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L I M I T E D

M50 Moisture Monitor Handset User Guide (Percent Display)

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JR TECHNOLOGY LIMITED

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1 Introduction

The M50 is a modular moisture measurement system, designed for use in environments ranging from hand-held measurements to industrial monitoring and control. It can be used to measure the moisture content in any non-conducting material.

The M50 Handset is one component in the M50 system. It is a battery-powered unit that allows the M50 probe to be used in portable applications. The handset is shown below, connected an M50-P-A probe.

Two versions of Handset user interface are available. This document describes Handset part number M50-PHP-P, as shown in the figure below, which displays the moisture content as a percentage of the material's dry weight. The alternative user interface, which is targeted at composite test applications, shows the moisture content in a graphical format and is documented in a separate user guide.

Figure 1: M50 handset and probe.

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1.1　Handset Features

The handset's firmware can be customised for different applications, but this document only describes the standard unit. The unit's primary features include:

- Moisture displayed as % moisture by dry weight.
- Configurable density of the material under test, so the handset can be used with a range of materials.
- One-touch application of a zero-offset to focus on changes in moisture content across a sample.
- Eight preset density values can be programmed into the handset, for quick selection by the user when working with different materials.
- Data logging function to store readings in the handset for download to a PC.
- USB interface to allow handset configuration from a computer, download of log data, and recharging unit's batteries.
- Rechargeable batteries giving up to 20 hours continuous usage from a full charge.
- Batteries can be recharged by plugging the handset into a USB interface or a mains-powered USB charger.
- The unit is designed to have a IP65 ingress protection rating[1].

1.2　Packing List

The following items are shipped with the standard M50 handset system:

- Handset (fitted with rechargeable batteries).
- Docking station for recharging the batteries and communicating with a PC.
- M50 probe, fitted with cable and handle for connection to handset.
- Mains powered USB charger.
- USB cable to connect the docking station to the mains charger or a computer.
- Software installation disk for PC software to configure the handset.
- Protective rubber boot for handset (optional item).
- Carry case for handset (optional item).

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1 Design goal – not yet formally tested.

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1.3   Setting up the Handset and Probe

First connect the probe to the handset. The connector on the probe's cable fits to the screw connector on the top of the handset. It is keyed and will only fit one way. Screw the connector in until it is finger-tight. Do not use any tools to tighten the connector.

To set up the docking station for battery charging, connect the USB socket on the rear of the docking station either to a USB mains charger or to a computer's USB port. Then the batteries can be charged simply by placing the handset in its docking station, The batteries may only be partially charged when the unit ships, and could take up to ten hours to fully charge.

The docking station is fitted with a location pin and the following steps are required to place the handset in the docking station correctly.

	Step 1 Locate the front end of the handset in the docking station. Make sure that the location pin at the top of the docking station fits into the handset.
	Step 2 Rotate the handset downwards so that the electrical contacts on the underside of the handset make contact with those on the docking station.

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1.4 Replacing The Batteries

The unit ships with 3 NiMH 'AA' rechargeable batteries with nominal capacity of 2850mAh. If the batteries need to be replaced in the future (they are accessible from the underside of the handset), it is important to replace them with equivalent NiMH batteries.

The handset is configured to charge the batteries when docked in the docking station, with a charging current appropriate to these high-capacity NiMH cells. It is important that the correct rechargeable cells be fitted. Under no circumstances fit anything other than NiMH batteries.

⚠	**Only fit the correct high capacity NiMH batteries.**

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2 Handset Controls

The figure below shows the handset's screen indicators and keypad controls.
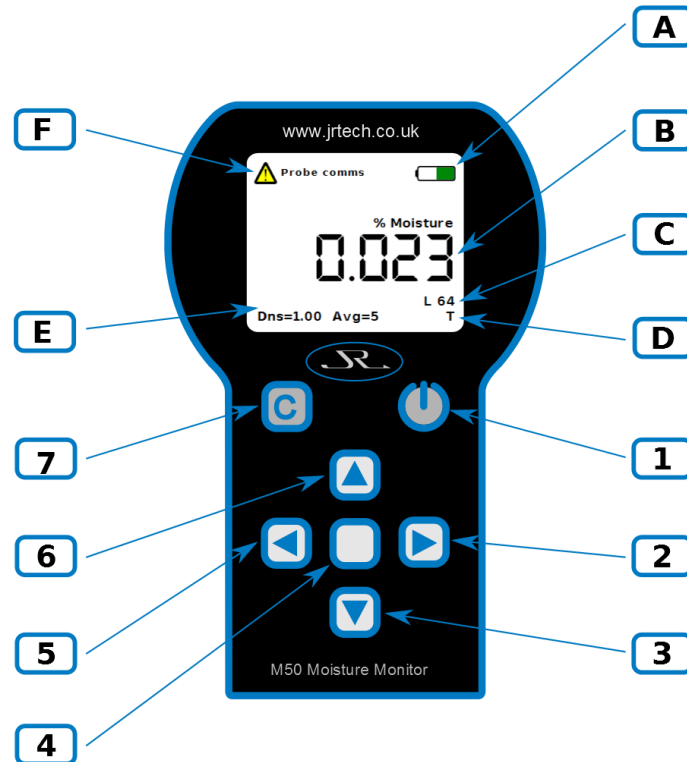
Figure 2: Handset's Indications and Control Keys

2.1 Screen Indicators

The indicators labelled A to F in the above figure have the following meanings.

2.1.1 Indicator A – Battery Level Indicator

The battery indication shows the charge remaining in the batteries. Normally the display is green, but when the charge drops below about 25% the colour changes to orange.

The unit is recharged by placing it in the docking station, which can be plugged into a mains-powered USB charger or into a computer's USB port. In either case the unit will draw power over the USB connection to charge the batteries. When the battery is charging the indicator shows an animated display in a loop where the battery level rises from zero to fully charged.

When the handset is connected to an external power source it will beep to confirm that it has external power. If the unit is switched off when it is docked then it will turn on the LCD at low intensity to provide an indication of the battery charging status. If the unit is removed from the dock it will beep again and switch off.

2.1.2 Indicator B – Current Moisture Reading

The current moisture reading is shown in large digits in the centre of the display. This value is the percent moisture content by weight of the sample under test. It is calculated using the following formula:

$$Percent\ Moisture = \frac{Weight_{moist} - Weight_{Dry}}{Weight_{Dry}} \times 100$$

The moisture reading depends on the dry weight of the material, which is configured in the handset by setting the material's density. - see Sections 3.2 and 3.3 for details on how to configure the density.

The sample measurement period that the handset uses is also configurable. There is a trade-off between faster measurement updates and the amount of noise present in the measurements. Eight different sample periods are available, configured by setting the probe's averaging time – see Sections 3.2 and 3.3 for details. The averaging time is specified as a number between one and eight, as listed in the following table. The factory default value is 5.

Index	Measurement Period (ms)
1	22
2	24
3	40
4	76
5	124
6	154
7	184
8	219

Table 1: Averaging Times Used by The Probe.

The probe senses a relatively large volume of material and penetrates up to around 40mm into a sample (the sensitivity falls with distance from the probe with approximately an inverse square law). The calculation of moisture is based on an assumption of a homogeneous material with uniform distribution of moisture within it.

2.1.3   Indicator C – Number of Data Log Points Available

The handset allows up to 64 data points to be logged in its memory for downloading to a computer over the USB interface. This item shows the number of data log points that remain unused in the handset.

2.1.4   Indicator D – Auto Switch Off Timer

The handset provides a feature to automatically switch off the handset after a period of inactivity. When this feature is enabled a **T** symbol is shown on the screen. When the feature is disabled (the factory default) there is no symbol present in this location.

2.1.5   Indicator E – System Settings

By default this area of the screen displays the probe's settings (and this is what is shown in Figure 2). When the audio buzzer is enabled (see Section 3.7 for instructions on this feature) this area can also be used to display and configure the buzzer's sensitivity. Configuring the buzzer's sensitivity is discussed in Section 3.8.

2.1.5.1   Probe Settings

When displaying probe settings, the bottom line of this indicator shows the current density setting of the probe on the left, and the averaging setting on the right. These can be set both from the system menus (described in section 3.2), or by selecting a preset configuration (Section 3.3).

The handset contains eight preset configurations of material density and averaging period. If a preset configuration has been selected (as described in Section 3.3), then the top line in this indicator displays which preset is in use. Each preset can be configured with a text description which is also shown on the top line.

The factory default is for all the presets to have a density setting of $1g/cm^3$, an averaging of 5, and no text description.

If the probe's density or averaging setting is modified manually via the system menus then the top line will not be displayed since the handset settings no longer match the preset.

2.1.5.2   Buzzer Sensitivity

When displaying the buzzer sensitivity, the bottom line of this indication shows the current sensitivity as a number in the range 1 – 50, and the top line just displays the label *Buzzer*. This is shown in the figure below.
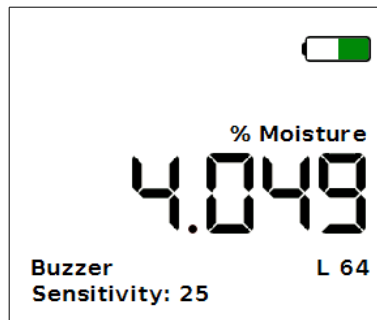

Figure 3: Display with Indicator E showing Buzzer Sensitivity.

2.1.6   Indicator F – Error Status

In normal operation the top left of the screen is blank. In the event of an error condition this space is used to report the problem. In Figure 2 above the warning means that the handset cannot communication with the probe (e.g. because it is disconnected).

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2.2   Keypad Controls

The buttons on the keypad labelled 1 to 7 in the above figure have the following functions.

2.2.1   Button 1 – Power key

This key is used to switch the handset on and off. Press this key once to switch on the handset. At start-up a splash screen is displayed showing the unit's part number and serial number, while a power-on self-test is performed. Once the start-up tests have completed, this key can be pressed again to switch the unit off.

The unit supports an automatic power-down facility, set via a configuration menu (see Section 3.1). This is provided to minimise battery usage in the event the unit is accidentally left switched on. The factory default is for the unit to remain switched on indefinitely.

2.2.2   Button 2 – Right Arrow Key

When the screen is showing the probe settings, this key is used to scroll through the preset probe configurations. Each time the key is pressed the next available preset is selected. When the handset reaches the end of the list of presets it will then return to the first preset in the list.

When the screen is showing the buzzer sensitivity, this key is used to increase the buzzer sensitivity, up to a maximum value of 50.

When navigating menus this key is used to activate the next sub-menu in the menu hierarchy.

2.2.3   Button 3 – Down Arrow Key

In the normal display mode this key is used for one-touch data logging. Each time the key is pressed the current moisture measurement and handset configuration is logged in memory. Up to 64 such data points can be recorded in the handset. This data can be downloaded to a PC and stored to disk, and the log is also cleared under control of the PC interface. See Section 4.2.2 for details.

When navigating menus this key is used to scroll through the menu items in the active menu. When the last item in a menu is active, pressing this key again scrolls around to the first item in the menu.

2.2.4 Button 4 – Menu Key

This key is used to enter and exit the system configuration menu. When the key is pressed the screen is redrawn showing just the battery level indication and the top-level menus, as shown below. In the diagram the top-level menu is active. The bar graph to the right is the sub-menu for the *Backlight* menu item, and is currently inactive (it is greyed out).
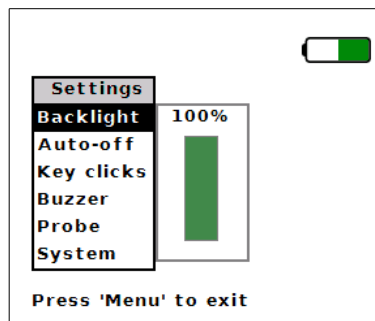

Figure 4: Top-level Menu

The four arrow keys on the keypad can then be used to navigate through the menus and configure the handset. Pressing the **Menu** key at any time when the menus are displayed will return to the main display screen.

The top-level menu has sub-menus to control or view the following:

- LCD backlight brightness
- Automatic switch-off of the instrument
- Settings for the handset key-clicks and buzzer
- Probe configuration.
- System version information

The highlighted menu item in the active menu can be changed using the **Up-Arrow** and **Down-Arrow** keys. The **Right-Arrow** key is used to activate the sub-menu of the highlighted item in the active menu. The **Left-Arrow** key is used to deactivate the current menu and return to its parent menu.

2.2.5 Button 5 – Left Arrow Key

When the screen is showing the probe settings, this key is used to scroll through the preset probe configurations. Each time the key is pressed the previous preset is selected. When the handset reaches the beginning of the list of presets it will then scroll around to the last preset in the list.

When the screen is showing the buzzer sensitivity, this key is used to decrease the buzzer sensitivity, to a minimum value of 1.

When navigating menus this key is used to deactivate the current menu and reactivate its parent menu.

2.2.6 Button 6 – Up Arrow Key

In the normal display mode this key is used for toggling between displaying the probe settings and buzzer sensitivity in indicator area 'E' (described in Section 2.1.5).

When navigating menus this key is used to scroll through the menu items in the active menu. When the first item in a menu is active, pressing this key again scrolls around to the last item in the menu.

2.2.7 Button 7 – Zero-Offset Key

This key provides a one-touch feature to zero-offset the handset. Pressing this key zeros the output of the handset. To remove the zero offset, simply point the probe into free air (where the moisture level should be zero) and press the **Zero-Offset** key again.

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3 Operating The Handset

The following sections describe how to use the handset.

3.1 Switching the Handset On, and Auto Switch-Off

To switch on the handset, press the power key once. The unit will switch on and run its self-tests before showing the main display screen. The unit is switched off by pressing the power key again.

3.1.1 Auto Switch-Off

To configure the auto switch-off timer, press the **Menu** key to enter the system configuration menu. Then use the **Down-Arrow** key to navigate to the *Auto-off* menu item. This will bring up a sub-menu (deactivated initially) with several options for the auto-off time, as shown below.
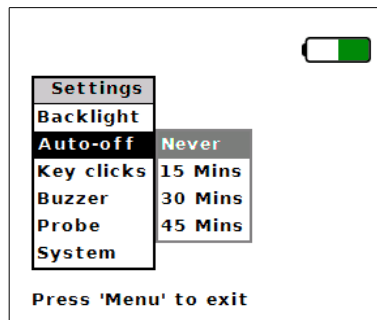

Figure 5: Auto-off Menu Item Selected.

The factory default setting of the is timer is *Never*, so that is the item highlighted in the sub-menu (albeit greyed out because the menu is inactive). To activate the sub-menu, press the **Right-Arrow** key once. The top-level menu will be deactivated and the sub-menu activated, as shown below.
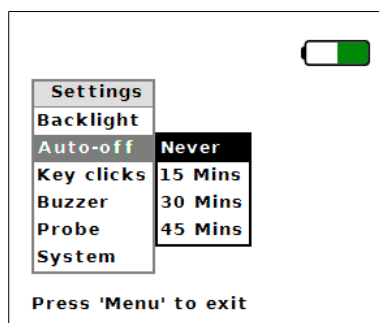
Figure 6: Auto-off Sub-Menu Activated.

Once the sub menu is activated, use the **Up-Arrow** and **Down-Arrow** keys to select the auto-off feature as desired. The options are:

1. Never switch the unit off automatically (the default)

2. Switch off after 15 minutes of inactivity

3. Switch off after 30 minutes of inactivity

4. Switch off after 45 minutes of inactivity

Inactivity is defined as the situation where no key has been pressed and the readout from the handset has not changed by more than 0.1% moisture reading. If a key is pressed, or if the moisture reading changes by more than this threshold, then the auto-off timer is reset.

After the desired auto-off setting has been selected, press the **Menu** key to return to the main display screen, or press the **Left-Arrow** key to re-activate the top-level menu in order to modify other features of the handset configuration.

3.2   Configuring the Probe

From the main display screen of the handset, press the **Menu** key once to enter into the system configuration menu. Then use the **Down-Arrow** key to navigate to the *Probe* menu item, as shown below. This will bring up a sub-menu (deactivated initially) with two items, one for setting the probe density and the other for setting the probe averaging period.
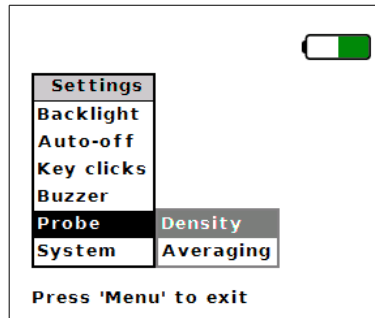
Figure 7: Probe Menu Item Highlighted.

Press the **Right-Arrow** key to activate the sub-menu. The active item is now *Density*, and a new sub-menu is displayed showing a bar graph that allows the probe's density setting to be configured (shown below).
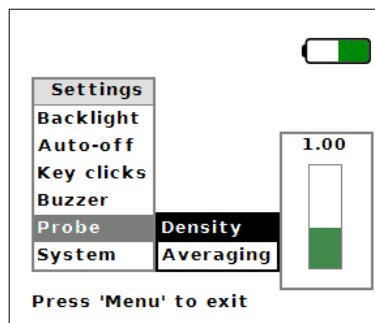

Figure 8: Probe Sub-Menu Active, With Density Highlighted

The **Up-Arrow** and **Down-Arrow** keys can be used to navigate between the two menu items *Density* and *Averaging*. To modify the density setting of the probe press the **Right-Arrow** key once more to activate this bar graph. The bar graph will now look as shown below.
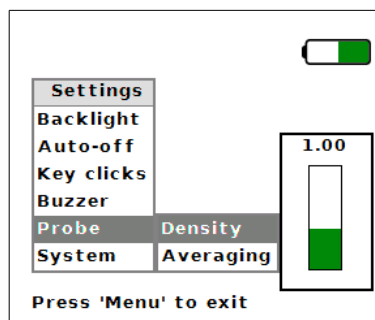

Figure 9: Density Sub-Menu Activated.

Once the bar graph is activated the **Up-Arrow** and **Down-Arrow** keys can be used to increase or decrease the probe's density setting. These keys can be held down if required to modify the setting without having to press the key multiple times. This change to the probe's density setting is actioned immediately, there is no confirmation dialogue required before the change is made.

If the only task required is to change the density setting then the menu can simply be dismissed by pressing the **Menu** key once more, and the handset will return to its main screen with the new density setting applied. Alternatively, press the **Left-Arrow** key to return control to the parent menu, so that the averaging setting can be modified too.

To change the averaging setting, navigate to the *Averaging* menu item. When this menu item is highlighted a further sub-menu will be displayed to its right, with eight options for the averaging time of the probe. This is shown below.
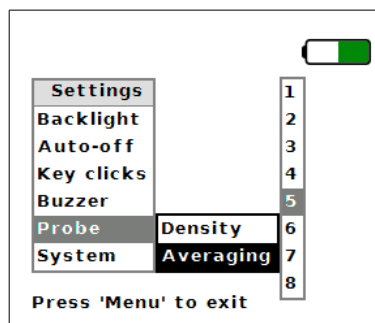

Figure 10: Probe Sub-Menu Active, With Averaging Highlighted

Press the **Right-Arrow** key to activate the averaging menu ,and then use the **Up-Arrow** and **Down-Arrow** keys to select the averaging setting required. The factory default setting is 5.

As with the other menu items, there is no confirmation required when a change is made, the setting is applied immediately. Therefore once a selection has been made the menu can be dismissed by pressing the **Menu** key again to return to the main display. Alternatively the **Left-Arrow** key can be used to go back to the parent menu or, if pressed a further time, to return to the top-level menu.

Averaging setting 1 gives the fastest response time for the probe, but with the most measurement noise. Averaging setting 8 gives the slowest response time for the handset, but with the least measurement noise. The averaging times that these numbers correspond to are shown in Table 1 on page 9.

3.3   Using Presets to Configure the Probe

This section describes how to select a preset to quickly switch between different probe configurations. The handset has eight presets which can be selected by the user. Each preset consists of a probe density setting, an averaging setting, and a text description.

Presets can only be configured via the USB data link from a computer. They cannot be configured from the handset itself. Configuring presets is described in section 4.2.1, this section is limited to describing how to use presets that have already been configured.

When the unit ships from the factory, all eight presets are configured with a probe density of 1g/cm^3 and an averaging setting of 5. The text description is blank.

To select a preset, press the **Right-Arrow** or **Left-Arrow** key. The **Right-Arrow** key switches to the next preset in the list (from 1 to 8). The probe is immediately configured to use the density and averaging setting of the preset chosen. If the **Right-Arrow** key is pressed when the current preset is 8 then it automatically rolls over to preset number 1. Similarly, the **Left-Arrow** key can be used to switch to the previous preset in the list. If the current preset is set to 1 then it scrolls round to preset 8 in the list.

The currently selected preset is shown on the bottom left of the display (display indication E in Figure 2).

If the probe's density or averaging settings are changed using the system configuration menus, and no longer match those of the preset, then no preset is displayed on the display – i.e. the top line of display indication E in Figure 2 is blank. In this case a preset can be reselected by pressing the **Left-Arrow** or **Right-Arrow** key again to scroll through the presets in the handset.

3.4   Applying a Zero-Offset

To apply a zero-offset, simply press the **Zero-Offset** key once. This will apply an offset such that the current probe reading is set to zero. The zero-offset can be updated at any time by pressing this key again.

To remove the zero offset simply point the probe into free air (where the moisture reading is zero) and press the zero-offset key again.

3.5   Logging Data Points

The handset allows up to 64 data points to be logged in its memory for downloading to a computer over the USB interface. Each data point contains the following information:

- a time-stamp
- the preset in use when the data point was logged
- the probe's density setting
- the probe's averaging setting
- the zero-offset applied to the reading
- the moisture level as reported on the handset.

The time-stamp is taken from the Handset's real-time clock. This clock is configured via the USB computer interface (see Section 4.2.3 for details on how to set the real-time clock).

The moisture level stored in the logged data point is that shown on the display when the log was taken, and it includes the effect of any zero offset applied to the measurement. The zero-offset is also included in the logged data so that the uncompensated reading is available too.

The number of log points available for use are shown on the bottom right of the display next to the 'L' symbol – display indication C in Figure 2. Initially this will read 64, since no data points are stored in the handset when it ships from the factory.

To store a data point, just press the **Down-Arrow** key once. This stores the current moisture measurement, and the number of available data points will decrement to show that a point has been taken.

The data log points cannot be cleared or viewed from the handset itself. This is only possible via the USB computer interface (see section 4.2.2 for details of how to read and clear the data log).

3.6   Setting the LCD Backlight Intensity

From the main display screen of the handset, press the **Menu** key once to enter into the system configuration menu. The *Backlight* menu item will be highlighted as it is the first item in the menu, and to the right its sub-menu (a bar graph) is displayed showing the LCD backlight intensity, on a percentage scale of 0 to 100%. This is shown below.
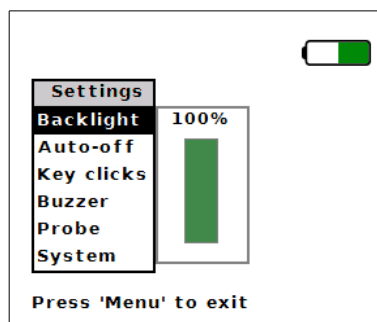

Figure 11: Top-Level Menu with LCD Backlight Item Highlighted.

This sub-menu is is not active when the main menu is first displayed. Activate the bar graph by pressing the **Right-Arrow** key on the handset. The *Backlight* menu item in the top-level menu will be greyed out, and the bar graph's display will be highlighted, as shown below.
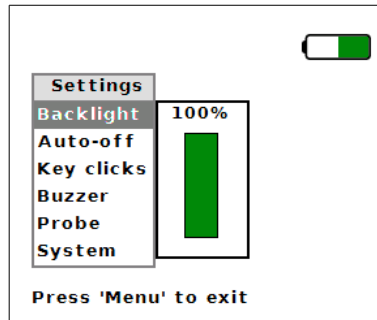
Figure 12: Backlight Sub-Menu Activated.

Once the bar graph is activated the **Up-Arrow** and **Down-Arrow** keys can be used to increase and decrease the backlight intensity respectively. To make large changes, hold the key down and after a brief delay the key action will auto-repeat to avoid having to press the key multiple times.

The changes made to the LCD brightness are actioned immediately,. So if the **Down -Arrow** key is held pressed the brightness will continually reduce until the key is released.

Once the desired brightness has been chosen, just press the **Menu** key again to dismiss the menus and return to the main display. Alternatively, press the **Left-Arrow** key to deactivate the brightness bar graph and reactivate the top level menu., Once the top-level menu has been reactivated, the **Up-Arrow** and **Down-Arrow** keys can be used to navigate to different items to modify other parts of the configuration.

3.7   Setting the Buzzer Controls

The Handset can be configured to output a tone with a pitch that increases with the moisture content being measured. This gives an audio indication of the moisture level in the material under test.

To configure the audio output, press the **Menu** key to enter the system configuration menu. Then use the **Down-Arrow** key to navigate to the *Buzzer* menu item. This will bring up a sub-menu (deactivated initially), as shown below.
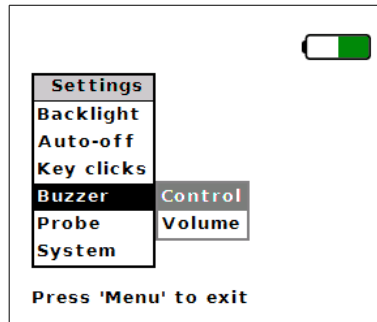
Figure 13: Buzzer Menu.

Then press the **Right-Arrow** key once to activate the sub-menu, after which the Handset will appear as shown below.
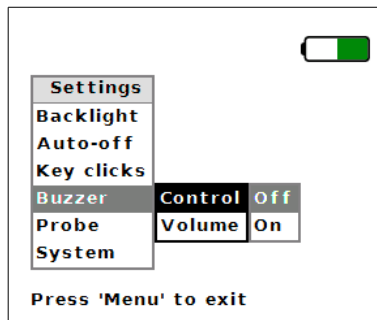
Figure 14: Buzzer menu, when activated.

To switch the buzzer on or off, press the **Right-Arrow** key once more to activate the Control sub-menu. The lowest level menu will then be activated, as shown below. Then use the **Up-Arrow** and **Down-Arrow** keys to enable or disable the buzzer.
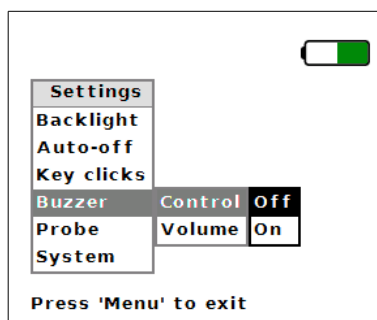

Figure 15: Buzzer Control sub-menu.

The loudness of the buzzer can be set by entering the buzzer's *Volume* sub-menu. From the menu state shown in Figure 14, press the **Down-Arrow** key to select the *Volume* sub-menu and then press the **Right-Arrow** key to activate it. The screen will appear as shown below.
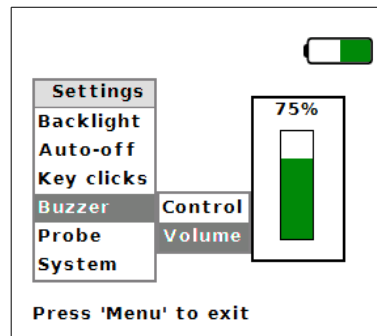
Figure 16: Buzzer's Volume control menu.

Once the bar graph is activated the **Up-Arrow** and **Down-Arrow** keys can be used to increase or decrease the buzzer's volume. These keys can be held down if required to modify the setting without having to press the key multiple times. This change to the buzzer's loudness is actioned immediately, there is no confirmation dialogue required before the change is made (but note that the buzzer is always disabled while using the menus).

3.8   Setting the Buzzer's Sensitivity

When the buzzer is enabled, the pitch of the buzzer's output depends on the moisture level measured by the handset. The buzzer is off when the indicated moisture content is below 0.1%. As the moisture level rises above 0.1%, the buzzer switches on and its frequency increases in proportion to the moisture level.

The rate at which the frequency rises is determined by the buzzer's sensitivity setting. The more sensitive the setting, the smaller the moisture level required to give the maximum frequency buzzer output.

By default the main screen displays the probe's settings in Indicator E (see Section 2.1.5). The buzzer's sensitivity can be displayed and modified by pressing the **Up-Arrow** key once from the main display screen of the handset. Pressing the **Up-Arrow** key a second time will return to the probe settings display. Note that this feature is only available when the buzzer is enabled.

When the buzzer sensitivity is displayed on the screen, pressing the **Right-Arrow** key on the handset will increase the buzzer's sensitivity (on a scale of 1 – 50), and pressing the **Left-Arrow** key will reduce the buzzer's sensitivity.

3.9   Configuring Key Clicks

The Handset can be configured to generate an audible click each time a button is pressed. To configure this, press the **Menu** key to enter the system configuration menu. Then use the **Down-Arrow** key to navigate to the *Key clicks* menu item. This will bring up a sub-menu (deactivated initially), as shown below.
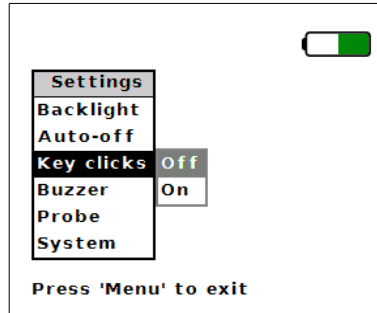
Figure 17: Key clicks Menu

Activate the sub-menu by pressing the **Right-Arrow** key on the handset. Then use the **Up-Arrow** and **Down-Arrow** keys to choose whether key clicks are enabled or disabled.

3.10 Viewing the System Version

The last item in the top-level menu reports the software version installed in the Handset. To view this information, press the **Menu** key once from the main display screen of the handset to enter into the system configuration menu. Then navigate to the *System* sub-menu. This menu item simply displays version numbers – it is not possible to modify anything.
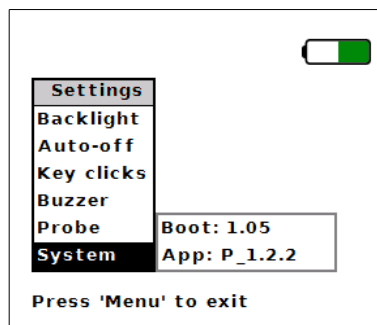

Figure 18: System Menu.

4   Configuring the Handset From a Computer

The Handset can be connected to a computer via a USB interface, and this provides a data connection that is used to configure the handset and manage logged data.

4.1   Installing the Software

The software is installed by double-clicking on the file called M50HandsetConfig.msi. This installs the software onto the computer, and it can be run either via the Windows Start menu or by double-clicking on the shortcut placed onto the desktop.

4.1.1   Installing USB Device Drivers in MS Windows

When the handset is first plugged into a PC, the computer should find and install the USB drivers automatically if the computer is connected to the Internet. For reference, the required software is FTDI's "virtual COM port (VCP)" driver for their FT232BL devices. Drivers are available for free download from their website http://www.ftdichip.com.

Once the USB driver is installed the Handset will appear to be connected on a Windows COM port. The way to find out which COM port has been assigned to the probe is to go to the Control Panel menu, then Administrative Tools, and open "Computer Management". Click on "Device Manager" in the left-hand pane of the window that opens, then scroll down to "Ports (COM & LPT)" in the right-hand pane. One of the items in this list will say something like "USB Serial Port (COM3)". In this example the probe would be connected on COM3.

4.2   Running the Software

When the software starts it first asks for the serial port on which the Handset is connected (see Figure 19).   Select the Handset's serial port from the drop-down selection and press OK. The software will download the Handset's preset configuration data and log and populate the main program window.
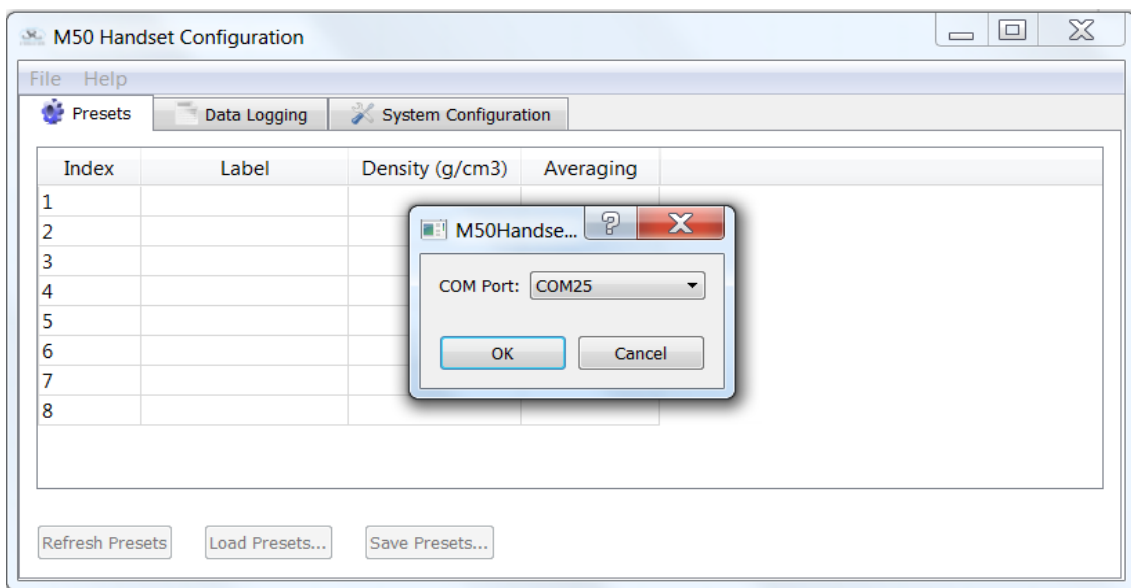

Figure 19: Startup Screen of the PC Software.

There are three tabs on the top of the program's main window, to control different aspects of the handset:

Presets   This tab shows the Handset's preset configuration data. The presets can be loaded, saved, and edited.

Data Logging   This tab shows data points logged in the handset. The log can be saved to disk and the handset's contents cleared.

System Configuration   This tab shows the Handset and Probe product codes, serial numbers and version numbers.

4.2.1   Configuring Presets

Select the Presets page by clicking on the top button on the left hand side of the main window. The figure below shows the screen with factory-default preset data.
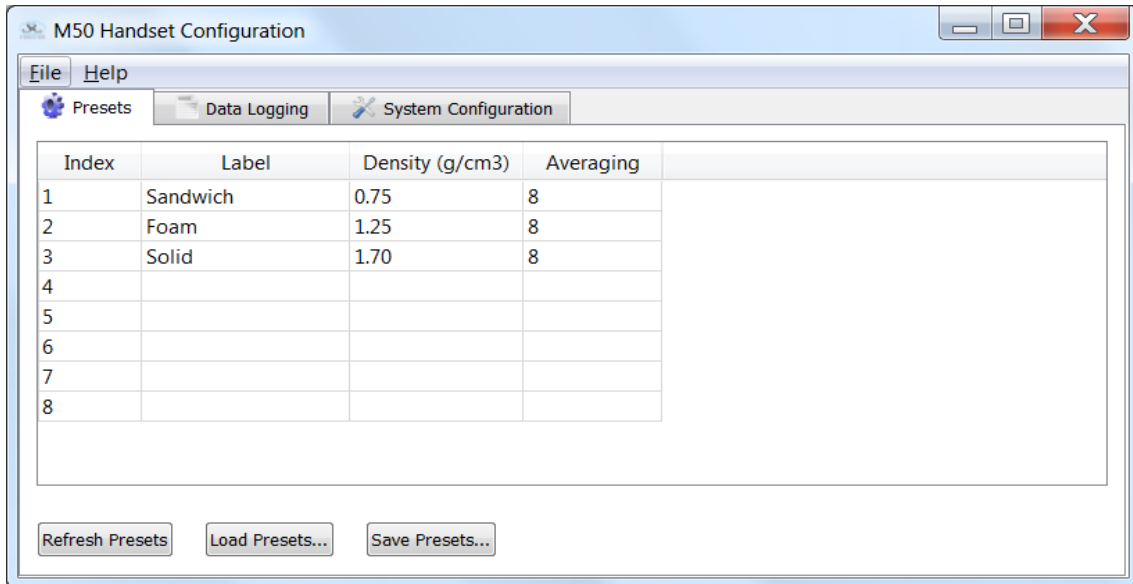
Figure 20: Preset Management Window.

The program loads the preset configuration data from the handset when it starts, but this data can be updated manually by pressing the **Refresh Presets** button on this page.

The preset configuration currently displayed in this window can be saved to disk by pressing the **Save Presets...** button. The data is saved in a file which has a `.PRS` suffix.

The **Load Presets...** button allows a previously saved `PRS` file to be reloaded into the Handset. When a `PRS` file is loaded, the new preset configuration is written to the handset, and then the handset's configuration is re-read back into the program. This ensures that the data displayed in the program always matches that stored in the handset.

4.2.1.1   Editing Presets

A single preset can be edited by double-clicking on a cell in the table. The data in the cell can then be edited, as shown below. When the Enter key is pressed or the mouse is clicked elsewhere on the screen the updated preset is written to the handset.
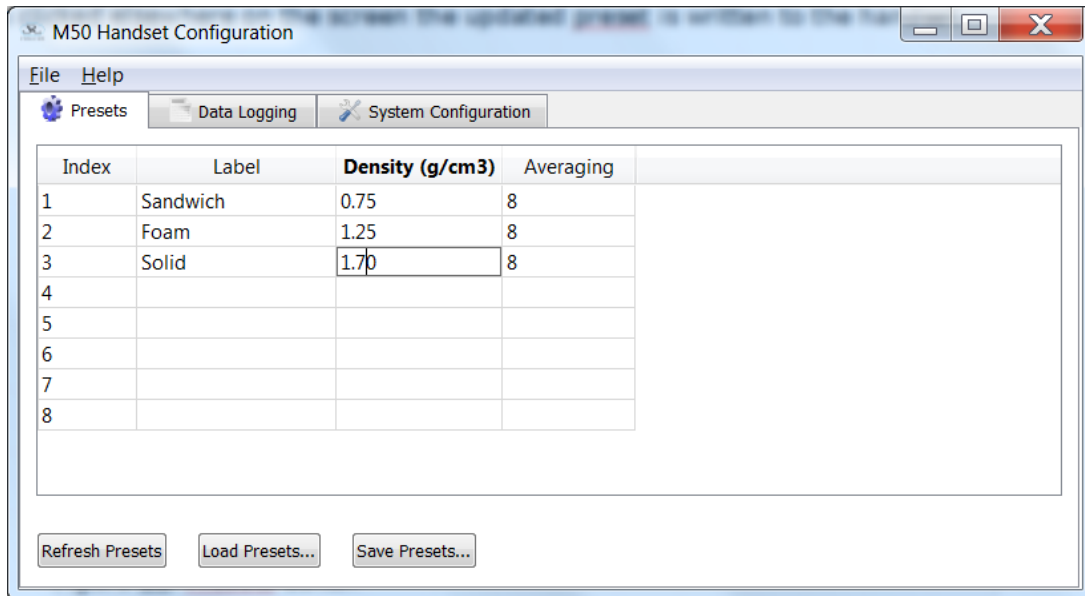

Figure 21: Presets Editor.

4.2.2   Managing Logged Data

View the data logged in the handset by selecting the Data Logging tab from the top of the program window. The table in the window will then show all the logged data. An empty log window is shown in Figure 22 below. Each log point contains the following information:

Index   A numerical index from 1 to 64

Time   The time at which the data point was logged, from the handset's real-time clock.

Preset   The number of the preset in use when the data was logged. A value of zero means that there was no preset in use.

Density   The density setting in use when the data point was logged.

Averaging   The averaging setting in use when the data point was logged.

Moisture   The moisture value as displayed on the handset's screen (i.e. the zero-offset is incorporated into this value)

Offset   The zero-offset in use when the data point was logged.
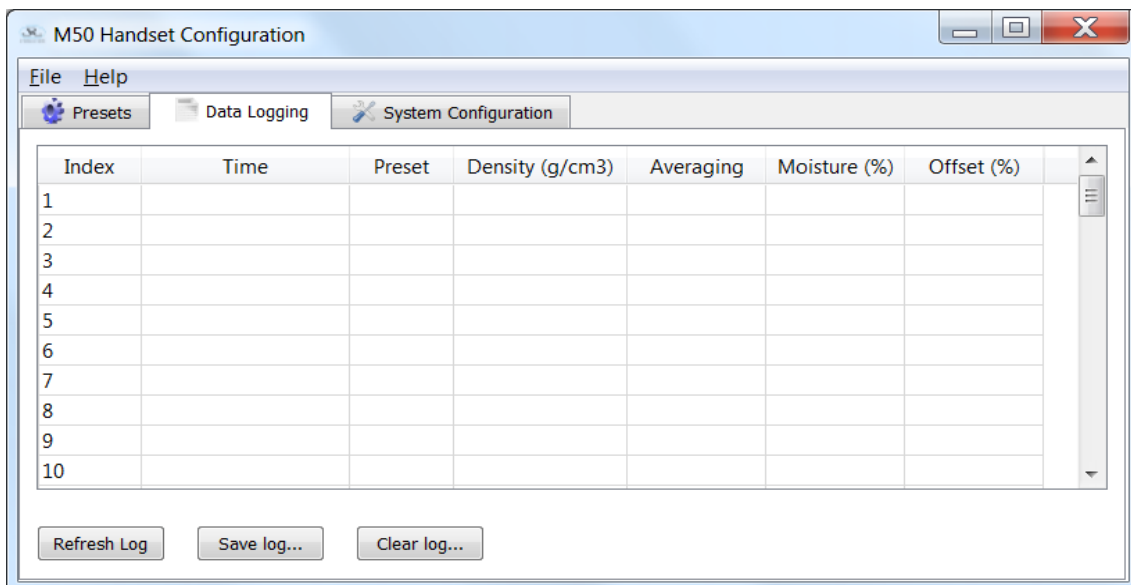

Figure 22: Data Logging Window, With Empty Log Table.

The log is downloaded to the PC when the software first connects to the handset, but it can be manually updated by pressing the **Refresh Log** button. The **Save Log...** button allows the log to be saved to disk as a CSV file. The **Clear Log...** button clears the log from the handset and also from the table displayed in the program.

4.2.3   System Configuration

The System Configuration tab is shown in Figure 23 below. At the top of the screen the handset and probe product codes, serial numbers, and firmware version numbers are displayed. Below this the program displays the setting of the real-time clock in the handset. This screen is also used to update the handset's firmware.
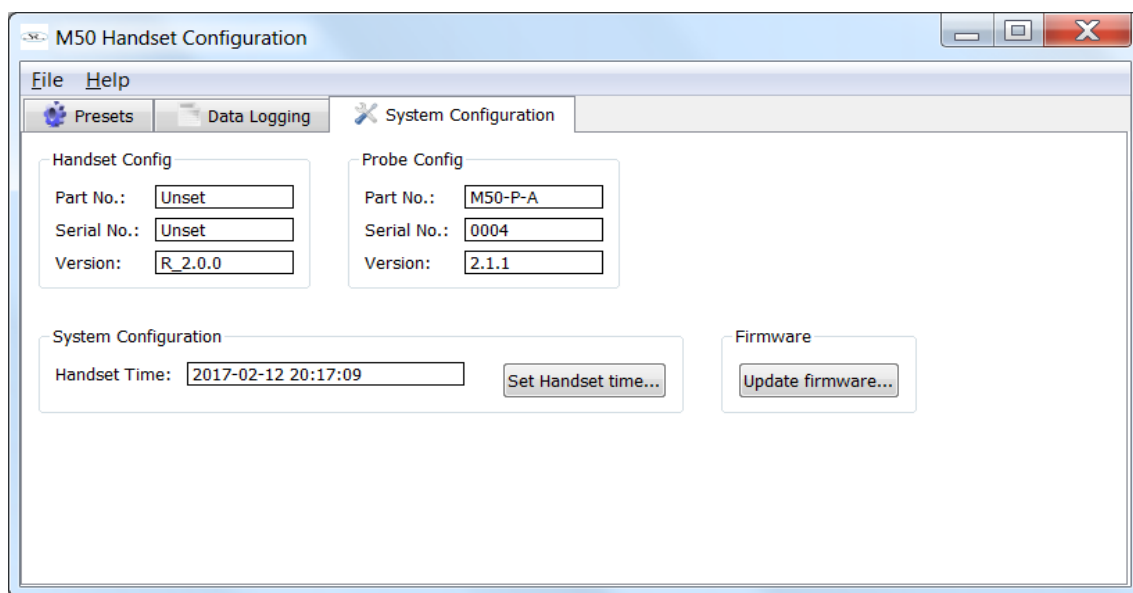

Figure 23: System Configuration Page.

To update the handset's real-time clock, click on the **Set Handset Time...** button. This opens a dialogue box for setting the time. The default setting in this dialogue is the PC's current time.   So it is sufficient just to press the OK button to set the handset's time to match that of the PC.

The handset's real-time clock will maintain its setting when the instrument is switched off. The time will be lost when the handset's batteries run down or are removed.

5 Error Messages

The top left of the LCD display is reserved for error messages. When the display is working properly, this area will be blank. The following error messages may be displayed:

Error message	Description
⚠ **Probe comms**	The handset is unable to communicate with the probe (e.g. the probe has been disconnected)

6 Revisions

Date	Revision	Description
2013-01-16	1	First Issue
2013-11-30	2	Update for version 1.2.2 of the handset firmware.
2017-02-14	3	Update for new version of PC control software.
2018-03-04	4	Add notes on how to fit handset to docking station.

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