



USER MANUAL
HDR-SERIES SHIELDED ANTENNAS
80, 160, 450 AND 750MHz



VERSION 1.1
December 2013

Product overview

The HDR-series (High Dynamic Range) is the latest addition to MALA's versatile product range. It is, from bottom up, a complete new design, based on patented cutting edge technology. These new antennas are hence not just an upgrade of earlier designs; they represent a leap in GPR-technology, not seen in the past 15 years. Due to the internal design, the HDR-antennas are self-contained GPR systems, so, naming them antennas is somewhat misplaced. Each one of them actually contains a full-blown GPR system

Compared with earlier, comparable systems, this new suit of GPR-systems is capable of much faster data acquisition rates, without violation of the FCC, EC and IC regulatory limits on emissions. Combined with increased bandwidth, this extreme performance gives the user a system with unprecedented dynamic range and resolution.

At the end of the day, these products give the GPR community access to easy-to use systems with significant deeper penetration as well as better detection capabilities. Add to this the positioning options, software capabilities and proven accessories and you have in your hands full access to the GPR-future. Never before has the GPR-market been offered so much value for the money.

Scope

This manual describes the MALA HDR series of shielded antenna. It's a hardware manual, intended to give users a fast guide for handling the antenna units in the field. It's not a complete system manual. For further information on using the GPR system, please refer to the software manual for the monitor you have bought with the system.

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1 Introduction

Thank you for purchasing the MALA HDR-80/160/450/750 system. We at MALA GeoScience welcome comments from you concerning the use and experience of this equipment, as well as the contents and usefulness of this manual. Please take the time to read through the assembling instructions carefully and address any questions or suggestions to the following:

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(Be sure to include instrument type and serial numbers)

1.1 Unpacking and Inspection

Great care should be taken when unpacking the equipment. Be sure to verify the contents shown on the packing list and inspect the equipment for any loose parts or other damage. All packing material should be preserved in the event that any damage occurred during shipping. Any claims for shipping damage should be filed to the carrier. Any claims for missing equipment or parts should be filed with MALA GeoScience.

1.2 Repacking and Shipping

If original packing materials are unavailable, the equipment should be packed with at least 80 mm of absorbing material. Do not use shredded fibers, paper wood, or wool, as these materials tend to get compacted during shipment and permit the instruments to move around inside the package.

1.3 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.

If this device is opened, or in any way tampered with internally, all warranties are void. Furthermore, if any changes or modifications are done internally, the users authority to operate the device may be void, in accordance with FCC §15.21.

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.

This Ground Penetrating Radar Device shall be used only by law enforcement agencies, scientific research institutes, commercial mining companies, construction companies and emergency rescue or firefighting organizations.

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.

2 External connectors indicators and controls

In figure 1, below, pictures of the HDR-160MHz are shown. All antennas in this series have the same basic layout, only that for the 750MHz, no-side handles are available. In the following a brief description of the unit is given, with reference to arrows and labels in figure

1. GPS. The black plastic on top of the connector tower hoses the in-build differential GPS-receiver and antenna. This receiver has in-built SBAS-correction capabilities. It is essential that the antenna is mounted in a such a way to give the GPS antenna as much of free sky as possible
2. Battery. The LI-Ion batteries are housed in a casing of worked aluminum, and have a nominal capacity of 7.8 Ah, 11.1V. This gives at least 5 hours of operation, somewhat varying between the different models.
3. Battery release knob. The batteries are held in place by a spring loaded pin, in order to release/mount the battery, the knob is pulled.
4. Measuring wheel mount. The measuring wheel is mounted via a protected, waterproof 9-oin d-sub connector. The wheel is locked in place by a vertical pin, see later section.
5. Mounting inserts. The units have 2 inserts, M6-threads, on each side, these are intended for mounting purposes, either mounting the antenna in a custom-designed carrier or for carrying purposes.
6. Carrying handles. By default the 3 lower frequencies have handles mounted on the perimeter of the units. These are intended for tunnel wall, rock-wall applications as well as for pure transportation handles.
7. Product label and LED-indicators see later sections.
8. Connection tower. Power, communications as well as on/off button is mounted in a casing of worked aluminum on top of the unit; this casing also contains the GPS unit and antenna, if this option is installed. Note the connection tower is not intended to be removed at any time, waterproofness of the unit cannot be warranted if this part is removed.
9. Inserts for wear-plate. Two inserts, back and front, are intended for fastening of wear plates, M4-threads.
10. Mounting inserts. Additional inserts, M6-threads, are mounted on the top metal plate, by means of insert-rivets.

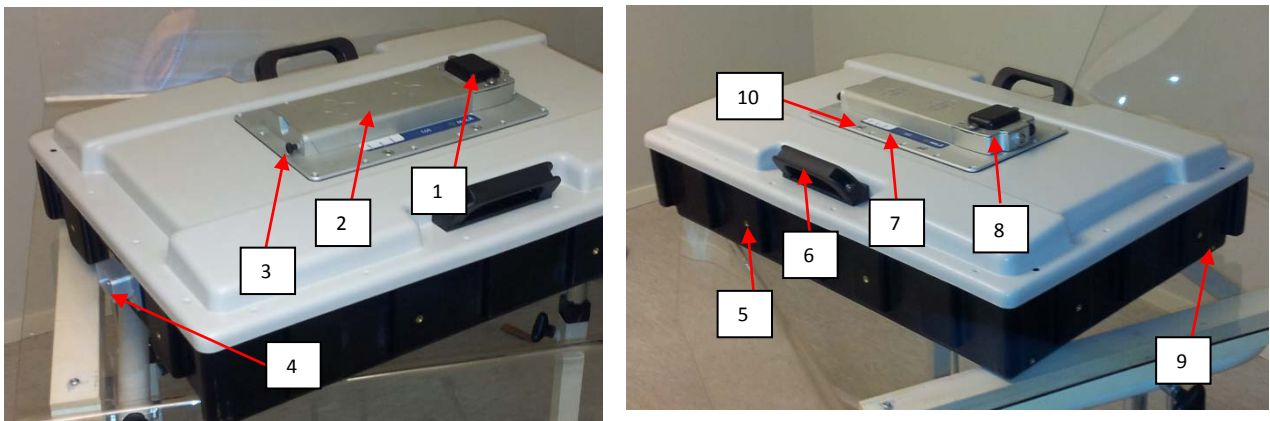


Figure 1, pictures from back (left), and front (right) of the HDR-160MHz antenna, arrows and labels refer to items explained in the text above.

2.1 Battery mount

In figure 2, below, a dummy battery as well as a normal battery is shown. They look similar but the dummy has a 4-pole fisher connector on the back. The dummy is used when the antenna is powered from an external 12V battery.

Both of these units are mounted in the same way on the antenna, see below.



Figure 2, dummy-battery and normal LI-Ion battery.

When mounting the battery, gently attach the d-sub connector in front of the battery with the d-sub on the mounting tower. Then pull the battery-relief knob and press down the battery in place. By releasing the knob, the battery is secured in place, see figure 3, below.



Figure 3, mounting and dismounting the battery.

2.2 Cables

The only cable needed, is the communication cable between the antenna and the monitor. See figure 4 below. The cable is a high-quality design with field-rugged ODU-connectors. It may be ordered in different lengths, at some extra cost.



Figure 4, Left cable for communication between the monitor and HDR-unit. Cable connected to the HDR-unit and (right) cable connected to the monitor.

If external batteries are to be used, special cables have to be ordered as well as the dummy-battery.

2.3 Important note on cables and near-by metal objects

The HDR-suit of GPR-systems represents an unprecedented leap in technology. Each one of the units is a high-tech precision instrument and most of them are capable of digitizing to more than 16-bits.

This means that the mounting and cabling used with the units become much more critical than for previous systems. All experienced GPR users knows the importance of keeping your cables tidily mounted, this is now much more important, because the sensitivity of these units are much higher.

For this reason all MALA cables have ferrites attached to them as well as recommended routing. If you experience some ring-down, please first check your cable mounting, it has been the main cause of internal complaints, previous acceptable routings are no longer valid.

2.4 Power ON/OFF

The units are powered on by a gentle push on the button mounted on the front of the connection tower, see figure 5 below. A weak “click” will be heard when the internal relay switches the power on. The ON-button internal LED will show a steady red light and the LED-indicators will come alive, see later section.

Power off is managed in two ways; 1) by leaving the data acquisition software in the monitor, and 2) by holding the on/off switch for approximately 3 seconds and then releasing it.

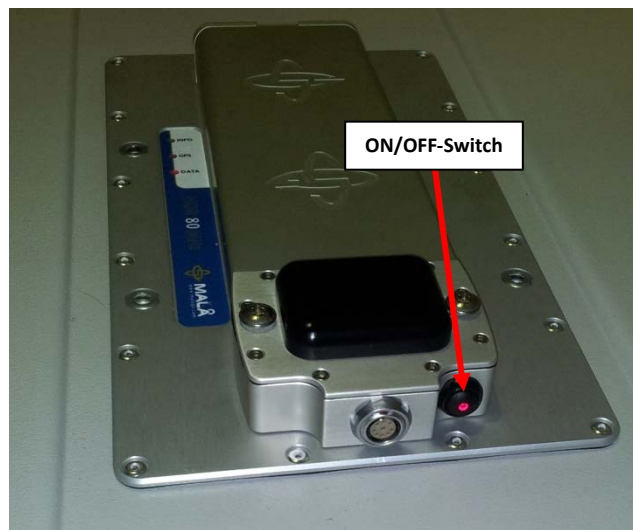


Figure 6, ON/OFF-Switch

2.5 LED-indicators

Three LED-indicators are mounted beneath the product label, see figure 7 below. The meaning of these indicators is as follows:

DATA: Continuous flashing light means that the unit is working properly and ready for data collection, no proof of that a monitor is able to receive data, though. If irregular flashing is seen on this LED, it means erroneous antenna configuration, possible software version issue. This LED is switching to continuous light 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-switch to continuous light whenever there's 4 or more satellites available. Nothing is told about whether differential correction is active, the latter information is shown in the monitor.

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



Figure 7, led indicators.

2.6 Mounting of measuring wheels

The several measuring wheels are available for the HDR-units. Each one of them has been designed to fit to the field-proven ruggedized connector housing on the back of the antennas.

To connect a wheel, gently push the wheel connector into the connector housing and attach the secure-pin.



Figure 8, mounting of measruring wheels.

3 Accessories

The HDR-suit has a number of accessories, including, but not limited to: Cart's, measuring wheels; road-carts, pulling handles, forest kits, and wear plates. In addition, there's cables, battery chargers, shipping cases etc. etc. In the following just a few of these are described.

3.1 Forest kits

Whenever GPR surveys needs to be done in rough terrain, a suitable mounting of the antenna is needed. The antenna units are quite squarely designed, meaning that they will stick to trees, boulders and whatever obstacles are passed. To mitigate this inconvenience we have designed the forest kits. They consist of a ski-formed wear-plate with a fastener in front, see figure 8 below. The design is such that the mounting plate in front will break, prior to the antenna housing, an important feature, if a 4-wheeler is in use.



Figure 9, a HDR-80MHz mounted in a forest kit, with measuring wheel attached.

4. Software

The HDR-antennas can only be operated with MALA XV-monitors; no windows PC software is available. Although a description of the acquisition software is outside the scope of this manual, a brief introduction is give below.

4.1 Projects

In order to streamline the data acquisition and provide a user interface optimized in terms of user friendliness, MALA provides application specific data acquisition schemes. In figure 10, below, the first screen (after the start-up info) is shown. The user has the options to choose between:

2D-project: a general, single line data acquisition scheme, the traditional way of gathering GPR-data.

3D-Grid Project: A data question whereby the user is guided in collection of data in a grid, suitable for MALA-2.5D visualization and interpretation.

Object-Mapper-Project: The MALA-proprietary model of mapping areas, marking objects in the data and producing client reports, with just a few clicks.

Besides these three data acquisition schemes the client have some extra options in using the GPR as a positioning and revieing previously collected data.

On the top line, the software version, a symbol showing connection status with the antenna and a battery indicator is shown. In this case no data acquisition is possible since no antenna is attached, indicated by a red X.

Note that whenever the option “Shut Down” is chosen, the antenna will be powered off, if it's attached and switched on.

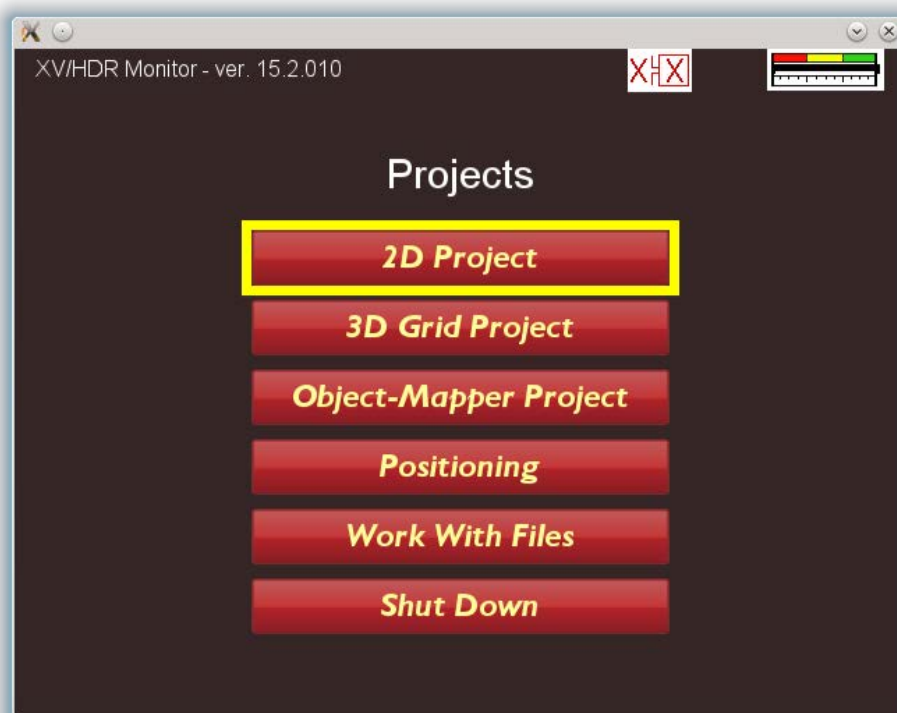


Figure 10, the first screen after booth up screen.

4.2 Data acquisition

For simplicity we here only describe the 2D project data collection scheme, which is perhaps the most general. In figure 11 below the menu is shown, and in the following a brief description is given.

All MALA systems are configured with the most useful and common acquisition parameters when delivered. Hence, the only thing one will have to do from the menu below is to hit the “New” control, in order for data acquisition to commence.

A few comments on the menu below:

To the right two indicators are shown, the yellow circle indicates that the in-build GPS has locked on satellites, the color yellow indicates normal mode. Whenever differential correction becomes available, it will switch to green.

At the bottom a few information fields are shown: the file name refers to the file which will be written, when the data acquisition commences. The GPS coordinates are presented in the Lat-Long format, for the current position and the soil velocity is shown for information only, it has no effect on the data acquisition whatsoever, but it controls the depth scale.

Once the “New” control is activated the data will show up on the screen and the user will have the option of enter markers and control the gain as well as zooming in on data, on the fly.

Whenever the operator chose the Quit control, the antenna will be powered off. To start a new project, the operator must manually switch the antenna on again, with the on/off button on the antenna.



Figure 11, data collection menu for 2D-Projects

During data acquisition the display shown in figure 12 below is shown. The operator can now, besides zooming, through the vertical bar, take instant screenshots (which will be tagged with the current position)

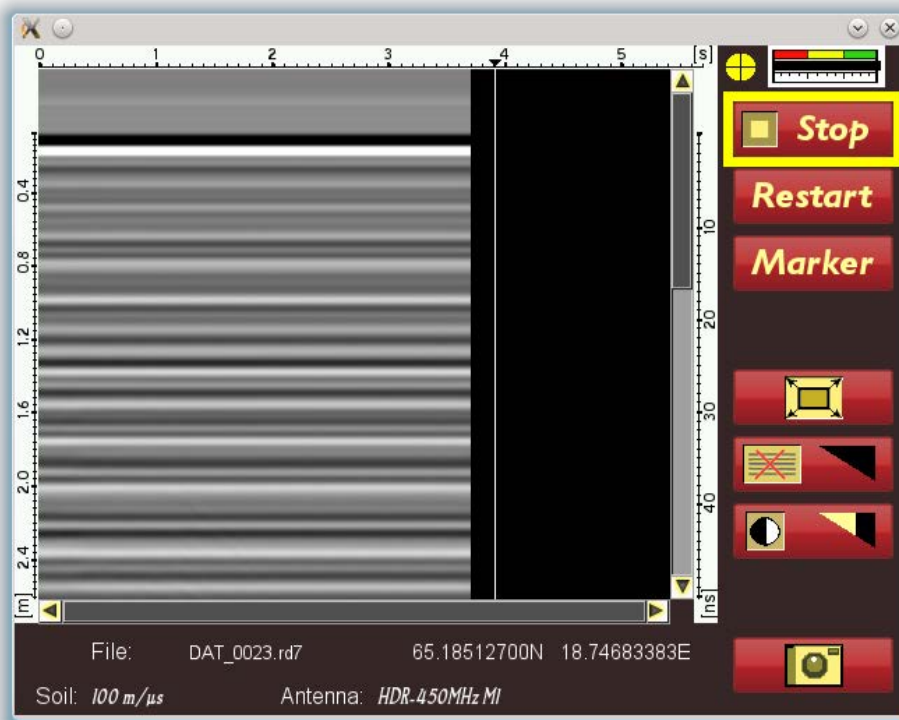


Figure 12, data acquisition display.

Settings

Although MALA prides itself for producing the easiest-to use GPR-systems, there are still some settings which operators may tweak. In figure 13, below the settings menu is shown.

Depth: this parameters sets the time-window during data collection to represent to a specific value, given the next parameter, the velocity.

Soil velocity: The operator must know this value, if hesitant please refer to tables available in MALA-literature. It does not matter for the actual data acquisition; the only risk is that not deep enough data is gathered. Normal values are 70-120m/us.

Acquisition mode: Refers to how the data collection is controlled. The most common way is use an odometer wheel. Other options are time and keyboard (the latter being very slow, should never be used).

Wheel-type: Gives the operator possibility to choose from a set of MALA standard wheels. It's possible to create new wheels based on client needs.

Point interval: define the distance between every point of measurement, i.e. the distance between every trace. Default values, guarantees no data aliasing.

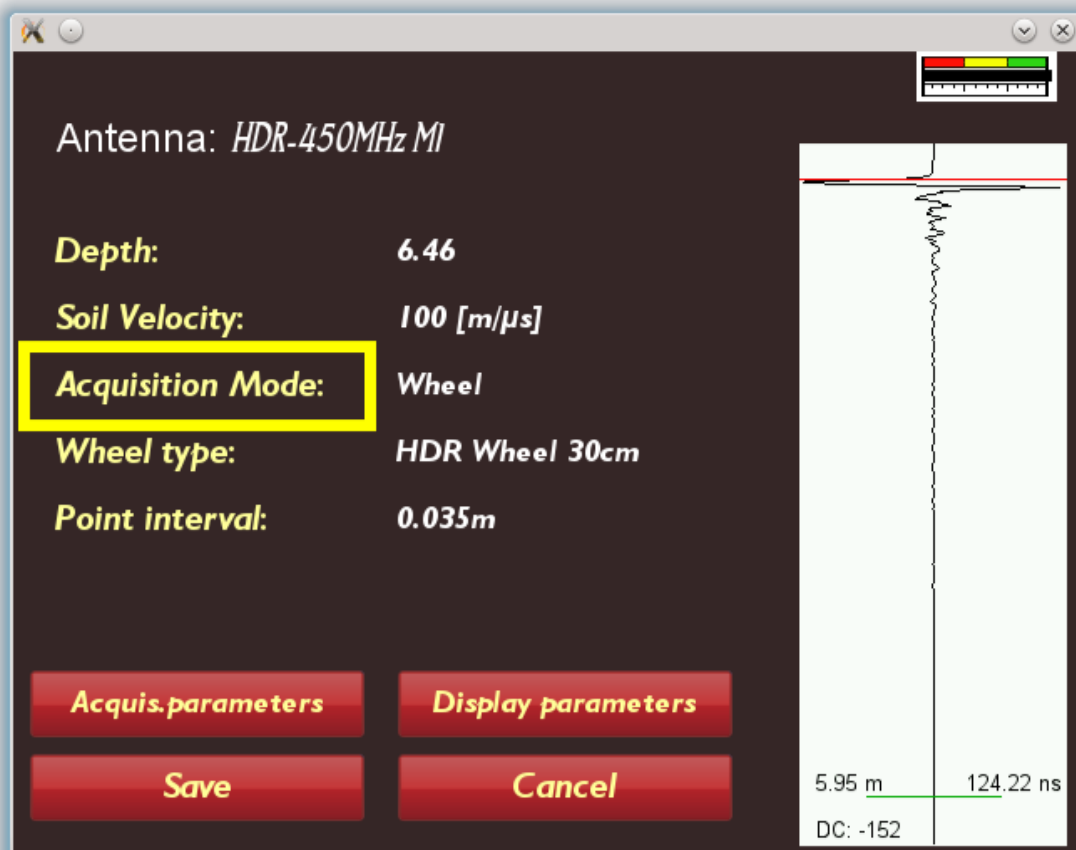


Figure 13, settings menu.