Rotary module

ERMB-...





Repair instructions (en)



Imprint

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Preface

These repair instructions are valid for the rotary modules listed on the title page to the exclusion of any liability claims.

Deviations compared to the descriptions in these repair instructions may arise depending on the modification status of the test device for rotary module. The user must check this prior to setting the rotery module and take the deviations into consideration if necessary.

These repair instructions have been prepared with care.

Festo SE & Co. KG does not, however, accept liability for any errors in these repair instructions or their consequences. Likewise no liability is accepted for direct or consequential damage resulting from improper use of the product.

More detailed information on this can be found in Chapter 7 on page 28.

The relevant regulations on occupational safety, safety engineering and interference suppression as well as the stipulations contained in these repair instructions must be observed when working on the products.

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1 Important information

1.1 About these repair instructions

This document contains important information about the professional repair of the type ERMB rotary module, sizes 20, 25 and 32.

Before carrying out a repair, the relevant chapter in these instructions must be read in full and followed consistently.

For reasons of clarity, these repair instructions do not contain complete, detailed information. The following documents should therefore also be available while doing repair work on the rotary model: Operating instructions ERMB... Contains information on the product's peripherals as well as its function, structure, application, installation, commissioning, maintenance and care, etc. (→ www. festo.com).

Spare parts documentation Contains an overview of the spare and wearing parts as well as information on their installation. This can be found in the online spare parts catalogue on the Festo website (→ www.festo.com/ spareparts).

"Tools and repair accessories" information brochure

Contains an overview of available assembly aids (e.g. lubricants, locking agent), special tools, schematic diagrams, fixtures, measuring devices, etc. The information can be found in the online spare parts catalogue on the Festo website (→ Tools and repair accessories.pdf).

1.2 Symbols used in these repair instructions

Danger categories

The following symbols identify text passages which draw attention to specific hazards.



Warning

Marking special information

The following symbols identify text passages which contain special information.



Note
Information
Documents
Environment



1.3 General safety instructions



Warning

The rotary module must only be repaired by authorised and trained persons in accordance with the specifications in the technical documentation and using original spare parts.

Installation and repair by unauthorised and untrained persons, repairs using non-original spare parts, as well as without the technical documentation required for installation and/or repair, are dangerous and therefore not permitted. Repairs must only be carried out in conjunction with these repair instructions as well as the respective device-specific operating instructions.



Note

Instead of carrying out the repair yourself, your local Festo sales office offers the option of having the repair carried out by Festo.



Environment

Components and equipment replaced as part of a repair must be disposed of in accordance with the locally valid environmental protection regulations.

2 General product description

2.1 Functional description

The ERMB-... is a rotary module with a toothed belt that converts the rotation of a servo or stepper motor to a hollow shaft with ball bearings (shaft module). The reference position of the hollow shaft can be sensed by means of an inductive proximity sensor.

The ERMB-... rotary module is intended for turning the work load by a defined rotation angle into a holding position.





2.2 Types and part numbers

Туре	Part number
ERMB-20	552706
ERMB-25	552707
ERMB-32	552708

The complete overview of features, accessories, type codes, technical data and dimensions for the ERMB-... rotary module can be found in the product catalogue or on the Festo website (\rightarrow www.Festo.com).

2.3 Mounting directions

This diagram provides an overview of the mounting directions of the rotary module that are used in these instructions.



3 Component overview

3.1 ERMB-20



This diagram is intended only to provide an overview of the individual components. To order spare and wearing parts, please use the online spare parts catalogue on the Festo website (\rightarrow spareparts.Festo.com).

Position	Designation, Type
1	Socket head screw, ISO 4762-M5X12-10.9
2	Cylindrical pin, DIN 6325-5M6X14
3	Cover
4	Housing
5	Threaded pin, M5X4-45H
6	Socket head screw, ISO 4762-M3X10-8.8
7	Centring ring
8	Cover cap
9	Cover cap
10	Toothed belt
11	Take-up pulley module
12	Toothed disc
13	Drive shaft
14	Retaining ring, JV-19
15	Compression spring
16	Ball
17	Ring
18	Shaft module
19	Guard ring
20	Socket head screw, ISO 4762-M4X16-8.8
21	Clamping component
22	Locking agent (threadlocker)

3.2 ERMB-25



This diagram is intended only to provide an overview of the individual components. To order spare and wearing parts, please use the online spare parts catalogue on the Festo website (\rightarrow spareparts.Festo.com).

Position	Designation, Type
1	Socket head screw, ISO 4762-M4X12-12.9
2	Cylindrical pin, DIN 6325-5M6X14
3	Cover
4	Housing
5	Threaded pin, ISO 4026-M5X5-45H
6	Centring ring
7	Cover cap
8	Cover cap
9	Toothed belt
10	Take-up pulley module
11	Toothed disc
12	Drive shaft
13	Retaining ring, DIN 472-22X1
14	Compression spring
15	Ball
16	Ring
17	Shaft module
18	Guard ring
19	Socket head screw, ISO 4762-M4X16-8.8
20	Clamping component
21	Locking agent (threadlocker)

3.3 ERMB-32



This diagram is intended only to provide an overview of the individual components. To order spare and wearing parts, please use the online spare parts catalogue on the Festo website (\rightarrow spareparts.Festo.com).

Position	Designation, Type
1	Socket head screw, ISO 4762-M5X16-10.9
2	Cylindrical pin, DIN 6325-5M6X14
3	Cover
4	Housing
5	Threaded pin, ISO 4026-M5X5-45H
6	Socket head screw, ISO 4762-M3X10-8.8
7	Centring ring
8	Cover cap
9	Cover cap
10	Toothed belt
11	Take-up pulley module
12	Toothed disc
13	Drive shaft
14	Retaining ring, DIN 472-37X1,5
15	Compression spring
16	Ball
17	Ring
18	Guard ring
19	Shaft module
20	Clamping component
21	Locking agent (threadlocker)



4 Repair steps

This chapter describes how to dismantle, repair and assemble the ERMB-... rotary module. Depending on the cause of the defect to be remedied it may be necessary to exchange several components. The cause of a defect must therefore always be determined before starting a repair.



Note

The repair should preferably be carried out on a stable and flat work surface with storage for small parts.

4.1 Replacing the toothed belt



Note

The rotary module must be dismantled in order to replace the toothed belt (\rightarrow <u>Chapter 4.2 on page 15</u>).

4.1.1 Replacing the toothed belt

Should it be necessary to change the toothed belt, the cause of the failure must be investigated to prevent, for example, repeated and premature failure. A rotary module that has been used as intended will not normally exhibit any premature signs of failure.

This is not necessary in the case of non-premature failure (fatigue time). However, the condition of the shaft module, the drive shaft and the tensioning roller module (wear of the material surface/shape of teeth, radial play of the bearing inner raceway with respect to the drive shaft: when new, it should fit tightly) and also the condition of the deep-groove ball bearings (e.g. perceptible bearing clearance, impaired roll-off behaviour and increased operating noise, etc.) should always be checked. If in doubt, it is recommended to replace all the components mentioned so as to rule out reciprocal effects during later operation.

Possible visible signs of wear to the toothed belt:

- Cracks on the back of the toothed belt are signs of wear, for example caused by operation outside the permitted temperature range, impermissible chemical influences or possibly fatigue.
- Visible individual glass fibre cords in the tooth base are signs of wear caused by fatigue. In this case, the shaft module, the drive shaft and the tensioning roller module must be checked very closely for wear.

If the toothed belt suffers premature failure, the operating conditions should be observed more closely.

The following possibilities should be considered, among others:

• Overloading

Note

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Incorrect default values for the braking ramp during STOP statuses (e.g. emergency stop, quick stop) result in overloading of the rotary module and can destroy it or dramatically reduce its service life.

- Check the settings for all braking ramps on your controller or the higher-order controller (deceleration values and jerking).
- Make sure that the deceleration values (braking deceleration, deceleration times) for the speed, the load to be moved and the installation position (horizontal/vertical) as well as the specified maximum driving torque correspond to the permissible values for the rotary module used.
- Use the Festo "PositioningDrives" sizing software, available via the Festo website (→ www.Festo.com) to size the rotary module.

\rightarrow

Note

Block-step acceleration profiles (without smoothing) cause high peaks in the motive force that can lead to drive overload. Positions outside of the permissible range can also occur.

A smoothed acceleration specification reduces vibrations in the entire system and has a positive effect on the stresses to which the mechanical system is subjected.

• Check which closed-loop controller settings can be adapted (e.g. smoothing of jerking, smoothing of the acceleration profile).

• Ambient conditions / material resistance

Check whether the ambient temperature is within the permissible range.

Check the chemical and physical ambient conditions for hazardous substances, such as dust, abrasive particles, cooling lubricants, solvents, ozone, radiation, water-soluble greases and oils, etc.

4.2 Dismantling the rotary module

4.2.1 Removing the cover

• Loosen the socket head screws in the front and rear of the covers and screw them out.

Туре	Number of socket head screws per side
ERMB-20	2
ERMB-25	4
ERMB-32	4



• Pull the cover off the housing.



Note

The covers are connected to the housing with dowel pins. Pulling them off may require a certain amount of force.



• If necessary, drive the dowel pins out of the covers and replace them.



4.2.2 Removing the shaft module

• Loosen the socket head screws in the guard ring and screw them out.

Remove the guard ring. ٠

Unscrew the threaded pin in the housing, so that you can turn the tension-• ing roller module.

Turn the tensioning roller module anti-clockwise to release the tension on • the toothed belt.

Note

Do not pull the shaft module out of the switching ring. The switching ring could come undone from the shaft module, and the compression springs and the balls could fall out.

- $\boxed{1}$ = Shaft module
- $\boxed{2}$ = Compression spring
- 3 = Ball

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 $\boxed{4}$ = Switching ring













• Push the shaft module with the two deep-groove ball bearings out of the housing from below.



Note

You do not need to remove the deep-groove ball bearings since the spare part includes the two bearings and the shaft.

• Check the inner raceways of the deep-groove ball bearings for a secure fit on the shaft module. If a bearing does not have a secure fit, replace the module.



Note

Ensure that the compression springs and the balls are not lost. Screen the shaft module with your hands or a suitable object.

- Carefully pull the switching ring off the shaft module.
- Remove the balls and the compression springs from the shaft module.







4.2.3 Removing the drive shaft

• Loosen the socket head screws in the centring ring and screw them out.

Туре	Number of socket head screws
ERMB-20	2
ERMB-25	2
ERMB-32	4



• Remove the centring ring.

• Pull the drive shaft with both deep-groove ball bearings out of the cover.



Note

You do not need to remove the deep-groove ball bearings since the spare part includes the two bearings and the shaft.

- Check the inner raceways of the deep-groove ball bearings for a secure fit on the drive module. If a bearing does not have a secure fit, replace the drive shaft.
- Dismantle the retaining ring.





4.2.4 Removing the tensioning roller module

• Screw the threaded pin out of the housing.





Note

To facilitate removing the tensioning roller module, screw an M3 screw into the thread of the tensioning roller and pull it upwards out of the housing. You do not need to remove the deep-groove ball bearings since the spare part includes the two bearings and the shaft.

- Check the deep-groove ball bearings for a secure fit on the tensioning roller module. If a bearing does not have a secure fit, replace the module.
- Take the toothed belt out of the housing.







4.3 Assembling the rotary module

4.3.1 Preparing the housing

• Clean the outside and the inside of the housing using a cloth and an air gun.

4.3.2 Installing the tensioning roller module



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Note (only for ERMB-32)

Pay attention to centring on the bottom of the tensioning roller module. It must sit in the drill hole in the housing.







• Apply a thin film of locking agent to the threaded pin and screw this into the housing, but do not tighten it yet.

Push the tensioning roller module into the housing.

4.3.3 Installing the drive shaft

• Place the retaining ring into its guide.



Note

Check the retaining ring for correct fit.



Warning

Note the minimum bending radii when handling the toothed belt (\rightarrow <u>Chapter 4.3.8 on page 25</u>).

- Push the toothed belt into the housing.
- Push the drive shaft into the housing.



Note

Make sure that the drive shaft is located within the toothed belt.

• Place the centring ring onto the housing with the centring pointing down.

- Apply locking agent to the socket head screws and screw them into the housing through the centring ring.
- Tighten the socket head screws to the corresponding torque (\rightarrow table).

Туре	Torque	Number of socket head screws
ERMB-20	1.2 Nm	2
ERMB-25	3.0 Nm	2
ERMB-32	1.2 Nm	4











4.3.4 Installing the shaft module

- Place the compression springs and the balls into the shaft module.
- Press the balls into their seat and hold them tight.



Note

Ensure that you do not let go of the balls too early to prevent them from getting lost.

• Carefully push the switching ring onto the shaft module.



Note (only for ERMB-32)

Note the position of the cut-outs (a) on the shaft module. They must correspond with the drill holes.

• Push the shaft module into the housing.



Note

You can guide the toothed belt over the gearing of the shaft module through the drill hole underneath.

• Place the guard ring onto the housing with the centring pointing down.



Note (only for ERMB-20)

The threaded holes for the proximity sensor must point to the front or rear. The factory setting has the threaded hole pointing to the rear.

• Apply locking agent to the socket head screws and screw them into the housing through the guard ring.

• Tighten the socket head screws to the corresponding torque (\rightarrow table).

Туре	Torque
ERMB-20	3.0 Nm
ERMB-25	3.0 Nm
ERMB-32	6.0 Nm











4.3.5 Pretensioning the toothed belt



Note

Pretensioning the toothed belt is done by turning the tensioning roller module clockwise.

If two drill holes of the tensioning roller module are parallel to the outer edge of the housing (back pressure perceivable) during pretensioning, the toothed belt tension is close to the desired value.

• Pretension the toothed belt with the help of a face pin wrench.

• Hold the pretension and screw the threaded pin tight in order to fix the tensioning roller module in its position.

4.3.6 Checking the toothed belt tension

Measuring the toothed belt pretension using a test device

The exact procedure for checking the toothed belt pretension can be found in the operating instructions "**Test device for toothed belt pretension TB-TE-EQ5**" (\rightarrow <u>TB-TE-EQ5_en.pdf</u>).









Measuring the toothed belt pretension without a test device

The toothed belt tension is determined by measuring the basic oscillation (natural frequency) of the toothed belt. The toothed belt is adjusted by turning the eccentric tensioning roller module (a).



Warning

The toothed belt tension has a direct influence on the service life of the toothed belt and the performance of the rotary module. The toothed belt tension must therefore be checked with great care.

Before the toothed belt tension can be measured, the rotating plate must be turned several rotations to allow the toothed belt to fully settle and differences in tension to be equalised.



Note

The tension of the toothed belt can only be checked with the covers unscrewed. The values would otherwise be distorted.

- If screwed on, remove the covers from the housing as described in Chapter 4.2.1 on page 15
- Lever the cover caps out of the housing.

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 If necessary, pretension the toothed belt as described in <u>Chapter 4.3.5 on</u> page 22.



Note

To assess the toothed belt tension, several measurements should be taken to balance out measurement tolerances.

Before the toothed belt tension can be measured, the rotating plate must be turned several rotations to allow the toothed belt to fully settle and differences in tension to be equalised.

- Direct the acoustic frequency meter towards the centre of the toothed belt as described in the corresponding operating instructions.
- Make the toothed belt oscillate by striking it with a narrow and heavy object, for example an Allen key or pin punch.



Note

The large drill hole in the housing of the rotary module is for fixing the measuring head and the small drill hole is for attaching the toothed belt.



• Compare the measurement with the specified value (\rightarrow table).

Туре	Minimum frequency (f)	Minimum frequency (f)
ERMB-20	405 Hz	435 Hz
ERMB-25	270 Hz	290 Hz
ERMB-32	300 Hz	330 Hz

4.3.7 Setting the toothed belt tension



Warning

The pretension of the toothed belt diminishes during storage and operation. This is normal and must not be changed by increasing the tension of the toothed belt.

The reduced pretension, as described above, must not be used for assessing the condition of the toothed belt.

If the measured natural frequency of the toothed belt is outside the specified range, the toothed belt tension must be adjusted as follows.

- Hold the pretension of the tensioning roller module with the help of the face pin wrench.
- Undo the threaded pin in the housing.





Note

Turning the tensioning roller module clockwise increases the tension in the toothed belt and thus its oscillation frequency.

Turning the tensioning roller module counterclockwise reduces the tension in the toothed belt and thus its oscillation frequency.

• Tighten the threaded pin in the housing.



Note

Before measuring the toothed belt tension again, the rotating plate must be turned several rotations to allow the toothed belt to fully settle and differences in tension to be equalised.







• If the measured natural frequency of the toothed belt is within the specified range, tighten the threaded pin to the corresponding torque (→ table).

Туре	Torque
ERMB-20	3.0 Nm
ERMB-25	3.0 Nm
ERMB-32	3.0 Nm



• Carefully push the cover caps into the housing.



Note

Do not push too hard since the cover caps are easily pushed through.



4.3.8 Further information on testing the toothed belt tension

The correct toothed belt tension is of critical importance for the service life of the toothed belt as well as the positioning accuracy and performance of the rotary module.

The conventional method for measuring the toothed belt tension via the deflection force is too inaccurate and can therefore not be used. Accurate results are achieved by measuring the oscillation frequency. The natural frequency of a belt is based on its tension (span force), mass and span length.



Note

The span length is the oscillating length of a belt.

A stimulus is applied to the toothed belt to make it start oscillating. The natural frequency of the toothed belt generated in this way is recorded using a meter and displayed as a frequency value in Hertz.



Note

The frequency value is calculated using the specified values for span force (pretension force), belt mass and length of the free belt span according to the following formula:

	f	Natural frequency of the freely oscillating span [Hz]
-1 / I	\overline{V}_V L	Span length [m]
$-\frac{1}{2\cdot L}\cdot\sqrt{n}$	n F _v	Pretension force [N]
	m	Weight per metre of the toothed belt [kg/m]

Note on measurement using the acoustic belt tension meter

If the toothed belt is excited by means of a force stimulus, the span oscillates with its natural frequency; this dies down reasonably quickly depending on the attenuation.

The frequency meter measures the natural frequency generated (transverse oscillation) using the acoustic operating principle. In addition to the basic oscillation (natural frequency), harmonic oscillation can also occur. From experience it is always the first harmonic oscillation. In other words, a further oscillation node is generated, and therefore, in addition to the basic oscillation frequency, values that are twice the natural frequency can also be measured.



For this reason, several measurements should always be taken to differentiate the necessary basic oscillation (natural frequency) from the harmonic oscillation. Only this frequency can be used to extrapolate the force acting along the strand.



Warning

Do not bend or fold the toothed belt, as this can result in damage to the tensile bodies and shorten its service life by tearing it. Note the minimum bending radius for assembly and storage:

ERMB-20: R _{min} = 6 mm ERMB-25: R _{min} = 6 mm ERMB-32: R _{min} = 10 mm

4.3.9 Attaching the cover



Note (only for ERMB-32)

Note the position of the dowel pins in the cover and drill holes in the housing.

• Place the covers onto the housing.



- Apply locking agent to the socket head screws and screw them into the housing through the covers at the front and rear.
- Tighten the socket head screws to the corresponding torque (\rightarrow table).

Туре	Torque	Number of socket head screws per side
ERMB-20	6.0 Nm	2
ERMB-25	3.0 Nm	4
ERMB-32	6.0 Nm	4



4.4 Assembly and functional test

After completing the assembly work on the rotary module, the correct function must be checked as follows.

4.4.1 Measuring the twisting force of the rotating plate



Note

Measuring the twisting force is done without the drive screwed on.

- Test the twisting force by turning the rotating plate (\rightarrow table).
- The rotating plate must be turned by at least one rotation.
- The rotating plate must rotate smoothly and evenly.



Note

The twisting force can be determined using a torque wrench with a dial gauge and a drag indicator.

Туре	Min. twisting force	Max. twisting force
ERMB-20	0 Ncm	15 Ncm
ERMB-25	20 Ncm	40 Ncm
ERMB-32	95 Ncm	130 Ncm



5 Maintenance

This chapter contains key technical information about how to carry out maintenance work on the rotary module. An exact description of the steps for care and maintenance can be found in the operating instructions. Further information on the assembly aids and lubricants can be found on the Festo website (\rightarrow www.Festo.com).

5.1 Cleaning the rotary module

If necessary, clean the rotary module with a soft cloth and a non-abrasive cleaning agent. Due to its service life lubrication, the rotary module does not require any further maintenance.

5.2 Toothed belt tension



Warning

The toothed belt is set to the specified value in the factory and is thus maintenance-free over its entire service life. The pretension of the toothed belt diminishes during storage and operation. This is normal and must not be changed by increasing the tension of the toothed belt.

The reduced pretension, as described above, must not be used for assessing the condition of the toothed belt.

6 Tools

This chapter provides an overview of the tools and aids required to repair and maintain the rotary module.

6.1 Standard tools

The following standard tools are required for repair and maintenance of the rotary module:

- Engineer's hammer/plastic hammer
- Pin punch
- Pliers for retaining rings (interior protection for drill hole)
- Allen key
- Torque wrench
- Torque wrench with dial gauge and/or drag indicator (for measuring the twisting force)
- Face pin wrench

6.2 Devices and measuring devices

You will need the following accessories to measure the toothed belt pretension.

Part no.	Description	Illustration
Туре		
TB-TE-EQ5	Device to check the toothed belt pretension.	
	Suitable for drives of type ERMB/EHMB.	
	Holds the test probe of the acoustic frequency meter of the type TB-TE-EQ3 or TB-TE-EQ13 and excites the toothed belt by means	
	or a prunger.	
	The exact procedure for checking the toothed belt pretension can	
	be found in the operating instructions "Test device for toothed	
	belt pretension TB-TE-EQ5" (→ <u>TB-TE-EQ5_en.pdf</u>).	
TB-TE-EQ13	Acoustic frequency meter for measurement with and without test	
	equipment.	
	An extension cable that can be installed between the frecuency	
	meter and the acoustic test probe is included in the scope of	A Real Property of the second se
	delivery.	
200926	Mounts the acoustic test probe in the test device by means of	-
O-ring 10x1	clamping friction.	
	Included in the scope of delivery of the frequency meter	
	TB-TE-EQ13.	
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For further information on the fixtures and measuring devices, refer to the **"Tools and repair accessories"** information brochure. It can be found in the online spare parts catalogue on the Festo internet site (Tools and Repair Accessories.pdf).

To order the Test device TB-TE-EQ5 or Frequency meter TB-TE-EQ13, please contact your local support.

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When exporting the electronic documentation, the licence holder must observe the export regulations of the exporting country and those of the purchasing country.

III. Warranty

1. Festo products are being further developed with regard to hardware and software. The hardware status and, where applicable, the software status of the product can be found on the type plate of the product. If the electronic documentation, no matter in what form, does not directly accompany the product, i. e. if the product is not supplied together with a portable data storage medium (floppy disk, CD-Rom, removable disk), Festo does not guarantee that the electronic documentation corresponds to every hardware and software status of the product. In this case, the printed documentation from Festo accompanying the product alone is decisive for ensuring that the hardware and software status of the product matches that of the electronic documentation.

2. The information contained in this electronic documentation can be amended by Festo without prior notice and does not commit Festo in any way.

IV. Liability/Limitations of liability

1. Festo supplies this electronic documentation in order to assist the user in creating his machine and system documentation. In the case of electronic documentation that does not directly accompany a product in the form of portable data storage media (floppy disk, CD-Rom, removable disk), i. e. that is not supplied together with that product, Festo does not guarantee that the electronic documentation provided/supplied separately matches the product actually used by the user. The latter applies particularly to extracts of the documents for the user's own documentation. The guarantee and liability for separately provided/supplied data storage media, i. e. except for the electronic documentation provided/supplied via the Internet/Intranet, is limited exclusively to proper duplication of the software, whereby Festo guarantees that in each case the data storage medium or software contains the latest update of the documentation. Concerning electronic documentation available on the Internet/Intranet, there is no guarantee that it will have the same version status as the last typographically published edition.

2. Furthermore, Festo cannot be held liable for the lack of economic success or for damage or claims by third parties resulting from the use of the documentation by the user, with the exception of claims arising from infringement of the protection rights of third parties concerning the use of the electronic documentation.

3. The limitations of liability as per paragraphs 1 and 2 do not apply if, in cases of intent or gross negligence or the lack of warranted quality, liability is absolutely necessary. In such a case, Festo's liability is limited to the damage discernable by Festo when the definitive circumstances are made known.

V. Safety guidelines/documentation

Warranty and liability claims in conformity with the aforementioned regulations (items III. and IV) may be raised only if the user has observed the safety guidelines of the documentation in conjunction with the use of the machine and its safety guidelines. The user himself is responsible for ensuring that the electronic documentation, when not supplied with the product, matches the product actually used by the user.