Electric clamp – swing clamp version

Parallel drive, position and clamping force monitoring, DC voltage 24 V, minimum energy demand

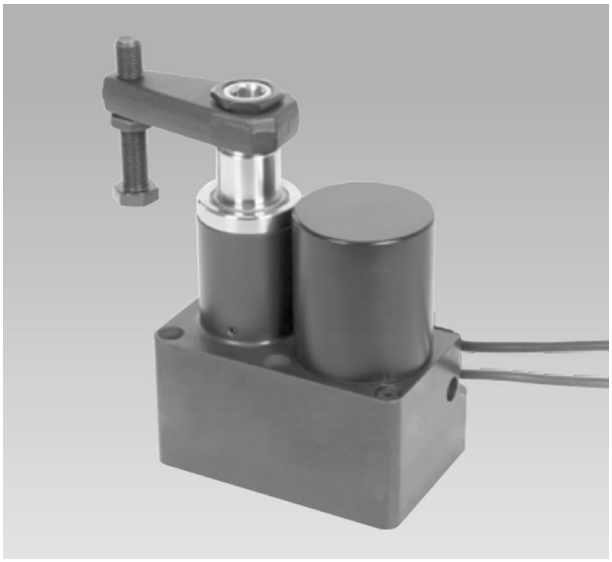


Table of contents

1 Description of the product

The electric clamp is driven by a wear-resistant, brushless DC motor. The motor speed is transformed by means of a gear and a threaded spindle into the swing and stroke movement of the piston rod.

For swinging the clamping arm by 180°, an axial stroke of only 3 mm is required.

If the clamping arm collides during the swing motion with a workpiece, the mechanism is protected against overload. The direct current motor is automatically and immediately switched off.

When unclamping, the clamping arm always swings back to the off-position.

2 Validity of the documentation

This document applies to the following products:

The following types or part numbers are concerned:

- 1835 C090 R26PXX
- 1835 C090 L26PXX
- 1835 C180 R26PXX
- 1835 C180 L26PXX
- 1835 C000 026PXX

XX= Options
OI= IO-Link
M= Metallic wiper
MI= Metallic wiper + IO-Link

3 Target group of this document

- Experts for installation and maintenance with electro-mechanical know-how.

Qualification of the personnel

Expert knowledge means that the personnel must

- be in the position to read and completely understand technical specifications such as circuit diagrams and product-specific drawing documents,
- have expert knowledge (electric, hydraulic, pneumatic knowledge, etc.) of function and design of the corresponding components.

An **expert** is somebody who has due to its professional education and experiences sufficient knowledge and is familiar with the relevant regulations so that he

- can judge the entrusted works,
- can recognize the possible dangers,
- can take the required measures to eliminate dangers,
- knows the acknowledged standards, rules and guidelines of the technology.
- has the required knowledge for repair and mounting.

4 Symbols and signal words

⚠ WARNING

Person damage

Stands for a possibly dangerous situation.
If it is not avoided, death or very severe injuries will result.

⚠ CAUTION

Easy injuries / property damage

Stands for a possibly dangerous situation.
If it is not avoided, minor injuries or material damages will result.

Hazardous to the environment

The symbol stands for important information for the proper handling with materials that are hazardous to the environment.
Ignoring these notes can lead to heavy damages to the environment.

Mandatory sign!

The symbol stands for important information, necessary protection equipment, etc.

NOTE

- This symbol stands for tips for users or especially useful information. This is no signal word for a dangerous or harmful situation.

5 For your safety

5.1 Basic information

The operating instructions serve for information and avoidance of dangers when installing the products into the machine as well as information and references for transport, storage and maintenance.
Only in strict compliance with these operating instructions, accidents and property damages can be avoided as well as trouble-free operation of the products can be guaranteed.
Furthermore, the consideration of the operating instructions will:

- avoid injuries
- reduce down times and repair costs,
- increase the service life of the products.

5.2 Safety instructions

- Avoid collisions and blockades of the clamping arm as well as shock and impact loads on all components.
  These can lead to damage to the internal mechanics. The electronic chamber in the lower area of the electric clamp has to be protected specifically against impacts because components are sensitive.
- The electric clamp can produce high forces. The application is applied as per the developed safety concept, general guidelines and standards. If required, a protection device has to be provided.
- If errors occur and are detected, the drive will be switched off. After troubleshooting and resetting the error message, operation can continue.
- Exceeding the maximum duty cycle can lead to damage to the electric motor or the electronics. Observe the technical characteristics.
- Components that are damaged or do not function properly must be taken out of service immediately.
- The product was developed, tested and built according to the applicable EMC standards.
  Check whether there are faults in or interactions between the components used when start up begins.
- With an open motor cover, when the internal control board is accessible, measures have to be taken to protect the electronic components against electrostatic discharge.
- Plugging operations at the line may only be effected in idle mode.

NOTE

Qualification of the personnel

All works may only be effected by qualified personnel familiar with the handling of electrical components.

5.3 Personal protective equipment

For works at and with the product, wear protective gloves!

For works at and with the product, wear safety shoes!

6 Application

6.1 Intended use

The products are designed exclusively for clamping of workpieces in industrial applications.
Furthermore, the following are intended uses:

- Use within the capacity indicated in the technical characteristics (see data sheet).
- Use as per operating instructions.
- Compliance with service intervals.
- Qualified and trained personnel for the corresponding activities.
- Mounting of spare parts only with the same specifications as the original part.
- Solely clamping arms may be moved.

6.2 Misapplication

⚠ WARNING

Injuries, material damages or malfunctions!

Modifications can lead to weakening of the components, reduction in strength or malfunctions.

- Do not modify the product!

The use of the products is not authorised:
- For domestic use.
- For use at fairgrounds and amusement parks.
- In food processing or in areas with special hygiene regulations.
- In mines.
- In ATEX areas (in explosive and aggressive environments, e.g. explosive gases and dusts).
- If physical effects (welding currents, vibrations or others) or chemically acting media damage the seals (resistance of the seal material) or components and this can lead to functional failure or premature failure.

Special solutions are available on request!

7 Installation

⚠ WARNING

Injury by dropping parts!

Some products have a heavy weight and can cause injury when dropping.

- Transport products professionally.
- Wear personal protection equipment!

Weight specifications see chapter "Technical characteristics".

⚠ CAUTION

Heavy weight may drop

- Some product types have a considerable weight. These have to be secured against dropping during transport.
- Weight specifications see chapter "Technical characteristics".

NOTE

Venting connection

- A vent hose has to be connected, if there is a possibility that aggressive cutting lubricants and coolants can penetrate though the venting port into the interior of the element. For this purpose the screw plug with air filter must be removed. The connected vent hose must be placed in a protected position. Under especially harsh environmental conditions, a positive air pressure connection is recommended.
- It is absolutely necessary to follow the instructions for venting of the spring area see data sheet G0.110.

7.1 Design

This electric clamping element is a pull-type cylinder where a part of the total stroke is used to swing the piston.
Thereby the clamping points are free for loading and unloading of the fixture.

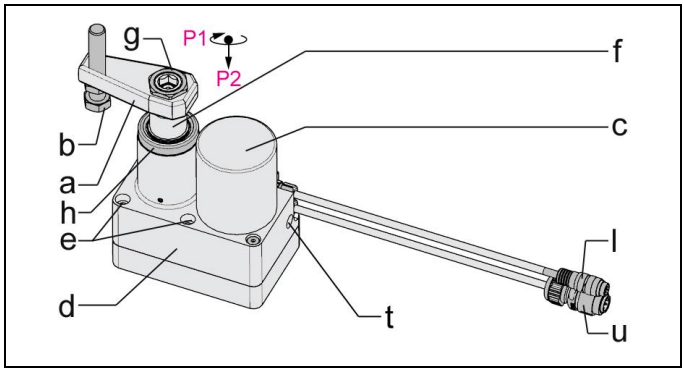


Figure 1: Components

a	Clamping arm (accessory)	h	Metallic wiper(option))
b	Contact bolt (accessory)	l	Connector for the transmission of control signals
c	Body with drive motor	t	Connection bleeding/ positive air pressure
d	Housing	u	Connector for the transmission of performance
e	Mounting holes (4x)	P1	Swing stroke
f	Piston with integrated swing mechanism	P2	Clamping stroke
g	Fixing nut (included in delivery)		

7.2 Swing angle and direction

The swing clamps are available with swing angles as specified in the data sheet. "Swing direction cw" means clockwise rotation, looking from above onto the piston- from the unclamped to the clamped position.

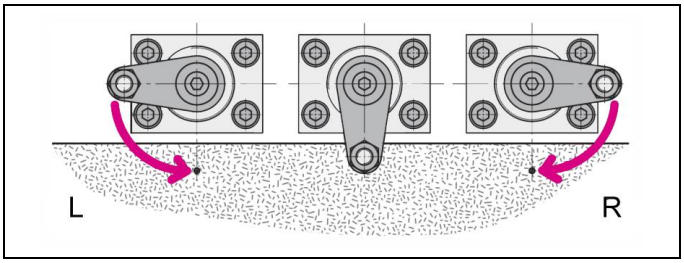


Fig. 2: Swing direction (L =counter-clockwise "ccw", R = clockwise "cw")

7.3 Critical swing directions

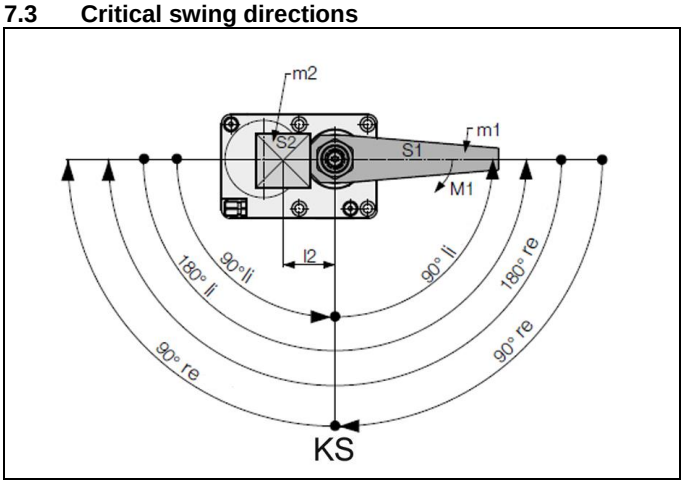


Fig. 3: Critical swing directions

li	Direction of rotation ccw	l2	Distance from centre of gravity of mass m2
re	Direction of rotation cw	KS	Critical swing directions
m2	Mass of counterweight		
M1	First order torque around the piston axis		

The electric clamp can be operated with the accessory clamping arm 0354 003 (e=75 mm) in every mounting position. In the case of longer and heavier special clamping arms in horizontal mounting position, the admissible radial torque of 0.4 Nm will be exceeded, which can lead to malfunctions and increased wear.

Remedy:

Provide the clamping arm with a counterweight.

NOTICE

Further Information

Further information for the use of special clamps are available on the data sheet.

7.4 Mounting types

NOTE

Accessibility in the case of troubles

The product should be accessible in the case of troubles to loosen the product or the clamping arm, if required.

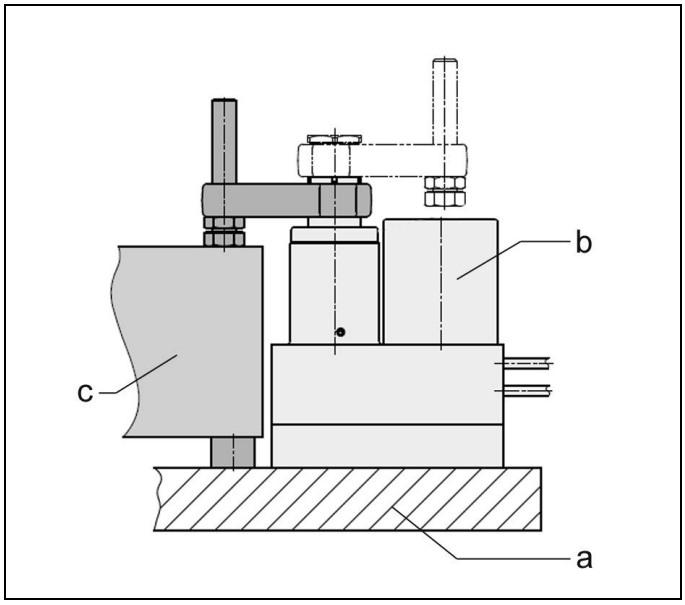


Figure 4: Types of installation

a Fixture body (provided by the customer) with installation geometry	b Clamping element c Workpiece

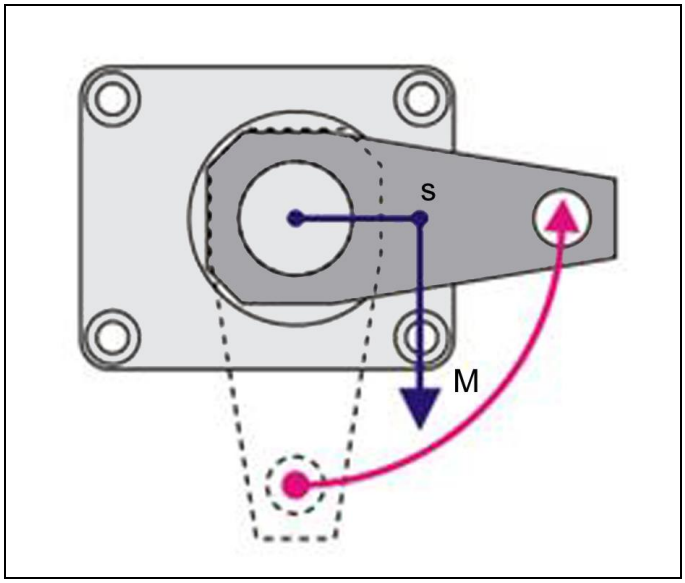


Fig. 5: Clamping position

When installing the electric clamp with horizontal piston axis and for swing motion from below to the top into the clamping position, the torque of the clamping arm has to be considered. Due to the internal coupling mechanism maximally 0.4 Nm are admissible. This corresponds to the value of the clamping arm 0354 003 with screw. If required, a remedy could be found by providing weight-reducing holes in the special clamping arm or by adding a counterweight.

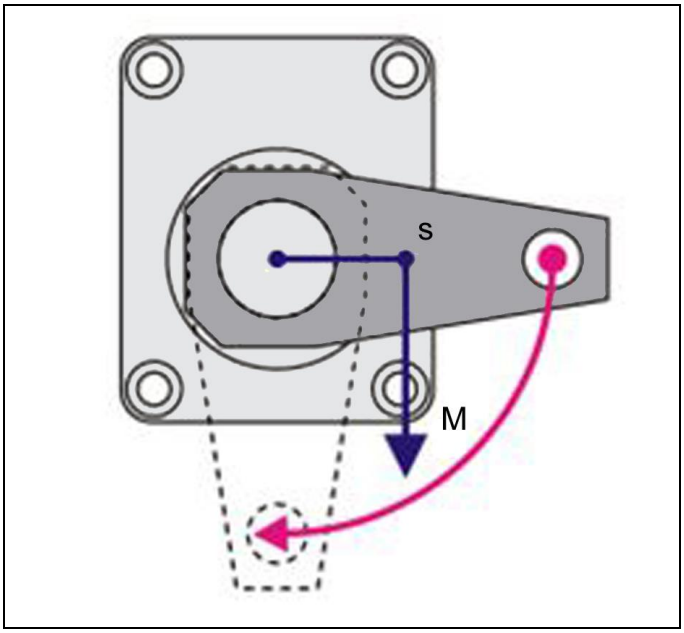


Fig. 6: Unclamped position

When installing the electric clamp with horizontal piston axis and the clamping arm in unclamped position in horizontal position, the torque of the clamping arm has to be considered. This torque can cause a rotation of the clamping arm out of the unclamped position. Therefore maximally 0.4 Nm are admissible. This corresponds to the value of the clamping arm 0354 003 with screw. If required, a remedy could be found by providing weight-reducing holes in the special clamping arm or by adding a counterweight.

s Clamping arm	M Radial torque

7.4.1 Assembly and disassembly of the clamping arm

⚠ WARNING

Injury by crushing!

Components of the product make a movement while they are in operation, this can cause injuries.

- Keep parts of the body and items out of the working area!

⚠ CAUTION

Damage or functional failure

Internal components can be damaged when tightening and loosening the fixing nut.

- It is imperative to back up the piston.
- No torques must be introduced into the piston.
- The conical surfaces of the piston and the clamping arm must be clean and grease free!

When fixing the clamping arm, no torques may be introduced in the internal mechanics. Tightening and untightening of the fixing nut must be made within the swing range, where the required degrees of freedom are available. It is imperative to back up the clamping arm. The tightening torque is 90 Nm. The following procedure proved to be useful in practice.

7.4.2 Assembly

1. Loosely put on the clamping arm onto the piston and rotate both components up to the stop to the clamping position.
2. Align the clamping arm in this piston position to the desired clamping point **(1)**.

3. In this position, the clamping arm can be lightly beaten with a hammer.
4. Rotate the piston with the clamping arm to a position between both stops in the swing area **(2)**. In this position there is no danger that the forces generated during tightening the fixing nut will be transferred to the mechanics.
5. Tighten the fixing nut with the specified torque. It is imperative to hold the clamping arm with a second open-ended wrench **(3)**.

⚠ WARNING

The internal mechanics can be destroyed

Inappropriate fixation of the clamping arm can damage the internal mechanics.

- When fixing the clamping arm, it must be hold with a second wrench **(3)**.

7.4.3 Disassembly

1. Rotate the piston with the clamping arm to a position between both stops in the swing area **(2)**. In this position, there is no danger that the forces generated during untightening the fixing nut will be transferred to the mechanics.
2. Loosen the fixing nut. It is imperative to hold the clamping arm with a second open-ended wrench **(3)**.
3. Disassembly of the clamping arm shall be made by means of an extractor **(4)**.

⚠ WARNING

The internal mechanics can be destroyed

When loosening the clamping arm with a hammer, the internal mechanics can be damaged.

- Disassembly of the clamping arm shall always be made by means of an extractor **(4)**.

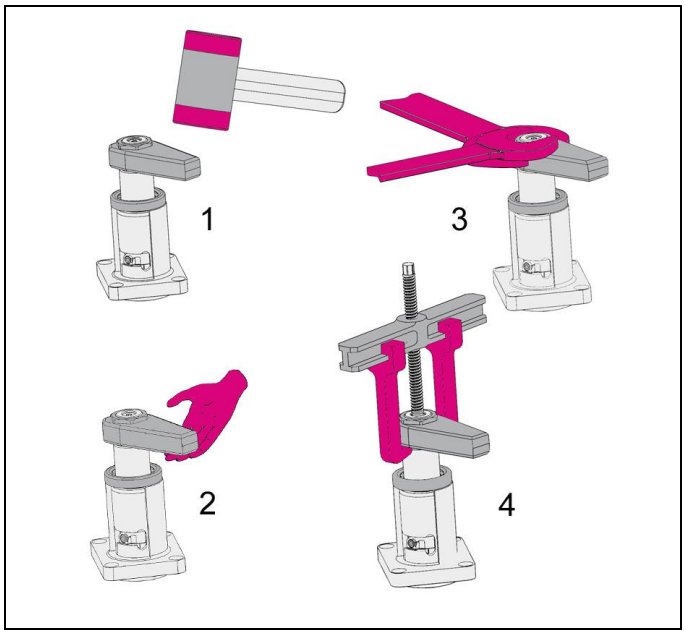


Figure 7: Assembly and disassembly of the clamping arm

7.5 Adjustment of contact bolt

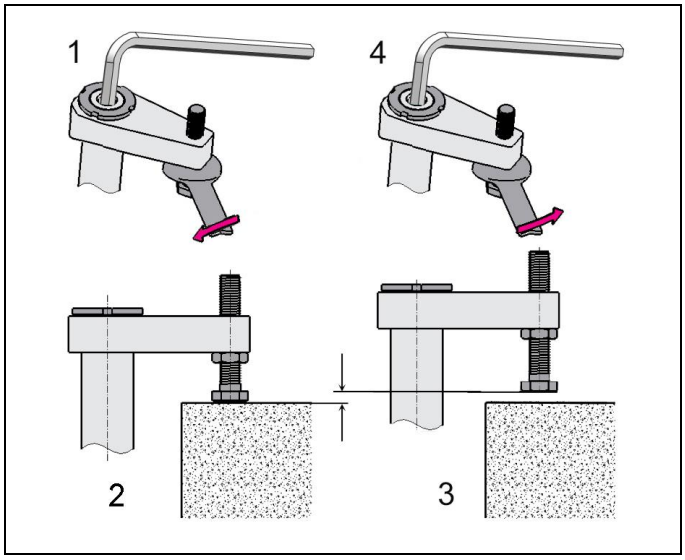


Fig. 8: Adjustment of the clamping arm (example)

1. Loosen the lock nut at the contact bolt and completely turn back the contact bolt. (Fig. Loosening the contact bolt, **pos. 1**)
2. Move or rotate the clamping arm to the clamping position above the workpiece. (Observe the tolerance of the swing angle, see data sheet information.)
3. Unscrew the clamping screw until it makes contact with the workpiece. (Fig. Adjusting the clamping screw, **pos. 2**)
4. Turn back the contact bolt by half the clamping stroke (see data sheet information) (Fig. Adjusting the contact bolt, **pos. 3)**.
5. Rotate the piston with the clamping arm to a position between both stops in the swing area. In this position there is no danger that the forces generated when the lock nut is tightened will be transferred to the mechanics.
6. Tighten the lock nut at the contact bolt. Hold the clamping arm with an Allen key. (Fig. Tightening the contact bolt, **pos. 4**)

7.6 Assembly of the metallic wiper

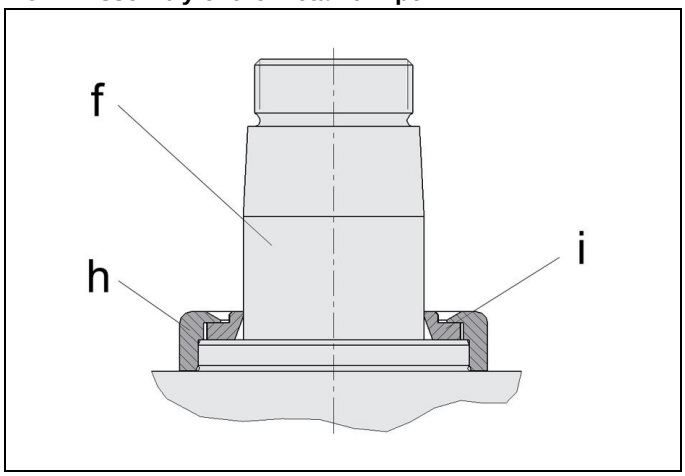


Figure 9: Metallic wiper

f	Piston with integrated swing mechanism	i	Metallic wiper, wiper ring (accessory)
h	Metallic wiper, retaining ring (accessory)		

The swing clamp is optionally supplied with mounted metallic wiper.

The metallic wiper can also be mounted later as an accessory:

1. Put the wiper ring onto the piston rod until the ring touches the body, pay attention to smooth running.
2. If the wiper ring is too stiff, the hard sealing edge must be ground with emery since otherwise the piston rod will be damaged in the long run.
3. Uniformly press the retaining ring without jamming, onto the collar of the body.

7.7 Power supply / supply voltage

7.7.1 Interfaces

The connection of the electric clamp to the higher-level control is carried out via two short lines with circular connectors. The first line is for the supply voltage of the drive. As momentarily high currents flow during clamping and acceleration, the cable cross-section and current load capacity of the plug contacts must be designed according to the size.

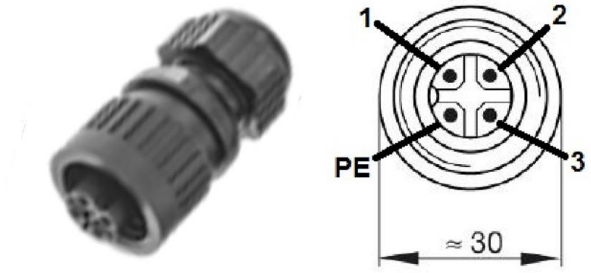
The second line contains all interface signals (IO-Link or discrete signal lines) that are required to control the electric clamp. Only low capacities are transmitted, so that the cable cross section can be given relatively small dimensions. The connection via plug-type connectors ensures fast replacement of the electric clamp in the event of a breakdown. The customer can realise the connection to the higher-level control according to their requirements (length and cross-section, resilience to environmental influences, mechanical load, electromagnetic interference, etc.).

NOTICE

Shielded cables

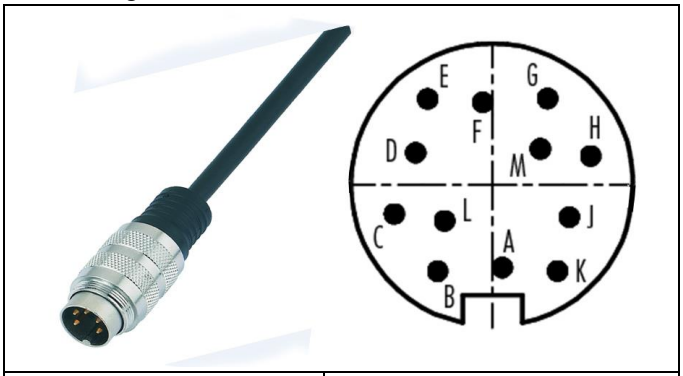
Use shielded cables.

The available control signals are indicated in the following chart:



Cable plug power Wire cross-section < 12 m: 1.5 mm² < 20 m: 2.5 mm² < 30 m: 4 mm²	Pin 1 +UB (24 VDC) 2 GND (power)

Discrete signal lines



Cable plug control	Wire cross-section min. 0.25 mm²
Pin A Command “clamping” B Command “unclamping” C Message “clamped” D Message “unclamped” E Message “cycle counter” F Message “error code”	Pin G GND (control) H +24 VDC (control) J K Command "Reset error" L Analogue input (0 - 10 V) clamping force M Analogue output (0 - 10 V) clamping stroke

IO link

Cable plug Control unit Wire cross-section min. 0.34 mm²	
Pin	
1 (brown)	+24 VDC (control)
3 (blue)	GND (control)
4 (black)	C/Q IO-Link data line

The shield must be connected to earth at the power supply unit. Cable lengths longer than 30 m are not allowed. Intermediate coupling elements such as plug-type connectors and sliding contacts must be designed for the correct current load capacity (see Chapter Technical characteristics).

If several electric clamps have to be operated at the same time at one line, the cross sections have to be increased accordingly. The signal exchange is made by standardised signals as commonly used in PLC controls (24 VDC, PNP, as well as 0-10 V analogue).

Appropriate socket connectors for customer's connection are offered by ROEMHELD as accessories.

NOTICE

Harsh environmental conditions

For use in harsh ambient conditions, a pneumatic connection is available for venting or positive air pressure connection.

⚠ CAUTION

Electrostatic discharge

With open motor cover, if also the internal control board is accessible, measures have to be taken to protect the electrical components against electrostatic discharge.

Plugging of lines

Connection and disconnection of lines via plug-type connectors may only be effected in idle mode.

7.7.2 Power supply

The electrical supply is provided by low voltage (24 VDC). This has advantages with regard to the electrical safety and allows the use of very compact drives. The current supply is provided by the customer.

The maximum operating current indicated below the technical characteristics is only required for a short time to build up the clamping force and to accelerate to high speed. For this reason it is good to use a switching power supply that offers a high overload capacity for a short time (2 sec.). It can be designed for peak current capacity.

If several electric clamps are operated at the same time, the power supply must be designed for the sum of the maximum operating currents of all electric clamps. If the clamps are clamped successively or in groups, the power supply can be reduced accordingly. The power supply must be designed with short circuit protection.

- Line protection disconnections generally only 1 pole (+)
- Safety shutdowns only via the power cable plug. The +24 V DC port on the control unit cable plug should always be connected.

NOTICE

Power supply

The power supply of the integrated control board must be separated from the power supply of the electric motor. This shall avoid any influence due to pressure drop caused by the motor current and the introduction of electromagnetic interferences. The integrated control board can be supplied by the available power supply of the customer's control. The electric motor with its higher power requirement shall be supplied with power by a separate power supply. The masses of both power supplies has to be connected on the side of the customer’s control by the shortest possible line.

8 Start up

NOTICE

Cable fixing

The cables must be fixed by the user so that no bending and tensile stress will act and the cables cannot be damaged in any way.

8.1 Signal description

Command "Clamping"

Machine command to electric clamp to clamp the workpiece. If this line is placed on 1-signal (24 V), clamping occurs. If the signal is placed on 0-signal during clamping, the clamping process will be interrupted. A continuation of the clamping process is not possible for reasons of operational safety. In this case the clamp must be completely unclamped first. Only then a renewed clamping process can be triggered. The command “clamping” must always be available at least until the message “clamped” is given.

Command "Unclamping"

Machine clamp to electric clamp to unclamp the workpiece. If this line is placed on 1-signal (24 V), unclamping occurs. If the signal is placed on 0-signal during unclamping, the unclamping process will be interrupted. The unclamping process can be triggered from every position. Unclamping always has to be made completely, since the unclamping position represents the reference position.

Only then a renewed clamping process can be triggered. The command “unclamping” must always be available at least until the message “unclamped” is given.

Command "Reset"

Pending error messages will be reset. The electric clamp is functional again, provided that no further error conditions exist. The signal is evaluated as positive edge and is debounced by approx. 200 ms. The signal must be applied at least for that time.

Message "Clamped"

If all the conditions are fulfilled, that are important for the integrated control to recognise that the clamping process was completed correctly, the message "clamped" is passed to the machine. To do this, the line is placed on +24 V. The machine can then trigger a follow-up function. The message "clamped" remains, even after removing the command "clamping".

If no workpiece is inserted, i.e. the defined clamping range (see chapter "Working areas") is fallen below, there will be *no* message "clamped" (0 V). This condition is not defined as an error, there will not be an error message in this case.

Message "Unclamped"

If all the conditions are fulfilled, that are important for the integrated control to recognise that the unclamping process was completed correctly, the message "unclamped" is passed to the machine. To do this, the line is placed on +24 V. The machine can then trigger a follow-up function. The message "unclamped” remains, even after removing the command "unclamping".

Message "Error code"

If there is an electric clamp fault, a flash code will be shown via this interface signal. For more information, please refer to the section Error detection.

Message "Number of cycles"

The number of cycles message gives an indication of the number of clamping cycles performed. For more information, please refer to the section Maintenance.

Analogue input "Clamping force"

This interface signal can be connected to an analogue output of a PLC control. By applying a DC voltage in the range from U_{AN} = 0…10 V, the clamping force (F) of the electric clamp can be varied between the minimum and the maximum clamping force. The relation between applied DC voltage and clamping force is represented in the diagram.

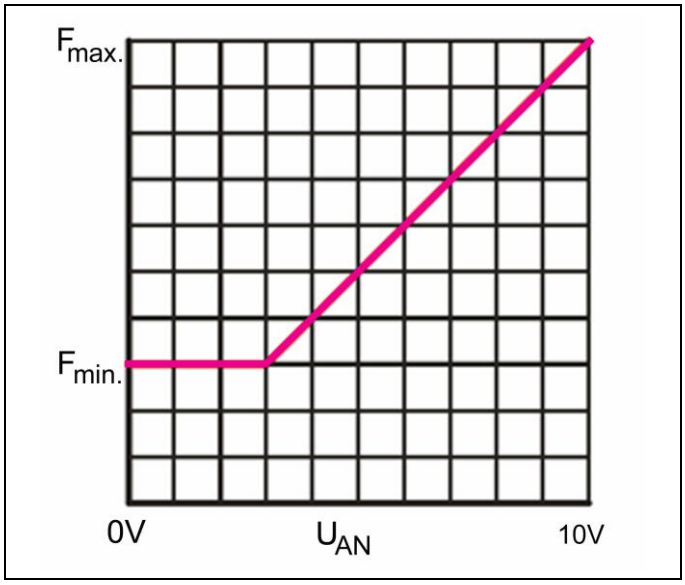


Fig. 10: The relation between DC voltage and clamping force

To adjust the clamping force via the analogue input or the IO-Link interface, trimmer F on the control board must be set to 0. Otherwise, the position of the trimmer F determines the clamping force. In order to use the clamping force adjustment in clamped condition, the command "clamping" must be applied.

Analogue output "clamping stroke"
This interface signal can be connected to an analogue input of a PLC control. The electric clamp outputs a DC voltage in the range of 0 to 10 V, whose value is proportional to the stroke effected by the piston in the range of 0 to 100 mm. In unclamping position, the value of the DC voltage is 0 V. The value that is output in clamped condition of the workpiece, can be used for "learning" of the workpiece position. By comparing the analogue signal with defined limits, the correct position of the workpiece in the fixture can be determined.

8.2 Working areas

After the swing motion to the clamping position, first the motor has to be accelerated. In this range no workpiece can be detected and should therefore be avoided. Clamping within this range is recognised as an error and will be signalised. After the range of the usable clamping stroke, there is the overrun where the motor is decelerated. Here the condition “no workpiece” will be detected. Within this range, workpieces cannot correctly be clamped. There is no message "Clamped", but also no error message.

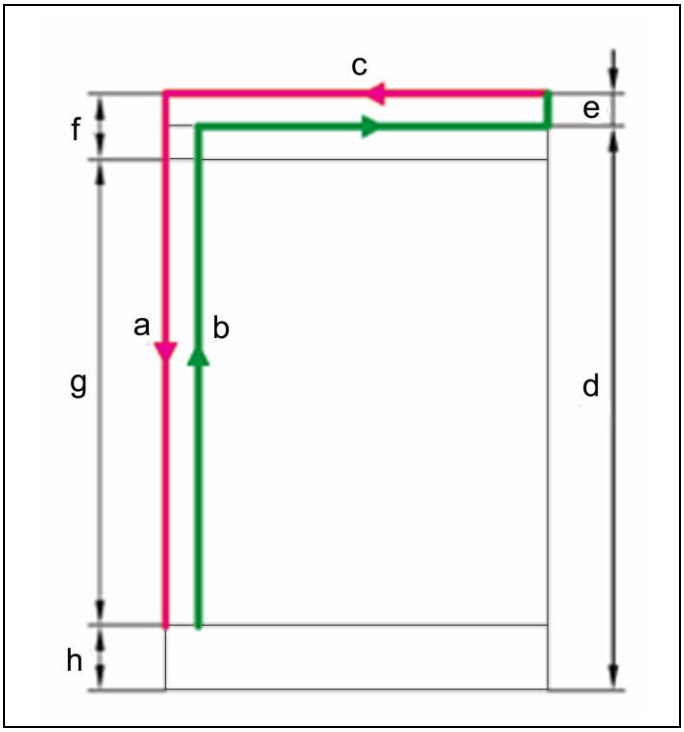


Fig. 11: Working area

a	Clamping	f	Way to accelerate the motor (approx. 3 mm)
b	Unclamping	g	Usable clamping stroke
c	Swinging	h	Overrun (approx. 3 mm)
d	Mechanical lifting range		
e	Spring stroke		

NOTICE

Usable range
The workpiece must be positioned so that there is enough distance to the usable ranges.
The swivelling range must be free of obstructions.

8.3 Effective clamping force Fsp as a function of the clamping arm length L

The effective clamping force is smaller the longer the clamping arm. For longer clamping arms, the clamping force must be reduced so that the admissible bending moment will not be exceeded.

The clamping force is adjusted on the control board or externally via the analogue input L. The default setting is suitable for the accessory clamping arm with contact bolt.

Size 1835

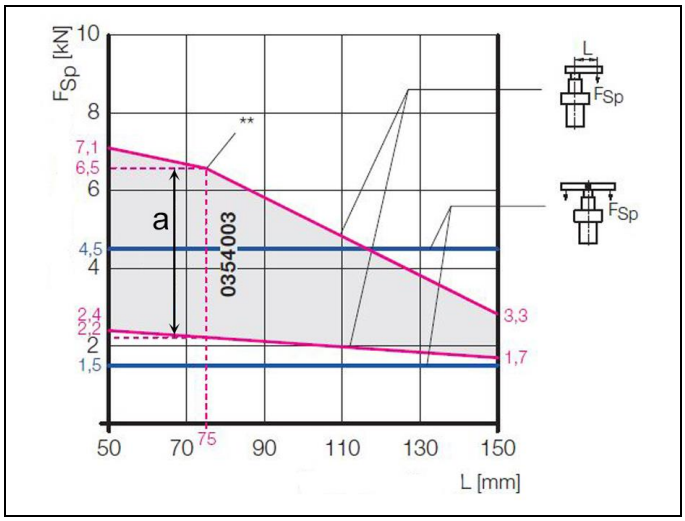


Fig. 12: Clamping force diagram

Fsp Effective clamping force L Clamping arm length	a Adjustment range

NOTICE

Further details

- For further technical data see ROEMHELD data sheet.

8.4 Permissible displacement force Fv for the horizontal positioning of a workpiece

The electric clamp can push, i.e. position a workpiece against fixed points. The permissible displacement force depends on the set clamping force and the length of the clamping arm. It equal to 15 % of the set clamping force.

An example of this is size 1835:

A clamping arm with 75 mm centre distance to the clamping point is used. Trimmer F is set to 9. The trimmer E setting is not relevant for the calculation of the displacement force. According to the clamping force diagram (see below), a clamping force FSP of approx. 6.5 kN is thus set. The permissible displacement force FV is thus

$$F_V = F_{SP} * 15\% = 6{,}5\ \text{kN} * 0{,}15 = \mathbf{0,98}\ \text{kN}$$

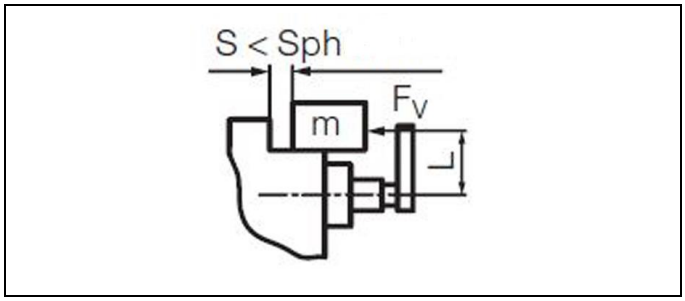


Fig. 13: Admissible displacement force

Sph Clamping stroke Fv Admissible displacement force	L Clamping arm length m Weight

NOTICE

Further details

- For further technical data see ROEMHELD data sheet.

8.5 Make settings

The clamping force acting on the clamping point depends on the trimmer setting at the control board and the used clamping arm.

The setting of the trimmers is made on the controller board, located under the engine cover. For this purpose, the engine cover must be carefully unscrewed. The setting can also be made via the optional IO-Link interface. To do this, the corresponding trimmer must be set to zero (factory setting for IO-Link variant).

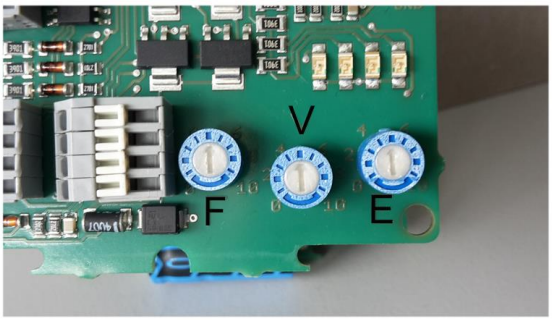


Fig. 14: Clamping force diagram

F Trimmer for clamping force v Trimmer for swing speed	E Trimmer compensation

Trimmer F adjusts the clamping force. Alternatively, the clamping force can also be adjusted via the analogue input or the IO-Link interface (see the chapter on interfaces and IO-Link interface description).

Trimmer V adjusts the swing speed of the electric clamp. The higher the moment of inertia of the clamping arm, the lower the trimmer or the value in the IO-Link interface must be set.

Trimmer E is used for the compensation of elasticities in the system, especially of the clamping arm. The longer the clamping arm, the higher the trimmer or the value in the IO-Link interface must be set.

The settings can be made according to the following chart. The table is based on practical experience with a normal clamping arm design, which tapers to the clamping point. In the case of deviating designs or materials (e.g. aluminium), the setting of the trimmer E or the value in the IO-Link interface must be estimated. For high accuracy requirements, the clamping force must be measured by the customer.

Clamping force adjustment size 1835

Used clamping arm		Axial force set Fz	Distance between piston axis and clamping point [mm]					
			60	75	90	110	130	150
Analogue input [v]	Trimmer **V**		10	10	8	5	3	0
	Trimmer **E**		4.0	5.0	6.0	7.3	8.7	10.0
	IO-Link **E**		35 %	50 %	65 %	80 %	90 %	100 %
	Trimmer **F**		Clamping force F [N]					
3.33	1	3000	2273	2143	2027	1891	1772	1667
4.17	2	3750	2841	2679	2534	2363	2215	2083
5.00	3	4500	3409	3214	3041	2836	2657	2500
5.83	4	5250	3977	3750	3547	3309	3100	2917
6.67	5	6000	4545	4286	4054	3782	3543	3333
7.50	6	6750	5114	4821	4561	4254	3986	
8.33	7	7500	5682	5357	5068	4727		
9.17	8	8250	6250	5893	5574			
10.0	9	9000	6818	6429				

8.6 IO-Link interface descriptions

The IODD (IO Device Description) is an XML file that describes the IO-Link device. It is required for project planning of the swing clamp in any engineering tool. The IODD of the electric clamp can be found in the IODDfinder of the IO-Link Community at the following address: https//ioddfinder.io-link.com//.

According to the IO-Link standard, the data transmitted via IO-Link can be divided into 3 categories. The process data are transmitted cyclically. Parameter data are transmitted acyclically on request. System events, also called events, are transmitted to the IO-Link master immediately after they occur.

8.6.1 Cyclical process data

8.6.1.1 Output data (IO-Link master to swing clamp)

Byte 0

31	30	29	28	27	26	25	24
RES							

Byte 1

23	22	21	20	19	18	17	16
RES					clamp	unclamp	reset

Byte 2

15	14	13	12	11	10	9	8
setpoint force [N]							

Byte 3

7	6	5	4	3	2	1	0
setpoint force [N]							

Clamp
If this bit is set, the swing clamp carries out a clamping process.

Unclamp – Unclamping
If this bit is set, the swing clamp carries out an unclamping process.

Reset – Reset error
A pending internal error is reset by triggering with this bit.

Setpoint Force – Setpoint value of the clamping force
The nominal value of the clamping force is specified in this data word. The clamping force is specified in integer form from 0 … 10,000 Newton. Observe minimum clamping force, see chapter “Start up”. To set the clamping force via IO-Link, trimmer F on the control board must be set to 0. Otherwise, the position of the trimmer F determines the clamping force. In order to use the clamping force adjustment in clamped condition, the command "clamping" must be applied.

8.6.1.2 Input data (swing clamp to IO-Link master)

Byte 0

47	46	45	44	43	42	41	40
RES					Error	unclamped	clamped

Byte 1

39	38	37	36	35	34	33	32
error code							

Byte 2

31	30	29	28	27	26	25	24
stroke [mm]							

Byte 3

23	22	21	20	19	18	17	16
stroke [mm]							

Byte 4

15	14	13	12	11	10	9	8
actual force [N]							

Byte 5

7	6	5	4	3	2	1	0
actual force [N]							

Error
If this bit is set, there is an internal error in the swing clamp.

Unclamped
If this bit is set, the swing clamp is in the “unclamped” position.

Clamped
If this bit is set, the swing clamp is in the “clamped” position.

Error code
An internal error code 2...24 is output. An error description can be found in the chapter “Error detection”.

Stroke – Clamping stroke
Output of the current piston position or clamping stroke in 1/100 millimetre

Actual Force – Clamping force
Output of the achieved clamping force. The clamping force is output as an integer from 0 … 10,000 Newton.

8.6.2 Acyclic process parameters and system commands

The parameter data are used for identification, configuration and diagnosis of the electric clamp. These parameter data are addressed via index and subindex. Standardised process parameters are defined by the IO-Link standard, other process parameters are device-specific. All parameters are defined in the IODD file.
During project planning, the parameter data can be read out and changed with project planning software (e.g. SIEMENS S7-PCT). Reading out and changing parameter data during ongoing system operation can be realised with the help of function blocks (e.g. FB IO_LINK_CALL from Siemens). For more information, contact the PLC or IO-Link master manufacturer.

8.6.2.1 Standardised process parameters

Index (dec)	Variable	Access	Data type	Comment
0x0002 (2)	System-Command	W	uInt 8	Executing system commands
0x0010 (16)	Vendor Name	R	String	Manufacturer name
0x0011 (17)	Vendor Text	R	String	Manufacturer text
0x0012 (18)	Product Name	R	String	Product name
0x0013 (19)	Product ID	R	String	Product ID
0x0014 (20)	Product Text	R	String	Product text
0x0015 (21)	Serial Number	R	String	Serial number
0x0016 (22)	Hardware Revision	R	String	Hardware status; BP = Basic board, KP = Communication board
0x0017 (23)	Firmware Revision	R	String	Firmware status
0x0020 (32)	Error Count	R	uInt 16	Number of errors since start or reset

8.6.2.2 Device-specific process parameters

Index (dec)	Variable	Access	Data type	Comment
0x0042 (64)	Overall-Cycles	R	Int	Overall cycles
0x0041 (65)	Cycles-ToService	R	Int	Number of cycles until maintenance. Counter is reset during maintenance.
0x0042 (66)	Speed	R/W	Int	Adjustment of swing speed in %. The swing speed used depends on the clamping arm used (see Make settings)
0x0043 (67)	Correc-tionValue	R/W	Int	Compensation of elasticities in the clamping system (see Make settings)
0x0044 (68)	Confirma-tionNo	R	String	Production confirmation number
0x0045 (69)	DrawingIn-dex	R	String	Drawing status

9 Maintenance

⚠ WARNING

Burning due to hot surface!
During operation, surface temperatures on the product can exceed 70°C.
- Maintenance and repair work should only be performed in a cooled down condition and/or with protective gloves.

It is recommended to send the electric swing clamp after 500,000 clamping cycles to ROEMHELD for overhaul. On this occasion, the spring elements are replaced, and the spindle cleaned and greased.
In order to display the service interval, a cycle counter is integrated in the control board. This counts and stores the effected clamping cycles and displays the counter reading via a flashing signal. The flashing signal is optically recognizable via a blue LED on the integrated control board and can be evaluated via the interface signal "Message special function" by the higher-level control.

NOTE

Further Information
Further information on settings is available in the technical documentation of the electric swing clamp which you can obtain on request.

9.1 Cleaning

⚠ CAUTION

Material damage, damage to moving components

Damage to piston rods, plungers, bolts, etc., as well as wipers and seals can lead to leakage or premature failure!

- Do not use cleaning agents (steel wool or similar) that cause scratches, marks or the like.

Material damage, damage or functional failure

Aggressive cleaning agents can cause damage, especially to seals.

The product must not be cleaned with:

- corrosive or caustic substances or
- organic, solvents such as halogenated or aromatic hydrocarbons and ketones (cellulose thinner, acetone, etc.).

The product must be cleaned at regular intervals, especially the area of the piston or the plunger housing has to be cleaned from swarf and other liquids.

In the case of heavy contamination, the cleaning has to be made in shorter intervals.

9.2 Regular checks

1. Check tightness of plug-in connector (visual control).
2. Check running surfaces of the piston rod if there are marks and scratches. Run marks can be an indication for a contaminated system or an inadmissible side load of the product.
3. Clamping force control
4. Check the observance of the maintenance intervals.

10 Trouble shooting

10.1 Fault detection

Faulty clamping operations can be caused by external influences, such as hindrances in the swing area or by internal faults. The electric clamp carries out a series of checks and reports faults with a flash code. This information is optically recognizable via a red LED on the integrated control board and can be evaluated via the interface signal “Message error code” by the higher-level control. The error code consists of a series of flash pulses followed by a pause. The error code can be determined by counting the flashing pulses between the pauses. With the optional IO-Link interface, the error description is transmitted in plain text, see the chapter entitled IO-Link interface descriptions.

The currently evaluated errors are listed in the following table.

Error code	Description	Corrective measures
2	Reset of the processor during clamping process. The microcontroller of the control makes a reset while the clamping process is active.	Reset error and check function. Should the error occur repeatedly, contact our service staff.
3	Undervoltage of the supply of the control. The supply voltage of the control (24V) falls for a period of 50 ms below a value of approx. 20V.	Check the height and stability of the power supply to the control and correct as necessary.
4	Overvoltage of the supply of the control. The supply voltage of the control (24V) exceeds for a period of 50 ms a value of approx. 32V.	Check the height and stability of the power supply to the control and correct as necessary.
5	Error when swinging to clamping position (obstacle). Swinging from the unclamped position to the clamping position could not be effected. Mostly a hindrance (e.g. swarf) in the swing area is the reason that causes the activation of the mechanical overload protection device.	Check the swing area, if there are any obstacles. Check the smooth running of the swing motion by hand, slowly rotate the clamping arm. The unclamped position must be approached beforehand.
6	Time for releasing the clamped condition too long. A missing or overloaded power supply of the motor (performance) can be the cause.	Check the supply voltage of the motor. In order to loosen the condition clamped, possibly the clamping arm has to be detached.
8	Time for a motion sequence too long (timeout), without a high current flow. This message appears when a more specific error detection is not possible, does not work or is not anticipated.	Reset error and check function. If the error occurs repeatedly, try to determine the motion sequence that leads to the error and contact our service staff.
9	Clamping arm wrongly adjusted (acceleration distance to the workpiece too short). After the swing motion to the clamping position, the motor must accelerate to high speed. During this time the control cannot detect the contact with the workpiece. Therefore, a minimum distance to the clamping stroke must be available after the swing motion.	Adjust the clamping arm or clamping screw so that the minimum clamping stroke does not fall below approx. 3...4 mm.
11	Inadmissible signal states of the commutation electronics in the interior of the electric motor. Possibly cabling defective.	Reset error and check function. Should the error occur repeatedly, contact our service staff.
12	During a motion sequence, the current limit was reached. Often this condition is intercepted by a more specific error detection and should not occur.	Reset error and check function. If the error occurs repeatedly, try to determine the motion sequence that leads to the error and contact our service staff.
13	High overcurrent by defective component (cross fault) Probably a defective power transistor of the motor control.	Reset error and check function. Should the error occur repeatedly, contact our service staff.
15	Relative duty cycle exceeded. The admissible relationship between operating and pause time has been	Let the electric clamp cool down and check the operating conditions.

	exceeded. This can lead to inadmissible heating.	
16	During the clamping process, a workpiece was detected and built-up of the clamping force was started. The piston has left the admissible clamping range. The workpiece is too deep located or the clamping arm is incorrectly set.	Check dimensioning and adjustment of the clamping arm. Possibly the clamping point can be corrected by inserting e.g. disks.
17	The piston cannot swing away from the unclamped position (sensor). If the mechanics is smooth running, a missing power supply of the motor (performance) can be the cause. Note: A bridge in the control box has to connect the masses of the power supply of the control and the motor (performance).	Check the supply voltage of the motor.
18	The springs in the coupling mechanics cannot be released by the drive during the swing motion to the clamping position.	You can try to release the springs manually by “beating” the clamping arm back in the direction of the unclamping position. Reset error and check function. Should the error occur repeatedly, contact our service staff.
19	Due to too little friction in the swivel coupling and an unfavourable installation position as well as a heavy clamping arm, the clamping arm may tip before reaching the guiding groove of the clamping range. This condition is signalled by the error detection. Often worn springs in the coupling mechanics are the cause.	Reset error and check function. Should the error occur repeatedly, contact our service staff.
20	Swinging from the clamped position to the unclamping position could not be effected. Mostly an obstacle in the swing area is the cause for the activation of the electronic overload protection device.	Check the swing area, if there are any obstacles. Check the smooth running of the swing motion by hand, slowly rotate the clamping arm.
21	Current limit reached when releasing the clamped condition was reached. Possibly mechanical jamming for example because of too long clamping arm. In the case of long operating times, poor lubrication and wear can lead to this error. A clamping force that is incorrectly too high is also a possible cause.	Check mechanical conditions. When clamping and unclamping pay attention to noises. In order to loosen the condition clamped, possibly the clamping arm has to be detached.
22	Impermissibly long and high current flow without reaching the internal current limit or motor supply voltage too low. This error can occur if the power supply is undersized and cannot supply the required current or if the line cross-section is too small for a given line length. Possibly too many electric clamps are operated at the same time on the same power supply or the same line.	Check the power supply and line for performance.
23	Defect of built-in sensors for position recognition.	Reset error and check function. Should the error occur repeatedly, contact our service staff.
24	Serial data connection to the IO-Link module interrupted (timeout). Internal defect in the IO-Link module. IO-Link communication may also not be possible. For safety reasons, the electric clamp is switched off.	Reset error and check function. Should the error occur repeatedly, contact our service staff.

10.2 Error handling

To restore the operational readiness after an error, the following approach is recommended:
When an error occurs, the pending motion command (clamping or unclamping) should be immediately reset. The error message can only be reset by setting the signal “Reset”. The electric clamp must always be moved back to its reference position by setting the signal “unclamping”. This is the only way to ensure that the electric clamp is again ready for operation. The reason for this error must be eliminated first, before new clamping process can be initiated. If the error condition should continue, again an error message will be displayed.
During error handling, the user has to pay attention that no dangerous or damaging conditions will occur.

11 Accessory

11.1 Selection of the clamping arm

⚠ CAUTION

Material damage or functional failure

Use of an incorrectly dimensioned clamp can lead to damage on the product.

- When dimensioning, consider length, mass and the resulting radial torque and mass moment of inertia (see data sheet or installation drawing).

12 Technical characteristics

Characteristics

Clamping time [s] approx.	3
Unclamping time [s] approx.	3
Clamping arm length [mm]	max. 150
Nominal voltage [V DC]	24
Operating voltage range [V DC]	22….30

Residual ripple [%]	< 10
Max. power consumption [A]	15
Rating motor [W]	40
Duty cycle [%]	25 (S3)
Code class IP	67
Ambient temperature [°C]	-5….+40
Mounting position	preferably any
Weight approx.[kg]	10.75

Energy efficiency

Standby current consumption of control and sensors	approx. 1.2 W
Clamping / unclamping cycle	approx. 400 Ws
For 100,000 clamping cycles per year and 250 working days there will be a total energy consumption of	approx. 20 h

Thread	Tightening torque of the fixing nut of the clamping arm [Nm]
M18 x 1.5	**30**
M28 x 1.5	**90**
M35 x 1.5	**160**
M45 x 1.5	**280**

NOTE

Further information

- For further technical data see ROEMHELD data sheet. B18320

13 Ambient conditions

The electric clamp is designed for use in harsh environmental conditions, as it is commonly used in machine tool machining areas. In particular, water impermeability is crucial.
The plug-type connectors, cable glands and the static seals reach code class IP67.
The piston rod wiper seal must not be directly pressurised with a high-pressure water jet.
The entry of small quantities of liquid cannot be excluded during motion. As this can lead to larger problems with electrical drives than in the case of hydraulic components, it is recommended to connect a positive air pressure in such conditions.
In order to prevent condensation of moisture within the electric clamp, the positive air pressure must be dried.
For the protection of the piston rod wiper seal against hot swarf a metallic wiper is available as an option. The electrical connections as well as the motor cap must be protected against hot swarf.

NOTICE

Connect vent hose

If there is any danger that fluids penetrate into the electric clamp, the screw plug at the venting port G 1/8 has to be removed and a vent hose has to be connected. The other end has to be placed in a dry area.

14 Storage

⚠ CAUTION

Damage due to incorrect storage of components

In case of improper storage, the seals can embrittle and resinification of the anti-corrosive oil or corrosion on/in the element can occur.

- Storage in the packaging and moderate environmental conditions.
- The product must not be exposed to direct sunlight, since UV light may cause serious damage to the seals.

ROEMHELD products are treated as standard with a corrosion prevention agent.
This ensures that the products are protected internally for six months from corrosion, when they are stored in dry rooms with a stable temperature.
Extended storage times require treatment with a non-resinifying corrosion prevention agent, and the external surfaces will also require treatment.

15 Disposal

Hazardous to the environment

Due to possible environmental pollution, the individual components must be disposed only by an authorised expert company.

The individual materials have to be disposed as per the existing regulations and directives as well as the environmental conditions.
For the disposal of electrical and electronic components (e.g. stroke measuring systems, proximity switches, etc.) country-specific legal regulations and specifications have to be kept.

16 Declaration of incorporation

Manufacturer

Römheld GmbH Friedrichshütte
Römheldstraße 1-5
35321 Laubach, Germany
Tel.: +49 (0) 64 05 / 89-0
Fax: +49 (0) 64 05 / 89-211
E-mail: info@roemheld.de
www.roemheld.com

Responsible person for the documentation:
Dipl.-Ing. (FH) Jürgen Niesner, Tel.: +49(0)6405 89-0.

This declaration of incorporation applies to the following products:

The following types or part numbers are concerned:

- 1835 C090 R26PXX
- 1835 C090 L26PXX
- 1835 C180 R26PXX
- 1835 C180 L26PXX
- 1835 C000 026PXX

XX= Options
OI= IO-Link
M= Metallic wiper
MI= Metallic wiper + IO-Link

The listed products are designed and manufactured in line with the relevant versions of the directives **2006/42/CE** (EC-MSRL) and in compliance with the valid technical rules and standards. In accordance with EC-MSRL, these products are not yet ready for use and are exclusively designed for the installation in a machine, a fixture or a plant.

The following additional EU directives were applied:

- **2006/42/EC,** Machinery directive [www.eur-lex.europa.eu]

The following harmonised standards have been applied:

DIN EN ISO 12100, 2011-03, Safety of machinery; Basic concepts, General principles for design (replacement for part 1 and 2)

DIN EN 60204-1; 2007-06, Safety of machinery - Electrical equipment of machines, Part 1: General requirements

DIN EN ISO 13849-1:2023-12, Safety of machinery - Safety-related parts of control systems - General principles for design

DIN EN ISO 13849-2, 2008-09, Safety of machinery - Safety-related parts of control systems - Validation

The products may only be put into operation after it was assessed that the machine, in which the product shall be installed, corresponds to the machinery directives (2006/42/EC).

The manufacturer commits to transmit the special documents of the products to state authorities on request.
The technical documentation as per appendix VII part B was prepared for the products.

i.V. Ralph Ludwig

Ralph Ludwig
Head of Research and Development

Römheld GmbH
Friedrichshütte

Laubach, 05.12.2024

17 Declaration of incorporation

Importer
Roemheld (UK) Limited
28 Knowl Piece, Wilbury Way,
SG4 0TY Hitchin

E-Mail: sales@roemheld.co.uk
www.roemheld.co.uk

Authorised person to compile the technical documentation:
Darren Rowell, 28 Knowl Piece, Wilbury Way, SG4 0TY Hitchin.

This declaration of incorporation applies to the following products:

The following types or part numbers are concerned:

- 1835 C090 R26PXX
- 1835 C090 L26PXX
- 1835 C180 R26PXX
- 1835 C180 L26PXX
- 1835 C000 026PXX

XX= Options
OI= IO-Link
M= Metallic wiper
MI= Metallic wiper + IO-Link

The listed products are designed and manufactured in line with the relevant versions of the directives **2006/42/CE** (EC-MSRL) and in compliance with the valid technical rules and standards. In accordance with EC-MSRL, these products are not yet ready for use and are exclusively designed for the installation in a machine, a fixture or a plant.

The following additional UKCA directives were applied:

- **Directive 2008 No. 1597**, Health and Safety

The following harmonised standards have been applied:

DIN EN ISO 12100, 2011-03, Safety of machinery; Basic concepts, General principles for design (replacement for part 1 and 2)

DIN EN 60204-1; 2007-06, Safety of machinery - Electrical equipment of machines, Part 1: General requirements

DIN EN ISO 13849-1:2023-12, Safety of machinery - Safety-related parts of control systems - General principles for design

DIN EN ISO 13849-2, 2008-09, Safety of machinery - Safety-related parts of control systems - Validation

The products may only be put into operation after it was assessed that the machine, in which the product shall be installed, corresponds to the Supply of Machinery (Safety) Regulations 2008, 2008 No. 1597.

The manufacturer commits to transmit the special documents of the products to state authorities on request.
The technical documentation as per appendix VII part B was prepared for the products.

Darren Rowell
Managing Director,

Roemheld UK Ltd