The Global Leader in Ground Penetrating Radar (GPR) Solutions

MALÅ

MALÅ Easy Locator Pro HDR Series User Manual

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Guide for Operating the MALÅ Easy Locator Pro HDR Ground Penetrating Radar

Our Thanks...

Thank you for choosing MALÅ Geoscience as your Ground Penetrating Radar solution provider.

The very core of our corporate philosophy is to provide our users with the very best products, support and services. Our development team is committed to providing you with the most technologically advanced and easy-to-use GPR products with the capability to meet your needs for efficiency and productivity now, and into the future.

Whether this is your first MALÅ Geoscience product, or addition to the MALÅ collection, we believe that small investment of your time to familiarize yourself with the product by reading this manual will be rewarded with a significant increase in productivity and satisfaction.

At MALÅ Geoscience, we welcome comments concerning the use and experience with our products, as well as the contents and usefulness of this manual.

MALÅ Geoscience team

MALÅ Geoscience

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Preface

About this Manual

This manual is written for the end user of the product and explains how to set up and configure the product, as well as providing detailed instruction on its use. Basic theory for Ground Penetration Radar is outlined to help the operator understand the underlining technology. References for thorough discussions of this topic and applications for the technology are also presented.

Known issues and limitations, precautions, best practices and tips are also presented so that the most efficient and productive use can be achieved.

Additional Resources

GPR Training	www.malags.com/Support/Training
GPR Applications	www.malags.com/Resources/Applications
GPR Case Studies	www.malags.com/Resources/Case-Studies
GPR White Paper	www.malags.com/Resources/White-Papers
GPR FAQ	www.malags.com/Support/FAQ

Feedback

Feedback regarding the contents of this manual or the product may be sent using any of the following channels.

Phone (Sweden)	+46 953 34550
Phone (USA)	+1 843 852 5021
Phone (China)	+86 108 225 0728
Phone (Malaysia)	+60 (0) 3 6250 7351
Phone (Australia)	+61 438 278 902
Web	www.malags.com/feedback

Safety and Compliance User Notices

This GPR-device is certified according to FCC, subpart 15, IC RSS-220 and ETSI EN 302 066-1&2.

According to the regulations stated in ETSI EN 302 066-1 (European Telecommunication Standards Institute):

The control unit should not be left **ON** when leaving the system unintended. It should always be turned **OFF** when not in use.

The antennas should point towards the ground, walls etc. during measurement and not towards the air.

The antennas should be kept in close proximity to the media under investigation.

Canadian and US regulations states that whenever GPR-antennas are in use the following notes apply:

This Ground penetrating Radar device shall be operated only when in contact with or within 1 m of the ground.

Only law enforcement agencies, scientific research institutes, commercial mining companies, construction companies and emergency rescue or firefighting organizations shall use this Ground Penetrating Radar Device.

This device complies with Industry Canada license-exempt RSS standards. Operation is subject to the following two conditions: (1) This device may not cause interference and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

French translations:

Cet instrument de Géoradar se devra d'être opéré seulement en contact à même le sol ou en deça d'un mètre du sol.

Cet instrument de Géoradar se devra d'être utilisé seulement par les agences chargées de l'application de la loi, les instituts de recherches scientifiques, les compagnies minières à buts lucratifs, les compagnies de construction et les organisations responsables pour le sauvetage et la lutte contre les incendies.

Cet instrument répond aux exigences de la licence avec Industrie Canada- exempt des standards RSS. L 'opération est sujette aux deux conditions suivantes : (1) Cet

instrument ne peut pas causer une interférence et (2) cet instrument se doit d'accepter quelque interférence que ce soit, incluant une interférence qui pourrait causer une opération non-souhaitable de l'instrument.

Get Ready. Set up. Go

This section walks through the steps for getting ready, setting up and basic operation of your new MALÅ GX HDR. Information is also available on what to do in case the equipment may have been damaged during shipment.

Note: If a defect in the equipment is discovered, make sure to contact MALÅ Geoscience prior to use and follow the instructions for Repacking and Shipping in this section.

MALÅ Easy Locator Pro HDR Features

The HDR-series (High Dynamic Range) is the latest addition to MALA's versatile product range. It is a completely new design, based on patented cutting edge technology. These new antennas are not just an upgrade of earlier designs; they represent a leap in GPR-technology, not seen in the past 15 years.

Advantages compared to conventional GPR technology

Real-time sampling technology – HDR enabled

Significantly faster data acquisition rates

Greater signal-to-noise ratio

Increased bandwidth

Unprecedented dynamic range and resolution

32 bit data output

Greater depth penetration

Better detection capabilities

Accessories and Optional Extras

Additional Battery and battery charger

Additional Li-ion Battery Pack 12 V (3.5 Hour) for the MALÅ Easy Locator Pro.

Additional MALÅ Li-ion Battery Charger

Unpack. Inspect. Register

Great care should be taken when unpacking the equipment. Be sure to verify the contents shown on the packing list and inspect the equipment and accessories for any loose parts or other damage.

> **Note:** The packing list that is included with the shipment should be read careful and any discrepancy should be reported to our sales department at www.malags.com/corporate/contact

File any claim for shipping damage with the carrier immediately after discovery of the damage and before the equipment is put into use. Any claims for missing equipment or parts should be filed with MALÅ Geoscience within fourteen (14) business days from the receipt of the equipment.

> **Note:** All packing material should be kept in the event that any damage occurred during shipping.

> **Note:** Two serial numbers are attached to the equipment, (1) on the underside of the monitor and (2) on top of the antenna.

Repacking and Shipping

The MALÅ Geoscience packing kit is specially designed for shipping MALÅ Easy Locator Pro HDR. The packing kit should be used whenever shipping is necessary. If original packing materials are unavailable, pack the instrument in a box that is large enough to allow at least 80mm of shock absorbing material to be placed all around the instrument. This includes top, bottom and all sides.

> **Warning:** Never use shredded fibres, paper or wood wool, as these materials tend to pack down and permit the instrument to move inside its packing box.

Please read our shipping instructions before returning instruments to MALÅ Geoscience. These instructions can be found on our website at:
www.malags.com/Support/Service-Repairs.

Registering MALÅ Easy Locator Pro HDR

By registering your equipment, you ensure that you receive up-to-date documentation, software upgrades and product information, which all helps to optimize the utilization of the equipment and realize the maximum return on your investment.

To register your equipment, simply visit – www.malags.com/Support/Product-Registration on our website and submit the registration form.

System Assembly and Set Up

MALÅ Easy Locator Pro is an integrated system, consisting of an Easy Locator controller and HDR antenna, linked through a single data/power cable.

Hardware Set Up

Convenient hand recesses enable easy lifting of the Easy Locator Pro HDR

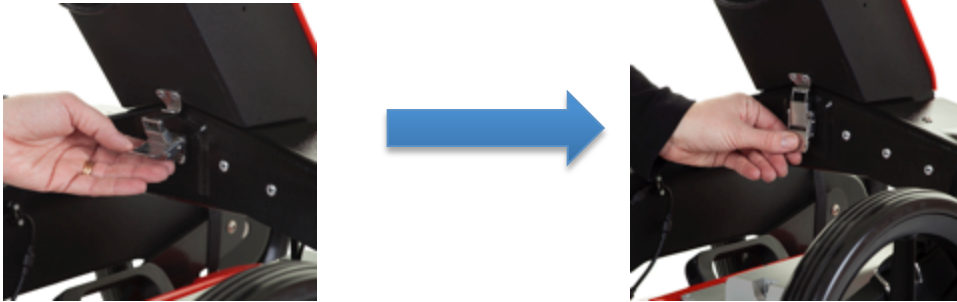# Raise the Handle

1 Release the main handle assembly clamp

2 Pull one side of the handle assembly out of out of its fixed position. Once released, do the same on the opposite side.
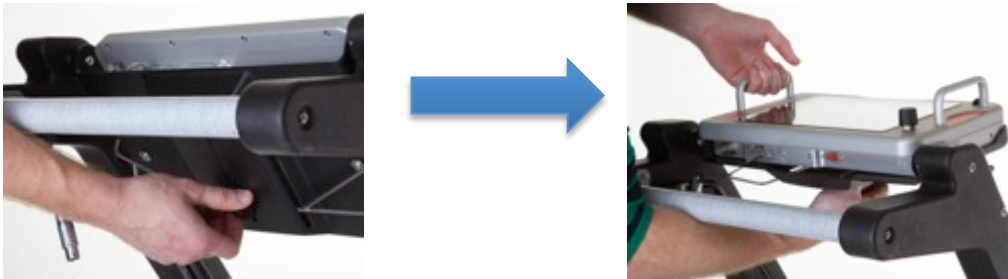
3 Using the handlebar, raise the handle assembly into the upright position and move the clamp into the locked position

4 Fasten the clasp on the rear of the handle assembly

5 Slacken the bolt on the rear of the controller, raise the controller to the desired viewing angle and re-tighten the bolt.

6 Adjust the four straps to raise or lower the antenna to the required height

Note: Under normal conditions, the antenna should be kept in contact with the ground where possible. Position the Easy Locator on the surface to be surveyed and then adjust the straps so there is a small amount of slack. This will compensate for any undulations along the survey line.

Connecting it all up

1 Connect the data cable to the Easy Locator Pro controller

> **Note:** Look for the countersink in the power cable and place it towards the mark on the connection. Push lightly. If you have it in the correct position it will go in its position smoothly. To disconnect, pull out holding the metal part of the connection.

2 Connect the data cable to the antenna

3 Raise the battery hatch and connect the batteries

4 Connect the encoder cable from the wheel to the antenna.

> **Note:** The precision of the encoder wheel depends on several factors, such as; the condition of measurement surface, the pressure applied on the wheel and possible wear.
>
> **Warning:** When using MALÅ Easy Locator, the wheel calibration must be changed to the appropriate wheel, enter the **Settings Menu** on the Easy Locator Controller and change the **Acquisition Parameters** to the correct wheel.

5 Power up

Start the Easy Locator Pro by pressing the power button on both the HDR antenna and the Easy Locator Controller.

To turn the antenna and monitor off, first select **QUIT** from the **Main Menu**, confirm the action by selecting **YES** then push the power button on the monitor and release quickly.

> **Note:** The antenna will automatically turn off when the monitor is powered down.
>
> **Note:** If a power cable is accidentally pulled out, the Easy Locator Pro components will start automatically when reconnected.

Antenna LED Indicators

Three LED-indicators are mounted beneath the antenna product label.

DATA: Continuous flashing light indicates the unit is working properly and ready for data collection. Irregular flashing on this LED means erroneous antenna configuration or possible software version issue. The LED switches to continuous illumination when the unit enters data collection.

GPS: Flashing light mean that the GPS option is installed and that the internal computers are successfully communicating with the GPS-unit. This LED switches to continuous light whenever there's 4 or more satellites available.

INFO: This LED indicates a serious system Error, whenever active. Please contact your local MALÅ representative.

Battery Maintenance and Charging

Easy Locator Pro Battery

A 12V/8.7Ah Li-ion battery pack is shipped with the MALÅ Easy Locator Pro HDR Antenna and is the recommended power source for the antenna. Under normal operating and handling conditions, this battery is capable of up to 3.5 hours of continuous operation. MALÅ Easy Locator Pro HDR antenna will automatically turn itself off when the battery voltage drops below 10V. A meter showing the remaining battery capacity is displayed on the Controller.

Tip: If storing the battery for long periods of time, discharge the battery to approximately 50%, this will maximise the life of the battery. Use the battery level indicator on the Controller to estimate 50%, wait until the indicator enters the yellow section, power down and remove the battery. This also applies to the internal battery in the Controller.

Charging the Easy Locator Pro Battery

With the use of the correct adaptor, connect the supplied battery charger to the battery pack.

The LED light on the charger indicates the following:

Red=Charged<80%
Yellow=Charged80-100%
Green = Maintenance charging

When re-mounting the battery, gently attach the d-sub connector on front of the battery with the d-sub on the mounting tower. Then pull the battery release pin and press down on the battery until the release pin slots into place.

> **Tip:** Though recharging up to 80% of the full capacity is typically very fast, it is recommended to keep the battery charging until it is fully charged to help extend the battery life.

> **Note:** The battery charger can be left on after the battery has been fully charged where it will then automatically enter a maintenance-charging mode.

Charging time for the 8.7Ah batteries is approximately 3-5 hours (80%-100%).

The temperature when charging should be within Zero to +45°C / 32 to 110°F. Do not charge the batteries in direct sunlight or when surrounding temperatures is below freezing point.

User Interface

The following sections contain a detailed description of the user interface and give tips and warning designed to help the user achieve the highest possible level of productivity and safety while operating the MALÅ Easy Locator Pro HDR.

Main Display Window

The MALÅ Easy Locator Pro Controller uses dedicated software designed specifically for the display and collection of GPR data.

> **Note:** The Controller utilizes a sunlight readable LCD display for maximum visibility in sunlight.
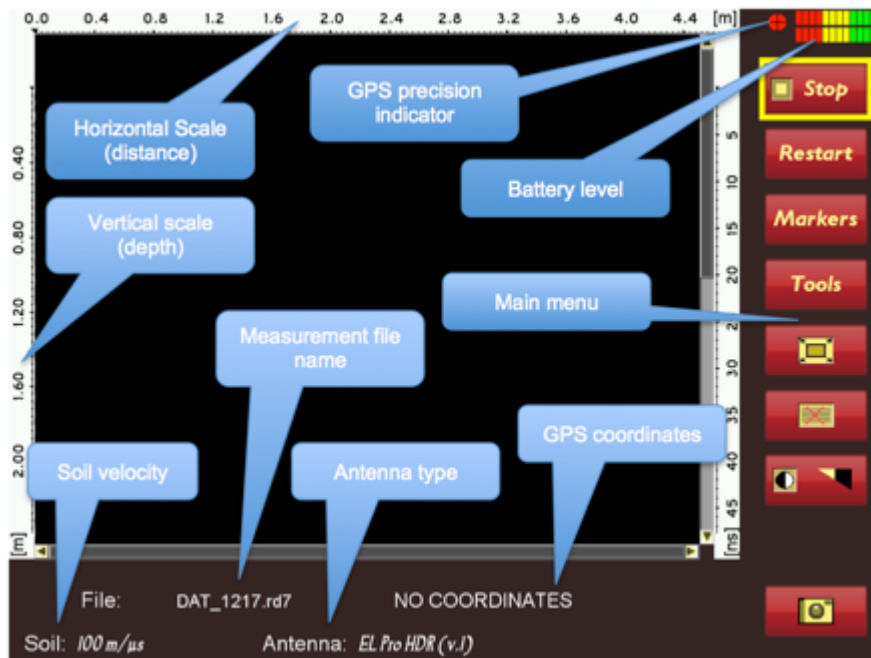
Navigating the Menus and Options

The Easy Locator Pro Controller is operated with a dual function **Navigator** for selecting options and functions. Menu items are selected by rotating the Navigator clockwise or anti-clockwise. The selected item is then executed by pushing the button.
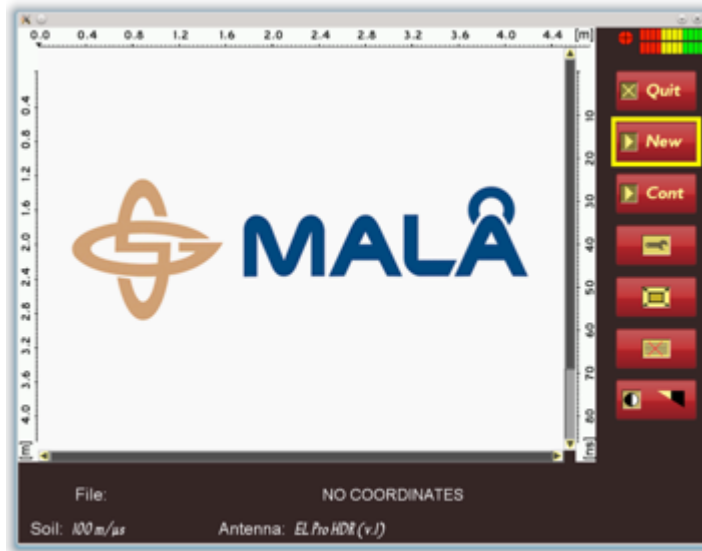
The Navigator control fitted to Easy Locator Pro Controller works in a similar way to a computer mouse allowing the user to navigate menus and update data. Rotating the knob either allows sequential scrolling through menu options to make a menu selection or changes selected parameter values. Pressing the knob either executes the currently selected menu option or sets the value of the selected parameter.

> **Note:** The controller **Main Display Window** appears about 20 seconds after turning on the controller and HDR antenna.

Main Menu

The items available under the **Main Menu** vary depending whether the system is in **Stopped mode** or **Started mode**.

Stopped mode:

Started mode:

> **Tip:** The Easy Locator Pro Controller is equipped with a **Zoom Function** for enlarging areas of interest in the **GPR Profile**.

Zoom Function

Use the **Navigator** to select the **Vertical scrollbar**. The vertical scrollbar turns yellow when selected. Push the **Navigator** once to activate scrolling. The **Vertical scrollbar** will turn blue indicating that it has been activated. Push, hold and turn the **Navigator** to zoom in and out, the vertical scroll bar will be blue with arrows.

Main Menu Icons

Quit and shutdown the system after completing the radar measurements

> **Note:** If the **QUIT** option is executed but the Controller is not turned off immediately, the unit has to be put through a power cycling sequence before it can be restarted. This is achieved by pressing the power switch on the Controller and then waiting for 5-10 seconds before pressing the power switch again. If this procedure is not followed, the unit will fail to turn on.

Select the **New** button to start scanning. The GPR data will begin to appear on the black screen as the unit is moved forward.

Select the **Continue** button to resume the last stopped measurement.

Press the **Measurement Parameters** button to access the measurement parameters menu. See the **Measurement Parameters** section for more information on the use of this option.

The **Full screen** button toggles the display to full-screen mode where the menu and status information is hidden and the entire display is used to display the GPR profile

The **Background removal filter** button is used to remove horizontal lines/reflections caused by noise from the GPR profile. By rotating the **Navigator,** various levels of background removal can be applied. The effect of the filtering can be seen when the button is deactivated, the level can be gradually adjusted to create the clearest and most interpretable image possible.

The **Contrast** button is used to set the contrast of the GPR profile. Rotating the **Navigator** increases and decreases the contrast level.

The **Time gain** button is used to adjust the time gain for the GPR profile. The **Navigator** is rotated to increase or decrease the applied time gain

Note: When the **Auto Gain** option in the **System Menu** is selected, the manual **Time gain** is deactivated and removed from the main screen.

Tip: Gain is very useful for making targets appear brighter in the GPR profile, this is especially important when searching for deeper targets.

Measurement Parameters Menu
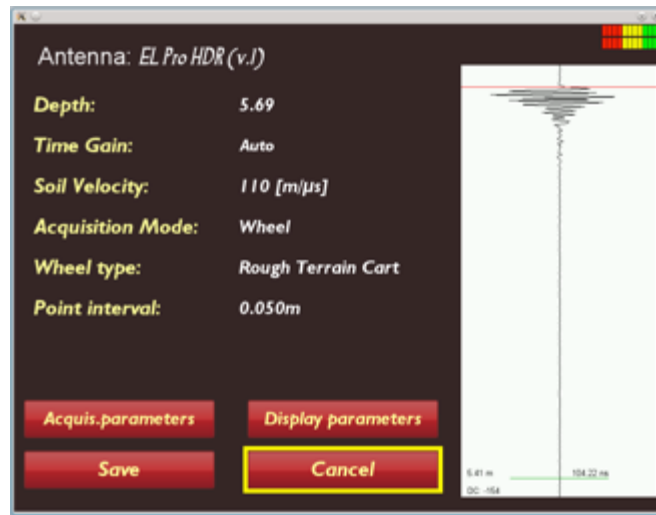
Depth:	Depth defines the length of the radargram vertical scale. This is sometimes refered to as the time window length. In this case, the velocity measuremt is used to calculate the depth window.

Note: This measurement will vary if the velocity measurement parameter is changed.

Time Gain:

Set to manual or auto (Automatic Gain Control).

Note: Manual gain activates the **Time Gain** button on the main screen and allows the user to manually adjust the gain. Selecting **Auto** deactivates the **Time Gain** button on the main screen and the Controller will apply the highest gain level for the signal to noise ratio.

Soil Velocity:

Set the velocity based on soil type. Setting the velocity allows the adjustment of the depth scale for differing soil conditions.

Warning: This is a critical setting if accurate depth information is required. Soil conditions can vary rapidly with location and all depth information must be used with caution.

Tip: The velocity can be set during the post processing stage; it is not critical that this measurement is established during the data collection stages, unless marking the depth on site

Acquisition Mode:

Set the type of trigger to be used for initiating a measurement.

Three triggering options are available:
Wheel, Time, or Keyboard Triggering.

> **Note:** Changing the three different trigger options will change the options listed below the **Acquisition Mode** icon

> **Note:** When measuring by time, make sure that the time interval is appropriate.

Wheel type:

Selecting the **Wheel type** icon can choose a selection of predefined wheels from the drop down list.

> **Tip:** Additional wheels and individual calibration can be added to the list by accessing the **Acquisition Parameters** menu

> **Note:** The precision of the encoder wheel is not infinite and depending on several factors as; the measurement surface, the pressure applied on the wheel and possible wear. If you are unsure of the encoder wheel precision a re-calibration should be made

Point interval:

Point interval sets the distance between the measured points/traces in the radargram.

Acquisition Parameters Menu
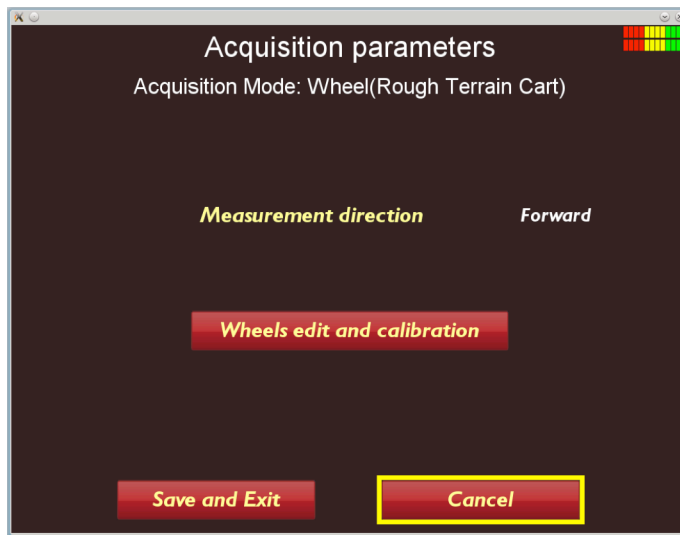
Measurement direction

Choose **Forward** or **Backward** depending on the direction of the scan whilst utilising the **Measuring Wheel** or **Cart.**

> **Note:** This option will not be available when **Time** or **Keyboard Triggering** is selected on the **Measurement Parameters Menu**

Wheels edit and calibration

Select the **Wheels Edit and Calibration** to enter the wheels calibration menu.

Wheels Edit and Calibration Menu

Trigger Name	pulses/m	dir.
Undefined Wheel	500.00	+
EL Pro Cart	360.67	-
Rough Terrain Cart	346.80	-

Select wheel   Create new wheel

Edit current wheel   Delete current wheel

Exit

Choose the **Select Wheel** to highlight the wheel to be edited or deleted from the list.

The **Create New Wheel** option allows the user to select a new type of wheel in addition to the standard list. This maybe useful if the encoder is attached to a non-standard wheel.

Select **Edit Current Wheel** calibrate the wheel, see **Wheel Edit Options** for further details.

> **Note:** First use the **Select Wheel** option to highlight the wheel to be edited.

Choose the **Delete Current Wheel** option to remove a selected wheel from the list.

> **Note:** First use the **Select Wheel** option to highlight the wheel to be deleted.

Wheels Edit Options

|	
Wheel name	Select **Wheel Name** to create a name for the new wheel.
Direction of calibration	Select **Forward or Reverse** depending on the direction of the wheel during the calibration process.
Distance for calibration	Measure a distance on the ground using a measuring wheel or tape. Enter this distance after selecting **Distance for Calibration.**

> **Tip:** For a higher level of accuracy, measure a length over the surface where the GPR is being used. A longer distance will average out any surface variations.

Start calibration	Select **Start Calibration** once the correct details are entered into the above options and when the GPR is positioned over the beginning of the measured length. Move the GPR towards the end of the measured length, when this process is complete, select **Stop Calibration.**

Display Parameters Menu
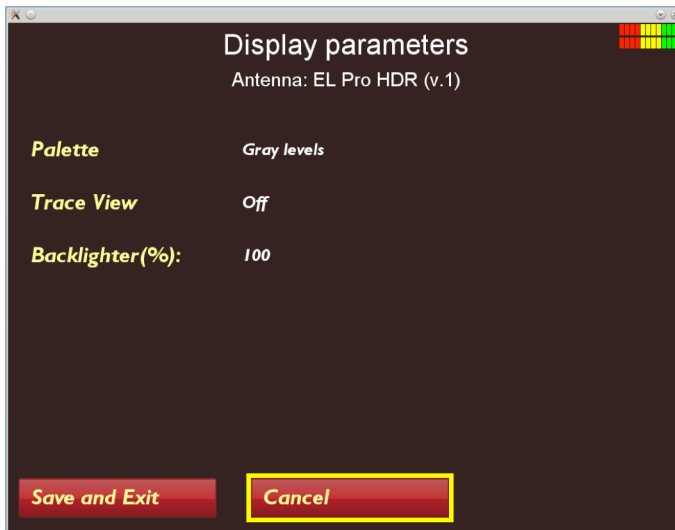
Palette	The palette refers to the display of the radargram, there are 3 options; grey scale or 2 color options.
Trace View	If Trace view is ON, a small window will appear during measurements, showing the actual measured trace.
Backlighter(%):	The intensity of the screen light can be changed with the backlighter option. **Tip:** Reducing the backlight will extend the battery life between charges.
Save and Exit	Saves changes and exits to previous screen
Cancel	Closes the **Menu** without applying changes.

Operating Instructions

The following sections walk you through more advanced modes of operation of the equipment.

2D Project

Select **2D Project** from the **main screen** options to conduct a simple 2D profile
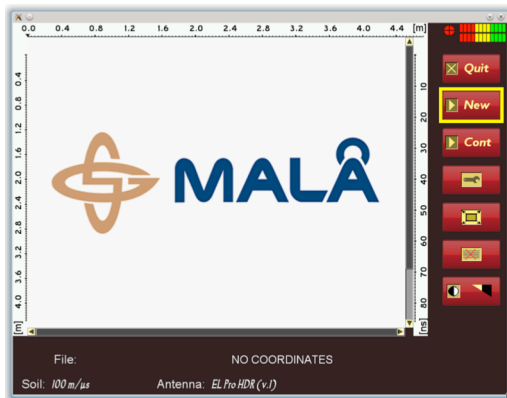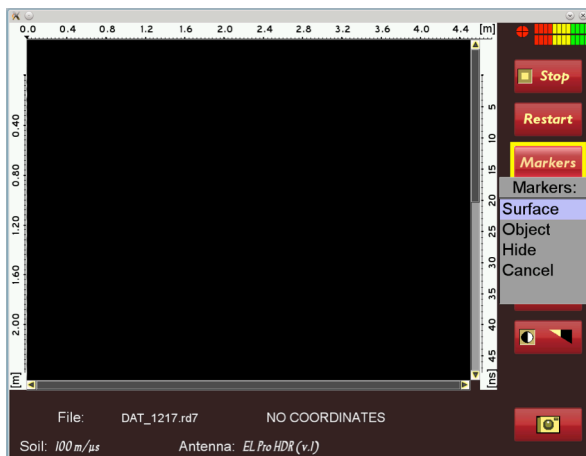

Select **New** to begin the measurement.

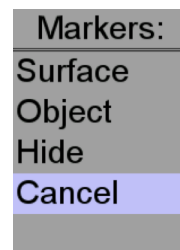See **Main Menu section** for a full description of the icons.

Note: Check **Settings** before commencing a measurement

Various markers can be inserted into the radargram by selecting the **Markers** icon

A dropdown box containing the marker options will appear when the **Markers** icon is selected

Surface Marker allows a marker to be placed at zero depth level on the radargram. This is useful for marking a feature that is visible on the surface. It can be marked as you pass the feature or reverse the Easy Locator Pro HDR antenna over the feature and then select **Surface.**

Object Marker allows a similar marker to the surface marker to be placed at a selected depth within the radargram. Reverse the Easy Locator antenna over the feature and select **Object,** a crosshair will appear on the vertical curser which can be positioned at the correct depth by using the **Navigator** control.

Hide removes the markers from the display. This is not permanent; the markers can be made visible again by selecting **Show,** which is indicated after **Hide** is selected**.**

Select **Cancel** to exit the **Marker Menu**

Select **Tools** to enter the **Tools Menu.**
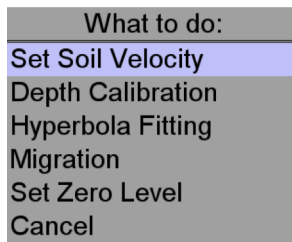
A dropdown menu appears when the Tools Icon is selected.

What to do:
Set Soil Velocity
Depth Calibration
Hyperbola Fitting
Migration
Set Zero Level
Cancel

Set Soil velocity. If the soil velocity has been determined, enter the value by selecting **Set Soil Velocity** icon and then use the Navigator to set the correct figure.

Depth Calibration. If the true depth of an item is known, place the antenna so the curser is positioned over the feature in the radargram, select **Depth Calibration** to activate the vertical curser/cross hair and use the **Navigator** to position vertical curser to the top of the reflector of the known depth. Press the **Navigator** and enter the value for the true depth. Finally, press the **Navigator** again to accept the value and the Easy Locator Controller will automatically calculate the velocity based on the entered value.

Hyperbola fitting. If there is a clear hyperbolic response in the radargram, utilise the **Hyperbola fitting** feature to calculate the velocity of the soil. Position the antenna so the vertical curser is over the hyperbola, press the Navigator to activate the horizontal crosshair and rotate the **Navigator** to place the cross hair on the top of the hyperbola. Press the **Navigator** reveal the simulated hyperbola, now rotate the **Navigator** to increase or decrease the simulated hyperbola so it "fits" the true hyperbola in the radargram. Press the **Navigator** to complete the process; the calculated velocity will be saved.

Migration this options applies migration to the dataset, which will have the effect of removing the hyperbola to leave a point in the radargram. First, complete any of the above velocity calculations to determine the soil velocity and then select **Migration** to apply the process to the radargram.

> **Tip:** Accurate calculation of the soil velocity is required for the migration to work effectively. Depth Calibration is often the most accurate and this should be the first option if available.

3D Grid Project

Grid Project is a tool that makes the visualization of radar data measured in two perpendicular directions easier.
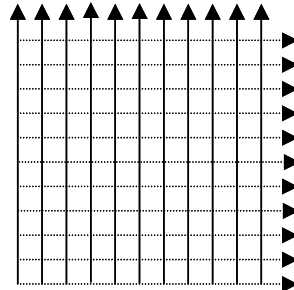
A typical Grid project can be used to map a larger area where the direction and location of utilities for instance is unknown. It enables the use of the plan view to visualise the utilities. The Grid Project option in the Easy Locator Controller will guide you through all steps involved in the data collection to the final processed 3D view of the investigated area.

Creating a 3D Project

Select **3D Grid Project** from the **Start Menu**

The **New Grid Project** screen appears, the user has the opportunity to select the relevant parameters before data collection begins. The parameters are: size of the grid, spacing between lines (profiles) and point interval (trace interval). These parameters are not changeable afterwards.

Tip: The text fields with information on site, customer, name etc. can be changed afterwards.

First enter the size of your grid.

Using the **Navigator,** select and edit the **X-size** and **Y-size**.

Then select and enter the **Point Interval** for the measurement between the traces.

Next select and enter the **Line Spacing** for the measurement between each profile.

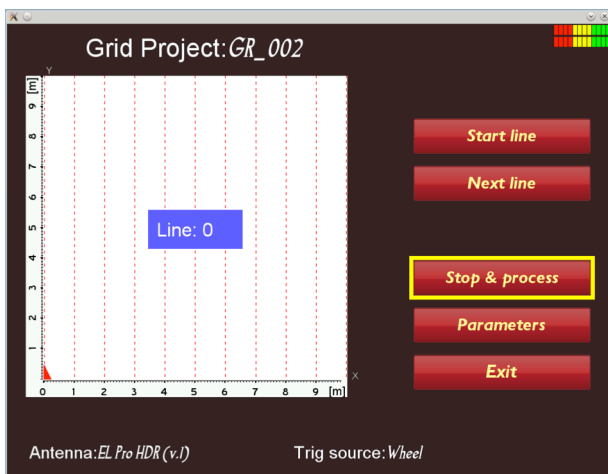Customer, Operator and Site details can be enter along with any additional comments

Finally, select **Start the Project**
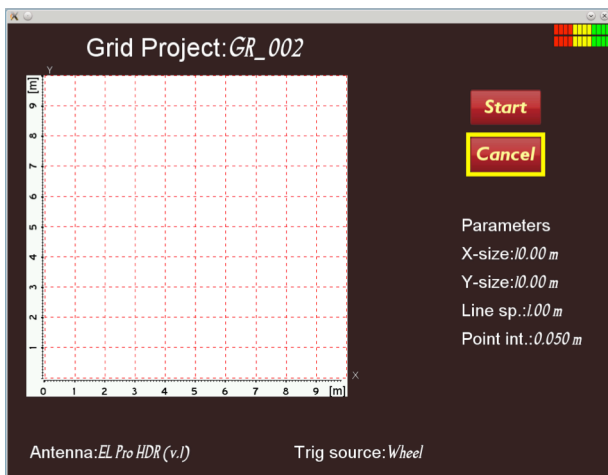
Before the project commences, a summary screen indicating the chosen settings can be reviewed.
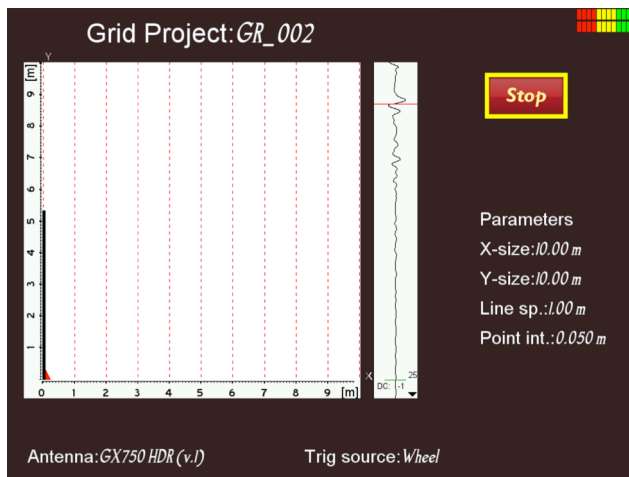
A plan view of the grid and its size is also shown.

Select **Start** to move onto the next screen or **Cancel** to move to the previous screen.

Position the Easy Locator HDR antenna in the X=0 & Y=O position, pointing the antenna in the direction of the Y axis, as indicated by the small red triangle and dashed red line.
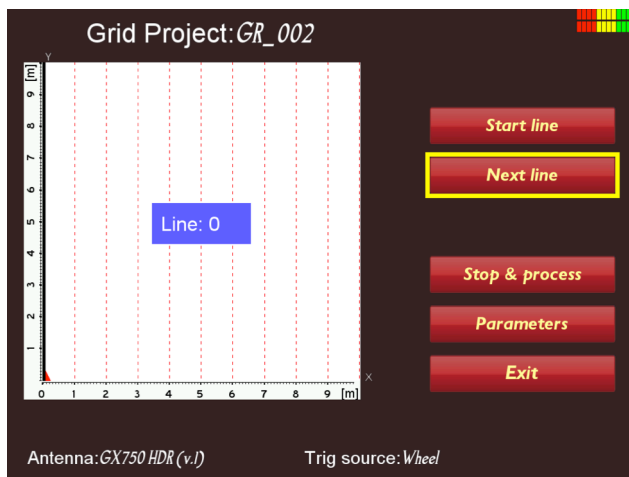
Select **Start Line**

Move the antenna to the end of the line

As the antenna is moved forward, a black line indicates the progressing along the grid line

If a mistake is made during the measurement or the line is not completed, select **Stop** and then **Next Line,** an option will appear to restart the line.


When the line is completed, the **Easy Locator Controller** will indicate the completed line by changing the screen ready for the next line.

Move the antenna over to the next grid line and select **Next Line.**

Repeat these steps until the X-axis is completed.

Move the antenna to the start of the Y-axis and continue the measurements along the Y-axis until the grid is completed. Next, select **Stop and Process** to complete the initial processing stage.
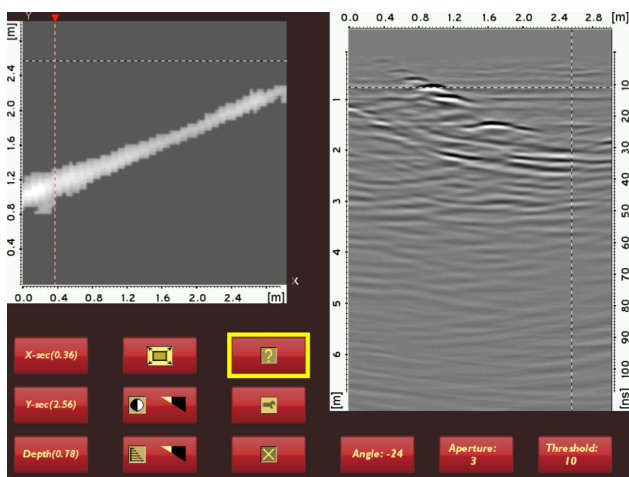
Once the processing is complete, the Grid Project screen shows the plan view and one cross sectional (side) view in the X or Y-axis.

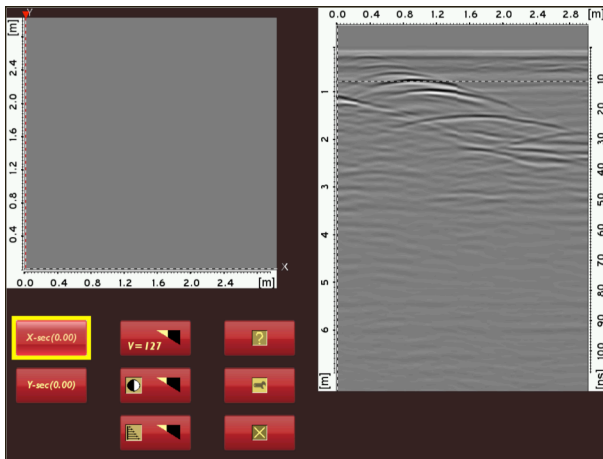Select the **Settings** Icon to proceed to the next step.
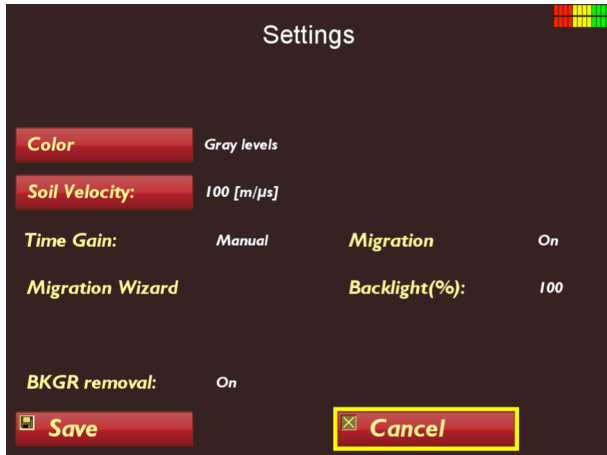
Select **Background Removal** option to **On** if removal of horizontal lines in the dataset is required.

Next, select **Migration Wizard**, this enables the correct velocity setting to obtain the best possible top view.

Next, choose an X or Y cross-section with a well-defined hyperbola.


Select the **Velocity** button, Increase or decrease the velocity value until the hyperbola becomes a point.

Tip: Too high a velocity value will cause the hyperbola to invert, reduce the value until the desired response/reflector is achieved. The reflector should be in-between the inverted hyperbola and the standard hyperbola.

Finally, select the **Quit** button to exit and apply the migration to the entire data set.
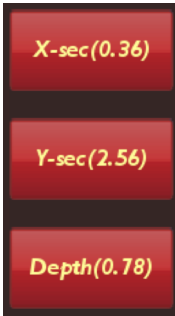
Select the **X-Section** button to view the X-axis data in the side view. When activated, use the **Navigator** to scroll across the data set.
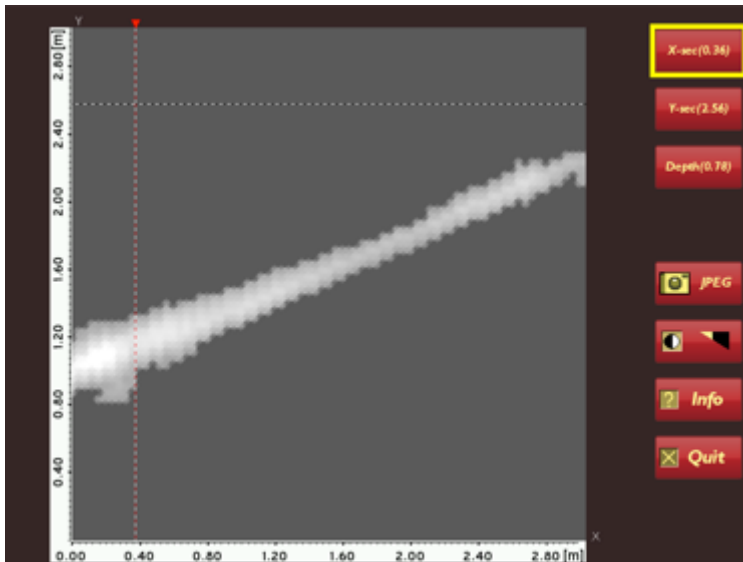
Select the **Y-Section** button to view the Y axis data in the side view

Select the **Depth** button and use the **Navigator** to scroll through the time slices in the top view window
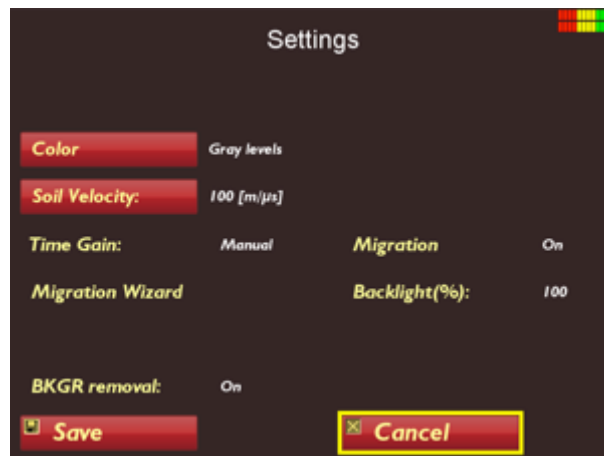
Select the **Full Screen** option. This enables access the screen capture options

3D Project **Full Screen** menu

Select the **JPEG** button to access the screen capture options

3D Project Settings Menu

Color

Change the color scheme for the GPR profiles. Three options are available, a grey scale and two different color schemes.

Soil Velocity:

Set the velocity based on soil type. Setting the velocity allows the adjustment of the depth scale for differing soil conditions.

> **Warning:** This is a critical setting if accurate depth information is required. Soil conditions can vary rapidly with location and all depth information must be used with caution.

Time Gain:

Set to manual or automatic gain control.

> **Note:** Manual gain activates the **Time Gain** button on the main screen and allows the user to manually adjust the gain. Selecting Auto deactivates the **Time Gain** button on the main screen and the Easy Locator Controller will apply the highest gain level for the conditions.

Migration

Select **Migration** to **On,** this applies migration to the 3D Project.

Migration Wizard

Run the **Migration Wizard** to ensure the correct velocity value is applied to the radar dataset.

Backlight(%): Select the correct level of backlight for the ambient light levels. This setting can be adjusted within the range of 0–100%.

> **Tip:** Reducing the backlight will extend the battery life between charges.

BKGR removal: The **Background removal filter** button is used to remove horizontal lines/reflections from the GPR profile.

ObjectMapper Project

An Object Mapper Project is a tool to easily handle and interpret radar profiles acquired with the **Easy Locator Controller**, where a number of radar profiles are linked to a common baseline or positioned with GPS. See the examples below.
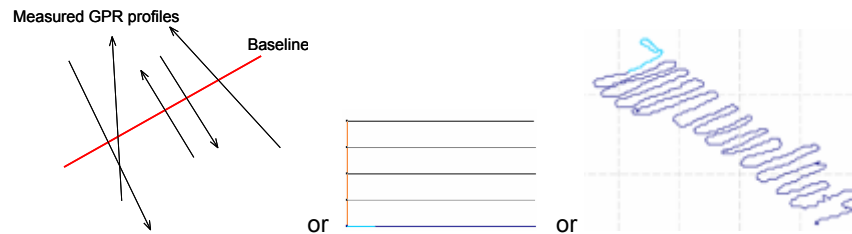
Once an **ObjectMapper Project** is created within the **Easy Locator Controller**, it can be directly opened in the **ObjectMapper** program, a Windows based interpretation software for quick mapping of underground features. For further information, see the **ObjectMapper Operating Manual**.

Creating an Object Mapper Project

Start working with Object Mapper Projects by selecting **ObjectMapper Project** on the Start Screen.
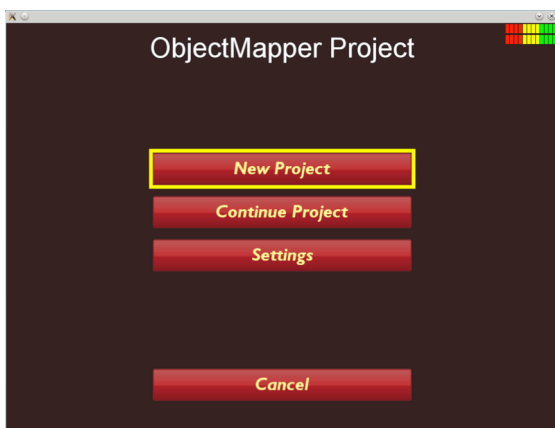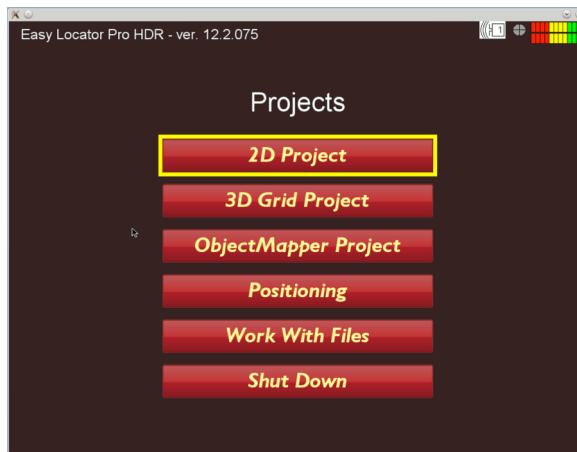
ObjectMapper Project start screen

| **Settings** | Select **Settings** to apply correct measurement values. See **Measurement Parameters Menu** for full details |

| **New Project** | Select **New Project** to start the project and move onto the following screen |

New ObjectMapper Project

Project Name:	OMP_
GPS positioning	**Off**
Baseline/ Start/ X coord:	0.000 m
Baseline/ Start/ Y coord:	0.000 m
Baseline/ Stop/ X coord:	1.000 m
Baseline/ Stop/ Y coord:	0.000 m
Start the project	**Cancel**
Current distance:	**0.00m**

| **Project Name:** | Select **Project Name** to tag a name to the project. Use the **Navigator** to enter the name, one character at a time. |

| **GPS positioning** | To activate the GPS positioning, select the **GPS Positioning** to **On** |

> **Note:** If the GPS option is ON, no baseline is needed and the X-Y co-ordinates are deactivated

| **Baseline/ Start/ X coord:** **Baseline/ Start/ Y coord:** **Baseline/ Stop/ X coord:** **Baseline/ Stop/ Y coord:** | The location of the baseline is given by setting the X and Y-coordinates of the start and stop positions of the line. If no coordinates are available, the baseline is defined as 0 m for X and Y start position and then the length of the line for X or Y stop position. |

> **Tip:** The coordinates for the baseline can be edited later in the ObjectMapper program.

| **Start the project** | When the baseline is defined or **GPS Positioning** is **ON** press **Start the Project** to collect the Object Mapper files. |

> **Tip:** In this screen, before pressing **Start the Project**, the **Easy Locator** System measuring wheel can also be used as a measuring tape, showing the travelled distance at the bottom of the screen. To set the measuring tape function to zero, select the **Current Distance** option and press the **Navigator** once.

Object Mapper Measurements with Baseline

When the **Start the project** button is pressed, the **Start Profile** screen appears

Once **Start Profile** is pressed, the user returns to the ordinary measurement screen. The additional **Baseline Crossing** icon will be active on this screen.

When passing the baseline, select the menu option **BL Crossing** to place a marker on the GPR profile. This marker will be used to connect the current profile to the defined baseline.

Note: The baseline can be created anywhere along the GPR profiles e.g. at the beginning, middle or end and the baseline must cross through all the profiles. If starting the profile directly on the baseline, press **BL Crossing** immediately after pressing **Start**, in other words, before moving the antenna.
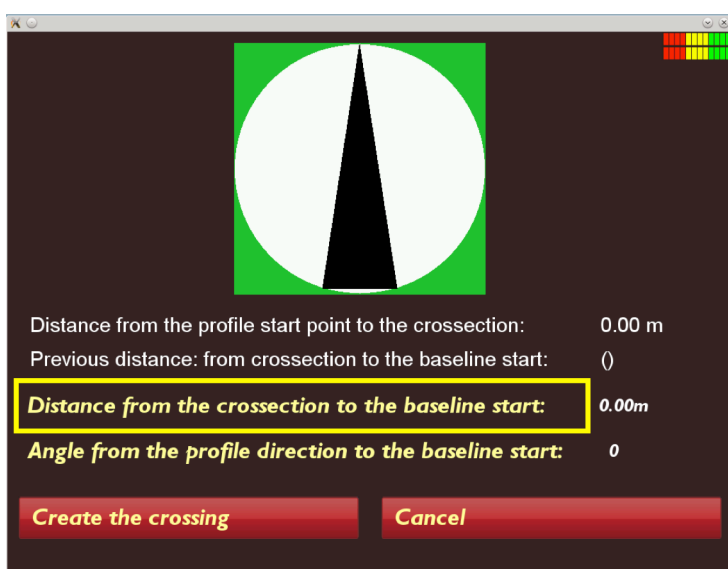
After pressing **BL Crossing** the screen to the left is seen. Here the current profile is defined, in terms of distance from the baseline start point and the direction of the profile in relation to the baseline. See the picture illustration below.
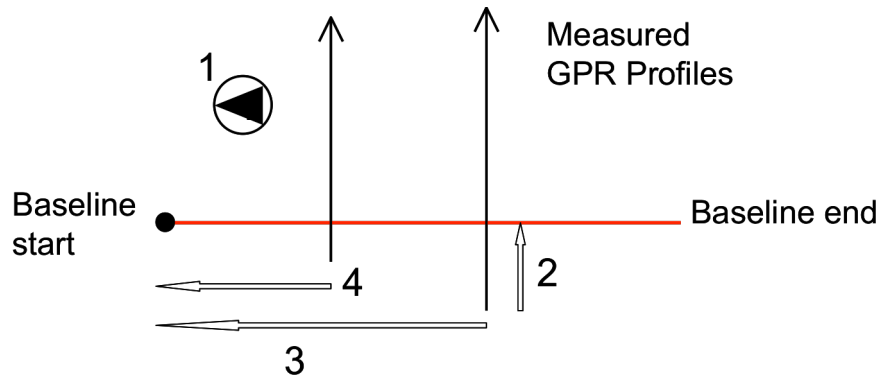
Key:
1: Orientation to baseline start point. In this case it is 270 degrees.
2: Distance from the start of the current profile to the baseline
3: Distance from baseline start to the current profile
4: Previous distance

First set the distance from the baseline start point to the current profile. The select the angle of the profile to the baseline start point. Finally, select **Create the crossing**, the screen reverts back to the measurement screen and a blue marker dot is seen on the GPR profile. Continue the measurement along the current profile.

Once a profile is completed, select **Stop**, the **Start Profile** screen will be seen and a new profile can be started as usual, again applying the **BL Crossing** option when passing the baseline.

Note: The Easy Locator Controller and the Object Mapper project will automatically suggest the distance and the angle to the baseline start after 3 passes of the baseline.

Tip: Moving in the opposite direction after each profile is finished can optimise Data collection. If measuring every second profile in the opposite direction and at a right angle to the baseline the angle from the profile direction to the baseline start will be 270, 90, 270, 90 and so on.

When all the Object Mapper profiles are measured, select **Stop ObjectMapper Project** on the **Start Profile** screen to close and save the Object Mapper Project.

This project is then easily uploaded to a computer; see the **Transferring Data** section, where it can be opened in the Object Mapper PC software, for simple interpretation of underground features. For further information, see the Object Mapper Operating Manual.

Tip: Separate files can be opened or uploaded from the project, enabling the user to view individual profiles if required.

Object Mapper measurements with GPS
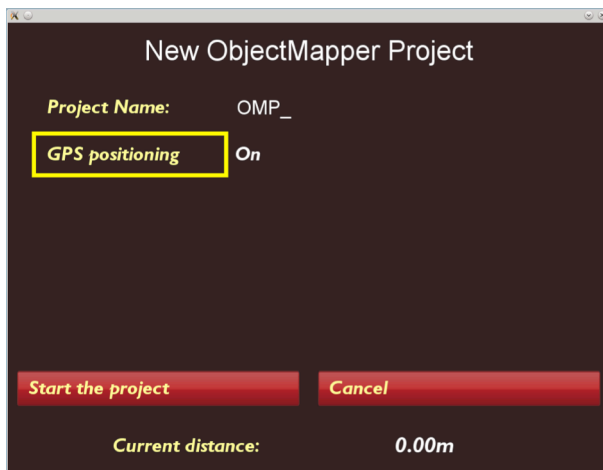
To create a project with GPS positioning, start a new project and select the **GPS Positioning** to **On** and select **Start the Project**
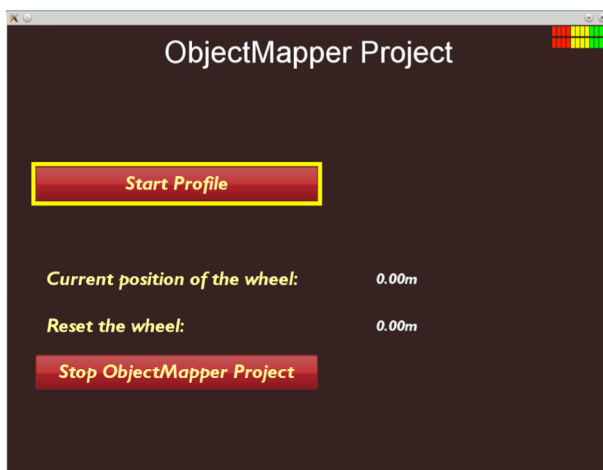
Next, select start profile and the screen will return to the main measurement screen.

Tip: With GPS positioning activated, the user can complete one long profile in a zig-zag formation around the area to be surveyed, or stop and start profiles to create a number of parallel profiles.

When the project is complete, select **Stop ObjectMapper Project**

Continuing an Object Mapper measurements Project

To continue a previously started ObjectMapper Project select **Continue OM Project** in the Project Main screen. Use the **Navigator** to choose between the Object Mapper Projects and press the button to continue the selected Project.

System Menu

To enter the System Menu, select **Shut Down** from the **Start Menu** to enter the **Quit screen**. When on the **Quit Screen,** rotate the **Navigator** 3 "clicks" clockwise, then 3 "clicks" counter-clockwise and finally, 3 "clicks" clockwise.

The **Easy Locator Controller** will now enter the System Menu.

Select **Time and Date** to modify the internal clock settings.

Select **Battery max level** to set the battery level indicator. Enter 12 (Volts) if a generic external 12Volt battery is being used; select 11 for the MALÅ battery packs.

Battery Save Mode allows the user to activate or de-activate the backlight dimming option.

Select **Imperial** or **SI** for the appropriate localised requirements.

Hardware Tests

Select the **Hardware Tests** icon to enter the hardware test screen. Select **Start Test** or **Start Ethernet Test** to start the self-test procedure. Each item of hardware will be tested sequentially with the results of each tested displayed on the screen and written to a file. Once the test is completed, select Upload "test_results.jpeg" to save the results to USB memory device.

Data Disk Format

Used to reformat the SSD radar data storage device in the **Easy Locator Controller**.

Select the **Data Disk Format** option and press the **Navigator** to initiate reformatting.

A confirmation dialog is displayed before commencing the operation.

> **Tip:** It is recommended that reformatting is performed periodically to maintain peak performance for data management.

> **Note:** Reformatting does not affect the operating system or the Easy Locator Controller software.

Software Upgrade

The Easy Locator Controller software can be upgraded by downloading the latest software from the MALÅ website downloads page and installing onto a USB data storage device.

Copy the file **ram10img.gz (**and parameter files: **eeprom_1, eeprom_2** if they exists**)** to the root of a USB data storage device.

Insert the USB data storage device into the Easy Locator Controller USB port and select **Software Upgrade.** If a confirmation request is displayed, accept the request by selecting YES.

The upgrade can take several minutes to install and the **Easy Locator Controller** will re-boot after installation.

> **Warning:** Make sure the batteries are fully charged before starting the software upgrade and **DO NOT** turn off the Easy Locator Controller while the upgrade is in progress.

Restore Predefined Settings

Rotate the **Navigator** to select the **Restore Predefined Settings** option and press to perform a reset when experiencing problems or if you would like to reset the settings to a predefined state. A confirmation dialog is displayed before reset operation is performed.

> **Note:** This restore is a low-level reset and should be performed as the first option before executing the **Restore Factory Settings** option

Restore Factory Settings

Select the **Restore Factory Settings** option and press to perform a reset when experiencing problems, or if you would like to reset the settings to the default factory settings. A confirmation dialog is displayed before reset operation is performed.

NEXT SCREEN >>

Select **Next Screen** to access additional **System Menu** options.

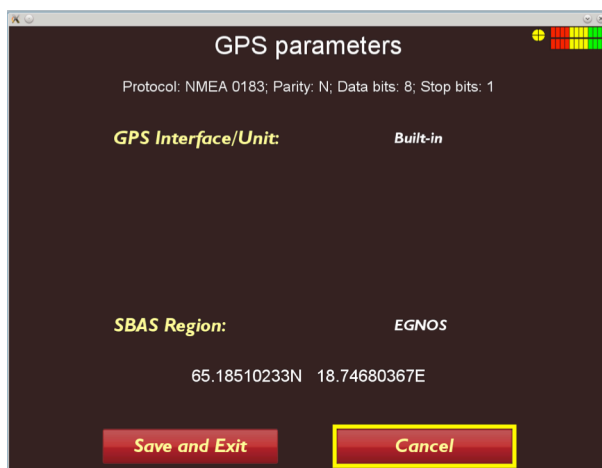**Default Start Depth** value determines the depth widow at start of a scan. The entered value has no effect on the total depth of the time widow.

Select **GPS ON/OFF** to toggle the GPS function on or off depending on requirements.

GPS options and settings

GPS Parameters

Select **GPS Parameters** to enter the settings screen for the GPS options.


There are 3 options for the **GPS Interface/Unit** setting.

1. **Built-in**, this option selects the built-in DGPS module. Select the correct **SBAS Region** for your area. Currently available options are listed below
2. **COM Port**, this option is selected for a RTK GPS input via the COM port. An external RTK GPS antenna can be mounted on the Easy Locator antenna. Once this option is activated, various parameters will be activated, see below.
3. **USB,** select this option if a simple GPS antenna is attached to the USB port.
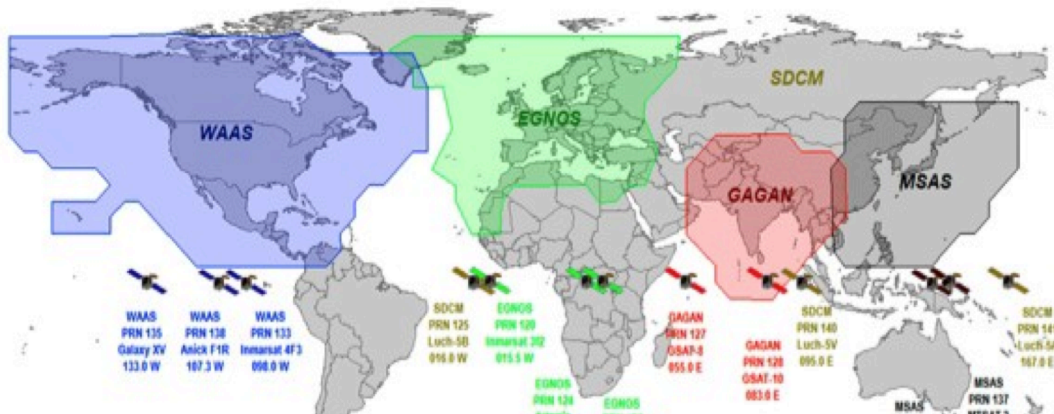
SBAS DGPS Differential correction service areas
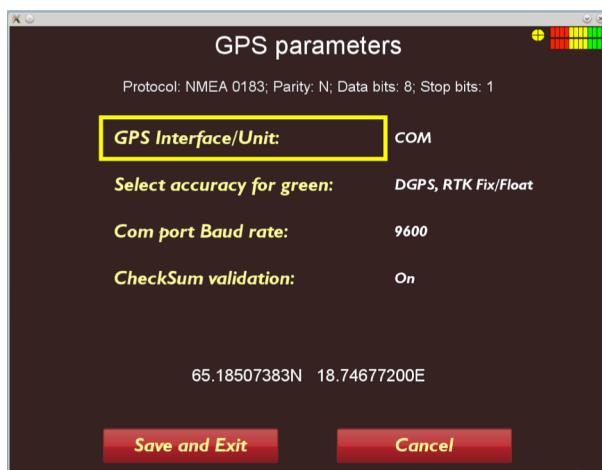
COM Port settings for external RTK GPS.

The **Select accuracy for green** option allows the user to set the tolerance for the **GPS precision indicator** that is displayed at the top right of the monitor's screen while in **Started mode**. Use the **High** setting if utilising a RTK GPS.

Select the correct values for the **COM Port Baud Rate** and **CheckSum Validation** to match the external RTK GPS output.

Troubleshooting - Frequently Answered Questions

MALÅ Easy Locator Pro HDR has been design to be robust and reliable under adverse conditions. If you encounter a mechanical failure that cannot be fixed on site, please contract MALÅ Geoscience or your MALÅ Geoscience representative for advice.

System Malfunctions

Most malfunctions are power/data communications or user settings related. Before contacting your local MALÅ Geoscience office or authorized dealer please follow these simple steps.

Check user settings

Enter the **Measurement Parameters menu** and check the settings for **Acquisition Mode, Wheel Type, Point interval** etc.

Check battery capacity

Connect the battery to the charger and switch on the charger at the electrical outlet. The light on the battery charger should be either yellow or green indicating an operative charge. If the indicator light is red, continue charging until the charging cycle is complete, i.e. indicator light turns green.

Check connectors

Disconnect and reconnect the battery pack on the Easy Locator HDR antenna
If using the external battery bag, disconnect and reconnect the battery connector in the battery bag.
Disconnect and reconnect both ends of the data cable between the antenna and the MALÅ Easy Locator Controller.
Check the pulse encoder connector on the rear of the antenna.

Restart MALÅ Easy Locator Pro HDR Controller and Antenna

Turn off the MALÅ Easy Locator HDR antenna and controller, by first selecting **QUIT** from the on-screen menu options on the Controller, confirm the action by selecting **YES** then push the power button on the Controller and release quickly. The red light will then stop blinking and the unit will also emit a click when turning off. Wait 10 seconds before switching on the Controller and antenna.

> **Note:** If the Controller is not responding, turn the unit off by pushing the power switch.

Service and Repairs

To maintain maximum performance, the MALÅ Easy locator Pro HDR should be regularly serviced. Contact MALÅ Geoscience or your local MALÅ Geoscience representative for more information on how to service your MALÅ Easy locator Pro HDR.

Technical Support

MALÅ Geoscience is committed to providing exceptional product support. Our technical support representatives are available online to help you find answers to even the most challenging technical support issues. Our experienced support team works very closely with the development teams to ensure that every client receives the best possible support.

Technical support requests can be made directly from our website: www.malags.com/support

Glossary

A

Auto-Gain

Similar to Time-Gain except the software decides the coefficients to be applied to give a response across the depth range without over amplifying the trace.

B

Background removal

Background removal is used to remove horizontal and nearly horizontal features in the radargram by subtracting a calculated mean trace from all traces, sample by sample. It can be useful for removing the direct airwave (first arrival) or ringing (due to poor ground conditions) from the data. Care must be taken in this process not to remove real linear features from the data.

D

Differential GPS (DGPS)

Differential GPS, uses satellites and a correction from a reference station/satellite, accuracy around ± 0.5-2 m. The available systems for the Easy Locator Controller are currently EGNOS (Europe), WAAS (USA), GAGAN (India) and MSAS (Japan).

G

GPR profile

Individual line of GPR data represented in a cross-sectional (profile) view of the sub-surface.

Ground Penetrating Radar

Geophysical method that uses radar pulses to image the subsurface

H

Hyperbola

The type of reflection often associated with a round object or a utility, especially when the angle (profile) of the radar is at 90 degrees to the utility. It is a distinctive "n" shaped reflection.

N

Noise

Typical GPR reflection profiles contain noise and unwanted reflections that are produced by antenna "ringing", differences in the coupling of energy with the ground, multiple reflections that occur between the antenna and the ground surface and system and background "noise".

Navigator

The push-turn knob fitted to the MALÅ Monitors & Easy locator Controller that acts in a similar way to a computer mouse allowing the user to navigate menus and update data. Rotating the knob either allows sequential scrolling through menu options to make a menu selection or changes selected parameter values. Pressing the knob either executes the currently selected menu option or sets the value of the selected parameter.

P

Planar reflections

Reflections that appear as horizontal or sub-horizontal lines in GPR profiles. They are generated from any linear boundary between materials, such as buried stratigraphic and soil horizons, the water table, and horizontal archaeological features, such as house floors, as well as pipelines that are parallel to the GPR scan.

Point source reflections

Reflections which often appear as hyperbolas in GPR profiles. They are commonly generated from distinct, spatially-restricted, non-planar features ('point targets'), such as rocks, metal objects, walls, tunnels, voids, and pipes crossed at right angles to the GPR scan.

R

Real Time Kinematic GPS (RTK GPS)

Real Time Kinematic GPS is a highly accurate instrument for positioning, it uses two GPS receivers (one stationary base and one rover) and a correction signal from the base antenna. The accuracy is around ± 1-2 cm. Network RTK also available in many locations, where the correction factor is received via a GSM mobile.

S

Signature

A representation of the reflected radar signal in a GPR profile. Reflected signals are caused by changes in the dielectric properties of the target medium. These dielectric differences are usual caused by differences in materials, e.g., a buried object or reinforcing in concrete. Objects of a discrete length are generally characterized by a hyperbolic reflection in the GPR profile, and are referred to as point source reflections. A linear object, such as a pipe, will also display the characteristics of a discrete-length object if the GPR scan is performed perpendicular to its longitudinal alignment, and are referred to as planar reflections. As the scan is moved towards the longitudinal alignment of the linear object, the hyperbolic refection flattens until it approaches a horizontal line in the GPR profile. The shape of the signature is also affected by many other factors, including the size of the object, the signal velocity, and the object material.

SSD

SSD is an abbreviation for Solid State Drive, which the memory device used for the operating system and to store data.

Standard GPS

Relatively inexpensive GPS that only uses satellites for positioning, These systems generally have an accuracy around ± 4 m and are suitable for large scale layer mapping projects

T

Time-Gain

Time-Gain applies a time-varying gain to compensate for amplitude loss due to spreading and attenuation. The trace is multiplied by a gain function combining linear and an exponential gain, with coefficients set by the user.

Trace

A "trace" is a single, vertical column of GPR data, representing the signal "traced" by a radar pulse as it travels from the instrument into the subsurface. Each trace is com- posed of individual "samples," the smallest measurement unit in the vertical dimension. Because of geometrical "spreading," the radar signal decreases in strength with depth as $1/r2$, where r is depth.