Order no.	3216-9-		0	0	
DC-B-009		1			
2Phase-010		2			
HLS-010, limit switch (Hall effect)		1			

RS-40 Rotation Stage

Order no. 3216-9-

User Manual

Version: **00.001** Date: 03.05.2022

CONTENTS

1. ABOUT THIS DOCUMENT

All specifications in this user manual refer only to the standard products that are included in the PI miCos catalog. Any special features that are different, in particular special requests from customers, are supplied with the user manual as additional documentation in the form of "Technical Notes".

1.1 Objective and Target Group of this User Manual

- This user manual contains all information required for the intended use of the RS-40.
- Basic knowledge on servo systems, motion control concepts and applicable safety measures is assumed.
- The latest version of the user manual and answers to any questions can be obtained from our customer service department (see chapter 9)

1.2 Symbols and Typographic Conventions

The symbols and typographic conventions used in this manual have the following meanings:

NOTICE

Information for easier handling, tricks, tips, etc.

NOTICE

Dangerous situation!
If not avoided, the dangerous situation will result in death, injuries or damage to the equipment
-> Actions to take to avoid the situation

1.3 Other Applicable Documents

All products and programs from PI miCos mentioned in this documentation are described in separate user manuals.
The latest versions of the user manuals can be obtained from our customer service department (see chapter 9).

2. SAFETY

2.1 Intended Use

The RS-40 is a laboratory device as defined by DIN EN 61010. It is intended for indoor use and use in an environment that is free of dirt, oil, and lubricants.

In accordance with its design, the RS-40 is intended for single-axis positioning, adjusting and rotation of loads around an axis at various velocities. The RS-40 can be mounted horizontally or vertically.

The intended use of the RS-40 is only possible in conjunction with suitable electronics. The following options are available:

1. Drive electronics and controller with suitable software
2. Combination device with suitable software

- The electronics are not included in the scope of delivery of the RS-40.
- The electronics must provide the required voltages. To ensure proper performance of the servo-control system, the electronics must be able to read out and further process the signals from the reference switch as well as those from the incremental position encoder.

2.2 General Safety Instructions

The RS-40 is built according to state-of-the-art technology and recognized safety standards. Improper use of the RS-40 may result in personal injury and/or damage to the E-40.

1. Only use the RS-40 for its intended purpose, and only use it if it is in good working order.
2. Read the user manual.
3. Immediately eliminate any faults and malfunctions that are likely to affect safety.

The operator is responsible for the correct installation and operation of the RS-40.

2.2.1 Organizational Measures

User Manual

- Always keep this user manual available when using the RS-40. If the user manual is lost or damaged, contact our customer service department (see chapter 10).
- Add all information from the manufacturer such as supplements or technical notes to the user manual.

- Only use the device on the basis of the complete user manual. If your user manual is incomplete and is therefore missing important information, serious or fatal injury as well as damage to the equipment can result.
- Only install and operate the RS-40 after you have read and understood this user manual.

Personnel Qualification

The RS-40 may only be started up, operated, maintained and cleaned by authorized and appropriately qualified personnel.

2.2.2 Measures during Installation

The RS-40 may be damaged by excessively long screws and wrongly mounted parts.

- Only use screws of the correct length for the respective mounting holes.
- Only mount the RS-40 and the loads on the mounting fixtures (holes) intended for this purpose.
- The RS-40 heats up during operation. High temperatures can influence your application.
- Install the RS-40 so that your application is not affected by the dissipating heat.
- Cable extensions can affect the performance of the RS-40 and damage the electronics.
- Only use genuine PI miCos parts to connect the RS-40 to the electronic equipment.
- Do not use cable extensions. If you need longer cables, use cable extensions from PI miCos.
- Avoid short circuiting the lines for motor voltages since this can damage the electronics.

2.2.3 Measures during Start-Up

- Do not put your RS-40 into operation until it is fully mounted and connected.

Your system can be damaged by uncontrolled oscillation of the RS-40. Noise generated during operation of the RS-40 is a typical sign of oscillation.

Immediately switch off the servo-control system of the affected rotational axis.

- Check the settings of the servo-control parameters.

Moving parts attached to devices with motorized rotation stages can accelerate rapidly and generate high forces which can cause injury or damage to equipment.

Unintentional motion of the rotation stage is possible when it is connected to the controller for the first time. Defective software or incorrect operation of the software can also result in unintentional motions.

- Do not place any objects in areas where they can be caught by moving parts.

Set the control signal so that the moving part does not stop abruptly or try to continue motion.

- Determine the maximum velocity for your application.

2.2.4 Measures during Operation

- If noise occurs during operation of the RS-40, check the settings of the servo-control parameters of your controller.
- During continuous operation at room temperature, do not exceed a maximum of 90 % of the control signal level.
- For continuous operation at other temperatures, observe the maximum allowable duty cycle in relation to the ambient temperature
  or obtain information from our customer service department (see chapter 9).

2.2.5 Measures during Maintenance

The RS-40 is precision adjusted.

- Do not loosen any sealed screws.

Dirt, oil, lubricants and condensation will render the motor/drive inoperable.

- Keep the motor of the RS-40 free from lubricants.
- Keep the RS-40 free of dirt and condensation.

3. UNPACKING

1. Unpack the RS-40 with care.
2. Compare the contents with the items listed in the contract and the packing list.
3. Inspect the contents for signs of damage. If there is any sign of damage or missing parts, contact PI miCos immediately.
4. Keep all packaging materials in case the product needs to be returned.

WARNING

Risk of suffocation for children. Keep the packaging foil away from children.
Dispose of packaging materials according to environmental regulations.

NOTICE

All specifications in this user manual only refer to the standard products that are included in the PI miCos catalog. Any special features that are different, in particular special requests from customers, are supplied with the user manual as additional documentation in the form of "Technical Notes".

4. PRODUCT DESCRIPTION

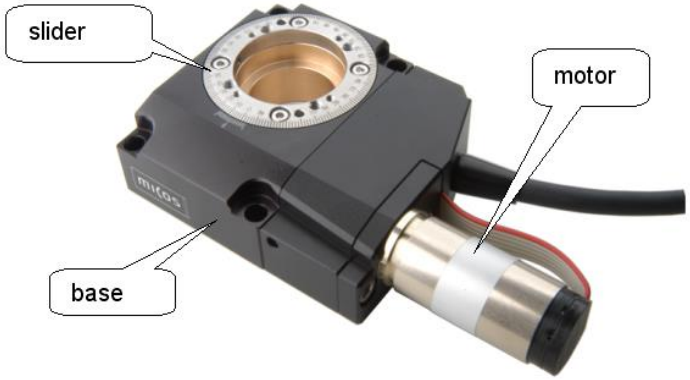
4.1 Features and Application Area

Our products are designed specifically for use in the laboratory.

4.2 Model Overview

Order no.	3216-9-		0	0	
DC-B-009		1			
2Phase-010		2			
HLS-010, limit switch (Hall effect)		1			

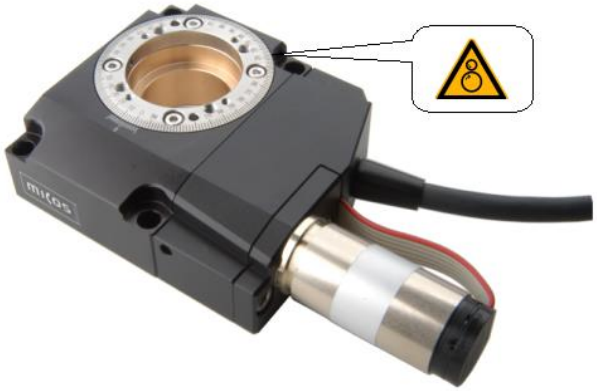
4.3 Product View



NOTICE

Modifications and servicing on this axis may only be carried out by the manufacturer or persons authorized by the manufacturer. The manufacturer is not liable for damage caused by unauthorized tampering. Unauthorized tampering invalidates the guarantee.

4.4 Safety Instructions



NOTICE

Protect the product against mechanical damage (knocking, shock, ...).
Never start up an axis if you suspect it to be damaged or broken.
Do not disconnect or connect connectors when voltage is present.

WARNING

Risk of catching by rotating parts such as couplers and ball screws

WARNING

It is recommended that all persons entrusted with working with this product and who therefore come into contact with areas marked by the ESD warning symbol, are given training and a comprehensive explanation of the ESD warning symbol with respect to the ESD precautions.

4.5 Scope of Delivery

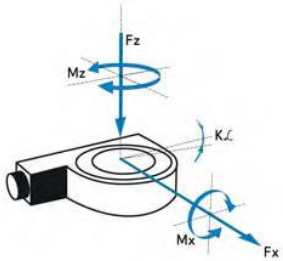
- Rotation stage according to order.
- Mounting accessories (screws & pins) in fast-sealing bag.

4.6 Optional Accessories

Obtain more information on optional accessories from our customer service department (chapter 9).

4.7 Technical Features

4.7.1 Load Capacity Data



FACTS

Load characteristics	Fx(N)	Fz(N)	Mx(Nm)	Mz(Nm)	kax(µrad/Nm)
DC-B-009	10	20	2	0.2	270
2Phase-010	5	10	1	0.2	270

4.7.2 Motors

DC-B-009

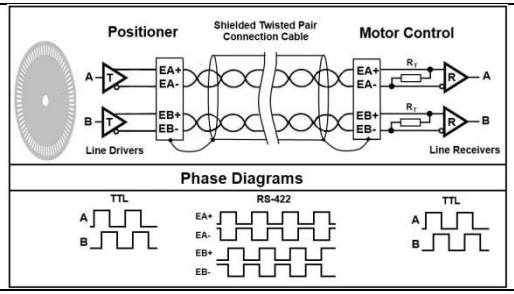
Motor type		DC brush 1516-012 CR
Nominal voltage	V	12
Max. continuous current	A	0.16
Electrical resistance	Ω	60
Electrical inductance	mH	0.400
Torque constant	mNm/A	8.26
Velocity constant	rpm/V	1160
n/M slope curve	rpm/mNm	8430
No load velocity	rpm	12900
Max. continuous velocity	rpm	5000
Max. continuous velocity at nominal torque	rpm	
Inertia	kgm^2	0.4 E-7
Continuous torque	mNm	0.8
Rotary encoder		**RE-005** RS422-outputs 2 channel (1)
Gearbox		Low backlash, 15/8
Gear ratio		387283 / 5103
Encoder increments (quad counts)	n	2048
with additional line-driver PCB in stage or Sub-D (m),15-pin connector-shell		

RE-005

Rotary magnetic encoder RS-422 quadrature

Encoder type		IE2-512 rotary magnetic MR encoder
Quadrature counts per revolution	n	2048
Signal output		TTL / RS-422 (1)
Channels		2
Supply voltage	VDC	5 +/- 10%
Current consumption, typical (Vcc = 5 V DC)	mA	30
Frequency range	KHz	160
Code disc inertia	kgm2	9E-9
Operating temperature	°C	-15..85

(1) with additional line-driver PCB in stage or Sub-D (m), 15-pin connector-shell



2Phase-010

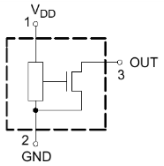
Motor type		2-phase bipolar AM-1524-A0.25
Phase current	A	0.25
Step angle	°	15 °
Steps	n	24
Coil resistance	Ω	12.5
Coil inductance	mH	6.3
Holding torque	mNm	6
Inertia	kgm^2	45E-9
Gearbox		Low backlash, 15/8
Gear ratio		387 283 / 5103
Weight	kg	0.036

4.7.3 Limit Switch

Hall sensor limit switches, DC motor stages

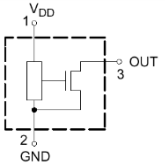
Supply voltage, Vdd	V	5 (connected to encoder supply)
Supply current	mA	<5 mA
Output configuration		Open collector
Max. sink current	mA	20
Max. switching voltage (resistive load)	VDC	3-24
Contact type		Normal closed
Output type		npn
Operating temperature	°C	40 to +85

Caution: There is no separate pin for the sensor supply, sensor shares encoder supply!



Hall sensor limit switches, 2SM motor stages

Supply voltage, Vdd	V	3.8 .. 24
Supply current	mA	<5 mA
Output configuration		Open collector
Max. sink current	mA	20
Max. switching voltage (resistive load)	VDC	3-24
Contact type		Normal closed
Output type		npn
Operating temperature	°C	40 to +85

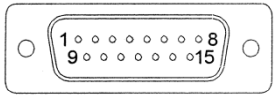


4.7.4 Connector

ST-063

DC motor Sub-D (m), 15-pin assignment with Hall sensors

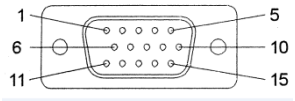
Sub-D (m), 15-pin	Function	
1	EA+	Encoder channel A+
2	EB+	Encoder channel B+
3		
4	EGND	GND supply encoder & sensor limit
6	M+	DC brush motor +
7	nc	
8	nc	
9	EA-	Encoder channel A-
10	EB-	Encoder channel B-
11		
12	E5V	Supply voltage encoder & sensor limit
14	M-	DC brush motor -
15	LE1	Homeswitch



ST-013

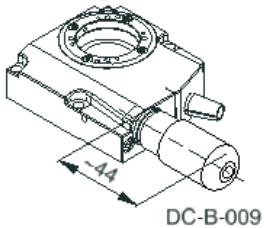
2SM motor, HD Sub-D (m),15-pin with Hall sensors

HD Sub-D (m), 15-pin	Function	
1	MA+	Motor phase A+
2	MA-	Motor phase A-
3	nc	
4	nc	
5	MB+	Motor phase B+
6	MB-	Motor phase B-
7	nc	
8	nc	
9	nc	
10	LVcc	Hall sensor limit supply
11	nc	
12	nc	
13	nc	
14	LE1	Homeswitch
15	LGND	GND sensor limit

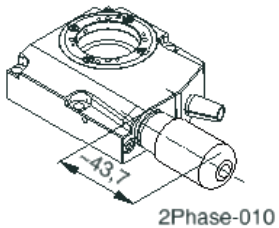


4.7.5 Technical Data

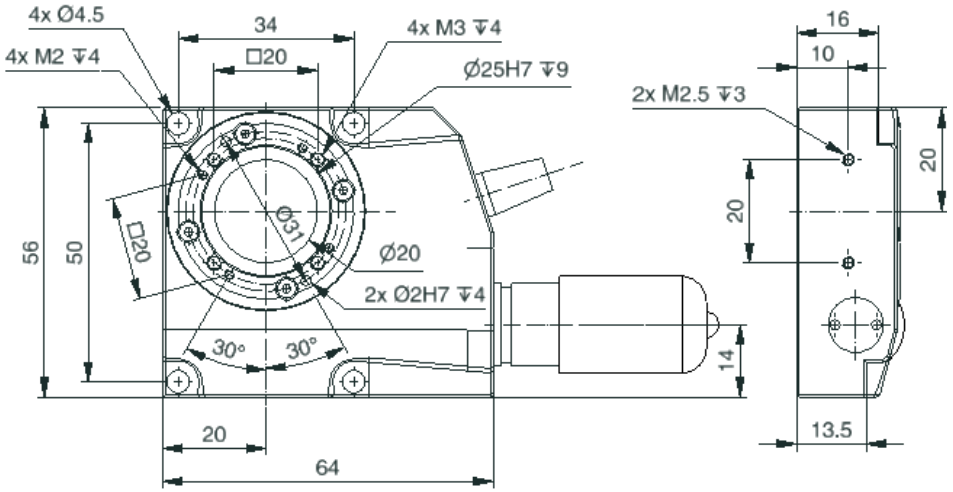
TECHNICAL DATA		
Travel range (°)	360°, continuous	
Evenness (µm)	±5	
Eccentricity (µm)	±5	
Pitch angle (µrad)	±35	
Weight (kg)	0.4	
Motor	DC-B-009	2Phase-010
Max. velocity (°/sec)	7	5
Calculated resolution (°)	2.57E-05 (RE)	0.0021961(FS)
Typical resolution (°)	0.005	0.005
Bidirectional repeatability (°)	± 0.04	± 0.04
Unidirectional repeatability (°)	0.005	0.005
Nominal current (A)	0.16	0.25
Max. operating voltage (V)	12	<38
Gearhead ratio	90 : 1	
Accuracy	on request	
Velocity range (°/sec)	0.002..7	
Material	Aluminum, black anodized, stainless steel, red brass	

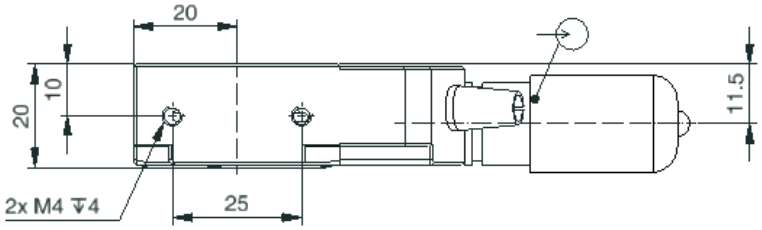


DC-B-009



2Phase-010





4.8 Ambient Conditions

For indoor use only.

- The RS-40 was calibrated at an ambient temperature of 20 °C (+/- 3 °C).
- The permissible operating temperature is between 20 °C and 40 °C.
- The permissible relative humidity is between 20% and 80%.
- Always keep the RS-40 free of dirt, dust, and corrosive gases.

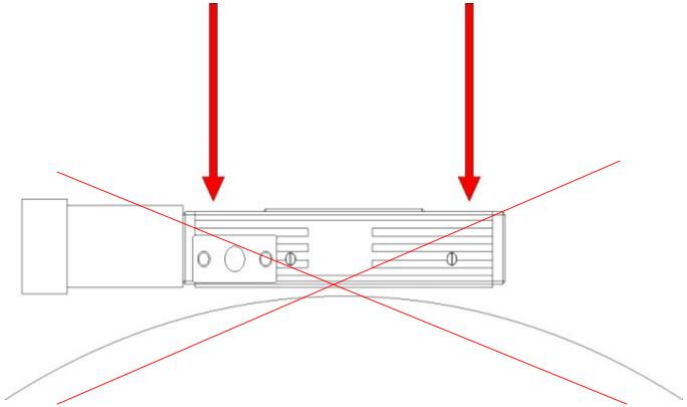
5. INSTALLATION

5.1 General Notes on Installation

Requirements

The axis must be screwed onto a surface with an evenness better than 5 µm. It is necessary to make sure that no dust, dirt or other foreign bodies are between the surface and the axis, otherwise the properties of the axis can be impaired by mechanical tension.

To guarantee the prescribed specifications (see Internet www.pimicos.com), the evenness of the mounting surface must be better than 5 µm. (Reference surface of PI miCos measuring granite is 3 µm).



5.2 Mounting the Rotation Stage

Requirements

You have read and understood the general notes on installation (see chapter 5.1).

Mounting material

screws, pins and auxiliary material or tools supplied (see chapter 4.5 "Scope of Delivery").

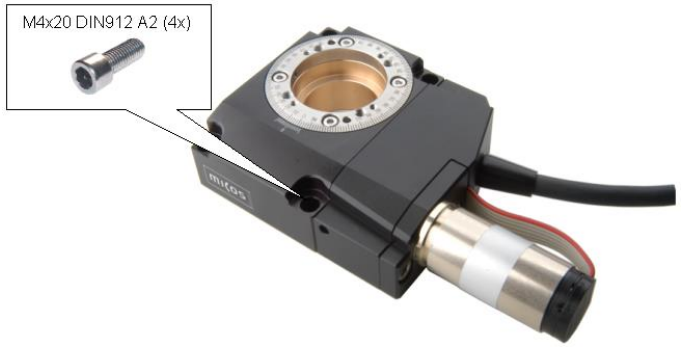
- DIN 912 screws and DIN 6325 dowel pins, m6 tolerance field

Tightening torques of the mounting screws to be used should not have values higher than the following:

- M3 DIN 912 1.5 Nm
- M4 DIN 912 2.0 Nm
- M5 DIN 912 2.5 Nm
- M6 DIN 912 3.0 Nm

Mounting the RS-40

1. Mount the rotation stage with the screws supplied.
2. Make sure that the screw heads do not protrude from the countersunk holes.



5.3 Affixing the Load

Requirements

You have read and understood the general notes on installation (see chapter 5.1).

The load must have an evenness better than 5 µm.

It is necessary to make sure that no dust, dirt or other foreign bodies are between the load and the axis, otherwise the properties of the axis can be impaired by mechanical tension.

Mounting material

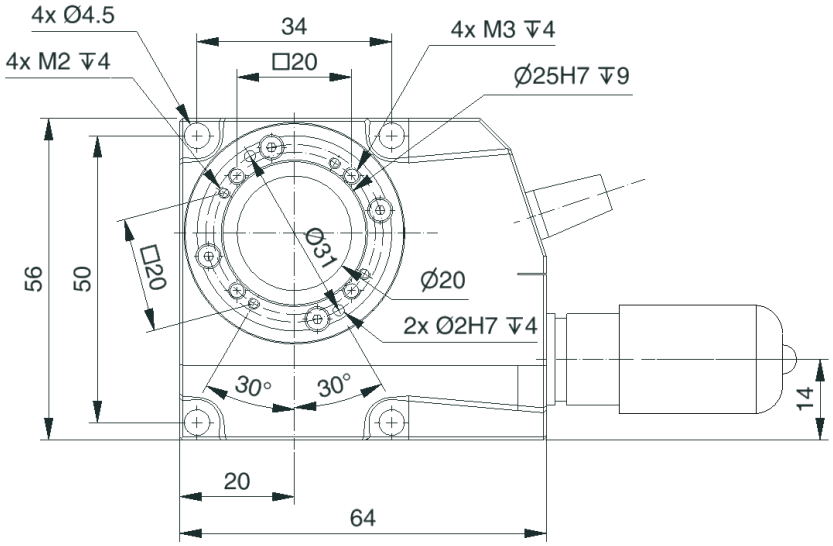
- DIN 912 screws and DIN 6325 dowel pins, m6 tolerance field

Tightening torques of the mounting screws to be used should not have values higher than the following:

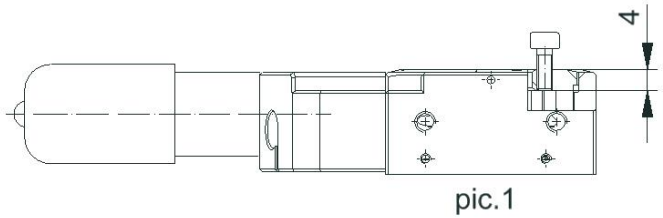
- M3 DIN 912 1.5 Nm
- M4 DIN 912 2.0 Nm
- M5 DIN 912 2.5 Nm
- M6 DIN 912 3.0 Nm

Mounting the Additional Part

- Select the mounting position so that the existing fixing holes in the slider of the RS-40 can be used for the additional part to be affixed.
- Mount the additional part with the corresponding screws.



The screw-in depth of the mounting screws may never exceed 4mm.



pic.1

6. START-UP

6.1 General Notes on Start-Up

This rotation stage must be started up with a suitable cable and the associated controllers.

7. MAINTENANCE

Depending on the operating conditions and the period of use of the RS-40, the following maintenance measures are required:

Maintenance Run

The maintenance run serves to distribute the existing lubricant.

- To evenly distribute the existing lubricant on the stage guidings, perform a maintenance run over one complete rotation after 500 hours of operation, or after 1 year at the latest.
- If the rotation stage is operated continuously in an industrial environment and its motion is over a small range (less than 70°), perform a maintenance run over one complete rotation after 5000 motion cycles.

Lubrication

Under laboratory conditions, extra lubrication is only necessary in exceptional cases. For continuous industrial use, the lubrication intervals must be defined individually.

- Do not lubricate the RS-40 without consulting our customer service department (see chapter 9).
- To lubricate, follow the instructions in the maintenance manual, which you can obtain from our customer service department.

8. TROUBLESHOOTING

If the problem that occurred with your system is not listed in the table above or cannot be solved as described, contact our customer service department (see chapter 9).

9. CUSTOMER SERVICE

For inquiries and orders, contact your PI miCos sales engineer or send us and email (info@pimicos.com).
If you have questions concerning your system, have the following information ready:

1. Product codes and serial numbers of all products in the system
2. Current firmware of the controller (if present)
3. Software version of the driver or the user software (if present)
4. User operating system (if present)

10. OLD PRODUCT DISPOSAL

In accordance with EU directive 2002/96/EC (WEEE), as of 13 August 2005, electrical and electronic equipment may not be disposed of in the member states of the EU via the municipal residual waste.

Dispose of your old equipment according to international, national, and local rules and regulations.

In order to fulfil the responsibility as the product manufacturer, PI miCos GmbH undertakes environmentally correct disposal of all old PI miCos equipment made available on the market after 13 August 2005 without charge.

Any old PI miCos equipment can be sent free of charge to the following address:
PI miCos GmbH
Freiburger Strasse 30
79427 Eschbach, Germany
(http://www.pimicos.com)

11. EU DECLARATION OF CONFORMITY

For the RS-40, an EU Declaration of Conformity has been issued in accordance with the following European directives:

2014/30/EU, EMC Directive
2011/65/EU, RoHS Directive

The applied standards certifying the conformity are listed below.

EMC: EN 61326-1:2013
Safety: EN 61010-1:2010
DIN EN ISO 12100:2010
RoHS: EN 50581:2012