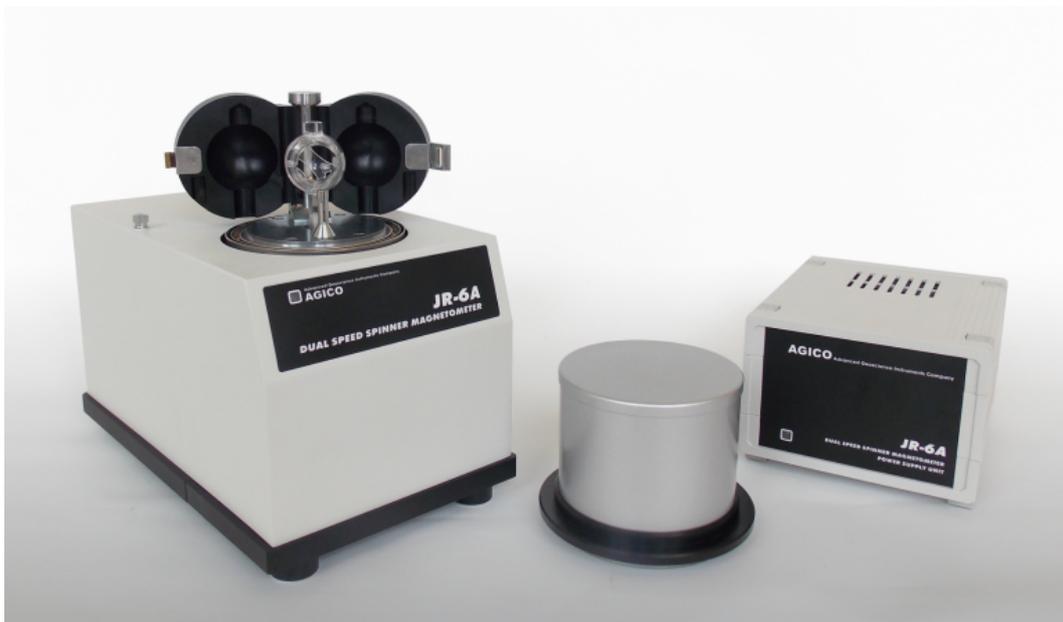


# JR-6A / JR-6

SPINNER MAGNETOMETER FOR MEASUREMENTS  
OF REMANENT MAGNETIZATION



User Manual

Version 3.2  
September 2022

AGICO



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## User Manual Conventions

 **Prohibition** symbol is used to prohibit any action which may cause a loss of properties, damage or injury.

 **Warning** symbol is used to draw a special attention to an important information.

 **Information** symbol is used to give a useful hint or tip for more comfortable work with the instrument.

## JR-6 Software Conventions

**Speed** User interface terms.  
6.3 A/m (Default values are underlined.)

 User interface buttons.  


Execute|Calibration Menu Item.  
[F1] Keyboard shortcuts.

## Status Bar Indicators

 **Green** Instrument is ready.  
 **Orange** Instrument in action.  
 **Red** Error or User stop.

## General Safety Instructions

Before beginning of work with the instrument review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

**Service procedures should be performed by qualified personnel only!**

-  **Do Not Operate Without Covers!** To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.
-  **Do Not Operate in Wet or Damp Conditions!** To avoid electric shock, do not operate this product in wet or damp conditions.
-  **Do Not Operate in an Explosive Atmosphere!** To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.
-  **Do Not Disconnect Connectors!** To avoid damage of the instrument never disconnect any connector while the device is ON.
-  **Do Not Operate With Suspected Failures!** If you suspect there is damage to this product, have it inspected by qualified service personnel.
-  **Ground The Instrument!** The instrument is grounded through the Protective Earth lead of the power cord. To avoid electric shock, it is essential to connect the earth terminal of power cord to the Protective Earth terminal before any inputs or outputs.
-  **Do Not Insert Anything into the Holes of Fan!** Do not insert anything into the holes of the fan to avoid damaging the instrument.
-  **Use Proper Power Cord!** To avoid fire hazard, use only the power cord specified for this product.
-  **Fasten Connectors!** Do not operate the instrument if all connectors are not properly plugged and fixed by screws.

-  **Use Proper Mains Voltage!** Do not operate this product from a power source that is outside of the specified voltage range.
-  **Use Proper Fuses Only!** Do not use fuses which are not specified by the manufacturer. If a fuse with a different characteristics or value is used, the protection is not effective.
-  **Operator's Training!** Operator should be familiar with operation of the instrument and Safety Regulations.
-  **Use Manufacturer's Cables Only!** Other devices can be connected to the instrument via the appropriate cables only.
-  **Do not drop the product and do not expose it to any major shocks!**
-  **Do not operate the product outside the power limits given in the specifications!**
-  **Keep the packaging material out of the reach of children to prevent the risk of suffocation!**
-  **The first installation and customer training is performed exclusively by the AGICO technician or by the authorized representative.**

 Unstable or highly disturbed AC power may invoke safety circuits to protect the sensitive electronic parts by switching OFF the instrument or burning inner fuses.



**Dispose of packaging material immediately according to locally applicable regulations!**

## **Storage and Transportation**

The properly wrapped instrument can be stored and transported at a temperature -20 °C to + 55 °C and relative humidity up to 80 %. The instrument must be stored at suitable place, free of dust and chemical evaporation. The instrument can be transported only with installed transportation screws in Pick-Up Unit. **Handle with care!**

# 1 JR-6 Introduction

The **JR-6 spinner magnetometer** is the world's most sensitive and accurate instrument for measurement of remanent magnetization of rocks based on classical (non-cryogenic) principle. Two rotation speeds are available, the higher one enabling the maximum sensitivity to be reached, and the lower one enabling the soft specimens to be measured. Instrument enable measurement even of very weakly magnetic sedimentary rocks including limestone.

The JR-6 spinner magnetometer consists of an Pick-Up Unit and Power Supply Unit. All functions are microprocessor controlled. The microprocessor controls measurement, carries out digital filtration of the signal, controls and tests the speed of specimen rotation. The JR-6 automatically executes tests for erroneous conditions. The measurement process is fully controlled by a PC notebook or desktop.

## 1.1 Main Features

- High sensitivity  $2.4 \times 10^{-6}$  A/m.
- Measuring range up to 12500 A/m.
- Two speeds of rotation.
- Automatic change of sample position (JR-6A only).
- Triple Permalloy shielding of measuring coils.
- Rapid measurement of remanent magnetization.

## 1.2 JR-6 versions

### 1.2.1 JR-6A

The JR-6A (automated) version is destined for rapid and accurate measurement of remanent magnetization. The specimen is manually only inserted into the specimen holder and the changes of positions in the holder in order to get complete vector are made automatically by the instrument.

### 1.2.2 JR-6

The JR-6 version is destined for simple measurement of remanent magnetization with manual change of measuring positions of a specimen. According to the accuracy demands, one can measure the specimen in two, four, or six positions.

### 1.3 Measuring Principle

Rock specimen of defined size and shape rotates at a constant angular speed in the Pick-Up Unit inside a pair of coils. An AC voltage is induced in the coils whose amplitude and phase depend on the magnitude and direction of the remanent magnetization (RM) vector of the specimen. The voltage is amplified, filtered and digitized. Using harmonic analysis, the computer calculates two rectangular components of the projection of RM vector into the plane perpendicular to the axis of rotation.

### 1.4 Specimens to be measured

The nominal specimen is either a cube with an edge of 20 or 23 mm, or a cylinder 25.4 mm (1 inch) in diameter, 22 mm long. Below is a table which describes exact dimensions of a different specimens which can be measured in JR-6 spinner magnetometer. All deviations from the nominal dimensions (affecting the accuracy of the measurement) must be taken into account.

-  Holders for specimens of slightly different size can be supplied on request.
-  Strongly inhomogeneous and damaged specimens, that could cause strong vibrations or inbalance while spinning, cannot be measured.

<b>Cylinder specimen</b>	Automatic holder	Manual holder
Diameter	25.4 mm (+0.1, -0.5)	25.4 mm (+0.5, -1.0)
Diameter	25.0 mm (+0.1, -0.5) [ <sup>4</sup> ]	
Length	22.0 mm (+0.5, -1.0)	22.0 mm (+1.0, -1.0)
<b>Cubic specimen</b>		
Size	20.0 mm (+0.1, -0.5) [ <sup>5</sup> ]	20.0 mm (+0.2, -1.0)
Size		22.7 mm (+0.2, -1.0) [ <sup>6</sup> ]
Size		23.5 mm (+0.2, -1.0) [ <sup>6</sup> ]

<sup>4</sup>Automatic holder for nominal diameter 25 mm (red arrow) on request only.

<sup>5</sup>Automatic holder for cube 20 mm available as an option only.

<sup>6</sup>On request only.

## 1.5 Data acquisition software REMA6

All functions of JR-6 spinner magnetometer are controlled by the software REMA6. This software for MS Windows® operating systems supports manual, semi-automatic or automatic measurements, it enables also measurements of anisotropy of remanent magnetization (ARM). REMA6 incorporates viewer of resulting data files which enable visualization of results with respect to magnetic state or name of the specimen or results of step-wise demagnetization. REMA6 allows to export the graphics into Windows Meta files. Last versions of REMA6 can be downloaded from AGICO web pages [www.agico.com](http://www.agico.com) for free.

Results of the measurements are automatically saved to two data formats \*.jx6 and \*.txt. Both are ASCII-text files, but with a different structure. Software also allows to export the results to other data formats:

- **JR6** is fundamental data file (ASCII-text file) which can be loaded by REMA6W or Remasoft3 software. Each line of the file contains an information about Specimen name, Magnetic treatment, X/Y/Z component of RM vector, Magnitude of components, Input specimen angles and Orientation parameters.
- **TXT** file is more or less copy of all the information obtained after the successful measurement.
- **RS3** file is binary data format used by the Remasoft3 software. This file can be obtained using File|Export function from the Main menu bar.
- **DAT** format is simple ASCII-file in the form of table. Such data file is created if the table from the **Specimens** or **Magnetic states** tabs are exported. RM vector components are shown in chosen coordinate system – Specimen, Geographic, Tilt corrected or Full corrected system.
- **ARE** data file is a binary data format created after complete Anisotropy of Magnetic Remanence routine. This file can be loaded by the Anisoft4.2 software.
- REMA6 software also allows to export results into the Enkin file (\*.PMD), SuperIODP (\*.dat) formats, but their functionality is not guaranteed.

## 1.6 Technical Specifications

### Basic specifications

Speeds of rotation	87.7 rps and 16.7 rps
Measuring range	up to 12500 A/m (auto range)
Noise	2.4 $\mu$ A/m [ <sup>1</sup> ]
Sensitivity	2.4 $\mu$ A/m [ <sup>2</sup> ]
Accuracy of measurement of RM components	1%, $\pm$ 2.4 $\mu$ A/m [ <sup>3</sup> ]
Power requirements	230, 120, 100 V $\pm$ 10 %, 50 / 60 Hz
Power consumption	40 VA
Operating temperature range	+15 to +35 °C
Storing temperature range	-20 to +35 °C
Relative humidity	max. 80 %

### Dimensions / Mass

Pick-Up Unit	310 mm×190 mm×185 mm / 24 kg
Power Supply Unit	200 mm×160 mm×120 mm / 2.5 kg

### Selectable parameters

Speed of rotation	high / low
Type of holder	auto / semi-auto / manual
Number of positions for manual holder	2 / 4 / 6
Time of integration	short / normal / long
Measurement mode	single / repeat

<sup>1</sup>Standard error of repeated measurement of any RM component, Pick-Up Unit without specimen holder, the most sensitive range, high speed of rotation, normal integration time.

<sup>2</sup>Standard error of any RM vector component in repeated measurement. Specimen of the absolute value of RM less than 100  $\mu$ A/m, the measurement according standard measuring procedure in six positions, (each component is measured 4 times), high speed of rotation, normal integration time.

<sup>3</sup>Specimen of nominal size and shape. Deviations in size and shape will cause errors in position and/or possible increase of vibrations during measurement and thus decrease precision of measurement.

## 2 Instrument description

### 2.1 Power supply Unit

The Power Supply Unit incorporates transformer and electronics for stabilization and test of individual voltages. Two-color LED indicating the status of the Power Supply Unit is located on the front panel. Green color means instrument is ready, and red color indicates error condition. Mains switch and main fuse is situated on rear panel.

### 2.2 Pick-Up Unit

The Pick-Up Unit incorporates the main electronics board, the motor, the spinner system, the pick-up coils with preamplifier and triple Permalloy shield, and (optionally) the automatic manipulator. Detailed picture of the coils with automatic holder is shown in Figure 1.

A three-color LED on the front panel indicates the status of magnetometer. Green means instrument is ready, yellow on and blinking yellow indicates the measurement procedure is in progress and red color signalizes error condition. The Pick-Up Unit is connected to the computer via serial channel with USB adapter.



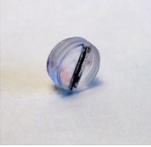
**Figure 1:** Pick-Up coils with the automatic holder

### 2.3 Standard set of accessories

Standard set of accessories provided together with the JR-6 is listed below.

Part	Quantity
<b>Accessories for both JR-6 versions</b>	
Manual Cylindrical Specimen Holders for 4 positions	2
Manual Cylindrical Specimen Holders for 6 positions	1
Manual Cubic Specimen Holder (for 23.5 mm cubes)	1
Cylindrical calibration standard	1
Cubic calibration standard	1
Driving rubber belt	2
Screwdriver bit for connector safety screws	1
Marking tool	1
Screw for manual specimen holders	2
Fuse T1.25 A (230V version) or T2.5 A (115V version)	2
<b>Accessories for automatic version (JR-6A) only</b>	
Automatic Cylindrical Specimen Holder	2
Screwdriver for automatic specimen holder	2
Screw for automatic specimen holder	2
Tool for setting the main azimuthal position	1
Tool for setting the hexagonal key	1

## 2.4 Spare parts and accessories

<p>JR ACC26</p> 	<p>JR ACC26 Automatic Cylindrical Specimen Holder for standard size specimen (diameter 25.4 mm, length 22 mm)</p>	<p>JR ACC25</p> 	<p>JR ACC25 Automatic Cylindrical Specimen Holder for slim specimens (diameter 25.0 mm, length 22 mm)</p>
<p>JR ACCUB</p> 	<p>JR ACCUB Automatic Cubic Specimen Holder for cubic specimen 20x20x20 mm</p>	<p>JR SCRY</p> 	<p>JR SCRY Spare Screw for JR ACC26 and JR ACC25</p>
<p>JR SCRBB</p> 	<p>JR SCRBB Spare Screw for JR ACCUB</p>	<p>JR SCD</p> 	<p>JR SCD Screw Driver for Automatic Specimen Holders</p>
<p>JR CYL626</p> 	<p>JR CYL626 Cylindrical Specimen Holder for standard size specimen (diameter 25.4 mm, length 22 mm) 2, 4, or 6 positions in manual measurement mode</p>	<p>JR CYL426</p> 	<p>JR CYL426 Simple Cylindrical Specimen Holder for standard size specimen (diameter 25.4 mm, length 22 mm) 2 or 4 positions in manual measurement mode</p>
<p>JR CUH20</p> 	<p>JR CUH20 Cubic Specimen Holder for specimen 20x20x20 mm 2, 4, or 6 positions in manual measurement mode</p>	<p>JR CUH23</p> 	<p>JR CUH23 Cubic Specimen Holder for soft specimen in plastic box 22.7x22.7x22.7 mm 2, 4, or 6 positions in manual measurement mode</p>
<p>JR CUH24</p> 	<p>JR CUH24 Cubic Specimen Holder for soft specimen in plastic box 23.5x23.5x23.5 mm 2, 4, or 6 positions in manual measurement mode</p>	<p>JR SCRMM</p> 	<p>JR SCRMM Spare Screw for JR manual specimen holders</p>

<p>JR CYS26</p>		<p>JR CYS26 Cylindrical Calibration Standard diameter 25.4 mm, length 22 mm</p>	<p>JR CUS20</p>		<p>JR CUS20(23;24) Cubic Calibration Standard size 20x20x20 mm (22.7x22.7x22.7 mm; 23.5x23.5x23.5 mm)</p>
<p>JR CCH20</p>		<p>JRCCH20(23) Column for JR CUH20(23) cubic specimen holder</p>	<p>JR BCH20</p>		<p>JR BCH20(23) Crossbar for JR CUH20(23) cubic specimen holder</p>
<p>JR NCH</p>		<p>JR NCH Nut for JR CUH20(23) cubic specimen holders</p>	<p>JR CMA</p>		<p>JR CMA Marking Tool for Standard Cylindrical Specimens</p>
<p>JR DBL</p>		<p>JR DBL Driving Belt for JR-5(A)/JR-6(A)</p>	<p>JR CLK</p>		<p>JR CLK Locking clip for pick-up coils</p>

### 3 Installation Procedures

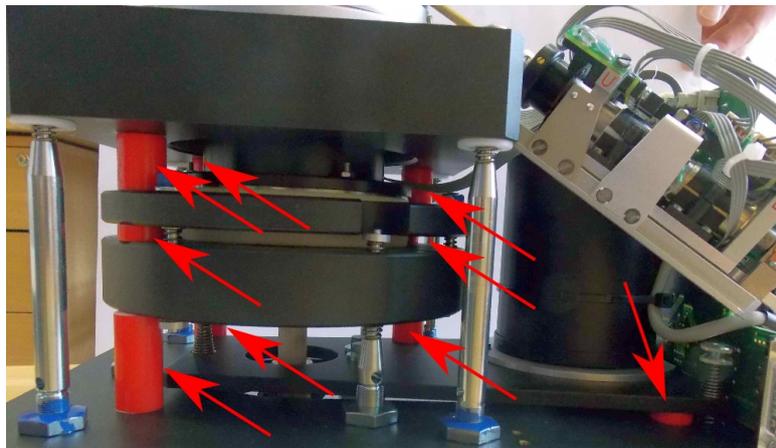
The first installation and customer training is performed exclusively by the AGICO technician. If you need later to reinstall the apparatus, due to moving the instrument to another place or any other reasons, be sure that the following conditions are met to achieve guaranteed parameters.

#### 3.1 Choosing the Place

-  To reach best measuring results do not place the instrument near to the sources of alternating magnetic field, e.g. big transformers, electric motors or electricity power source wires.
-  Due to weight of Pick-Up Unit the solid and durable table is required. Minimal distance between Power Supply Unit and Pick-Up Unit is 0.5 m.
-  Make sure that the **red transportation screws** and **washers** are removed from the Pick-Up Unit before running the instrument.

#### 3.2 Removal of the transportation screws

When the JR-6 spinner magnetometer is transported to the customer's laboratory, the mechanics inside Pick-Up Unit is fixed with transportation screws. Before any use of the instrument, it is necessary to remove all transportation screws and red washers shown in Figure 2. Whole procedure is described in detail in the sec. 5.1.4.



**Figure 2:** Transportation screws and washers in Pick-Up Unit

### 3.3 Interconnection of Units

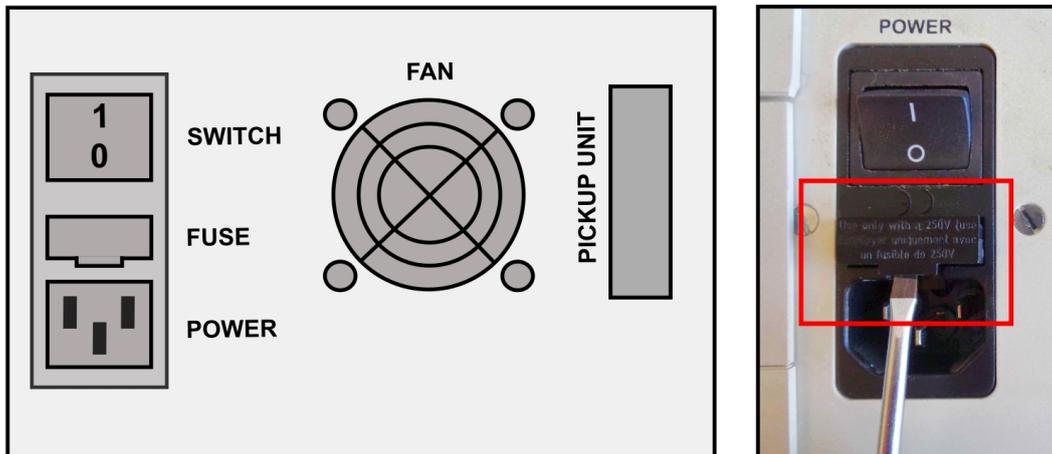
Be sure that the mains cord is unplugged during connecting or disconnecting the cables. 15-pin Canon cable (power cable) is plugged into the rear panel of the Power Supply Unit and Pick-Up Unit. A cable with 9-pin female connectors (serial communication cable) interconnects serial channel of your computer with the Pick-Up Unit. All connectors are fixed by the screws. The supply voltage is specified on the rear panel of the Power Supply Unit.

### 3.4 Main Switch and Main Fuse

Main switch and main fuse of the instrument are located in the upper right corner on the rear panel of Power Supply Unit. See Fig.3 (left) for reference. If needed, main fuse can be easily replaced. First switch off the instrument and unplug all the cables from Power Supply Unit. Use flat head screwdriver to unlock the socket, then pull out the socket. After replacing of the fuse push in the socket and lock it with screwdriver. For more details please refer to Fig.3 (right).

Ratings of the fuses are as follows: T1.25A for mains voltage 220-240 V/250 V or T2.5A for mains voltage 100 V-120 V. Time-lag (slow) type fuse is required.

**✘ Mains cord must be disconnected!** Power switch must be turned off and mains cord must be disconnected from Control Unit during fuse exchange.

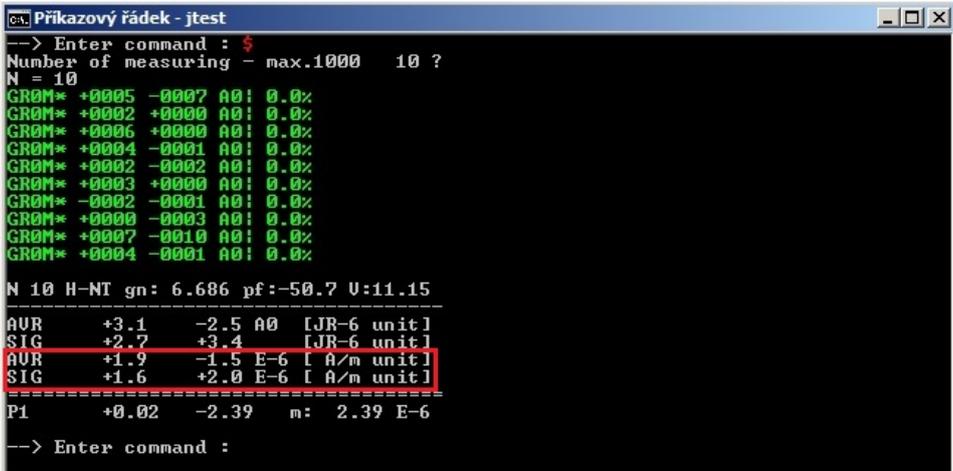


**Figure 3:** Left: Back panel of JR-6 Power Supply Unit. Right: Opening the fuse socket.

### 3.5 Testing the instrument sensitivity

Sensitivity test of JR-6 spinner magnetometer is based on repeated measurement of the empty coils with program JR6TEST.EXE and estimation of standard deviation of components of the RM vector. Procedure is described in next steps:

- Switch ON the JR-6 spinner magnetometer and run the JR6TEST.EXE software. Remove any holder from the coils, close the empty coils and install the shielding hat.
- Press the command [h] to set high speed of rotation. Then press the commands [0], [\$] and [Enter] to start a series of measurements. Default number of measurements is 10.
- Program calculates and displays the statistical data from the measurements, similar to Fig. 4. The line starting with “SIG” shows standard deviation of all measurements.
- After analyzing the results, press the command [l] (small “L”) to set low speed of rotation. Then use commands [0], [\$] and [Enter] to start the test on low speed.
- Both components and respective errors in A/m (not JR-units) should be lower or equal to the declared sensitivity. Acceptable value for high speed is less than  $2.4 \mu\text{A/m}$  and for low speed  $12.0 \mu\text{A/m}$ . In case of higher values check the environment according to chapter 3.1 or contact AGICO for further analysis.



```

Příkazový řádek - jtest
--> Enter command : $
Number of measuring - max.1000  10 ?
N = 10
GR0M* +0005 -0007 A0! 0.0%
GR0M* +0002 +0000 A0! 0.0%
GR0M* +0006 +0000 A0! 0.0%
GR0M* +0004 -0001 A0! 0.0%
GR0M* +0002 -0002 A0! 0.0%
GR0M* +0003 +0000 A0! 0.0%
GR0M* -0002 -0001 A0! 0.0%
GR0M* +0000 -0003 A0! 0.0%
GR0M* +0007 -0010 A0! 0.0%
GR0M* +0004 -0001 A0! 0.0%
-----
N 10 H-NT gn: 6.686 pf:-50.7 U:11.15
-----
AUR   +3.1   -2.5 A0 [JR-6 unit]
SIG   +2.7   +3.4 [JR-6 unit]
AUR   +1.9   -1.5 E-6 [ A/m unit]
SIG   +1.6   +2.0 E-6 [ A/m unit]
-----
P1    +0.02  -2.39  m: 2.39 E-6
-----
--> Enter command :

```

Figure 4: Results from JR6TEST software



## 4 Measurements

### 4.1 Specimen holder installation

The Pick-Up Unit allows easy installation of the specimen holders via a bayonet mount of the specimen holder shaft. **To install the holder** press and hold the brake by your one hand (to prevent turning of the shaft during the holder installation) and put the holder on the shaft by your other hand (see Fig.5).

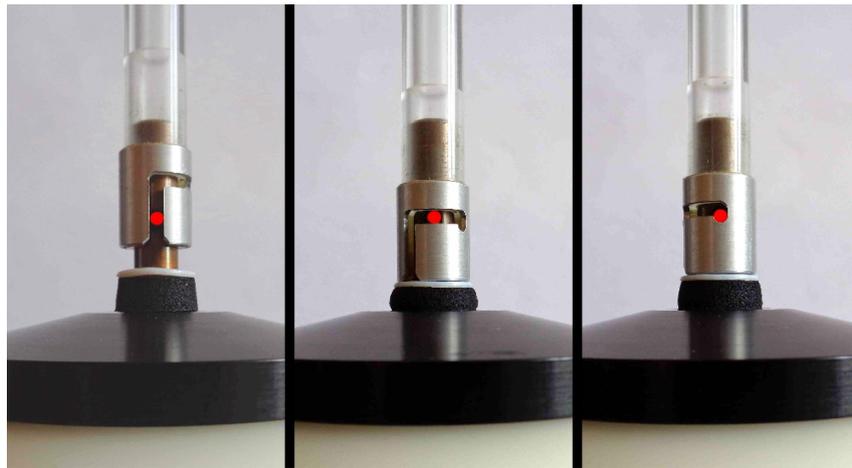


**Figure 5:** Specimen holder installation

Press down slightly and at the same time turn the holder clockwise until the drive pin slides into a notch of the holder. At this moment, press little bit more downwards (see Fig. 6, left) to overcome the pressure of an elastic pad under the shank of the holder until the drive pin fits into a horizontal part of the bayonet groove (see Fig. 6, middle).

Continue turning the holder clockwise, without downward pressure until the holder pops upward a little bit. At this moment the drive pin engages the end of the bayonet groove and retains the holder in a fixed orientation relative to the drive-shaft (Fig. 6, right).

**To remove the holder** press and hold the brake by your one hand to prevent turning of the shaft. By your other hand push down the holder and at the same time turn the holder anticlockwise until the drive pin meets the horizontal part of the bayonet groove. Continue turning the holder, without downward pressure, until the drive pin reaches the vertical part of the bayonet groove. Take the holder out in this position by pulling the holder upwards.



**Figure 6:** Detailed view to holder installation

-  The upwards "jump" of the holder is necessary evidence of proper installation of the holder.

In the case of an absence of this jump, it is necessary to find out the cause.

-  Even a small impurity inside the shank of the holder can cause this problem and, as a result, the automatic mechanism for changing specimen orientation may fail.

## 4.2 Operation basics

### 4.2.1 Magnetometer Switching ON and OFF

The JR-6 spinner magnetometer is powered on by the main "ON/OFF" switch. Upon switching on, the LED on the Power Supply Unit is red for a while but after approx. two seconds should change to green indicating that Pick-Up Unit is properly powered and connected. The LED on the front panel of Pick-Up Unit alternates all three colors in approx. one second interval and remains green indicating the instrument is ready to operate. If you notice other combination of the colors, check chapter 5 for troubleshooting.

For the most sensitive measurements it is recommended to start with routine work approx. 15 min. after the switching on the instrument. When JR-6 spinner magnetometer is **ON**, run the REMA6 software and select measuring mode in the Settings|Instrument Configuration (shortcut [F12]) window (eg. holder type, speed of rotation etc.). Then press the **INITIALIZE** button to initialize instrument. Activation window will pop-up and steps of the activation routine are shown.

When switching **OFF** the instrument close the software first and then switch off the main switch on the backside of the Power Supply Unit.

### 4.2.2 Measurements with manual holder in 4 positions

Standard measurement of the RM vector consists of successive measurements in four positions of specimen with regard to the holder using the manual specimen holder for four or six positions (which is the case of cylindrical holder denoted by two black dots on the front side instead of a black circle.) The complete measurement yields four values for z component of RM vector and two values of x and y components from which the average values are calculated.

This process eliminates any residual non-compensated value of the holder RM and reduces measuring errors caused by an inaccurate shape of the specimen and by instrument noise. It must be noted, however, that one of the three components is always measured four times while the remaining two components are only measured twice.

The mutual positions of the specimen and the holder for individual measuring orientations are shown in Fig. 7. The system of positions is identical for cubic and for cylindrical specimens.

**Measurement routine** is as follows:

- Check if appropriate type of the holder is installed in the measuring coils.
  - Be sure the instrument is properly calibrated and correct parameters are set.
  - Press the **NEW SPECIMEN** button in REMA6 software and fill the information about the specimen in the appropriate window. Default volume of the specimen can be changed in the `Settings|Instrument Configuration` window.
  - Fix the specimen in the holder in position No.1 (see Fig. 7), close the coils and install the shielding hat.
  - Press the **P1** button to execute the measuring routine. After the routine, the holder is set to initial position. Software REMA6 shows the two components of projection of RM vector to horizontal plane.
  - If you need immediately to stop the process press the **STOP** button or shortcut [Spacebar].
  - Wait until the beep, then remove shielding hat and adjust the specimen into the position No.2 (see Fig. 7). Close the coils, install the shielding hat and run the measurement in next position by pressing appropriate button.
  - The whole procedure is repeated until the specimen has been measured in all preset positions. Resulting values of the RM vector can be saved to the datafile by clicking on the **SAVE** button. The **CANCEL** button disregards all the results from the actual measurement.
  - Software REMA6 returns to main page and one can proceed with next specimen.
- i** Four position measuring scheme does not require holder correction. Remanent magnetization of the holder is subtracted automatically due to the design of the measuring positions.
- After measurement in current position the holder with specimen stops in the angular position corresponding to the next measuring position (i.e. the arrow on the holder is on the reverse side of the holder provided the position higher than No.2 is the following). This feature simplifies the manipulation during positioning the specimen.
- i**

### 4.2.3 Measurements with manual holder in 2 and 6 positions

If less than four positions are used, the residual components of the holder are not eliminated automatically. One must rely upon the compensation procedure. It is recommended to reduce the measuring cycle to two positions only for less sensitive measurements or for measurements of the highly magnetized specimens.

Sometimes it may be useful to expand the measuring cycle to 6 measuring positions, especially in case of weakly magnetized specimens. All three components of RM vector are measured four times, so 6 position design brings slightly better precision and statistics. For this measurement routine use manual holder for six positions only.

 See also the chapter 4.2.2 *Measurements with manual holder in 4 positions* for operation details.

### 4.2.4 Measurements with automatic holder

Standard measurement of RM vector in automatic mode consists of three successive measurements of the specimen oriented in three perpendicular axes. The specimen is inserted into an automatic holder once and its orientation is changed by the automatic manipulator during the measuring process. Positions of the automatic holder are shown in Fig. 7.

**Measurement routine** is as follows:

- Insert the specimen into the automatic holder in the position No.1 and secure the specimen by a fixing screw using the special screwdriver. Do not unscrew the screw too far, otherwise it will prevent motion of the inner spherical shell.
- You must exercise maximum care to obtain the best centering possible during installation of the specimen. Use two black rings on the rotating core as the centering marks.
- Close the coils and install the shielding hat. Then press the **NEW SPECIMEN** button in REMA6 software and fill the information about the specimen in the appropriate window.
- Press the **START** button to execute the measuring routine. Specimen is automatically measured in three perpendicular positions, then holder is turned back to initial position. Measuring routine ends after third beep.
- If you need to stop the process immediately press the **STOP** button or shortcut [Spacebar].

- Resulting values of the RM vector can be saved to the datafile by clicking on the **SAVE** button. The **CANCEL** button deletes all the results from the actual measurement. Software returns to main page and you can continue with next specimen.



In case of considerable vibrations of the specimen inside the measuring coils, please check the instrument according to chapter 5 *Maintenance* or contact Agico for further assistance.

#### 4.2.5 Measurements in semi-automatic mode

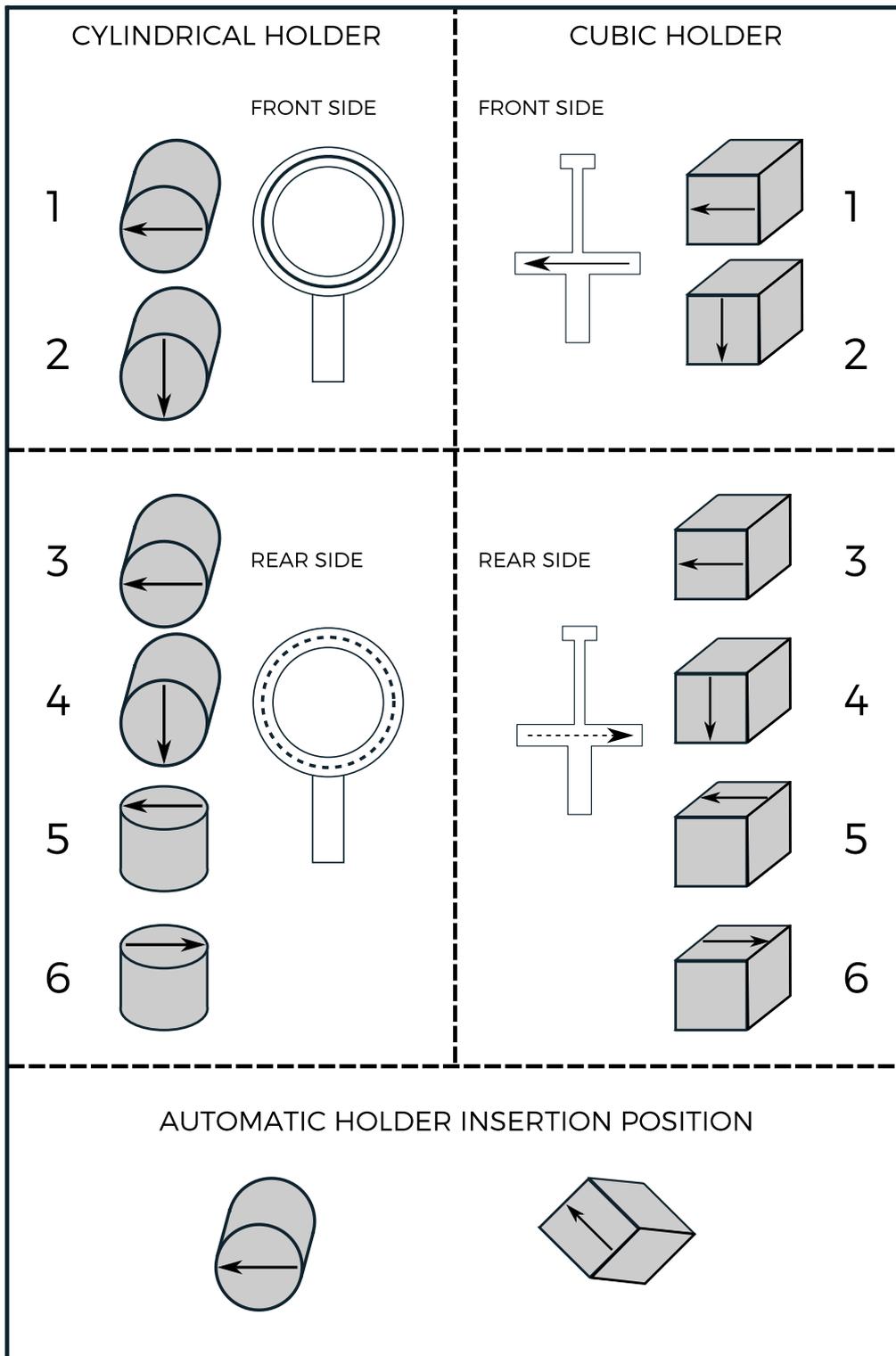
Measurement in semi-auto mode may be useful in case of the malfunction of the auto-position manipulator. The automatic holder is used, but the individual positions have to be set manually.

**Measurement routine** is as follows:

- Install automatic holder into the coils and set semi-automatic holder in the `Settings|Instrument Configuration` window. Fix the specimen in the holder in position No.1 (see Fig. 7), close the coils and install the shielding hat.
- Press the **NEW SPECIMEN** button and fill the information about the specimen in the appropriate window. Then press the **P1** button to execute the measuring routine in first position.
- For immediate stop of process press the **STOP** button or shortcut [Spacebar].
- Wait until the beep, then remove shielding hat and turn manually the holder shell into the position No. 2 (see Fig. 8). Close the coils, install the shielding hat and run the measurement in second position by pressing the **P2** button.
- Repeat previous step and run the measurement in third position.
- Resulting values of the RM vector can be saved to the datafile by clicking on the **SAVE** button. The **CANCEL** button deletes all the results from the actual measurement. Software returns to main page and you can proceed with next specimen.



See also the chapters 4.2.2 *Measurements with manual holder in 4 positions* and 4.2.4 *Measurements with automatic holder* for operation details.



**Figure 7:** Measuring positions



**Figure 8:** Measuring positions for semi-automatic mode

### 4.3 Calibration

The magnetometer calibration is a measurement of the calibration standard which yields the gain and phase for calculating the remanence vector components. Instrument is calibrated according to the type of a measured specimen with cylindrical or cubic calibration standard. Values of magnetization [A/m] and volume [cm<sup>3</sup>] are written on the top side of each calibration standard. These values can be set in **Calibration standard values** window in REMA6 software, thru `Settings|Calibration standard` item in the Main menu bar. Results of the calibration routine are Gain and Phase. These parameters must be within the ranges shown in Table 1.

**Calibration routine** is as follows:

- Insert the calibration standard in the holder in the position No.1 (see Fig. 7), close the coils and install the shielding hat.
- Run the REMA6 software and select **Instrument calibration window** in the `Execute|Calibration` (shortcut [F3]) from Main menu bar.
- Run calibration by clicking on the **START** button or pressing [Enter].
- If you need immediately to stop the process press the **STOP** button or shortcut [Spacebar].
- Software REMA6 checks results of the calibration routine (**Gain** and **Phase**) and informs about successful or invalid calibration.
- Calibration results are saved by clicking on the **SAVE** button. If the **CANCEL** button is used, then previous calibration constants remain valid.

<b>Speed of rotation</b>	Gain	Phase
High (87.7 rps)	$7 \pm 0.7$	$-40 \pm 15$
Low (16.7 rps)	$77 \pm 10$	$70 \pm 15$

**Table 1:** Proper calibration values ranges for both speeds of rotation

-  Calibration of the instrument should be performed regularly to achieve best possible results. Values of calibration constants within required range are best indicator of proper function of the instrument.
-  Changing of the calibration standard values zeroes previous calibration results and holder correction values.
-  In case of invalid calibration check the position of calibration standard, values saved in REMA6 software or contact AGICO for assistance.

#### 4.4 Holder Correction

Holder correction routine is the measurement of the empty holder. Resulting values are saved in configuration file of REMA6 software and they are used for further subtraction from the measurement of the specimen. Holder correction is crucial especially if weakly magnetized specimens are measured.

**Holder correction routine** is as follows:

- Make sure that the holder installed in the coils is clean and empty, close the coils and install shielding hat.
- Run the REMA6 software and select **Holder Correction window** in the Execute | Holder Correction (shortcut [F4]) from Main menu bar.
- Run the Holder correction routine by clicking on the **START** button or pressing [Enter]. Measurement along single (manual holders) or three axes (automatic holder) is performed.
- If you need immediately to stop the process press the **STOP** button or shortcut [Spacebar].
- Results are saved by clicking on the **SAVE** button. If the **CANCEL** button is used, then previous holder correction values remain valid.

-  Holder correction should be performed regularly to achieve best possible results. It must be performed each time you replace the holder.
-  If magnetization of the empty holder is too high, software warning will notify you to clean the holder. Note that software allows to save the holder values regardless they are valid or suspicious.
-  To clean the holder use only warm water, possibly with a small amount of the detergent and soft brush. Carefully dry all the parts after the cleaning. Ultrasonic water bath can be used as well. For more details see section 5.2.1.
-  Do not use alcohol or any other solvents for cleaning of the holder. It may lead to the damage of the holder.

#### 4.4.1 Holder Correction of the manual holder

The residual value of the remanent magnetization of the manual holder for measurement in four or six positions is fully eliminated even if the correction for the holder was not performed. It is due to position design of manual positioning with respect to the holder. This is not valid for the automatic holder.

#### 4.4.2 Holder Correction of the automatic holder

The automatic specimen holder consists of a partly spherical outer shell and a rotatable inner spherical core in which the specimen is secured by a plastic screw. The system of specimen orientation occurs by specimen rotation around the body diagonal of a cube (the 111 axis of crystallography) which only has three-fold symmetry. For this reason it is impossible to find a combination of positions which would eliminate the residual value of the remanent magnetization of the holder as with traditional four- or six- orientation magnetometer measurement. It is necessary to rely entirely upon the correction done by the instrument. This fact may negatively influence the result, especially in case of very soft and weak specimens when small impurities moving obligatory on spherical core can generate misleading results.

## 5 Troubleshooting and Maintenance

### 5.1 Troubleshooting

JR-6 spinner magnetometer contains plenty of hardware control circuits and software diagnostic tests to prevent any serious damage to the instrument. Some potential errors and their solution are noted below. Please keep in mind, that best way to solve problems with AGICO instruments, is to contact manufacturer via. email address [agico@agico.cz](mailto:agico@agico.cz). Lifetime email support is free of cost, so do not hesitate to contact us with any questions.

-  It is strongly prohibited to interfere with the magnetometer electronics. In case of malfunction please contact the manufacturer.

#### 5.1.1 Hardware Error Indications

Actual state of the instrument is indicated by two LED lights located on the front panels of Pick-Up Unit and Power Supply Unit. Table 2 describes meaning of light colors combinations.

Pick-Up Unit	Power Supply Unit	Meaning and Solution
		JR-6 spinner magnetometer is ready to use.
		Current operation was interrupted by software due to unexpected error. Check the position of the holder and automatic manipulator. Check software error messages.
		Pick-Up Unit is not connected, or some voltages are not present. Check the cables. Check software error messages (Table 3). If it does not help, contact AGICO for assistance.
		Check if JR-6 is switched ON. Check if mains plug is correctly connected. Check main fuse (section 3.4).

**Table 2:** LED indicators on front panels of Pick-Up Unit and Control Unit

### 5.1.2 Software Error Messages

Software error messages inform about actual problems of the instrument. Table 3 concludes recommended troubleshooting steps after some error occurs. These error messages are shown in the bottom status bar of **REMA6** software.

Error number	Error description and solution
E0	<b>Wrong or missing index pulse (1x).</b> Screen of optical system is dirty and index pulse notch is masked. Clean the optical system (see sec. 5.2.3).
E1	<b>Wrong or missing pulses (100x).</b> Screen of optical system is dirty and pulse notches are masked. Clean the optical system (see sec. 5.2.3).
E2	<b>Insufficient speed of rotation.</b> High friction between rotating parts. Check if driving belt is properly mounted and if holder rotates freely.
E3	<b>Initial speed test is out of range.</b> Rotor run-time error. Contact Agico for assistance.
E4	<b>Wrong setting on index pulse.</b> Setting the holder to initial azimuthal position failed. Optical system is dirty or holder does not rotate at all. Clean the optical system (see sec. 5.2.3).
E5	<b>Up/Down error of automatic manipulator.</b> Pulses from manipulator optocouplers are not present or hexagonal pin is blocked.
E6	<b>Wrong or missing pulse 3x120 of automatic manipulator.</b> Setting of the hexagonal pin to next position failed. Check if all connectors on manipulator are properly plugged. Contact Agico for assistance.
E7	<b>Wrong or missing pulse 1x360 of automatic manipulator.</b> Setting of the hexagonal pin to initial position failed. Check if all connectors on manipulator are properly plugged. Contact Agico for assistance.
E8	<b>Automatic manipulator is missing or unconnected.</b> Check if cable from manipulator is properly connected to electronic board. Check if all connectors on manipulator are properly plugged.
E9	<b>Run time overflow error.</b> Signal out of range during measurement. Clean the optical system (see sec. 5.2.3) or contact Agico for assistance.
EA	<b>Run-time pulse (1x) error.</b> Wrong or missing pulse (1x) during measurement. Clean the optical system or contact Agico for assistance.
EB	<b>Run-time pulse (100x) error.</b> Wrong or missing pulses (100x) during measurement. Clean the optical system or contact Agico for assistance.

**Table 3:** List of errors shown by **REMA6**

### 5.1.3 Diagnostic software JR6TEST

The test program JR6TEST.EXE is program which can serve for diagnostics of the instrument. The program allows the user to send the basic commands to the instrument and see the response. JR6TEST is a DOS based software which can run in Windows operating systems using MS DOS emulator called DOSBox. All this software is available in one package on Agico websites [www.agico.com](http://www.agico.com), section Software > Older software > DOSBox packages. A complete list of user available commands for JR6TEST program is in Table 4.

Command	Description
F1	Help key to show full list of commands
Esc	Immediate stop of current process
g	Go (run) measurement in current holder position (JR-6 units)
1...6	Run measurement in position No.1...6 (JR-6 units)
h	Set high speed
l	Set low speed
i	Set holder to initial azimuthal position
o	Set holder to opposite azimuthal position
y	Set automatic manipulator to initial position
t	Set automatic manipulator to next position
r	Set automatic manipulator to rest (down) position
w	Set automatic manipulator to working (up) position
Ctrl P	List firmware version of JR-6
Ctrl X	Set Long measurement time (2 times longer than Normal time)
Ctrl Y	Set Short measurement time (2 times shorter than Normal time)
Ctrl Z	Set Normal measurement time
@	Set Repeat mode
a	Set Auto range
R 0...6	Set Manual range from 0 to 6 (R0 is most sensitive)
?	Request last result
U	Communication test, return 2 characters (01 and 55 in hex. code)
\$	Sensitivity test, execute 10-1000 measurements and show results

**Table 4:** List of commands for diagnostic software JR6TEST

### 5.1.4 Installation of the transportation screws

Before the JR6 spinner magnetometer is to be transported to another place or to Agico for repair or refurbishment, it is **absolutely necessary to fix the mechanics in Pick-Up Unit with the transportation screws**. Absence of these screws during transportation will lead to the extensive damage of the mechanical as well as electrical parts of the Pick-Up Unit. Installation of transportation screws is as follows:

- Switch the instrument OFF and unplug all the cables from Pick-Up Unit. Loose two fixing screws and remove the top white cover.
- Put the Pick-Up Unit on steady solid stands, prepare transportation screws and red washers (see Fig. 9A).
- Install all four transportation screws with the respect of correct positions of screws and washers, according to Fig. 9B. Tighten properly all four screws with 13 mm wrench.
- Check if the mechanics is properly fixed. There are three long screws fixing the round plates (Fig. 9C) and one shorter screw fixing the bottom trapezoidal plate (Fig. 9D).
- Reinstall the top white cover and and tighten the fixing screws.

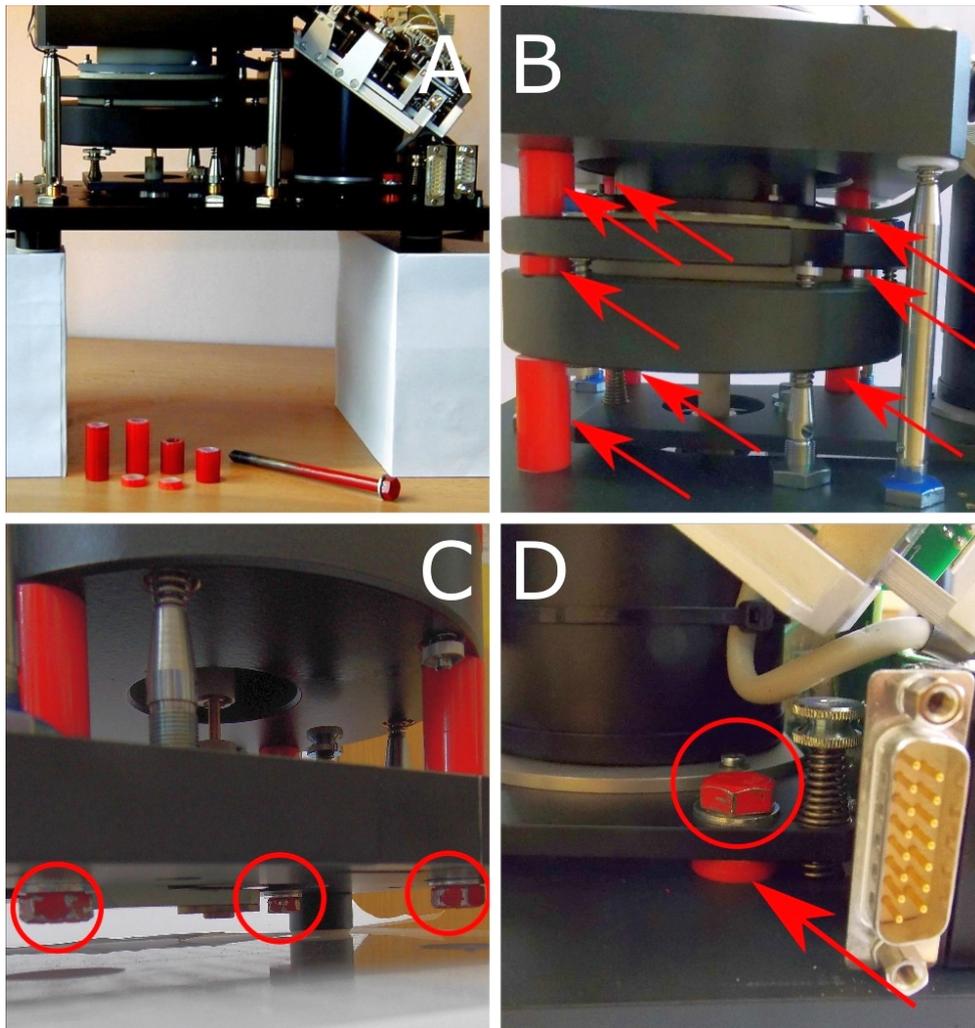
 If the transportation screws and washers are not available in your laboratory, ask Agico for providing set of the screws.

### 5.1.5 Packing the instrument

This chapter describes how to pack the JR6 spinner magnetometer in case that the instrument is transported to another laboratory or to Agico for repair. We recommend to pack the instrument into original case in which it was supplied, and use the original style of packing when the Pick-Up Unit is protected by special plastic case, and suspended by eight foam-plastic "corners".

 **It is absolutely necessary to install the transportation screws** into the Pick-Up Unit before you pack the instrument. For more details see previous chapter 5.1.4 *Installation of transportation screws*.

 Before sending the JR6 spinner magnetometer, please contact Agico for the detailed packing and shipping instructions.

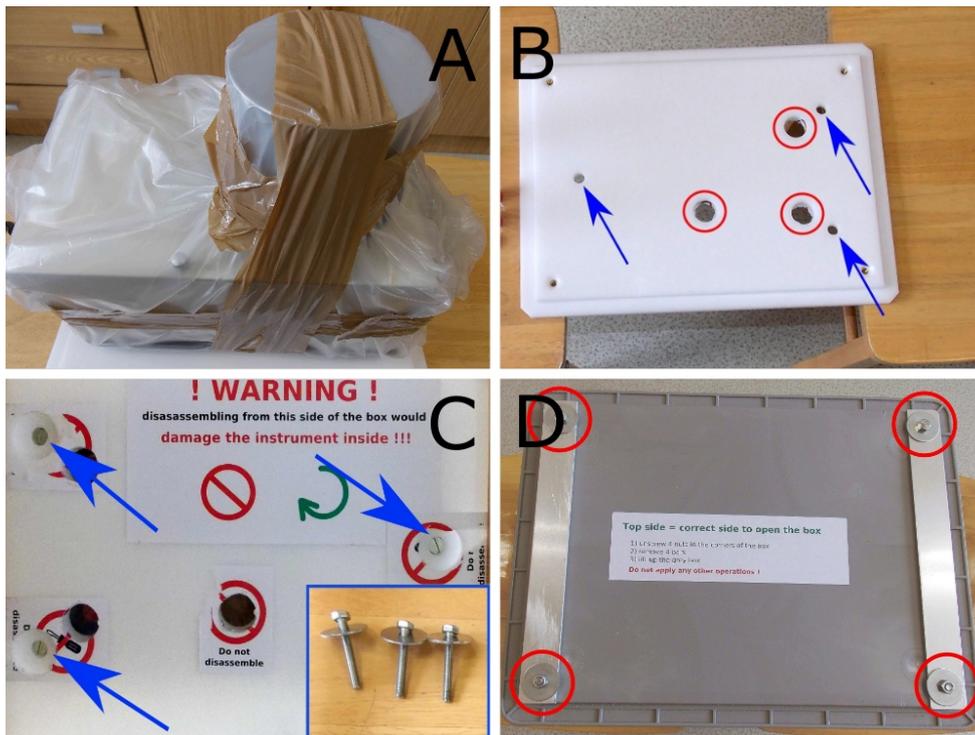


**Figure 9:** Installation of transportation screws

**Packing the Pick-Up Unit to original case** is as follows:

- Make sure that the transportation screws are mounted.
- Remove any holder, close the coils and install the shielding hat. Cover the Pick-Up Unit with plastic foil and fix the shielding hat with a tape, as shown in Fig. 10A.
- Put the bottom part of the original plastic case (white board with holes) on some solid stands, as shown in Fig. 10B.
- Put the Pick-Up Unit on the white board and locate three screws that holds the legs of the Pick-Up Unit (blue arrows in Fig. 10C).

- Remove the screws and and install three fixing screws with pads that are shown in the corner of the picture.
- Fix the Pick-Up Unit to the white board by tightening the fixing screws, using 10 mm tube wrench.
- Cover the Pick-Up Unit with the grey plastic case and install long screws into the corners. Tighten the nuts marked by red circles in Fig. 10D.



**Figure 10:** Packing the Pick-Up Unit to original case

If the original plastic case is not available then put the Pick-Up Unit on the solid board, made of rigid material such as plywood, with dimensions 30 x 20 cm (12.5 x 8 inches). Use a persistent sticking tape (duct tape) to fix the Pick-Up Unit on the board. As shown in Fig. 11, bottom board covers the bottom of the instrument and sticking tape fixes the permalloy shielding hat.

#### **Packing the instrument into a paper box:**

Whole instrument must be packed into a solid paper box. Parts to be sent are **Pick-Up Unit, Power Supply Unit, interconnecting cables, mains cord** and **calibration standard**. Paper box which was provided together with the instrument is best choice, but any good quality paper box with appropriate dimensions may be used

for transportation. Non-original paper box must be sufficiently strong to prevent the instrument from damage. It is necessary to use some damping material (as much as possible) to reduce impacts during the transportation. Example of the good packing with original foam-plastic "corners" is shown in Fig. 12.



**Figure 11:** Alternative packing of Pick-Up Unit



**Figure 12:** Packing of whole instrument

## 5.2 Maintenance

Proper care and regular maintenance will greatly prolong the lifetime of the JR6 magnetometer. One of most important procedures is **regular cleaning of the interior space of the Pick Up Unit**. All sample holders must be kept clean and stored in original box with other accessories. For more details please refer to next chapters.

### 5.2.1 Cleaning the holder

After some time of use the specimen holder can be contaminated with dust and fragments of the rock specimens. Remanent magnetization of the holder can be increased to values which overcome acceptable range in holder correction routine. In this case it is recommended to rinse the holder in clean water with small amount of detergent and dry it up. In special cases, demagnetize the holder in AC magnetic field of several tens of mT.

- ✘ Using an alcohol or other solvents for cleaning may lead to the damage of the plastic parts of the sample holder.

If you need to **clean the automatic holder**, unscrew the adjusting screw and pull out all inner parts. Use a screwdriver for fixing specimens, as you can see in Fig. 13. When the holder is completely clean and dry, install all parts together.

To adjust **proper rotation** of automatic holder turn with a adjusting screw and find proper mechanical tension of the inner spherical shell . The inner shell should rotate freely but it should not be loosen too much.



**Figure 13:** Adjustment of automatic holder

### 5.2.2 Cleaning the Pick-Up Unit

Clean the interior of the Pick-Up Unit every 3-6 months. Remove top cover and use a vacuum cleaner or pressure air to remove dust and all rock fragments. If necessary, e.g. after breakage of a specimen and when it is impossible to remove fragments under the square plate without its removal, remove upper square plate with coils and clean rotation system.

**Dismantling the upper square plate** is as follows:

- Switch the instrument off and unplug the mains cord. Unscrew two fixing screws on Pick-Up Unit and remove the top white cover (see Fig. 14A). Then unplug the yellow-green grounding cable.
- Remove the holder from the coils. Then unplug four connectors from the electronic board according to Fig. 14B.
- Release four springs in the corners of the rectangular plate. Push the upper plate in each particular corner and remove the security pin (Fig. 14C). Put the springs on the desk in square pattern to prevent exchange of their position.
- Remove the upper rectangular plate with coils and specimen manipulator and put it on the corner of the desk to prevent any damage (Fig. 14D). Make sure that the springs are in original positions.

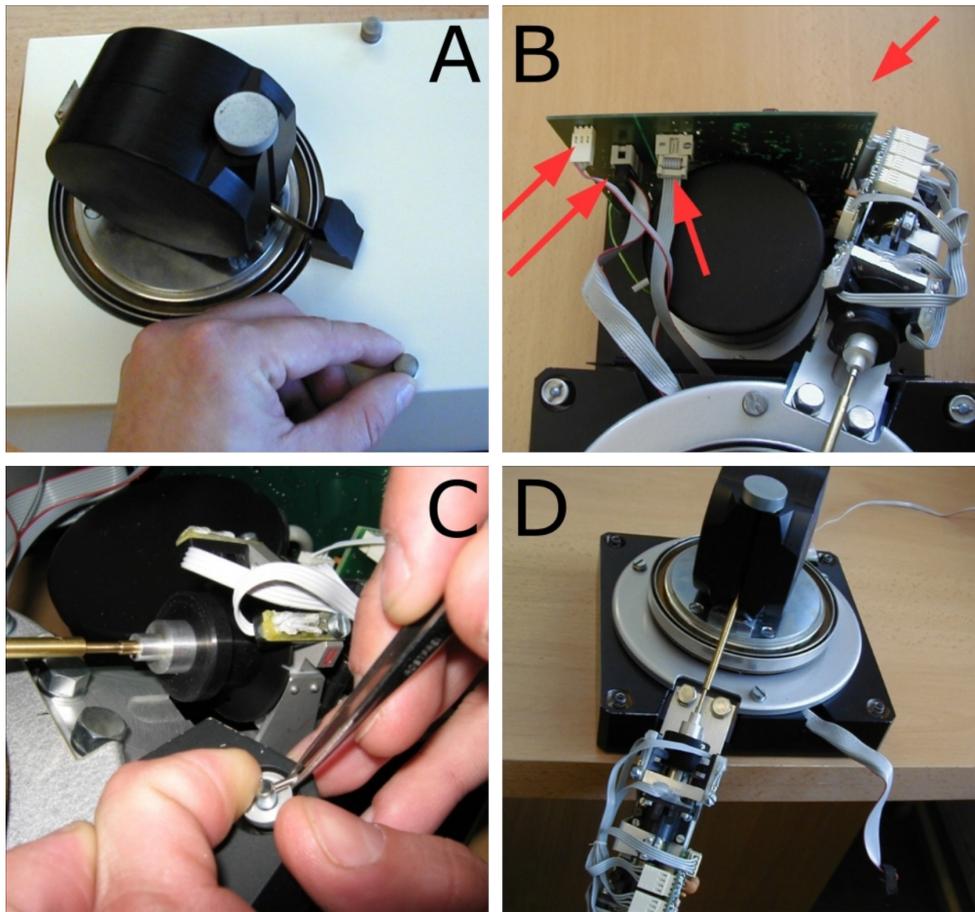
### 5.2.3 Cleaning the Optical system

Optical system of JR6 consists from black screen with 100 slots and from two optocouplers which control the actual position of the screen. During the specimen spinning the two kinds of time pulses are generated - one pulse per round (1x) and one hundred pulses per round (100x). When the Optical system is dirty (screen slots are masked by dust), the instrument shows an error connected with missing pulses. In this case clean whole Optical system according to procedure below.

-  See also the chapter 5.2.2 **Cleaning the Pick-Up Unit** for dismantling the upper square plate with coils and automatic manipulator.

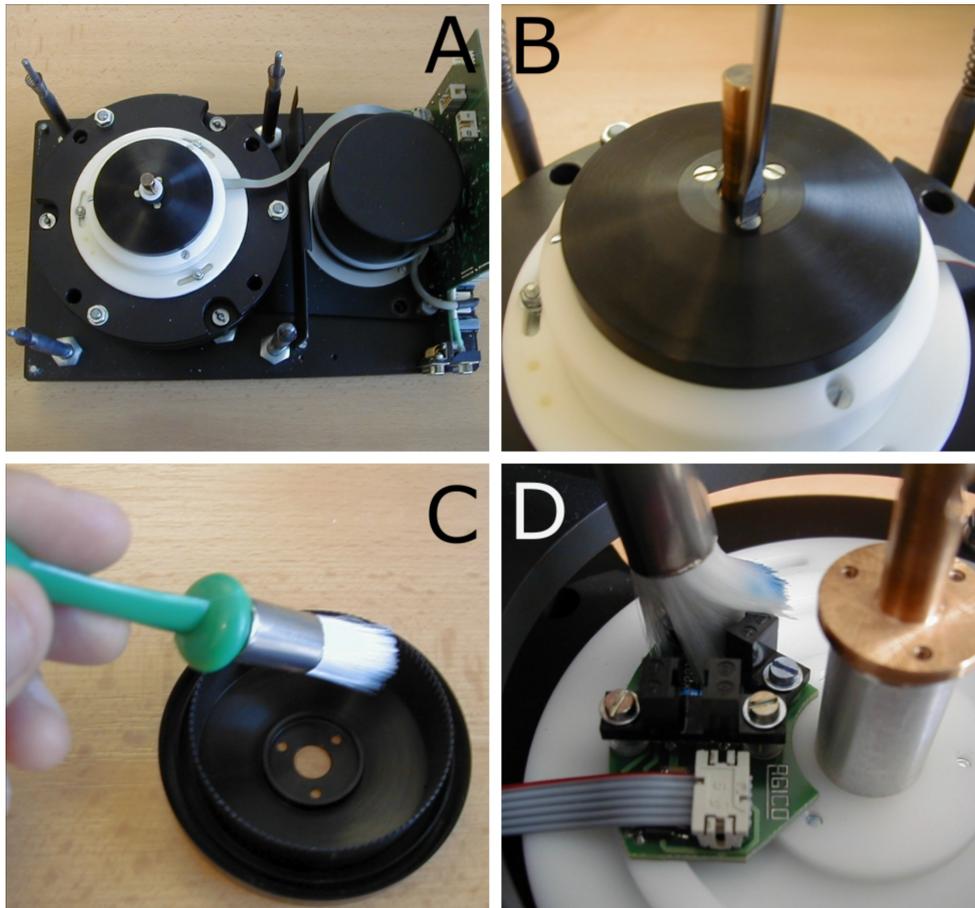
**Cleaning the Optical system** is as follows:

- Switch the instrument off and unplug the mains cord. Remove white top cover. Then remove upper square plate with coils and automatic manipulator (see chapter 5.2.2).



**Figure 14:** Dismantling the upper square plate

- Now you have an access to the Optical system (see Fig. 15A). Unscrew the carrier pin and remove the white teflon pad and black rubber pad from main shaft.
- Loose three small screws which fix the screen (see Fig. 15B) and carefully remove the screen.
- Check all the slots in the screen. Use soft brush to clean all the slots and entire screen from both sides (Fig. 15C). Check once more if all the slots are free.
- Clean interior of the Optical system, be careful not to damage two optocouplers inside. Clean the optocouplers using soft brush or cotton earbud. (see Fig. 15D)
- Reassemble the Optical system. Only one position of the black screen on the main shaft is possible. Test function of the instrument using JR6TEST or REMA6 software. If needed, contact Agico for assistance.



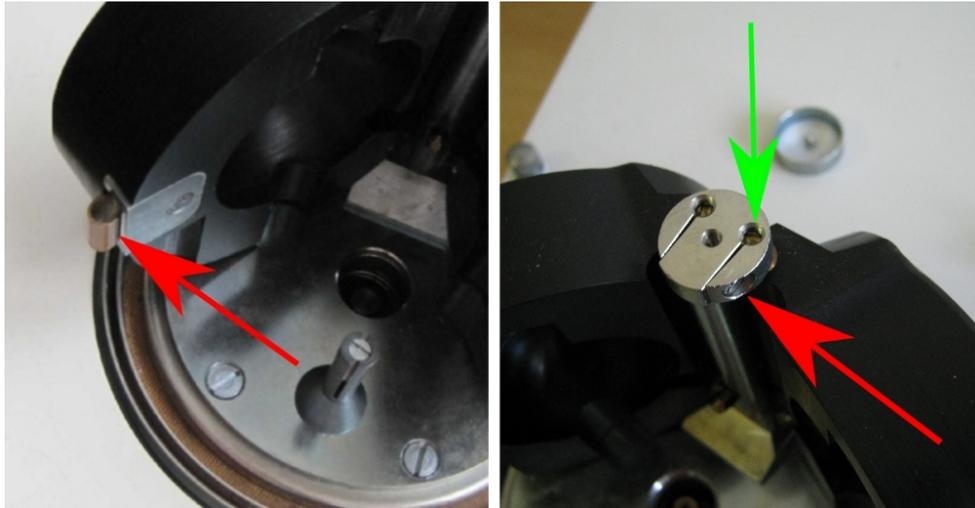
**Figure 15:** Cleaning the Optical system

#### 5.2.4 Coils adjustment

To keep the coils in correct position and to avoid a possible mechanical damage of the coils, it is necessary to perform a mechanical adjustment of the coils. The procedure is as follows:

1. Check if both sides of closed coils are firmly locked together by the bronze spring with the latch. If needed, manually adjust the proper tension of the bronze spring, marked by red arrow in Fig. 16, left.
2. The measuring coils should move with some weak tension during opening or closing. If not, set proper mechanical stiffness of each side of coils.
3. Unscrew top cover from the column which holds the coils. Loose fixing screw marked by red arrow in Fig. 16, right. Then set proper stiffness of one side of coils using adjusting screw marked by green arrow.

4. Repeat the process on the the other side of the coils. Then tighten fixing screws and mount the cover.
5. When the coils are closed, there must not be any visible gap between the both sides. Check the interior space of the coils, including spheres for holder, it should be without any significant damage. If not, contact Agico for assistance.



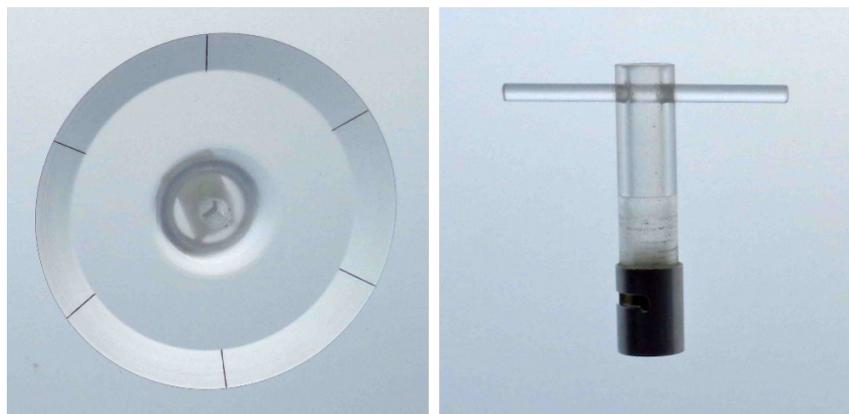
**Figure 16:** Adjustment of the measuring coils

### 5.2.5 Automatic manipulator adjustment

This chapter describes troubleshooting and probable reasons of the improper function of the automatic manipulator. In case of the problem, it is important to analyze the reason first and then perform an appropriate adjustment.

When JR-6 spinner magnetometer is **ON**, run the REMA6 software and from upper Main menu select `Execute|Auxiliary commands` or press the shortcut `[Alt+Bksp]`. Install the automatic holder and perform a simple test of automatic manipulator:

Press the **FRONTAL** button to set the the holder to initial position. Then press the **INITIAL** button to set the manipulator to initial position. Move the manipulator up using the **UP** button. Turn the manipulator to next angular position using the **TURN** button and finally move the manipulator down using the **DOWN** button. To set holder to opposite position press the **OPPOSITE** button. In each step check correct position of the holder and the manipulator. Appropriate adjustment is performed with help of two setting tools shown in Figure 17 – **hexagonal key tool (disc)** and **azimuthal setting tool**.



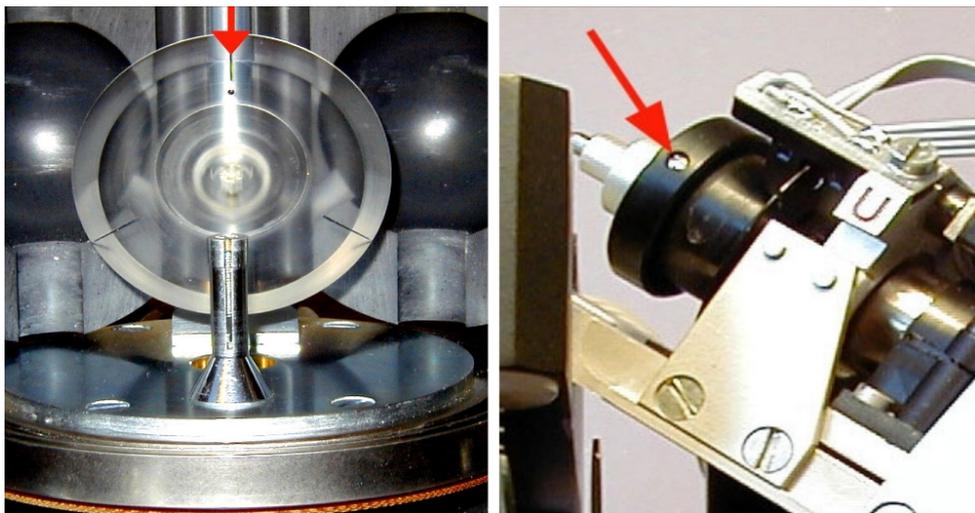
**Figure 17:** Setting tools for automatic manipulator

### Setting of hexagonal key:

This adjustment is needed when the angular position of the hexagonal key does not match angular position of the hexagonal socket of the holder. Walls of the hexagonal key must be parallel to the hexagonal socket of the holder. To check it perform this procedure:

- Remove any holder from the coils. Open *Auxiliary commands* window in the REMA6 software. Press the **INITIAL** button to set hexagonal key to initial position.
- Move up with the hexagonal key by pressing the **UP** button and install the hexagonal key tool (disc with six marks).
- Press the **TURN** button three times and check if the mark on the tool is aligned with the axis of column supporting the coils, as seen in Fig. 18, left.
- To adjust hexagonal key position locate the black screen with three slots and loosen a little bit a screw marked by red arrow in Figure 18, right. Use the screwdriver of proper size not to damage the screw.
- Turn the screen a little bit clockwise or anticlockwise and then gently tighten the screw, just to avoid the movement of the screen.
- Press the **TURN** button and the **INITIAL** button again and check the alignment between black mark on the disk and the column. If necessary, repeat the adjustment of the black screen.
- Tighten the fixing screw on black screen and remove the adjustment tool. Then press the **INITIAL** button and the **DOWN** button to set hexagonal key to initial and rest position.

- Mount the automatic holder and perform the final testing with JR6TEST or REMA6 software (automatic holder correction). If necessary repeat the particular adjustment.
- i** Hexagonal key tool and azimuthal setting tool can be found in the box with holders and accessories.
- !** If the automatic holder is installed, execute the **FRONTAL** button (initial holder position) before executing the **UP** button (manipulator up).
- ✘** Never turn the hexagonal key tool or the inner spherical shell of the holder by hand if the hexagonal key is in the working position - this may damage the holder or motor gear-box.



**Figure 18:** Setting of holder azimuthal position

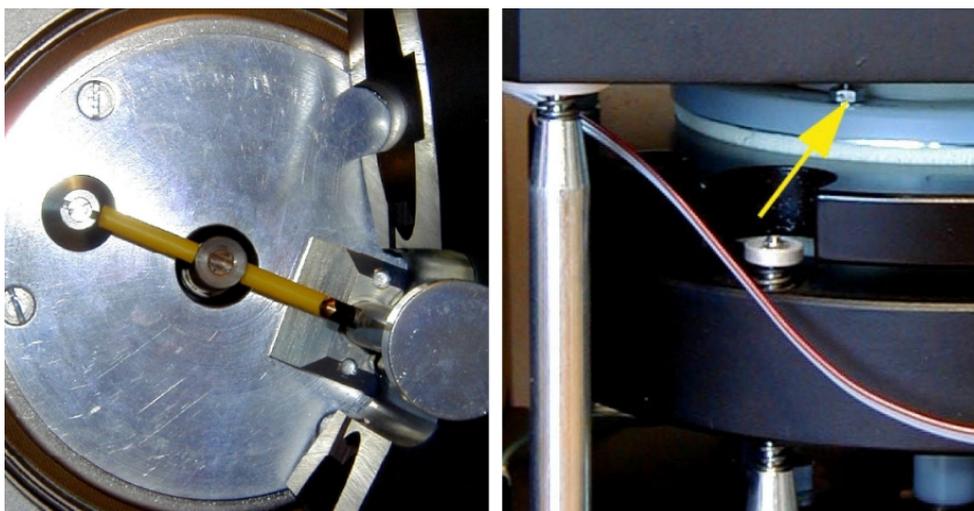
### 5.2.6 Holder position adjustment

This chapter describes how to adjust position of specimen holder in vertical axis. Correct position of the holder is one of the most important setting of the instrument. Especially the automatic holder is fully functional only when the axis of its hexagonal hole and the axis of hexagonal key are identical.

#### **Azimuthal holder position:**

This adjustment is needed in case when the holder stops in the incorrect angular position with respect to the axis of the hexagonal key. To check the azimuthal position remove any respective holder and mount the azimuthal tool in the same way as the normal holder. Then start with this procedure:

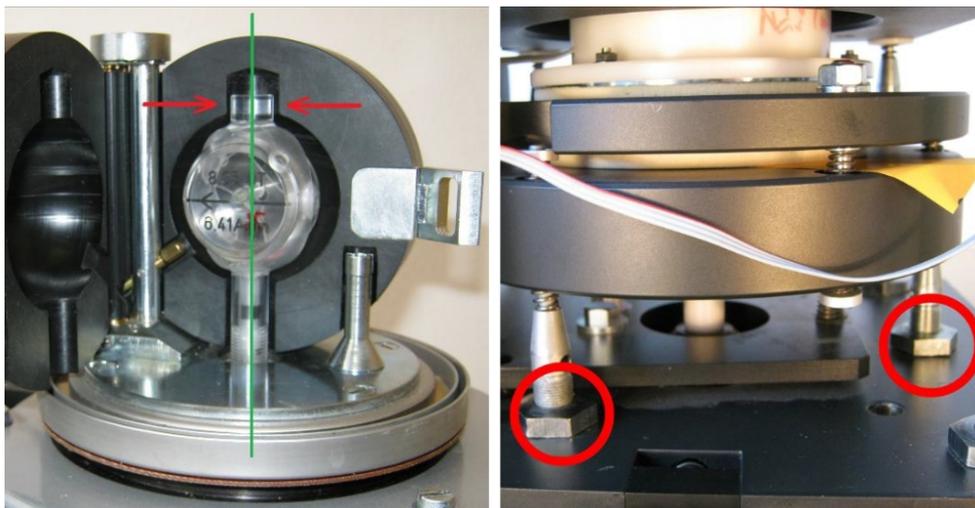
- Open *Auxiliary commands* window in the REMA6 software. Press the **FRONTAL** button. Check if the tool stopped in the axis of hexagonal key, as seen in Figure 19, left.
- If not, loosen three nuts located under the upper square plate, marked by yellow arrow in Figure 19, right. Then turn the rotational system around clockwise or anticlockwise to set the proper azimuthal position of the holder.
- Turn the tool to opposite angular position using the **OPPOSITE** button and then press the **FRONTAL** button. Check if the tool is in correct initial position. If necessary, repeat the adjustment of rotation system.
- When the adjustment is done, gently tighten three nuts. Make one more test and then remove the azimuthal tool.



**Figure 19:** Setting of azimuthal position of holder

**Vertical holder position:**

- Check the axis of specimen holder, marked by the green line in Fig. 20. Top part of holder must be in the middle of space marked by the red arrows.
- If not, locate three screws between base plate and round plates, marked by red circles in Fig. 20 (only two are marked). Loosen the nuts and then turn with the screws to adjust proper position of the holder.
- Adjust the **automatic holder** with respect to automatic manipulator. Check if the hexagonal key fits freely into the holder. The holder should be almost stationary as the hexagonal key rises to the working position.
- Open *Auxiliary commands* window in the REMA6 software. Press the **FRONTAL** button to set the holder in initial position.
- Raise the automatic manipulator to working position using the **UP** button and set individual positions using the **TURN** button. The automatic holder engages next position correctly when you hear characteristic "click" sound. Set manipulator down with using the **DOWN** button.
- After successful adjustment tighten the nuts. It is good to fix the screws by inserting a metal rod into the hole during tightening.
- Mount the automatic holder and perform the final testing with the REMA6 software (run *Holder Correction*). If necessary, repeat the particular adjustment.



**Figure 20:** Setting the vertical holder position

**i** Adjustment of vertical holder position is very sensitive. Always turn with only one adjusting screw a quarter of turn and then check the holder.

**!** Always check position of the automatic holder with installed shielding hat because the square plate with automatic manipulator is pushed down a little bit by the weight of the shielding hat.

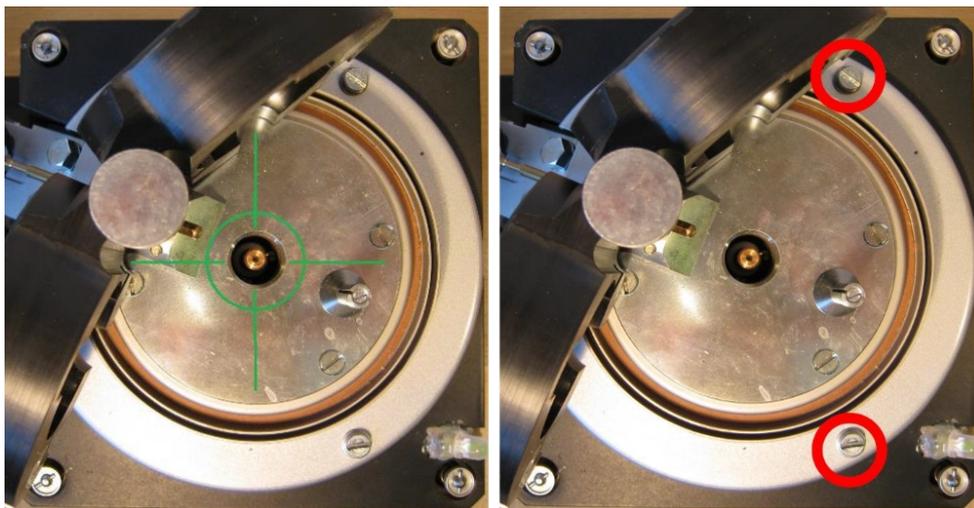
### Coils coaxiality:

- Remove a specimen holder and check if the axis of main shaft is coaxial with the hole in the circle plate, as shown in Fig. 21, left. If the main shaft touches the hole, the holder can hit the coils or the mechanical system can vibrate.
- Loose three screws marked by the red circles Fig. 21 right (only two are visible), and move entire coil system to get the main shaft in the center of the hole. Then tighten all three screws.

**i** Adjustment of coils coaxiality has an affect to the position of a specimen holder. After this procedure check the holder according to chapter 5.2.6

### Holder position adjustment.

**!** Perform the adjustment of coils coaxiality only when the main shaft is really far from the center of the hole.



**Figure 21:** Setting the coils coaxiality

### 5.2.7 Mechanical setting

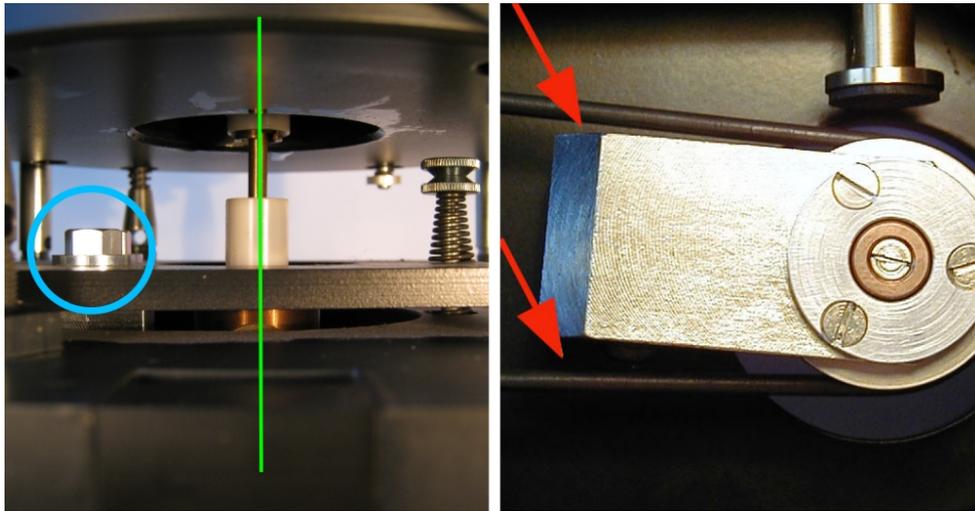
This procedure describes how to set the mechanics of JR6 spinner magnetometer in case of **increased vibration** during the spinning. The mechanical system can vibrate from many reasons. Following instructions may help to identify possible source of the problem and suggest an appropriate solution.

#### Cardan shaft:

- In ideal situation, axis of the cardan is coaxial with the specimen holder. Correct alignment of cardan is marked by green line in Fig. 22, left.
- In case of high vibration, install the holder with problematic specimen, close the coils and install shielding hat.
- Run JR6TEST software, switch on high speed using command [h] and run the measurement with command [g].
- Slightly move bottom trapezoidal plate (plate with motor) during the rotation of the specimen. Move the plate to right, left, back and forward, not up or down.
- If you will notice decrease or disappearing of the vibrations then try to adjust a position of cardan shaft.
- Note that cardan shaft should be aligned with the holder axis, but sometimes a small non-coaxiality is better, because it can reduce vibration of mechanics.
- Loosen two screws marked by the blue circle in Fig. 22 (left), adjust the cardan position and tighten the screws. It is better to dismantle driving belt during this operation.
- Check if the drive belt does not touch the pulley bearing box located in bottom side of the Pick-Up Unit (see Fig. 22, right).

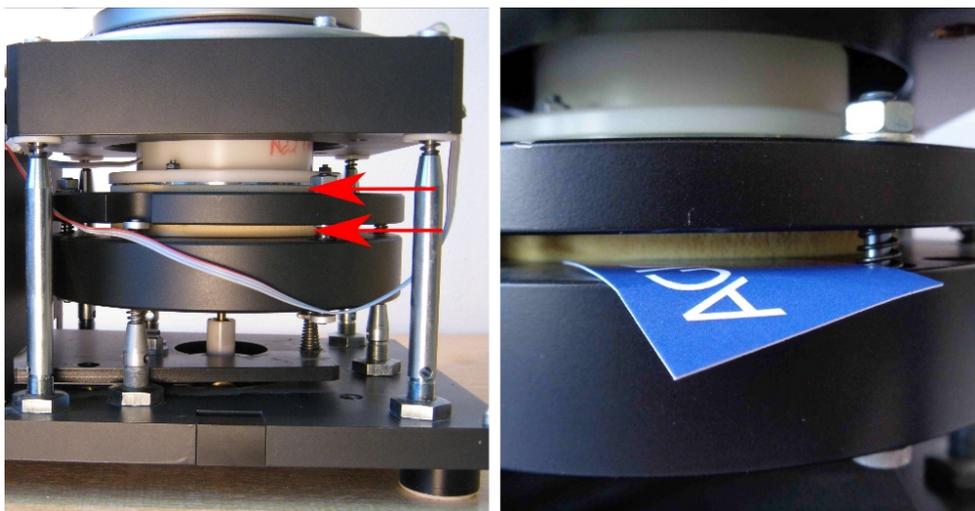
#### Damping foams:

- Check the integrity of two damping foams placed above and between bronze round plates, marked by two arrows in Fig. 23, left.
- Press bronze plates together few times and check flexibility of the damping foams. If they seems to be disintegrated, ask Agico for further assistance.
- Check correct distance between bottom round plate and bottom damping foam. The system is set properly when you can insert business card between them easily, but without any space left (see Fig. 23), right.



**Figure 22:** Setting the cardan shaft

- In case of high vibration, install the holder with problematic specimen, close the coils and install shielding hat.
- Run JR6TEST software, switch on high speed using command [h] and run the measurement with command [g].
- During the rotation of the specimen try to slightly change the distance between two round plates by pressing them or lifting them by hand. If you will notice some improvement contact Agico for assistance.



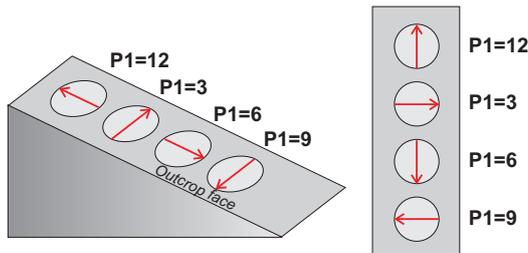
**Figure 23:** Damping foams



## 6 Appendix

### 6.1 Orientation parameters

#### Parameter P1

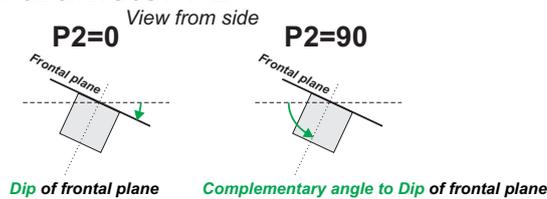


P1 is a clock value orientation of the **Arrow** which represents the x-axis of Specimen coordinate system (right hand rule, see *Legend*). The **Arrow** may be drawn:

- P1=12 Upslope
- P1=3 To the Right
- P1=6 Downslope
- P1=9 To the Left

Note that the **Azimuth** of the **Arrow** may, or may not be measured (see Parameter P3).

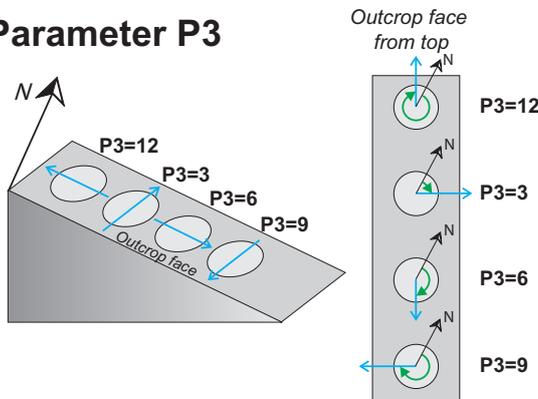
#### Parameter P2



P2 indicates which angle is measured as the specimen inclination.

- P2=0 **Dip** of specimen frontal plane
- P2=90 **Plunge** of specimen z-axis (Complementary angle to Dip of specimen frontal plane)

#### Parameter P3

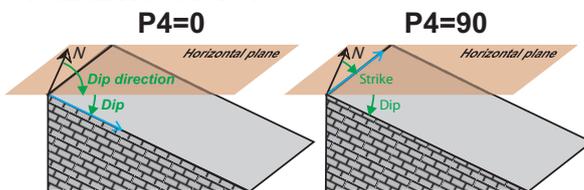


P3 is a clock value that indicates which **Direction** on the specimen frontal plane (x-y plane) is measured using geological compass and expressed as **Azimuth**.

- P3=12 Antipode of Dip direction
- P3=3 Right-handed Strike
- P3=6 Dip direction
- P3=9 Left-handed Strike

Note that the measured **Direction** may, or may not, coincide with **Arrow** (see Parameter P1).

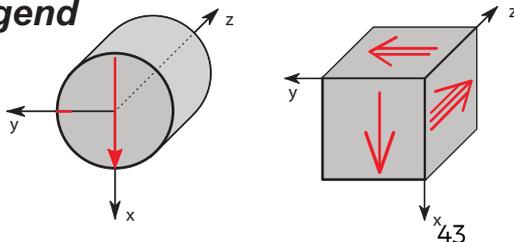
#### Parameter P4



P4 indicates how mesoscopic foliation adjacent to the specimen is measured.

- P4=0 **Dip direction/Dip** notation is used
- P4=90 **Strike/Dip** notation is used (right hand rule)

#### Legend

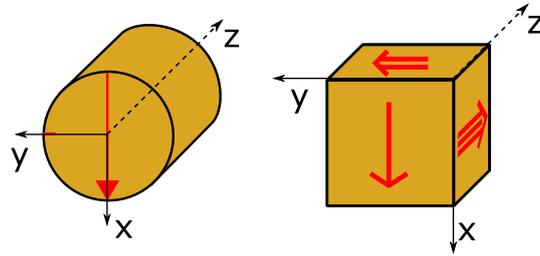


- Red Markings drawn on specimen
- Blue Measured directions (not drawn)
- Green Orientation angles

**Azimuth** is measured as a clockwise angle from North and it is expressed in degrees <0-360°). Anticlockwise angles are not allowed!

Figure 24: Orientation parameters

## 6.2 Specimen coordinate system



**Figure 25:** Specimen coordinate system

### 6.3 EC Declaration of Conformity

We,

AGICO, s.r.o., Ječná 29a, CZ - 621 00 Brno, IČO 607 313 54,

declare that the product:

Name:	Spinner Magnetometer with Automatic Manipulator
Type:	JR-6A
Modification:	JR-6
Manufacturer:	AGICO, s.r.o., Ječná 29a, CZ - 621 00 Brno, IČO 607 313 54
Place of producing:	AGICO, s.r.o., Ječná 29a, CZ - 621 00 Brno, IČO 607 313 54

fulfills the safety requirements for electrical equipment for measurement, control and laboratory use:

Instrument is certificated by using Directive 2014/35/EU.

ČSN EN 61010-1 ed.2:2011

Certification scheme: ČSN EN ISO/IEC 17067:2014, Scheme 1a

Electromagnetic compatibility test:

EN 61326-1: 2013,

EN 55022:2010,

EN 61000-3-2:2014,

EN 61000-3-3:2013,

EN 61000-4-2:2009,

EN 61000-4-3:2006,

EN 61000-4-4:2012,

EN 61000-4-5:2006,

EN 61000-4-6:2009,

EN 61000-4-11:2004

## 6.4 Warranty

AGICO warrants that this product will be free from defects in materials and workmanship for a period of usually 1 (one) year from date of installation. However, if the installation is performed later than 3 (three) months after the date of shipment due to causes on side of Customer, the warranty period begins three months after the date of shipment. If any such product proves defective during this warranty period, AGICO, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, Customer must notify AGICO of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. AGICO will decide if the repair is to be performed by AGICO technician or AGICO delegated serviceman in customers laboratory, or product shall be sent for repair to the manufacturer. In latter case, customer shall be responsible for packaging and shipping the defective product to the AGICO service centre. In both cases, all the costs related to a warranty repair shall be at expenses of AGICO.

The warranty becomes invalid if the Customer modifies the instrument or fails to follow the operating instructions, in case of failure caused by improper use or improper or inadequate maintenance and care, or if the Customer attempts to install the instrument without explicit written permission of AGICO company. AGICO shall not be obligated to furnish service under this warranty

- to repair damage resulting from attempts by personnel other than AGICO representatives to install, repair or service the product;
- to repair damage resulting from improper use or connection to incompatible equipment; or
- to service a product that has been modified or integrated with other products when the effect of such modification increases the time or difficulty of servicing the product.

This warranty is given by AGICO with respect to this product in lieu of any other warranties, expressed or implied. AGICO and its vendors disclaim any implied warranties of merchantability or fitness for a particular purpose. AGICO's responsibility to repair or replace defective products is the sole and exclusive remedy provided to the Customer for breach of this warranty. AGICO and its vendors will not be liable for any indirect, special, incidental, or consequential damages irrespective of whether AGICO or vendor has advance notice of the possibility of such damages.