TABLE OF CONTENTS

1. Preparation

1-1 Overview

This procedure describes how to calibrate the magnet field distribution inside of the sphere. There are two way for the shimming:

a.Mechanical Shimming
b.Passive Shimming

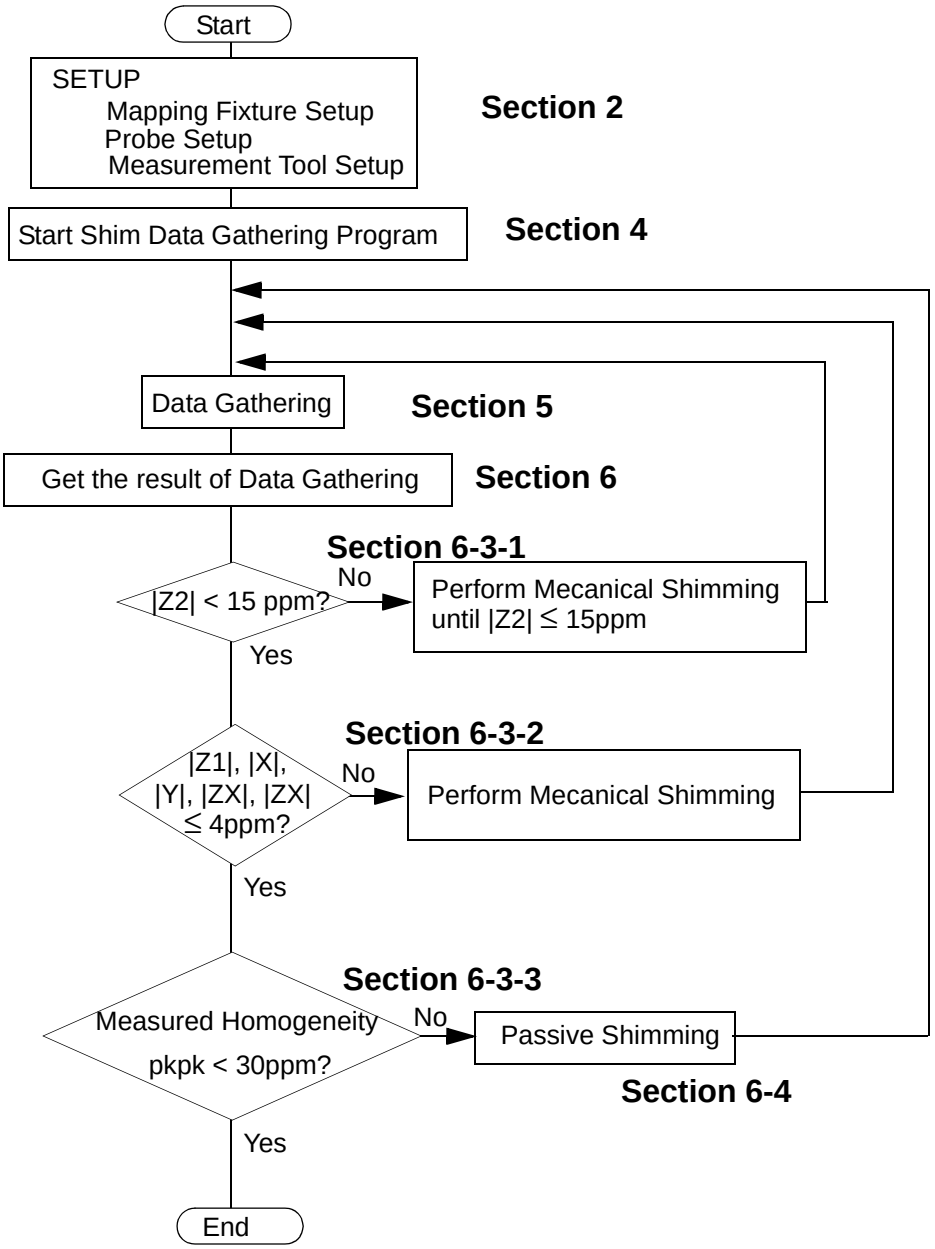
Mechanical Shimming adjust the Z^2, Z, X, Y, ZX, ZY using adjustment bolts attached to the Yoke of the Magnet. Passive shimming is performed if the pk-pk value is over 30ppm by attaching the shim plate on shim board. Shim plate position and number are calculated by software.
Passive shimming adjust the higher terms than Z^3 and partial inhomogenity

1-2 Required Tool

TABLE 1-1
REQUIRED TOOL

Items	Check
T-wrench and shaft	
Tesla Meter (metro lab tesla meter PT2025 (or equivalent))	
Probe (No 3)	
Service Key	
Mapping Fixture	
Automated Shimming Data Collector (46-323012G1)(Option) (Voice Synthesizer (Option) and Remote Switch (Option) are included)	
Passive Shim Kit (N/ S checker, Shim chips)	

1-3 Flowchart



SHIMMING FLOWCHART
ILLUSTRATION 1

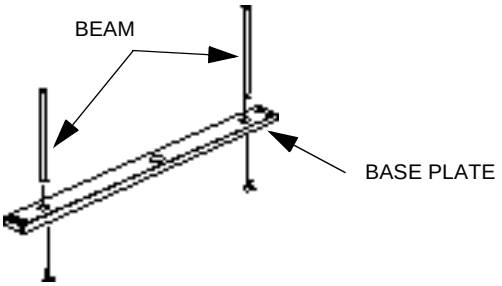
1-4 Prerequisite

1. TCU Power is ON and magnet temparature is stabiliszed.
2. Drift Rate of Magnet Center freaquency must be below 50Hz/5minutes.
   (See "Section 3 Field Stabilization" for detail)

2. Setup

2-1 Mapping Fixture setup

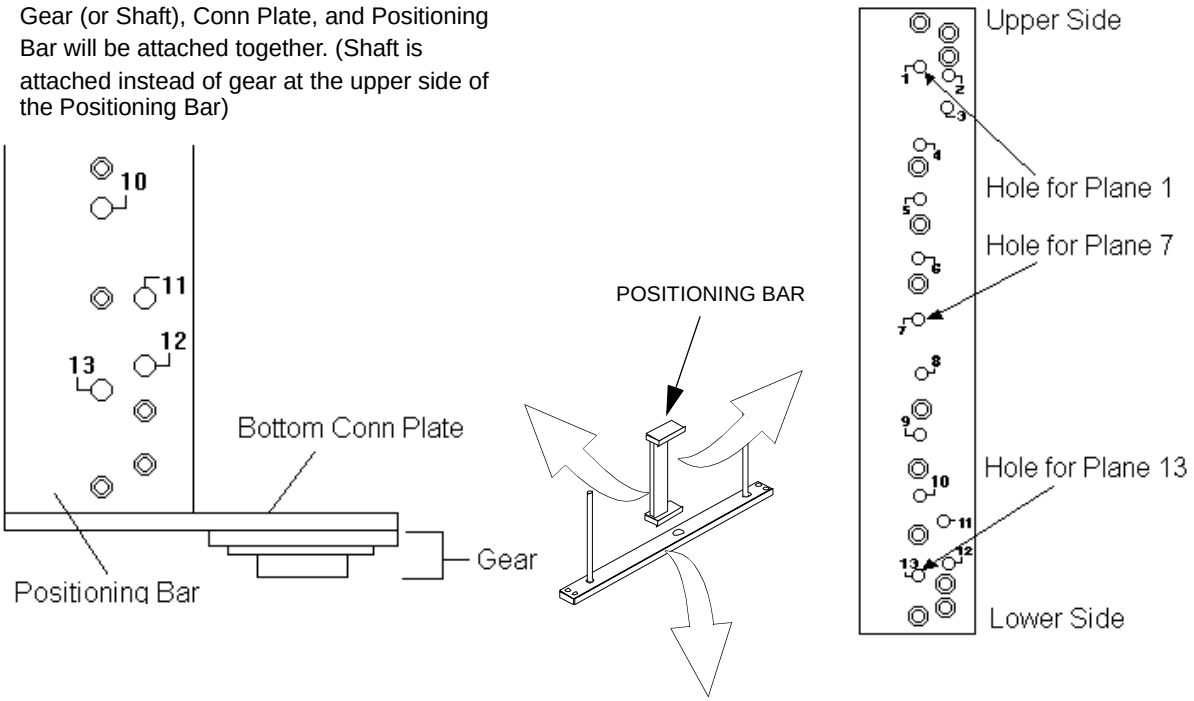
1. Attach the two Beams to the Base Plate with flat headed screws.



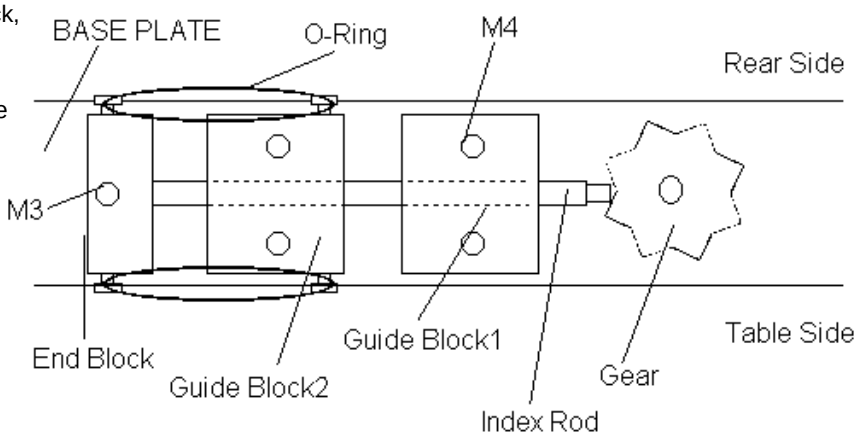
MAPPING FIXURE SETUP 1
ILLUSTRATION 2

2. Attach Positioning Bar to the Base Plate.

Gear (or Shaft), Conn Plate, and Positioning Bar will be attached together. (Shaft is attached instead of gear at the upper side of the Positioning Bar)



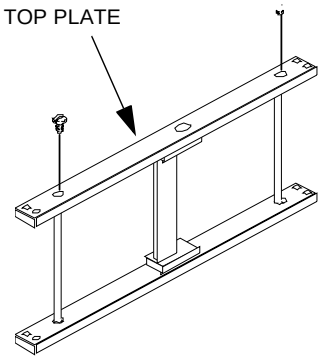
The Guide Block, End Block, and Index Rod will come attached to the Base Plate (The gear is attached to the Positioning Bar)**.** Attach O-Ring as shown.



MAPPING FIXURE SETUP 2
ILLUSTRATION 3

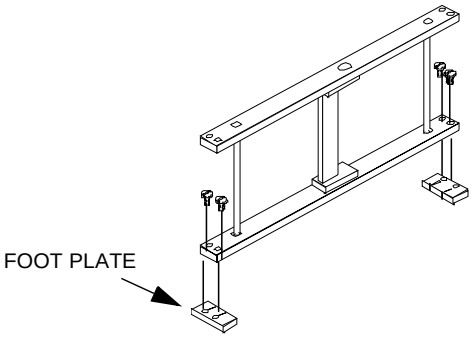
2-1 Mapping Fixture setup (continued)

3. Attach the Top Plate over the Beam and the Positioning Bar with flat headed screw.



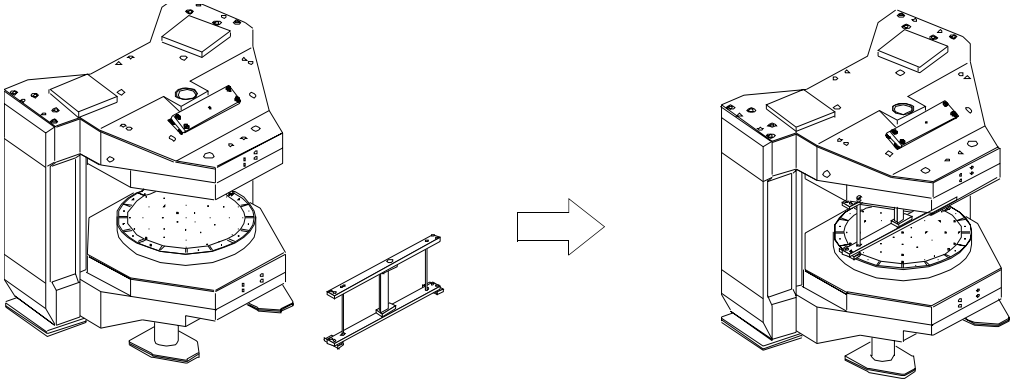
MAPPING FIXURE SETUP 3
ILLUSTRATION 4

4. Attach the two Base Plate under both sides of the Base Plate.



MAPPING FIXURE SETUP 5
ILLUSTRATION 5

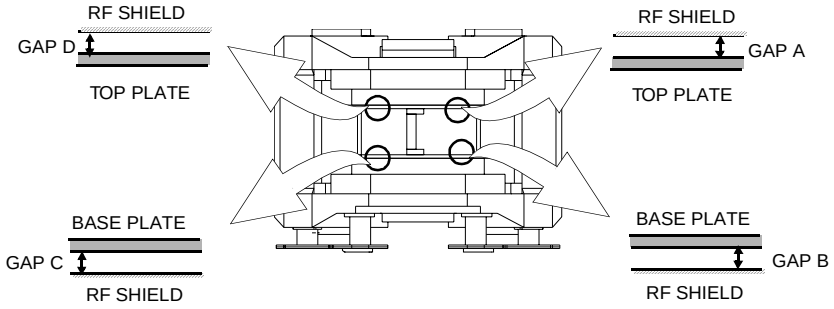
5. Install the Mapping Fixture with studs.

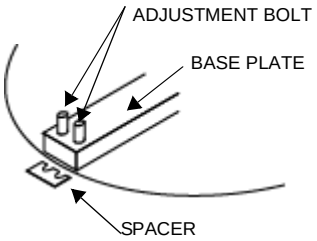


MAPPING FIXURE SETUP 6
ILLUSTRATION 6

2. Mapping Fixture setup (continued)

6. Adjust the gap between RF Shield and of the 4 corners of Mapping Fixture using spacers (1mm thickness or 2mm thickness).





Specification: GAP D - GAP A = ±1mm
GAP C - GAP B = ±1mm
GAP A - GAP B = ±1mm
GAP D - GAP C = ±1mm

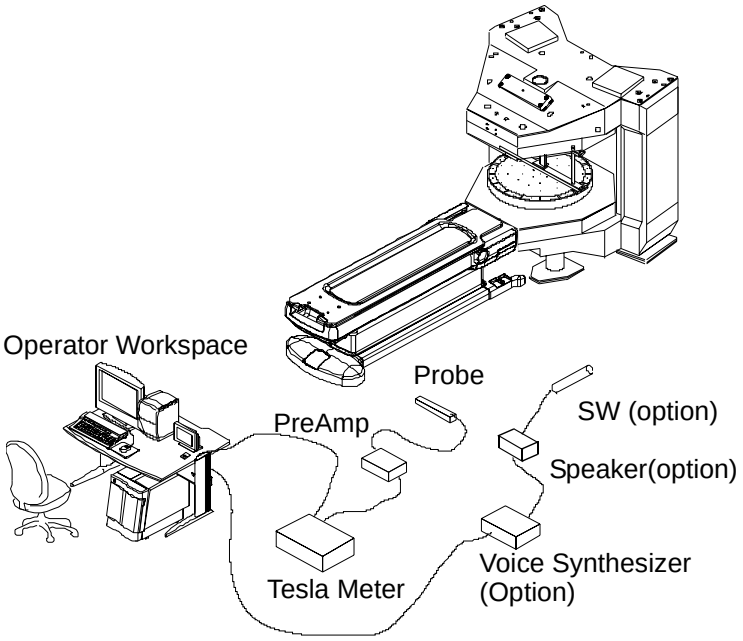
MAPPING FIXURE SETUP 7
ILLUSTRATION 7

2-1 Measurement Tool Setup

1. Turn system power OFF before cabling. Turn ON after cabling.
2. Set Up according to the following Illustration.

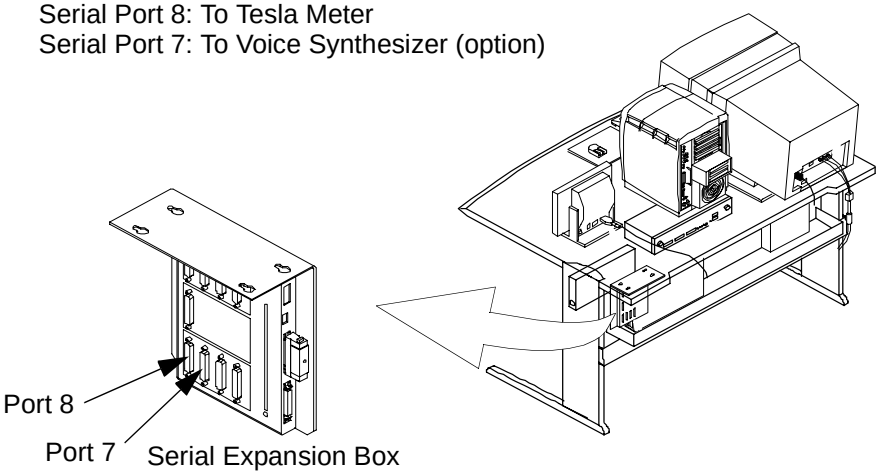
Cable Setup (Ovew view) :

Refer to each detail setup followed after this illustration.



CABLE SETUP (OVERVIEW)
ILLUSTRATION 8

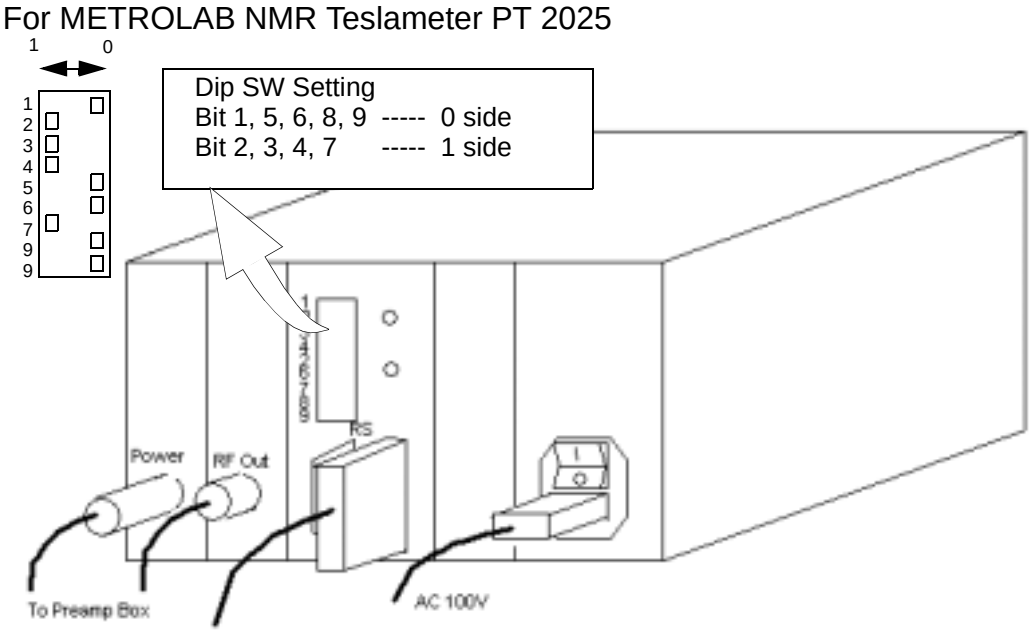
Serial Port 8: To Tesla Meter
Serial Port 7: To Voice Synthesizer (option)



SERIAL CABLE
ILLUSTRATION 9

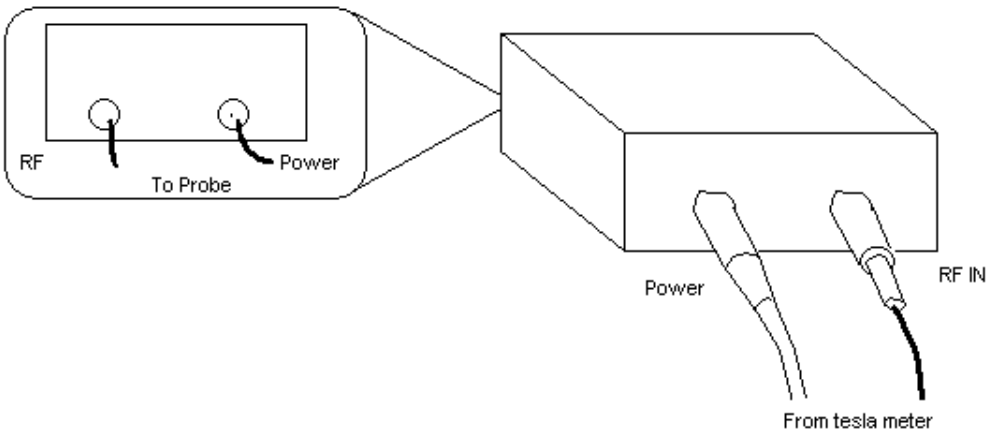
2-1 Measurement Tool Setup (continued)

Tesla Meter Setup:



TESLA METER SETUP
ILLUSTRATION 10

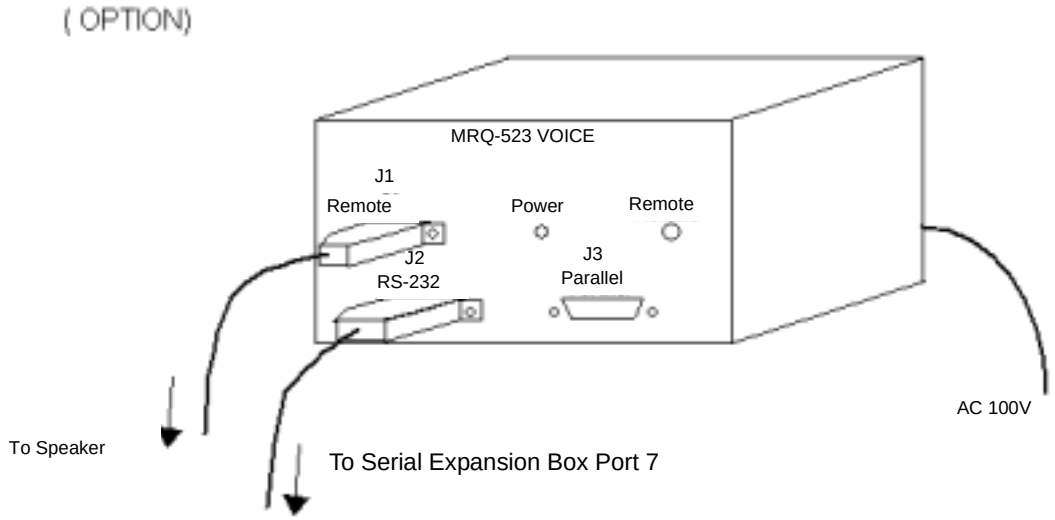
Pre-Amp Setup:



PREAMP BOX
ILLUSTRATION 11

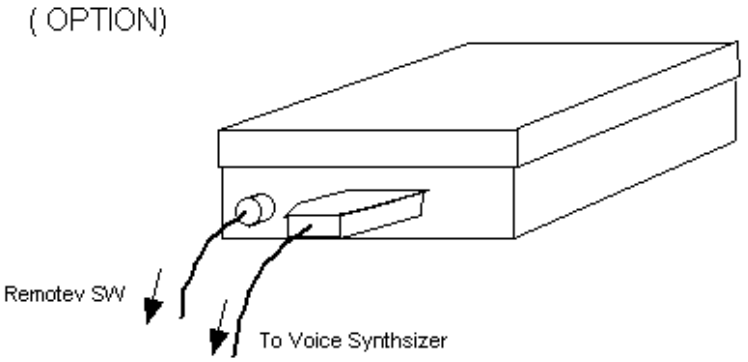
2-1 Measurement Tool Setup (continued)

Voice Synthesizer(Option) Setup:



VOICE SYNTHESIZER (OPTION)
ILLUSTRATION 12

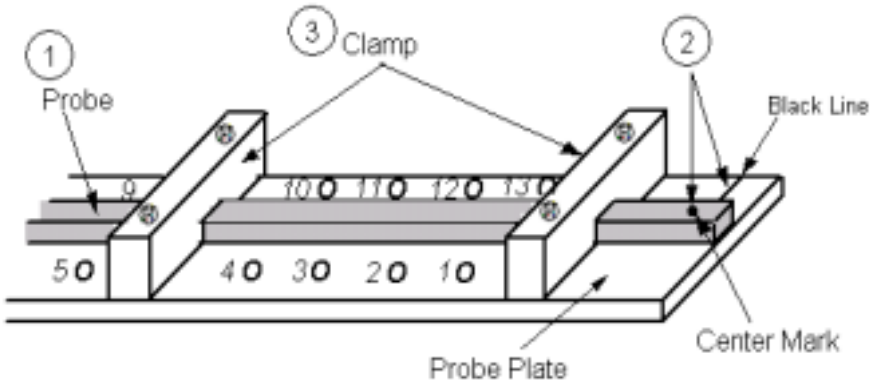
Speaker(Option) Setup:



SPEAKER (OPTION)
ILLUSTRATION 13

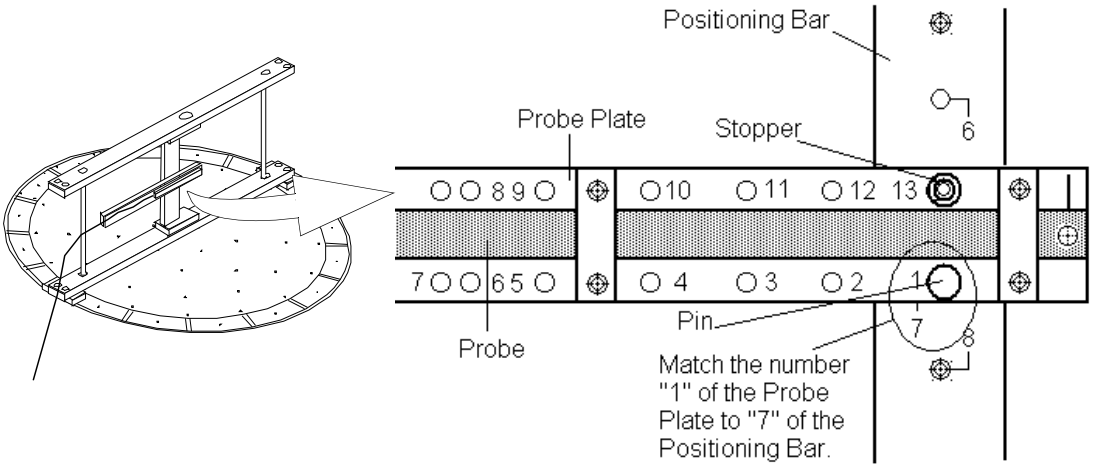
2-2 Probe Setup.

1. Place the Probe on the Probe Plate
2. Screw the Clamp over the Probe(4 screws).



PROBE SETUP 1
ILLUSTRATION 14

3. Attach the Probe to the **Magnet physical center(Isocenter)** as shown. Match the number "**1**" of the Probe Plate to "**7**" of the Positioning Bar.



PROBE SETUP 2
ILLUSTRATION 15

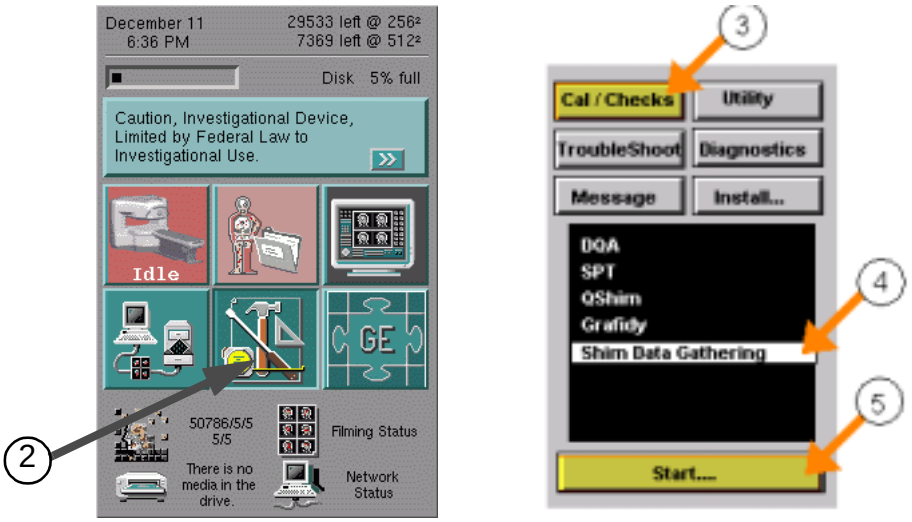
3. Field Stabilization

1. Verify that the probe is at the Magnet Isocenter.
2. Verify that the Physical Center Frequency is 14.85 MHz ± 10kHz.
   If not, adjust the temperature of the magnet and wait until the condition is satisfied.
3. Measure and record the frequency shown in Tesla Meter.
4. Wait 5 minutes.
5. Measure and record the frequency again.
6. If the difference between the 2 frequencies is:
   1. Below 50Hz/5minutes, go to Step 4 "Start Shim Data Gathering Program".
   2. Over 50Hz/5minutes, it is necessary to wait until the difference is below 50Hz/5minutes.

4. Shim Data Gathering Program Setup

4-1 Start Shim Data Gathering Program

1. Set Service Key.
2. Select [**Service Desktop**] Icon.
3. Select [**Cal/Checks**] .
4. Select [**Shim Data Gathering**].
5. Select [**Start...**].



SERVICE DESKTOP
ILLUSTRATION 16

6. Select your system configuration:
   If you are using Voice synthesizer, Perform 4-2 “Shim Data Gathering Program with Voice synthesizer”.
   If not, Perform 4-3 “Shim Data Gathering Program without Voice synthesizer”.

4-2 Shim Data Gathering Program with Voice synthesizer

Output/Prompts	Input/Comments
**** MR Magnet Mechanical Shim Data Collection ****	
Do you use the vocie synthesizer ? [1:Yes / 2:No]	
--> **1**	**1 [Return]**
MR Magnet Mechanical Shim Data Collection	
Enter number of selection:	
1 - Normal operation	
2 - Run mechanical plot only	
3 - Calculate shim currents from existing data	
4 - Display plot data	
5 - Display current data	
6 - Display magnet file information	
7 - Misc functions	
8 - Drift Test	
9 - Escape to shell	
10 - Exit	
--> **7**	**7 [Return]**
Miscellaneous Functions	
Enter number of selection:	
1 - System checkout	
2 - Synthesizer volume adjust	
3 - Teslameter bandwidth	
4 - Teslameter # samples to average/point	
5 - Teslameter retry count	
6 - Select/Deselect Switch	
7 - Enable/Disable switch feedback	
8 - Display plot format (volume map) file information	
9 - Display current plot format data	
10 - Exit	
--> **1**	
System Checkout	**1 [Return]**
Enter number of selection:	
1. Checkout voice synthesizer	
2. Checkout teslameter	
3. Checkout remote switch operation	
4. Exit	
--> **1**	**1 [Return]**
############################	

4-2 Shim Data Gathering Program with Voice synthesizer (continued)

Output/Prompts	Input/Comments
Voice Synthesizer Information Synthesizer Cable Information The synthesizer connects between the "SERIAL" connector on the synthesizer box to port No. 4 of the Specialix serial expander module in the Lightning Duplex Computer. This is an RS-232 link that does not implement any hardware handshake. The only required connections from the computer to the teslameter are with pins 2, 3, & 7 of the 25 pin D connectors. The cable must be a "null modem" type. If your cable is "one-to-one", then a null modem must be used. The cable supplied with the Auto Data Collection Tool IS "one-to-one", so you must use a null modem with this cable. Setup Information There is nothing to setup with the synthesizer. The synthesizer, on powerup, will autobaud to the correct baud rate upon the first <cr> that it receives. This is handled automatically. If the synthesizer does not operate, and the cable connection appears to be correct, then press the reset switch on the synthesizer, then enter the "R" selection to send a <cr> to it, and then press the space bar to attempt to send the test message. Press space bar to send test message, R to send <cr>, V to adjust volume, L to loop, or <return> to exit	<- Although description says port No.4, port No.7 is the correct port. 1. Press "R" 2. Press "V" and select "9" for full volume. 3. Press [Space]. Voice Synthesizer speaks. 4. Press [Enter]

4-2 Shim Data Gathering Program with Voice synthesizer (continued)

Output/Prompts	Input/Comments
Enter number of selection: 1. Checkout voice synthesizer 2. Checkout teslameter 3. Checkout remote switch operation 4. Exit --> **2**	**2 [Return]**
METROLAB TESLAMETER CHECKOUT --- Press space bar to attempt communication, return to exit	**Hit Space bar**
(If connection is correct, the following message is read:) Teslameter is communicating **(If not:)** No data received - check cable and connection Press space bar to attempt communication, return to exit	**Check connection and hit space bar [Return]**
System Checkout Enter number of selection: 1. Checkout voice synthesizer 2. Checkout teslameter 3. Checkout remote switch operation 4. Exit --> **4**	**4 [Return]**
Miscellaneous Functions Enter number of selection: 1 - System checkout 2 - Synthesizer volume adjust 3 - Teslameter bandwidth 4 - Teslameter # samples to average/point 5 - Teslameter retry count 6 - Select/Deselect Switch 7 - Enable/Disable switch feedback 8 - Display plot format (volume map) file information 9 - Display current plot format data 10 - Exit --> **2**	**2 [Return]**

4-2 Shim Data Gathering Program with Voice synthesizer (continued)

Output/Prompts	Input/Comments
Enter volume: (0-9) **9**	**9 [Return]**
Miscellaneous Functions	
Enter number of selection:	
1 - System checkout	
2 - Synthesizer volume adjust	
3 - Teslameter bandwidth	
4 - Teslameter # samples to average/point	
5 - Teslameter retry count	
6 - Select/Deselect Switch	
7 - Enable/Disable switch feedback	
8 - Display plot format (volume map) file information	
9 - Display current plot format data	
10 - Exit	
--> **3**	**3 [Return]**
Teslameter Bandwidth Adjusment	
This will allow you to adjust the bandwidth, or in other words the maximum frequency deviation allowed among the samples for a given point before the data is accepted. Once accepted, the samples are averaged for a given point.	
...	
Current bandwidth is 16 hz	
Enter new bandwidth (3-30 Hz):**30**	**30 [Return]**
Miscellaneous Functions	
Enter number of selection:	
1 - System checkout	
2 - Synthesizer volume adjust	
3 - Teslameter bandwidth	
4 - Teslameter # samples to average/point	
5 - Teslameter retry count	
6 - Select/Deselect Switch	
7 - Enable/Disable switch feedback	
8 - Display plot format (volume map) file information	
9 - Display current plot format data	
10 - Exit	
--> **4**	**4 [Return]**
Number of Readings to Average per Point	
This will allow you to adjust the number of readings that will be averaged for each point. The default...	
Current sample count is 3 readings	
Enter new sample count (2-10):**3**	**3 [Return]**

4-2 Shim Data Gathering Program with Voice synthesizer (continued)

Output/Prompts	Input/Comments
Miscellaneous Functions Enter number of selection: 1 - System checkout 2 - Synthesizer volume adjust 3 - Teslameter bandwidth 4 - Teslameter # samples to average/point 5 - Teslameter retry count 6 - Select/Deselect Switch 7 - Enable/Disable switch feedback 8 - Display plot format (volume map) file information 9 - Display current plot format data 10 - Exit --> **5**	**5 [Return]**
Teslameter Retry Count Adjustment This will allow you to change the number of retries... Current retry count is 10 Enter new retry count (2-10):**10**	**10 [Return]**
Miscellaneous Functions Enter number of selection: 1 - System checkout 2 - Synthesizer volume adjust 3 - Teslameter bandwidth 4 - Teslameter # samples to average/point 5 - Teslameter retry count 6 - Select/Deselect Switch 7 - Enable/Disable switch feedback 8 - Display plot format (volume map) file information 9 - Display current plot format data 10 - Exit --> **6**	**6 [Return]**
Select/Deselect Switch You can change your decision about whether or not to use the remote switch. ... Select/Deselect Switch:**Y**	**Y [Return]**

4-2 Shim Data Gathering Program with Voice synthesizer (continued)

Output/Prompts	Input/Comments
Miscellaneous Functions Enter number of selection: 1 - System checkout 2 - Synthesizer volume adjust 3 - Teslameter bandwidth 4 - Teslameter # samples to average/point 5 - Teslameter retry count 6 - Select/Deselect Switch 7 - Enable/Disable switch feedback 8 - Display plot format (volume map) file information 9 - Display current plot format data 10 - Exit --> **10**	**10 [Return]**

4-3 Shim Data Gathering Program without Voice synthesizer

Output/Prompts	Input/Comments
Do you use the voice synthesizer ? [1:Yes / 2:No]	
--> **2**	**2 [Return]**
MR Magnet Mechanical Shim Data Collection	
Enter number of selection:	
1 - Normal operation	
2 - Run mechanical plot only	
3 - Calculate shim currents from existing data	
4 - Display plot data	
5 - Display current data	
6 - Display magnet file information	
7 - Misc functions	
8 - Drift Test	
9 - Escape to shell	
10 - Exit	**7 [Return]**
--> **7**	
Miscellaneous Functions	
Enter number of selection:	
1 - System checkout	
2 - Synthesizer volume adjust	
3 - Teslameter bandwidth	
4 - Teslameter # samples to average/point	
5 - Teslameter retry count	
6 - Select/Deselect Switch	
7 - Enable/Disable switch feedback	
8 - Display plot format (volume map) file information	
9 - Display current plot format data	
10 - Exit	
--> **1**	**1 [Return]**
System Checkout	
Enter number of selection:	
1. Checkout voice synthesizer	
2. Checkout teslameter	
3. Checkout remote switch operation	
4. Exit	
--> **2**	**2 [Return]**

4-3 Shim Data Gathering Program without Voice synthesizer (continued)

Output/Prompts	Input/Comments
**** MR Magnet Mechanical Shim Data Collection ****	
METROLAB TESLAMETER CHECKOUT	

Press space bar to attempt communication, return to exit	**Hit Space bar**
(If connection is correct, the following message is read:)	
Teslameter is communicating	**(If connection is correct)**
(If not:)	
No data received - check cable and connection	**Check connetion and hit space bar**
Press space bar to attempt communication, return to exit	**[Return]**
System Checkout	
Enter number of selection:	
1. Checkout voice synthesizer	
2. Checkout teslameter	
3. Checkout remote switch operation	
4. Exit	
--> **4**	**4 [Return]**
Miscellaneous Functions	
Enter number of selection:	
1 - System checkout	
2 - Synthesizer volume adjust	
3 - Teslameter bandwidth	
4 - Teslameter # samples to average/point	
5 - Teslameter retry count	
6 - Select/Deselect Switch	
7 - Enable/Disable switch feedback	
8 - Display plot format (volume map) file information	
9 - Display current plot format data	
10 - Exit	
--> **3**	**3 [Return]**

4-3 Shim Data Gathering Program without Voice synthesizer (continued)

Output/Prompts	Input/Comments
Teslameter Bandwidth Adjusment This will allow you to adjust the bandwidth, or in other words the maximum frequency deviation allowed among the samples for a given point before the data is accepted. Once accepted, the samples are averaged for a given point. ... Current bandwidth is 16 hz Enter new bandwidth (3-30 Hz):**30**	**30 [Return]**
Miscellaneous Functions Enter number of selection: 1 - System checkout 2 - Synthesizer volume adjust 3 - Teslameter bandwidth 4 - Teslameter # samples to average/point 5 - Teslameter retry count 6 - Select/Deselect Switch 7 - Enable/Disable switch feedback 8 - Display plot format (volume map) file information 9 - Display current plot format data 10 - Exit --> **4**	**4 [Return]**
Number of Readings to Average per Point This will allow you to adjust the number of readings that will be averaged for each point. The default... Current sample count is 3 readings Enter new sample count (2-10):**3**	**3 [Return]**
Miscellaneous Functions Enter number of selection: 1 - System checkout 2 - Synthesizer volume adjust 3 - Teslameter bandwidth 4 - Teslameter # samples to average/point 5 - Teslameter retry count 6 - Select/Deselect Switch 7 - Enable/Disable switch feedback 8 - Display plot format (volume map) file information 9 - Display current plot format data 10 - Exit --> **5**	**5 [Return]**

4-3 Shim Data Gathering Program without Voice synthesizer (continued)

Output/Prompts	Input/Comments
This will allow you to change the number of retries...	
Current retry count is 10	
Enter new retry count (2-10):**10**	**10 [Return]**
Miscellaneous Functions	
Enter number of selection:	
1 - System checkout	
2 - Synthesizer volume adjust	
3 - Teslameter bandwidth	
4 - Teslameter # samples to average/point	
5 - Teslameter retry count	
6 - Select/Deselect Switch	
7 - Enable/Disable switch feedback	
8 - Display plot format (volume map) file information	
9 - Display current plot format data	
10 - Exit	
--> **6**	**6 [Return]**
Select/Deselect Switch	
You can change your decision about whether or not to use	
the remote switch. ...	
Select/Deselect Switch:**Y**	**Y [Return]**
Miscellaneous Functions	
Enter number of selection:	
1 - System checkout	
2 - Synthesizer volume adjust	
3 - Teslameter bandwidth	
4 - Teslameter # samples to average/point	
5 - Teslameter retry count	
6 - Select/Deselect Switch	
7 - Enable/Disable switch feedback	
8 - Display plot format (volume map) file information	
9 - Display current plot format data	
10 - Exit	
--> **10**	**10 [Return]**

4-4 Mechanical Plot Setting

1. Perform as follows:

Output/Prompts	Input/Comments
MR Magnet Mechanical Shim Data Collection Enter number of selection: 1 - Normal operation 2 - Run mechanical plot only 3 - Calculate shim currents from existing data 4 - Display plot data 5 - Display current data 6 - Display magnet file information 7 - Misc functions 8 - Drift Test 9 - Escape to shell 10 - Exit --> **2** **---**(Message comes here)--- Press Enter threshold value:	**2 [Return]** **[Return]**

2. After selecting #2, enter the following data.:

Output/Prompts	Input/Comments
Enter magnet serial number**: YC*** [Return]**	**Input serial number**
Is this GE or Oxford magnet (enter GE, Oxford, or press RETURN to Default to GE: **[Return]**	**[Return]**
Enter magnet location;(1 to 15 chars): ******* **[Return]**	**Input Hospital Name**
Enter magnet type (or press, RETRUN for type s2)**: ASM**	**ASM [Return]**
Is the magnet ramped normal (red to red, black to black) (y/n)**:Y**	**Y**
Enter volume type (c6,s40)(or press RETURN for s40)**:pmh [return]**	**pmh [Return]**

4-4 Mechanical Plot Setting (Continued)

3. Hit [**Return**] key or **<Remote Switch>** when the information is correct. Enter "i", "d", or "s" if needed. (Refer to the following.):

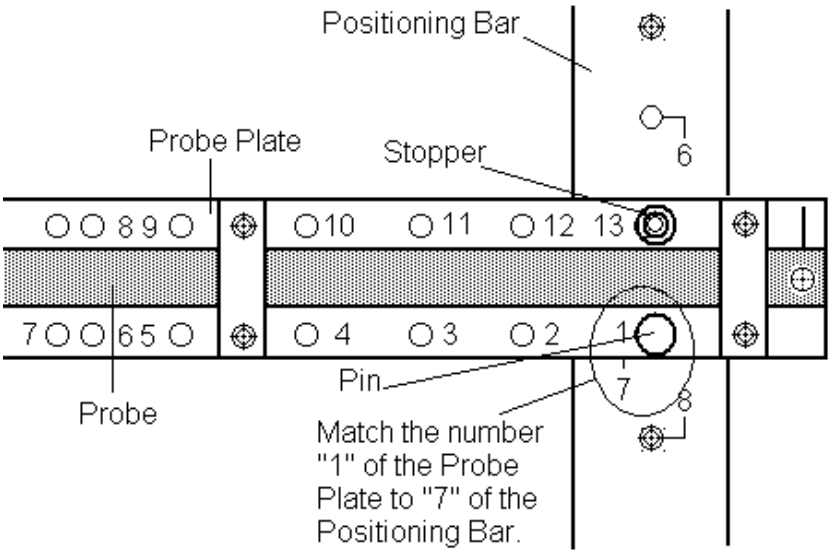
Output/Prompts	Input/Comments
MR Magnet Mechanical Plotting This iteration will be for plot a GE Magnet Magnet serial number: YC*** Magnet location : ****** Magnet type : ASM Volume type : pmh Magnet IS ramped normal Press <return> to continue Enter i to re-run previous iteration Enter d to alter magnet data for serial # ** Enter s to select a new serial number -->[**Return**]	[**Return**]

PLOTTING DATA STARTS RUNNNING.

Output/Prompts	Input/Comments
GE Magnet Mechanical Plotting This iteration will be for plot v Shim data collection in progress, press any key to pause... Current probe position: Isocenter	

5. Data Gathering

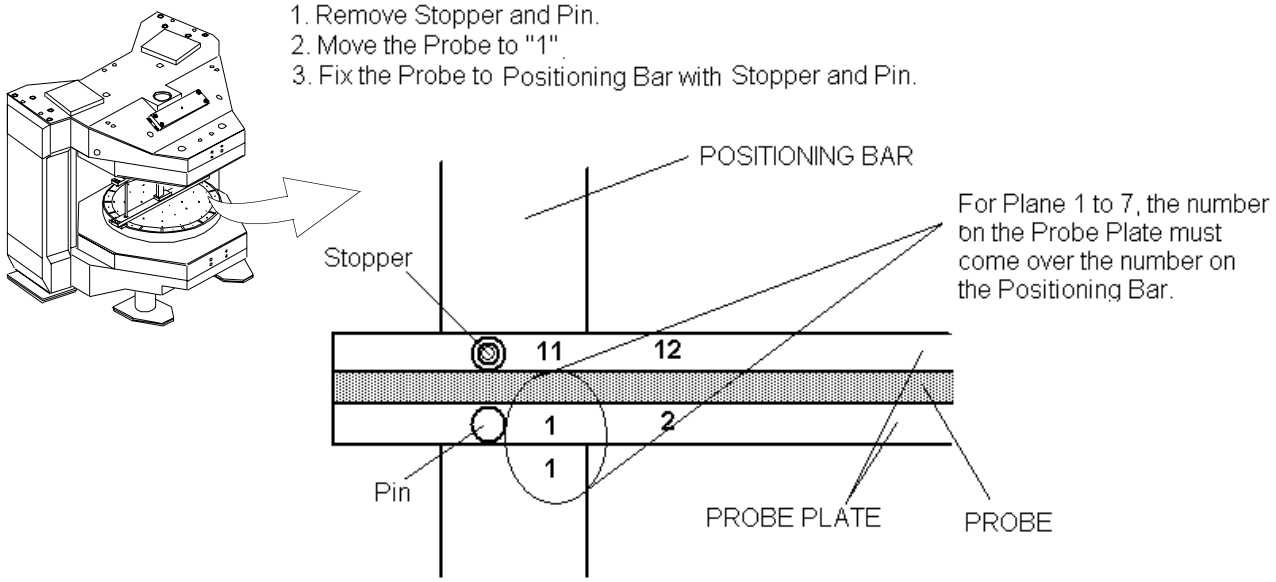
1. Confirm that the probe is at manget isocenter.



PROBE SETUP AT MAGNET CENTER
ILLUSTRATION 17

If you are using Voice synthesizer, press remote switch.
If not, press [**Return]** key on keyboard.Plotting Data starts runnning.

2. Set the probe to "Plane 1"

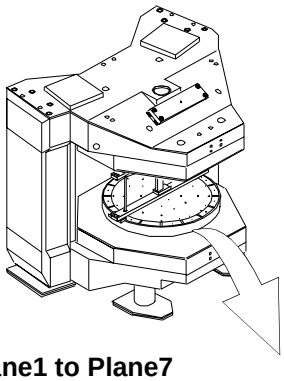


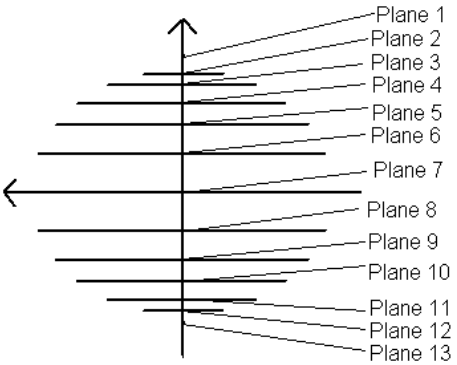
PROBE SETUP AT PLANE 1
ILLUSTRATION 18

If you are using Voice synthesizer, press remote switch.
If not, press [**Return]** key on keyboard.Plotting Data starts runnning.

5. Data Gathering (continued)

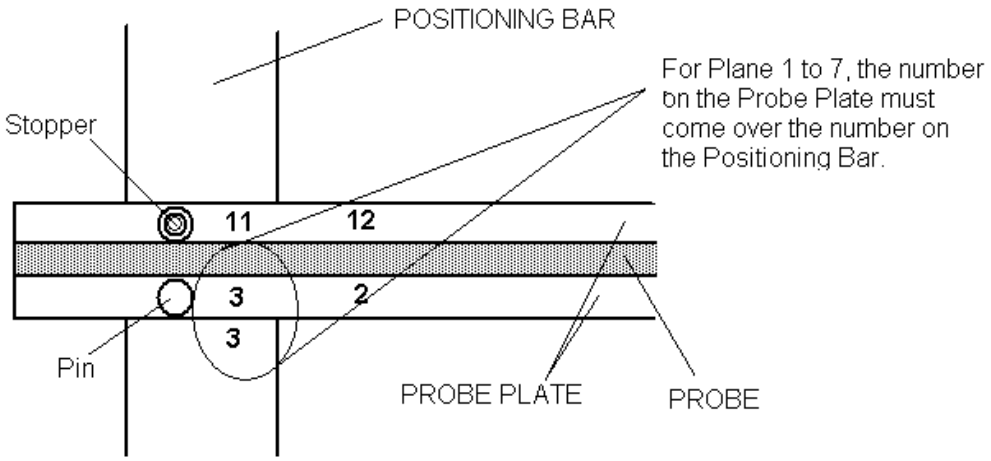
3. Set the probe to next plane.





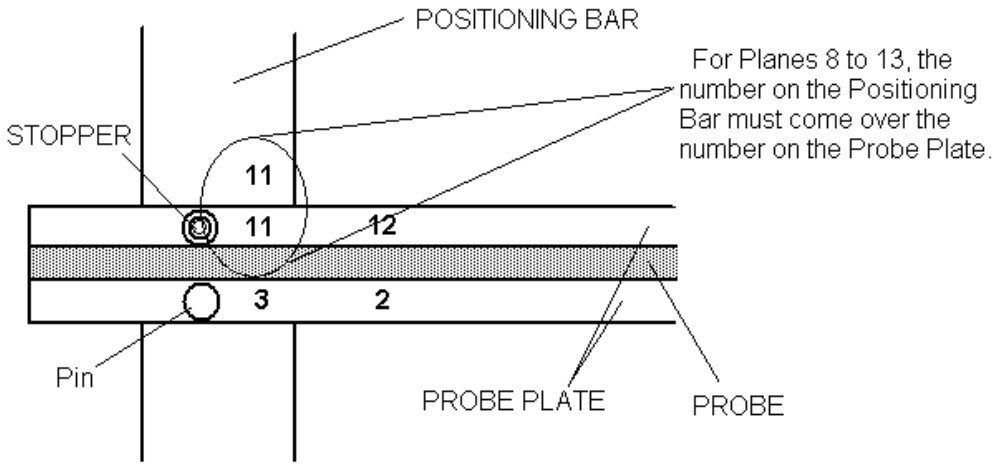
For Plane1 to Plane7

1. Remove Stopper and Pin.
2. Move the Probe
3. Fix the Probe to Positioning Bar with Stopper and Pin.



For Plane8 to Plane12

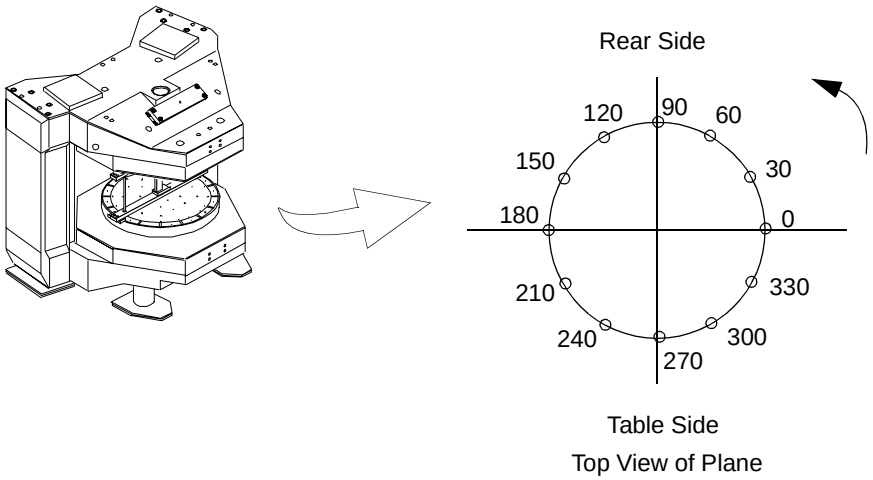
1. Remove Stopper and Pin.
2. Move the Probe.
3. Fix the Probe to Positioning Bar with Stopper and Pin.



NEXT PLANE
ILLUSTRATION 19

5. Data Gathering (continued)

4. Measure 0 degree thru 330 degree, step 30 degree..



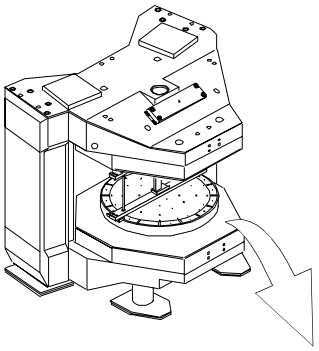
ROTATION
ILLUSTRATION 20

If you are using Voice synthesizer, press remote switch.
If not, press [**Return]** key on keyboard.Plotting Data starts runnning.

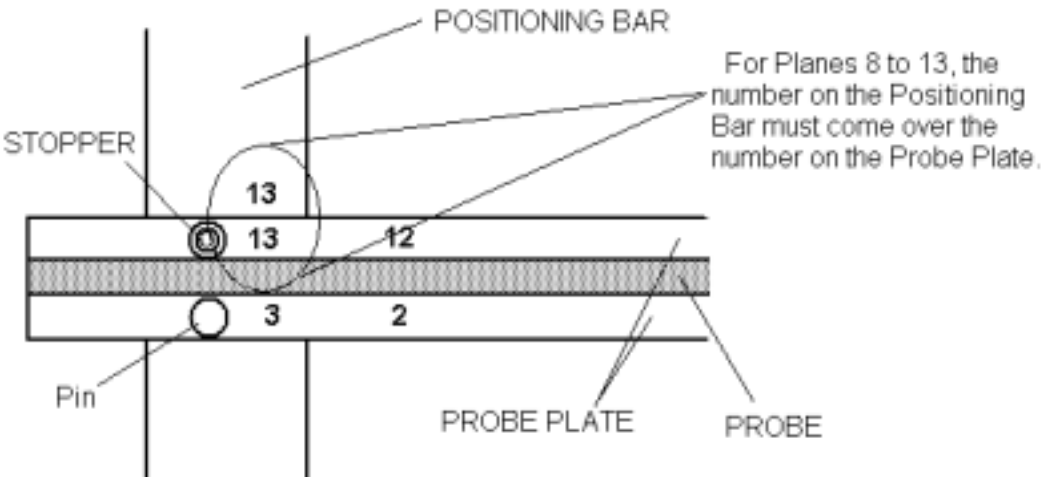
5. Go back to step 3 until Plane12 is performed.

5. Data Gathering (continued)

6. Set the probe to ""Plane 13""



1. Remove Stopper and Pin.
2. Move the Probe to 13.
3. Fix the Probe to Positioning Bar with Stopper and Pin.

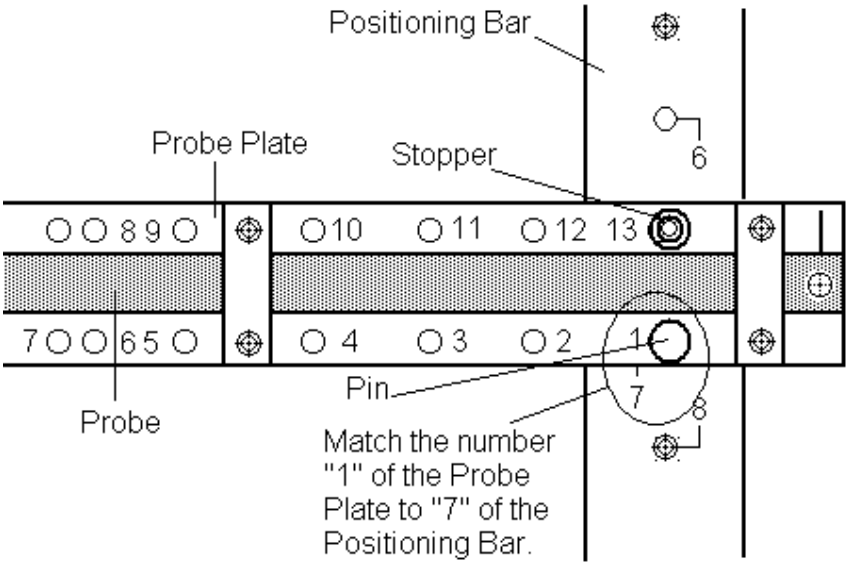


PROBE SETUP AT PLANE 13
ILLUSTRATION 21

If you are using Voice synthesizer, press remote switch.
If not, press [**Return]** key on keyboard.Plotting Data starts runnning.

5. Data Gathering (continued)

7. Measure the frequency at Magnet Isocenter.



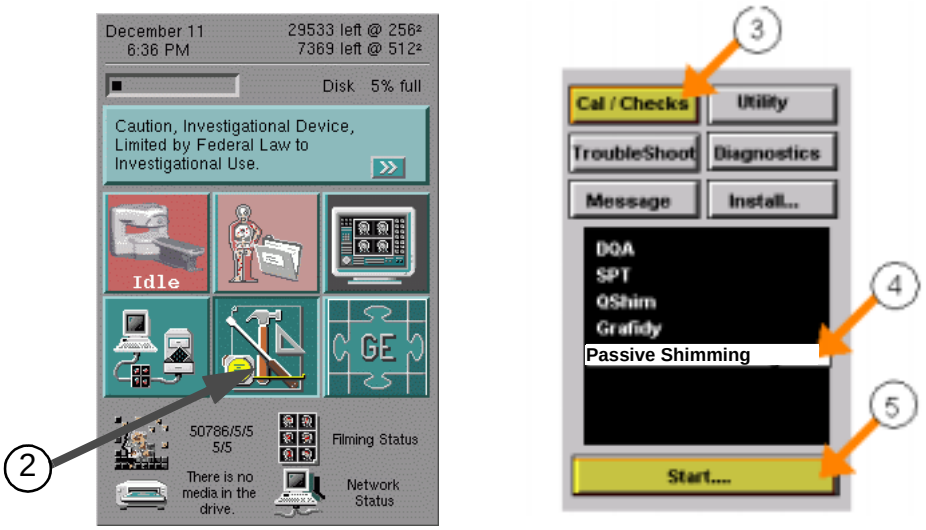
PROBE SETTING AT MAGNET CENTER
ILLUSTRATION 22

If you are using Voice synthesizer, press remote switch.
If not, press [**Return]** key on keyboard.Plotting Data starts runnning.

6. Get the Result of Data Gathering

6-1 Start the Program

1. Set Service Key.
2. Select [**Service Desktop**] Icon.
3. Select [**Cal/Checks**] .
4. Select [**Passive Shimming**].
5. Select [**Start...**].



SERVICE DESKTOP
ILLUSTRATION 23

6. The following menu will be displayed.

Output/Prompts	Input/Comments
<<< Permanent Magnet Shimming MENU >>> 1. Field Map File : gemech_SHIM-C_v.plot 2. First Passive? : yes 0. Accept Defaults and Run Analysis. q. Exit Passive/Mech Shim Enter the index number to change the default: (0..2) [0] :	

6-2 Modify the Field Map File and Passive Shim

1. If you want to change the plot data, perform the following:

Output/Prompts	Input/ Comments
Enter the index number to change the default: (0..12) [0] : Select Field Map File 1) gemech_SHIM-C_v.plot Nov 30 13:23 2) gemech_SHIM-C_a.plot Nov 30 13:23 3) gemech_YC2-a_v.plot Nov 30 11:56 4) gemech_YC2-a_h.plot Nov 30 11:56 5) gemech_YC2-a_g.plot Nov 30 11:56 6) gemech_YC2-a_c.plot Nov 30 11:56 7) gemech_YC2-a_e.plot Nov 30 11:56 8) gemech_YC2-a_d.plot Nov 30 11:56 9) gemech_YC2-a_a.plot Nov 30 11:56 10) gemech_YC2-a_b.plot Nov 30 11:56 11) gemech_YC2-a_f.plot Nov 30 11:56 12) gemech_YC3_v.plot Nov 27 13:39 13) gemech_YC3_h.plot Nov 27 13:38 14) gemech_YC3_g.plot Nov 27 13:38 15) gemech_YC3_f.plot Nov 27 13:38 16) gemech_YC3_e.plot Nov 27 13:38 17) gemech_YC3_d.plot Nov 27 13:38 18) gemech_YC3_b.plot Nov 27 13:38 19) gemech_YC3_a.plot Nov 27 13:38 Enter the index: (1..19) [1] :	**1 [Return]** **Enter #**

2. If the passive shiming has already done before, perform the following:

Output/Prompts	Input/ Comments
<<< Permanent Magnet Shimming MENU >>> 1. Field Map File : gemech_YC008_v.plot 2. First Passive? : yes 0. Accept Defaults and Run Analysis. q. Exit Passive/Mech Shim Enter the index number to change the default: (0..2) [0] : **2** Is this the first passive? (yes/no) [yes] : **n** Select Last Passive Shim File 1) shim_loc.gemech_YC008_a.plot Apr 26 15:00 2) shim_loc.gemech_YC008_b.plot Apr 26 14:34 Enter the index: (1..2) [1] :	**2 [Return]** **n [Return]** **Enter #**

6-2 Modify the Field Map File and Passive Shim

3. After the Last Passive Shim File was selected, Menu is displayed as follows.

Output/Prompts	Input/ Comments
<<< Permanent Magnet Shimming MENU >>> 1. Field Map File : gemech_YC008_v.plot 2. First Passive? : no Last Passive Shim File : shim_loc.gemech_YC008_a.plot 0. Accept Defaults and Run Analysis. q. Exit Passive/Mech Shim Enter the index number to change the default: (0..2) [0] :	**<- Selected Shim File**

6-3 Mechanical or Passive Shimming

4. After all setting is done, enter "0" and hit [Return] key.

Output/Prompts	Input/Comments
<<< Permanent Magnet Shimming MENU >>> 1. Field Map File : gemech_SHIM-C_v.plot 2. First Passive? : no 0. Accept Defaults and Run Analysis. q. Exit Passive/Mech Shim Enter the index number to change the default: (0..12) [0] :	**0 [Return]**

5. Result of gathered data will be displayed.

6-3-1 If |Z2| ≥ 15 ppm...

1. If |Z2| ≥ 15 ppm, following is displayed.

Output/Prompts	Input/Comments
Writing to setup file Writing to init file Executing pmshim_ssm Isocenter Frequency : Start = 14844273 [Hz] : End = 14844276 [Hz] : Difference = 3 [Hz] (Field Map File): gemech_SHIM-C_v.plot <<< Display Current Field Map File [difference in unit of PPM] >>> deg| (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) ---|--- 0| -25. -24. -11. 0. -4. 11. 14. 20. 3. 3. -2. -11. -9. 30| -25. -15. -11. -9. 4. 14. 9. 17. 6. -11. -1. -7. -9. : 330| -25. -21. -11. -10. 3. 11. 21. 10. 3. -2. -1. -6. -9. ----|--- avg| -25. -17. -15. -6. 2. 14. 17. 13. 5. -1. -4. -6. -9. MxMn| 0. 14. 14. 13. 17. 8. 23. 15. 14. 23. 14. 9. 0. Peak to Peak = 53.9 PPM Axial coefficients ... z 1= -4.3 **z 2= -17.6** Transverse coefficients ... x= -0.4 y= -0.7 zx= 0.1 zy= -0.2 --- <<< Mech_Shim Output Summary >>> --- Z2 Mech_shim is recommended. **Shift center freq to 615 [Hz] by turning upper handle** **Shift center freq to 615 [Hz] by turning lower handle** Write Shim Files ? (N,Y) [Y]:	**Start**:**CF Value at the atart time of Gathering** **End: CF Value at the last time of Gathering** **Difference: Start - End. It should be 450Hz or lower.** **If the difference is 450 or higer. Recheck that the Drift rate is within 50Hz/5min. Perform the gathering again within 30~40 min.** **If |Z2| value is higher than 15ppm, it is necessary to adjust Z2.** **Target Frequency = CF + the value here** Y [Return] **to save the output file** N [Return] **If you calculate as trial, choose "N". Or, the result of this calcuration influence to the next calculation.**

6-3-1If |Z2| ≥ 15 ppm... (continued)

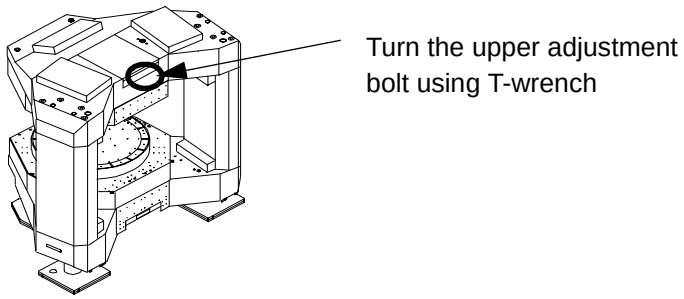
Note

To avoid large center frequency drift, you have to perform mechanical shimming as soon as you can after calculation.

Note

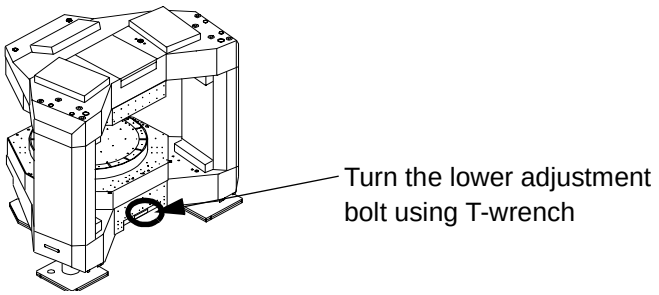
Remove the cylindrical shaped insulator covering the mechanical shim point when performing the mechanical shimming. Do not remove another insulator.
After the mechanical shimming is finished and restoring cylindrical shaped insulator, be careful not to push the insulator too much. Otherwise, it will be hard to remove it

1. Turn the upper adjustment bolt until Target Frequency is displayed on Tesla Meter.
   a. Read Center Frequency of displayed on Tesla Meter.
   b. Calculate the Target Frequency
   Target Frequency = Center Frequency + Value of Mech_Shim Output Summary



Z2 ADJUSTMENT (UPPER)
ILLUSTRATION 24

2. Turn the lower adjustment bolt until Target Frequency is displayed on Tesla Meter.
   a. Read Center Frequency of displayed on Tesla Meter.
   (The value after the upper adjustment)
   b. Calculate the Target Frequency
   Target Frequency = Center Frequency + Value of Mech_Shim Output Summary



Z2 ADJUSTMENT (LOWER)
ILLUSTRATION 25

6-3-2 If |Z2| < 15 ppm and |Z1|, |X|, |Y|, |ZX|, or |ZY| ≥ 4 ppm...

1. If |Z2| < 15 ppm and |Z1|, |X|, |Y|, |ZX|, or |ZY| ≥ 4 ppm, following is displayed.

Output/Prompts	Input/Comments
Writing to setup file Writing to init file Executing pmshim_ssm Isocenter Frequency : Start = 14844273 [Hz] : End = 14844276 [Hz] : Difference = 3 [Hz] (Field Map File): gemech_SHIM-C_v.plot <<< Display Current Field Map File [difference in unit of PPM] >>> deg| (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) ---|---------- 0| -25. -24. -11. 0. -4. 11. 14. 20. 3. 3. -2. -11. -9. 30| -25. -15. -11. -9. 4. 14. 9. 17. 6. -11. -1. -7. -9. : 330| -25. -21. -11. -10. 3. 11. 21. 10. 3. -2. -1. -6. -9. ----|---------- avg| -25. -17. -15. -6. 2. 14. 17. 13. 5. -1. -4. -6. -9. MxMn| 0. 14. 14. 13. 17. 8. 23. 15. 14. 23. 14. 9. 0. Peak to Peak = 53.9 PPM Axial coefficients ... z 1= -4.3 z 2= -14.6 Transverse coefficients ... x= -0.4 y= -0.7 zx= 0.1 zy= -0.2 ---------- <<< Mech_Shim Output Summary >>> ---------- Z1 Mech_shim is recommended. Shift center freq to 204 [Hz] by turning Top handle Shift center freq to -204 [Hz] by turning Bottom handle Trans Mech_shim is recommended. **TA= 2.0 (CW)** **TB= 1.5 (CCW)** **TC= 2.0 (CCW)** **TD= 1.5 (CW)** **BA= 2.0 (CW)** **BB= 1.5 (CW)** **BC= 2.0 (CCW)** **BD= 1.5 (CCW)** Write Shim Files ? (N,Y) [Y]:	**Start**:**CF Value at the atart time of Gathering** **End: CF Value at the last time of Gathering** **Difference: Start - End. It should be 450Hz or lower.** **If the difference is 450 or higer. Recheck that the Drift rate is within 50Hz/5min. Perform the gathering again within 30~40 min.** **If |Z1| value is higher than 4ppm, it is necessary to adjust Z1 by mechanical shimming.** **Target Frequency = CF + the value here** **Value of rotation to adjust the Transverse Term.** Y [Return] **to save the output file** N [Return] **If you calculate as trial, choose "N".** **Or, the result of this calcuration influence to the next calculation.**

6-3-2 If |Z2| < 15 ppm and |Z1|, |X|, |Y|, |ZX|, or |ZY| ≥ 4 ppm... (continued)

Note

To avoid large center frequency drift, you have to perform mechanical shimming as soon as you can after calculation.

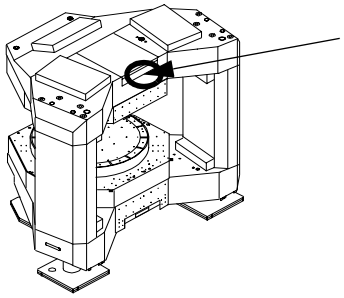
1. Turn the upper adjustment bolt until Target Frequency is displayed on Tesla Meter.
   a. Read Center Frequency of displayed on Tesla Meter.
   b. Calculate the Target Frequency
   Target Frequency = Center Frequency + Value of Mech_Shim Output Summary

Note

Remove the cylindrical shaped insulator covering the mechanical shim point when performing the mechanical shimming. Do not remove another insulator.

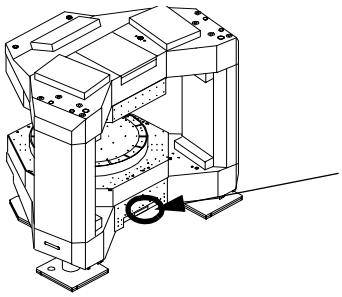
CAUTION

For Z1 Adjustment, there is a mechanical stopper at adjustment screw.
If you feel screw is reached to the stopper, DO NOT turn the screw.



Z1 ADJUSTMENT (UPPER)
ILLUSTRATION 26

2. Turn the lower adjustment bolt until Target Frequency is displayed on Tesla Meter.
   a. Read Center Frequency of displayed on Tesla Meter.
   (The value after the upper adjustment)
   b. Calculate the Target Frequency
   Target Frequency = Center Frequency + Value of Mech_Shim Output Summary



Z1 ADJUSTMENT (LOWER)
ILLUSTRATION 27

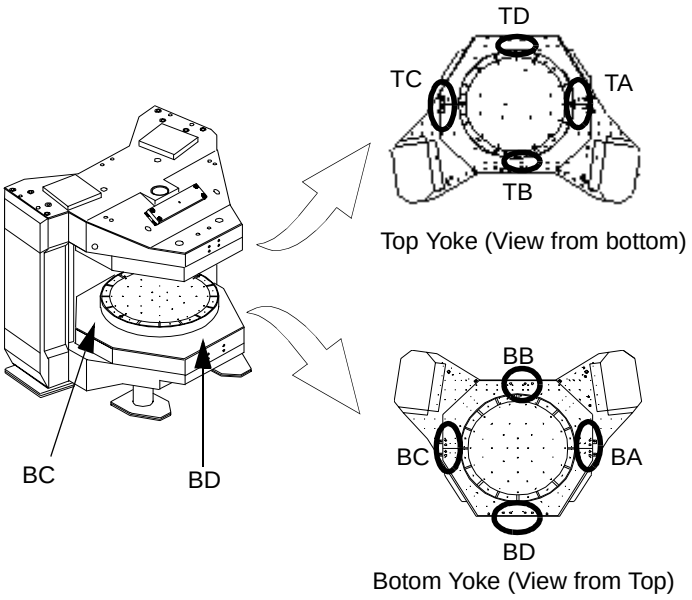
6-3-2 If |Z2| < 15 ppm and |Z1|, |X|, |Y|, |ZX|, or |ZY| ≥ 4 ppm... (continued)

3. Turn the adjustment bolts at TA, TB, TC, TD, BA, BB, BC, BD according to the result file.

Note

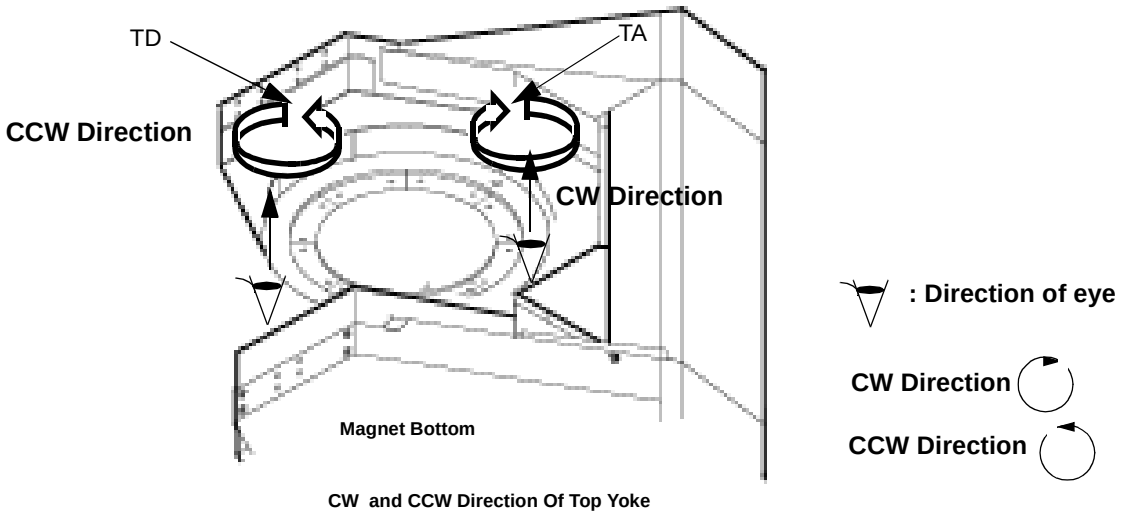
Remove the cylindrical shaped insulator covering the mechanical shim point when performing the mechanical shimming. Do not remove another insulator.

After the mechanical shimming is finished and restoring cylindrical shaped insulator, be careful not to push the insulator too much. Otherwise, it will be hard to remove it.



Note

Be careful when turning the adjusting bolts of Top Yoke.
Look up and turn the bolt to the derection described in the result file.
See following illustration.



MECHANICAL SHIMMING
ILLUSTRATION 28

6-3-2 If |Z2| < 15 ppm and |Z1|, |X|, |Y|, |ZX|, or |ZY| ≥ 4 ppm... (continued)

CAUTION

If following message is appeared at the monitor, do not turn the screw. Mechanical Shimming cannot be performed any more.
Perform passive shimming according to the instruction displayed at the monitor.

```
**CAUTION! Screws must not be turned any more.**
Hit RETURN Key, and then start the passive-shim.
```

6-3-3 If |Z2| < 15 ppm and |Z1|, |X|, |Y|, |ZX|, or |ZY| < 4 ppm...

1. If |Z2| < 15 ppm and |Z1|, |X|, |Y|, |ZX|, or |ZY| < 4 ppm, following is displayed.

Output/Prompts	Input/Comments
Writing to setup file Writing to init file Executing pmshim_ssm Isocenter Frequency : Start = 14844273 [Hz] : End = 14844276 [Hz] : Difference = 3 [Hz] (Field Map File): gemech_SHIM-C_v.plot	**<- If measured homogenity is under 30ppm and it is not necessary to perform passive shimming, record this value in data sheet as a final center frequency.**
<<< Display Current Field Map File [difference in unit of PPM] >>> deg| (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) ---|--- 0| -25. -24. -11. 0. -4. 11. 14. 20. 3. 3. -2. -11. -9. 30| -25. -15. -11. -9. 4. 14. 9. 17. 6. -11. -1. -7. -9. : 330| -25. -21. -11. -10. 3. 11. 21. 10. 3. -2. -1. -6. -9. ----|--- avg| -25. -17. -15. -6. 2. 14. 17. 13. 5. -1. -4. -6. -9. MxMn| 0. 14. 14. 13. 17. 8. 23. 15. 14. 23. 14. 9. 0.	
Peak to Peak = 53.9 PPM Axial coefficients ... z 1= -4.3 z 2= -14.6 Transverse coefficients ... x= -0.4 y= -0.7 zx= 0.1 zy= -0.2	
--- <<< Mech_Shim Output Summary >>> --- No need mechanical shimming.	**If mechanical shim is not needed, this message is displayed.**
--- <<< Passive Shim Output Summary >>> --- Measured homogeneity in PPM : 65.8 Calculated PPM (LP Unrounded) : 16.9 Calculated PPM (LP Rounded) : 51.9 Calculated PPM (DS added) : 32.4 :	**If Measured Homogenity is over 30ppm, Passive Shim Program will run.** **LP:Linear Program Method** **DS:Direct Serch Method**
Location | U1 U2 U3 U4 U5 U6 U7 L1 L2 L3 L4 L5 L6 L7 ---|--- Shim (mm)| 4 4 7 7 7 12 12 4 4 7 7 7 12 12 | SUM ---|--- Current | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 0 Delta | 0 3 4 4 1 4 1 0 0 0 0 0 1 11 | 29 ---|--- Total | 0 3 4 4 1 4 1 0 0 0 0 0 1 11 | 29 ---	**<- Current shim mag No.** **<- Shim Mag No.to be added**

6-3-3 If |Z2| < 15 ppm and |Z1|, |X|, |Y|, |ZX|, or |ZY| < 4 ppm... (continued)

Output/Prompts	Input/Comments

```
Display Shim Direction and Shim Location   *** TOP DELTA ***
INDEX                          Rotation (Degrees)
(No.)     0    30    60    90   120   150   180   210   240   270   300   330
-------------------------------------------------------------------------------
   U1     0     0     0     0     0     0     0     0     0     0     0     0
   U2     0     0    N1     0     0     0     0    N1     0     0    S1     0
   U3     0     0     0     0     0    N1     0     0     0    N1    N1    N1
   U4     0     0     0     0     0    S1     0     0     0    S1    S1    S1
   U5     0     0     0     0     0     0     0     0     0     0     0    N1
   U6     0     0     0     0    N1    N1  -1       0     0    N1     0     0
   U7     0     0  -2N1     0     0     0     0     0     0     0    S1     0

       Display Shim Direction and Shim Location   *** BOTTOM DELTA ***
INDEX                          Rotation (Degrees)
(No.)     0    30    60    90   120   150   180   210   240   270   300   330
-------------------------------------------------------------------------------
   L1     0     0     0     0     0     0     0     0     0     0     0     0
   L2     0     0     0     0     0     0     0     0     0     0     0     0
   L3     0     0     0     0     0     0     0     0     0     0     0     0
   L4     0     0     0     0     0     0     0     0     0     0     0     0
   L5     0     0     0     0     0     0     0     0     0     0     0     0
   L6     0     0    S1     0     0     0     0     0     0     0     0     0
   L7    N2     0     0  -3N1     0     0    N2    N1    N3     0     0     0
-------------------------------------------------------------------------------

        Display Shim Direction and Shim Location   *** TOP TOTAL ***
INDEX                          Rotation (Degrees)
(No.)     0    30    60    90   120   150   180   210   240   270   300   330
-------------------------------------------------------------------------------
   U1     0     0     0     0     0     0     0     0     0     0     0     0
   U2     0     0    N1     0     0     0     0    N1     0     0    S1     0
   U3     0     0     0     0     0    N1     0     0     0    N1    N1    N1
   U4    S1     0     0     0     0    S1     0     0     0    S2    S1    S1
   U5     0     0     0     0    N1     0     0     0     0     0     0    N1
   U6     0     0     0     0    N1    N1     0     0     0    N1     0     0
   U7     0     0     0     0     0     0     0     0     0     0    S1     0

     Display Shim Direction and Shim Location   *** BOTTOM TOTAL ***
INDEX                          Rotation (Degrees)
(No.)     0    30    60    90   120   150   180   210   240   270   300   330
-------------------------------------------------------------------------------
   L1     0     0     0     0     0     0     0     0     0     0     0     0
   L2     0     0     0     0     0     0     0     0     0     0     0     0
   L3     0     0     0     0     0     0     0     0     0     0     0     0
   L4     0     0     0     0     0     0     0    N1     0    N1     0     0
   L5     0     0     0    N1     0     0    N1     0     0     0    N1    N1
   L6     0     0    S2     0     0     0     0     0     0     0     0     0
   L7    N2     0     0    N1    S1     0    N2    N1    N3     0     0     0

 Write Shim Files ? (Y,N) [Y]:
y
 -----Output file-----
 shim_loc.gemech_YC3_e.plot
 ---------------------
Press [Enter] to quit -->
```

Delta

See Next Page how to read this table.

Total

Y [Return] **to save the output file**

N [Return] **not to save the output file**

6-3-3If |Z2| < 15 ppm and |Z1|, |X|, |Y|, |ZX|, or |ZY| < 4 ppm... (continued)

Note

Refer to the followting illustration to read the table.

Remove two Shim Magnets and add one "N" Shim Magnet

Add one "N" Shim Magnet

Remove one Shim Magnet

For Top Shim Plate

Display Shim Direction and Shim Location *** TOP DELTA ***

INDEX (No.)	Rotation (Degrees) 0	30	60	90	120	150	180	210	240	270	300	330
U1	0	0	0	0	0	0	0	0	0	0	0	0
U2	0	0	N1	0	0	0	0	N1	0	0	S1	0
U3	0	0	0	0	0	N1	0	0	0	N1	N1	N1
U4	0	0	0	0	0	S1	0	0	0	S1	S1	S1
U5	0	0	0	0	0	0	0	0	0	0	0	N1
U6	0	0	0	0	N1	N1	-1	0	0	N1	0	0
U7	0	0	-2N1	0	0	0	0	0	0	0	S1	0

For Bottom Shim Plate

Display Shim Direction and Shim Location *** BOTTOM DELTA ***

INDEX (No.)	Rotation (Degrees) 0	30	60	90	120	150	180	210	240	270	300	330
L1	0	0	0	0	0	0	0	0	0	0	0	0
L2	0	0	0	0	0	0	0	0	0	0	0	0
L3	0	0	0	0	0	0	0	0	0	0	0	0
L4	0	0	0	0	0	0	0	0	0	0	0	0
L5	0	0	0	0	0	0	0	0	0	0	0	0
L6	0	0	S1	0	0	0	0	0	0	0	0	0
L7	N2	0	0	-3N1	0	0	N2	N1	N3	0	0	0

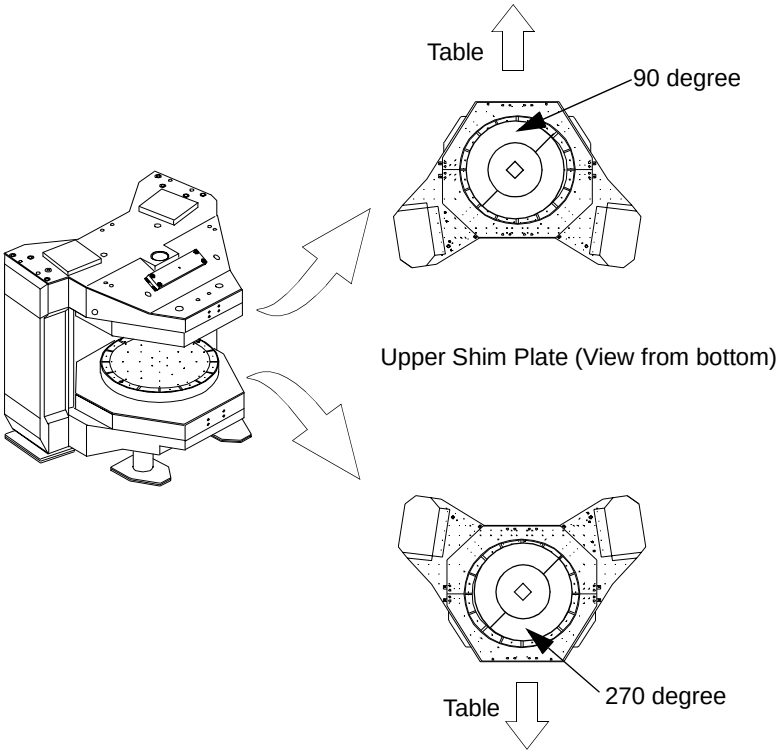
HOW TO READ THE TABLE

ILLUSTRATION 29

6-4 Passive Shimming

Note

Refer to the following illustration to understand the position relationship between upper and lower shim plate.



POSITION RELATIONSHIP OF UPPER AND LOWER SHIM PLATE
ILLUSTRATION 30

6-4-1 Upper Shim Plate Shim Setting

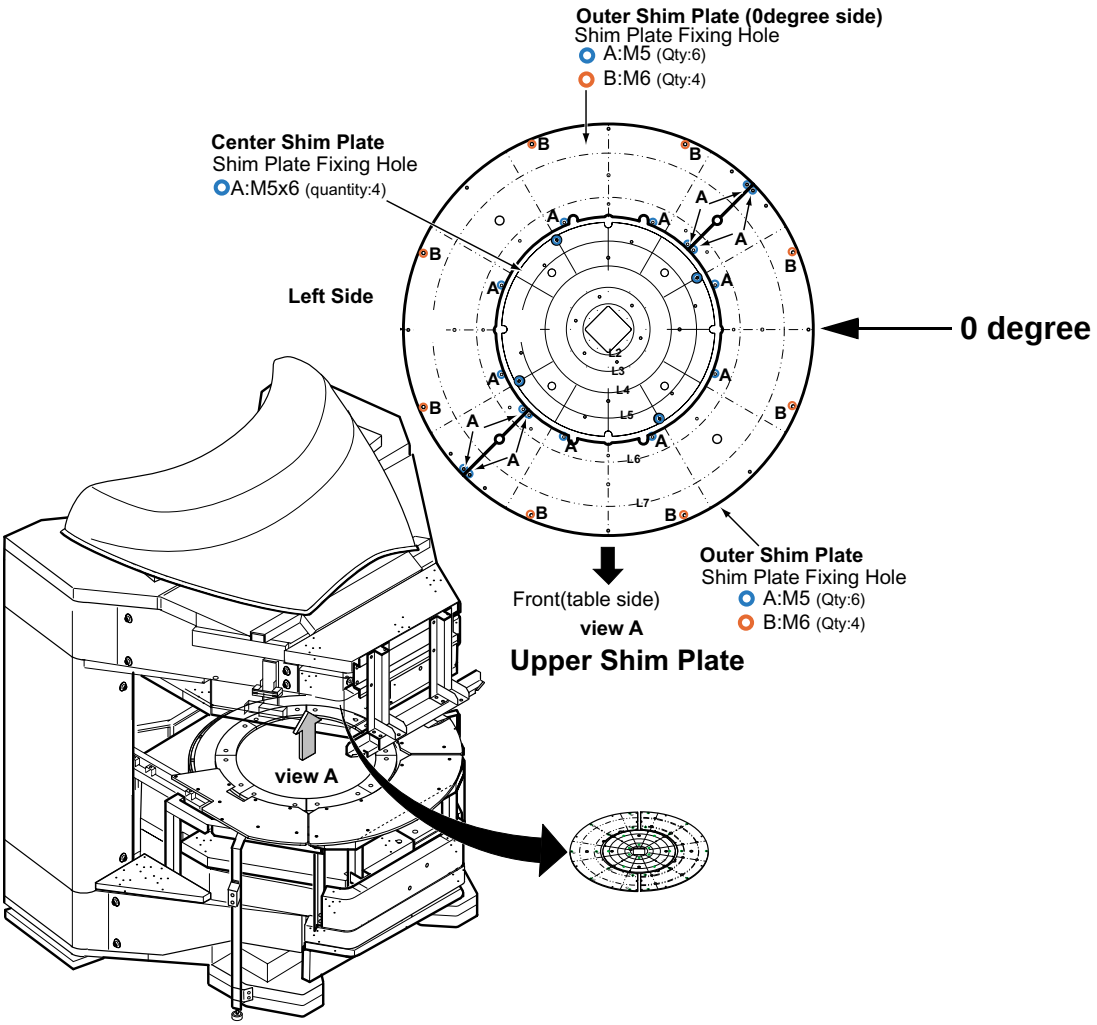
1. Remove upper shim plate from magnet by loosening A and B screws.

Note

You can remove the Shim Plates without removing the Mapping Fixture

CAUTION

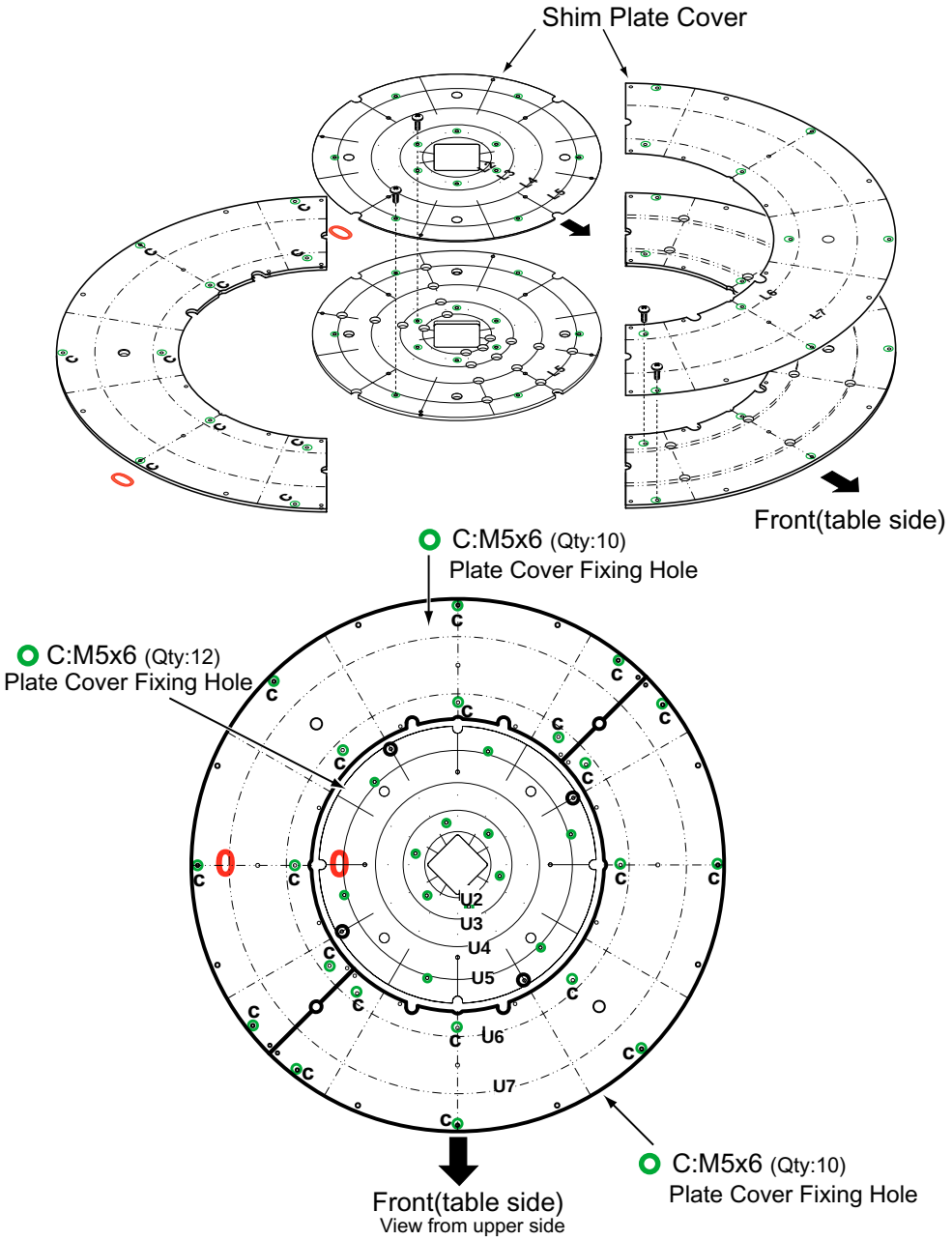
When upper shim plates are Installed to magnet, align 0degree of shim plates to left side(view from under side)as illustration. You can install center shim plate by rotating 90degree to magnet. The each outer shim plates can be installed to reverse position.



UPPER SHIM PLATE 1
ILLUSTRATION 31

6-4-1 Upper Shim Plate Shim Setting (continued)

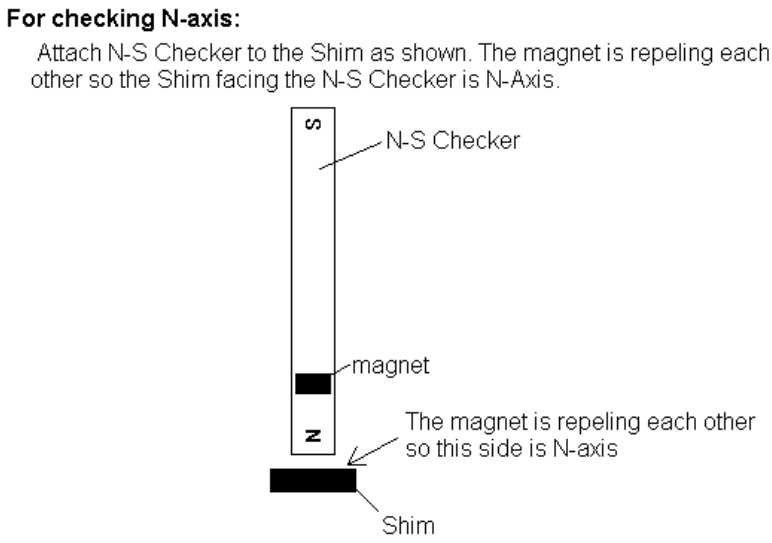
2. Remove cover from upper shim plate by loosening C screws.



UPPER SHIM PLATE 2
ILLUSTRATION 32

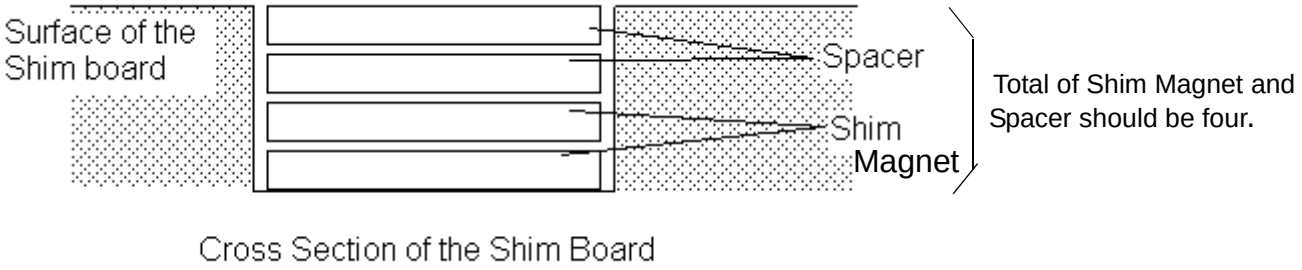
6-4-1 Upper Shim Plate Shim Setting (continued)

3. Verify to check the pole(N-pole or S-pole) of the Shim by using N-S Checker.



NS CHECKER
ILLUSTRATION 33

4. Add or take out Shim Magnet on the Shim Board according to the output from the pshim program.



ADD SHIM MAGNET
ILLUSTRATION 34

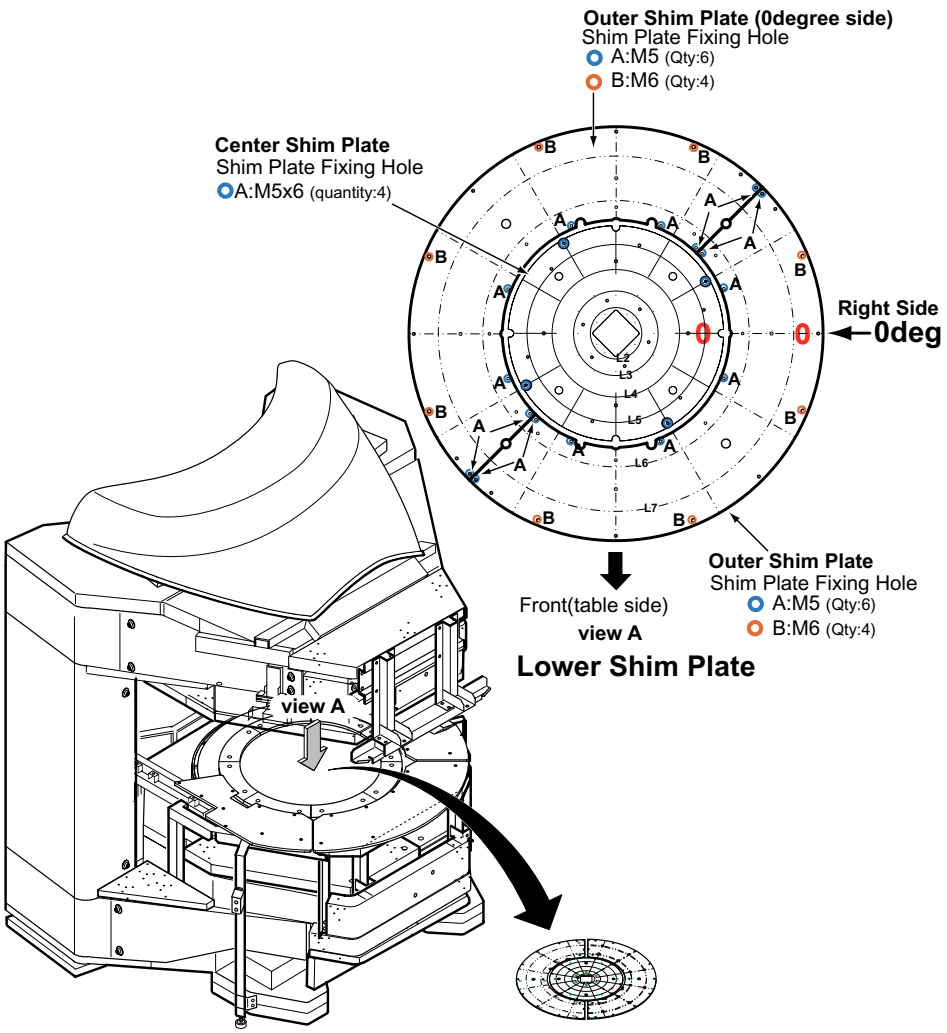
5. Installtion is reverse order of removal.

6-4-2 Lower Shim Plate Shim Setting

1. Remove upper shim plate from magnet by loosening A and B screws.

CAUTION

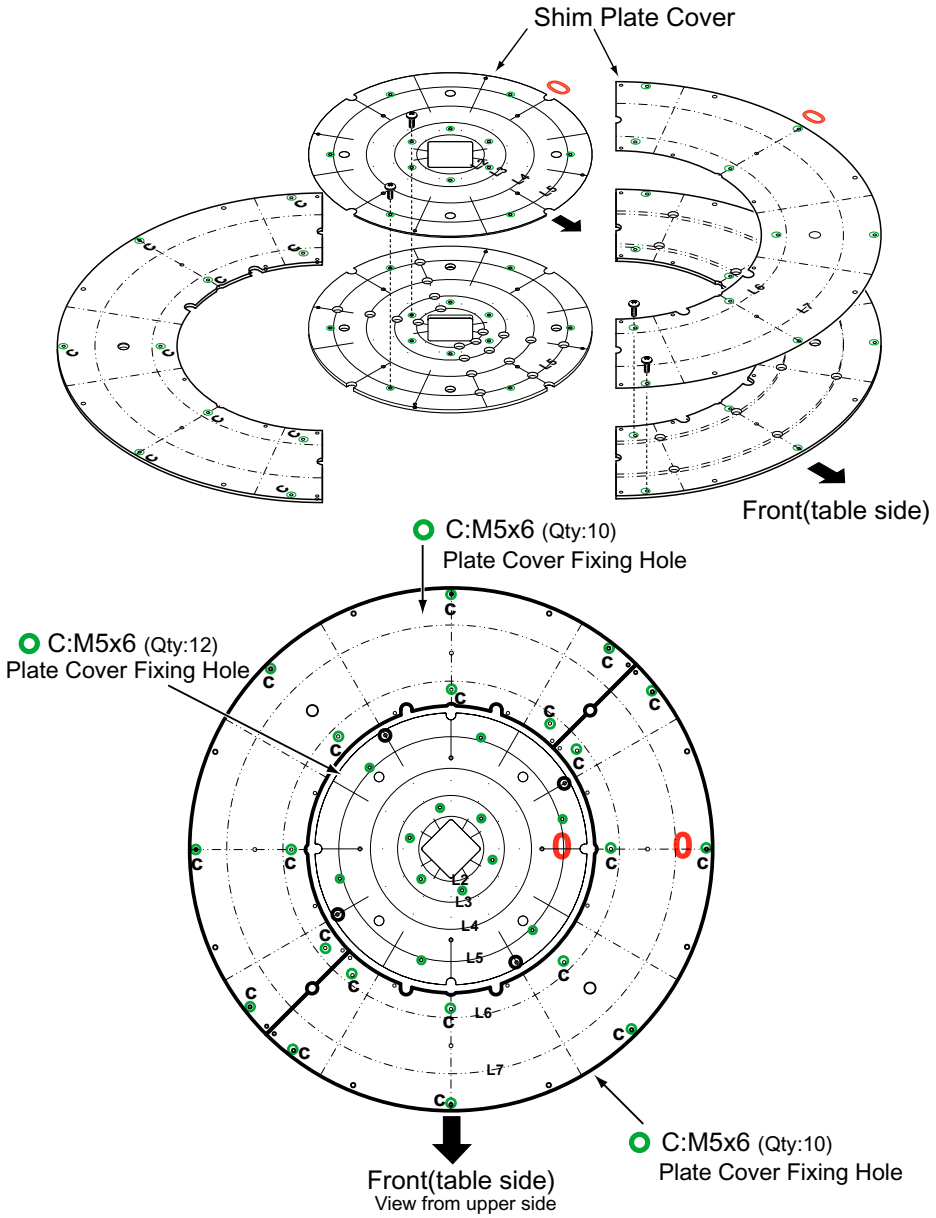
When lower shim plates are install to magnet,align 0degree of shim plates to right side (view from upper side) as illustration. You can install center shim plate by rotating 90degree to magnet.The each outer shim plates can be installed to reverse position.



LOWER SHIM PLATE 1
ILLUSTRATION 35

6-4-2 Lower Shim Plate Shim Setting (continued)

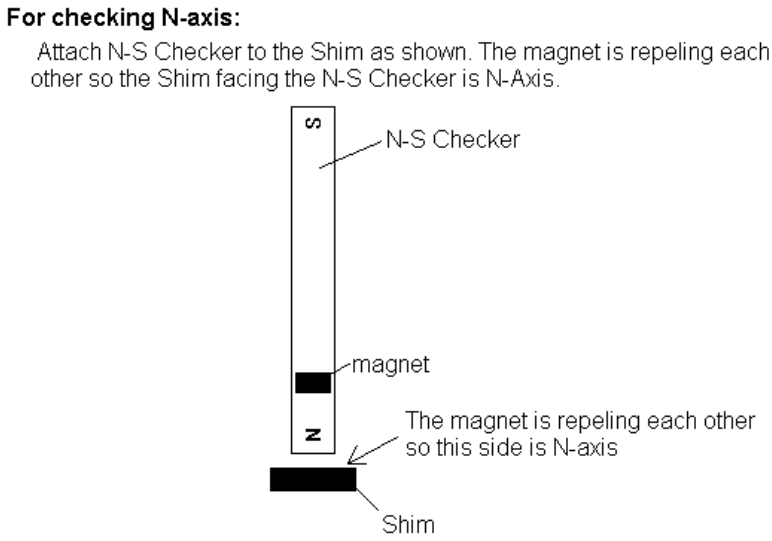
2. Remove cover from lower shim plate by loosening C screws.



LOWER SHIM PLATE 2
ILLUSTRATION 36

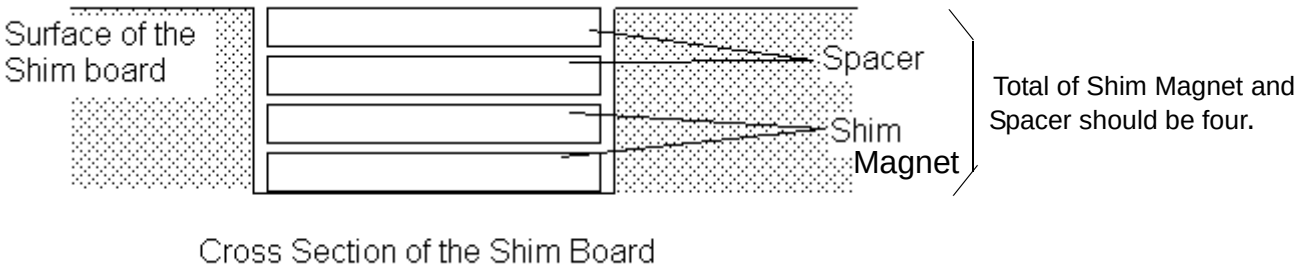
6-4-2 Lower Shim Plate Shim Setting (continued)

3. Verify to check the pole(N-pole or S-pole) of the Shim by using N-S Checker.



NS CHECKER
ILLUSTRATION 37

4. Add or take out Shim Magnet on the Shim Board according to the output from the pshim program.



ADD SHIM MAGNET
ILLUSTRATION 38

5. Installtion is reverse order of removal.

Revision History

Rev	Date	Author	Primary Reasons For Change
0	Dec 20, 2000	Y. Masumo	Initial Version
1	May 19, 2001	Y. Masumo	Misc Correction
2	Oct 16, 2001	Y. Masumo	Misc Correction
3	Jan 28, 2002	Y. Masumo	Misc Correction
4	Jan 28, 2002	Y. Masumo	Page 4 to 9: Clarify the charactor and illustration. P39: Added to record Center Frequency Value. Page 42: Added explanation of upper and lower shim plate position relation-ship.