HLMU

Helium Level Measurement Unit

User Manual

Version 004

think forward

This manual was written by

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© February 25, 2010: Bruker Biospin GmbH

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DWG-Nr.: 1443004

For further technical assistance on the HLMU unit, please do not hesitate to contact your nearest BRUKER dealer or contact us directly at:

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1 Introduction

This manual is included with the delivery of the Helium Level Measurement Unit (HLMU). It provides instructions on how to install and connect the HLMU unit, as well as how to configure and operate the unit.

1.1 Intended Use

The HLMU is designed to measure the level of liquid helium and nitrogen (optional) in Bruker magnets independently of the BSMS.

The HLMU should always be installed in conjunction with an NMR magnet and is not for use in publicly-accessible areas.

The unit should only be used for its intended purpose as described here. Use of the unit for any purpose other than that for which it is intended is taken only at the users own risk and invalidates any and all manufacturer warranties.

1.2 Safety Issues

Please read the following information carefully, it provides important instructions on safety, usage and maintenance of the device.

- Never use the device if it is damaged in any way.
- Use the device only for the intended purpose.
- Check if the voltage indicated on the device corresponds to the local mains voltage before you connect the device.
- Always use a grounded wall socket.
- Keep the device and cables away from heat, moisture, sharp edges, etc.
- Do not use the device outdoors.
- Site the device in an open area to allow adequate ventilation.
- Always operate the device in a safe and dry place.
- The HLMU should only be operated by qualified personnel.
- Service or maintenance work on the unit must be carried out by qualified personnel.
- The HLMU may only be used with original manufacturer accessories
- The ambient temperature is defined by BRUKER (refer to the Avance site planning manual).
- Read this manual before operating the unit. Pay particular attention to any safety related information.

1.3 Important Information

- The HLMU measures the helium and nitrogen levels and triggers an alarm when one or both of the levels are below the designated level. However, the HLMU does not provide any capability for helium or nitrogen refilling. Helium or nitrogen refilling must be carried out separately by qualified personnel.

- The HLMU without a N2-option checks the time interval between two consecutive nitrogen refilling and activates a warning if the time exceeds a certain period. The nitrogen refilling itself must be performed by qualified personnel and then confirmed on the HLMU.

- The helium level, nitrogen level and nitrogen refill monitoring works only when the HLMU is on, the helium level sensor is properly calibrated, and the alarm limits and measuring currents are set correctly. The HLMU functionality must also be verified at a regular interval.

- Set the alarm limits carefully, preferably through consultation with the manufacturer. The helium and nitrogen alarm level must be set high enough so that service has enough time to refill the helium before a magnet quench occurs.

1.4 Safety Symbols Used in this Manual

⚠ **DANGER**

Type and source of the danger

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

▶ Countermeasure 1

▶ Countermeasure 2

▶ ...

⚠ **WARNING**

Type and source of the danger

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

▶ Countermeasure 1

▶ Countermeasure 2

▶ ...

> ⚠ **CAUTION**
>
> **Type and source of the danger**
>
> Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury or major material damage.
>
> ▶ Countermeasure 1
>
> ▶ Countermeasure 2
>
> ▶ ...

> *NOTICE*
>
> **Type and source of the danger**
>
> Hazard, which could result in material damage.
>
> ▶ Countermeasure 1
>
> ▶ Countermeasure 2
>
> ▶ ...

i References, which facilitate the work for the user.
Notes for the optimal use of the unit.

2 HLMU General Information

The HLMU is designed to measure the level of liquid helium and nitrogen in Bruker magnets independently of the BSMS. The HLMU can be controlled manually (with the help of buttons on the device), via a Web interface, or by the HLMU control software. This manual describes how to control the HLMU manually and with the Web interface. For instructions on how to control the device through software, refer to the HLMU software user manual.

2.1 Functional Characteristics

The functional characteristics of the HLMU unit include:

- Manual and automatic helium and nitrogen level measurement.

- Continuous helium level measurement during helium refilling.

- Continuous nitrogen level measurement during nitrogen refilling.

- Monitoring of nitrogen refilling (HLMU without N2-option).

- Quick and easy setting of the He-level probe type.

- The use of visual and acoustic alarms (low helium level, low nitrogen level or nitrogen refill period overrun).

- A history of the last measurements, nitrogen refills, alarms, and various other events.

- Magnet identification.

- A Web server for remote control and data acquisition via ethernet / internet.

2.2 Shipping List

The HLMU is delivered with the following components:

- HLMU unit
- Mains power cable
- Nitrogen level probe cable
- Helium level probe cable

Inspect the package for any missing parts before putting the HLMU into operation for the first time.

2.3   Overview of the HLMU

1.	**Display**	The display on the HLMU front panel shows the last measured helium and nitrogen level in standby mode.
2.	**LED Diodes**	Alarm (red): Blinks in the event of an alarm (low helium level, low nitrogen level or nitrogen refill period exceeded).
		Error (yellow): Blinks in the event of an error (e.g. probe not connected, probe incorrectly calibrated, etc.).
		Fill (yellow): When on it indicates that the HLMU is in "Fill Mode".
		Auto (green): When the LED is ON it indicates that the level auto measurement is on. When BLINKLING it indicates that a helium and nitrogen level measurement is being performed. When OFF it indicates that the level auto-measurement is off.
3.	**UP/DOWN Buttons**	Allow you to scroll up and down in the menu, submenus and lists. The buttons also allow you to change values, etc.
4.	**ENTER Button**	Opens the menu and submenus. Also allows you to select and start a function, confirm, or skip forwards.
5.	**CANCEL Button**	Backs up one level, clears the current value, skips backward, or returns to standby mode.
	In standby mode:	Press and hold the button to display the IP address and firmware version.

Figure 2.1   HLMU Front Panel
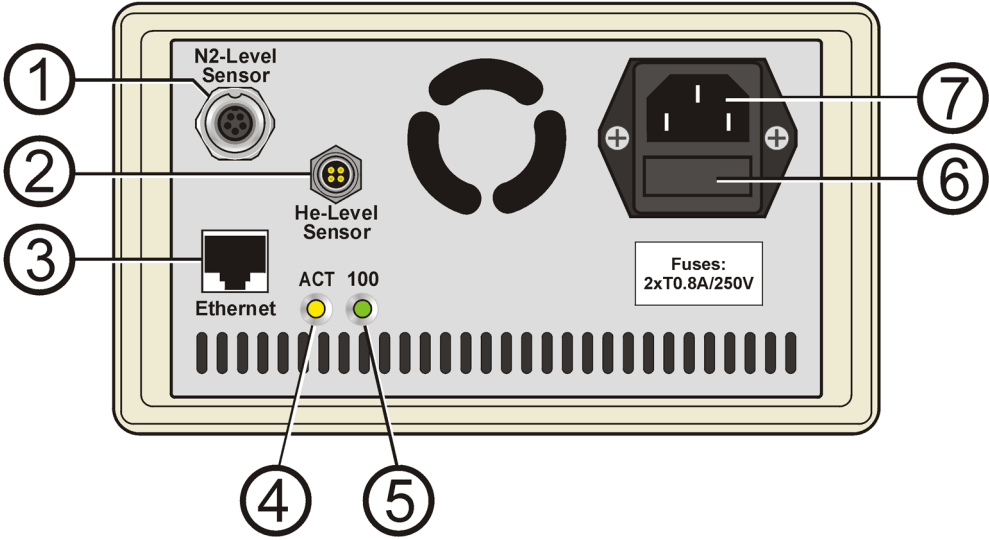
1.	Connection for the nitrogen level sensor.
2.	Connection for the helium level sensor.
3.	Connection for Ethernet, up to 100 MBit/s, RJ-45 connector.
4.	LED ACT: Indicates activity.
5.	LED 100: Indicates 100 MBit/s connection.
6.	Fuses.
7.	Connection for mains power cord.

Figure 2.2   HLMU Rear Panel - Cable Connections

2.4 General Operating Instructions

2.4.1 Standby Mode

The HLMU is in standby mode and is ready for use when the last measured helium and nitrogen level appear on the display.
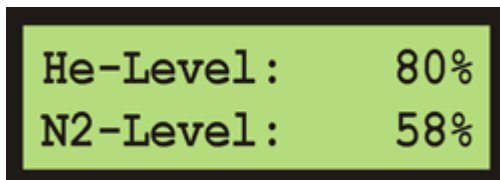
If an alarm occurs, the red LED **Alarm** blinks and the alarm message appears on the display in standby mode. For example:
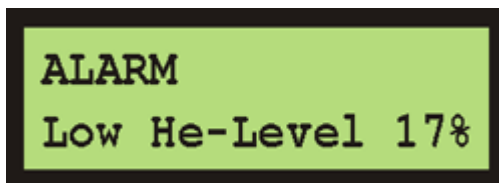
2.4.2 Menu Navigation

The menu allows you to easily access the many functions in the HLMU. These functions are arranged in menus and submenus.

In standby mode press the **Enter** button to access the menu.

Press the **Up/Down** buttons to scroll to the desired function or submenu, e.g. Settings.

Press the **Enter** button to select the function or submenu.

Press the **Cancel** button to return to the previous selection.

2.4.3   Security

Some functions and settings are protected by a 4-digit security code (PIN). The factory setting for the PIN is 0000.

PIN Control:

UP/DOWN buttons: Edit number

ENTER button: Next number, confirm

CANCEL button: Back
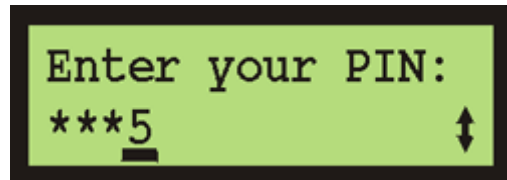
Change PIN: (see)

> **Keep the PIN in a safe place where you can access it again if required.**

Z31735_00_04

3 Preparation

3.1 HLMU Cable Connections

⚠️	**⚠ WARNING**
Material damage hazard from strong magnetic fields!
Strong magnetic fields may cause significant damage to the HLMU.
▶ The HLMU should be placed as far as possible outside of the 5 gauss line of the magnet stray field.

⚠️	**⚠ CAUTION**
Accident hazard from contact with hot or cold surfaces on the magnet turrets.
Contact with the hot or cold surfaces of the magnet turret may result in serious burns.
▶ Do not touch magnet turret parts.
▶ Be careful when connecting a cable to the helium level sensor connector on the helium turret and to the nitrogen level sensor on the nitrogen turret.
▶ Wear protective gloves when working in the magnet turret area.

Connect the cables in the following order, see Figure 3.1:

1. Connect the cable to helium fill-in port.

2. Connect the cable to nitrogen fill-in port (optional).

3. Connect the line cord (this switches the HLMU on).

4. If the device will be operated with an ethernet connection, first set all the network parameters (IP address, subnet mask and standard gateway) before you connect it to the ethernet. See "Initial Settings Via the Ethernet Connection" on page 19.

HLMU Rear Panel
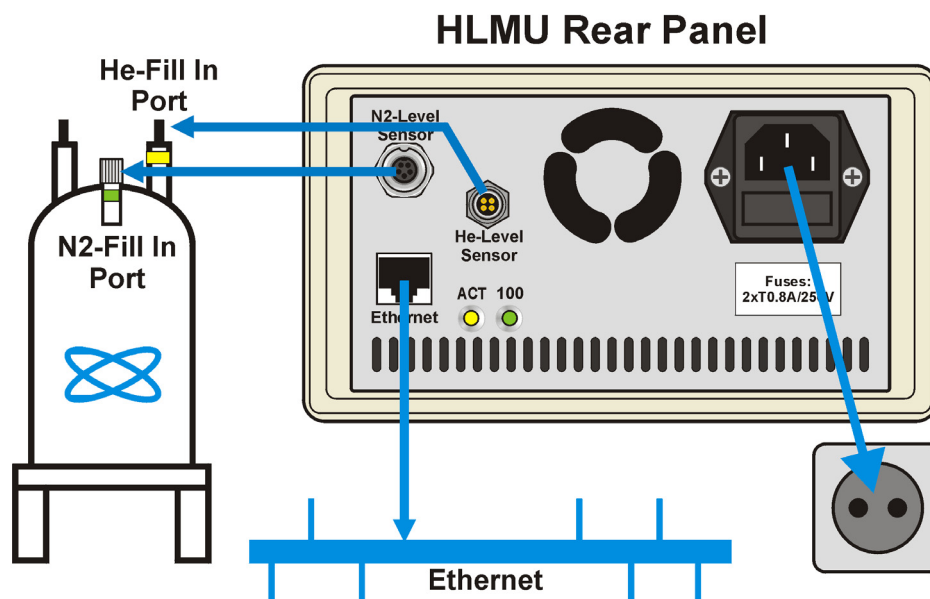
Figure 3.1   Typical Installation

3.2   Switching the HLMU On or Off

The HLMU is intended for continuous use and therefore has no mains switch. To switch the HLMU **on**, plug the mains cord into the mains supply (wall socket).

Wait approximately 25 seconds until the HLMU boots.

While booting, the LED's are first tested (all four LED's are on for 6 seconds) and then a loading status window appears on the LCD.
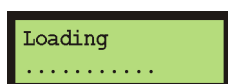
The HLMU enters standby mode after booting. The last measured helium level and nitrogen level should appear on the display. If the "Loaded default values" message appears, it means that all user settings have been set to the factory default. In this case it is recommended that you check all settings.

To switch the HLMU **off**, unplug the mains cord line from the wall socket. All settings, measurements, history, date & time, etc. will be saved.

3.3 Initial Settings Via the Ethernet Connection

This section describes how to set the initial settings for the helium level sensor selection using a standard Web browser and the **HLMU Service Web** via the ethernet connection. If you are using the device without an Ethernet connection, see the instructions "Initial Settings without an Ethernet Connection" on page 25.

The following initial settings must be made before you can use the HLMU:

- Set the network parameters.

- Select the type of helium probe (sensor) used in a magnet.

- Set the date & time.

3.3.1 Setting the Network Parameters

If you have not done so you must first set the network parameters (IP address, subnet mask and standard gateway). Check with your network administrator for the required network parameters.

Tip: To display the current IP address (and firmware version) press and hold the **Cancel** button while in standby mode.

Hold 2 seconds
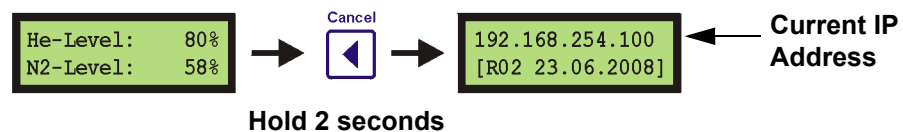
You will need to know the PIN number in order to set the network parameters. The default PIN is 0000.
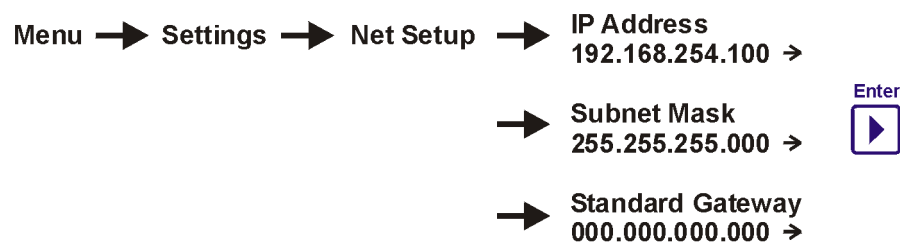
In the menu, navigate to Settings > Net Setup > IP Address, Subnet Mask or Standard Gateway. Press the **Enter** button to edit the parameter.

While in edit mode, use the following buttons to change the parameters:

- UP/DOWN: To change the values.

- ENTER: To go to the next number, to save and to exit.

- CANCEL: To navigate backwards.

After you finish editing the network parameters, reset the unit by unplugging the mains cable for a few seconds and then plugging it in again!

You can now connect the HLMU to the Ethernet connector. Enter the new IP address in your Web browser Address field to start the HLMU Service Web. The following window should appear:

New IP Address
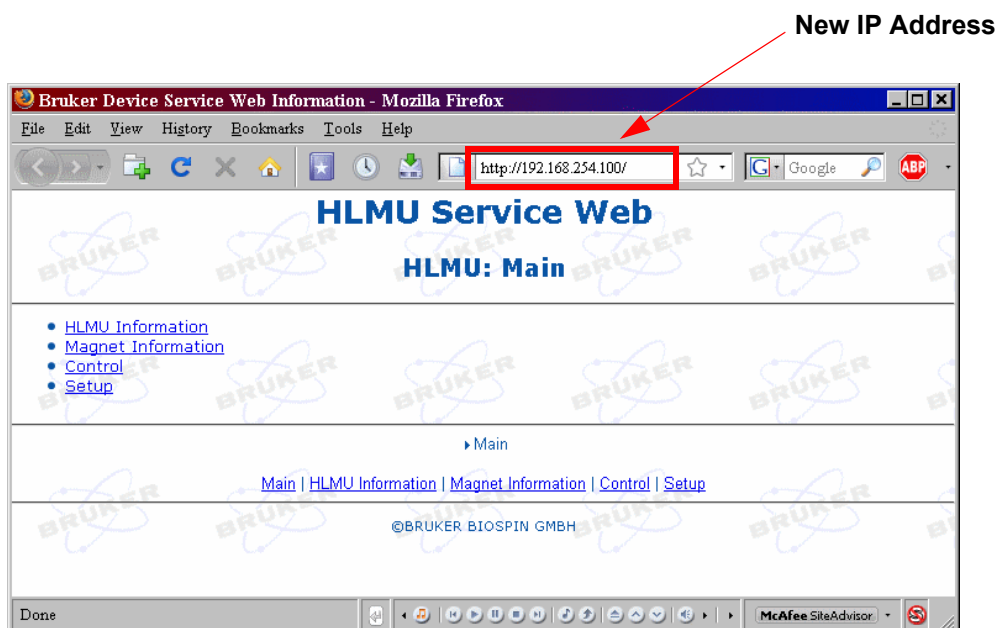
Figure 3.2   The HLMU Service Web

3.3.2   Selecting the Helium Level Probe Type

The properties of the helium level probe are represented by two resistance values, which are used to calculate the helium level:

• Probe resistance at a 100% helium level.

• Probe resistance at a 0% helium level.

For easier selection of the HLMU, these resistances are represented by a so-called **dummy** (see Figure 3.3). The dummy's are connectors with the same resistance as the probe at either 0% or 100% helium.

Figure 3.3   Various Dummy Connectors for Selection

If you know the color of the dummy for your magnet you can easy select the helium level probe by choosing the color of the dummy directly from the menu in the setup window.

If you don't know the color of the dummy you must first measure the resistance manually. This can be also done in the setup window of the Service Web.

Logging into the HLMU Service Web

1. Click **Setup** on the HLMU Service Web Main page (see "Web Interface Operating Instructions" on page 47).

2. Click **He-Level Sensor Calibration** on the HLMU Setup page.

3. When the window "*Authentication Required*" (Firefox) or "*Enter Network Password*" (Internet Explorer) appears, enter the following parameters and press **OK**:

    User Name: **user**

    Password: Your **PIN** (default PIN is set to 0000)

    The following page should appear:

Figure 3.4   HLMU Web: He-Level Sensor Calibration

In the Helium (He) Level Sensor Calibration window you can set the parameters for the 0% and 100% resistance in three different ways:

1. By selecting the appropriate dummy connector when known.

2. By measuring the values when the values are not known.

3. By entering the appropriate values when known.

3.3.2.1 Selecting the Dummy Connector

Probe selection at 0% helium level:

Choose the dummy or type of sensor from the list and click on the **Set Dummy** button:

Choose dummy   **Click**

Probe selection at 100% helium level:

Default for all types of sensors is a black dummy (0 Ohm). When you use this dummy you do not need to do anything further.

Click

3.3.2.2 Measuring the Resistance Values are When They are NOT Known

When the dummy connectors and the resistance values are not available, the 0% and 100% sensor resistances can be measured on a partially empty and a completely full magnet:

For the **Level - 0%** selection, start with a partially empty magnet. Adjust the sensor so that it's lower end is approximately 1 cm above the liquid helium.

- Click on the **Measure** button in the frame **0% Helium**. The measurement will finish after 10 seconds and the measured resistance will be displayed in the edit box below the measure button.

Click

For the **Level - 100%** selection, fill the magnet completely.

- Click on the **Measure** button in the frame **100% Helium**. The measurement will finish after 12 seconds and the measured resistance will be displayed in the edit box below the measure button.

Click

3.3.2.3   Entering the Resistance Values When the Values are Known

When you know the resistance value of the probe at the **0%** helium level, enter this in the edit box and click on the **Set 0%** button. The dummy connector in the list will be automatically be set to "Other type".

Enter value   **Click**

When you know the resistance value of the probe at the **100%** helium level, enter this in the edit box and click on the **Set 100%** button:

Enter value   **Click**

3.3.3 Setting the Date and Time

To set the date and time in the HLMU Service Web:

1. Click **Setup** on the HLMU Service Web Main page (see Figure 3.2).

2. Click **HLMU Setup**.

HLMU Main Page ➡ Setup ➡ He-Level Sensor Calibration

If you have not logged in previously, log in as described in the section "Logging into the HLMU Service Web" on page 21.

3. Find the **Date and Time** frame on the HLMU Setup page:

Date And Time

Date	dd.mm.yyyy	10 . 02 . 2005	Set	
Time	hh:mm:ss	14 : 42 : 09	Set	

4. Enter the date and click on the **SET** button.

5. Enter the time and click on the **SET** button.

To refresh the actual date and time use the [Refresh] button on the Webpage, *do not use the Web browser refresh button*!

3.4 Initial Settings without an Ethernet Connection

This section describes how to set the initial settings for the helium level sensor selection when **no Ethernet** connection is present. If you are using the device with an Ethernet connection, see the instructions "Initial Settings Via the Ethernet Connection" on page 19.

The following initial setting must be made before you can use the device:

• Select the type of helium probe (sensor) used in a magnet.

• Set the date & time.

3.4.1 Selecting the Helium Level Probe Type

The properties of the helium level probe are represented by two resistance values, which are used to calculate the helium level:

• Probe resistance at a 100% helium level.

• Probe resistance at a 0% helium level.

For easier selection of the HLMU, these resistances are represented by a so-called

dummy (see Figure 3.3). The dummy's are color-coded connectors with the same resistance as the probe at either 0% helium (blue, silver, red, brown, violet and green) or 100% helium (black - common for all types of probes). The dummy connectors are delivered as an accessory with a magnet.

If you know the color of the dummy for your magnet you can easy calibrate the helium level probe by choosing the color of the dummy directly from the menu on the HLMU unit (see "Probe Selection With the Help of a Dummy" on page 28).

If you don't know the color of the dummy you must first measure the resistance manually (see "Probe Selection Without the Use of Dummies" on page 29).

3.4.1.1 Using the HLMU Calibration Menu

The probe selection is protected with a PIN (see section "Security" on page 15), you will need to enter the PIN to access the selection menu.

A navigational chart for the HLMU Calibration Menu is provided in Figure 3.5. To navigate through the menu:

• Use the **Up**/**Down** buttons to scroll within the menu.

• Use the **Enter** button to select a dummy, self measure resistance, skip forward or to save the settings.

• Use the **Cancel** button to skip backward or to cancel.
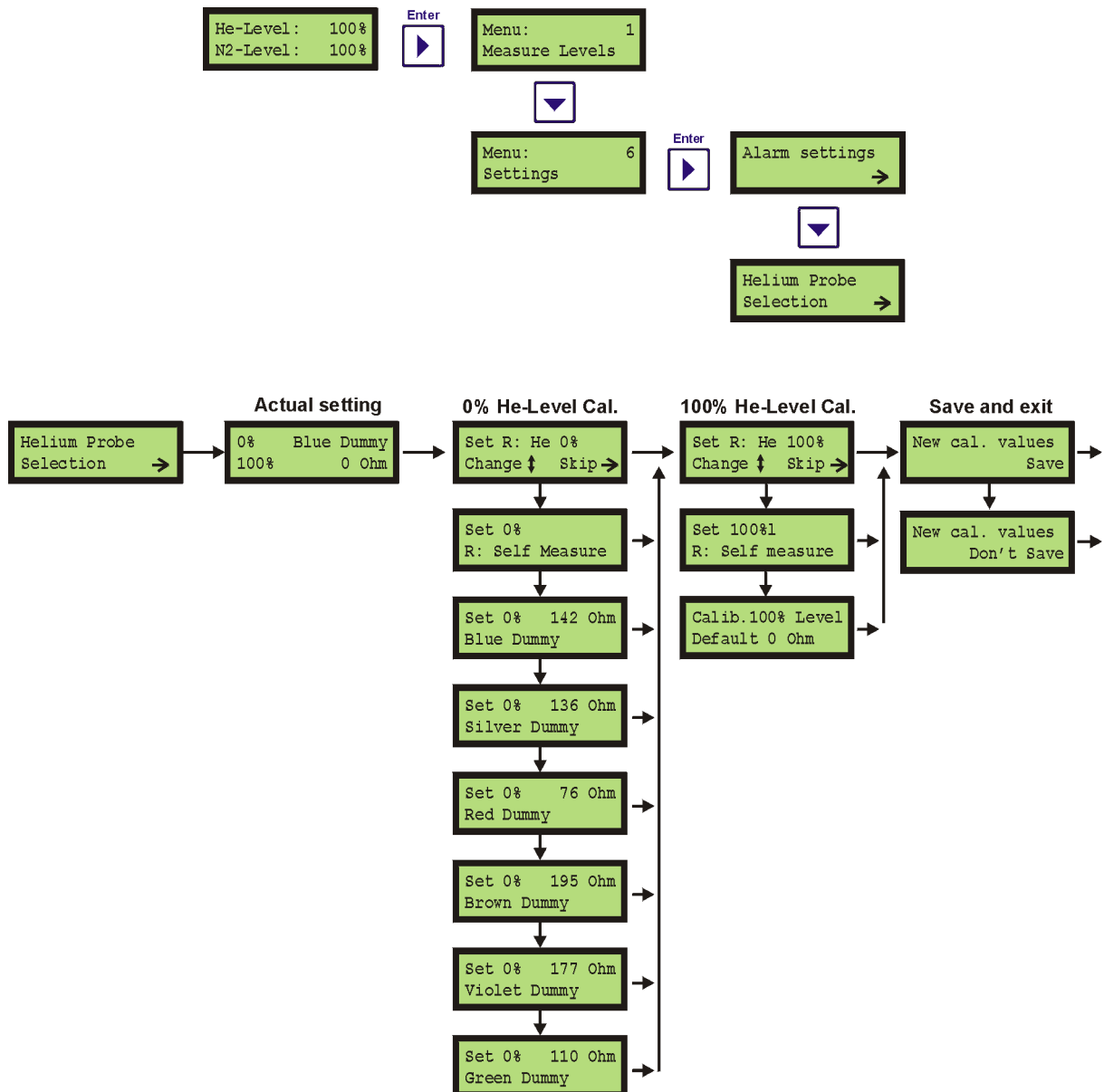
Figure 3.5   The HLMU Probe Calibration Menu

3.4.1.2 Checking the Actual Probe Settings

Menu ➡ Settings ➡ Helium Probe Selection ➡

```
0%    Blue Dummy
100%       0 Ohm
```

In the example provided the probe resistance at 0% helium level is calibrated with a blue dummy and the resistance at 100% helium level is calibrated to 0 Ohm.

To exit press the **Cancel** button.

3.4.1.3 Probe Selection With the Help of a Dummy

If you know the color of the dummy for a probe used in a magnet you can set the probe type in the selection menu as follows:

Step 1: Using the **Up**/**Down** buttons choose the dummy for a 0% helium level.

Menu ➡ Settings ➡ Helium Probe Selection ➡

```
Set 0%     76 Ohm
Red Dummy
```

▲ ▼

Step 2: Press the **Enter** button to continue.

```
Set 0%     76 Ohm
Red Dummy
```
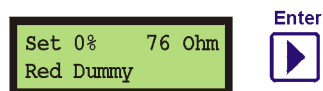
Enter
▶

Step 3: Set resistance for 100% helium level.

```
Set R: He 100%
Change ↕   Skip➔
```

▲ ▼
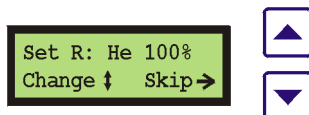
With the **Up**/**Down** buttons select the **Default 0 Ohm** resistance by 100% or you can skip this step by pressing the **Enter** button.

Step 4: Press the **Enter** button twice to save and exit.

```
Set 100%
Default 0 Ohm
```

Enter
▶

```
New cal. values
          Save
```

Enter
▶

3.4.1.4   Probe Selection Without the Use of Dummies

If the dummy connectors are not available or you do not know which one to use, the 0% and 100% resistances can be measured using a partially empty and a completely filled magnet:

For the **0% selection**, start with a partially empty magnet. Adjust the probe so that the lower end of the probe is approximately 1 cm above the liquid helium.

1.   In the menu go to **Set R: He 0%**.

Menu ➡ Settings ➡ Helium Probe Selection ➡
```
Set R: He 0%
Change ↕   Skip→
```
▲ ▼
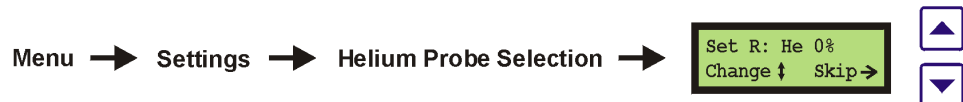
2.   Using the **Up**/**Down** buttons select the **Set 0% - R: Self Measure.**

3.   Press the **Enter** button to measure resistance.
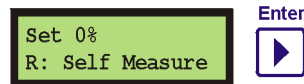
```
Set 0%
R: Self Measure
```
Enter
▶

After approximately 10 seconds the measured resistance will be displayed for a short time on the display.

For the **100% selection**, fill the magnet completely.

1.   Using the **Up**/**Down** buttons select the **Calib.100% Level - Self Measure** and press the **Enter** button to measure the resistance.
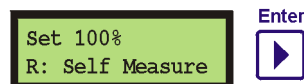
```
Set 100%
R: Self Measure
```
Enter
▶

After approximately 10 seconds the measured resistance will be displayed for a short time on the display.

2.   Press **Enter** to save.

```
New cal. values
          Save
```
Enter
▶
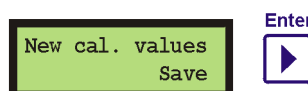
3.4.2   Setting the Date and Time

The HLMU has an internal real-time clock which is used for measurement and event logging, checking nitrogen refilling, etc. Check if the date and time are set correctly before using the unit.

To display the actual date and time select:

Menu ➡ Settings ➡
```
Date and Time
20.01.2005 17:04
```

To change the date or time press the **Enter** button.

```
Set Date:
20.01.2005
```
➡
```
Set Time:
17:04:00
```
➡ **Enter** ▶   **Press Enter to update date and time**

Use the following buttons to change the values:

UP/DOWN: Change values.

ENTER: Move cursor to the right.

CANCEL: Move cursor to the left.

4 Operating Instructions

This chapter provides instructions on how to operate the HLMU with help of the front panel menu and four navigation buttons (**Enter**, **Cancel**, **Up** and **Down**). To operate the HLMU via an Ethernet connection and standard Web browser, see "Web Interface Operating Instructions" on page 47.

4.1 Menu Overview

When in standby mode the last helium and nitrogen level measurement will normally appear on the display.

```
He-Level:     80%
N2-Level:     58%
```
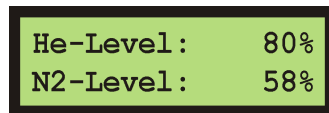
4.1.1 Quick Access Menu

In standby mode, the **Up** and **Down** buttons can be used to view the date and time of the last measurement or the last nitrogen and helium refill.

```
He-Level:     80%
N2-Level:     58%
```
↕
```
Last Measurement
29.05.08    06:00
```
↕
```
Last N2 Refill
15.05.08    15:06
```
↕
```
Last He Refill
15.05.08    17:39
```

▲
▼
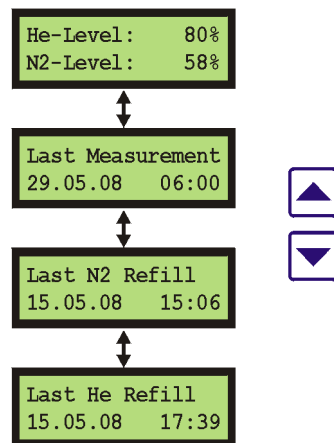
To view the IP Address and the firmware version, press and hold the **Cancel** button.

```
He-Level:     80%
N2-Level:     58%
```
→ *Cancel* ◄ →
```
192.168.254.100
[R02 23.06.2008]
```
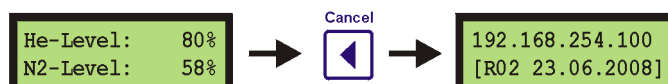
4.1.2   Main Menu

To access the main menu press the **Enter** button when in standby mode.

Press the **Up/Down** buttons to scroll within the menu.

Press the **Cancel** button to return to standby mode.

Press the **Enter** button to select the function or submenu.

`He-Level:    80%` `N2-Level:    58%`	**Enter** ▶	`Menu:        1` `Measure Levels`

To measure the helium and nitrogen level.

`Menu:        2`
`Nitrogen Refill`

For continuous measurement of the nitrogen level while refilling.

`Menu:        3`
`Helium Refill`

For continuous measurement of the helium level while refilling.

`Menu:        4`
`History`

To view a list of the last level measurements, nitrogen refills, alarms and events.

`Menu:        5`
`Magnet ID`

For information identifying the magnet.

`Menu:        6`
`Settings`

Settings: e.g. alarms, currents, date, time, He-probe type, net parameters etc.

4.2   Helium and Nitrogen Level Measurement

The helium and nitrogen level can be measured manually or automatically. The following sections will describe these procedures.

4.2.1   Manual Level Measurement

The unit must be switched on (standby mode) for this measurement.

Press the Enter button **twice**, or **press and hold** the Enter button for two seconds.

Standby

```
He-Level:    80%
N2-Level:    58%
```

Enter

**Press twice
or hold down**

Measurement running

```
Measuring    12s
I=120 mA
```

Standby

```
He-Level:    78%
N2-Level:    55%
```
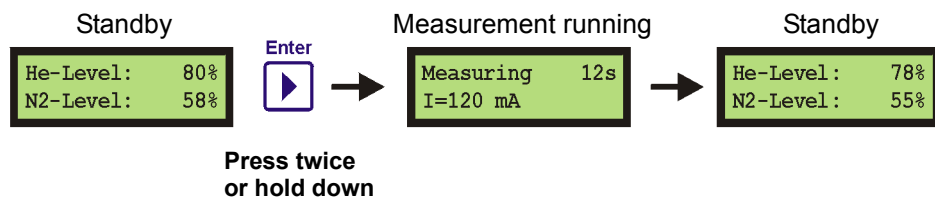
The level measurement takes 12 seconds, whereas the green LED **Auto** will blink.

During the first 4 seconds a higher sensor current (I_{thaw}) is used to thaw the ice on the upper part of the helium sensor. A smaller sensor current (I_{meas}) is then used for the next 8 seconds to run the measurement itself. The currents I_{thaw} and I_{meas} can be changed as described in "Helium Probe Current Settings" on page 41.

The actual helium and nitrogen levels appear on the display after the measurement.

The manual level measurement is not stored in the history.

When the HLMU is not equipped with the N2-Option hardware or the nitrogen level measurement is disabled, **N/A** (Not Available) will appear by the N2-Level on the display.

```
He-Level:    80%
N2-Level:    N/A
```

4.2.2   Automatic Level Measurement

The HLMU allows for the automatic measurement and routine monitoring of the helium and nitrogen level at predefined intervals. The available intervals are 0 (off), 6, 12, or 24 hours.

The green LED **Auto** indicates when the level auto measurement is on.

All automatic measurements are saved to the history.

To change the interval and the initial time of the automatic measurement see "Setting the Automatic Level Measurement" on page 40.

4.3 Alarms

The HLMU uses alarms to indicate a low helium or nitrogen level, or to indicate when the nitrogen refill period has been overrun. An alarm is always indicated by the red flashing **Alarm** LED, a message on the display, and optionally a beeping signal (see "Setting the Beep Tone" on page 43).

4.3.1 Low Helium Level Alarm

This alarm occurs if the helium level in a magnet sinks lower than the preset value.

```
ALARM
Low He-Level 17%
```
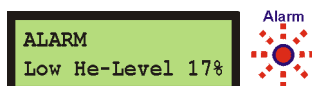
The **date** and **time** of the alarm and the **helium level** are saved in the alarms section of the history. The alarm is saved in the history each time a helium level measurement is made (manually or automatic).

4.3.2 Low Nitrogen Level Alarm

This alarm occurs if the nitrogen level in a magnet sinks lower than the preset value.

```
ALARM
Low N2-Level 20%
```
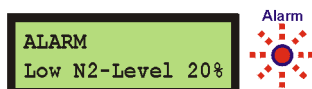
The **date** and **time** of the alarm and the **nitrogen level** are saved in the alarms section of the history. The alarm is saved in the history each time a nitrogen level measurement is made (manually or automatic).

4.3.3 Nitrogen Refill Period Overrun Alarm

This alarm occurs if the nitrogen hasn't been refilled within the preset time interval (available only with an HLMU without the N2-option hardware, or if the N2-Level measurement is disabled).

```
ALARM   N-Refill
2 days overrun
```
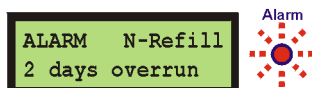
The **date** and **time** of the alarm and the **number of days** are saved in the alarms section of the history. The alarm information is saved in the history once a day.

4.3.4 Clear Alarm Tone

You can temporarily deactivate the alarm tone if desired. While in standby mode hold the **Cancel** key down and then choose **Yes**. The alarm tone is reactivated with the next level measurement, or 24 hours after the last nitrogen refill alarm.

4.4 Nitrogen Refill

The "Nitrogen Fill Mode" and "Nitrogen Refill Confirmation" are only available only if the HLMU is equipped with the N2-option hardware and the N2 Level measurement is enabled (see "Enable/Disable the Nitrogen Measurement" on page 41).

4.4.1 Nitrogen Fill Mode

The HLMU allows continuous nitrogen level measurement to monitor the nitrogen level during nitrogen filling.

To start the "Fill Mode" scroll to the Nitrogen Refill in the menu and press the **Enter** button.

Menu ➡ **Nitrogen Refill** ➡
```
N2 Fill Mode
N2 Level: 85%
```

The Fill Mode is indicated by the flashing yellow **Fill** LED and a short beep sound. The actual nitrogen level will appear on the display.

When the nitrogen refill is finished press the **Enter** button to exit. The last nitrogen refill date and time (see "Quick Access Menu" on page 31) will be updated.

The Fill Mode is automatically switched off after 30 minutes.

4.4.2 Nitrogen Refill Confirmation

The HLMU monitors the time between two consequent nitrogen refills in order to provide a warning (an alarm occurs) when a nitrogen refill interval has been exceeded. When the nitrogen refill has been made it must be confirmed manually on the HLMU.

To confirm the nitrogen refill press the **Enter** button while in the Nitrogen Refill menu:

Menu ➡ **Nitrogen Refill** ➡
```
Nitrogen Refill:
Update now    ➔
```
Enter ▶ **Press Enter to confirm N2-refill**

The Nitrogen Refill menu can be used to display:

• the date and time of the last nitrogen refill,
• the nitrogen refill period, and,
• the number of remaining days to the next refill.

Menu ➡ **Nitrogen Refill** ➡
```
Nitrogen Refill:
Update now    ➔
```
➡
```
Last N Refill
21.06.08    14:20
```
▲ ▼
➡
```
Period    11 days
Due in     2 days
```
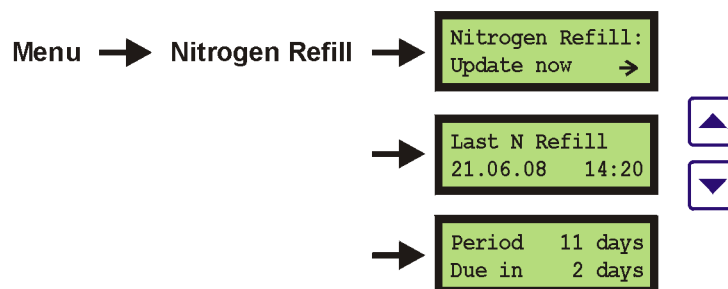
4.5   Helium Refill

The HLMU allows continuous helium level measurements to monitor the helium level during helium refilling. To start the "Fill Mode", scroll to the menu option Helium Refill and press the **Enter** button.

Menu ➡ **Helium Refill**   Enter ▶   He Fill Mode He:33%   I=130mA

The Fill mode is indicated by the flashing yellow **Fill** LED.

During the first 10 seconds the helium level measurement will run, then the actual helium level and measuring current will appear on the display. When the level value is updated, a short beep sounds. If you want to change the update interval, see "Period of Measurements During Helium Filling" on page 52.

To prevent inaccurate measurements due to turbulence of the vapor helium (whereas the measured helium level jumps to a certain value and doesn't change) you can change the measuring current during Fill mode using the **UP/DOWN** buttons. This setting doesn't affect the default Fill mode current setting.

He Fill Mode He:33%   I=130mA   ▲ **+ 5 mA**   ▼ **- 5 mA**
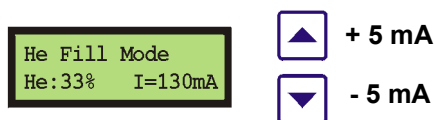
When the helium refill is finished press the **Enter** button to exit. This event will be saved in the history as *"He Filled"* and will contain the final helium level, the date and the time.

You can change the default measuring current while in Fill mode, see "Helium Probe Current Settings" on page 41. It is recommended that only expert users perform this task. The setting is protected with a PIN number.

To help prevent a large helium loss the Fill mode is automatically switched off after 30 minutes.

4.6   History

The HLMU stores the following information in the history:

- The last 30 automatic helium and nitrogen level measurements.

- The last 5 nitrogen refill dates.

- The last 5 alarms.

- The last 5 events (helium refill, reset, errors, setting changes etc.).

Menu ➡ History ➡ **History: He and N2 Levels** ➡ `1↓  22.05. 06:25` `He: 90%  N2: 87%`   **Scroll UP**

➡ **History: N2 Refill** ➡ `01.05.   14:30:55` `22.04.   15:05:11`   ▲

➡ **History: Alarms** ➡ `21.02.   10:00:00` `Low He-Level 17%`   ▼ **Scroll DOWN**

➡ **History: Events** ➡ `17.05.   14:45:00` `He Filled: 100%`
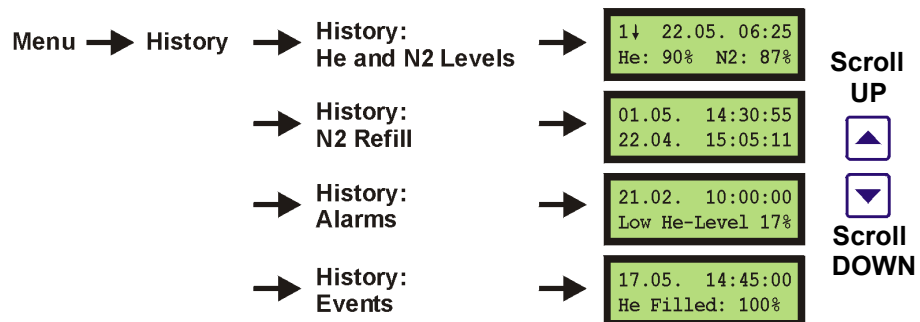
4.7   Magnet Identification

The HLMU stores the following information to assist the HLMU in identifying its position and which magnet it is connected to.

Menu ➡ Magnet ID ➡ **Magnet Part Nr.**
Magnet Serial Nr.
Coil Nr.
Magnet Nr.
Magnet ID
Magnet Description
Place Of Installation
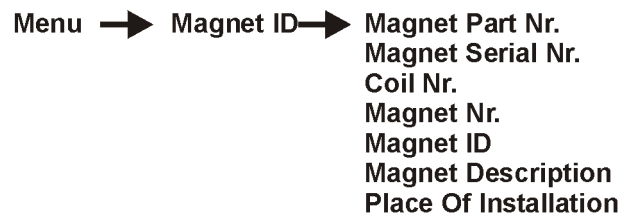
To change these values, refer to the section "Magnet Identification Setup" on page 53.

4.8   Settings

4.8.1   Overview

To access the HLMU settings, scroll to **Settings** in the menu and press the **Enter** button. The following settings can be changed:

Enter ▶ Alarm settings →	Helium and nitrogen level alarm boundary. Nitrogen refill period overrun alarm.
He and N2 Level Auto Measurement	Automatic level measurement interval. Automatic level measurement initial time.
N2 Measurement Enabled Edit →	Enable / disable nitrogen level measurement.
Helium Probe Selection →	Selection of the helium probe used in a magnet.
Helium Probe I-Setup	Currents setup for the helium measurement.
Net Setup →	IP address, subnet mask, standard gateway.
Date and Time 25.06.2008 14:58	Date and time.
Unit Setup →	PIN, display contrast, beep, firmware version, load default values

```
Menu:        6
Settings
```

Most of these settings are protected with a PIN number.

4.8.2 Setting the Alarm Boundaries

For expert users only!

You can change the alarm boundaries for the helium level, nitrogen level and nitrogen refill period if you are not satisfied with the default setting. Considerable care should be used when setting the new values:

• When the helium or nitrogen alarm level is set too low it may result in a **quench**. Set the alarm boundary so that service personnel have enough time to refill the magnet if the alarm occurs.

• When the nitrogen refill period is set too high it may result in complete nitrogen evaporation and extremely liquid helium consumption.

A PIN number is required to change these settings.

Use the following buttons to change the settings:

UP/DOWN: Used to change the level value.

ENTER: Used to save and exit.

CANCEL: Back.

4.8.2.1 Changing the Helium Level Alarm

Menu ➡ Settings ➡ Alarm settings ➡ He-Level Alarm 20% Edit ➡ Edit He-Alarm 20%

The default helium level alarm is **30%**.

4.8.2.2 Changing the Nitrogen Level Alarm

Menu ➡ Settings ➡ Alarm settings ➡ N2-Level Alarm 20% Edit ➡ Edit N2-Alarm 20%

The default helium level alarm is **30%**.

### 4.8.2.3 Changing the Nitrogen Refill Period Alarm

Menu ➡ Settings ➡ Alarm settings ➡ N Refill Period 11 days Edit ➡ Edit N-Fill Per. 11 days

The default nitrogen refill period is **11 days**.

4.8.3 Setting the Automatic Level Measurement

The Interval and initial time of the automatic level measurement (helium and nitrogen together) can also be changed. Follow the instructions provided in the following sections.

4.8.3.1 Changing the Automatic Measurement Interval

Menu → Settings → He and N2 Level Auto Measurement →

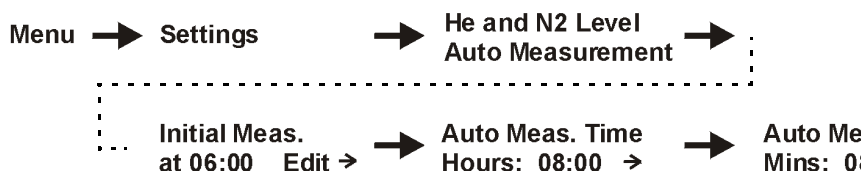⋯ Auto Meas. Freq. every 24h Edit→ → Auto Meas. Freq. 24 Hrs.
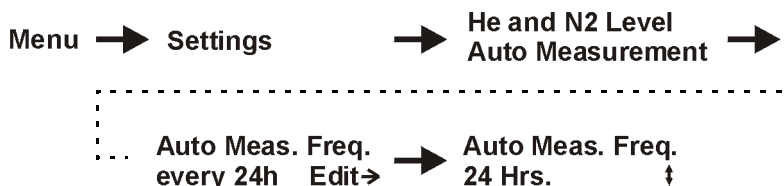
UP/DOWN: Used to set the new interval: 24h - 12h - 6h - Off.

ENTER: Used to save and exit.

CANCEL: Back.

4.8.3.2 Changing the Automatic Measurement Initial Time

Select:

Menu → Settings → He and N2 Level Auto Measurement →

⋯ Initial Meas. at 06:00 Edit → → Auto Meas. Time Hours: 08:00 → → Auto Me Mins: 0

UP/DOWN: Used to change the hours and minutes.

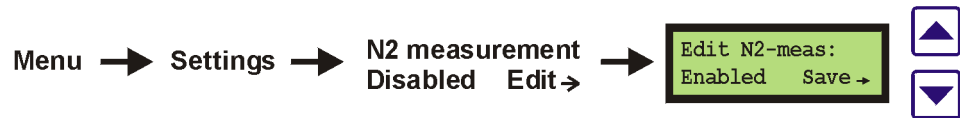ENTER: Used to save and exit.

CANCEL: Back.

If you set the initial time, for example, to 8:15 then the automatic measurement runs in relation to the period as follows:

• 24 hour interval (once a day): at 8:15

• 12 hour interval (twice a day): at 8:15 and 20:15

• 6 hour interval (4 times a day): at 8:15, 14:15, 20:15 and 2:15

Frequent measurements will result in higher liquid helium consumption!

4.8.4 Enable/Disable the Nitrogen Measurement

The nitrogen level measurement can be enabled if your magnet is equipped with a nitrogen level probe.

Menu ➡ Settings ➡ N2 measurement Disabled Edit→ ➡ `Edit N2-meas:` `Enabled    Save→` ▲ ▼

UP/DOWN: Used to toggle between *Enabled* and *Disabled*.

ENTER: Used to save and exit.

CANCEL: Back.

A PIN number is required to change these settings.

Disable the nitrogen level measurement if your magnet isn't equipped with the N2-Level probe, otherwise the HLMU will indicate an error (ERROR 14, N2 Probe N.C.).

If the HLMU isn't equipped with the N2-Option hardware, this setting is unavailable.

4.8.5 Setting the Helium Level Probe Type

See "Selecting the Helium Level Probe Type" on page 20.

4.8.6 Helium Probe Current Settings

For expert users only! A PIN number is required to change these settings.

The current setting affects the accuracy of the helium level measurement. Too low of a measuring current causes insufficient thawing of the upper part of the sensor and hence the measured level will be too high. Likewise, too high of a current can cause not only the upper part of the sensor, which is plunged into liquid helium, to thaw, but also the part over the liquid helium level, and thus the measured level will be too low.

You can change the settings for the following currents:

I thaw: Current used during the sensor thaw (default 120 mA) - flows the first 4 seconds of the helium level measurement.

I meas: Current used during the measurement (default 110 mA) - flows for the next 8 seconds of the measurement, following the I thaw.

I filling: Current used during helium filling (default 130 mA).

4.8.6.1 Changing the Current Values

(to a maximal value of 150 mA):
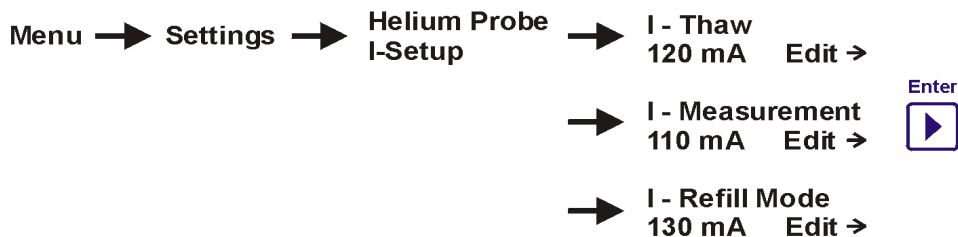
UP/DOWN: Used to change the values.

ENTER: Used to save and exit.

CANCEL: Back.

4.8.7 Network Setup

See "Setting the Network Parameters" on page 19

4.8.8 Date and Time Settings

See "Setting the Date and Time" on page 25
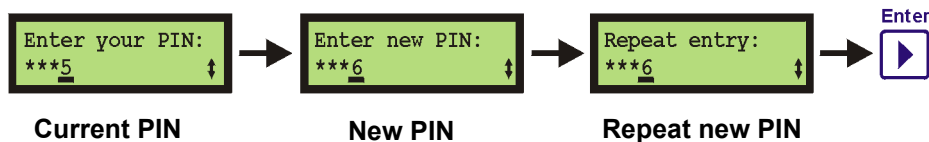
4.8.9 Changing the PIN Code

You can change the PIN to any 4-digit number that you find easier to remember.

UP/DOWN: Used to change the number.

ENTER: Used to move to the next number and/or confirm.

CANCEL: Used to move to the previous number and/or escape.

4.8.10   Setting the Display Contrast

You can change display contrast to 10 different levels:

Menu ➡ Settings ➡ Unit Setup ➡
```
Display Contrast
4            Edit →
```
➡ **Enter** ▶

Press the **UP/DOWN** buttons repeatedly to adjust the contrast, then press the **Enter** button to confirm.

4.8.11   Setting the Beep Tone

You can choose one of three beep settings:

- **On** (default): All of the signal tones are on.
- **Off**: All of the signal tones are off (not recommended).
- **Alarms**: All of the signal tones except the alarm tone are off.

Menu ➡ Settings ➡ Unit Setup ➡
```
Beep
On            Edit →
```
➡

UP/DOWN: Used to select one of the modes from the list: On - Off - Alarms.

ENTER: Used to select, save and exit.

CANCEL: Back.

4.8.12   Monitoring Temperature Inside the HLMU

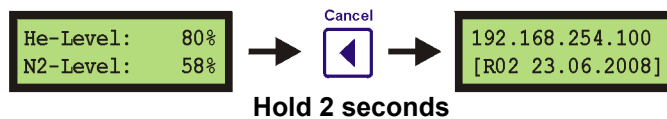Displays the actual temperature of the heat sink and air inside the HLMU:

Menu ➡ Settings ➡ Unit Setup ➡
```
Heatsink:    42°C
Air-in:      45°C
```

4.8.13   Firmware Version

Displays the firmware version:

Menu ➡ Settings ➡ Unit Setup ➡
```
Firmware Version
[R02 26.06.2008]
```

Tip: You can also display the firmware version and the IP Address by holding down the **Cancel** button while in standby mode.

```
He-Level:    80%
N2-Level:    58%
```
➡ Cancel ◀ ➡
```
192.168.254.100
[R02 23.06.2008]
```
Hold 2 seconds

4.8.14   Load Default Values

Menu ➡ Settings ➡ Unit Setup ➡
```
Load Default
Values
```
➡
```
User Settings
Overwrite?  YES➡
```
Enter ▶

The following values will be set as default:

He level alarm:	30%
N2 level alarm:	30%
N2 refill period:	11 days
Auto measurement interval:	12 hours
Auto measurement initial time:	7:00
Fill mode measurement period:	30 seconds
N2 measurement:	Disabled
I - thaw:	120 mA
I - measurement:	110 mA
I - fill mode:	130 mA
PIN Code:	0000
Display contrast:	0
Beep tone:	On

4.9 Error Messages

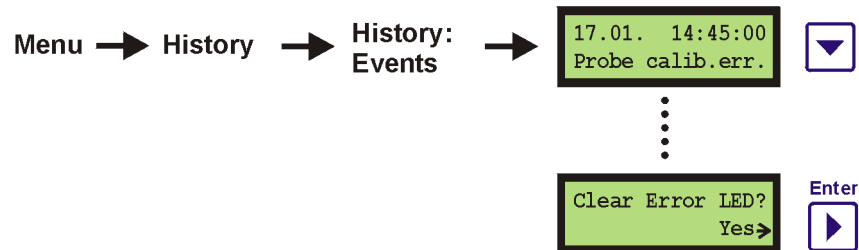An error state is indicated by a blinking yellow **Error** LED. The error messages are stored under History - Events.

Menu ➡ History ➡ History: Events ➡ | 17.01. 14:45:00
Probe calib.err. |

4.9.1 Clearing the Error LED

The LED can be cleared only if there are no more errors present and you have listed the error messages in History - Events.

Menu ➡ History ➡ History: Events ➡ | 17.01. 14:45:00
Probe calib.err. | ▼

| Clear Error LED?
            Yes➤ | **Enter** ▶

4.9.2　List of Error Messages

Message	Description	Possible solution
AutoMeas. failed	HLMU was busy when it was time for an automatic He-level measurement.	Set the time for the automatic measurement so it doesn't collide with another activity on the HLMU (e.g. He Refilling).
Wrong Setup Value	Attempted to save incorrect setup values.	Pay particular attention to format, max. allowed values etc. when entering values
ERROR 2 Current set error.	Measured current doesn't match the required current.	
	Resistance of the He-probe is >200 Ohm.	Change the He-probe.
	Contact problem.	Check the connection to the He-probe.
	Ground loop.	Check the isolation on the LN2 probe.
ERROR 3 He-Probe Not Connected	Helium probe not connected.	Connect the probe.
	Contact problem.	Check the connection to the probe.
ERROR 4 Overheated	Temperature inside the HLMU is > 65°C.	Provide better ventilation to the HLMU.
		Check functionality of the fan on the rear side.
ERROR 5 Power Supply Error	HLMU power supply is probably improperly set or is damaged.	Contact Bruker service.
ERROR 7 Current disabled	Measured current = 0 mA.	
	Contact problem.	Check the connection to the probe.
ERROR 8	HLMU internal error (ADC Time-out)	Try again. If the error reoccurs, contact Bruker service.
ERROR 9	The input voltage too high.	
	Resistance of the He-probe is >200 Ohm.	Change the probe or reduce the measuring current.
ERROR 10 Probe calib. error	Measured resistance > probe resistance set for 0% helium level	Check the probe selection (e.g. correct color of dummy) or re-calibrate the probe
ERROR 12 Current disabled	Current is disabled (electronic fuse blown).	Measure the helium level one more time (fuse is automatic reset before each measurement).
ERROR 14 N2 Probe Not Connected	Nitrogen probe not connected.	Connect the probe.
	Contact problem.	Check the connection to the probe.
3x wrong PIN!!! PIN blocked	The PIN code was entered incorrectly 3 times. Functions which require the PIN are blocked.	Contact Bruker service.

Table 4.1　List of Error Messages

5 Web Interface Operating Instructions

This chapter describes how to operate the HLMU with the help of a Web browser via an Ethernet connection. To operate the HLMU with help of a menu and buttons, see "Menu Overview" on page 31.

All the functions of the HLMU are accessible through a Web interface except the nitrogen refill confirmation, fill mode and clear alarm tone. To use the Web interface you will need an Internet or Ethernet connection and a Web browser (Internet Explorer, Firefox, Opera, etc.). The HLMU has its own Web server and IP address (see "Initial Settings Via the Ethernet Connection" on page 19).

Displaying the HLMU Main Page:

In an Web browser navigate to the HLMU IP address (e.g. http://192.168.254.100).
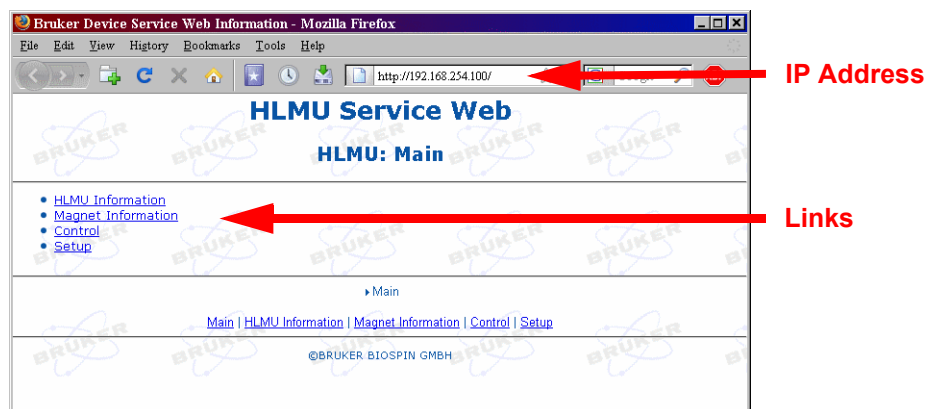
Figure 5.1   HLMU Web: Main page

There are four links on the main page of the HLMU, as shown in the figure above:

- **HLMU Information:** A link to information about the HLMU and it's components (e.g. serial number, firmware version, BIS, etc.).

- **Magnet Information:** A link to information identifying the magnet which is connected to the HLMU (e.g. magnet part number, serial number, coil number, ID, description and place of installation).

- **Control:** A link to the helium and nitrogen level measurement data (lists of the last 20 automatic level measurements, the last 5 nitrogen refills, the last 5 alarms, and the last 5 events).

- **Setup:** A link to the HLMU setup data (e.g. date, time, alarms, currents, auto measurement period, etc.).

5.1   Security

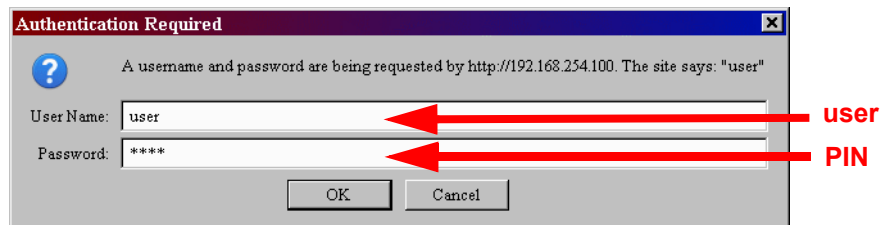Some functions and settings are protected by a 4-digit security code PIN.

Figure 5.2   HLMU web: Enter Network Password

User Name: **user** (Note: The user name is always "user")

Password: Your **PIN** (default 0000)

All protected pages became "unlocked" after entering the PIN. This is a feature of the Web browser. The PIN is deactivated when you close your browser.

5.1.1   Changing the PIN Number:

You can change the PIN to any 4-digit number you find easier to remember.

HLMU Main Page ➜ **Setup** ➜ **Change PIN**

1. Enter old PIN:	0000	Enter **current** PIN.
2. Enter new PIN:	1234	Enter **new** PIN.
3. Repeat Entry:	1234	Repeat **new** PIN.
4. Confirm:	OK	Press OK button.
Status:		

5.2   Measuring the Helium and Nitrogen Level

HLMU Main Page ➡ Control
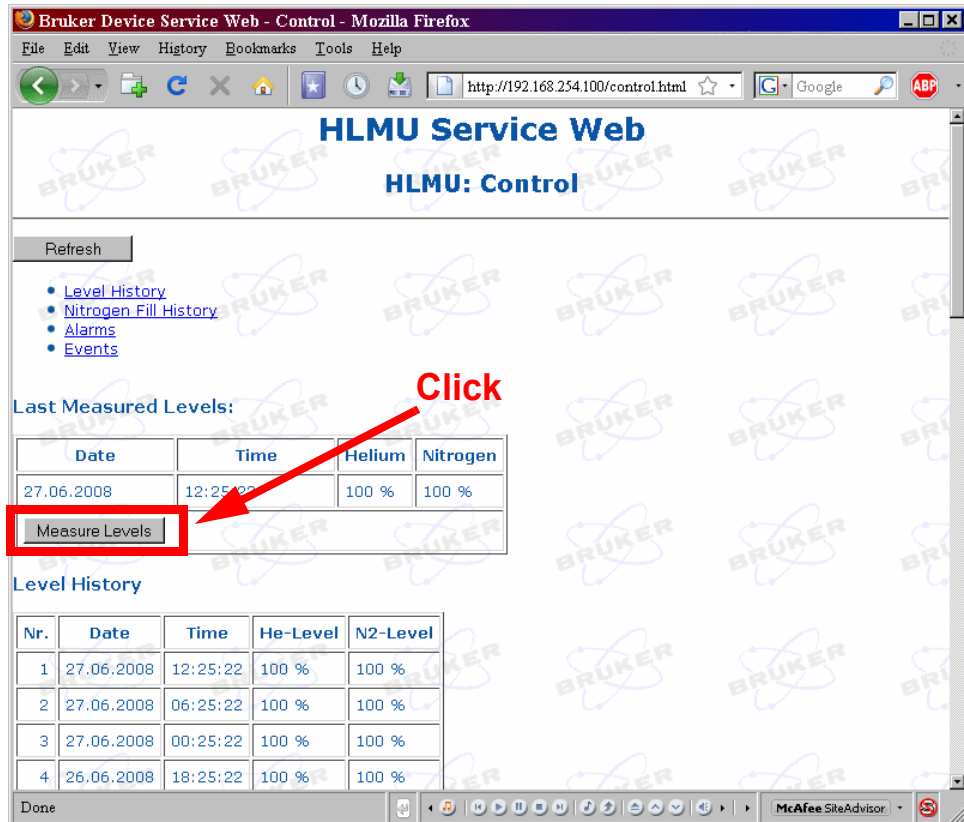
Figure 5.3   HLMU Web: Measure Helium & Nitrogen Levels

Click on the **Measure Now** button on the HLMU Control page. After 15 seconds the actual helium and nitrogen level will be displayed in the same frame:

Figure 5.4   HLMU Web: Last Helium & Nitrogen Level Measurements

The last 20 automatic level measurements, the history of nitrogen refill, and any alarms and events will also be displayed on this page.

5.3   HLMU Setup Using the Web Interface

You can set the HLMU parameters quickly and comfortably using the Web interface. From the main page, click on the **Setup** link to navigate to the Setup page:

Figure 5.5   HLMU web: Setup

Link	Configuration Use
HLMU Setup:	Date and time, alarms (helium and nitrogen level alarm, nitrogen refill period), currents, settings for automatic helium level measurement, see "HLMU Unit Setup" on page 51.
He-Level Sensor Calibration:	Setting the type of the helium level sensor in a magnet, see "Selecting the Helium Level Probe Type" on page 20.
Net Setup:	Setting the network parameters (IP Address, Subnet Mask, Standard Gateway), see "Net Setup" on page 53.
Magnet Identification Setup:	Magnet Serial Nr., Coil Nr., Place of Installation etc., see "Magnet Identification Setup" on page 53.
Change PIN:	Change PIN via ethernet, see "Security" on page 48.

Table 5.1   The HLMU Setup Page

Refer to the previous chapters (especially "Settings" on page 38 **and** "Helium Probe Current Settings" on page 41**) for detailed information on the functions and settings.**

5.4 HLMU Unit Setup

The HLMU Unit setup page allows you to set the date and time, alarms, currents, and settings for automatic level measurement.

To display this page click on the **HLMU Setup** link on the setup page.

5.4.1 Alarms

In this frame you can set the alarm limits:

- He-Level Alarm: 1 - 99%
- N2-Level Alarm: 1 - 99%
- N-Refill Period: 1 - 30 days.

When done, click on the [Save Changes] button.

See also "Alarms" on page 34.

5.4.2 Helium Probe Current Settings

In this frame you can set three different parameters under **Current Settings**:

- Thaw I: Current during sensor thaw (10 - 150 mA).
- Measuring I: Current during measurement (10 - 150 mA).
- Fill-in I: Current during helium filling (10 -150 mA).
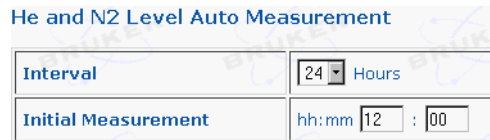
When done, click on the [Save Changes] button.

See also "Helium Probe Current Settings" on page 41.

5.4.3 Helium and Nitrogen Level Auto Measurement

This frame is used to set the automatic level measurement interval and the initial time of the measurement.

Interval: 24 hours - 12 hours - 6 hours - 0 (0 means that the auto measurement is OFF).

When done, click on the [Save Changes] button.

See also "Automatic Level Measurement" on page 33.

5.4.4 Period of Measurements During Helium Filling

In this field you can set how often the helium level will be measured during the Fill Mode (during helium refilling).

Interval: every 60 seconds, every 30 seconds (default), 0 - He-Level is measured continually (bigger consumption of liquid helium).

When done, click on the [Save Changes] button.

5.4.5 Load defaults

When you click on the [Load Defaults] button, the defaults settings will be loaded and saved.

See also "Load Default Values" on page 44.

5.5 Net Setup

The Net Setup page allows you to set the network parameters (IP Address, Subnet Mask, Standard Gateway).

To display this page click on the **Net Setup** link on the setup page.

When done, click on the **Save Values** button, and then the **Press to Reset** button. After a reset the HLMU operate with the new net parameters.

5.6 Magnet Identification Setup

The Magnet Identification Setup page allows you to set the magnet serial number, coil number, place of installation, etc.

To display this page click on the **Magnet Identification Setup** link on the setup page.

The HLMU stores information used to better identify it's position and the magnet that the HLMU is connected to.

When finished with editing, click on the **Save All** button to save the changes.

6 Product Data

6.1 Declaration of Conformity

The product herewith complies with the requirements of the following EMC Directive 2004/108/EEC (previous 89/336/EEC) and the Low Voltage Directive 2006/95/EEC (previous 73/23/EEC).

For the assessment the following norms were applied:

EMI:	EN 61326-1:2006 Class B
	EN 61000-3-2:2006
	EN 61000-3-3:1995+A1:01+A2:05
Safety:	DIN EN 61010-1: 2002
	EN 61010-1: 2001 (2nd ed.)
	IEC 61010-1: 2001 (2nd ed.)

The declaration of conformity concerned has been signed and is available from Bruker. If you require a copy of the original please contact your nearest Bruker BioSpin representative.

6.2 Technical Data

Input Voltage:	AC: 100 - 240 V, single phase, variation max. +/- 10%
Input Frequency:	50 - 60 Hz
Current:	0.8A max at 100V AC input, full load condition
Power Consumption:	Standby: 16 VA
	Full load: 30 VA
Fuses:	2 x T250V~, 0.8A
Output Voltage He-Probe:	DC: 0 - 35 V
Output Current He-Probe:	DC: 0 - 150 mA
Resistance measurement range (He):	0 - 200 Ohm at 150 mA
Output Voltage N2-Probe:	DC: +/- 10 V
Output Current N2-Probe:	DC: +/- 130 mA
Voltage measurement range (N2):	DC: 0 - -5 V
Degree of pollution:	2
Over voltage category:	2

6.3 Pre-defined Helium Probe Types

1300/700 N 3/4" D205:	$R_{0\%}$= 142 Ohm,	Blue Dummy
1300/700 N 1" D260:	$R_{0\%}$= 142 Ohm,	Blue Dummy
1200/670 N 1" D220:	$R_{0\%}$= 136 Ohm,	Silver (colorless) Dummy
950/360 N 3/4" D230:	$R_{0\%}$= 76 Ohm,	Red Dummy
1564/975 N 3/4" D240:	$R_{0\%}$= 195 Ohm,	Brown Dummy
1500/900 N D370:	$R_{0\%}$= 177 Ohm,	Violet Dummy
1150/540 Z57793:	$R_{0\%}$= 110 Ohm,	Green Dummy

6.4 Physical data

Height:	98 mm
Width:	155 mm
Depth:	270 mm
Weight:	1.8 kg

6.5 Operating Environment

Altitude:	Maximum 2000 m.
Temperature:	5 ~ 40 °C.
Air humidity:	Maximum 80% for temperatures up to 31°C, linearly decreasing to 50% humidity at 40 °C.
Storage:	5 ~ 40 °C.
	Air humidity maximum 80% for temperatures up to 31°C, linearly decreasing to 50% humidity at 40 °C.

6.6 Care and Maintenance

The HLMU should be treated with care:

- Protect the HLMU from moisture and humidity.

- Do not store the HLMU in dusty, dirty areas.

- Do not store the HLMU in hot areas. High temperatures can shorten the life of electronic devices.

- Do not drop, knock, or shake the HLMU. Rough handling can damage components inside the device.

6.7 Cleaning

Clean the device according to following instructions.

1. Unplug the power cord and the Ethernet cable.

2. Wipe the case with a dry or damp cloth.

Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the device.

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3. Let the device completely dry before you plug in the power cord.

Z31735_00_04

7 Contact

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http://www.bruker-biospin.com

NMR Hotlines

Contact our NMR service centers.

Bruker BioSpin NMR provide dedicated hotlines and service centers, so that our specialists can respond as quickly as possible to all your service requests, applications questions, software or technical needs.

Please select the NMR service center or hotline you wish to contact from our list available at:

http://www.bruker-biospin.com/hotlines_nmr.html

Contact

Appendix A

A.1 Warning Signs

Warning Signs

A.2   Figures

Figures

A.3 Tables

Tables

A.4 Glossary

The following terms and definitions are applicable for this manual:

HLMU:	**H**elium **L**evel **M**easurement **U**nit
EWS:	**E**mbedded **W**eb **S**erver
BIS:	**B**oard **I**nformation **S**ystem
BSMS:	**B**ruker **S**mart **M**agnet control **S**ystem
NMR:	**N**uclear **M**agnetic **R**esonance

Glossary

A.6 Index

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