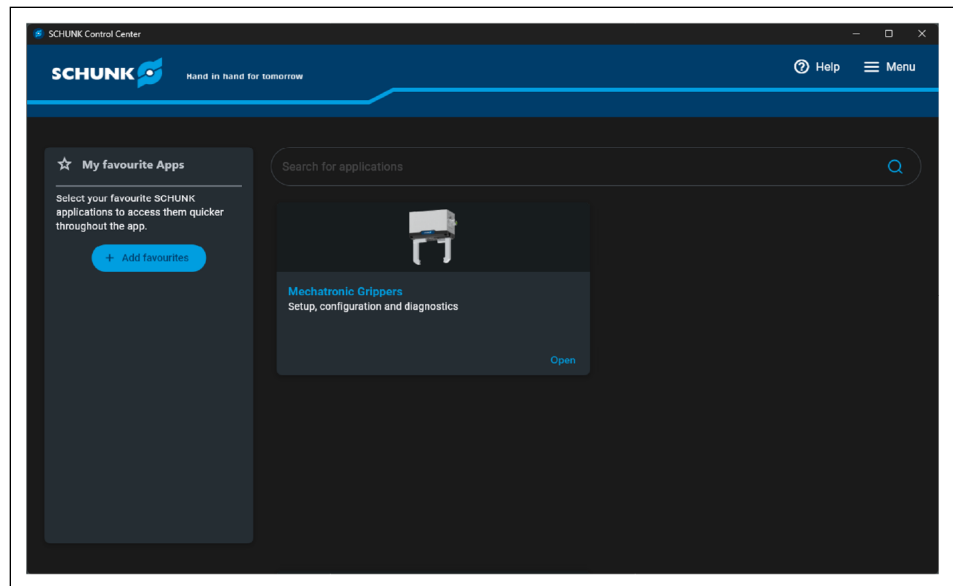
---

#### NOTE

In order to ensure the *Mechatronic Grippers* app communicates with the module via an Ethernet network, ensure that communication is not prevented by a firewall or any other network technology.

---

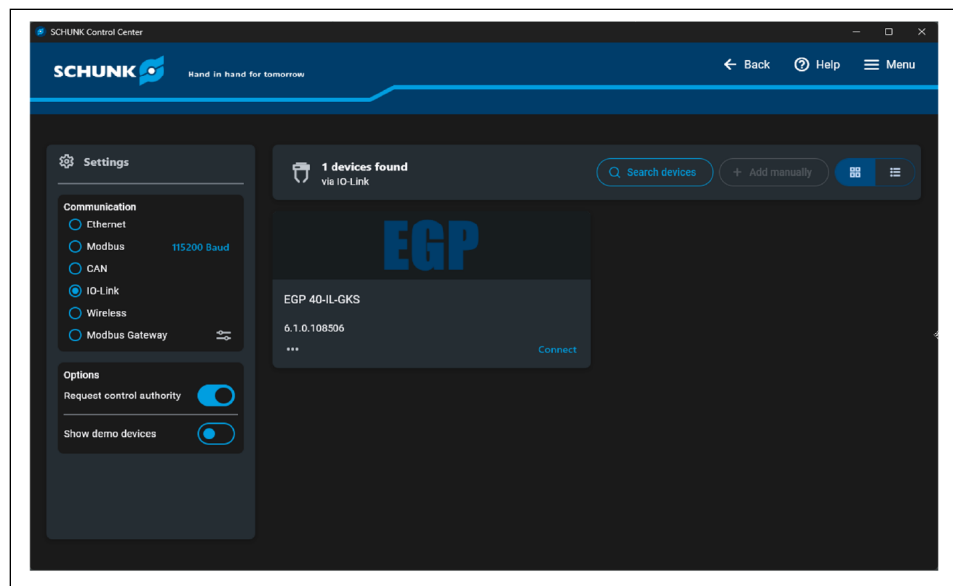
- The module is electrically connected to the power supply unit.
  - SCHUNK Control Center is installed.
1. Connect the computer directly to the module via Ethernet.  
OR:  
Connect the computer to the network in which the module is integrated.
  2. Open SCHUNK Control Center.  
⇒ The start screen is displayed.



Start screen

### 3. Select the *Mechatronic grippers* app.

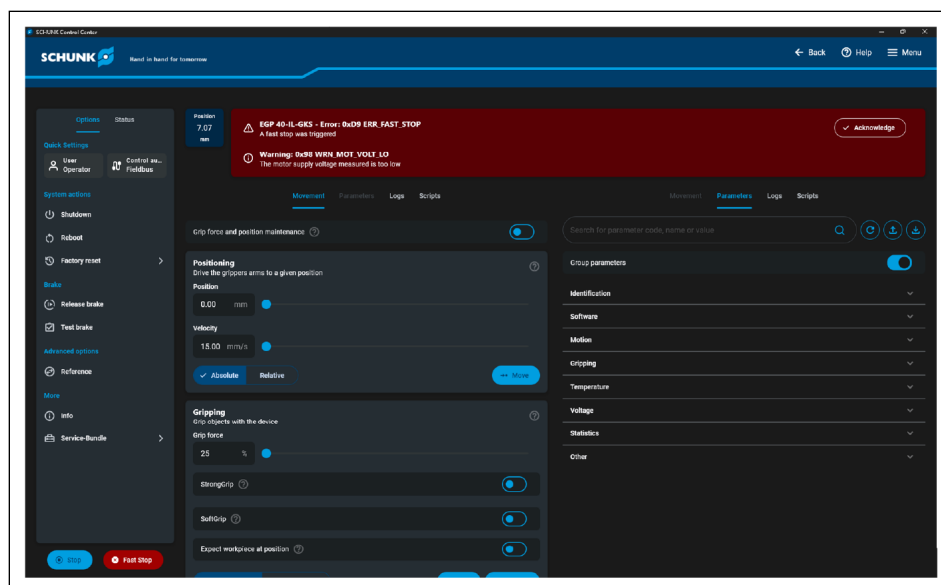
- ⇒ The system automatically searches for modules that are located in the network.
- ⇒ Modules found are displayed in the selection window of the communication interfaces.



Communication interfaces selection window

### 4. Select the desired module.

- ⇒ The app connects to the module.
- ⇒ Access to the functions of the module is possible.



Range of functions

## 5.4 Commissioning IO-Link

Modules with IO-Link interface are connected to a controller via an IO-Link master. For commissioning and parameterization on an IO-Link master, SCHUNK provides the associated IODD file.

The files can be downloaded at [schunk.com/downloads-software](https://www.schunk.com/downloads-software).

## 5.5 PLC function module for Allen Bradley controller in case of control with an IO-Link Master

Function modules serve as a tool for integrating the module into the sequence control.

The software can be downloaded from [schunk.com/downloads-software](https://www.schunk.com/downloads-software).

### 5.5.1 Module for cyclical communication with IO-Link master

#### Integrating the module

For information on integrating the function module, see <https://www.rockwellautomation.com>

Note: In the Rockwell software *Studio 5000 Logix Designer*® the block can be integrated under "Add-On Instruction".

The module processes the cyclic communication protocol of the module, ► 5.5.2 [ 70].

Input and output data are shown in the following graphic:

| EGU_EGK_IO_Link_Cyclic_Com 1_0_1       |                                  |                                         |
|----------------------------------------|----------------------------------|-----------------------------------------|
| EGU_EGK_IO_Link_Cyclic_Com 1_0_1       | EGU_EGK_IO_Link                  |                                         |
| b_in_RELEASE_FUNCTION_BLOCK            | 2#0000_0000                      | b_out_00_READY_FOR_OPERATION            |
| b_in_00_FAST_STOP                      | 2#0000_0000                      | b_out_01_CONTOL_AUTHORITY_FIELDBUS      |
| b_in_01_STOP                           | 2#0000_0000                      | b_out_02_READY_FOR_SHUTDOWN             |
| b_in_02_ACKNOWLEDGE                    | 2#0000_0000                      | b_out_03_NOT_FEASIBLE                   |
| b_in_03_PREPARE_FOR_SHUTDOWN           | 2#0000_0000                      | b_out_04_COMMAND_SUCCESSFULLY_PROCESSED |
| b_in_04_SOFTRESET                      | 2#0000_0000                      | b_out_05_COMMAND_RECEIVED_TOGGLE        |
| b_in_05_RELEASE_FOR_MANUAL_MOVEMENT    | 2#0000_0000                      | b_out_06_WARNING                        |
| b_in_06_REPEAT_COMMAND_TOGGLE          | 2#0000_0000                      | b_out_07_ERROR                          |
| b_in_07_GRIP_DIRECTION                 | 2#0000_0000                      | b_out_08_RELEASED_FOR_MANUAL_MOVEMENT   |
| b_in_08_JOG_MODE_NEGATIVE              | 2#0000_0000                      | b_out_09_SOFTWARE_LIMIT_REACHED         |
| b_in_09_JOG_MODE_POSITIVE              | 2#0000_0000                      | b_out_11_NO_WORKPIECE_DETECTED          |
| b_in_11_RELEASE_WORKPIECE              | 2#0000_0000                      | b_out_12_WORKPIECE_GRIPPED              |
| b_in_12_GRIP_WORKPIECE                 | 2#0000_0000                      | b_out_13_POSITION_REACHED               |
| b_in_13_MOVE_TO_ABSOLUTE_POSITION      | 2#0000_0000                      | b_out_14_WORKPIECE_PRE_GRIP_STARTED     |
| b_in_14_MOVE_TO_RELATIVE_POSITION      | 2#0000_0000                      | b_out_16_WORKPIECE_LOST                 |
| b_in_16_GRIP_WORKPIECE_AT_EXPECTED_POS | 2#0000_0000                      | b_out_17_WRONG_WORKPIECE_DETECTED       |
| b_in_30_BRAKE_TEST                     | 2#0000_0000                      | b_out_31_GRIP_FORCE_AND_POS_MAINTAINANC |
| b_in_31_ACTIVATE_GRIP_FORCE_AND_POS_MA | 2#0000_0000                      |                                         |
| di_in_POSITION                         | 0#                               |                                         |
| di_in_VELOCITY                         | 0#                               |                                         |
| di_in_GRIPPING_FORCE                   | 0#                               |                                         |
| di_out_ACTUAL_POSITION                 | 0#                               |                                         |
| si_out_DIAGNOSIS_ERROR                 | 0#                               |                                         |
| si_out_DIAGNOSIS_WARNING               | 0#                               |                                         |
| in_PROZESS_DATA_IO_Link_Gripper        | EGU_70_IO_Link_A1.ProcessDataIn  |                                         |
| out_PROZESS_DATA_IO_Link_Gripper       | EGU_70_IO_Link_A0.ProcessDataOut |                                         |

Input and output data for cyclic communication

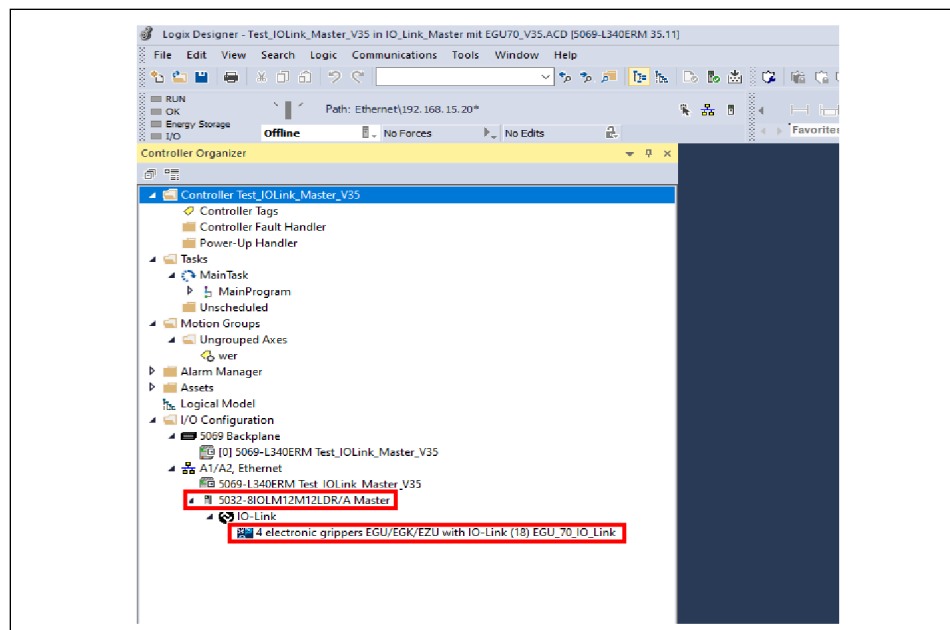
### 5.5.2 Acyclical communication with IO-Link master

The following describes how acyclical communication with an Allen Bradley controller Allen Bradley 5069-L340ERM CompactLogix 5380 takes place with an IO-Link master Allen Bradley 5032-8IOLMxxxxx .

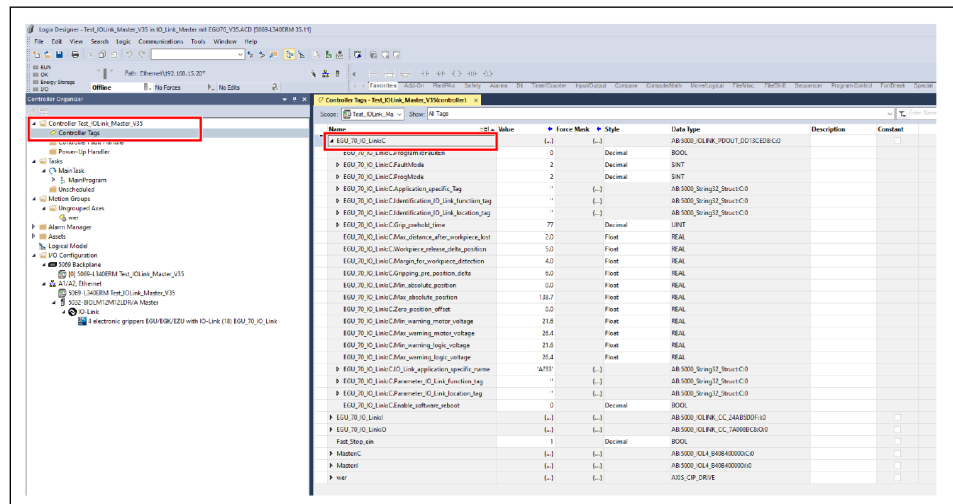
The following example shows how acyclical parameters for the operation of the module are transferred without endangering the failure of the running program.

#### Example

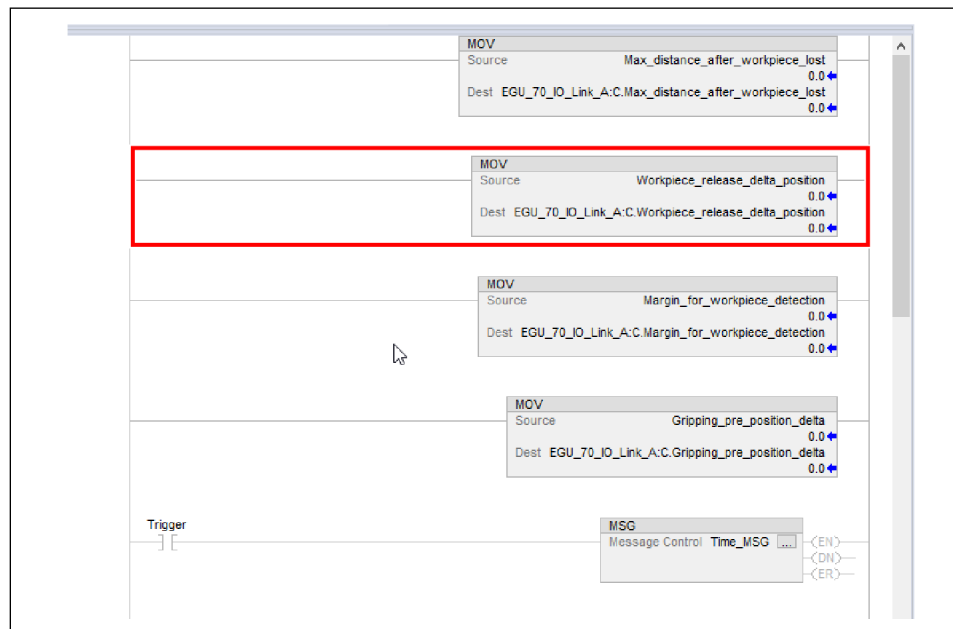
1. Set up the hardware: Integrate the IO-Link master and import the IODD of the module.
2. Configure the module to a port of the IO-Link master.



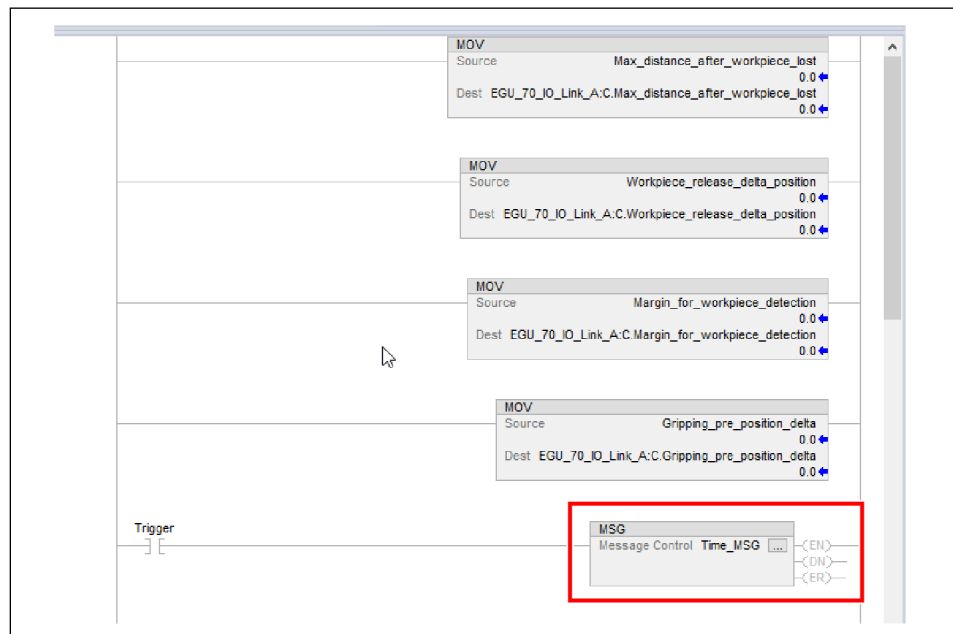
- ⇒ A list of the module's configuration data appears in "Controller Tags" (in the example here: *EGU\_70\_IO\_Link:C*).



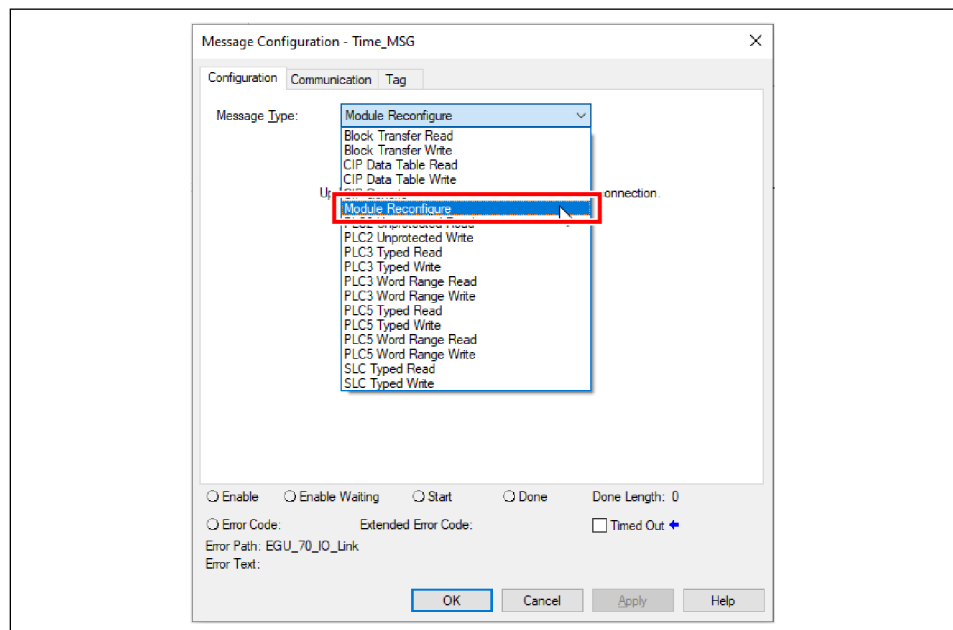
3. It is now possible to write to the variables using the Move command, for example.



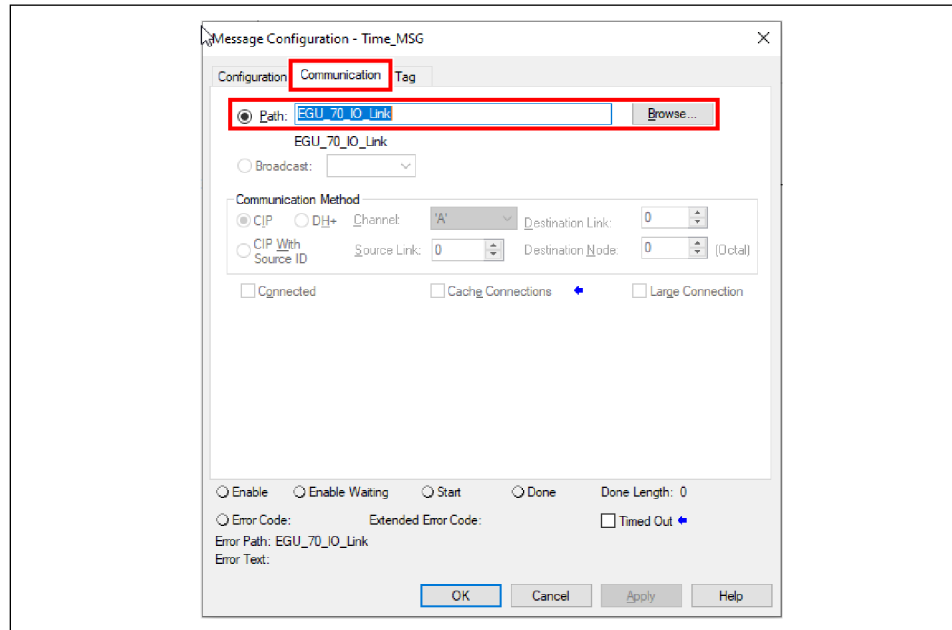
#### 4. Select MSG Box (Message Box).



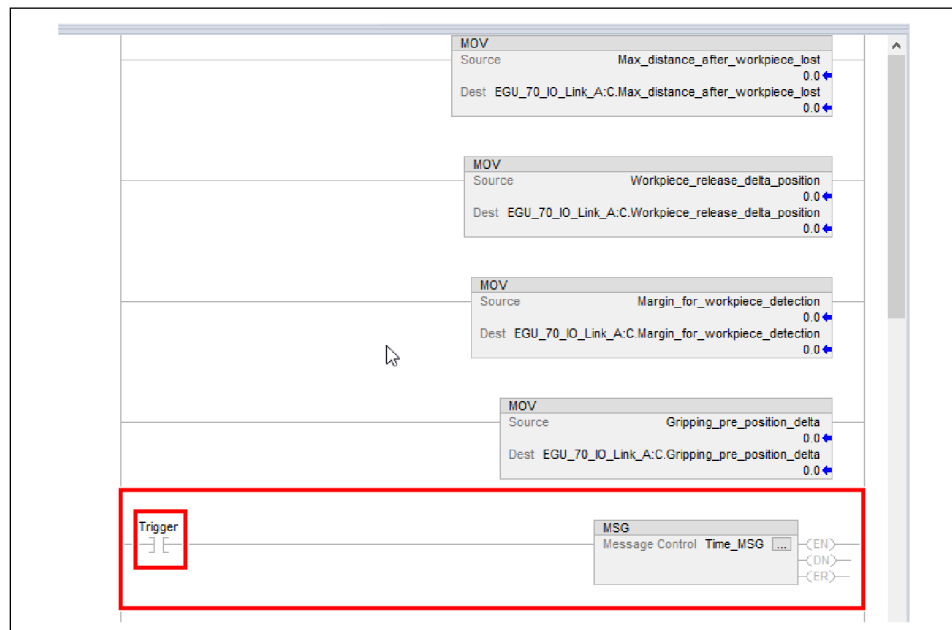
#### 5. Configure MSG Box: Select "Module Reconfigure" message type. With this type, data can be written directly to the module.



6. Select module. To do this, select the "Communication" > "Browse" tab.



7. Trigger the trigger bit of the MSG box to transfer the data.



- ⇒ A response is issued at output "DN" (Done) if data transfer was successful.
- ⇒ Acyclical communication between the module and the IO-Link master stops.

## 6 Diagnostics

The diagnostics are used to monitor the system and respond to detected diagnostic events by generating the appropriate diagnostic codes. The diagnostics of the module run permanently in the background.

### Diagnostic events

Diagnostic events are subdivided into warning and error events. Information about diagnostic events that have occurred is transmitted in the cyclical input data.

### 6.1 Warnings

If the diagnostics detect that a warning event has occurred, the module enters a warning state. A warning code is generated and transmitted cyclically. The issue related to a warning is displayed by setting the status bit "warning".

---

#### NOTE

- If more than one warning is present, the last occurring warning code is transmitted cyclically.
  - If there is a warning that is not listed below, contact SCHUNK Service.
- 

### Warning state

In a warning state, the module remains ready for operation but may be operated at the limit of the error state.

### Warning code

Each detectable warning event includes a unique warning code that is transmitted in the cyclical input data.

### Acknowledging

Warnings are both acknowledgeable and self-acknowledging. By setting the control bit "acknowledge" (Bit 2) the acknowledgment of an existing warning is triggered, ▶ 7.2 [ 90].

If the cause of the warning event no longer exists at that time, the warning is acknowledged. If the cause of the warning event still exists, the warning cannot be acknowledged at that time and remains active. If the module detects that the cause of an existing warning event no longer exists, this warning is automatically acknowledged.

### Recognizable warning events

Listed below are all warning events and their associated warning codes that can be detected by the module.

#### HEX 0x90 / DEC 144

#### WRN\_LGC\_TEMP\_LO

#### WARNING\_LOGIC\_TEMP\_LOW

Diagnostic event:    The logic temperature measured is too low.  
 Ability to            self-acknowledging  
 acknowledge:

**HEX 0x91 / DEC 145****WRN\_LGC\_TEMP\_HI****WARNING\_LOGIC\_TEMP\_HIGH**

Diagnostic event: The logic temperature measured is too high.  
 Ability to self-acknowledging  
 acknowledge:

**HEX 0x94 / DEC 148****WRN\_NOT\_FEASIBLE****WARNING\_CMD\_NOT\_FEASIBLE**

Diagnostic event: The control command sent to the module is not feasible.  
 Ability to acknowledgeable/self-acknowledging  
 acknowledge:

---

**NOTE**

- Further information on the cause of this warning is stored in the diagnostic memory. Read out diagnostic memory, see parameters <sys\_msg\_req> (► 4.2 [□ 52]).
  - If this warning is displayed, the reason for the non-feasibility can be read out via the cyclic data, ► 2.1.1 [□ 11]. The list of causes can be found in the attachment to this document, ► 7.4 [□ 96].
- 

**HEX 0x95 / DEC 149****WRN\_POS\_LIMIT****WARNING\_POSITION\_LIMIT\_REACHED**

Diagnostic event: The movement during jog mode was automatically terminated by reaching the minimum or maximum position.  
 Ability to self-acknowledging  
 acknowledge:

**HEX 0x96 / DEC 150****WRN\_LGC\_VOLT\_LO****WARNING\_LOGIC\_VOLTAGE\_LOW**

Diagnostic event: The logic supply voltage measured is too low.  
 Ability to self-acknowledging  
 acknowledge:

**HEX 0x97 / DEC 151****WRN\_LGC\_VOLT\_HI****WARNING\_LOGIC\_VOLTAGE\_HIGH**

Diagnostic event: The logic supply voltage measured is too high.  
 Ability to self-acknowledging  
 acknowledge:

**HEX 0x98 / DEC 152**

**WRN\_MOT\_VOLT\_LO**

**WARNING\_MOTOR\_VOLTAGE\_LOW**

Diagnostic event: The motor supply voltage measured is too low.

Ability to self-acknowledging  
acknowledge:

**HEX 0x99 / DEC 153**

**WRN\_MOT\_VOLT\_HI**

**WARNING\_MOTOR\_VOLTAGE\_HIGH**

Diagnostic event: The motor supply voltage measured is too high.

Ability to self-acknowledging  
acknowledge:

**HEX 0x9F / DEC 159**

**WRN\_SD\_NOT\_PREP**

**WARNING\_SHUTDOWN\_NOT\_PREPARED**

Diagnostic event: The module was not requested to be switched off before the supply voltage was disconnected.

Ability to self-acknowledging  
acknowledge:

## 6.2 Error

If the diagnostics detect that a warning event has occurred, the module enters an error state. An error code is generated and transmitted cyclically. The issue related to an error is displayed by setting the status bit "error".

---

### NOTE

- If more than one error is present, the last occurring error code is transmitted.
  - If there is an error that is not listed below, contact SCHUNK Service.
- 

#### Error state

In an error state, the module is not longer ready for operation. By changing to the error state, the module is forced into a standstill.

For modules with GPE: the GPE is activated.

#### Error code

Each detectable error event includes a unique error code that is transmitted in the cyclical input data.

#### Acknowledging

Errors can be separated into those requiring acknowledgment and errors that are non-acknowledgeable.

**Errors requiring acknowledgment:** By setting the control bit "acknowledge", the acknowledgment of an error requiring acknowledgment is triggered.

If the cause of the error event no longer exists at that time, the error is acknowledged. If the cause of the error event still exists, the error cannot be acknowledged at that time and remains active.

**Non-acknowledgeable errors:** If a serious error occurs, the module may become damaged or destroyed if restarted. The error state cannot be exited. In cases such as this, contact SCHUNK Service.

#### Recognizable error events

Listed below are all error events and their associated error codes that can be detected by the module.

#### HEX 0x28 / DEC 040

##### ERR\_BT\_FAILED

##### ERROR\_BRAKE\_TEST\_FAILED

Diagnostic event: The brake test was performed unsuccessfully.  
 Ability to requiring acknowledgment  
 acknowledge:

**HEX 0x70 / DEC 112****ERR\_LGC\_TEMP\_LO****ERROR\_LOGIC\_TEMP\_LOW**

Diagnostic event: The logic temperature measured is too low.  
 Ability to requiring acknowledgment  
 acknowledge:

**HEX 0x71 / DEC 113****ERR\_LGC\_TEMP\_HI****ERROR\_LOGIC\_TEMP\_HIGH**

Diagnostic event: The logic temperature measured is too high.  
 Ability to requiring acknowledgment  
 acknowledge:

**HEX 0x72 / DEC 114****ERR\_LGC\_VOLT\_LO****ERROR\_LOGIC\_VOLTAGE\_LOW**

Diagnostic event: The logic supply voltage measured is too low.  
 Ability to requiring acknowledgment  
 acknowledge:

**HEX 0x73 / DEC 115****ERR\_LGC\_VOLT\_HI****ERROR\_LOGIC\_VOLTAGE\_HIGH**

Diagnostic event: The logic supply voltage measured is too high.  
 Ability to requiring acknowledgment  
 acknowledge:

**HEX 0x74 / DEC 116****ERR\_MOT\_VOLT\_LO****ERROR\_MOTOR\_VOLTAGE\_LOW**

Diagnostic event: The motor supply voltage measured is too low.  
 Ability to requiring acknowledgment  
 acknowledge:

---

**NOTE**

For modules *with* GPE: As long as GPE is activated, this error is *not* monitored.

For modules *without* GPE: Monitoring of this error is permanently active.

---

HEX 0x75 / DEC 117

**ERR\_MOT\_VOLT\_HI****ERROR\_MOTOR\_VOLTAGE\_HIGH**

Diagnostic event: The motor supply voltage measured is too high.  
 Ability to requiring acknowledgment  
 acknowledge:

**NOTE**

For modules *with* GPE: As long as GPE is activated, this error is *not* monitored.

For modules *without* GPE: Monitoring of this error is permanently active.

HEX 0xD5 / DEC 213

**ERR\_SOFT\_LOW****ERROR\_SOFT\_LOW**

Diagnostic event: The lower software limit has been reached or exceeded.  
 Ability to requiring acknowledgment  
 acknowledge:

HEX 0xD6 / DEC 214

**ERR\_SOFT\_HIGH****ERROR\_SOFT\_HIGH**

Diagnostic event: The upper software limit has been reached or exceeded.  
 Ability to requiring acknowledgment  
 acknowledge:

HEX 0xD9 / DEC 217

**ERR\_FAST\_STOP****ERROR\_FAST\_STOP**

Diagnostic event: A fast stop was triggered.  
 Ability to requiring acknowledgment  
 acknowledge:

HEX 0xE4 / DEC 228

**ERR\_TOO\_FAST****ERROR\_TOO\_FAST**

Diagnostic event: The maximum permissible speed was exceeded by a factor of 1.2.  
 Ability to requiring acknowledgment  
 acknowledge:

**HEX 0xEF / DEC 239****ERR\_COMM\_LOST****ERROR\_COMMUNICATION\_LOST**

Diagnostic event: The communication link between the module and the receiver (controller or *Mechatronic Grippers* app ► 5.3 [67]) has been interrupted.

Ability to acknowledge: requiring acknowledgment

**HEX 0xF0 / DEC 240****ERR\_REF\_ABORT\_TO****ERROR\_REFERENCE\_ABORT\_TIMEOUT**

Diagnostic event: Referencing could not be performed within the expected period of time.

Ability to acknowledge: requiring acknowledgment

**HEX 0xF1 / DEC 241****ERR\_MOV\_ABORT\_TO****ERROR\_MOVE\_ABORT\_TIMEOUT**

Diagnostic event: Positioning could not be performed within the expected period of time.

Ability to acknowledge: requiring acknowledgment

**HEX 0xF2 / DEC 242****ERR\_NO\_REF****ERROR\_NO\_REFERENCE**

Diagnostic event: The module is not referenced and should execute a movement.

Ability to acknowledge: requiring acknowledgment

**HEX 0xF4 / DEC 244****ERR\_MOVE\_BLOCKED****ERROR\_MOVE\_BLOCKED**

Diagnostic event: The drive was blocked.

Ability to acknowledge: requiring acknowledgment

## 7 Appendix

### 7.1 Application examples

The following application examples describe the operation and behavior of the module.

#### NOTE

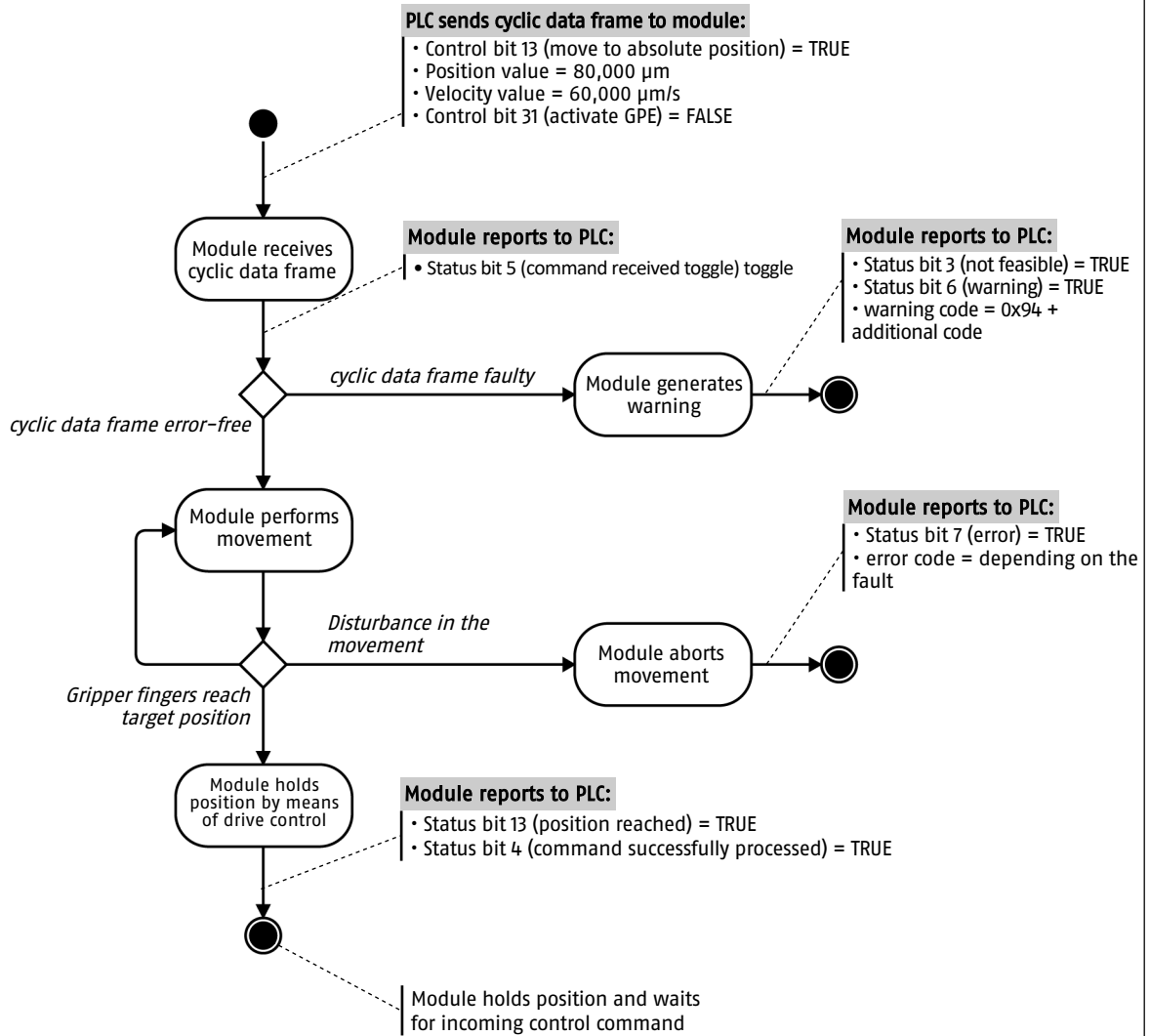
Due to the sometimes significant deviations between the modules, it is possible that the application examples described here may lead to different results for a specific module. For example, not every module is able to move to the absolute position 80 mm. However, this does not change the basic statements of the application examples.

| Scenario description                                                                                                                                                                    | Example                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| An absolute position movement is carried out.                                                                                                                                           | ► <a href="#">Example 1 [ 82]</a> |
| A relative position movement is carried out.                                                                                                                                            | ► <a href="#">Example 2 [ 83]</a> |
| A workpiece is gripped: <ul style="list-style-type: none"> <li>• without re-gripping</li> <li>• Workpiece holding by drive control</li> </ul>                                           | ► <a href="#">Example 3 [ 84]</a> |
| A workpiece is gripped: <ul style="list-style-type: none"> <li>• with re-gripping</li> <li>• Workpiece holding by GPE</li> </ul>                                                        | ► <a href="#">Example 4 [ 85]</a> |
| A workpiece is gripped in SoftGrip mode: <ul style="list-style-type: none"> <li>• with re-gripping</li> <li>• Workpiece holding by drive control</li> </ul>                             | ► <a href="#">Example 5 [ 86]</a> |
| A workpiece is gripped at the expected position: <ul style="list-style-type: none"> <li>• without re-gripping</li> <li>• Workpiece holding by GPE</li> </ul>                            | ► <a href="#">Example 6 [ 87]</a> |
| A workpiece is gripped at the expected position: <ul style="list-style-type: none"> <li>• with re-gripping</li> <li>• Workpiece holding by drive control</li> </ul>                     | ► <a href="#">Example 7 [ 88]</a> |
| A workpiece is gripped at the expected position in SoftGrip mode: <ul style="list-style-type: none"> <li>• without re-gripping</li> <li>• Workpiece holding by drive control</li> </ul> | ► <a href="#">Example 8 [ 89]</a> |

## EXAMPLE 1 Absolute positioning movement

### Application example – move to absolute position

- Movement to absolute position 80 mm
- Maximum permissible velocity of movement 60 mm/s
- Position holding by drive control prerequisites:
- Status bit 0 (ready for operation) = TRUE
- no movement of the gripper fingers

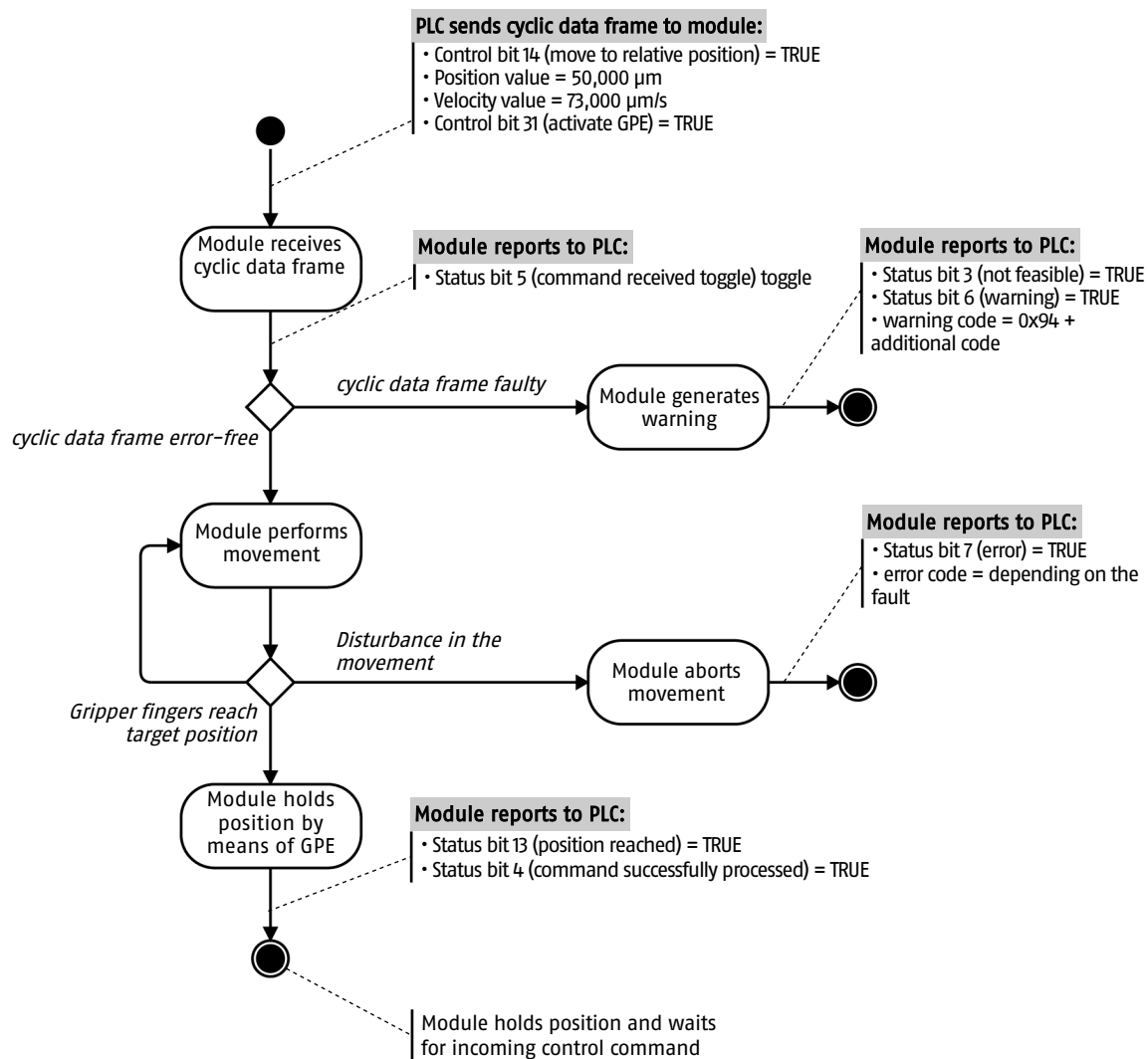


For further information, see chapter ► 3.2.2 [25].

## EXAMPLE 2 Relative positioning movement

### Application example – move to relative position

- Movement from current position –50 mm
- Maximum permissible velocity of movement 73 mm/s
- Position holding by GPE prerequisites:
- Status bit 0 (ready for operation) = TRUE
- no movement of the gripper fingers



For further information, see chapter ▶ 3.2.3 [27].

### EXAMPLE 3 Workpiece gripping (1)

#### Application example – grip workpiece

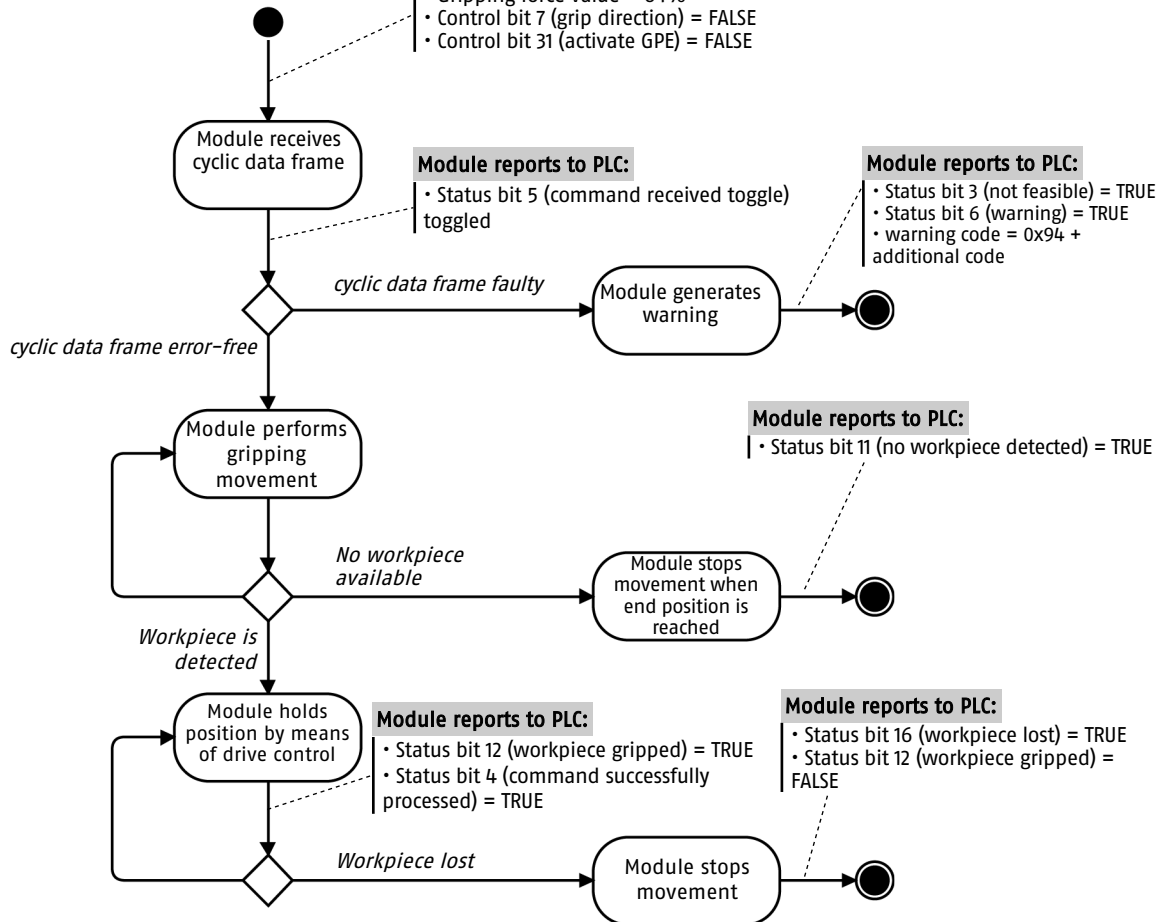
- Grip workpiece with 64% gripping force
- Grip workpiece from the outside
- without re-gripping
- Workpiece holding by drive control prerequisites:
- Status bit 0 (ready for operation) = TRUE
- no movement of the gripper fingers

#### Parameterization of the module:

- `grp_prehold_time` = 0 ms

#### PLC sends cyclic data frame to module:

- Control bit 12 (grip workpiece) = TRUE
- Velocity value must be equal to 0  $\mu\text{m/s}$
- Gripping force value = 64%
- Control bit 7 (grip direction) = FALSE
- Control bit 31 (activate GPE) = FALSE



For further information, see chapter ► 3.3.1 [ 30].

## EXAMPLE 4 Workpiece gripping (2)

### Application example – grip workpiece

- Grip workpiece with 78% gripping force
  - Grip workpiece from the inside
  - with re-gripping
  - Workpiece holding by GPE
- prerequisites:
- Status bit 0 (ready for operation) = TRUE
  - no movement of the gripper fingers

### Parameterization of the module:

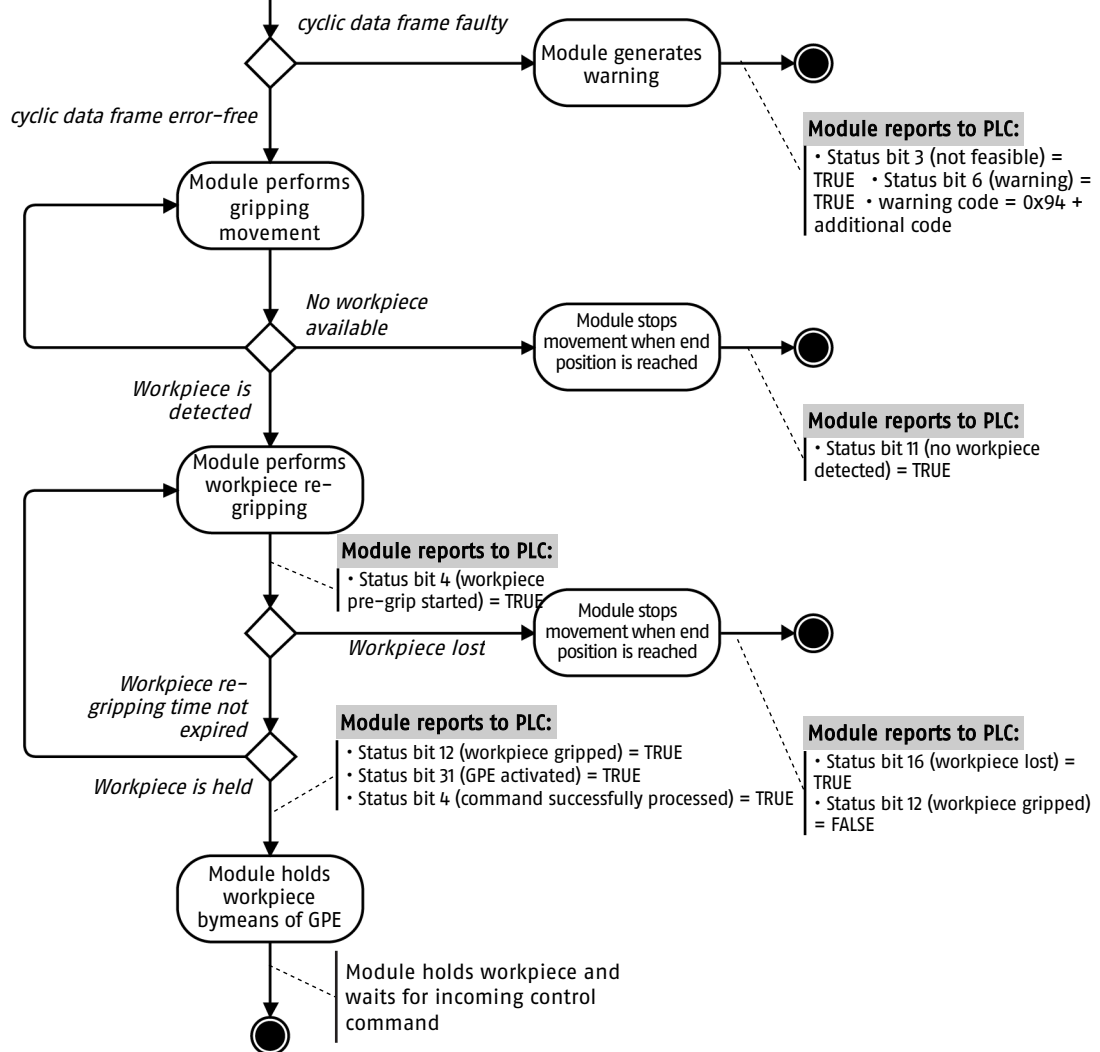
- grp\_prehold\_time = 5000 ms

### PLC sends cyclic data frame to module:

- Control bit 12 (grip workpiece) = TRUE
- Velocity value must be equal to 0 µm/s
- Gripping force value = 78%
- Control bit 7 (grip direction) = FALSE
- Control bit 31 (activate GPE) = FALSE

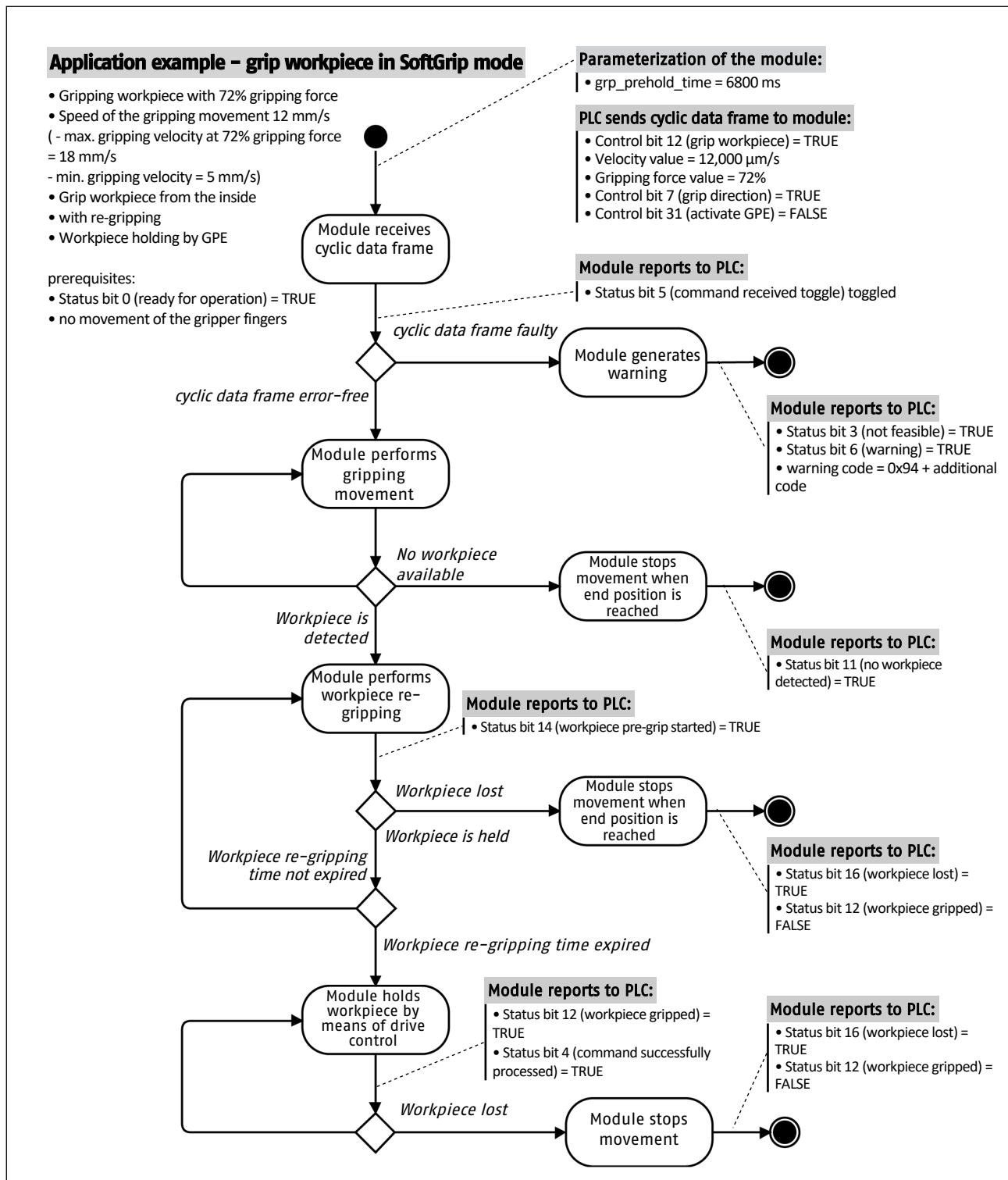
### Module reports to PLC:

- Status bit 5 (command received toggle) toggled



For further information, see chapter ▶ 3.3.1 [30].

## EXAMPLE 5 Workpiece gripping in SoftGrip mode



For further information, see chapter ▶ 3.3.1 [ 30 ].

## EXAMPLE 6

## Workpiece gripping at expected position (1)

## Application example – grip workpiece at expected position

- Grip workpiece with 91% gripping force
- Workpiece size is 38 mm
- Grip workpiece from the outside
- without re-gripping
- Workpiece holding by GPE prerequisites:
- Status bit 0 (ready for operation) = TRUE
- no movement of the gripper fingers

## Parameterization of the module:

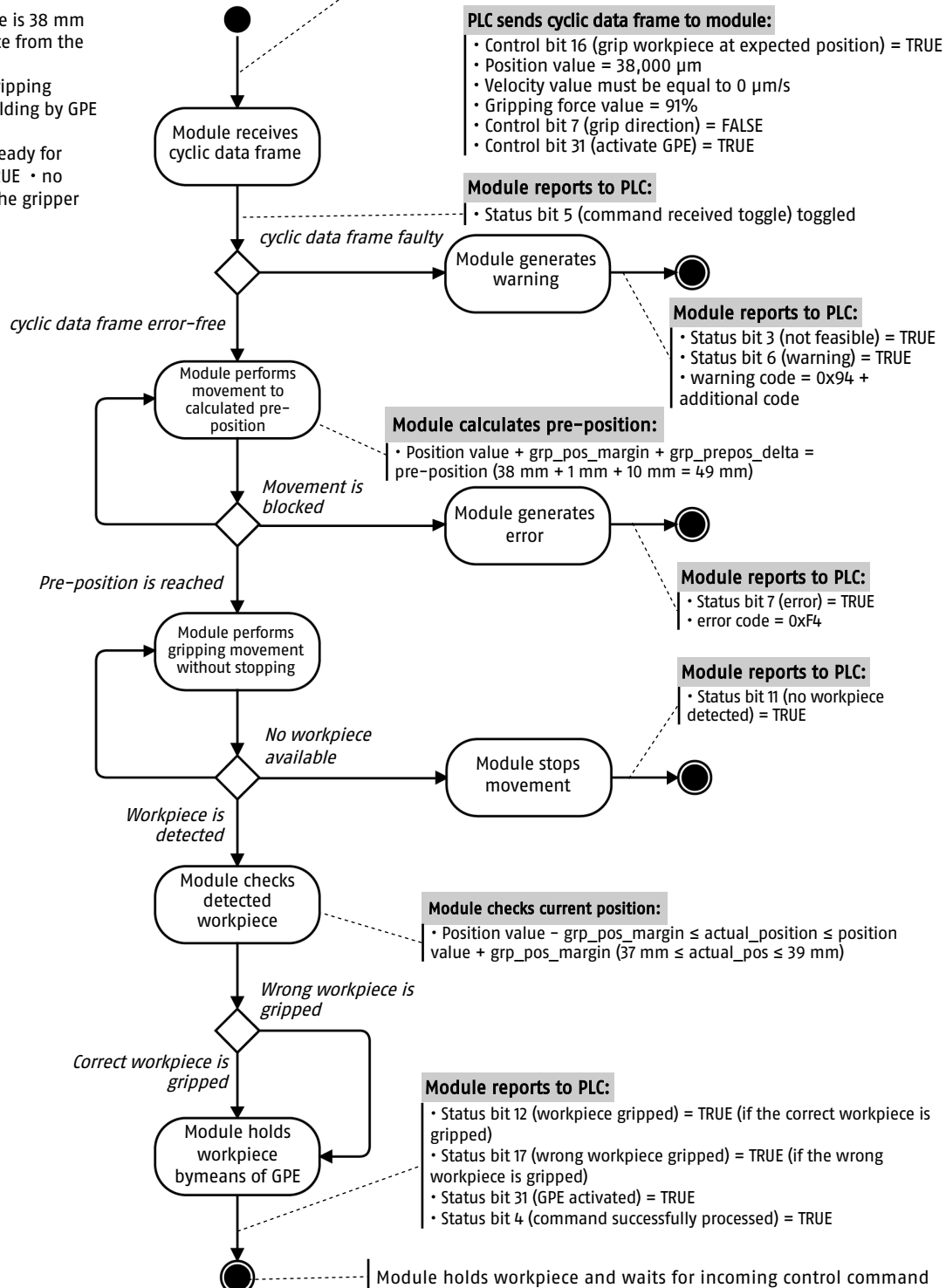
- grp\_prehold\_time = 0 ms
- grp\_prepos\_delta = 10 mm
- grp\_pos\_margin = 1 mm

## PLC sends cyclic data frame to module:

- Control bit 16 (grip workpiece at expected position) = TRUE
- Position value = 38,000  $\mu\text{m}$
- Velocity value must be equal to 0  $\mu\text{m/s}$
- Gripping force value = 91%
- Control bit 7 (grip direction) = FALSE
- Control bit 31 (activate GPE) = TRUE

## Module reports to PLC:

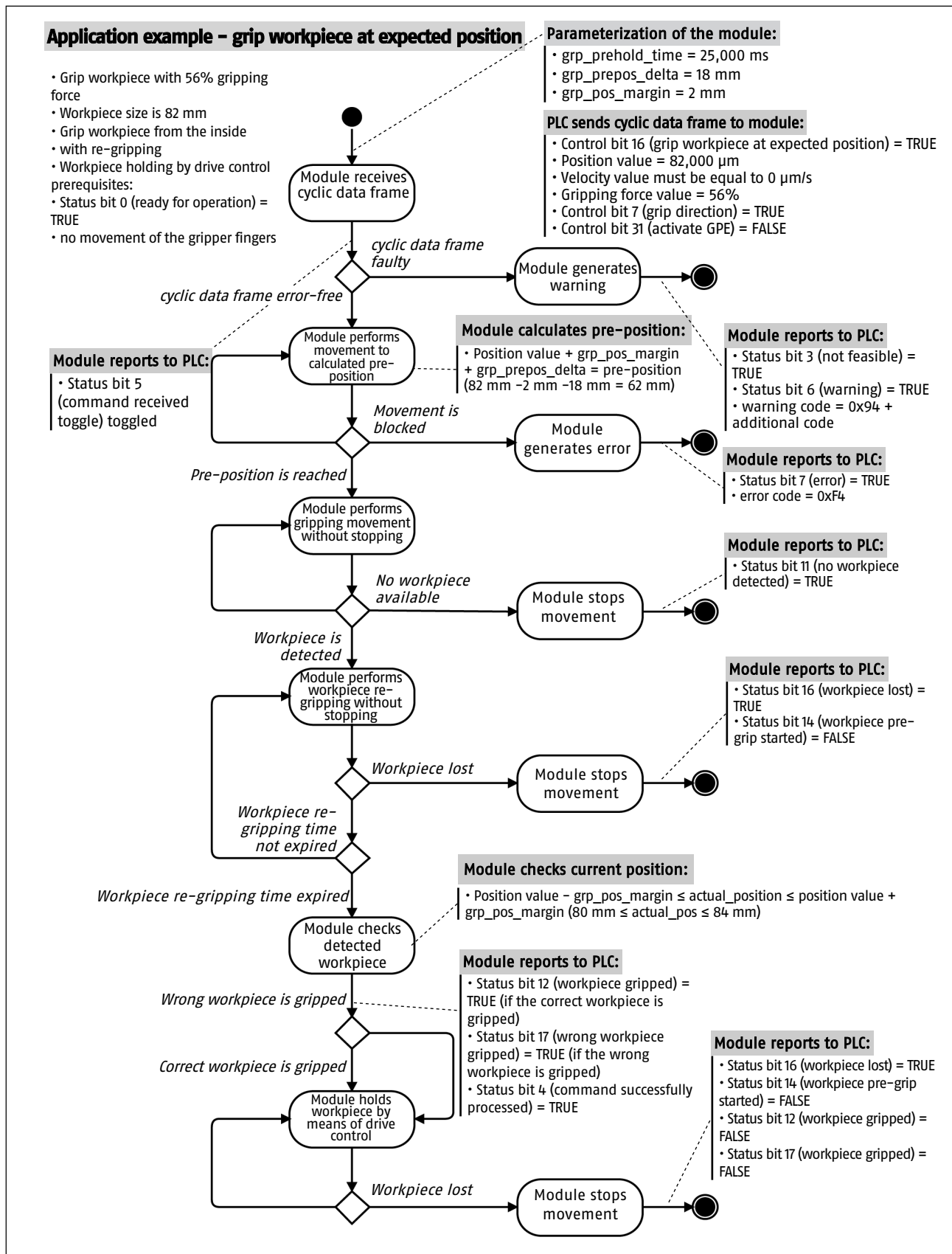
- Status bit 5 (command received toggle) toggled



For further information, see chapter ▶ 3.3.2 [ 32 ].

## EXAMPLE 7

## Workpiece gripping at expected position (2)



For further information, see chapter [3.3.2 \[32\]](#).

## EXAMPLE 8

## Workpiece gripping at expected position in SoftGrip mode

**Application example – grip workpiece at expected position in SoftGrip mode**

- Grip workpiece with 52% gripping force
  - Workpiece size is 43 mm
  - Velocity of the gripping movement 8 mm/s
- Info:
- max. gripping velocity at 52% gripping force = 13 mm/s
  - min. gripping velocity = 5 mm/s
  - Grip workpiece from the outside
  - without re-gripping
  - Workpiece holding by drive control

- prerequisites:
- Status bit 0 (ready for operation) = TRUE
  - no movement of the gripper fingers

**Parameterization of the module:**

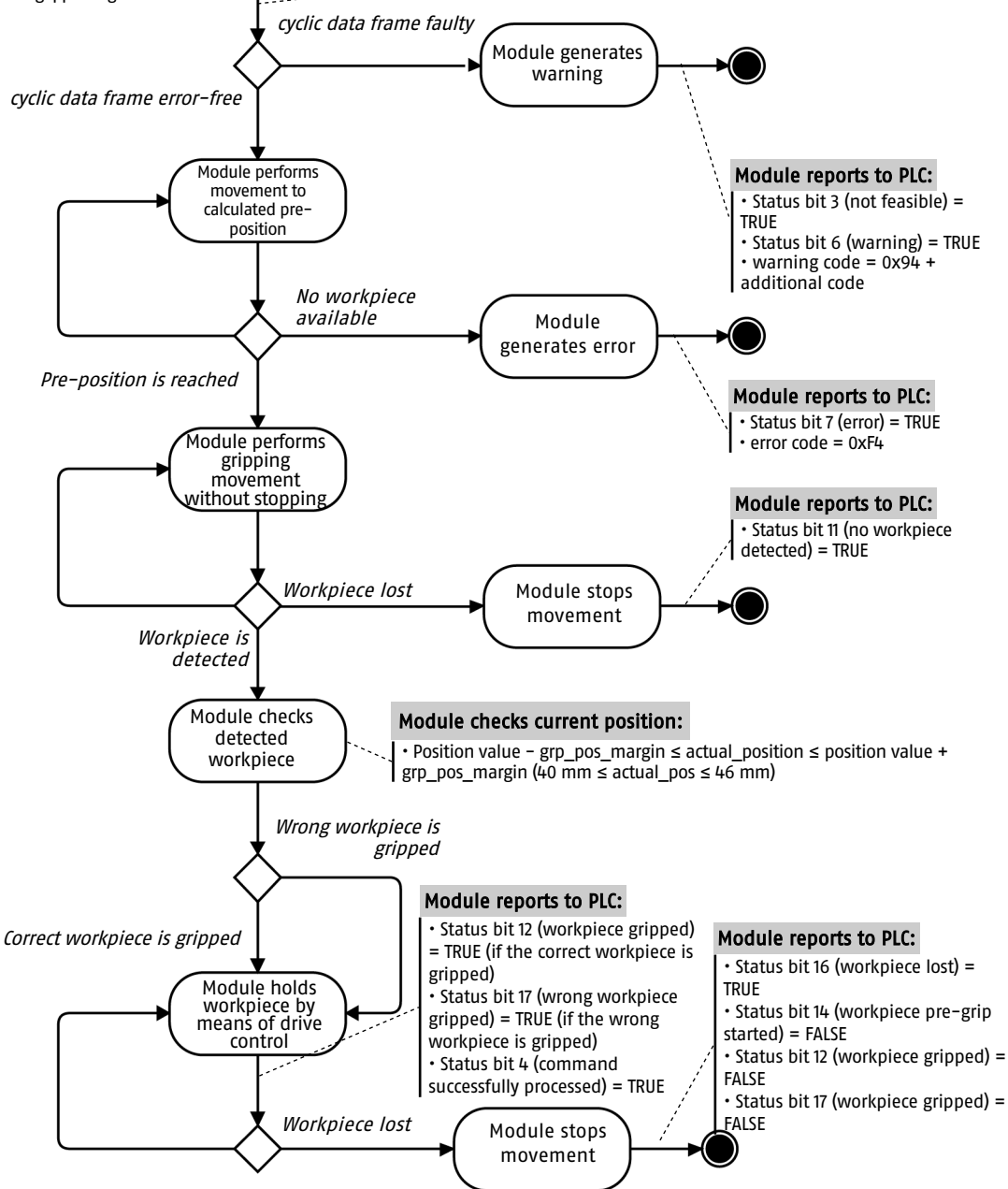
- grp\_prehold\_time = 0 ms
- grp\_prepos\_delta = 4 mm
- grp\_pos\_margin = 3 mm

**PLC sends cyclic data frame to module:**

- Control bit 16 (grip workpiece at expected position) = TRUE
- Position value = 43,000 µm
- Velocity value = 8,000 µm/s
- Gripping force value = 52%
- Control bit 7 (grip direction) = FALSE
- Control bit 31 (activate GPE) = FALSE

**Module reports to PLC:**

- Status bit 5 (command received toggle) toggled



For further information, see chapter ▶ 3.3.2 [ 32 ].

## 7.2 Control double word

The control bits of the control double word are described in detail below. For a clear illustration of the control double word, see chapter ▶ 2.1.1.1 [12].

### Bit 0 – fast stop

| Edge change | Module reaction                                 |
|-------------|-------------------------------------------------|
| 0 → 1       | no reaction                                     |
| 1 → 0       | The module performs a quick stop, ▶ 3.2.5 [30]. |

### Bit 1 – stop

| Edge change | Module reaction                                      |
|-------------|------------------------------------------------------|
| 0 → 1       | The module performs a controlled stop, ▶ 3.2.4 [29]. |
| 1 → 0       | no reaction                                          |

### Bit 2 – acknowledge

| Edge change | Module reaction                                                                           |
|-------------|-------------------------------------------------------------------------------------------|
| 0 → 1       | The module tries to acknowledge all existing warnings and errors, ▶ 6.1 [74], ▶ 6.2 [77]. |
| 1 → 0       | no reaction                                                                               |

### Bit 3 – prepare for shutdown

| Edge change | Module reaction                                     |
|-------------|-----------------------------------------------------|
| 0 → 1       | The module is preparing for shutdown, ▶ 3.1.2 [21]. |
| 1 → 0       | no reaction                                         |

### Bit 4 – softreset

| Edge change | Module reaction                                             |
|-------------|-------------------------------------------------------------|
| 0 → 1       | The module is restarted on the software side, ▶ 3.1.3 [23]. |
| 1 → 0       | no reaction                                                 |

### Bit 5 – release for manual movement

| Edge change | Module reaction                                                           |
|-------------|---------------------------------------------------------------------------|
| 0 → 1       | GPE is deactivated in order to manually remove a workpiece, ▶ 3.3.6 [43]. |
| 1 → 0       | no reaction                                                               |

**Bit 6 – repeat command toggle**

| Edge change | Module reaction                                                    |
|-------------|--------------------------------------------------------------------|
| 0 → 1       | The module repeats the control command whose bit is still pending. |
| 1 → 0       | The module repeats the control command whose bit is still pending. |

Note: Depending on the current status of the module, there may be feedback that movements cannot be carried out again.

**Bit 7 – grip direction**

| Status | Module reaction                                                   |
|--------|-------------------------------------------------------------------|
| 0      | During a gripping process, the gripping is done from the outside. |
| 1      | During a gripping process, the gripping is done from the inside.  |

**Bit 8 – jog mode negative**

| Edge change | Module reaction                                                                                                |
|-------------|----------------------------------------------------------------------------------------------------------------|
| 0 → 1       | As long as the bit is set, the module executes a movement in the negative direction of movement, ▶ 3.2.1 [24]. |
| 1 → 0       | no reaction                                                                                                    |

**Bit 9 – jog mode positive**

| Edge change | Module reaction                                                                                                |
|-------------|----------------------------------------------------------------------------------------------------------------|
| 0 → 1       | As long as the bit is set, the module executes a movement in the positive direction of movement, ▶ 3.2.1 [24]. |
| 1 → 0       | no reaction                                                                                                    |

**Bit 10 – reference**

| Edge change | Module reaction                                           |
|-------------|-----------------------------------------------------------|
| 0 → 1       | The module executes the referencing routine, ▶ 3.4.1 [44] |
| 1 → 0       | no reaction                                               |

**Bit 11 – release workpiece**

| Edge change | Module reaction                                |
|-------------|------------------------------------------------|
| 0 → 1       | The module releases a workpiece, ▶ 3.3.5 [42]. |
| 1 → 0       | no reaction                                    |

**Bit 12 – grip workpiece**

| Edge change | Module reaction                                      |
|-------------|------------------------------------------------------|
| 0 → 1       | The module performs workpiece gripping, ▶ 3.3.1 [30] |
| 1 → 0       | no reaction                                          |

**Bit 13 – move to absolute position**

| Edge change | Module reaction                                                                   |
|-------------|-----------------------------------------------------------------------------------|
| 0 → 1       | The module performs a positioning movement to an absolute position, ▶ 3.2.2 [25]. |
| 1 → 0       | no reaction                                                                       |

**Bit 14 – move to relative position**

| Edge change | Module reaction                                                                  |
|-------------|----------------------------------------------------------------------------------|
| 0 → 1       | The module performs a positioning movement to a relative position, ▶ 3.2.3 [27]. |
| 1 → 0       | no reaction                                                                      |

**Bit 15 – reserved**

| Edge change | Module reaction |
|-------------|-----------------|
| 0 → 1       | no reaction     |
| 1 → 0       | no reaction     |

**Bit 16 – grip workpiece at expected position**

| Edge change | Module reaction                                                  |
|-------------|------------------------------------------------------------------|
| 0 → 1       | The module performs workpiece gripping at the expected position. |
| 1 → 0       | no reaction                                                      |

**Bit 17 – 29 – reserved**

| Edge change | Module reaction |
|-------------|-----------------|
| 0 → 1       | no reaction     |
| 1 → 0       | no reaction     |

**Bit 30 – brake test**

| Edge change | Module reaction                                 |
|-------------|-------------------------------------------------|
| 0 → 1       | The module performs a brake test, ▶ 3.4.4 [47]. |
| 1 → 0       | no reaction                                     |

**Bit 31 – Activate grip force and position maintenance**

| Status | Module reaction                                              |
|--------|--------------------------------------------------------------|
| 0      | Gripping forces and positions are held by the drive control. |
| 1      | Gripping forces and positions are held by the GPE.           |

**7.3 Status double word**

The status bits of the status double word are described in detail below. For a clear illustration of the status double word, see chapter ▶ 2.1.1.2 [16].

**Bit 0 – ready for operation**

| Status | Module feedback                        |
|--------|----------------------------------------|
| 0      | The module is not ready for operation. |
| 1      | The module is ready for operation.     |

**Bit 1 – control authority fieldbus**

| Status | Module feedback                             |
|--------|---------------------------------------------|
| 0      | The fieldbus does not have a control logic. |
| 1      | The fieldbus has a control logic.           |

**Bit 2 – ready for shutdown**

| Status | Module feedback                         |
|--------|-----------------------------------------|
| 0      | No information is provided in feedback. |
| 1      | The module is ready to be shut down.    |

**Bit 3 – not feasible**

| Status | Module feedback                                                    |
|--------|--------------------------------------------------------------------|
| 0      | No information is reported.                                        |
| 1      | The control command sent to the module is not feasible. ► 6.1 [75] |

**Bit 4 – command successfully processed**

| Status | Module feedback                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0      | No information is reported.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 1      | <p>The following control commands sent to the module were successfully <i>processed</i>.</p> <ul style="list-style-type: none"> <li>• Bit 1 – stop</li> <li>• Bit 8 – jog mode negative</li> <li>• Bit 9 – jog mode positive</li> <li>• Bit 10 – reference</li> <li>• Bit 11 – release workpiece</li> <li>• Bit 12 – grip workpiece</li> <li>• Bit 13 – move to absolute position</li> <li>• Bit 14 – move to relative position</li> <li>• Bit 16 – grip workpiece at expected position</li> </ul> |

**Bit 5 – command received toggle**

| Status change | Module feedback                                       |
|---------------|-------------------------------------------------------|
| 0 -> 1        | The module acknowledges receipt of a control command. |
| 1 -> 0        | The module acknowledges receipt of a control command. |

**Bit 6 – warning**

| Status | Module feedback      |
|--------|----------------------|
| 0      | There is no warning. |
| 1      | There is a warning.  |

**Bit 7 – error**

| Status | Module feedback    |
|--------|--------------------|
| 0      | There is no error. |
| 1      | There is an error. |

**Bit 8 – released for manual movement**

| Status | Module feedback                                    |
|--------|----------------------------------------------------|
| 0      | No information is provided in feedback.            |
| 1      | Module is ready for manual removal of a workpiece. |

**Bit 9 – software limit reached**

| Status | Module feedback                     |
|--------|-------------------------------------|
| 0      | No information is reported.         |
| 1      | A software limit has been exceeded. |

**Bit 10 – referenced**

| Status | Module feedback               |
|--------|-------------------------------|
| 0      | The module is not referenced. |
| 1      | The module is referenced.     |

**Bit 11 – no workpiece detected**

| Status | Module feedback                          |
|--------|------------------------------------------|
| 0      | No information is reported.              |
| 1      | The gripping process was not successful. |

**Bit 12 – workpiece gripped**

| Status | Module feedback                                                                    |
|--------|------------------------------------------------------------------------------------|
| 0      | No information is reported.                                                        |
| 1      | The previous gripping process was successful or the correct workpiece was gripped. |

**Bit 13 – position reached**

| Status | Module feedback                             |
|--------|---------------------------------------------|
| 0      | No information is reported.                 |
| 1      | The module has reached the target position. |

**Bit 14 – workpiece pre-grip started**

| Status | Module feedback                     |
|--------|-------------------------------------|
| 0      | No information is reported.         |
| 1      | The module has started re-gripping. |

**Bit 15 – reserved**

| Status | Module feedback             |
|--------|-----------------------------|
| 0      | No information is reported. |
| 1      | No information is reported. |

**Bit 16 – workpiece lost**

| Status | Module feedback                 |
|--------|---------------------------------|
| 0      | No information is reported.     |
| 1      | The gripped workpiece was lost. |

**Bit 17 – wrong workpiece gripped**

| Status | Module feedback                                                                      |
|--------|--------------------------------------------------------------------------------------|
| 0      | No information is reported.                                                          |
| 1      | During workpiece gripping at the expected position, the wrong workpiece was gripped. |

**Bit 18 – 30 – reserved**

| Status | Module feedback             |
|--------|-----------------------------|
| 0      | No information is reported. |
| 1      | No information is reported. |

**Bit 31 – Grip force and position maintenance activated**

| Status | Module feedback    |
|--------|--------------------|
| 0      | GPE is not active. |
| 1      | GPE is active.     |

## 7.4 Additional code when warning is present

### WRN\_NOT\_FEASIBLE

If the warning WRN\_NOT\_FEASIBLE is issued, an additional code can be read out. The following is a list of possible causes for non-execution.

**HEX 0x00****NF\_NO\_REASON**

There is no warning.

**HEX 0x01****NF\_IOLINK\_FUNCTION\_NOT\_SUPPORTED**

A customer-specific function was triggered acyclically via the IO-Link master, which is not supported by the module.

|          |                                                                                                                                                                                                                                                                                                                 |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HEX 0x02 | <b>NF_IOLINK_RESET_CONDITION_ONLY_ALLOWED_IN_ERROR_STATE</b><br>The module was not in an error state when one of the following functions was triggered via the IO-Link master: <ul style="list-style-type: none"> <li>• Application Reset</li> <li>• Restore Factory Settings</li> <li>• Back-To-Box</li> </ul> |
| HEX 0x03 | <b>NF_SHUTDOWN_NOT_FEASIBLE_IN_CURRENT_STATE</b><br>The shutdown is not permitted be triggered from the current state, ▶ 3.1.2 [□ 21].                                                                                                                                                                          |
| HEX 0x04 | <b>NF_RESET_NOT_FEASIBLE_IN_CURRENT_STATE</b><br>The restart is not permitted to be triggered from the current state, ▶ 3.1.3 [□ 23].                                                                                                                                                                           |
| HEX 0x05 | <b>NF_COMMAND_NOT_ALLOWED_IN_CURRENT_STATE</b><br>Reset to factory settings is not permitted to be triggered from the current state, Factory settings.                                                                                                                                                          |
| HEX 0x06 | <b>NF_COMMAND_NOT_ALLOWED_IN_ERROR_STATE</b><br>The module was in an error state when the function was triggered.                                                                                                                                                                                               |
| HEX 0x07 | <b>NF_IOLINK_FACTORY_RESET_NOT_ALLOWED_WHILE_DATASTORAGE_ACCESS</b><br>The module executed the function <i>DataStorage</i> when a reset function was triggered via the IO-Link master.                                                                                                                          |
| HEX 0x08 | <b>NF_SOFT_RESET_DISABLED_BY_PARAMETER</b><br>The restart is not enabled by the parameter <enable_softreset>, ▶ 4.2 [□ 65].                                                                                                                                                                                     |
| HEX 0x09 | <b>NF_CANNOT_TRIGGER_COMMAND_WHILE_FAST_STOP_IS_ACTIVE</b><br>The status bit "fast stop" (bit 0) was reset when a function was triggered.                                                                                                                                                                       |
| HEX 0x0A | <b>NF_MULTIPLE_COMMANDS_TRIGGERED_SIMULTANEOUSLY</b><br>Several functions are to be triggered at the same time.                                                                                                                                                                                                 |
| HEX 0x0C | <b>NF_COMMAND_NOT_ALLOWED_DURING_BRAKE_TEST</b><br>The module was performing a brake test when an improper function was triggered.                                                                                                                                                                              |
| HEX 0x0D | <b>NF_RELEASE_BRAKE_ONLY_ALLOWED_IN_ERROR_STATE</b><br>The module was not in an error state when manual workpiece removal was triggered, ▶ 3.3.6 [□ 43].                                                                                                                                                        |
| HEX 0x0E | <b>NF_RELEASE_WORKPIECE_COMMAND_ONLY_ALLOWED_WHILE_GRIPPING</b><br>The module was not holding a workpiece when the workpiece release was triggered, ▶ 3.3.5 [□ 42].                                                                                                                                             |

|                 |                                                                                                                                                                                        |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>HEX 0x0F</b> | <b>NF_COMMAND_NOT_ALLOWED_WHILE_HOLDING_A_WORKPIECE</b><br>While the module was holding a workpiece, an impermissible function was triggered.                                          |
| <b>HEX 0x10</b> | <b>NF_DESIRED_POSITION_OUT_OF_RANGE</b><br>The target position resulting from the cyclically transmitted position value is outside the position limits, ▶ 1.2.1 [46].                  |
| <b>HEX 0x12</b> | <b>NF_COMMAND_NOT_ALLOWED_DURING_GRIPPING_COMMAND</b><br>While the module was executing a gripping movement, an impermissible function was triggered.                                  |
| <b>HEX 0x13</b> | <b>NF_DESIRED_VELOCITY_OUT_OF_RANGE</b><br>The cyclically transmitted speed value is outside the permissible speed limits, ▶ 4.2 [457] and ▶ 4.2 [458].                                |
| <b>HEX 0x15</b> | <b>NF_COMMAND_NOT_ALLOWED_DURING_MOVE_TO_POSITION</b><br>While the module was executing a positioning movement, an impermissible function was triggered.                               |
| <b>HEX 0x1D</b> | <b>NF_COMMAND_NOT_ALLOWED_DURING_RELEASE_BRAKE_COMMAND</b><br>While the module was in the state in which a workpiece can be removed manually, an impermissible function was triggered. |
| <b>HEX 0x1E</b> | <b>NF_COMMAND_NOT_ALLOWED_DURING_RELEASE_WORKPIECE_COMMAND</b><br>While a workpiece was released, an impermissible function was triggered.                                             |
| <b>HEX 0x22</b> | <b>NF_MINIMUM_POSITION_OUT_OF_RANGE</b><br>A value that is outside the permissible limits was supposed to be written to the <min_pos> parameter, ▶ 4.2 [456].                          |
| <b>HEX 0x23</b> | <b>NF_MINIMUM_POSITION_ABOVE_MAXIMUM_POSITION</b><br>A value greater than the value of the parameter <max_pos> should be written to the parameter <min_pos>.                           |
| <b>HEX 0x24</b> | <b>NF_MAXIMUM_POSITION_OUT_OF_RANGE</b><br>A value that is outside the permissible limits was supposed to be written to the <max_pos> parameter, ▶ 4.2 [457].                          |
| <b>HEX 0x25</b> | <b>NF_MAXIMUM_POSITION_BELOW_MINIMUM_POSITION</b><br>A value was supposed to be written into the parameter <max_pos> that is smaller than the value of the parameter <min_pos>.        |
| <b>HEX 0x26</b> | <b>NF_RELEASE_WORKPIECE_WOULD_VIOLATE_SOFTWARE_LIMIT</b><br>The target position during workpiece release is outside the position limits, ▶ 3.3.5 [442].                                |

|                 |                                                                                                                                                                             |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>HEX 0x27</b> | <b>NF_MOVEMENT_INTO_WORKPIECE_NOT_ALLOWED</b><br>The target position when releasing a workpiece by absolute or relative position travel is located within the workpiece.    |
| <b>HEX 0x28</b> | <b>NF_GPE_FEATURE_NOT_AVAILABLE_ON_GRIPPER_WITHOUT_BRAKE</b><br>The GPE should be used to hold a workpiece or position, although the module does not have a GPE.            |
| <b>HEX 0x29</b> | <b>NF_DESIRED_FORCE_OUT_OF_RANGE</b><br>The cyclically transferred gripping force value is outside of the permissible gripping force limits, ▶ 4.2 [□ 58] and ▶ 4.2 [□ 58]. |

## 7.5 Brands

- IO-Link is a registered trademark of PROFIBUS Nutzerorganisation e.V.

## 7.6 Software copyright notices

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>STM32CubeH7</b>             | Name: STMicroelectronics<br>URL: <a href="https://github.com/stmicroelectronics/STM32CubeH7">https://github.com/stmicroelectronics/STM32CubeH7</a><br>Version: 5.3<br>Description: Cortex Microcontroller Software Interface Standard<br>Copyright: Copyright (c) 2009–2019 ARM Limited. All rights reserved<br>License: <a href="https://scancode-licensedb.aboutcode.org/apache-2.0.html">https://scancode-licensedb.aboutcode.org/apache-2.0.html</a> |
| <b>IO-Link stack</b>           | Name: TMG Technologie und Engineering GmbH<br>URL: <a href="https://www.tmgte.de">https://www.tmgte.de</a><br>Version: 1.1.226<br>Description: IO-Link device stack<br>Copyright: Copyright by TMG TE GmbH<br>Licence: <a href="https://scancode-licensedb.aboutcode.org/bsd-new.html">https://scancode-licensedb.aboutcode.org/bsd-new.html</a>                                                                                                         |
| <b>Loki associative vector</b> | Name: Andrei Alexandrescu<br>URL: <a href="https://erdani.org/index.php/books/modern-c-design/index.html">https://erdani.org/index.php/books/modern-c-design/index.html</a><br>Version: 2001<br>Copyright: Copyright (c) 2001 by Andrei Alexandrescu<br>License: <a href="https://scancode-licensedb.aboutcode.org/mit-old-style.html">https://scancode-licensedb.aboutcode.org/mit-old-style.html</a>                                                   |



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Spanntechnik | Greiftechnik | Automatisierungstechnik

Bahnhofstr. 106 – 134  
D-74348 Lauffen/Neckar  
Tel. +49-7133-103-0  
info@de.schunk.com  
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