MAS II

User manual

Version 001

The information in this manual may be altered without notice.

BRUKER BIOSPIN accepts no responsibility for actions taken as a result of use of this manual. BRUKER BIOSPIN accepts no liability for any mistakes contained in the manual, leading to coincidental damage, whether during installation or operation of the instrument. Unauthorised reproduction of manual contents, without written permission from the publishers, or translation into another language, either in full or in part, is forbidden.

This manual was written by

Uwe Döttling

Rheinstetten, Germany

P/N: Z31701E
DWG-Nr: 1407001

Contents

Contents

Declaration of Conformity

1

CE

DECLARATION OF CONFORMITY

The undermentioned product

MAS/2 PNEUMATIC CONTROL UNIT H13000

conforms to the main requirements
set by the commission for the
Harmonization of Regulations of the EU Member States
with regards to electromagnetic compatibility
(EMI 89/336/ECC) and safety (Low Voltage Electrical
Equipment: 72/23/ECC) regulations.

For the assessment the following norms were applied:

EMI: EN 61326-1: 2001
Test report: Nemko FS-0211-03949
Safety: EN 61010-1: 2nd ed. (2001)
Test report: Nemko EL-0212-04079

Documentation: Z????? Docu Standard: MAS II Pneumatic Control Unit

Manufacturer's Name: BRUKER BIOSPIN GmbH
Manufacturer's Address: 76287 Rheinstetten, Silberstreifen, Germany

Declaration approved by:

Dr. Tonio Gianotti

Head of Development

Rheinstetten 26.01.2004

(Signature)

Declaration of Conformity

Introduction 2

Introduction 2.1

This manual is intended to assist operators who have recently acquired a MAS II Pneumatic Unit (P/N H13000). Having read the manual the operator should

- be able to install the unit
- understand the basic functions of the hardware
- be able to use a set of basic software commands or keypad functions to operate the unit.

This manual is **not** intended to describe

- solid NMR or specifically MAS applications
- sample preparation
- MAS data analysis
- variable temperature work
- MAS probes

Manual Layout 2.2

The following section is intended to help the reader make the most use of this manual.

Chapter 3 describes the facilities that need to be installed in the laboratory prior to installation.

Chapter 6 describes the actual installation of the unit.

Chapter 7, chapter 8 and chapter 9 describes the setup of the MAS II unit.

Chapter 10 describes the usage of the unit.

Other Useful Manuals on the Subject of MAS *2.3*

While this manual concentrates on describing the operation of the MAS PU from a users perspective other manuals which contain useful information are listed below.

SB-MAS Operation Manual	P/N Z31401
High Resolution Magic Angle Spinning Spectroscopy	P/N B2265
AVANCE DMX/DSX Spectrometers, Solids Experiments User Manual	P/N H9321
High Resolution MAS Probes	P/N Z31391

Facility Requirements 3

Main Air Supply 3.1

Particulates: Oil free air with particle size not greater than 0.01 microns.

Dew point: < -30°C.

Flow rate: This will depend to some extent on spin rates etc., but typically a flow of 300 l/min (2.35 cu.ft./min.) flowing at greater than 6 bar (87 psi) will suffice.

Input pressure: Max.: 10 bar (145 psi)

Min.: 4 bar (58 psi)

Ideal: 6-8 bar (87-116 psi)

Control of Sample Temperature 3.2

The control of the sample temperature requires a BVT variable temperature unit and a 25l (0.88 cu.ft) liquid nitrogen dewar. This is standard NMR equipment and not specific to MAS.

Nitrogen Supply for Low Temperature Work 3.3

For low temperature work the most common arrangement is to use a pressurized liquid nitrogen tank with a nitrogen boil-off device. A 60l (2.11 cu.ft.) gas cylinder (200 bar / 2900 psi) will typically last for 1 hour.

The various configurations for low temperature work are dealt with extensively in the manual ‘Avance DMX/DSX Spectrometers, Solids Experiments User Manual’ P/N H9321.

Ambient Laboratory Environment 3.4

No special requirements in respect to temperature and humidity are required.The MAS II Unit will operate under standard laboratory conditions suitable for NMR spectrometer.

Electrical Supply *3.5*

The electrivcal supply must be 230V 50/60 Hz single phase, A.C.

Maintenance *3.6*

The unit requires no special maintenance procedures. A well-controlled temperature and humidity environment in the laboratory will extend the life cycle of all parts. The quality of the gas input into the rear of the PU is particularly important in preventing problems arising from impurities / particles etc.

External Connections

4

Front Panel Connections 4.1

RS232

This is the serial connection to the Communication Control Unit (CCU - standard port is TTY07). This connection enables remote control of the MAS II using XWIN-NMR. If the unit is to operated locally then this connection is not required.

The spectrometer software (X-Win NMR / Topspin) needs to know which TTY port on the CCU is used. This information is provided during the **cfmas** routine.

SPIN

Electrical **input** signal used to monitor the spin rate of the rotor.

AUX

This is an auxiliary **input-output** connector, which is currently not used

TRIG

Electrical **output** to the Timing Control Unit (TCU). This is a TTL 5V signal that replicates the spinning of the rotor and can be used to synchronize the phase of the rotation with specific NMR pulse sequences.

AUX TRIG

Additional electrical **output** to the TCU. This is a TTL 5V signal, which will become functional in the next fimrware version.

MONITOR

Electrical o**utput**, used to monitor the analog spinning rate signal. This signal is in the range of 0 to 5 V.

Rear Panel Connections *4.2*

AIR IN max. 12 Bar

This is the main pneumatic pressure **input** to the MAS II and is the source of all other pressures that are used. This pressure must be in the range between 4 and 12 bar.
For information on adjusting this input, please read chapter ***"Main Pressure Set-up" on page 29***.

BEARING OUT (3)

The pneumatic **output** will be connected to either a heat exchanger or directly to the probe, and serves the bearings from the probe.

VERTICAL (7)

Output that switches the stator back to the vertical position to enable the rotor to be ejected or a new rotor inserted. This output is required for all probes using Flip mechanics (mostly used for standard bore magnets).

MAGIC ANGLE (8)

Output that tilts the stator to the desired angle. This output is required for all probes using Flip mechanics (mostly used for standard bore magnets).

OPTION 1

An optional pressure **output** with no current function assigned

OPTION 2

An optional pressure **output** with no current function assigned

BEARING SENSE (6)

This **input** serves to ensure that the pressure elevating the rotor (the BP) as detected at the probe base is sufficient. This ensures that abnormal pressure losses do not occur along the plastic tubing connecting the MAS II Bearing Out connector and the probe. The sense of bearing pressure must be at least 50% (adjustable) of the Bearing Out pressure. If this is not the case then the Drive Pressure will be reduced. More information is available in chapter ***"BSp Cutoff" on page 37***

DRIVE OUT (5)

Pressure **output** used to rotate the rotor.

INSERT

This pressure **output** inserts the rotor into the probe assembly.
This output is not always connected. If you are not sure if this output is needed, please refer to your probe manual. If a Sample Changer system is used, then this connection is required.

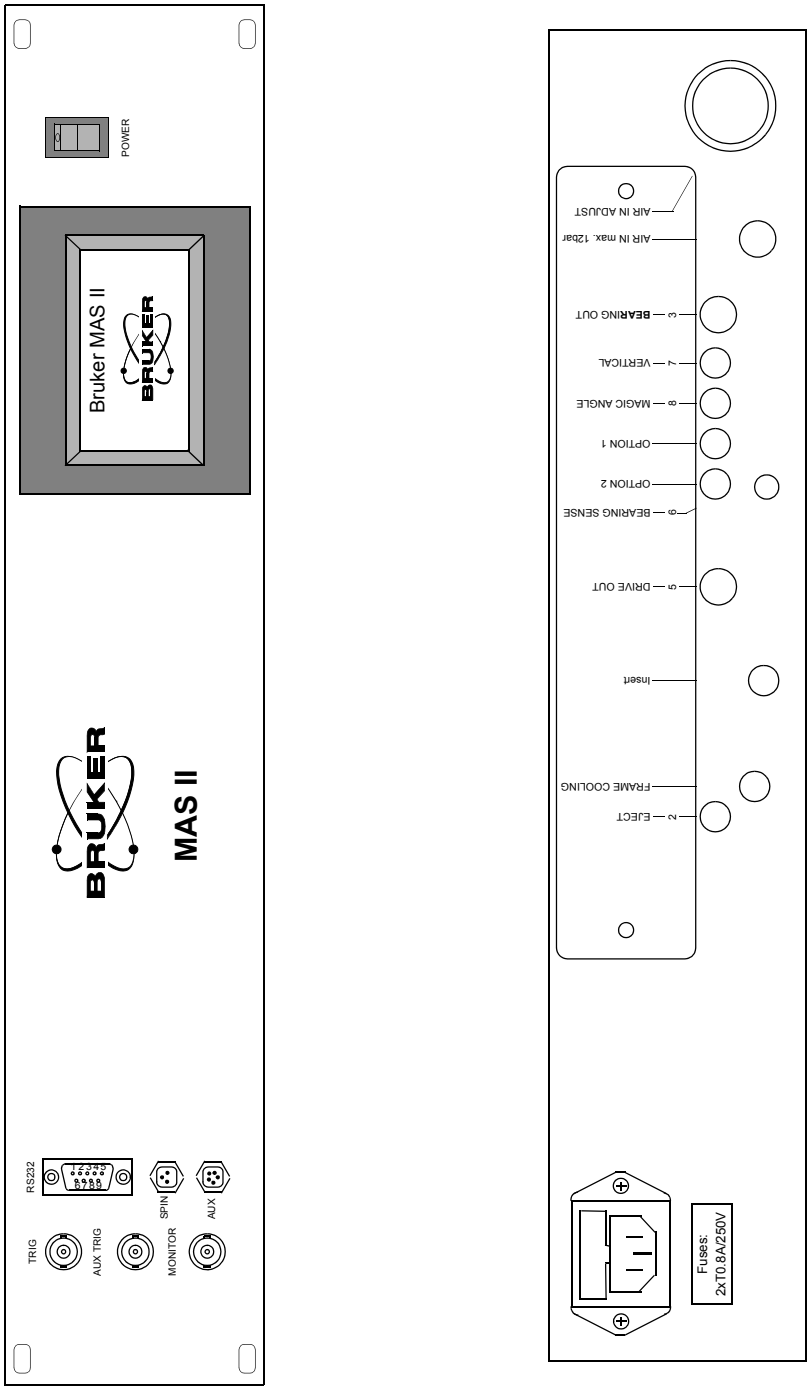
FRAME COOLING

Pressure **output** which cools the probe assembly.

EJECT (2)

Pressure **output** which ejects the rotor from the stator.

Figure 4.1. Front- and Rear Panel Connections



Touch-Display 5

Introduction 5.1

To operate the MAS II unit graphical touch display has been implemented. This Display serves as an input, as well as an outputddevice for the MAS II unit.

When using the unit, various keys and layouts are displayed. To activate the key function, the key must be touched. Sometimes there are key functions, which are not shown with a dedicated key sign. These key functions will be discussed separatelly in a later chapter.

Key Functions 5.2

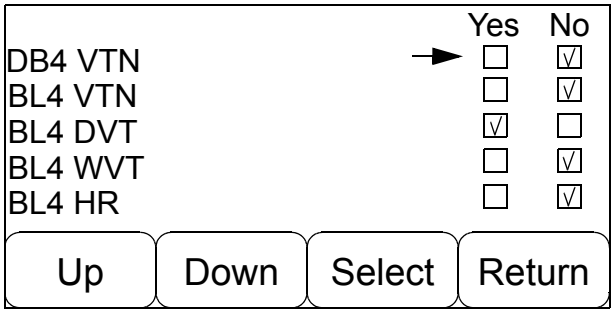
There are different kinds of keys available:

- Keys which will start a function if pressed once (e.g. Return in most of the menu' s).
- Keys which must be touched and hold as long as the function should work (e.g. change pressure in manual mode).
- Keys which will change its function during operating the MAS II Unit.

Menu's Using Checkboxes 5.3

Sometimes there are selection menu's displayed, in which the user must choose their selection from a list of entrys. Using this kind of menu always uses the same rules for operation.

Figure 5.1. Example of a selection menu



Using the key Up or Down the cursor will scroll upwards or downwards. If a page-boundary is crossed, the next page will automatically be dispalyed, if there is addi-

tional information available. If there are no more data, the cursor will stop in the last position. The key Select, checks the element at the current cursor position. This will be indicated by the √ sign in the Yes checkbox. Items not selected are identified with the √ sign in the No checkbox.

There are a various kinds of selection displays available:

- Displays where more than one selection is possible (e.g. Setup Probe display)
- Displays where only one selection can be done
- Displays where the Yes or No checkbox are replaced by different names (e.g. Valve Setup display, where an O for Open replaces the Yes and a C for Closed replaces No. The Select key is then renamed to Change key).

Return Function *5.4*

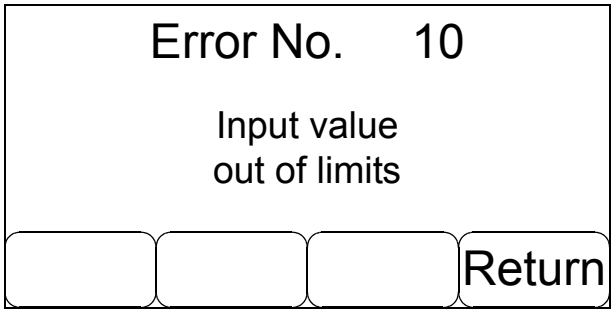
Using the Return key normally brings you one menu level higher, or back to the main selection menue.

Sometimes you can change from one menu to the other without using the return key. For example, this is possible when changing from manual mode to automatic mode using the key Auto or vice versa using the Manu key to change from automatic mode to manual mode.

Errors *5.5*

When operation the MAS II unit, it is possible that errors may occur.
Errors are indicated by an error message. These error messages always have the same format and an example is being shown in the following figure

Figure 5.2. Error Message



The header line shows the error identification code, followed by the text message for the error. In the example above a too high spinning rate was selected for the auto mode.

Every error message can be acknowledged using the Return key. Sometimes there will be additional keys shown, for special functions based on the error.

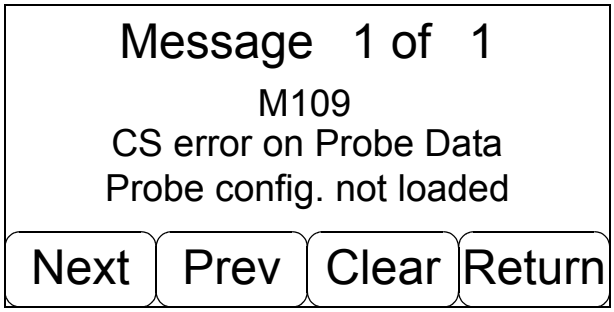
If further assistance is required from Bruker based on an error message, you always will always be asked for the error number and the error text.

Messages *5.6*

Under some circumsdances it is possible that some Messages are shown from the MAS II unit. These are mostly information about problems during the initialisation of the unit.

A message is displayed in the format shown in the following figure:

Figure 5.3. Message Queue



The header line shows the number of the current message and how many messages are available.

The 2nd line shows the ID code for this message, while line 3 and line 4 give the text for the message.

Using the keys Next/Prev you can check all available messages. Clear deletes the actuall message shown from the message queue and Return quits the message mode and brings you back to the main selection menue.

You should read every message before deleting with Clear. The message in the above example means :

The datachecksum which is stored together with the probe configuration data is not correct. This could be a result of the data representing your probe configuration being corrupt, whereas your probe configuration has not been loaded.

A detailed description of all errors and messages is available in the chapter ***"Problems and Troubleshooting" on page 59***.

Installation 6

Shipping Checklist 6.1

MAS Unit:	H13000
Trigger cable:	HZ 10022
RS232 cable:	HZ04055
This manual:	Z31701E

Useful Part Numbers 6.2

Power cable	66384
Spinning rate cable:	Z4035
Additional case for standalone usage:	W3004729

Installation procedure 6.3

Please verify that you have received all parts on the shipping checklist.

Depending on your spectrometer system, the MAS II unit has to be connected to your spectrometer as follows.

All electrical connections, except the main power connector are on the front side of the unit and all pneumatical connections are available on the rear of the MAS II unit (see also ***"External Connections" on page 15***).

Spinning rate cable

The cable Z4035 used to measure the spinning rate has, to be connected between the input Spin on the front panel of the MAS II unit and the Spinning rate Assembly connector(H8394) of the probe.

Please be sure the cables are connected in the right direction. The cables are marked with different labels on each end. The end labeled Probe has to be connected to the Spinning rate assembly of the probe and the end labeled MAS must be connected to the MAS II unit.

RS232 Cable

If the MAS II unit will be used remotely from X-WIN NMR then the RS232 interface has to be used. In this case the cable HZ04055 must be connected between the RS232 connector of the MAS II unit and the connector TTY7 of the AQS TTY extension panel. Please also check the direction of this cable. The end labeld Device must be connected to the MAS II unit and the other end normally to port TTY7 of the spectrometer.

Trigger Cable

If synchronization of the phase of the rotation with specific NMR pulse sequences is required, then the trigger connection between the MAS II unit and the TCU is required.

Attach the trigger cable HZ10022 between the TRIG output of the MAS II unit and the back panel trigger input of the spectrometer.

Power Cable

Connect this cable (PN. 66384) to a 10 A wall outlet or to a free socket of the spectrometer safety box.

Please check for defective power cables or defective wall outlets and replace these as soon as possible.

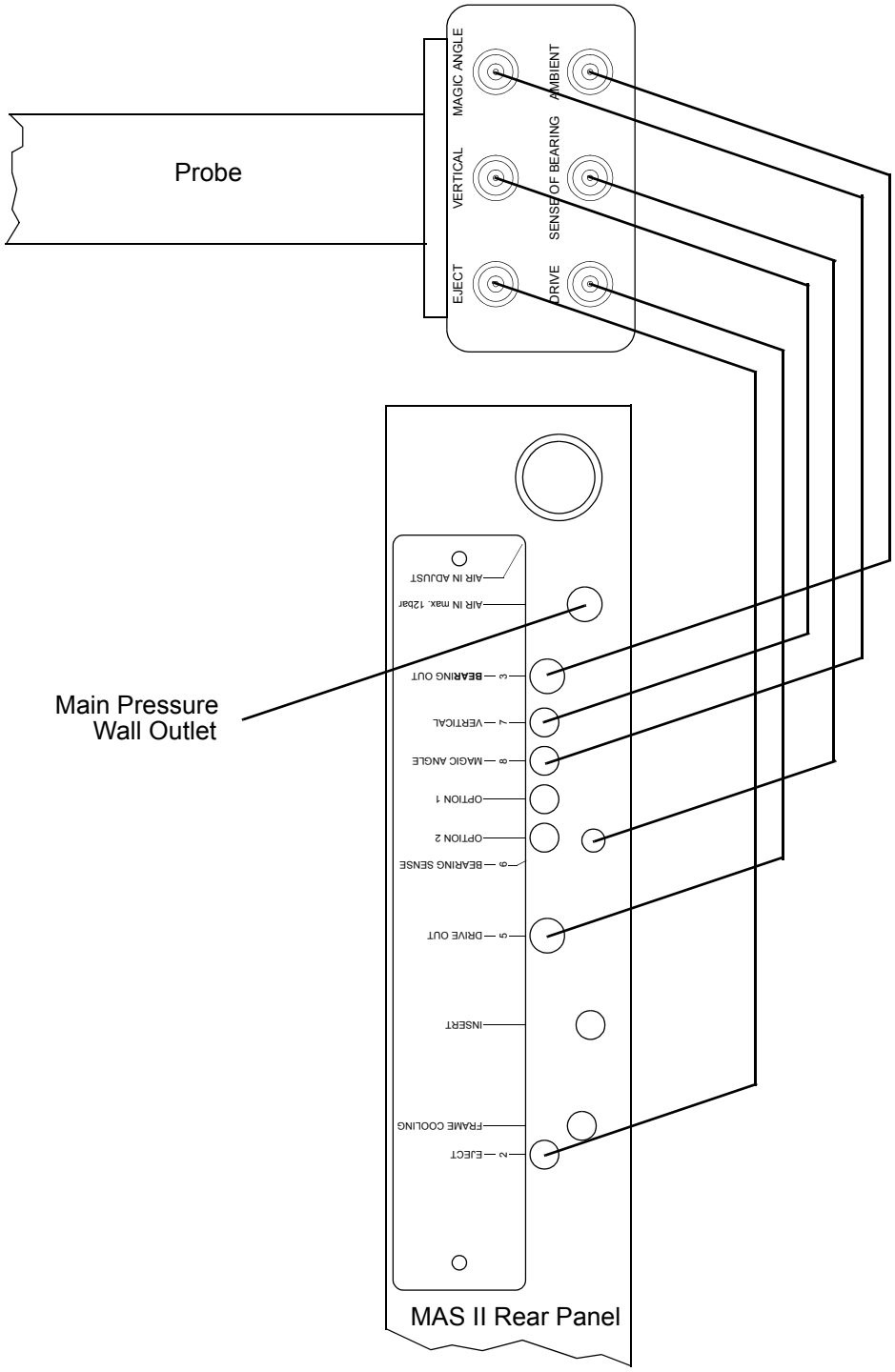
Pneumatic Connections for Room Temperature Work *6.3.2*

All pneumatical connections should be done using the originall air hoses delivered from Bruker. These hoses are either part of the MAS II unit or an accessory from the Probe.

Different pneumatical connections are necessary for the different probes. The following figure shows all the necessary pneumatical connections for probes using a switching mechanic for Magic Angle / Vertical so called Flip-type probes. These probes are mostly used together with standard bore magnets.

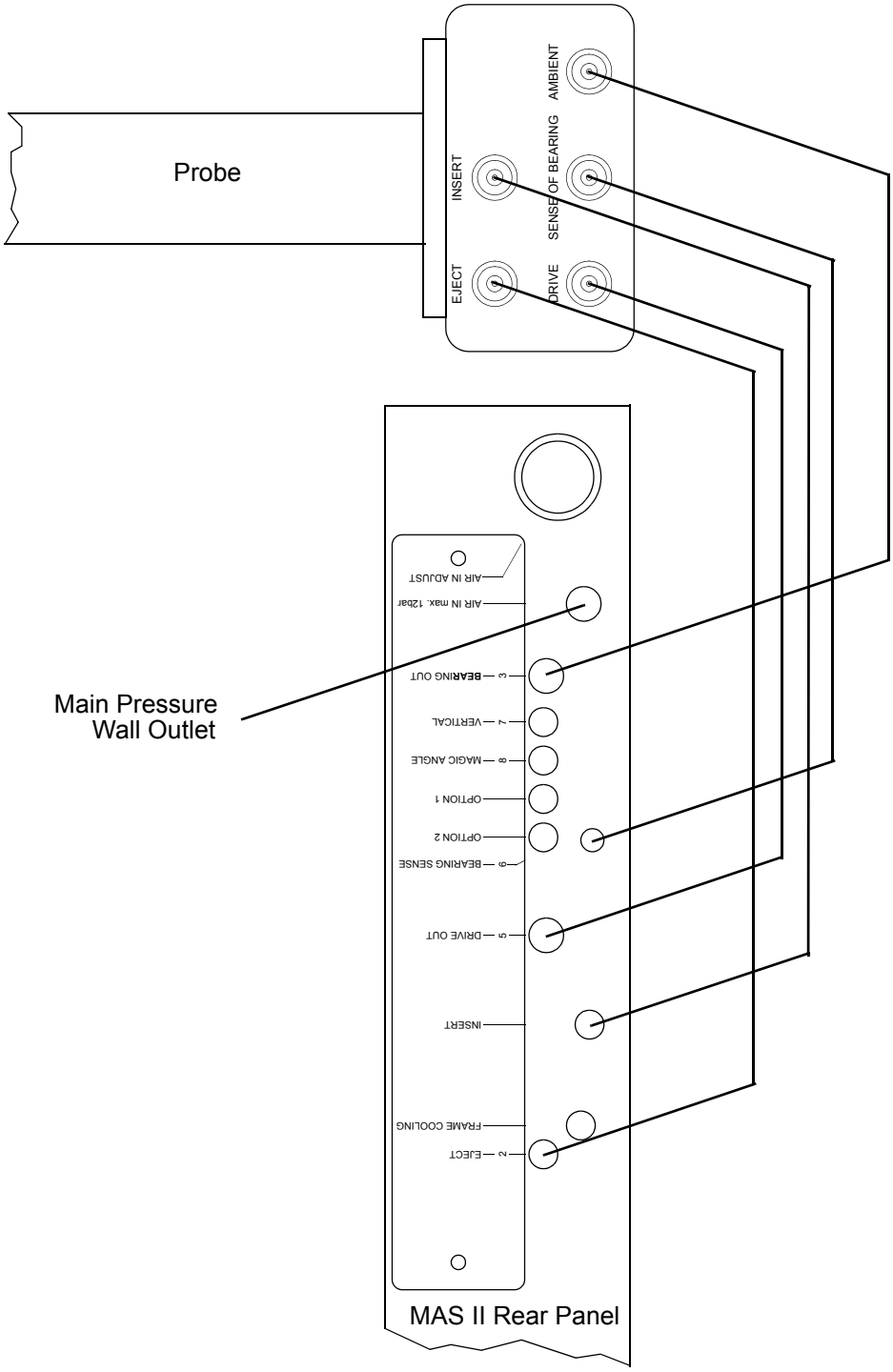
Some tubing sets use a special numbering scheme. Please attache the tubes based on the numbers on the airhose, the probe and the MAS II unit.

Figure 6.1. Pneumatical Connections for Flip-type Probes.



If you are using a none Flip-type probe (mostly used for widebore magnets) then the connections Magic -Angle and Vertical are not necessary. These probes normally need an insert connection. The following figure shows the connections for these type of probes.

Figure 6.2. Pneumatical Connections for non Flip-type Probes



The pneumatical connection for Frame Cooling is not shown here. This connection may be important and must then be connected seperately.

Connect the MAS II unit to the pneumatical wall outlet, but do not open before the MAS II unit is powered on.

Connections for Temperature Experiments *6.3.3*

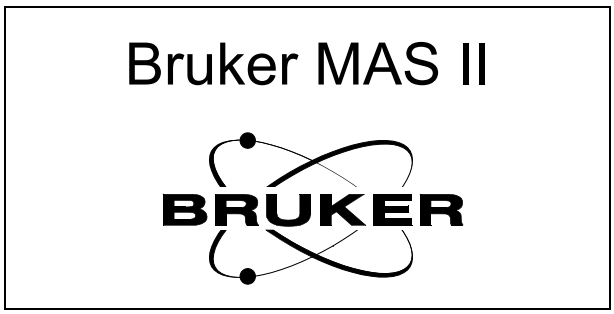
The Bearing output is normally connected directly to the probe base as shown in ***Figure 6.1.*** or in ***Figure 6.2.*** However, for low temperature work the Bearing output may be connected first to a heat exchanger and then applied to the probe base.

Temperature experiments need special equipment and will therefore be descriped in a special manual.

Main Settings 6.4

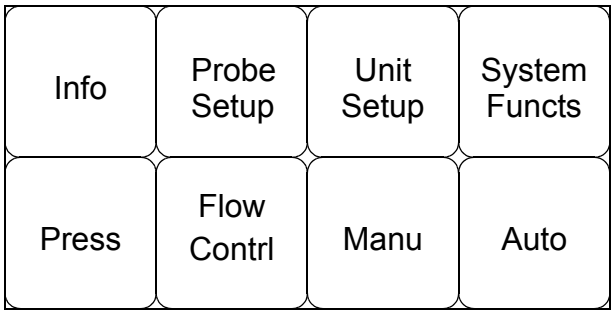
After you have completed all the electrical and pneumatical connections, you can power up your MAS II unit. After a reset sequence the unit will show the initial display:

Figure 6.3. MAS II Initial Display



Please touch the display to enter the main selection display.

Figure 6.4. Main selection display



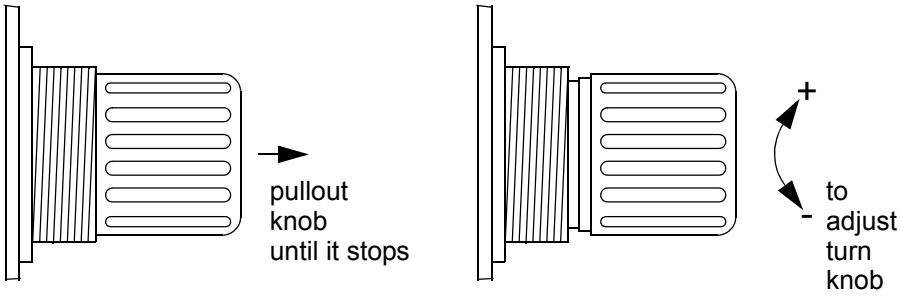
The selection of all functions can be made from this main selection menu. You can return to this menu by hitting the Return key in most of the display masks.

Main Pressure Setup 6.4.1

For optimal work the internal pressure of the MAS II unit has to be adjusted in accordance to your local pressure supply.

To adjust the internal pressure you must pull out the Main Pressure Adjust knob on the rear of the MAS II unit. In this position the internal pressure can be adjusted.

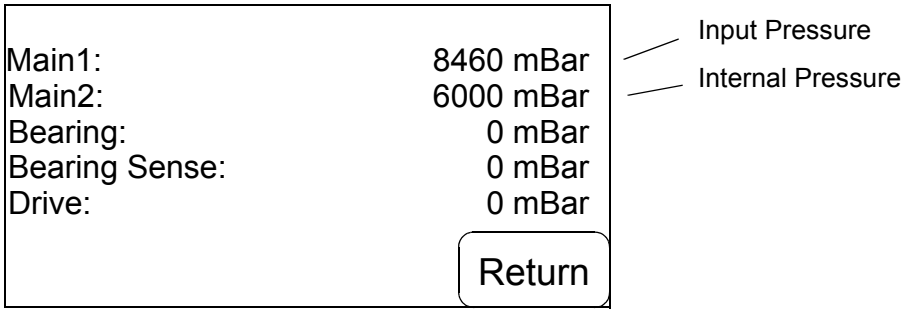
Figure 6.5. Pressure Adjustment



Increase the internal pressure by turning the pressure adjustment knob clockwise (+), or decrease the internal pressure by turning the knob counterclockwise (-).

You can test the pressure adjustment using the LC-display. In the main selection menu you have to touch the key „Press“ to show the Pressure display. Main2 is the internal pressure, which you can adjust by using the pressure adjustment knob.

Figure 6.6. Pressure Display



The best pressure setting is 500 mBar below the lowest pressure your pressure-supply can deliver, but 500 mBar above the highest pressure you want to use with your MAS II unit. The highest possible pressure the MAS II unit can deliver at the outputs bearing or drive is around 5000 mBar. The best pressure setting in this case is then 5500 mBar if the lowest available pressure is at least 6000 mBar.

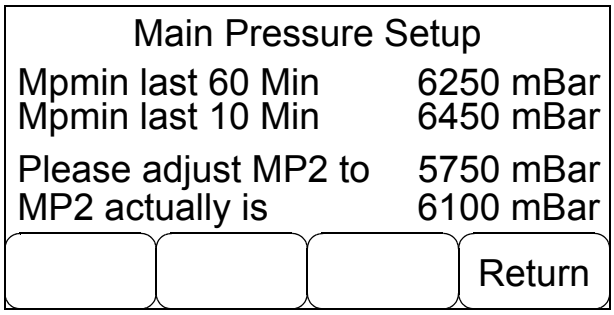
The lowest pressure of your pressure supply system is the value of Main1. The lowest value over a longer time period is the lowest pressure of your pressure system.

In most cases you need to find a compromise between these two points. As nearly as possible try to reach the best setting. If you are not able to find an optimal setup, then try to lower the internal pressure below this point, whereas you will not be able to reach the full range of output pressure (5000 mBar) or not to have a pressure difference of at least 500 mBars to the maximum output pressure.

When the pressure adjustment is finished, return the adjustment knob back to its initial position to lock the adjusted setting.

Alternately you can use the function Main Pressure Setup, which is available using the System Functions Menu.

Figure 6.7. Main Pressure Setup Display



After running the MAS II unit for more than one hour the unit will detect the lowest pressure available from your pressure supply system. Please adjust the internal pressure MP2 to the suggested value.

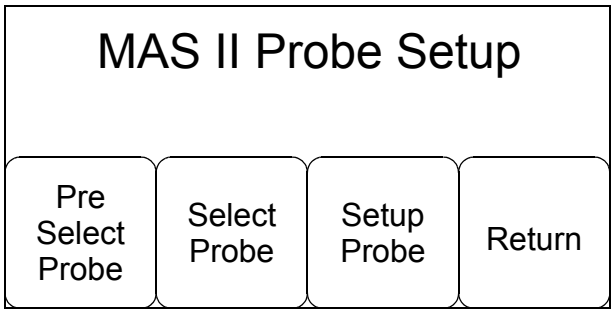
Probe Setup 7

Introduction 7.1

To use the MAS II unit, the user must first adjust a view settings according to the spectrometer equipment. These are settings based on the available probes and the magnet system.

To select and setup your probes for the MAS II unit you have to touch the key Set-up Probe in the main selection menu. The following screen will appear:

Figure 7.1. Setup Probe Display



Preselect Probe 7.2

As a first step all available probes must be selected from a list. This list contains all Bruker probe families, independent of the spectrometer frequency and the magnet type. It is a description of the probe stator assembly.

After pressing the key Pre Select Probe the following display will appear:

Figure 7.2. Preselect Probe Display - Page 1

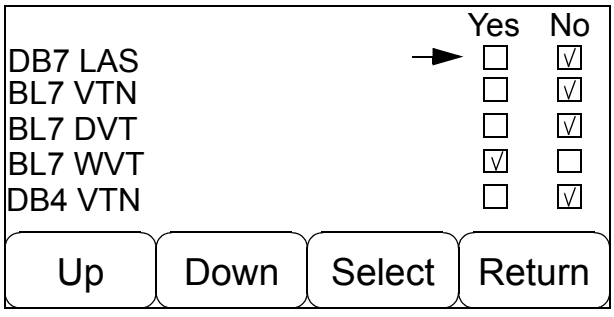


Figure 7.3. Preselect Probe Display - Page 2

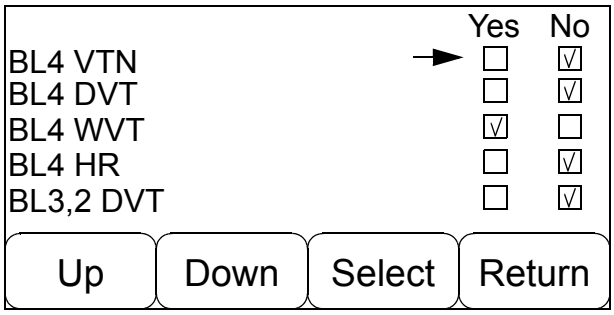
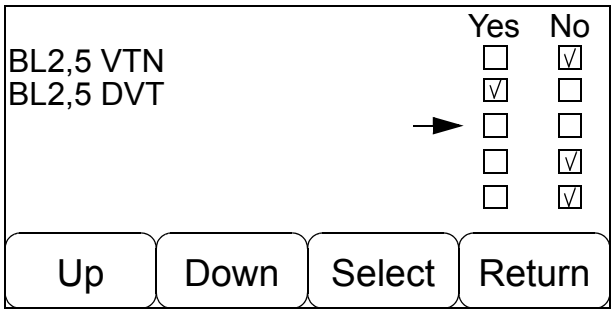


Figure 7.4. Preselect Probe Display - Page3



Use the keys Up or Down to move the cursor to the position of the first available probe, then press Select to mark this probe as selected. If the last position of a page is reached, then press the Down key to switch to the next available page. Press the Up key to scroll to the beginning of the list.

An incorrectly selected probe can be deselected by pressing the Select key a second time.

Using this function you should now select all available probes. There is a maximum of 10 possible selections allowed. All selected probes can be stored in an EEPROM, to be available even after power off.

In the above example the following probes are selected:

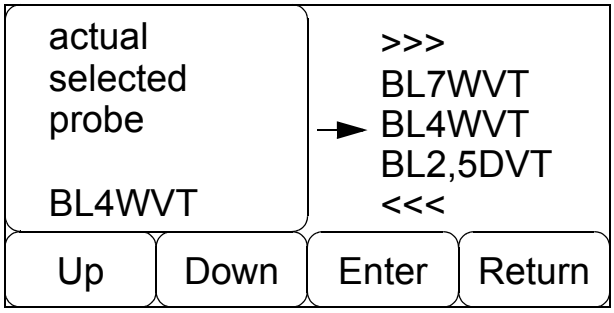
BL7WVT, BL4WVT and BL2,5DVT

Normally the Preselect Probe only has to be carried out after changing the MAS II unit to another spectrometer, or after adding a new probe.

Select Probe *7.3*

As a second step you have to select the actual probe to be used from the list as done in step 1. Press the key Select Probe in the menu Probe Setup. The following display will appear:

Figure 7.5. Select Probe Display



In the above display you will see all the probes which have been selected in step 1 - Preselect Probe. The probe that is currently will be shown in the left window. To change this selection, use the Up or Down key to move to another probe, then select this probe with the Enter key. The window with the currently selected probe then will be updated. There is only one selection possible.

This setup will also be stored in memory and will be available after a power off - power on.

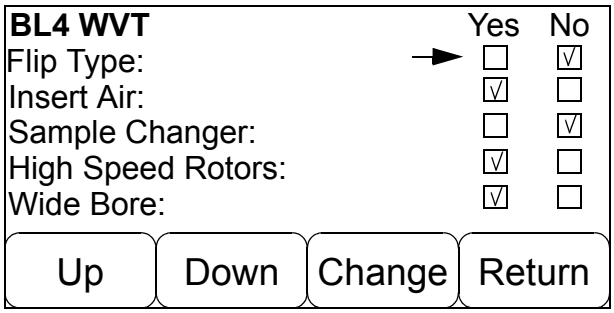
The next step is to configure the current probe based on your spectrometer equipment.

Setup Probe 7.4

Every probe has a properties view which has to be configured so that the MAS II unit can control this probe correctly. This includes information about the probe stator mechanics, the magnet type used and the materials used for the rotor.

These properties must now be configured for the probe which was selected in step 2. To do this press the key Setup Probe from the Probe Setup menu, whereas the following display will appear:

Figure 7.6. Setup Probe Display Page 1- Example for BL4 WVT probe



You must now navigate using the Up / Down keys and select the properties for the selected probe using the Change key. If you are not sure of the properties for your probe please refer to the probe manual.

Setup Options Page 1 7.4.1

Flip Type

Some probes mechanically till the Stator between the Magic Angle position and the Vertical position. To switch between these two positions pressurized gas is used. The MAS II unit must know if the outputs Magic Angle and Vertical must be controlled for ejecting or inserting a rotor.

Insert Air

The insert air usage is different from probe to probe. Some probes need this air pressure to insert the rotor securely into the stator. In most cases these are probes for wide bore magnets. Probes for standard bore magnets normally do not need this air pressure. If your probe is equipped with the input Insert then you typically should select this property.

Sample Changer

If you are using a MAS Sample changer then you must select this property. If not selected, control of the Sample changer will not be correct.

High Speed Rotors

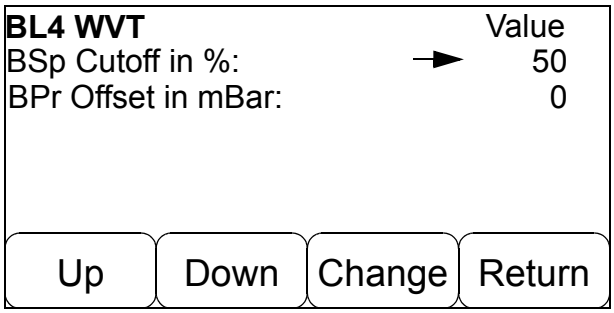
If you are using high speed rotors, then you must select this property, as the higher speeds are only available when this property is selected.

Wide Bore

The MAS II unit must know about the type of magnetsystem used. The Bearing pressure is different depending on that setting. Probes for standard bore magnets have to use a slightly higher Bearing pressure.

Pressing the Down key a second time, brings you to page 2 of the Setup Probe Menu. On page 2 you can move to the position to change, when you press the key Change a data input window will appear, where you can input the desired value for this property.

Figure 7.7. Setup Probe Display Page 2- Example for BL4 WVT probe



Setup Options Page2 *7.4.2*

BSp Cutoff

This property is the threshold for the Bearing Sense value which is necessary to run the rotor safely. The default for this property is 50%. This means that the Bearing Sense pressure must always be higher than 50% of the Bearing pressure. If during a rotation the Bearing Sense pressure sinks below this 50% value, then the rotation will be stopped, removing the Drive pressure.

Always use this function with caution. If, for example you enter the threshold value 0%, then a rotation can not be stopped even if there is insufficient Bearing pressure available. This can damage your rotor and/or the stator assembly of your probe.

BPr Offset

Using this function you can slightly change the Bearing pressure which the MAS II unit is calculating for your probe. There are probes which will rotate much better if the Bearing pressure is a little lower than the normal calculated value for the se-

lected probe. In this case the Bearing pressure can be decreased by a max. of 250 mBar.

The Bearing pressuer can also be increase for very heavy rotors which need this.

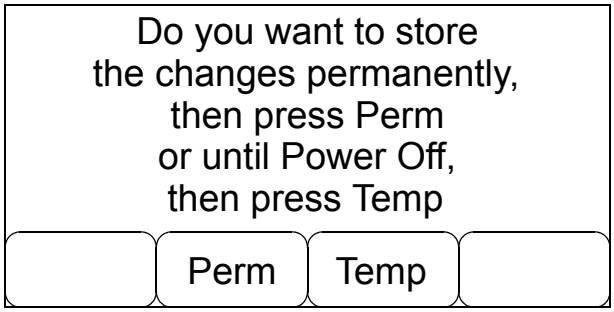
All selected or changed properties are stored for the specific probe which is shown in the status line of the display, and which were selected using the function Select Probe.

Storing the Probe Setup *7.5*

All adjustments done during the Probe Setup can be stored permanently, and are available even if you have used another probe or if you have switched off the MAS II unit. The adjustments for a probe are only lost if you are deleting it from the probe list using the Preselect Probe function.

If you are leaving the Probe Setup menu and you have made changes in the Preselect Probe menu or in the Setup Probe menu you will see a storage confirmation message:

Figure 7.8. Data Storage Confirmation Message



If you press the Perm key all the data you have changed will be saved to an EE-Prom, and will be available for future sessions, even if you have switched off the MAS II unit.
Storing the data needs a little time, therefore a storing message will be displayed during this step.

If you press the Temp key the Data is only stored until you switch of the MAS II unit. This can be used if you just want to try a special setting and you are not sure if you want to use this as the final setting.

Unit Setup

8

Introduction 8.1

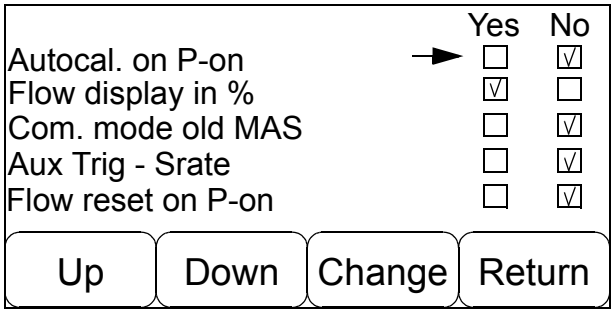
After setting up the probes you now have to configure some MAS II specific settings. These settings are necessary for optimal operation of the MAS II unit.

Press the key Unit Setup from the main selection menu. The submenu MAS II Unit Setup will appear where you must select the key Change Setup.

Change Setup 8.2

As a first step you must configure the page 1 settings.

Figure 8.1. Change Setup - Page 1



Setup Options - Page 1 8.2.1

Autocal. on P-on

If you select this option every time you power on the MAS II unit an auto calibration cycle for the pressure sensors will be performed. This, for example, may be necessary if the stored pressure sensor calibration values are corrupt.

This function is not implemented in the actual firmware version 031216. If it is necessary to auto calibrate the MAS II unit, you have to do it manually using the System Functs. menu.

Flow Display in %

You can select whether to display the flow settings for the outputs Insert, Eject and Frame Cooling as a percentage or as a position counter of the stepper motors controlling the flow outputs (steps from 0 - 650). See also ***"Flow Control" on***

page 45.
Generally the percentage display is most often used.

Com Mode old MAS

If you are using the RS232 connection you can select whether the MAS II unit should use a compatible mode to the old MAS unit (H2620) for communication to the spectrometer.
This setting is necessary if you want to use X-WIN NMR 3.5 or older.

Aux Trig - Srate

Selecting this property enables a special mode for the Aux-Trig output. The signal Aux-Trig is then used to tell the spectrometer if the actual spinning rate is inside the selected Spin Lock window or not.

This function is not yet implemented in the actual firmware version 031216!

Flow Reset on P-On

If you select this property the MAS II unit performs a new initialization of the flow setting for the outputs Insert, Eject and Frame Cooling every time you power on the MAS II unit. That means that the setting you have used during the last session is renewed.

Normally, this selection is not necessary, because during power off the flow setting can not be changed, and therefore is still available after power on. It is only used when a reset of this setting into a defined state is necessary after a repair or transportation over a long distance.

Setup Options - Page 2 *8.2.2*

Spin Lock Tol.

You can change the size of the Spin Lock window in the range of ±1Hz to ±100 Hz. The size of the Spin Lock window defines the starting point of data acquisition, if the MAS II unit is used in automation from the spectrometer. If the spinning rate enters the Spin Lock window the NMR data acquisition will start.
These settings also influence the function Aux.Trig - Srate (see ***"Aux Trig - Srate" on page 40***.

Insert time

This setting determines how long the Insert function will operate if you are using the MAS II unit in local auto mode.

Eject time

This setting determines how long the Eject function will operate if you are using the MAS II unit in local auto mode.

Standby time

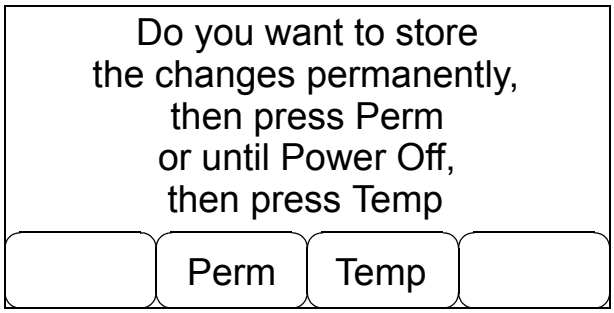
With this setting you can select how long the MAS II unit will operate with the selected spinning rate in case of a power outage. After the standby time the experiment that was running will be stopped.

Storing the MAS II Settings *8.2.3*

All settings you have modified during the Change Setup can be stored permanently to have these settings available after every power on.

If you leave the Change Setup menu and have made any changes you will see a display mask which asks for the storing mode.

Figure 8.2. Store Display Mask



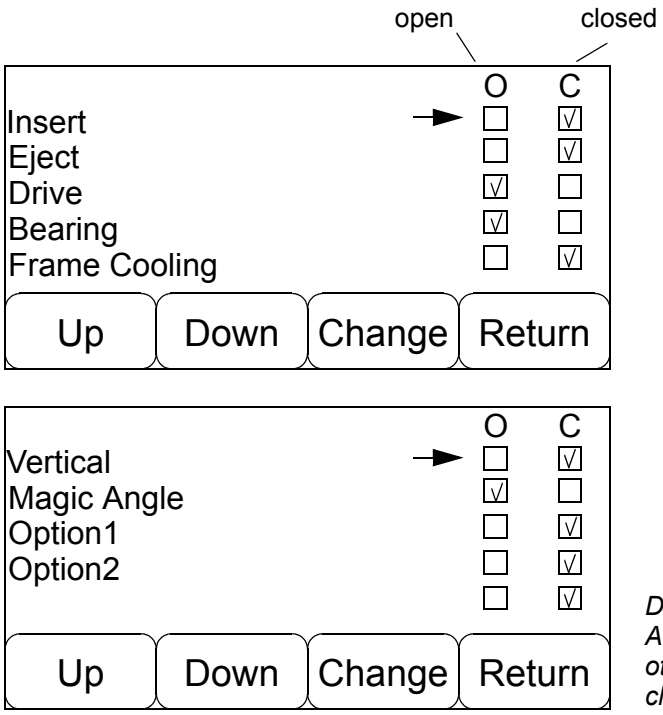
If you press the Perm key all the data you have changed will be saved to an EEProm, and will be available even if you have switched off the MAS II unit.
Storing the data takes time, therefore a storing message will be displayed during the data storing process.

If you press the Temp key the data is only stored until you switch off the MAS II unit. This may be used if you want to test a special setting and you are not sure if you want to save this as the final setting.

Valve Setup *8.3*

This function can be accessed from the MAS II Unit Setup menu and can be used to control the settings of all valves for the MAS II unit.

Figure 8.3. Valve Setup Display - Page1 and Page2



Drive, Bearing and Magic Angle are opened. All other valves are closed.

Use the valve functions only if you are sure that a change in the valve settings will not destroy your probe. Opening the Eject valve or closing the Bearing valve while rotating a spinner will cause severe damage to the probe stator assembly.
If you are not sure if it is possible to use these functions, then use the auto or manual mode display to Insert or Eject.

Use the keys Up or Down to select the valve you want to open or close, and then use the Change key to change the setting of this valve.

Insert

This pressure output inserts the rotor into the probe assembly. Non flip-type probes need the insert air, because there is a curve in the transfer line which the rotor cannot move through the line without air pressure.

Eject

This pressure output ejects the MAS rotor from the stator. The flow has to be adjusted so that the rotor moves to the end of the transfer system until it just touches it.

Drive

This is the output valve for the Drive pressure.
Do not close this valve if the rotor is rotating faster then 1000 Hz.

Bearing

This is the output valve for the Bearing pressure.
Do not close this valve if the rotor is rotating faster then 100 Hz.

Frame Cooling

This is the output valve for the Frame Cooling output. It is used to cool the whole probe assembly but cannot be used as a port for deep temperature experiments.

Vertical

This output is used to control the flip mechanic of a flip-type probe. If this output is opened and the output Magic Angle is closed, then the stator is in the Vertical position Vertical and an Insert or Eject can be performed.

Don’t change the setting if the spinning rate is > 100 Hz.

Magic Angle

This output is also used to control the flip mechanic of a flip-type probe. If this output is opened and the Vertical output is closed, then the stator is in the Magic Angle position and the NMR experiment can be started.

Don’t change the setting if the spinning rate is > 100 Hz.

Option1

This output is reserved for future use.

Option2

This output is reserved for future use.

Flow Setup

9

Introduction 9.1

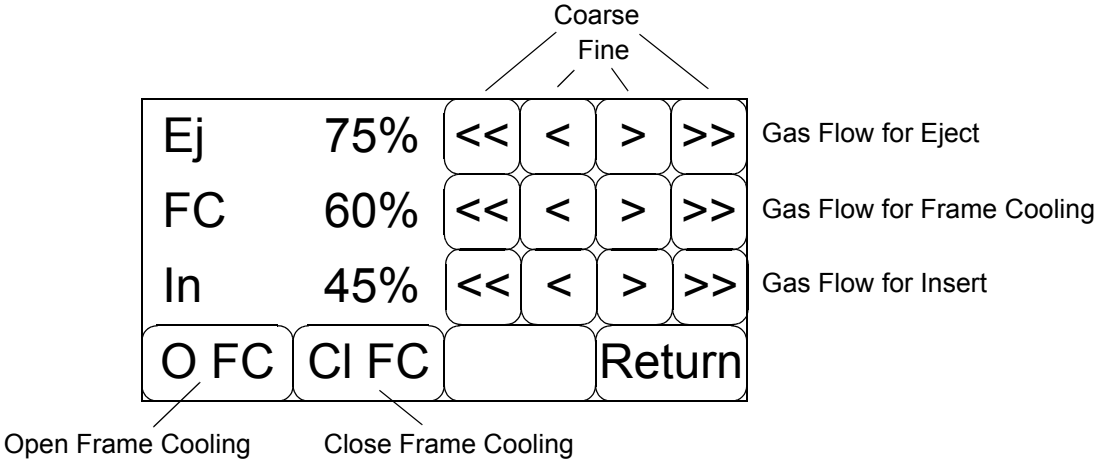
Using this setup you can control gas flow through the outputs Insert, Eject and Frame Cooling.

The gas flow is changed through the use three small stepmotors, which change the width of the outputs. You will typically hear a stepmotor sound when you are changing the setting of one of the outputs. Changing the setup is only allowed inside the adjustment range. Sensors have been built in to ensure that the setting remain in this range.

Flow Control 9.2

To change the gas flow for an output, press the key Flow Contrl from the main selection menu. The following display then will appear:

Figure 9.1. Flow Control Display



Using the arrow keys you can change the airflow of the selected channel in the range from 0 to 100%. For fine tuning please use the single arrow key.

Alternatively, the flow setting can be displayed with the position counter of the stepmotors controlling the output flow (see also ***"Flow Display in %" on page 39***). But consider that the smallest gas flow (0%) will be displayed with the highest value of stepmotor position (650), and vice versa, the highest gas flow (100%) with the smallest value of step positions (0).

Additionally, you can find a key to open (key O FC) or close (key Cl FC) the Frame Cooling output.

Please use the functions supplied in the auto or manual mode to open or close the Insert and Eject valves.

Description of the Flow outputs 9.2.1

Eject 9.2.2

The required gas flow for the Eject output depends on the kind of probe, the kind of rotor and the substance, that the rotors filled with. To achieve good operation the gas flow for eject must be tuned.

The setting for the Eject gas flow must be increased if the gas flow is not sufficient to eject the rotor to the eject position of the transfer system. Likewise the setting must be decreased if the gas flow is too high, whereas the rotor is hitting the upper end of the transfer system, which may cause it to be damaged.

Insert 9.2.3

The Insert is the gas flow for inserting the rotor into the stator assembly. The gas flow required for your system must be adjusted.

If the rotor does not insert correctly with the first Insert cycle, often this problem will be corrected after running 2 or 3 Insert/Eject cycles.

Frame Cooling 9.2.4

Frame Cooling is needed to cool down the probe. The setting is dependent on the operator and/or the NMR experiment.

Using Local Mode 10

Introduction 10.1

If you are operating the MAS II unit using the front panel you are using the local mode. All settings and commands are done using the touch display.

There are two different ways to use the MAS II unit in local mode, the

"Automatic Mode" and the ***"Manual Mode"*.**

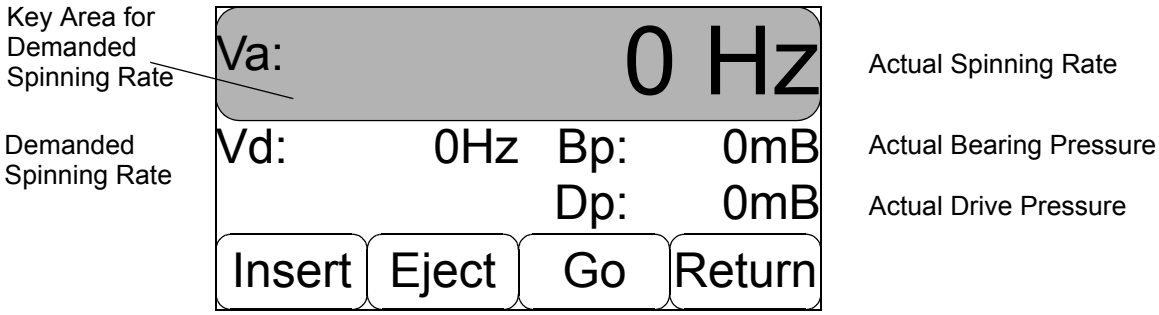
Automatic Mode 10.2

In the automatic mode the required spinning rate will be automatically reached and stabilized.

The key functions for some keys are changing during operation in the automatic mode.

1. The Insert key will be changed to a Manu key if the spinning rate is > 0 Hz.
2. The Eject key will be changed to a Stop key if the spinning rate is > 0 Hz.

Figure 10.1. Automatic Mode Display - Srate = 0 Hz



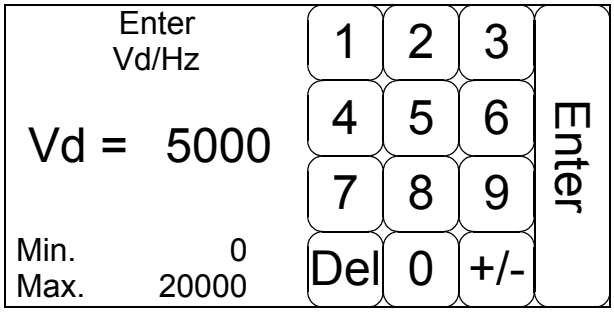
Demanded Spinning Rate 10.2.1

To work in automatic mode the MAS II unit must know the demanded spinning rate. This is the spinning rate in which the rotor should rotate for the NMR experiment.

To enter a new demanded spinning rate please touch the display area which is greyed in ***Figure 10.1.***. A new display mask will be shown where you can enter a new demanded spinning rate.

Please use the number keys to enter a demanded spinning rate. Press the Enter key to accept the new value, and to return to the automatic mode, or use the Del key to delete the last entrance or use the Esc key to quit without entering a new value.

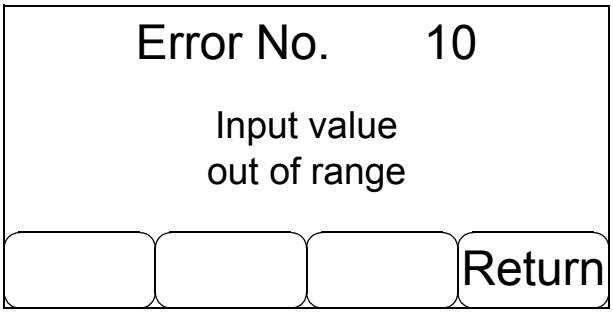
Figure 10.2. Data Input Display for Demanded Spinning Rate with Vd = 5000 Hz



If you are using the Del key as in example ***Figure 10.2.*** the input value 5000 will change to 500, then to 50, then to 5 and then to the value 0 Hz. At the same time the function of the key Del will change to Esc. If you press Esc you will leave the data input display without entering a new value. You can also type in another new value.

The minimum and maximum values that are allowed for the data input are displayed in the lower left region of the display. These values are dependent on the selected probe and may differ from the example shown.
When the new value is not inside the allowed range, then an error message will appear the moment you hit the Enter key.

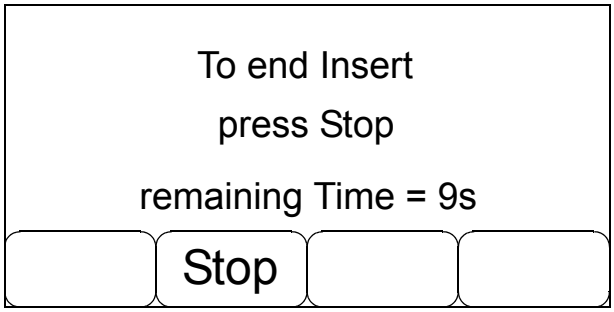
Figure 10.3. Error Message for an Incorrect Input Value



Insert *10.2.2*

The next step is to insert the rotor you want to use into the probe stator. Place the rotor into the transfer system and then press the Insert key. The following display will appear:

Figure 10.4. Insert Display in Automatic Mode



You can abort the Insert function by pressing the Stop key at any time, or you can wait until the automatic timer ends the insert function. In both cases you will return to the automatic mode display. You can change the insert time to meet your requirements using the function Change Setup in the MAS II Unit Setup menu (see also ***"Insert time" on page 40***).

The key Insert is only available if the spinning rate is 0 Hz or if the outputs Bearing and Drive are both 0 mBars.

If you are using a flip-type probe, or if you are not sure if there is still a rotor in the stator, you should perform an eject function before inserting a new rotor. In the case of a flip-type probe this brings the stator in the Vertical position to enable inserting of a rotor.

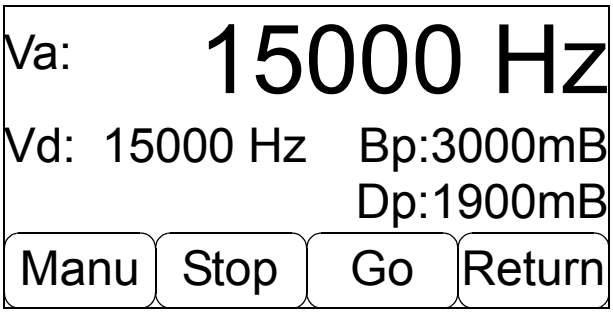
When using a probe with flip type mechanics, control of the valves Vertical and Magic Angle will be done automatically if you have selected the setup for a flip type probe in the Setup Probe menu (see also ***"Flip Type" on page 36***).

Go *10.2.3*

The rotation of the rotor will be started after pressing the key Go . The MAS II unit performs a start procedure optimized for your probe to bring the rotor up to speed. The spinning rate will then be stabilized at the demanded spinning rate.

After pressing the Go key the key Insert will change to Manu and the key Eject will change to Stop.

Figure 10.5. Automatic Mode Display After Confirming the Go Key



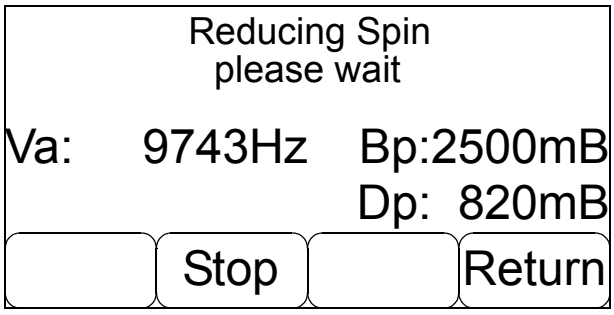
While in the regulation mode you can change the demanded Spinning rate at any time using the ***"Demanded Spinning Rate"*** function.

You can switch to manual mode whenever you want using the key Manu, and likewise you can stop the rotation using the key Stop.

Stop *10.2.4*

This key function will stop the spinning of the rotor. After pressing the key the Stop program will begin, whereas the Stop Display mask will be displayed until the Stop program is finished.

Figure 10.6. Stop Display in Automatic Mode



Please wait until the Stop function is finished, or press the Stop key to quit the Stop function, which will return you to the automatic mode display mask.

If you press the Return key, this will also end the Stop function, but will return to the main selection display mask.

When the rotation has stopped and the auto display is shown, the functions of the keys Manu and Stop will change back to the Insert and Eject key functions.

Now you can Eject and remove the rotor using the Eject key function.

Eject *10.2.5*

The Eject function ejects the rotor from the stator to be taken at the upper part of the transfer system, or into the MAS sample changer if one is used. The Eject function works similarily to the Insert function and can be aborted at any time using the Stop key. By default the eject time is 10 seconds, but this can be changed by using the function Change Setup in the MAS II Unit Setup menu (see also ***"Eject time" on page 40***).

The Magic Angle and Vertical valves will be controlled automatically for the Insert function if the property flip type is selected in the Probe Setup.

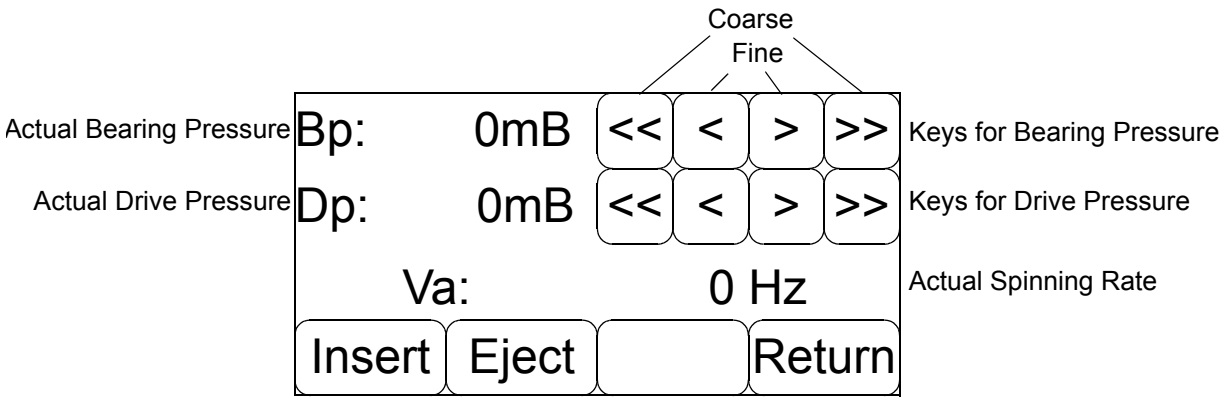
Manual Mode 10.3

You also can use the MAS II unit in manual mode. In comparison to the automatic mode you have to set the pressures for Bearing and Drive by yourself.

Please use this mode only if you are sure you know the pressures needed for Bearing and Drive for the spinning rate you want to rotate with your probe. A too low pressure at the Bearing output or a too high pressure at the Drive output can damage or destroy your rotor or the probe stator assembly.

After you have selected the manual mode the following display mask will appear:

Figure 10.7. Manual Mode Display



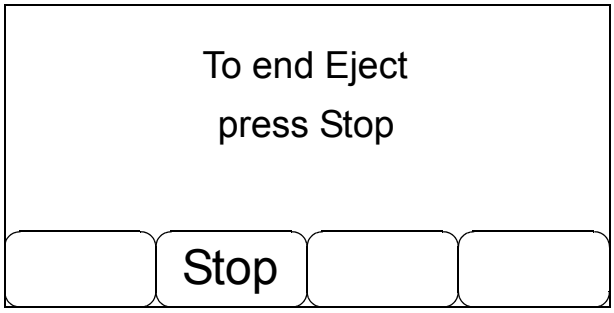
Insert 10.3.1

Using the Insert key you can insert the rotor into the stator as with the automatic mode. The difference is that the Insert valve remains open until you press the Stop key in the Insert display mask.

Eject *10.3.2*

This function ejects the rotor from the stator to be removed at the top of the transfersystem. The function continues until the Stop key is pressed.

Figure 10.8. Eject Display in Manual Mode



Bearing and Drive Setting *10.3.3*

Using the 4 arrow keys near the Bearing Pressure display you can change the Bearing pressure and likewise using the arrow keys near the Drive Pressure display you can change the Drive pressure.

<< This key decreases the pressure quickly (used for rough tuning)

< This key decreases the pressure slowly (used for fine tuning)

> This key increases the pressure slow

>> This key increases the pressure quickly

Using these keys you can change the pressures in the entire allowable range. But if the internal pressure MP2 is lower than 5 Bar this reduces the maximum available Bearing and Drive pressures to the value of MP2.

If you are increasing one of the output pressures the keys Insert and Eject will change into the keys Auto and Stop. Thus you can switch at any time from manual mode to automatic mode. This could be useful if you must start a probe manually but you want to use the automatic mode to stabilize the spinning rate after the rotor has started. In this case the actual spinning rate at the time you change to the automatic mode will be used as the new demanded spinning rate. You now can use this as your new demanded spinning rate or you can change it. But in both cases you must press the key Go to enable regulation of the spinning rate.

Additionally, you can change to the auto mode by first pressing the Return key and then the Auto key in the main selection menu. Unlike the previously described

method this will not use the actual spinning rate as a demanded spinning rate but rather the demanded spinning rate from the last automatic experiment will be used, whereas you don't have to enter in this spinning rate again.

Stop *10.3.4*

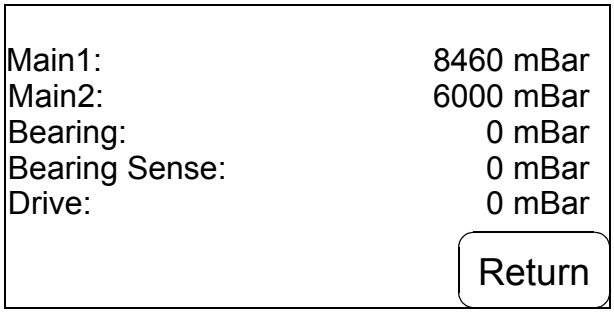
The Stop key in manual mode has exactly the same function as the Stop key in automatic mode as discussed in chapter ***10.2.4***.

Miscellaneous Functions 11

Pressure Display 11.1

If you want to check all the MAS II pressures you can use the key Press in the main selection menu. After pressing the key you will see the following display mask:

Figure 11.1. Pressure Display



The display values have the following meaning

Main1

Input pressure for the MAS II unit (max. allowed pressure is 12 Bar).

Main2

Internal pressure for the MAS II unit (after the pressure limiter):

Bearing

The Bearing output pressure.

Bearing Sense

The Bearing Sense input pressure.

Drive

The Drive output pressure.

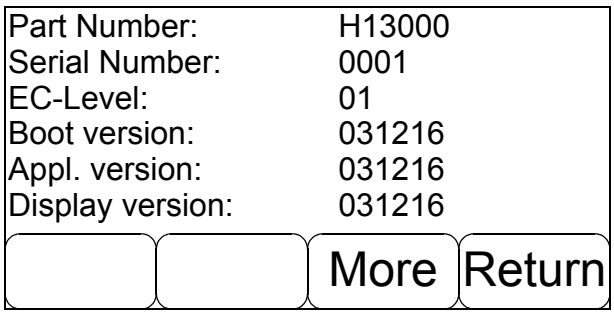
The Information (Info) Display *11.2*

Using this display mask you can obtain information about firmware and hardware versions for your MAS II unit. This data is necessary if you require support or service from Bruker for the MAS II unit.

There is a total of 6 pages of information available.
Using the More key you can toggle through all the available pages.

Page 1 gives you the information about the MAS II unit

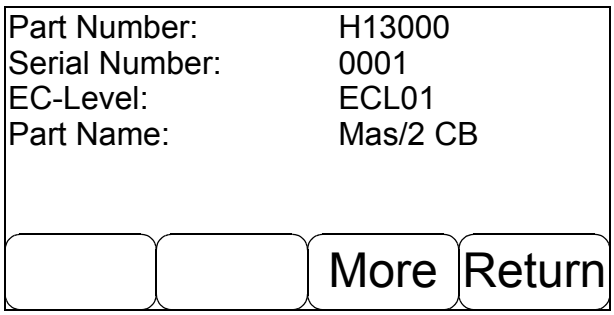
Figure 11.2. Information Display - Page 1 Unit Information



Pages 2 through 6 contain information about all subassemblies:

Page 2: Mas/2 Control Board
Page 3: Mas/2 Pressure Sensor Board
Page 4: Mas/2 Stepper Motor Connector Board
Page 5: Mas/2 Pneumatics
Page 6: Mas/2 Power Supply

Figure 11.3. Information Display - Page 2 - 6 Subassembly Information



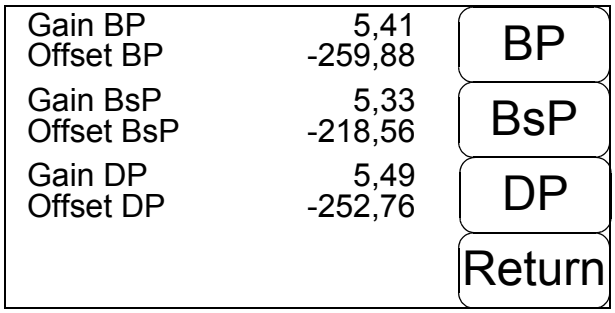
Auto Calibration *11.3*

This function is available using the key Auto Calib. from the MAS II System Functions menu.

Using this function you can automatically calibrate the pressure sensors for Bearing, Bearing Sense and Drive. Normally this function is not needed, however if the calibration data for the MAS II unit is corrupt, then you can automatically calibrate your MAS II unit for further work. A corrupt calibration data will be displayed using a message directly after power on of the unit.

The Auto calibration values are lost if you switch off the MAS II unit, so you will need to recalibrate the unit wehn you switch it on again.

Figure 11.4. Auto. Calibration

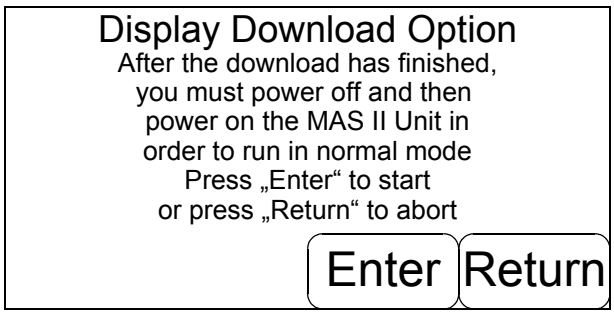


Press the key BP if you want to calibrate the Bearing sensor. Wait until both the Gain and Offset values are calculated befor proceeding with the other channels.

Display Download *11.4*

This function is only needed when a new firmware version requires a new display software. In this case you have to press the key Disp. Download from the MAS II System functions menu.

Figure 11.5. The Display Download Option



To start the Display Download press Enter, to cancel press the Return key.

After pressing Enter you have to start a special communications tool on your spectrometer computer, or any other PC connected to the RS232 Interface. This tool transfers the whole software to the Display. A progress bar will indicate the status of the download. After the download has finished the „MAS II Please wait“ screen will appear.

To activate the new software you will need to power off and then power on the MAS II unit after the display download has finished.

Problems and Troubleshooting 12

Introduction 12.1

While working with the MAS II Unit situations could occur which are not normal. In general this includes the following errors:

- Errors due to broken or improper adjusted hardware.
- Errors which occur during initialization of the system.
- Errors caused from improper handling.
- Errors caused by incorrect input data.
- Errors during normal operation, caused by external influences.

Any of these errors could lead to a malfunction of the operation. Please read the error or the message carefully, as very often the error text gives a clue to solving the problem.

Please consider the following safety warning.

Only skilled personel are allowed to open the MAS II Unit.
Please remove the mains cable before opening the unit, as there could be a dangerous voltage present even with the mains power switched off.

Hardware Problems *12.2*

The MAS II Unit cannot be switched on

- Check the mains cable and the wall outlet, including its fuse.
- Check the MAS II unit inputfuse (see ***"Main Fuse" on page 66***) or the internal fuse of the power supply (see also ***"Accumulator Fuse" on page 66***).
- Check if the accumulators for the Uninterruptible Power Supply (UPS) is connected correctly (see ***"Accumulators" on page 68***

Error during Power off

As the MAS II unit cannot differentiate between a power outage or a normal power off, the unit performs a few tests after the mains is removed. Some setup data are written to an EEProm during this step which will cause a small delay until the unit is switched off.

The MAS II unit cannot be switched off.

If there is no message on the display after switching of the mains switch and the unit will not switch off then there will be a hardware failure. In this case you can only switch off the unit using a display function (This feature is not yet implemented in firmware version 031612). Please contact Bruker service for more information.

Errors During Initialization *12.3*

Errors ocurring during the initialisation of the MAS II unit are shown as messages. Please see also ***"Messages" on page 21***

The following messages are currently defined:

M100 - Position sensor No.1 not detected

The position sensor for the stepper motor Eject could not be detected. Changing the gas flow for Eject therefore is not possible.

M101 - Position sensor No.2 not detected

The position sensor for the stepper motor Frame Cooling could not be detected. Changing the gas flow for Eject therefore is not possible.

M102 - Position sensor No.3 not detected

The position sensor for the stepper motor Insert could not be detected. Changing the gas flow for Eject therefore is not possible.

M103 - Checksum error on BIS of Pressure Sensor Board

The BIS Data (BIS = Bruker Information System) of the MAS II Pressure Sensor Board may be corrupt and are therefore not available. This has no immediate effect on your system. But it is not possible to read the stored information part number, serial numbers and EC-level of the Pressure Sensor Board.Ttherefore it is not possible to display this data using the Info function.

M104 - Checksum error on BIS of Control Board

Same Error as M103 but the BIS Data for the MAS II Control Board is affected.

M105 - Checksum error on BIS of Stepper Connector Board

Same Error as M103 but the BIS Data for the MAS II Stepper Connector Board is affected.

M106 - No BIS found on Pressure Sensor Board

The EEProm with the BIS Data of the MAS II Pressure Sensor Board can not be read, and therefore also the calibration data of the pressure sensors. The default data will be loaded, which is not optimal for your MAS II unit, but will allow you to continue working with the MAS II unit. But you should now use the function ***"Auto Calibration" on page 57*** to temporary calibrate your system.
In addition the information as described in M103 is not available.

M107 - No BIS found on Control Board

The EEProm with the BIS Data for the MAS II Control board can not be read, and thus the BIS data itself. See M104.

M108 - No BIS found on Stepper Connector Board

The EEProm with the BIS Data for the MAS II Stepper Connector Board can not be read. Therefore the stored calibration data for the flow outputs Eject, Insert, Frame Cooling can also not be read. It is not possible to change these outputs. To recalibrate these outputs please call Bruker Service.

M109 - CS error on SC Board flow control not possible

The stored calibration data for the flow outputs are corrupt (CS error = Checksum Error). It is not possible to initialize these outputs, and therefore to control these outputs anylonger. Please contact Bruker service.

M110 - CS error on SC Board flow out not initialized

The stored position data for the last setting of the flow outputs are corrupt (CS error = Checksum Error). It is not possible to initialize these outputs to the last used position. The flow setup therefore uses its reset value which is not optimized for your probe. You have to readjust the settings of the outputs Eject, Insert and Frame Cooling. Use the function Flow Control from the main selection menu (see also ***"Flow Control" on page 45***). While switching off the MAS II unit this data then will be written to the EEProm, and will be available at the next power on.

M111 - CS error on System Data Usersetup not loaded

The stored data of your MAS II unit setup are corrupt (CS error = Checksum Error). All information you have provided during the Setup Unit - Change Setup (***"Change Setup" on page 39***) therefore could not be loaded. You can enter this data again and then store. At the next power on this message should no longer be displayed any more. If the message still appears, please contact for Bruker service.

M112 - CS error on Probe Data Probeconfig. not loaded

The stored data of your probe setup is corrupt (CS error = Checksum Error). All information you have provided during the Probe Setup - Preselect Probe ***"Preselect Probe" on page 33*** and Probe Setup - Setup Probe ***"Setup Probe" on page 36*** therefor could not be loaded. You have to configure and store your probe setup again before you can work with your MAS II unit.
At the next power on this data should load. If the same message appears again, the EEProm for this data is defective and should be replaced. Please contact Bruker service.

M114 - Last reset was a Watchdog reset

The MAS II Unit has performed a Watchdog reset because of a firmware malfunction.
There is no risk for your probe and/or your rotor, as this kind of reset does not switch the valves Bearing, Drive or Magic Angle, and does not change any output-pressures. You can use the MAS II unit as before, but please consider that a rotor which rotated before the reset still rotates but with a not running regulation. Before switching off the MAS II unit you should therefore use the function Stop and Eject if you want to eject the rotor.

Errors During Normal Use *12.4*

E1 - Autostart failed use manual mode

The autostart has been stopped, as the rotor was not able to reach a certain frequency. Please use the manual mode or try to refill the rotor and then using auto mode again.

E2 - Eject not allowed while rotation

You have tried to eject the rotor while it was still rotating. This is only allowed if the frequency is smaller the 100 Hz.

E3 - Insert not allowed while rotation

You have tried to insert a new rotor when there was probably a rotor loaded into the stator. Please stop this rotor first and eject it before you insert the new rotor.

E4 - Drive max. reached use manual mode

The maximum available drive pressure was reached.

E5 - Bearing max. reached use manual mode

The maximum available bearing pressure was reached.

E10 - Inputvalue out of limits

You tried to enter an invalid value. The allowed data range is shown on the lower left side of the data input display. (Min. shows the smallest allowed value and max the highest allowed value).

E11 - Maximum numbers of probes reached

The maximum number of stored probe configurations has been reached. To enter new probes to the list, you must first delete some older probes from the list (see also ***"Preselect Probe" on page 33***).

E12 - No Probe preselected first use Preselect Probe

You have not selected your probes from the list of available probes. Please use the function Preselect Probe from the menu MAS II Probe Setup (***"Preselect Probe" on page 33***).

E13 - No Probe configured first use Probe Setup

You have not selected or configured a probe to use. To select a probe use the function Select Probe (***"Select Probe" on page 35***). To change the probe setup use the function Setup Probe (***"Setup Probe" on page 36***) from the menu MAS II Probe Setup.

E30 - Mains Power failure Abort to shut down

The mains power has been disconnected. The MAS II unit now will be charged from the built-in accumulators. If there is still an experiment running, the unit will wait until the standby time (***"Standby time" on page 40***) has been reached. Then the unit will stop the rotor and shut down. If you want to stop during the standby time use the key Abort.

E31 - No Bearingsensepressure reducing Drivepressure

The pressure at the Bearing Sense Input is below the threshold value. This threshold value has been selected during the probe setup. This threshold value shows the relation between the bearing output pressure and the bearing sense input pressure in percent. The default is 50%. To change this threshold value please see also ***"BSp Cutoff" on page 37***.

The following reasons could have caused this error message:

- The tube for Bearing Sense is not connected properly.
- There is a leakage at the tubes for Bearing and/or Bearing Sense between the MAS II unit and the probe.
- There is a leakage inside the probe. This could happen for older probes.
- The outputs for Bearing and Drive can be interchanged at the MAS II unit or the probe.

If you cannot find one of the above errors, you can reduce the threshold value. But always bear in mind to maintain safe conditions for your probe.

E32 - No Mainpressure abort Regulation

The MAS II internal pressure has dropped below 4 Bar, whereas the regulation of rotation has been stopped. The outputs Bearing and Drive hold the last selected pressure.

Please check your pressure facility.

E33 - No Spin detected regulation aborted

While rotating the spinning rate signal could no longer be detected, thus the regulation of the spinning rate has been stopped. The rotor now rotates based on the last setting. This enables the NMR experiment to be completed without speed feedback.

The following reasons could have caused this error:

- The spinning rate cable Z4045 is not connected correctly or is broken.
- The colormark at the rotor is no longer sufficient.
- The spinning rate sensor at the probe is not working correctly.

The following reasons could also cause this error message:

- There is no rotor loaded inside the probe stator.
- The rotor and/or the rotor cap have been destroyed.

E33 - Accu voltage below limit shut down system

The output voltage of the accumulators is below the limit value. The standby time therefore will be aborted, the running rotor will be stopped and the MAS II unit switched off.

E33 - No Mainpressure

You tried to start a rotor without main pressure. The minimum allowed main pressure is 4 Bar.

E113 - Operation not allowed flow control not possible

Changing the flow setting for this output is not possible. Try to restart the MAS II unit and change this flow setting. If not possible please contact for Bruker service.

E200 - This start program is not yet implemented

The selected start program is not yet available.

Fuses 12.5

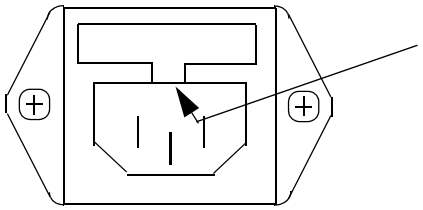
If the MAS II unit can not be switched on, a fuse could be blown.

Main Fuse 12.5.1

There are 2 input fuses at the 230 V AC mains inlet of the MAS II unit.
As a replacement use only fuses of the type 5x20mm for a maximal current of 800 mA of the type slow blow.

To change the fuses, remove the mains connector from the MAS II unit and then open the fuse holder on the rear side of the unit.

Figure 12.1. Fuse Holder Main Fuse



Use a screwdriver to withdraw the fuse holder at this position.

Change the blown fuses and move the fuse holder to its initial position.

The Bruker part number for this fuse is 2250
The description of this fuse is: SICH FEIN 5X20MM 0.8A T.

Accumulator Fuse 12.5.2

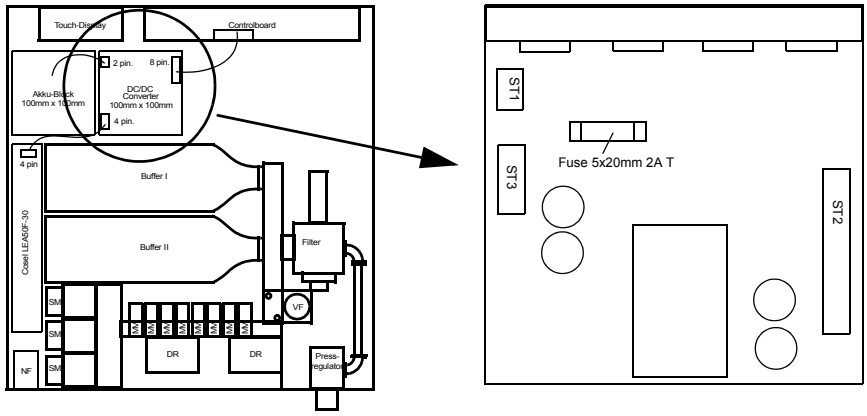
Inside the MAS II unit there is an additional fuse to protect the accumulator.

To change this fuse you first have to remove the mains connector from the MAS II unit, then open the upper case cover. The position of the fuse is shown in the ***Figure 12.2.***

You need a fuse type 5x20mm for a current of 2 A with characteristic slow blow.
The Bruker part number for this fuse is 2254
The description for this fuse is SICH FEIN 5X20MM 2.0A T.

Before changing the fuse you have to disconnect the cable from the ST1 connector. After replacing the fuse you must reconnect this connector.

Figure 12.2. Position of the Accumulator Fuse



Always remove the mains cable before carrying out any maintenance!
Line voltage is present even with the mains switch in the “off“ position.

Accumulators *12.6*

To avoid any rotor and/or probe damage in case of a power outage, the MAS II unit is equipped with an uninterruptible power supply (UPS). This power supply uses 2 lead acid accumulators each with a voltage of 12 V and a power of 1,2 Ah. These accumulators have a very long life. It is possible however, that the accumulators weaken over time.

To ensure safe operation of the MAS II unit, weak accumulators must be replaced.

To exchange use only the part number: 86594. The description for this part number is AKKU BLEIGEL 12V 1.2AH.

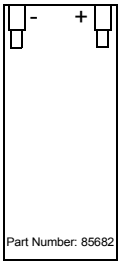
You always will need to replace both accumulators. Never replace only one of the accumulators.

To replace the accumulators remove the power cable from the MAS II unit. Then open the top cover.

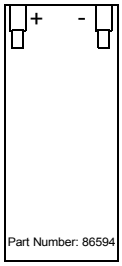
Always remove the mains cable before carrying out any maintenance!
Line voltage is present even with the mains switch in the "off" position!

Attention: There are two different types of accumulators, which differ in the polarization of the connecting terminals.

Part number: 85682

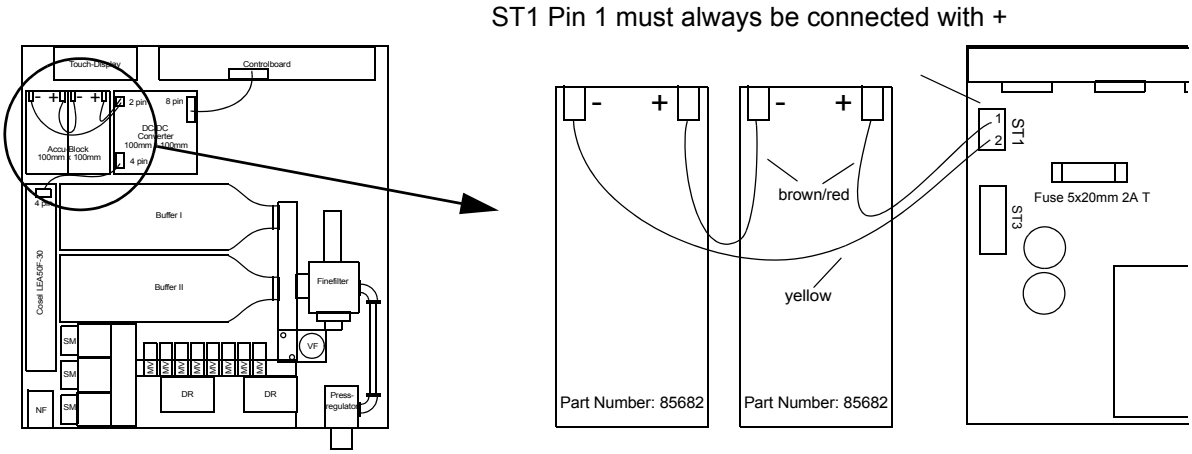


Part number: 86594



Please identify your type of accumulator and replace it accordingly to the following figure.

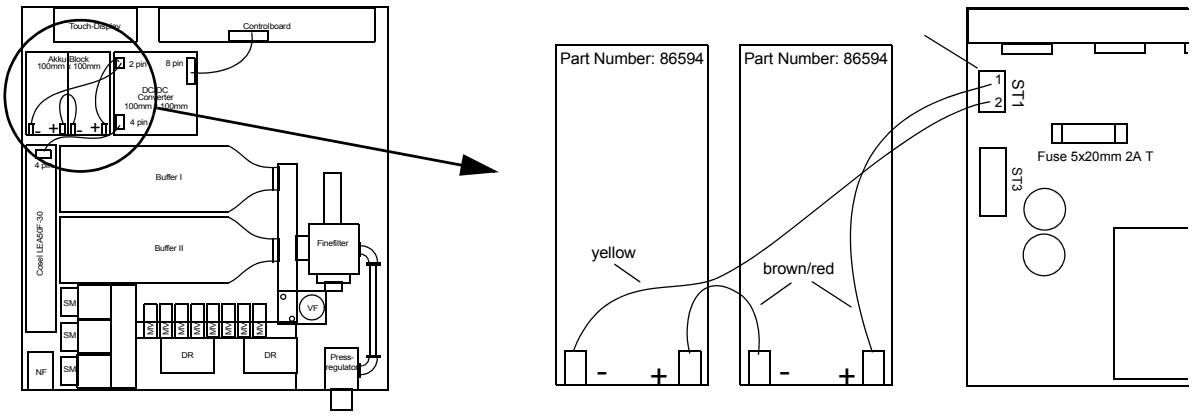
Figure 12.3. Connection of the accumulator with part number 85682



Top view with open case

This layout is only valid for accumulators with the part number 85682!

Figure 12.4. Connection of the accumulator with the part number 86594



Top view with open case

This layout is only valid for accumulators with the part number 86594!

You can replace accumulators of the part number 85682 with accumulators of the part number 86594 and vice versa. You then have to replace the accumulators according to the figure, and reconnect the cable based on the appropriate figure of the accumulator type (***Figure 12.3.*** for part number 85682 and ***Figure 12.4.*** for part number 86594).

Newly delivered accumulators are always type 86594.

Technical Data 13

Electrical Connections 13.1

RS232

Table 13.1. Connector RS232 9 Pin Mini-D Male

Pin No.	Pin Name
1	NC
2	RxD
3	TxD
4	DTR
5	GND
6	NC
7	RTS
8	CTS
9	NC

SPIN

Table 13.2. Connector Spin 3 Pin Male

Pin No.	Pin Name	Specification
1	Ground	-
2	+5 Volt	5 Volt Output max. 175 mA[a]
3	Srate Input	470 Ohm Input Impedance

a. Pin 2 Connector Spin and Pin 1 Connector Aux together max 175mA

AUX

Table 13.3. Connector Aux 5 Pin Male

Pin No.	Pin Name	Specification
1	+ 5 V	5 Volt Output max. 175 mA[a]
2	+ 24 V	24 Volt Output max. 100mA
3	In/Out1	TTL Input/Output
4	In/Out2	TTL Input/Output (Analog Out 0-5V/5mA)
5	Ground	-

a. Pin 2 Connector Spin and Pin 1 Connector Aux together max 175mA

TRIG

TTL Signal Output

AUX TRIG

TTL Signal Output

MONITOR

Analog Signal Output (Range 0 - 5 Volt, max 1mA)

Pneumatic Connections *13.2*

AIR IN max. 12 Bar

Input: A maximum of 12 Bar is allowed for this input.

BEARING OUT

Output: Can supply a maximum of 5 Bar with a flow of 100 nL/min. This output pressure is regulated.

VERTICAL

Output: Supplies the internal pressure set by the pressure regulator with a maximum flow of 25 nL/min (MP2 set to 6000 mBar).

MAGIC ANGLE

Output: Supplies the internal pressure set by the pressure regulator with a maximum flow of 25 nL/min (MP2 set to 6000 mBar).

OPTION 1

Output: Supplies the internal pressure set by the pressure regulator with a maximum flow of 25 nL/min (MP2 set to 6000 mBar).

OPTION 2

Output: Supplies the internal pressure set by the pressure regulator with a maximum flow of 25 nL/min (MP2 set to 6000 mBar).

BEARING SENSE

Input: A maximum of 10 Bars is allowed. This is an input for a pressure measurement. The measurement range is 0 to 5 Bars.

DRIVE OUT

Output: Can supply a maximum of 5 Bar with a flow of 100 nL/min. This output pressure is regulated.

INSERT

Output: Supplies the internal pressure set by the pressure regulator with a maximum flow of 125 nL/min (MP2 set to 6000 mBar). The flow can be regulated between the minimum and maximum.

FRAME COOLING

Output: Supplies the internal pressure set by the pressure regulator with a maximum flow of 125 nL/min (MP2 set to 6000 mBar). The flow can be regulated between the minimum and maximum.

EJECT

Output: Supplies the internal pressure set by the pressure regulator with a maximum flow of 125 nL/min (MP2 set to 6000 mBar). The flow can be regulated between the minimum and maximum.

Figures

Tables

Tables

Index

F

G

H

I

L

M

N

O

P

R

S

T

U

V

W