



Software manual

Pneumatic positioning device PPD with IO-Link®

Translation of original software manual

Imprint

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Our team is always available to answer any questions on this product and other solutions. We look forward to your challenging questions. We will find a solution!

Best regards,

Your SCHUNK team

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

Table of contents

1 General	5
1.1 About this document	5
1.2 Definitions.....	5
1.2.1 Minimum and maximum position	5
1.2.2 Directions of movement and gripping.....	6
1.2.3 Zero point	6
2 Commissioning	7
3 Communication	9
3.1 Data exchange.....	9
3.1.1 Cyclical data exchange	9
3.1.2 Acyclical data exchange	13
4 Module functions	14
4.1 Booting and establishing operational readiness.....	14
4.2 Movement functions	16
4.2.1 Calibrate	16
4.2.2 Jog control.....	17
4.2.3 Absolute positioning movement	18
4.2.4 Relative positioning movement	19
4.2.5 Open/close fully	20
4.2.6 Close all valves	20
4.2.7 Terminating a movement.....	21
4.2.8 Ventilation	21
4.3 Handling a workpiece	22
4.3.1 Workpiece gripping.....	22
4.3.2 Workpiece gripping at expected position (combined gripping movement).....	23
4.3.3 Workpiece loss detection	27
4.4 Additional functions	27
4.4.1 Handshake	27
4.4.2 LifeSign.....	27
4.4.3 Repeat control command with optimized time	27
4.4.4 IO-Link system command "Back-to-Box"	28
5 System parameters	29
6 Diagnostics	32
6.1 Warnings.....	32
6.2 Error.....	34
7 Appendix	35
7.1 Control double word	35
7.2 Status double word	39

Table of Contents

7.3 Gripper data for configuration	43
7.4 Trigger control command with optimized time.....	46
7.5 Software copyright notices	47

1 General

1.1 About this document

This software manual describes the operating and parameterization options of a pneumatic positioning unit PPD with a pneumatic gripper via an IO-Link® interface.

Conventions

The following conventions apply to this software manual:

- The PPD Pneumatic Positioning Unit is referred to below as the "module".
- A user-initiated action that the module is expected to perform is hereafter referred to as a "request".
- Identification of parameters: <parameter>
- Identification of events: WARNING
- Page number in references: [▶ 4]

Applicable documents

- General terms and conditions *
- Assembly and Operating Manual of the module *

The documents labeled with an asterisk (*) can be downloaded from schunk.com/downloads.

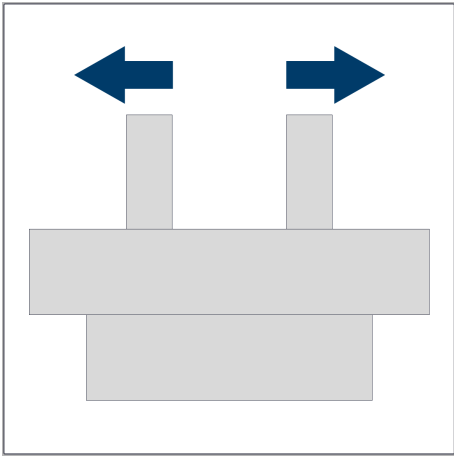
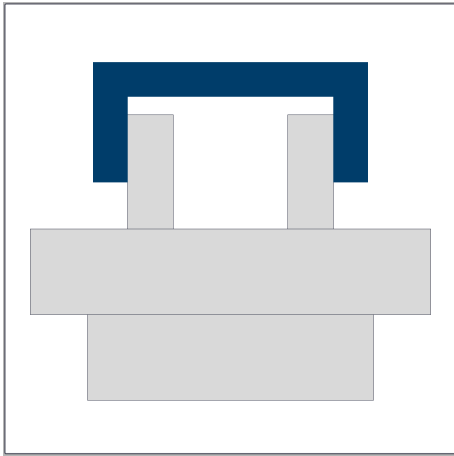
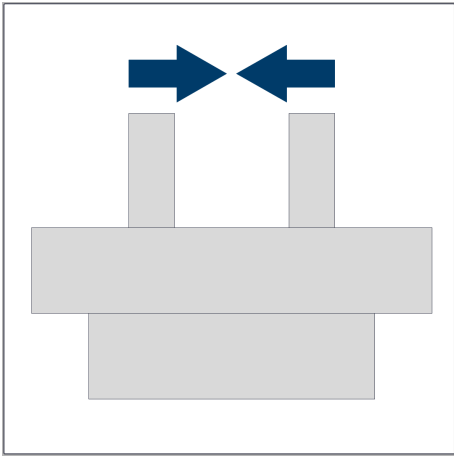
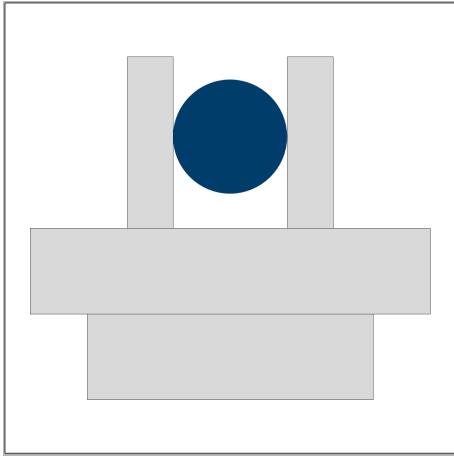
1.2 Definitions

1.2.1 Minimum and maximum position

After calibration ▶ 4.2.1 [16] of a gripper, the minimum position value of the base jaws is equal to 0 mm. The maximum position value of the base jaws is equal to the parameterized stroke of the gripper used, ▶ 5 [31].

1.2.2 Directions of movement and gripping

Directions of movement and gripping are shown below.

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

1.2.3 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 is determined when the Calibrate function is carried out, ▶ 4.2.1 [16].

2 Commissioning

Precautionary statements: 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.

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 <http://schunk.com/downloads-software>.

PLC function modules Schunk provides the following function blocks to help you integrate the module into Siemens, Beckhoff and Allen-Bradley controllers:

- Modules for cyclical communication
- Modules for acyclical communication

The modules can be downloaded at <http://schunk.com/downloads>.

NOTE

The function blocks are not protected. Further information can be found in the source code of the module.

**Commissioning
the PPD**

- Pneumatic positioning unit is mounted and connected according to the wiring diagram (see PPD Assembly and Operating Manual).
 - 1. Transmit parameters of the damaged gripper to the controller. For this purpose, the gripper parameters (piston stroke/stroke per jaw/piston area A/piston area B) are assigned acyclically, ▶ 3.1.2 [13].
 - 2. Call and execute sensor calibration routine cyclically, ▶ 4.2.1 [16].
- ⇒ The Pneumatic Positioning Unit is ready for use and can perform the functions listed below.

3 Communication

3.1 Data exchange

Data can be exchanged cyclically and acyclically between the module and the IO-Link® master via the integrated IO-Link® interface.

The PPD works in little endian format (Intel).

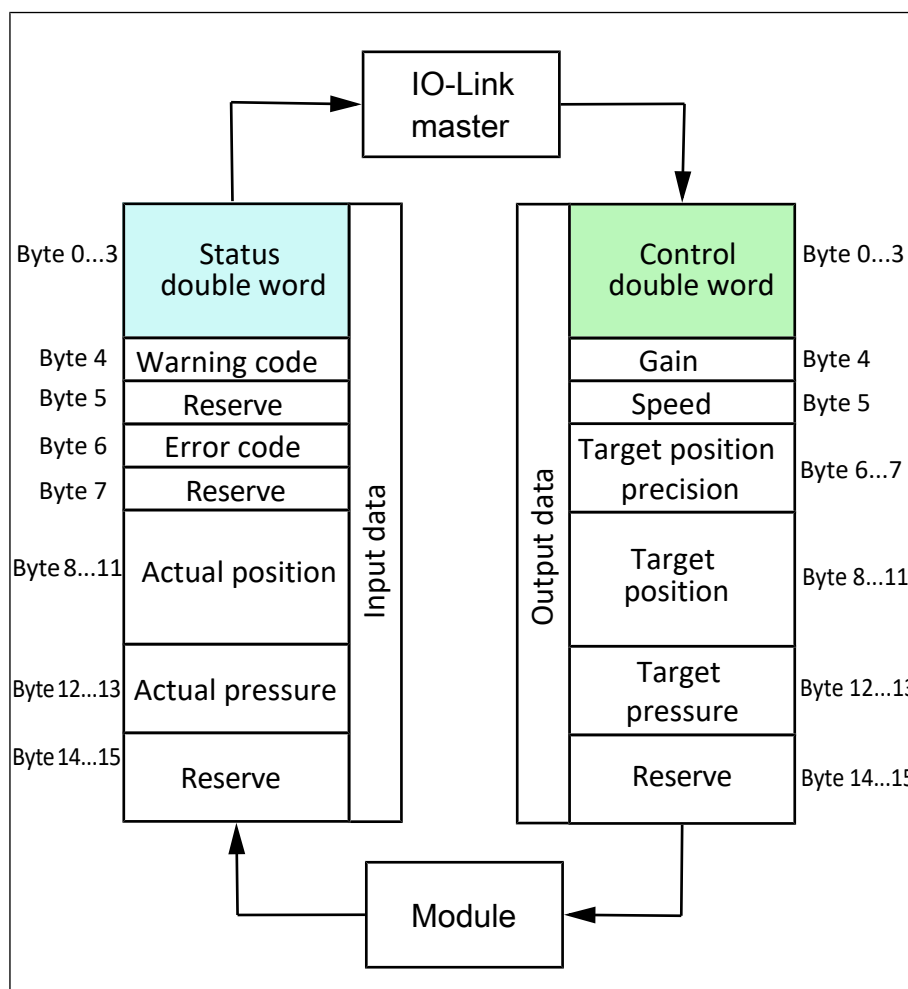
3.1.1 Cyclical data exchange

Execution of control commands

Based on the current activity of the module, the input of a control command may be allowed or disallowed.

- Permissible control commands are carried out.
- Impermissible control commands are not executed. This is displayed to the IO-Link® Master by the status bit "not feasible" being set. Furthermore, a corresponding warning code is transmitted via the diagnostics double word, ▶ 6.1 [32].

For cyclical data exchange, a fixed data frame is defined for input and output data. The data frame is based on the use of 16 bytes, which are partially grouped into words and double words.



Cyclical output/input data

Speed	<ul style="list-style-type: none"> • A velocity value is transmitted in byte 5. • Data format: unsigned 8 bit • Physical unit: - • Value range: 1 – 10 (1=langsam, 10=schnell) <p>Note: Depending on the individual overall structure of PPD and actuators, it is not always possible to achieve the maximum values.</p>
Target position precision	<ul style="list-style-type: none"> • An accuracy value for positioning is transmitted in bytes 6 – 7. • Data format: unsigned 16 bit • Physical unit: micrometre [μm] • Value range: 500 – 15.000 <p>Note: Select the target accuracy as high as possible. In order to position as accurately as possible (lowest "target accuracy"), the parameters "gain" and "speed" must be reduced. This must be determined on an application-specific basis.</p>
Target position	<ul style="list-style-type: none"> • A position value is transmitted in bytes 8 – 11. • Data format: signed 32 Bit • Physical unit: micrometre [μm] • Value range: -5.000.000 – 5.000.000
Target pressure	<ul style="list-style-type: none"> • A differential pressure value is transmitted in bytes 12 – 13. • Data format: unsigned 16 • Physical unit: millibars [mbar] • Value range: 2.000 – 8.000
Reserve	<ul style="list-style-type: none"> • No user data is currently transferred in bytes 14 and 15.

NOTE

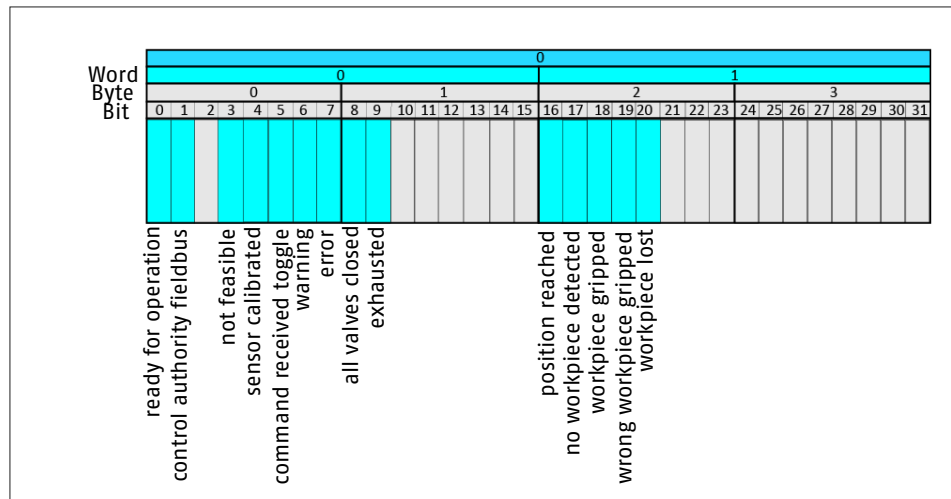
For technical reasons it is necessary to transfer values in micrometers. (1000 μm \cong 1 mm)

3.1.1.2 Cyclical input data

Feedback to the IO-Link® Master is transmitted from the module to the control via the cyclical input data.

Status double word

- In bytes 0 – 3, the status double word is transmitted. The following graphic shows the structure of the status double word. For a detailed description of the status double word, see chapter ▶ 7.2 [39].



Status bits "Position reached", "No workpiece detected", "Workpiece gripped", "Wrong workpiece gripped" and "Workpiece lost" are derived from pressure and position sensor values and the control medium air is compressible. They can therefore be susceptible to flickering. Check the function of these status bits for each specific application in combination with the control values used. If necessary, apply filters in the PLC program to avoid flickering status bit messages.

Warning code

- The warning code is transmitted in byte 4.
- Representation: Hexadecimal value

Error code

- In byte 6 the error code is transferred.
- Representation: Hexadecimal value

Actual position

- In bytes 8 – 11, the current position value of a base jaw is transferred.
- Data format: signed 32
- Physical unit: micrometre [µm]

Actual pressure

- In bytes 12 – 13 the current differential pressure value of the two pressure chambers is transferred.
- Data format: signed 16
- Physical unit: Millibar [mbar].

Reserve

- In bytes 5, 7, 14 and 15, no user data is currently transferred

3.1.2 Acyclical data exchange

Execution of acyclical data exchange complies with the specifications of the IO-Link Community (c/o Profibus User Organization, www.io-link.com).

For information on system parameters, see ▶ 5 [📄 29].

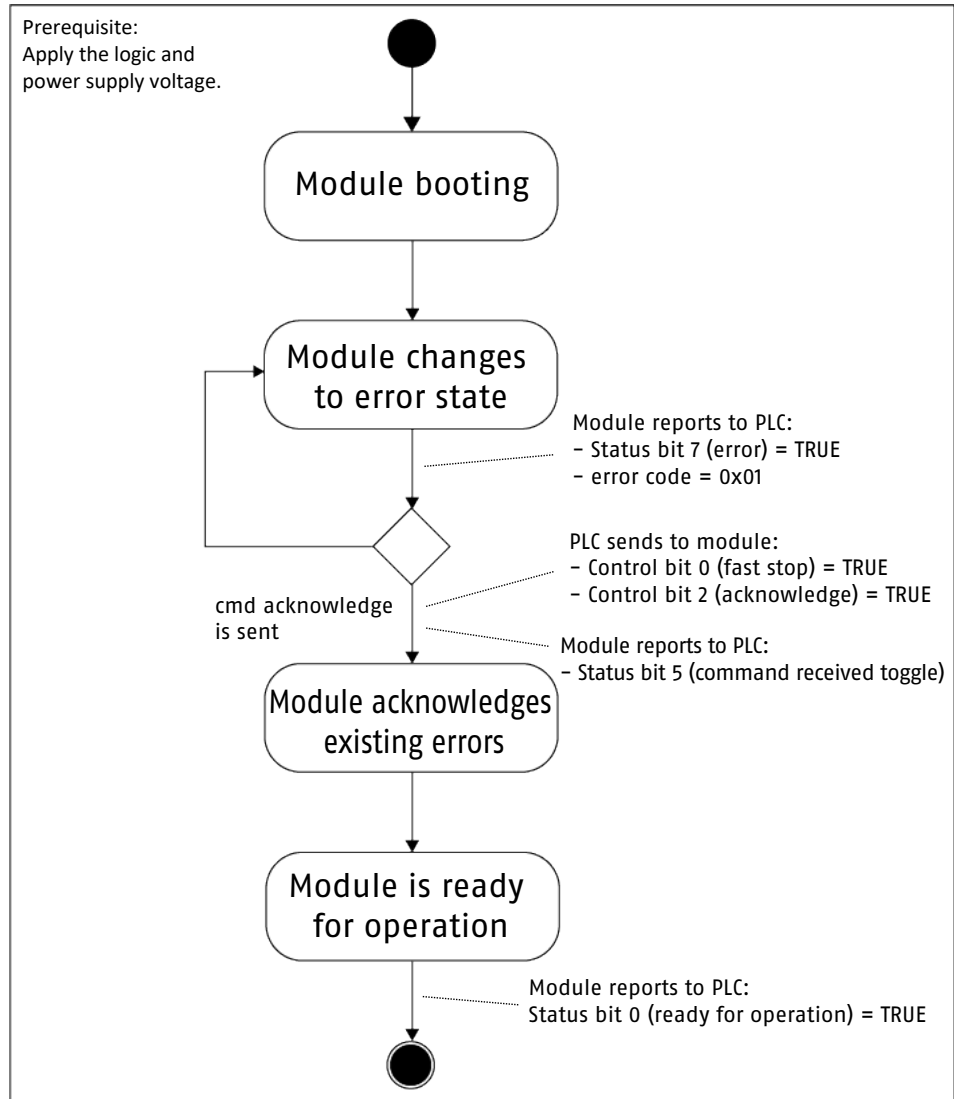
Gripper data for parameterization, see ▶ 7.3 [📄 43].

4 Module functions

4.1 Booting and establishing operational readiness

Short description

When booting, the firmware is prepared for operation. The module is always 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:



Trigger

Booting up can be initiated on the hardware side by applying the supply voltage.

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

NOTE

To prevent any unexpected behavior of the module, all control bits equal to 0 should be cyclically transmitted to the module during booting.

Module feedback

- The receipt of the control command is displayed by an immediate status change of the status bit "command received toggle" (bit 5). 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 the status bit "ready for operation" (bit 0) being set. The status bit "error" (bit 7) and the diagnostics code displayed are reset.

4.2 Movement functions

The following actions can also be carried out without a sensor system:

- fully open/fully closed
- exhaust
- all valves closed
- jog mode
- grip mode

The sensor system is required for all other functions.

4.2.1 Calibrate



⚠ WARNING

Risk of injury from crushing and knocking!

During calibration, serious injury could occur during the base jaw procedure and due to movement of the gripper fingers.

Short description

During calibration, the minimum and maximum position of the product used is determined and fixed.

NOTE

When using an MMS-22-IOL sensor, the dwell time in the end positions can take up to 30 seconds each for technical reasons. It must be ensured that no other functions are triggered during calibration.

Trigger

- Control bit "calibrate" (bit 11) is set, ▶ 7.1 [📄 35].

Movement parameter

For the following parameters, values must be transmitted cyclically to the module:

- none

Finish

Calibration is terminated by the following events:

- The movement ends automatically on successful or unsuccessful calibration.

Module feedback

- Status bit "command received toggle" (bit 5) changes its state. This confirmation serves exclusively to acknowledge that the control command has been received.
- Successful calibration is displayed by the status bit "sensor calibrated (bit 4)" being set.
- Unsuccessful calibration is indicated by the status bit "error" (bit 7) being set and the error ERROR_CALIBRATION_FAILED being reported.

4.2.2 Jog control

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.
<hr/>	
NOTE	
The jog mode is exclusively a function for commissioning the module. Do not use this function during automated operation!	
<hr/>	
Trigger	<ul style="list-style-type: none"> • Outward jog mode is triggered by setting the control bit "jog mode positive", (Bit 9) ▶ 7.1 [36]. • Inward jog mode is triggered by setting the control bit "jog mode negative", (Bit 8) ▶ 7.1 [36].
Movement parameter	For the following parameters, values must be transmitted cyclically to the module: <ul style="list-style-type: none"> • none
Finish	Jog mode is terminated by the following events: <ul style="list-style-type: none"> • Resetting the control bit "jog mode positive" or "jog mode negative" • When reaching the minimum or maximum position
Module feedback	<ul style="list-style-type: none"> • Status bit "command received toggle" (bit 5) changes its state. This confirmation serves exclusively to acknowledge that the control command has been received. • Status bit "\"command received toggle\" (bit 5) will change state. when jog mode is terminated.

4.2.3 Absolute positioning movement

Short description	With absolute positioning, a gripper moves to the cyclically transferred set position value. This position value refers to the zero point of the module.
<hr/>	
NOTE	
Using a positioning movement for gripping a workpiece represents a misuse. Furthermore, in this case no information such as "workpiece gripped" (bit 18) is sent to the IO-Link® master.	
<hr/>	
Trigger	<p>Absolute positioning is triggered as follows:</p> <ul style="list-style-type: none"> • Control bit "move to absolute position" (bit 16) is set, ▶ 7.1 [37]. • Control bit "move to absolute position" (bit 16) is set and control bit "repeat command toggle" (bit 6) changes state, ▶ 7.1 [35].
Movement parameter	<p>The following movement parameters must be transmitted cyclically to the module:</p> <ul style="list-style-type: none"> • Target position • Target position precision • Speed • Gain
Finish	<p>Absolute positioning is terminated by the following event:</p> <ul style="list-style-type: none"> • Another control command is triggered.
Module feedback	<ul style="list-style-type: none"> • Status bit "command received toggle" (bit 5) changes its state. This confirmation serves exclusively to acknowledge that the control command has been received. • Once the target position has been reached, it is displayed by the status bit "position reached" (bit 16) being set.

4.2.4 Relative positioning movement

Short description	<p>With relative positioning, a gripper moves from the current position by the cyclically transferred and signed set position value.</p> <hr/> <p>NOTE</p> <p>Using a positioning movement for gripping a workpiece represents a misuse. Furthermore, in this case no information such as "workpiece gripped" (bit 18) is sent to the IO-Link® master.</p> <hr/>
Trigger	<ul style="list-style-type: none"> • Control bit "move to relative position" (bit 17) is set, ▶ 7.1 [37]. • Control bit "move to relative position" (bit 17) is set and control bit "repeat command toggle" (bit 6) changes state, ▶ 7.1 [35].
Movement parameter	<p>The following movement parameters must be transmitted cyclically to the module:</p> <ul style="list-style-type: none"> • Target position • Target position precision • Speed • Gain <hr/> <p>NOTE</p> <ul style="list-style-type: none"> • The target position value must be selected so that the position to be approached does not exceed the permissible movement range <min_pos> to<max_pos>. • If the position is not within the permissible movement range, the module sets the status bit "not feasible" (bit 3) and reports back "WARNING_TARGET_POSITION_VALUE_INVALID". <hr/>
Finish	<p>Relative positioning is terminated by the following event:</p> <ul style="list-style-type: none"> • Another control command is triggered.
Module feedback	<ul style="list-style-type: none"> • Status bit "command received toggle" (bit 5) changes its state. This confirmation serves exclusively to acknowledge that the control command has been received. • Once the target position has been reached, it is displayed by the status bit "position reached" (bit 16) being set.

4.2.5 Open/close fully

Short description	With open fully, a gripper moves to maximum position. With close fully, a gripper moves to minimum position.
Trigger	<ul style="list-style-type: none">• For open fully: Control bit "fully close" (bit 18) is set, ▶ 7.1 [37].• For close fully: Control bit "fully open" (bit 19) is set, ▶ 7.1 [38].
Movement parameter	For the following parameters, values must be transmitted cyclically to the module: <ul style="list-style-type: none">• none
Finish	Open/close fully is terminated by the following events: <ul style="list-style-type: none">• Movement ends automatically on reaching the minimum or maximum position.
Module feedback	<ul style="list-style-type: none">• Status bit "command received toggle" (bit 5) changes its state. This confirmation serves exclusively to acknowledge that the control command has been received.• Reaching the minimum or maximum position is displayed by the status bit "position reached" (bit 16) being set. The status bit "position reached" is only set if the sensor is successfully calibrated. Otherwise, no feedback is given.

4.2.6 Close all valves

Short description	When all valves are closed, the air is trapped in the pressure chambers.
Trigger	Closing of all valves is initiated as follows: <ul style="list-style-type: none">• Control bit "Close all valves" (bit 22) is set, ▶ 7.1 [38].
Movement parameter	For the following parameters, values must be transmitted cyclically to the module: <ul style="list-style-type: none">• none
Finish	Closing all valves is ended by the following events: <ul style="list-style-type: none">• The movement ends automatically when all valves close.
Module feedback	<ul style="list-style-type: none">• Status bit "command received toggle" (bit 5) changes its state. This confirmation serves exclusively to acknowledge that the control command has been received.• Closing of all valves is indicated by the status bit "all valves closed" (bit 8) being set.

4.2.7 Terminating a movement

Short description	If movement is aborted, the current movement is forced to a standstill.
Trigger	<ul style="list-style-type: none"> Control bit "fast stop" (bit 0) is reset, ▶ 7.1 [35].

NOTE

The control bit "fast stop" (bit 0) is wire-break proof and therefore implemented as "low-active". This means that, in contrast to the other control commands, the movement abort must be triggered by resetting (edge change from 1 to 0) the control bit.

Module feedback	<ul style="list-style-type: none"> Status bit "command received toggle" (bit 5) changes its state. This confirmation serves exclusively to acknowledge that the control command has been received. Movement abort is indicated by the status bit "error" (bit 7) being set and the error ERROR_FAST_STOP being displayed.
------------------------	---

4.2.8 Ventilation

Short description	By opening all valves, all pressure chambers can be vented simultaneously.
Trigger	Ventilation is triggered by the control bit "exhaust" (Bit 10), ▶ 7.1 [36].
Movement parameter	For the following parameters, values must be transmitted cyclically to the module: <ul style="list-style-type: none"> none
Finish	Ventilation is terminated by the following event: <ul style="list-style-type: none"> The controlled movement ends automatically when all valves are opened. Note: Uncontrolled movements due to spring forces of the gripping force maintenance or external load are still possible.
Module feedback	<ul style="list-style-type: none"> Status bit "command received toggle" (bit 5) changes its state. This confirmation serves exclusively to acknowledge that the control command has been received. Ventilation is displayed by the status bit "exhausted" (bit 9) being set.

4.3 Handling a workpiece

4.3.1 Workpiece gripping

Short description	With workpiece gripping, a gripping movement is carried out with the aim of gripping a workpiece at an undefined position.
Trigger	<ul style="list-style-type: none">Control bit "grip workpiece" (bit 20) is set, ▶ 7.1 [📄 38].
Movement parameter	For the following parameters, values must be transmitted cyclically to the module: <ul style="list-style-type: none">Target pressureSpeedGripping direction (control bit 7)
Finish	Workpiece gripping is terminated by the following option: <ul style="list-style-type: none">Movement ends automatically on reaching the minimum or maximum position.
Module feedback	<ul style="list-style-type: none">Status bit "command received toggle" (bit 5) changes its state. This confirmation serves exclusively to acknowledge that the control command has been received.Gripping of a workpiece is displayed by the status bit "workpiece gripped" (bit 18) being set.Reaching the minimum or maximum position is displayed by the status bit "no workpiece detected" (bit 17) being set.

NOTE

The specified target pressure must be lower than the applied system pressure. If the specified target pressure is greater than the applied system pressure, no feedback is sent to the IO-Link® master because the specified target pressure is not (cannot be) reached.

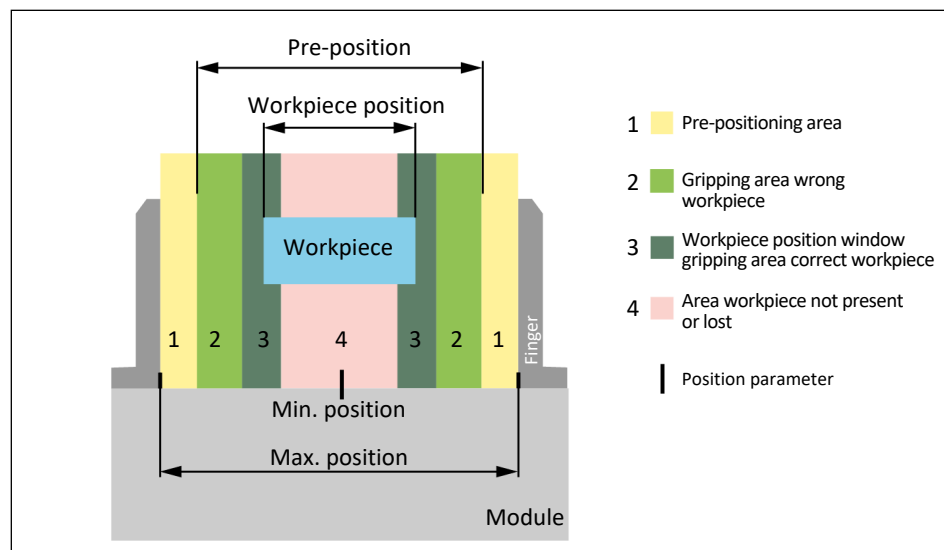
4.3.2 Workpiece gripping at expected position (combined gripping movement)

Short description

When gripping workpieces at an expected position, a gripping movement is carried out with the goal of gripping a workpiece within the workpiece position window. If the start position is "far away" from the workpiece position window, prepositioning is also carried out with the aim of saving cycle time.

NOTE

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

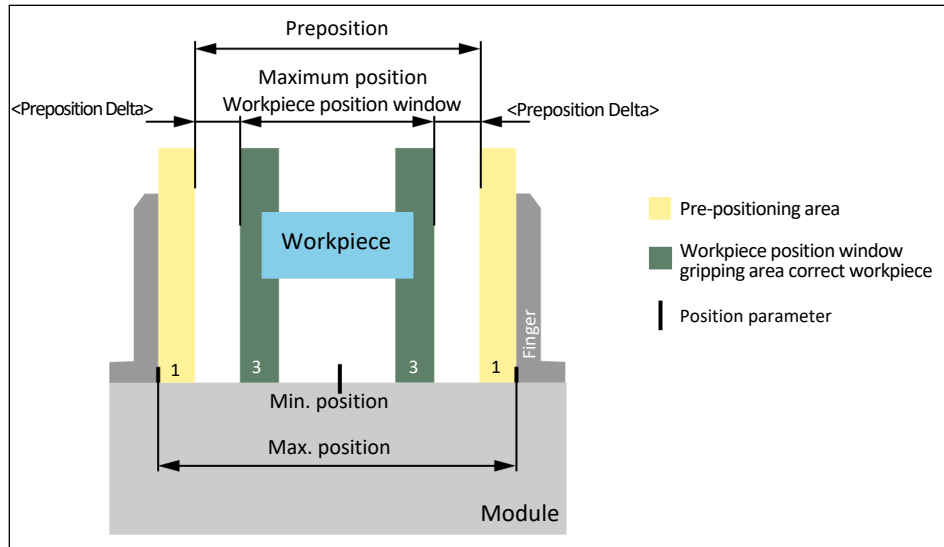


Gripping workpiece at expected position, example of O.D. gripping

Preposition

The preliminary position is calculated as follows:

- O.D. gripping: Target position + Target accuracy + <Preposition Delta>
- I.D. gripping: Target position + Target accuracy + <Preposition Delta>



Pre-positioning area for O.D. gripping

If one of the following conditions is met, prepositioning is carried out. (Fig: yellow area 1)

- O.D. gripping: The current position is greater than the calculated preliminary position
- I.D. gripping: The current position is less than the calculated preliminary position.

If none of the preceding conditions is met, gripping movement is carried out immediately.

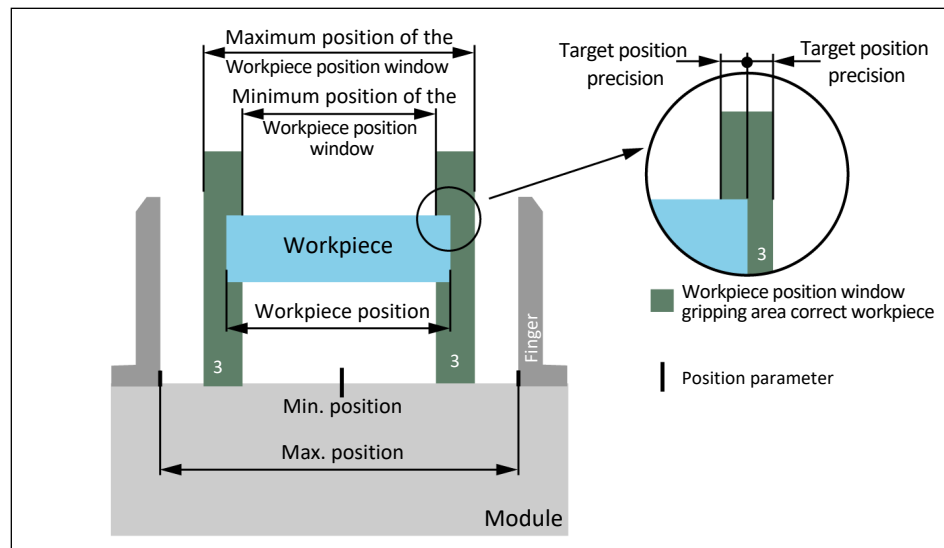
NOTE

Pre-positioning is performed at the maximum positioning speed.

Workpiece position window

The workpiece position window is a "virtual window" that is clamped around the expected workpiece position. The workpiece position window results as follows:

- Target position \pm Target precision



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

- Correct workpiece gripped: The gripping position is within the workpiece position window. (Fig.: dark green area 3).
- Incorrect workpiece gripped: The gripping position is between preposition and workpiece position window. (Fig.: light green area 2).

As soon as the workpiece position window is overrun, e.g. because no workpiece is present (Fig. light red area 4), a workpiece is detected as not present.

Trigger

Workpiece gripping at expected position is triggered as follows:

- Control bit "grip workpiece at expected position" (Bit 21) is set, ▶ 7.1 [38].

Movement parameter

For the following parameters, values must be transmitted cyclically to the module:

- Target position
- Target position precision
- Target pressure
- Speed
- Gripping direction (control bit 7)

Parameterization option

The parameter <Preposition Delta> can be used to parameterize the relative preposition (= difference amount in position between the workpiece position window and the preposition).

Finish

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

- Expected workpiece was gripped
- Unexpected workpiece was gripped
- Automatically when leaving the workpiece position window.
- Automatic when reaching the minimum or maximum position

Module feedback

- Status bit "command received toggle" (bit 5) changes its state. This confirmation serves exclusively to acknowledge that the control command has been received.
- Gripping of the expected workpiece is displayed by the status bit "workpiece gripped" (Bit 18) being set.
- Gripping of an unexpected workpiece is displayed by the status bits "wrong workpiece gripped" ("Bit" 19) being set.
- Exceeding the workpiece position window is displayed by the status bit "no workpiece detected" (Bit 17) being set.

NOTE

- The specified target pressure must be lower than the applied system pressure. If the specified set pressure is greater than the system pressure present, there will be no feedback to the IO-Link® Master since the specified set pressure is not reached (or cannot be).
 - If no workpiece is present and the workpiece position window is exited, the runout path of the gripper fingers depends on the specified gripping speed.
-

4.3.3 Workpiece loss detection

Short description	With workpiece loss detection, a workpiece is detected as lost as soon as the current position has left the workpiece position window.
Trigger	The workpiece loss detection does not have to be triggered. It is automatically activated as soon as a workpiece is held.
Module feedback	<ul style="list-style-type: none"> • A workpiece loss is displayed by the status bit "workpiece lost" (Bit 2) being set. • A set status bit "workpiece gripped" (Bit 18) is reset. • A set status bit "wrong workpiece gripped" (Bit 19) is reset.

4.4 Additional functions

4.4.1 Handshake

Short description	With the handshake, a recognized input of a control command is reported back to the controller. This confirmation serves exclusively to acknowledge that the control command has been received.
Module feedback	The status bit "command received toggle" (Bit 5) changes its state.

4.4.2 LifeSign

Short description	The acknowledge feature can be used to check communication between the control system and module. As soon as the Acknowledge 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.
Trigger	Acknowledgment is triggered by setting the control bit "acknowledge" (Bit 2), ▶ 7.1 [□ 35].
Module feedback	The receipt of the control command is displayed by an immediate status change of the status bit "command received toggle".

4.4.3 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.
Trigger	For time-optimized triggering of a control command, the corresponding control bit must remain set and the control bit "repeat command toggle" (Bit 6) must change state. For example, see appendix ▶ 7.4 [□ 46].

4.4.4 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.

5 System parameters

In the following, all system-relevant parameters are listed.

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 for which the user has write permissions can be parameterized via acyclic data exchange ► 3.1.2 [13].

Index: 66
Subindex: 0

Parameter name	pistons area side a
Short description	The area of the piston of side A can be parameterized and read out via this parameter.
Access rights	Read and write
Data type	UINT16
Unit	Square millimeters [mm ²]
Value range	100 – 65,000
Standard value	1256

Index: 67
Subindex: 0

Parameter name	pistons area side b
Short description	Using this parameter, the area of the piston of side B can be configured and read.
Access rights	Read and write
Data type	UINT16
Unit	Square millimeters [mm ²]
Value range	100 – 65,000
Standard value	1056

Index: 68
Subindex: 0

Parameter name	piston stroke
Short description	This parameter can be used to configure and read the measuring range of the position measuring system for the piston stroke.
Access rights	Read and write
Data type	UINT32
Unit	Micrometer [μm]
Value range	1,000 – 5,000,000
Standard value	100,000

Index: 88
Subindex: 0

Parameter name	position sensor raw value
Short description	The raw data of the position sensor can be read via this parameter.
Access rights	Read
Data type	UINT16
Unit	with analog sensor: milliamps [mA] without analog sensor: –
Value range	0 – 21,000

Index: 91
Subindex: 0

Parameter name	measured pressure side a
Short description	The measured pressure of side A can be read via the parameter.
Access rights	Read
Data type	UINT16
Unit	Millibar [mbar]
Value range	0 – 10,000

Index: 92
Subindex: 0

Parameter name	measured pressure side b
Short description	The measured pressure of side B can be read via the parameter.
Access rights	Read
Data type	UINT16
Unit	Millibar [mbar]
Value range	0 – 10,000

Index: 177
Subindex: 0

Parameter name	stroke per jaw
Short description	Using this parameter, the stroke of a base jaw can be configured and read.
Access rights	Read and write
Data type	UINT32
Unit	Micrometer [μm]
Value range	1,000 – 5,000,000
Standard value	100,000

Index: 178
Subindex: 0

Parameter name	preposition delta
Short description	This parameter can be used to parameterize and read the stroke between the workpiece window and the absolute preposition value.
Access rights	Read and write
Data type	UINT16
Unit	Millimeters [mm]
Value range	5 – 15
Standard value	10

Index: 24
Subindex: 0

Parameter name	io-link application specific tag
Short description	This parameter can be used to parameterize and read an application-specific designation.
Access rights	Read and write
Data type	UINT16
Format	ASCII string
Standard value	***

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 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

As soon as the module independently detects that the reason for a warning is no longer present, the corresponding 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 0x81 / DEC 129 **WARNING_SPEED_VALUE_INVALID**

Diagnostic event: An invalid speed value has been transferred in the cyclic output data.

Ability to acknowledge: acknowledgeable

HEX 0x82 / DEC 130 **WARNING_GAIN_VALUE_INVALID**

Diagnostic event: An unreliable gain value was transferred in the cyclical output data.

Ability to acknowledge: acknowledgeable

HEX 0x83 / DEC 131 WARNING_TARGET_ACCURACY_VALUE_INVALID

Diagnostic event: An unreliable target accuracy value was transferred in the cyclical output data.

Ability to acknowledge: acknowledgeable

HEX 0x84 / DEC 132 WARNING_TARGET_POSITION_VALUE_INVALID

Diagnostic event: An invalid target position value was transferred in the cyclical output data.

Ability to acknowledge: acknowledgeable

HEX 0x85 / DEC 133 WARNING_TARGET_PRESSURE_VALUE_INVALID

Diagnostic event: An invalid target pressure value was transferred in the cyclical output data.

Ability to acknowledge: acknowledgeable

HEX 0x86 / DEC 134 WARNING_EXECUTION_NOT_FEASIBLE

Diagnostic event: The triggered control command cannot be carried out from the current situation.

Ability to acknowledge: acknowledgeable

HEX 0x87 / DEC 135 WARNING_NOT_CALIBRATED

Diagnostic event: The measuring system has not yet been calibrated.

Ability to acknowledge: self-acknowledging

HEX 0x88 / DEC 136 WARNING_NO_POSITION_SENSOR_CONNECTED

Diagnostic event: No measuring system is connected to the module.

Ability to acknowledge: acknowledgeable

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 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.
Error code	Each detectable error event includes a unique error code that is transmitted in the cyclical input data.
Acknowledging	By setting the control bit "acknowledge" (bit 6) the acknowledgment of an existing warning can be triggered, ▶ 7.1 [35]. <ul style="list-style-type: none"> • 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 at this time, the error cannot be acknowledged at that time and remains active.
Recognizable error events	Listed below are all error events and their associated error codes that can be detected by the module.

HEX 0x01 / DEC 001 ERROR_FAST_STOP

Error cause	The module was started or a motion abort was triggered.
Ability to acknowledge:	requiring acknowledgment

HEX 0x02 / DEC 002 ERROR_CALIBRATION_FAILED

Error cause	Calibration was carried out unsuccessfully.
Ability to acknowledge:	requiring acknowledgment

7 Appendix

7.1 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 Link Zubehör.

Bit 0 – fast stop

Word	Byte	Bit	Cyclical output data
0	0	0	EN – short: fast stop DE – short: Schnellstopp
Edge change		Module reaction	
0 -> 1		no reaction	
1 -> 0		The module performs a quick stop, ▶ 4.2.7 [21].	

Bit 2 – acknowledge

Word	Byte	Bit	Cyclical output data
0	0	2	EN – short: ack DE – short: Quittieren
Edge change		Module reaction	
0 -> 1		Acknowledgment of pending warnings and errors is carried out.	
1 -> 0		no reaction	

Bit 6 – repeat command toggle

Word	Byte	Bit	Cyclical output data
0	0	6	EN – short: rpt cmd tgl DE – short: Kdo. wiederh.
Edge change		Module reaction	
0 -> 1		The control command whose bit is still pending is carried out again, ▶ 4.4.3 [27].	
1 -> 0		The control command whose bit is still pending is carried out again, ▶ 4.4.3 [27].	

NOTE

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

Bit 7 – grip direction

Word	Byte	Bit	Cyclical output data
0	0	7	EN – short: grip dir DE – short: Greifrichtung

Status	Module reaction
0	When performing a gripping operation, a workpiece is gripped from the outside.
1	When performing a gripping operation, a workpiece is gripped from the inside.

Bit 8 – jog mode negative

Word	Byte	Bit	Cyclical output data
0	1	8	EN – short: jog – DE – short: Tipp –

Edge change	Module reaction
0 → 1	A movement travel in negative direction of movement is carried out, ▶ 4.2.2 [□ 17].
1 → 0	The movement is stopped.

Bit 9 – jog mode positive

Word	Byte	Bit	Cyclical output data
0	1	9	EN – short: jog + DE – short: Tipp +

Edge change	Module reaction
0 → 1	Movement is carried out in a positive movement direction, ▶ 4.2.2 [□ 17].
1 → 0	The movement is stopped.

Bit 10 – exhaust

Word	Byte	Bit	Cyclical output data
0	1	10	EN – short: exhaust DE – short: Entlüften

Edge change	Module reaction
0 → 1	Ventilation of the pressure chambers is carried out, ▶ 4.2.8 [□ 21].
1 → 0	no reaction

Bit 11 – calibrate

Word	Byte	Bit	Cyclical output data
0	1	11	EN – short: calibrate DE – short: Kalibrieren
Edge change		Module reaction	
0 -> 1		Calibration of the measuring system is carried out, ▶ 4.2.1 [16].	
1 -> 0		no reaction	

Bit 16 – move to absolute position

Word	Byte	Bit	Cyclical output data
1	2	16	EN – short: pos absolute DE – short: Pos. absolut
Edge change		Module reaction	
0 -> 1		Absolute positioning is carried out, ▶ 4.2.3 [18].	
1 -> 0		no reaction	

Bit 17 – move to relative position

Word	Byte	Bit	Cyclical output data
1	2	17	EN – short: pos relative DE – short: Pos. relativ
Edge change		Module reaction	
0 -> 1		Relative positioning is carried out, ▶ 4.2.4 [19].	
1 -> 0		no reaction	

Bit 18 – fully close

Word	Byte	Bit	Cyclical output data
1	2	18	EN – short: fully close DE – short: vollst. schließen
Edge change		Module reaction	
0 -> 1		Complete closing is carried out, ▶ 4.2.5 [20].	
1 -> 0		no reaction	

Bit 19 – fully open

Word	Byte	Bit	Cyclical output data
1	2	19	EN – short: fully open DE – short: vollst. öffnen
Edge change		Module reaction	
0 → 1		Complete opening is carried out, ▶ 4.2.5 [20].	
1 → 0		no reaction	

Bit 20 – grip workpiece

Word	Byte	Bit	Cyclical output data
1	2	20	EN – short: grp wp DE – short: Werkst. greifen
Edge change		Module reaction	
0 → 1		Workpiece gripping is carried out, ▶ 4.3.1 [22].	
1 → 0		no reaction	

Bit 21 – grip workpiece at expected position

Word	Byte	Bit	Cyclical output data
1	2	21	EN – short: grp wp at pos DE – short: Werkst. greifen an erw. Pos.
Edge change		Module reaction	
0 → 1		Workpiece gripping at expected position is carried out, ▶ 4.3.2 [23].	
1 → 0		no reaction	

Bit 22 – close all valves

Word	Byte	Bit	Cyclical output data
1	2	22	EN – short: close all valves DE – short: Alle Ventile schließen
Edge change		Module reaction	
0 → 1		Closing of all valves is carried out, ▶ 4.2.6 [20].	
1 → 0		no reaction	

Bit – reserved

All control bits not described here are reserved control bits. An edge change of these bits is not followed by a reaction of the module.

7.2 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 Link Zubehör.

Bit 0 – ready for operation

Word	Byte	Bit	Cyclical output data
0	0	0	EN – short: ready for op DE – short: Betriebsbereit

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

Bit 1 – control authority fieldbus

Word	Byte	Bit	Cyclical output data
0	0	1	EN – short: ctrl authority fb DE – short: Fieldbus

Status	Module feedback
0	The IO-Link® master has no control authority.
1	The IO-Link® master has control authority.

Bit 3 – not feasible

Word	Byte	Bit	Cyclical output data
0	0	3	EN – short: not feasible DE – short: Nicht durchführb.

Status	Module feedback
0	No information is reported.
1	The control command sent to the module is not feasible.

Bit 4 – sensor calibrated

Word	Byte	Bit	Cyclical output data
0	0	4	EN – short: sensor calibrated DE – short: Sensor kalibriert

Status	Module feedback
0	The position sensor is not calibrated.
1	The position sensor is calibrated.

Bit 5 – command received toggle

Word	Byte	Bit	Cyclical output data
0	0	5	EN – short: cmd rcvd tgl DE – short: Kommandowechsel

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

Word	Byte	Bit	Cyclical output data
0	0	6	EN – short: warning DE – short: Warnung

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

Bit 7 – error

Word	Byte	Bit	Cyclical output data
0	0	7	EN – short: error DE – short: Fehler

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

Bit 8 – all valves closed

Word	Byte	Bit	Cyclical output data
0	1	8	EN – short: valves closed DE – short: Ventile geschl.

Status	Module feedback
0	No information is reported.
1	All valves are closed.

Bit 9 – exhausted

Word	Byte	Bit	Cyclical output data
0	1	9	EN – short: exhausted DE – short: Entlüftet

Status	Module feedback
0	No information is reported.
1	The module has been exhausted.

Bit 16 – position reached

Word	Byte	Bit	Cyclical output data
1	2	16	EN – short: pos reached DE – short: Positioniert

Status	Module feedback
0	No information is reported.
1	The target position was approached.

Bit 17 – no workpiece detected

Word	Byte	Bit	Cyclical output data
1	2	17	EN – short: no wp detected DE – short: Kein Werkstück

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

Bit 18 – workpiece gripped

Word	Byte	Bit	Cyclical output data
1	2	18	EN – short: wp gripped DE – short: Gegriffen

Status	Module feedback
0	No information is reported.
1	A workpiece was gripped during workpiece gripping or the correct workpiece was gripped during workpiece gripping at the expected position.

Bit 19 – wrong workpiece gripped

Word	Byte	Bit	Cyclical output data
1	2	19	EN – short: wrong wp gripped DE – short: Falsches Werkst.

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

Bit 20 – workpiece lost

Word	Byte	Bit	Cyclical output data
1	2	20	EN – short: wp lost DE – short: Werkst. verloren

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

Bit – reserved

All status bits not described here are reserved status bits. States or edge changes of these bits do not represent information.

7.3 Gripper data for configuration

Size	Piston stroke [mm]	Stroke per jaw [mm]	Piston area B (close) [mm²]	Piston area A (open) [mm²]
	<i>Piston stroke</i>	<i>Stroke per jaw</i>	<i>piston area side B</i>	<i>piston area side A</i>
PGL-plus-P 10	10	10	465	530
PGL-plus-P 13	13	13	696	795
PGL-plus-P 16	16	16	1152	1307
PGL-plus-P 20	20	20	1780	2043
PGL-plus-P 25	25	25	2820	3169
PGN-plus-P 50-1	4.8	4	436	465
PGN-plus-P 50-2	5.0	2	436	465
PGN-plus-P 64-1	7.2	6	697	747
PGN-plus-P 64-2	7.4	3	697	747
PGN-plus-P 80-1	9.5	8	1057	1170
PGN-plus-P 80-2	9.9	4	1057	1170
PGN-plus-P 100-1	11.9	10	1742	1896
PGN-plus-P 100-2	12.4	5	1742	1896
PGN-plus-P 125-1	15.5	13	2721	2923
PGN-plus-P 125-2	14.9	6	2721	2923
PGN-plus-P 160-1	19.1	16	4541	4855
PGN-plus-P 160-2	19.8	8	4541	4855
PGN-plus-P 200-1	25.0	25	8370	8861
PGN-plus-P 200-2	24.2	14	8370	8861
DPG-plus 64-1	7.2	6	570	620
DPG-plus 64-2	7.4	3	570	620
DPG-plus 80-1	9.5	8	954	1067
DPG-plus 80-2	9.9	4	954	1067
DPG-plus 100-1	11.9	10	1512	1666
DPG-plus 100-2	12.4	5	1512	1666
DPG-plus 125-1	15.5	13	2427	2628
DPG-plus 125-2	14.9	6	2427	2628
DPG-plus 160-1	19.1	16	3773	4087
DPG-plus 160-2	19.8	8	3773	4087
PZN-plus 64-1	7.2	6	1437	1590
PZN-plus 64-2	7.4	3	1437	1590
PZN-plus 80-1	9.5	8	2441	2642
PZN-plus 80-2	9.9	4	2441	2642

Size	Piston stroke [mm]	Stroke per jaw [mm]	Piston area B (close) [mm²]	Piston area A (open) [mm²]
	<i>Piston stroke</i>	<i>Stroke per jaw</i>	<i>piston area side B</i>	<i>piston area side A</i>
PZN-plus 100-1	11.9	10	4464	4778
PZN-plus 100-2	12.4	5	4464	4778
PZN-plus 125-1	15.5	13	6523	7014
PZN-plus 125-2	14.9	6	6523	7014
PZN-plus 160-1	19.1	16	11963	12768
PZN-plus 160-2	19.8	8	11963	12768
DPZ-plus 64-1	7.2	6	1437	1590
DPZ-plus 64-2	7.4	3	1437	1590
DPZ-plus 80-1	9.5	8	2441	2642
DPZ-plus 80-2	9.9	4	2441	2642
DPZ-plus 100-1	11.9	10	4464	4778
DPZ-plus 100-2	12.4	5	4464	4778
DPZ-plus 125-1	15.5	13	6523	7014
DPZ-plus 125-2	14.9	6	6523	7014
DPZ-plus 160-1	19.1	16	11963	12768
DPZ-plus 160-2	19.8	8	11963	12768
PZH-plus 20	20	20	1091	1242
PZH-plus 30	30	30	1763	2460
PZH-plus 50	50	50	3508	5101
PZH-plus 75	75	75	7127	10013
PHL 25-030	30	30	982	982
PHL 25-045	45	45	982	982
PHL 25-060	60	60	982	982
PHL 32-040	40	40	1608	1608
PHL 32-060	60	60	1608	1608
PHL 32-080	80	80	1608	1608
PHL 40-050	50	50	2513	2513
PHL 40-075	75	75	2513	2513
PHL 40-100	100	100	2513	2513
PHL 50-060	60	60	3927	3927
PHL 50-090	90	90	3927	3927
PHL 50-120	120	120	3927	3927
PHL 63-080	80	80	6235	6235
PHL 63-120	120	120	6235	6235

Size	Piston stroke [mm]	Stroke per jaw [mm]	Piston area B (close) [mm²]	Piston area A (open) [mm²]
	<i>Piston stroke</i>	<i>Stroke per jaw</i>	<i>piston area side B</i>	<i>piston area side A</i>
PHL-W 25-030	30	30	982	982
PHL-W 25-045	45	45	982	982
PHL-W 25-060	60	60	982	982
PHL-W 32-040	40	40	1608	1608
PHL-W 32-060	60	60	1608	1608
PHL-W 32-080	80	80	1608	1608
PHL-W 40-050	50	50	2513	2513
PHL-W 40-075	75	75	2513	2513
PHL-W 40-100	100	100	2513	2513
PHL-W 50-060	60	60	3927	3927
PHL-W 50-090	90	90	3927	3927
PHL-W 50-120	120	120	3927	3927
PHL-W 63-080	80	80	6235	6235
PHL-W 63-120	120	120	6235	6235

7.4 Trigger control command with optimized time

By default, control commands are triggered by control bits being set. If the same function is to be carried out again, the corresponding control bit must first be reset repeatedly and then set again, which results in the loss of cycle time.

Example:

Relative positioning is to be triggered six times in succession.

Output data frame n	Control bit'move to relative position' set
Output data frame n+1	Control bit'move to relative position' reset
Output data frame n+2	Control bit'move to relative position' set
Output data frame n+3	Control bit'move to relative position' reset
Output data frame n+4	Control bit'move to relative position' set
Output data frame n+5	Control bit'move to relative position' reset
Output data frame n+6	Control bit'move to relative position' set
Output data frame n+7	Control bit'move to relative position' reset
Output data frame n+8	Control bit'move to relative position' set
Output data frame n+9	Control bit'move to relative position' reset
Output data frame n+10	Control bit'move to relative position' set

The cycle time can be reduced by using the control bit "command repeat toggle" (bit 6).

Output data frame n	Control bit'move to relative position' set
Output data frame n+1	Change status of control bit 'command repeat toggle'
Output data frame n+2	Change status of control bit 'command repeat toggle'
Output data frame n+3	Change status of control bit 'command repeat toggle'
Output data frame n+4	Change status of control bit 'command repeat toggle'
Output data frame n+5	Change status of control bit 'command repeat toggle'

7.5 Software copyright notices

Texas Instruments F2837xS Support Library, F021 Flash API

TI Release: F2837xS Support Library v3.12.00.00

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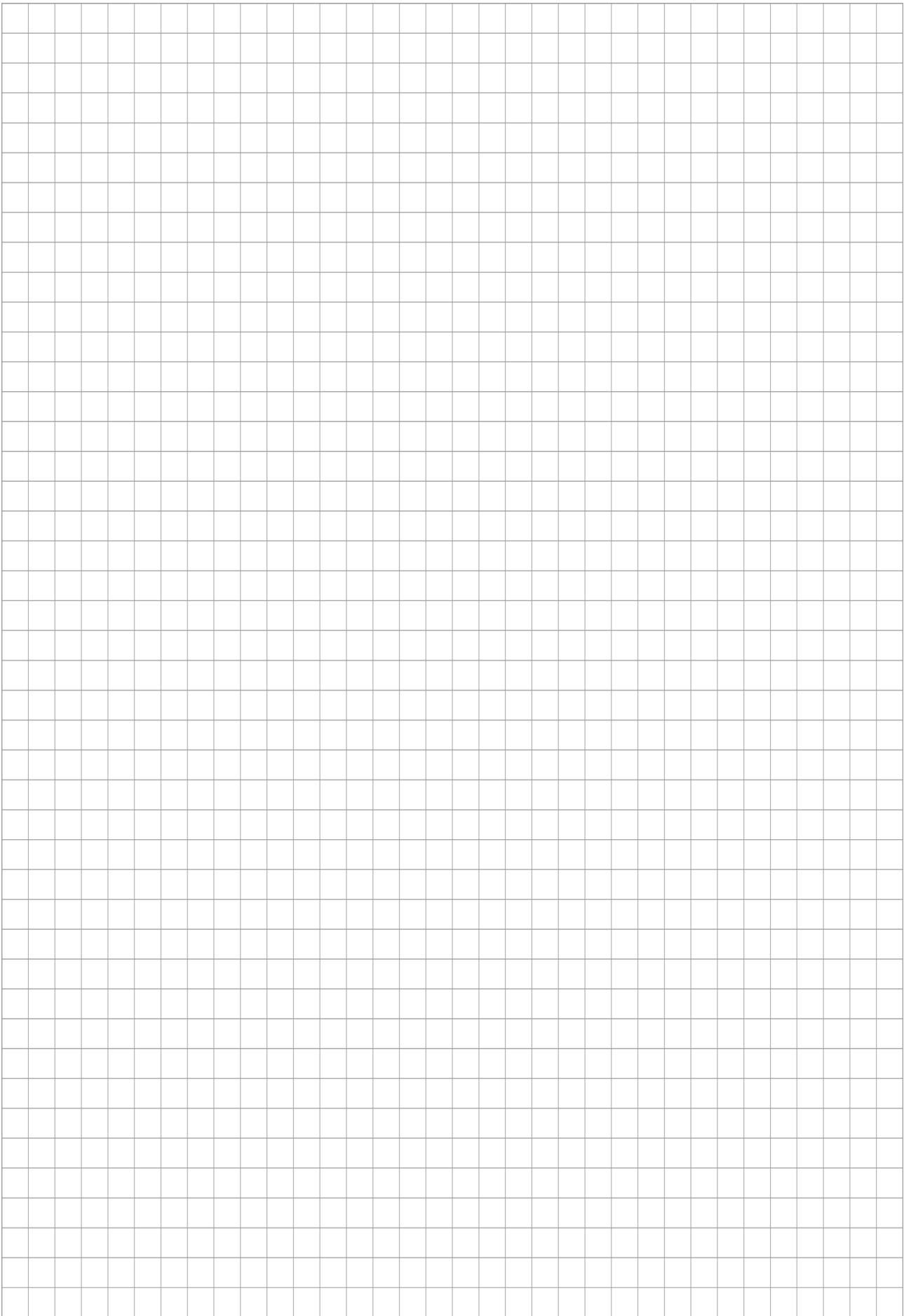
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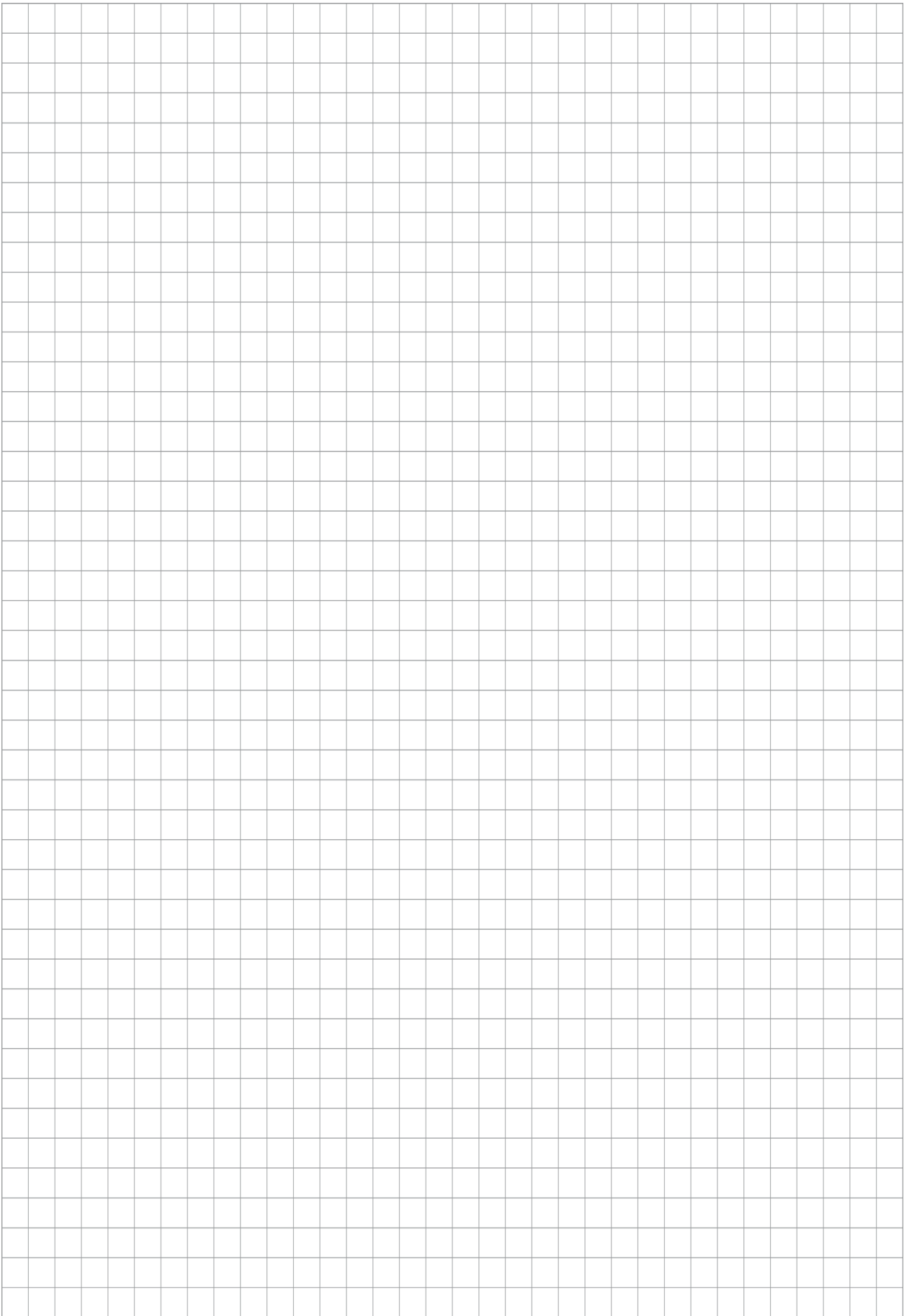
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