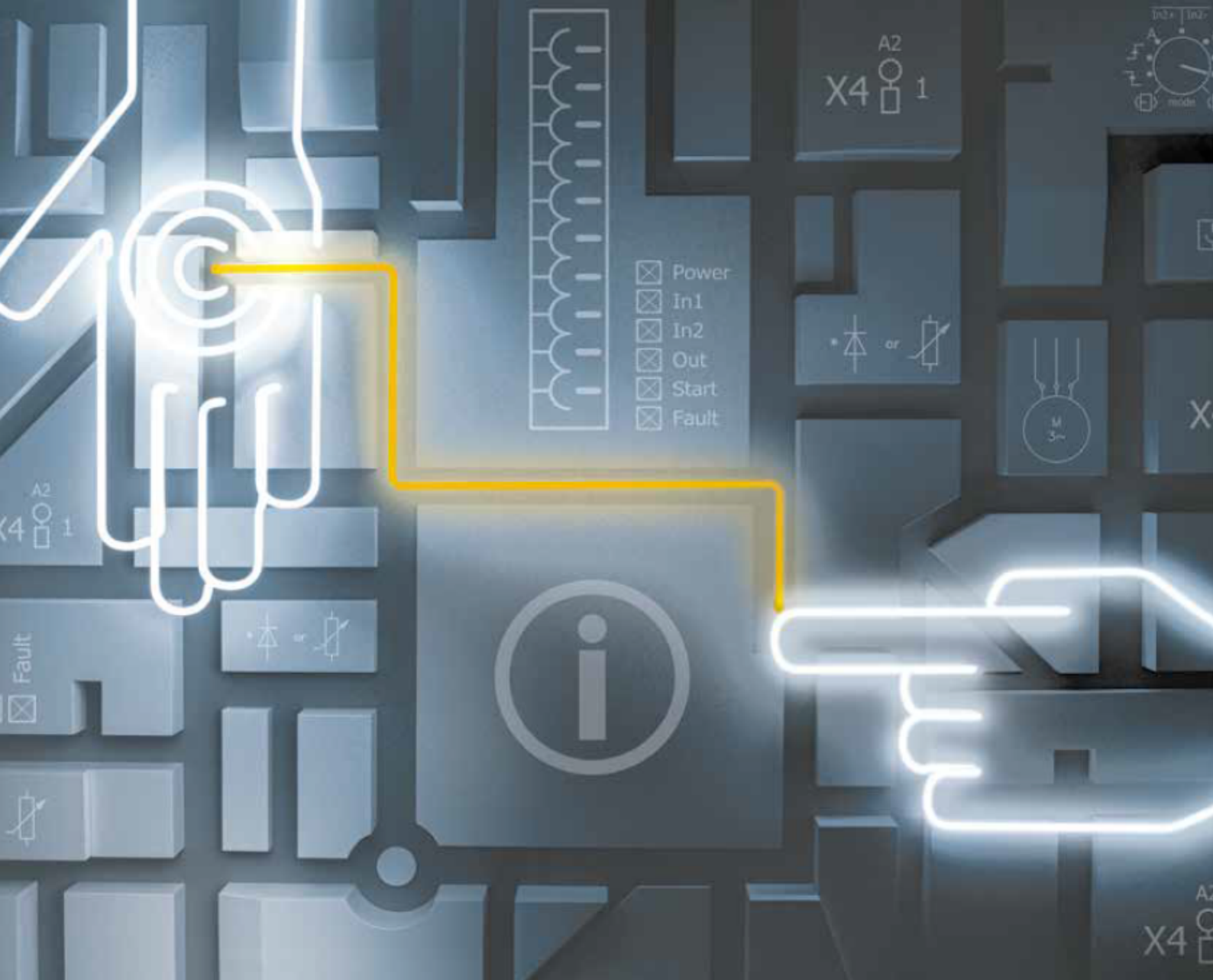




► PRMS device, PRMS Assistant

PILZ
THE SPIRIT OF SAFETY

Operating Manual-1005182-EN-03

- Robotics



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SD means Secure Digital

1 **PRMS Assistant and PRMS device**

This documentation describes the force measurement device **PRMS device** with the corresponding software tool **PRMS Assistant**.

2 Introduction

When using collaborative robots that operate alongside humans in workspaces, it is essential to guarantee that the human cannot be injured in the event of a collision with the robot. The international standard ISO DPAS 5672 defines safety requirements in this case, including maximum permitted values for force and pressure, which must not be exceeded in the event of a collision.

These limits depend on the biomechanical properties of the respective body regions. For HRC applications in accordance with method 4, therefore, it is necessary to measure and verify compliance with the permitted forces and pressures.

The **PRMS device** is used to precisely record and analyse the forces and pressures that can occur in the event of a collision between a robot and a human. The measurement takes into account the respective biomechanical properties of the affected body regions.

The Windows-based **PRMS Assistant** software is available for evaluation, visualisation and documentation of the measurement results. This software supports the verification of the limit values and ensures compliance with the safety requirements of the international standard ISO DPAS 5672.

3 Third-party manufacturer licence information

3.1 PRMS device

The product contains open source software, whose terms of use could further limit the product's application area. It is essential that you observe the third-party manufacturer licence information.

Further information is available in the document "Third-party manufacturer licence information PRMS" (document number 1007358) at www.pilz.com.

3.2 PRMS Assistant

The product contains open source software, whose terms of use could further limit the product's application area. It is essential that you observe the third-party manufacturer licence information.

Further information is available in the document "Third-party manufacturer licence information PRMS Assistant" (document number 1007359) at www.pilz.com.

4 Device description

The **PRMS device** is a force measurement device used to record and evaluate the force and the pressure that occur when a robot collides with a human.

One or more measurements is performed for each danger zone, based on the risk assessment. The maximum permitted force results from the biomechanical properties of the affected body region.

Springs with various spring constants are available for these measurements, to simulate a collision with the various body regions.

The force measurement device can be fitted with an appropriate spring, depending on the body region.

The necessary springs are supplied with the device.

The Windows-based software tool **PRMS Assistant** is available for evaluation and visualisation and for documentation of the measurement results.

Once all the measurements have been performed and evaluated, a measurement report can be generated.



CAUTION!

When performing force measurement, please note:

The measuring range of 0 ... 500 N must not be exceeded!
Exceeding the measuring range can lead to the destruction of the sensor in the device.



CAUTION!

Damage to the device if the spring is changed incorrectly!

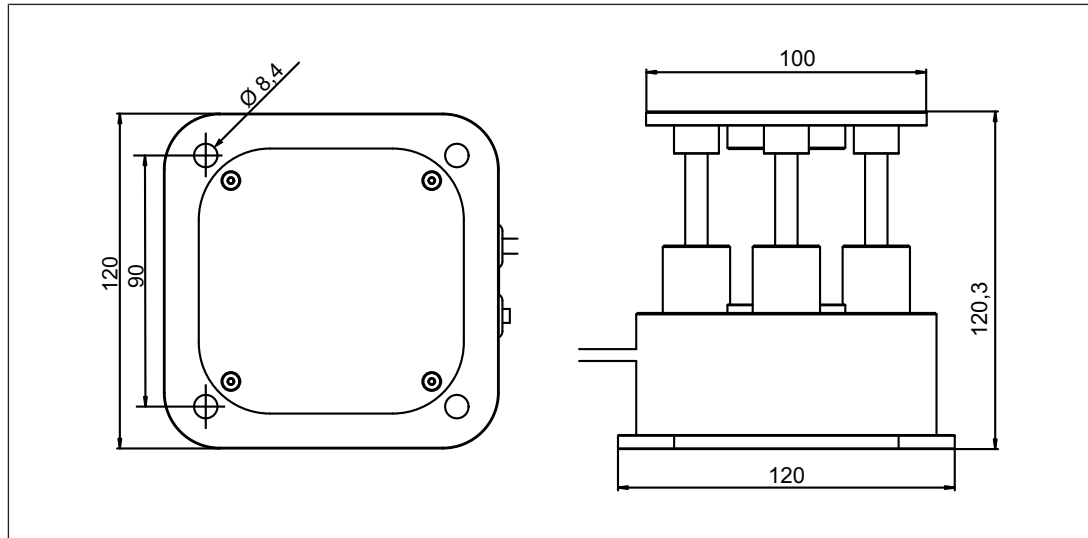
After changing the spring, check that the pin is re-engaged and the spring is inserted centrally into the locking plates on the top and bottom of the device!
Failure to comply with this could destroy the device.

5

Installation

- ▶ Install the force measurement device on a firm, level mounting surface, which cannot move when force is applied.
- ▶ The force measurement device should be secured using 4 screws (M8). Use the drill holes provided on the mounting surface (see drawing).
- ▶ Use a 13 mm ring spanner or 1/4-inch socket spanner to secure the hexagonal screws.

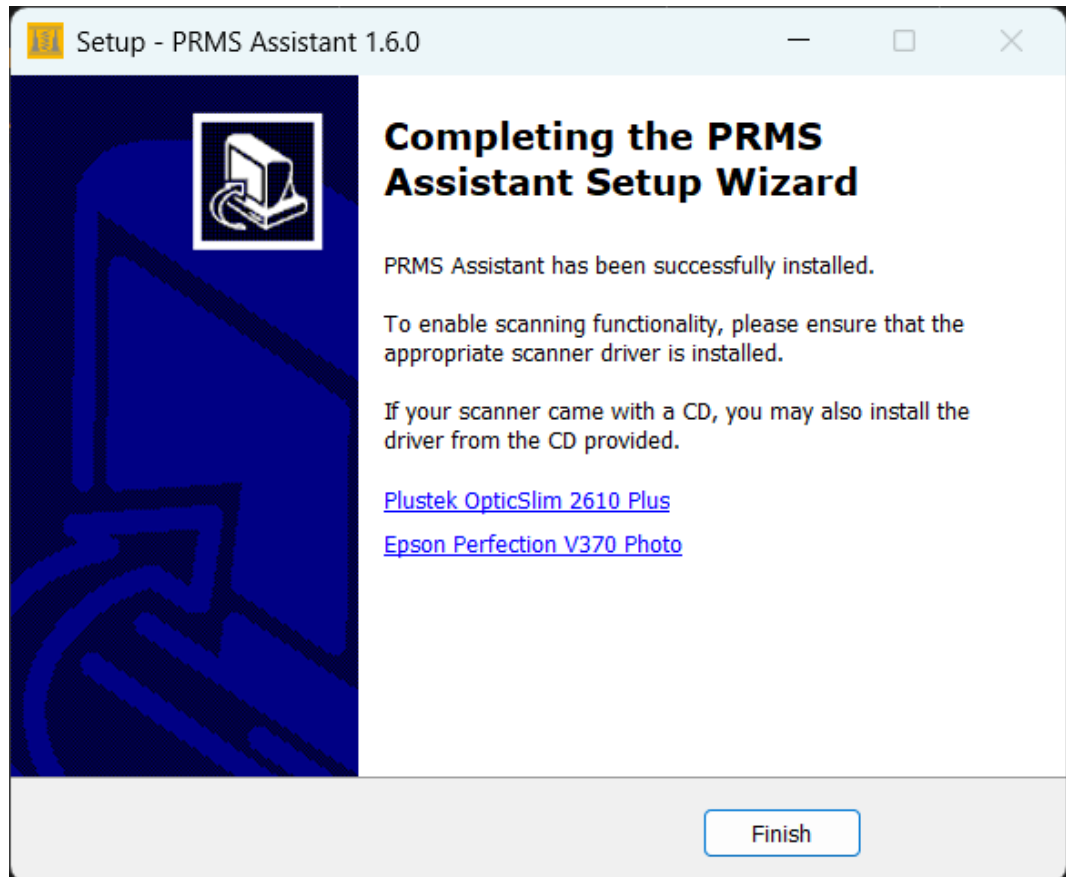
Dimensions in mm



6 Commissioning

To commission the system, proceed as follows:

- ▶ Install the software tool **PRMS Assistant** on your computer. The installation file **PRMS_Assistant.exe** can be found on the Internet at <http://www.pilz.com/support/downloads/>.
- ▶ To scan print films, install the appropriate scanner driver. Download it directly from the manufacturer.



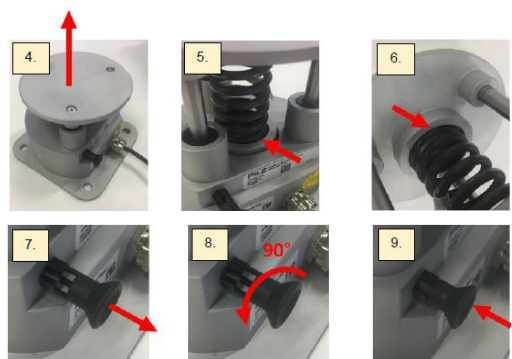
- ▶ Connect the force measurement device to your computer via the USB port to communicate with the software tool. The communication status is displayed bottom right (red: not connected/green: connected).
- ▶ Before taking the measurement, fit the appropriate spring to the force measurement device, depending on the body region that is being configured for a measurement point. When configuring a measurement point in the software tool, the display shows which spring must be used.

Change spring

1. Pull out the black pin on the force measurement device.
2. Turn the pin 90° to the right.
3. Release the pin.



4. Raise the collision surface.
5. Insert the spring.
6. **Make sure that the spring is inserted centrally into the locking plates on the top and bottom of the device!**
7. Pull out the pin.
8. Turn the pin 90° to the left.
9. Release the pin. The spring is now inserted.



CAUTION!

Damage to the device if the spring is changed incorrectly!

After changing the spring, check that the pin is re-engaged and the spring is inserted centrally into the locking plates on the top and bottom of the device! Failure to comply with this could destroy the device.

7 Create and edit project

A project is created for each HRC application in the software tool **PRMS Assistant**.

Enter the general information for your application first. Then you can configure the measurement points for the various body regions. You can set any number of measurements for each measurement point. Typically 3 measurements are performed. These are evaluated by the software tool and can be logged.

7.1 Create, save, open project

Basic actions for a project can be carried out via the toolbar on the user interface:

	Create new project
	Open existing project
	Save project
	Save project as
	Create report (Word document)
	Call up online help
	Change the user interface language

7.2 Project settings

To enable the project report to be attributable and transparent at a later date, you can enter all the relevant information about the project in the **Project settings** window.

► **Project title**

Enter the name of the project; this will be displayed on the title page of the protocol.

► **Version**

Select applicable standard

► **Project description**

This is where you enter the information about the project. The area can be edited. The pre-defined, standard lines and content can be changed, deleted or added according to need.

An illustration of the application should also be inserted at this point.

7.3 Create measurement points

Measurement points are created in the **Measurement points** window. A measurement point must be configured for each body region that could collide with the robot.

The measurement points are displayed and managed under **Points**.



Add new measurement point



Duplicate measurement point



Remove measurement point

Configure measurement point

In the list, click on the required measurement point under **Points** and make the settings for the measurement point.

► Title

The title describes the measurement point.

► Number of measurements

Number of measurements that are to be performed for the measurement point. 3 measurements are normally performed per measurement point.

► Speed

Set speed of the robot.

► Tolerance for force

Tolerance by which the limit value for the maximum permitted force may be exceeded. If the force is above the limit value but within the tolerance, the measured force value will be displayed in yellow.

► Collision type

Select **Quasi-static** if the affected body region can become trapped between the moving part of the robot and another element inside the workspace.

Select **Transient** if the affected body region cannot become trapped but can hit the moving part of the robot and be pushed away.

► Body region

From the list, select a body region for which the measurements are to be performed.

► Description of the measurement

Enter any relevant information about the measurement point. The area can be edited. Lines can be changed, deleted or added as required.

► Measurement setup

Insert images of the measurement setup here.

► Measurement evaluation

Enter your summary of the measurement point evaluation here.

► Axis positions

Here you can specify the positions (start position, collision position and end position) of the individual axes of the robot. An image can be attached to each position.

7.4 Perform measurements

To start measuring, switch to the **Measurements** window. Measurements are always performed per measurement point.

There are two areas: Under **Force** the force measurement is displayed, under **Pressure** the pressure measurement is displayed.

Pressure measurement for a measurement point is possible only when a force measurement has been performed for this measurement point.

The limit values for the measurements are defined automatically by the software tool in accordance with the configuration of the measurement point.

If a limit value is exceeded during a measurement, this will be displayed in red.

If the force is within the tolerance, it will be displayed in yellow.



CAUTION!

When performing force measurement, please note:

The measuring range of 0 ... 500 N must not be exceeded!
Exceeding the measuring range can lead to the destruction of the sensor in the device.



CAUTION!

Damage to the device if the spring is changed incorrectly!

After changing the spring, check that the pin is re-engaged and the spring is inserted centrally into the locking plates on the top and bottom of the device!
Failure to comply with this could destroy the device.

Please note:

To measure the pressure you will need a thermo-hygrometer, which is not included.

We recommend that you use a calibrated thermo-hygrometer (e.g. TESTO 608-H1) with the following properties:

- ▶ Calibration should take place at least once a year.
- ▶ Accuracy:
 - Temperature: ± 1 K
 - Humidity: 3 % r.h.
- ▶ Measuring range:
 - Temperature: 17 °C to 38 °C
 - Humidity: 35 % r.h. to 80 % r.h.

Force measurement

Proceed as follows when measuring the force:

1. In the list, select the required measurement point under **Points**.
2. Make sure that the force measurement device is using the right spring for the measurement point.
3. As soon as a measurement point is selected, the user interface displays which spring to use.
4. Click on **Start measurement**

5. A zero calibration is performed. Make sure that force measurement device has no load.
6. Select the corresponding compression element and place it on the measurement device.
7. Perform the measurements
8. The number of measurements must correspond to the number configured for the measurement point. The force progression and maximum speed is recorded and displayed graphically for each measurement.
9. Once the final measurement has been performed, the measurement will end automatically. If you wish to stop measuring before the final configured measurement has been finished, click on **Stop measurement**.

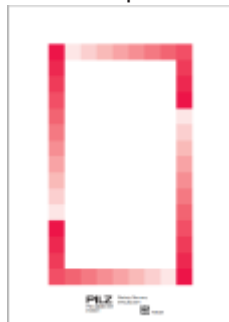
Pressure measurement

To measure pressure, the following conditions must be met:

- ▶ The PRMS Assistant in Version 1.5.0 must be installed
- ▶ The driver for Plustek Scanner must be selected when installing.
- ▶ The Plustek Scanner must be used

Proceed as follows when measuring the pressure:

1. In the list, select the required measurement point under **Points**.
2. Activate the print view by clicking **Print**.
3. Select the corresponding compression element and place it on the force measurement device.
4. Under **Settings**, enter the temperature and the humidity during measurement, and the used pressure indicating film (LW or LLW).
5. Select the corresponding pressure indicating film and place it on the compression element.
6. To scan in a new pressure indicating film, follow the instructions below:
 - Place the pressure indicating film on the calibration sheet within the red limit frame.



We recommend that you fix the indicating film with an adhesive strip to prevent slipping.

- Place the calibration sheet into the scanner so that the arrow on the calibration sheet points to the bottom left.



- Click on the icon  and wait until the scan process is complete.

7. Select the required area for pressure measurement using the tools.



Select required area for pressure measurement



Move print area



Zoom in view



Zoom out view

8. To apply the selected area for measurement, click the symbol . The pressure is calculated and displayed.

7.5 Create project report

Once all the measurements have been performed you can print a project report in Docx format. The project report contains all the project information and measurement results and can be provided for certification of the HRC application.

8 Messages

Error message	Description	Remedy
Connection lost	The software tool has lost the connection to the force measurement device.	▶ Check USB connection ▶ Unplug USB connector then plug it back in
No measurement point selected	The Start measurement button was clicked and no measurement point was selected	▶ Select/create measurement point
No body region selected	No body region has been selected for the selected measurement point	▶ Select body region
No confirmation received for start or stop	The Start measurement or Stop measurement button was clicked but there is no response from the force measurement device.	▶ Unplug USB connector then plug it back in ▶ Contact Pilz
No zero calibration possible	Zero calibration could not be performed at the start of the measurement.	▶ Make sure that the force measurement device has no load.
Maximum permitted force exceeded	The maximum permitted load on the force sensor has been exceeded.	▶ Reduce the load ▶ Make sure that the sensor is not damaged
Could not open the directory of measurements	PRMS Assistant has no access to the folder that contains the measurements.	▶ Save project to a location with write access
Calibration sheet not correctly detected!	PRMS Assistant could not detect all the colour squares for calibration	▶ Align calibration sheet as straight as possible to the A4 marking of the scanner (see Perform measurements  11)
Error saving the scan in the project directory	PRMS Assistant has not access to the folder that contains the measurements.	▶ Save project to a location with write access

9 Function test and calibration

Function test

To ensure that the measurement device functions correctly, we recommend that you perform a function test on the force measurement device **PRMS device** before certifying each application.

Use a reference weight of at least 5 kg to perform the function test, and compare it to the measured value.

Follow the instructions below:

1. **Commissioning the force measurement device**

Connect the device **PRMS device** to your computer and start the software tool **PRMS Assistant**.

2. **Create measurement point**

Create a measurement point, configure any body region.

3. **Perform measurement**

Start the measurement and place the reference weight on the active area within 2 s. Please note that the reference weight should be placed slowly, in order to avoid overshoots.

4. **Compare measurement**

Convert the mass (kg) of the reference weight in force (N) (1 kg corresponds approx. 9.81 N). Check whether the statistical maximum force corresponds to the force of the reference weight (Tolerance: max. 3 % of the maximum value).

Calibration

The force measurement device **PRMS device** must be calibrated annually. The calibration is carried out at Pilz in Ostfildern. Please contact Pilz Support.

Regular calibration ensures that the measurement results are accurate.

Failure to comply is considered improper use. Potential liability claims will be rendered invalid.

10 Technical data PRMS device

General	
Certifications	CE
Measuring range	0 ... 500 N
Accuracy of force measurement	3 % of maximum value
Environmental data	
Ambient temperature	
Temperature range	0 - 40 °C
Mechanical data	
Service life escape release	> 1,000,000 measurements
Dimensions	
Height	120,3 mm
Width	120 mm
Depth	120 mm
Diameter of sensing face	50 mm
Weight	1.080 g

► Support

Technical support is available from Pilz round the clock.

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We are represented internationally. Please refer to our homepage www.pilz.com for further details or contact our headquarters.

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