

TRIGAMMA™ MAS PROBE
USER MANUAL

Bruker BioSpin

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CAUTION!

Probe must be operated only inside the magnet.

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Table of Contents

1.	Introduction	3
2.	Specifications.....	4
2.1.	RF specifications	4
2.2.	Variable Temperature (VT) specifications	4
2.3.	Magic Angle Spinning (MAS) specifications:.....	4
3.	Probe interfaces	5
4.	Tuning the probe	7
4.1	Layout of the inserts in the "R.F. Insert kit"	7
4.2	Types of inserts	8
4.3	Removing the shield	9
4.4	Locations of the inserts	10
4.5	Exchanging inserts	11
4.5.1	<i>Exchanging type-A inserts</i>	11
4.5.2	<i>Exchanging type-B inserts</i>	12
5.	Included inserts	13
6.	Probe Tuning Tables	13
	Appendix: A - Tuning the probe, an example	15

1. Introduction

TriGamma is a family of triple channel (1H/X/Y), Magic Angle Spinning (MAS) probes designed for solid-state NMR applications.

This family of probes is equipped with two broadband channels together with a 1H channel. The X channel can be tuned to the specified nuclei that have Larmor frequencies between ^{31}P and ^{13}C . The Y channel can be tuned to the specified nuclei that have Larmor frequencies between ^{27}Al and ^{15}N .

It is important to note that the X channel and the Y channel can only be tuned to the specified nuclear combinations that are tabulated at the end of this document.



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2. Specifications

2.1. RF specifications

Maximum RF fields and maximum pulse durations.

Channel	Tuning range	Maximum field (kHz)	Maximum duration (ms)
1H	-	120	50
X	^{31}P - ^{13}C	60 (^{31}P) - 50 (^{13}C)	10
Y	$^{29}\text{Si}^*$ - ^{15}N	40	10

Table: 1

*The tuning range of the Y channel depends on the resonance frequency of the X channel.

2.2. Variable Temperature (VT) specifications:

Interface: Direct Variable Temperature (DVT)
 VT range: -50°C to +80°C

2.3. Magic Angle Spinning (MAS) specifications:

Rotor diameter (mm)	Maximum spin rate (kHz)
1.9	42

Table: 2

3. Probe interfaces

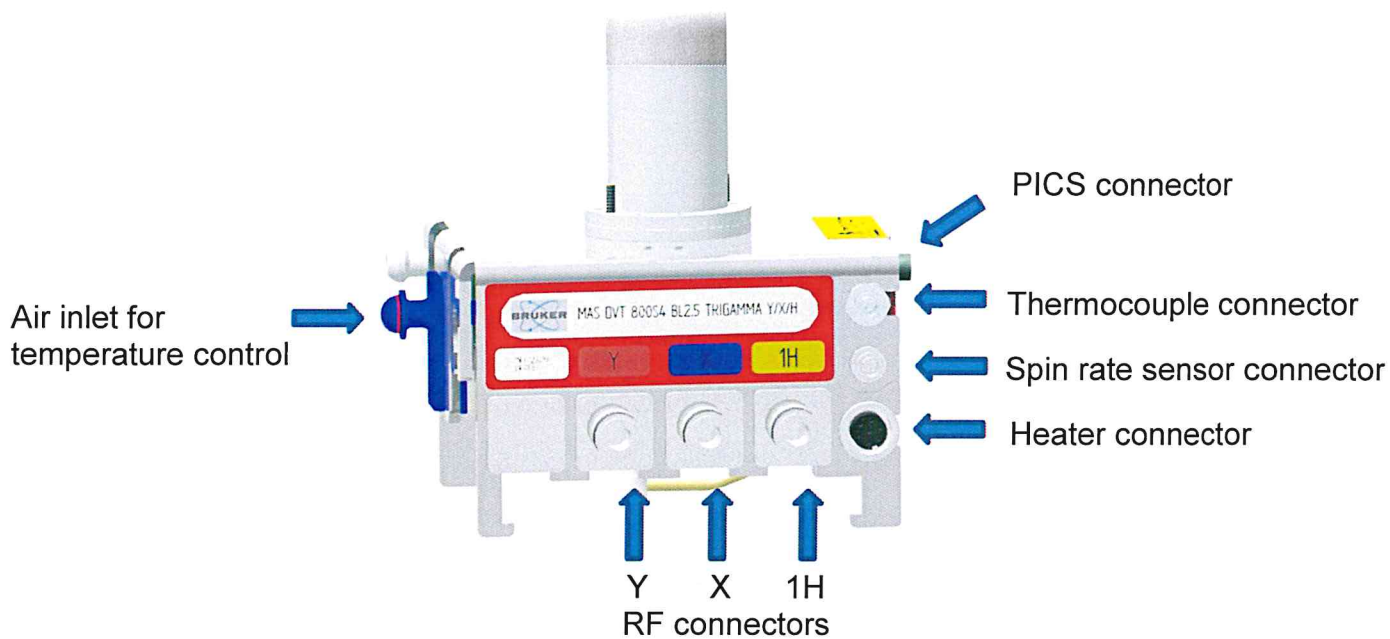


Figure: 1

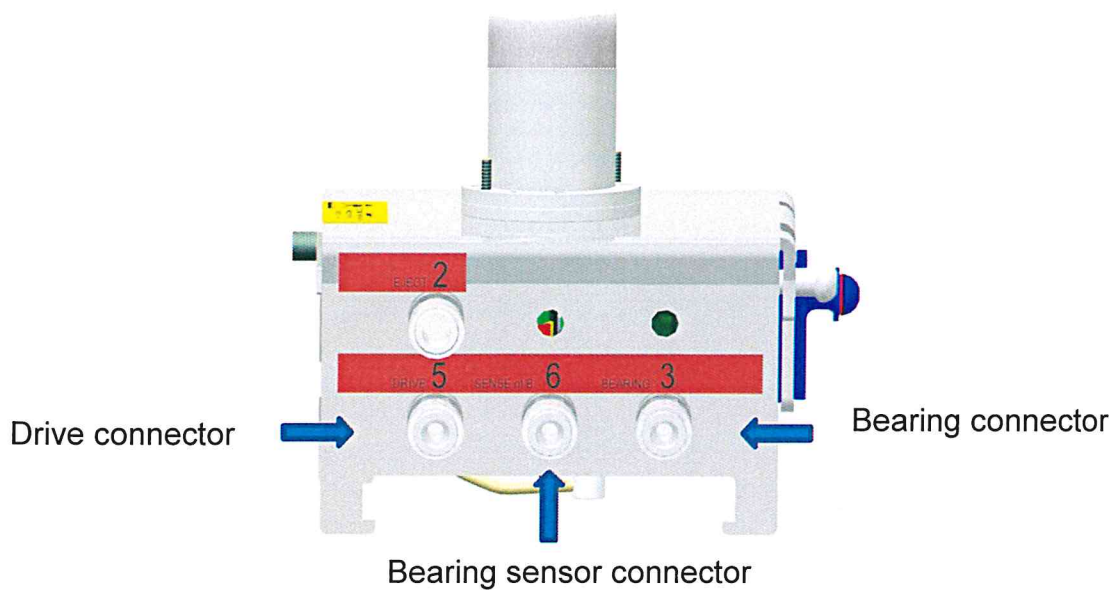


Figure: 2

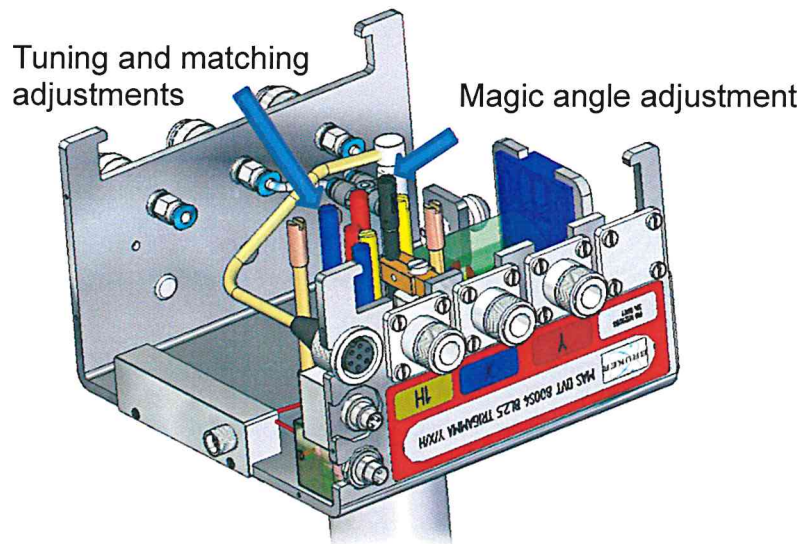


Figure: 3

4. Tuning the probe

The first step is to select the appropriate inserts from the “R.F. Insert kit” by consulting the provided tables located at the end of this manual (refer appendix A for an example). A dash (-) in the table indicates that the corresponding port does not require an insert, and as such must be left vacant. Once the inserts have been connected, the probe can be tuned and matched to the desired frequencies by adjusting the tuning and matching knobs located at the bottom of the probe.

4.1. Layout of the inserts in the “R.F. Insert kit”

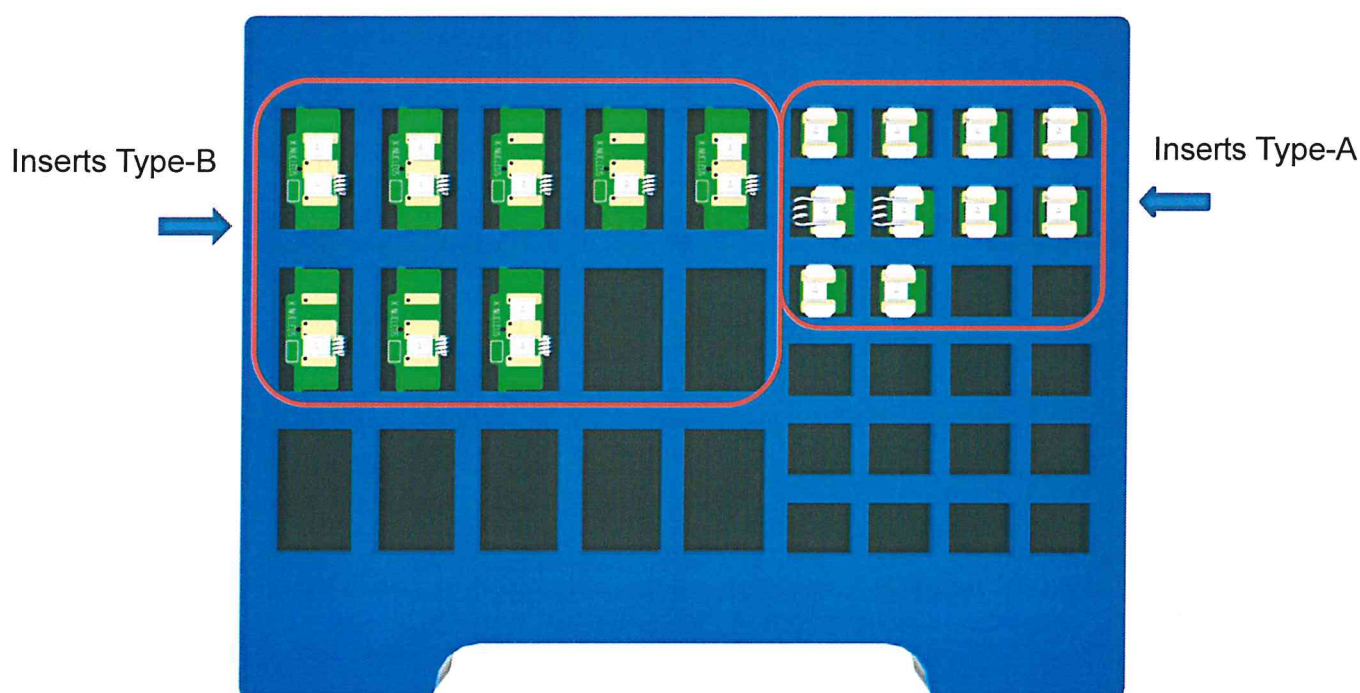


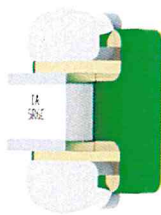
Figure: 4 Layout of the inserts in the “insert kit”.

4.2 Types of inserts

Two types of inserts are provided with the probe (Figure 5).

1. Type-A inserts.
2. Type-B inserts.

All inserts are delicate and must be handled with care.



1. A type-A insert.



2. A type-B insert.

Figure: 5

Type-A inserts without a label are referred to by the value printed on the capacitor as shown in figure: 6.

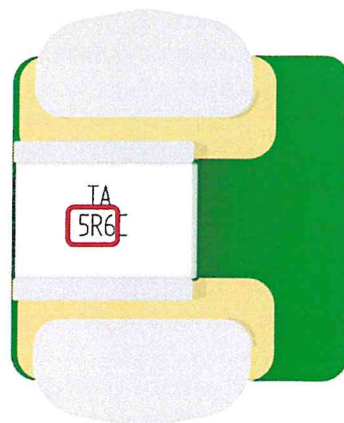
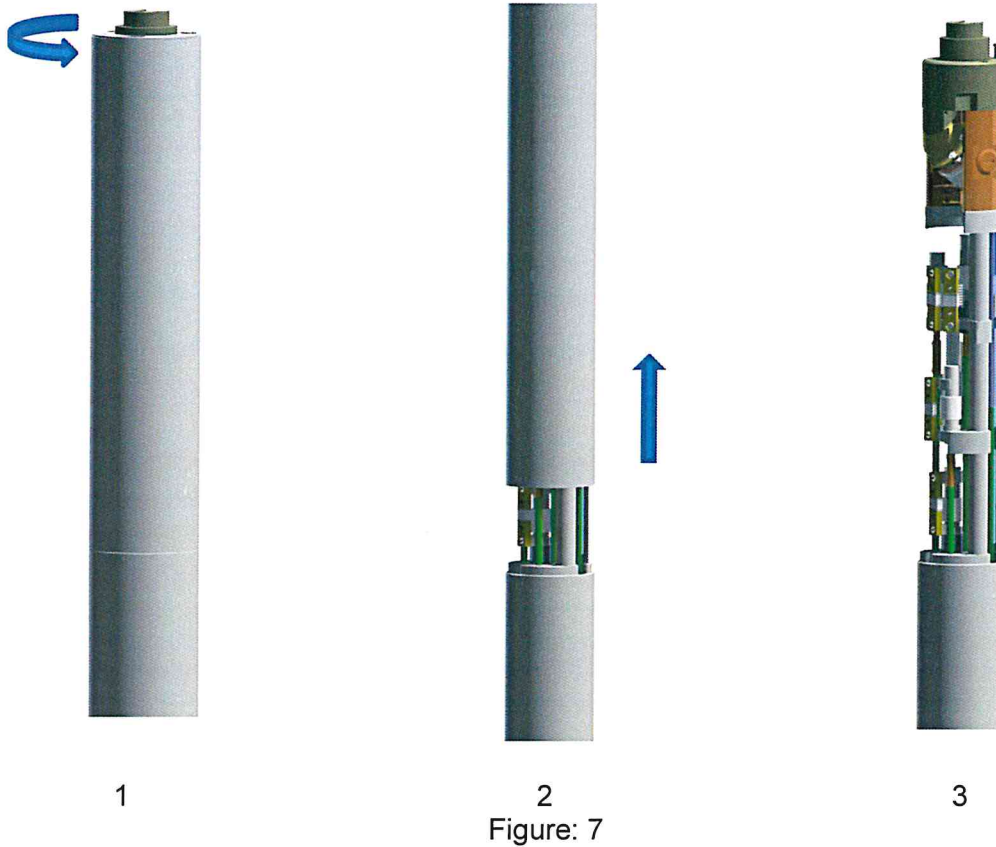


Figure: 6 Value of the capacitor.

4.3 Removing the shield



1. Rotate the top part of the shield, from left to right to unlock the shield (Figure 7).
2. Slide the shield up without rotating.
3. Remove the top part of the shield completely to access the inserts.

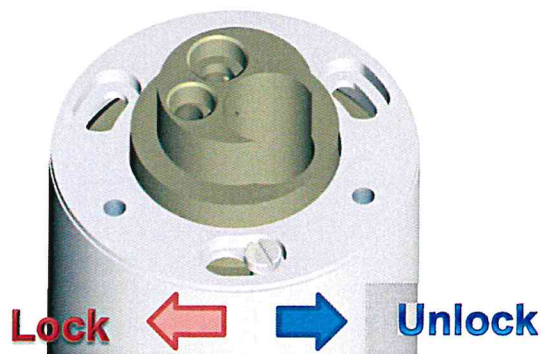


Figure: 8

4.4 Locations of the inserts

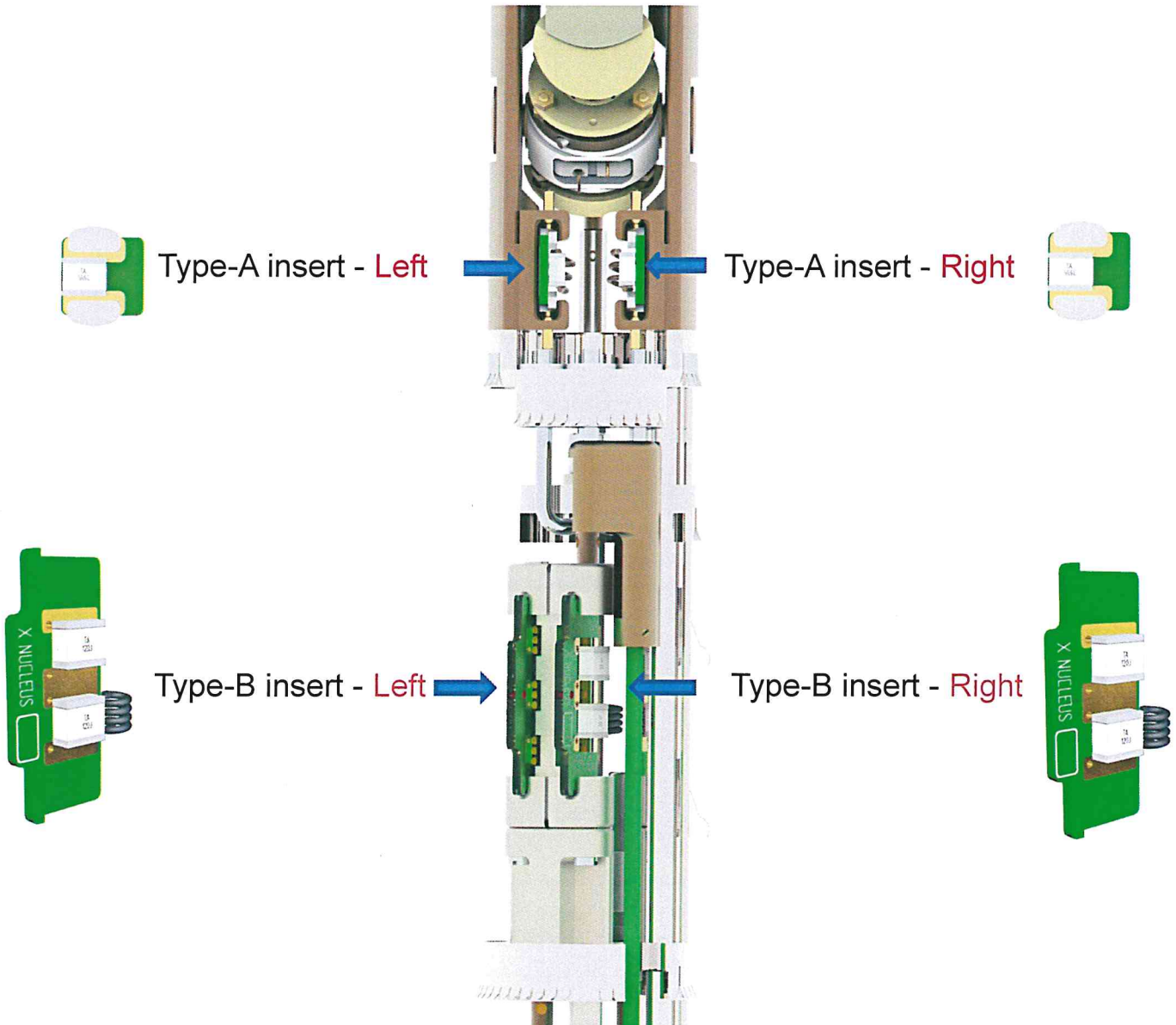


Figure: 9

4.5 Exchanging inserts

4.5.1 Exchanging type-A inserts

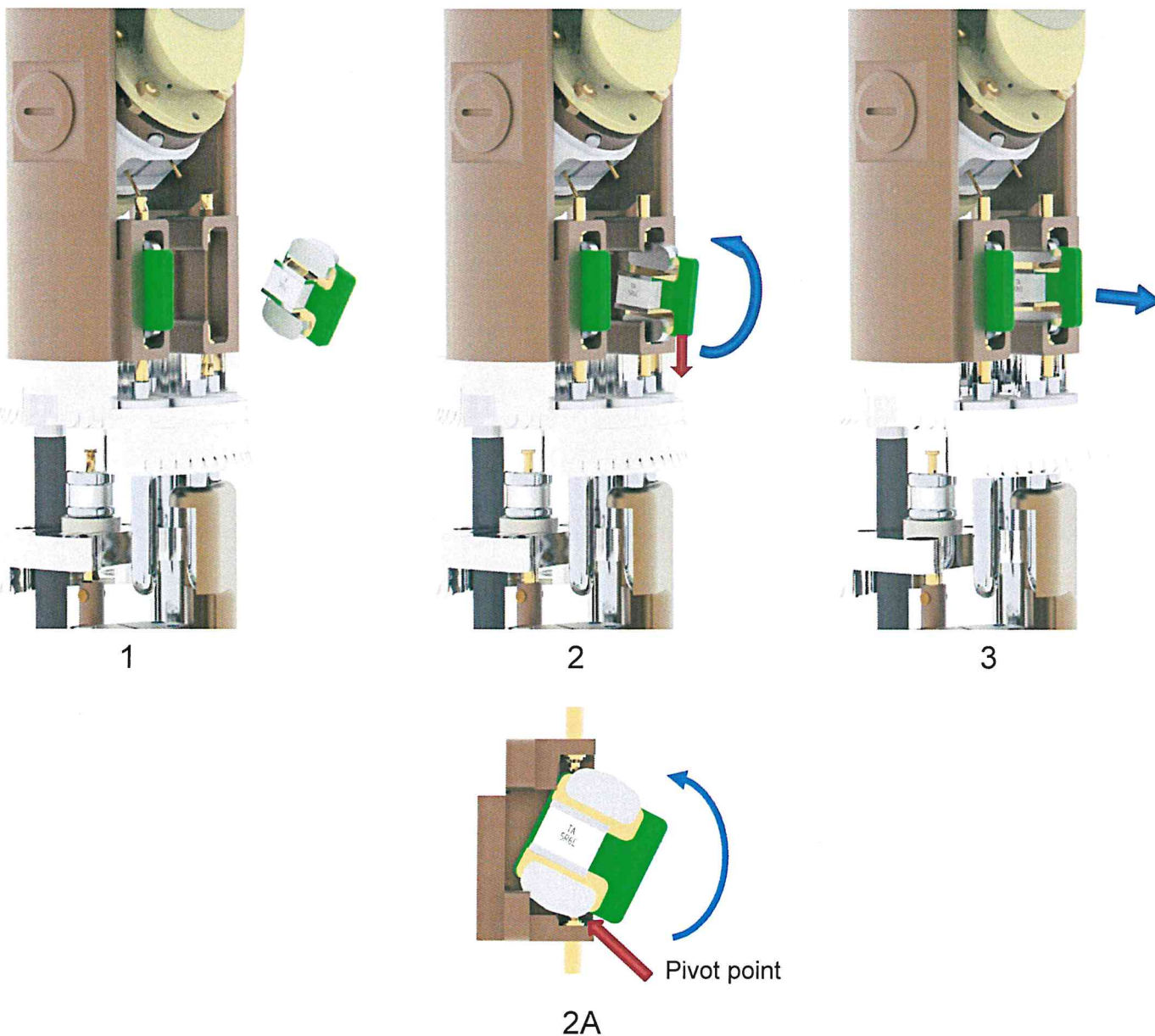


Figure: 10

 Do not push type-A inserts directly into the insert base.

1. Hold the type-A insert at angle as shown in figure 10-1.
2. Rotate the insert while firmly pushing down on the bottom spring loaded contact located in the insert base, as shown in figures 10-2 and 10-2A.
3. The insert can be removed by directly pulling on the insert.

4.5.2 Exchanging type-B inserts

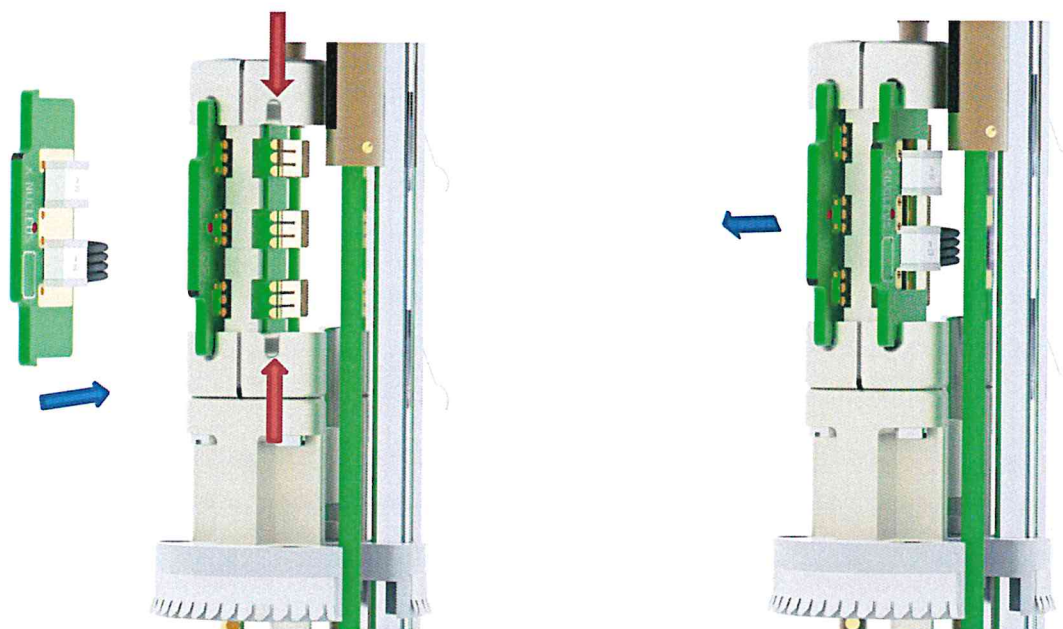


Figure: 11

1. Align the type-B insert with the grooves on the “insert base”, indicated by the red arrows in figure 11.
2. Push the insert in until the notch on the insert comes into contact with the insert base.
3. The insert can be removed by simply pulling on the insert.

5. Included inserts

Type-A inserts		Type-B inserts	
Number	Quantity	Number	Quantity
0R7	1	8.2-8.2	1
5R1	1	254-0	1
5R1-A	1	254-100	1
5R1-B	1	254-120	1
6R2	1	257-0	1
6R2-A	1	258-22	1
110	1	371-0	1
150-A	1	377-L1	1
160	1		
180-A	1		
191-10	1		
191-22	1		

Table: 3

6. Probe Tuning Tables

X Channel nucleus	Y Channel nucleus	Insert Type-A - Left	Insert Type-A - Right	Insert Type-B - Left	Insert Type-B - Right
^{31}P	^{27}Al	191-10	5R1-B	377-L1	-
	^{13}C	191-10	6R2-A	377-L1	-

Table: 4

X Channel nucleus	Y Channel nucleus	Insert Type-A - Left	Insert Type-A - Right	Insert Type-B - Left	Insert Type-B - Right
^7L	^{29}Si	180-A	5R1-A	371-0	8.2-8.2

Table: 5

X Channel nucleus	Y Channel nucleus	Insert Type-A - Left	Insert Type-A - Right	Insert Type-B - Left	Insert Type-B - Right
²³ Na	²⁹ Si	5R1	150-A	257-0	-

Table: 6

X Channel nucleus	Y Channel nucleus	Insert Type-A - Left	Insert Type-A - Right	Insert Type-B - Left	Insert Type-B - Right
²⁷ Al	²⁹ Si	5R1	150-A	257-0	254-120
	¹⁷ O	6R2	191-22	257-0	258-22

Table: 7

X Channel nucleus	Y Channel nucleus	Insert Type-A - Left	Insert Type-A - Right	Insert Type-B - Left	Insert Type-B - Right
¹³ C	²⁹ Si	6R2	150-A	254-0	-
	² H	5R1	0R7	257-0	258-22
	¹⁷ O	110	191-22	257-0	371-0
	¹⁵ N	160	191-22	257-0	254-100

Table: 8

Appendix: A - Tuning the probe, an example

Let us assume that we need to tune the probe to $^1\text{H}/^{13}\text{C}/^{15}\text{N}$ (X channel tuned to ^{13}C and the Y channel tuned to ^{15}N).

1. Select the table that has ^{13}C as the X channel nucleus.
2. Locate the Y channel nucleus that is of interest (in this case ^{15}N)
3. Select the appropriate inserts from the insert kit.
4. Attached selected elements to the probe as described in pages 11 and 12.

Step 1

Step 2

Step 3

X Channel nucleus	Y Channel nucleus	Insert Type-A - Left	Insert Type-A - Right	Insert Type-B - Left	Insert Type-B - Right
^{13}C	^{29}Si	6R2	150-A	254-0	-
	^2H	5R1	0R7	257-0	258-22
	^{17}O	110	191-22	257-0	371-0
	^{15}N	160	191-22	257-0	254-100