

StructureScan™ Mini LXT

Quick Start Guide



Image Your World



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StructureScan™ Mini LXT Quick Start Guide

A Fast Check List for Field Operation

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Please see our website, www.geophysical.com/regulatoryinformation, for current information and FCC Registration Form, including:

FCC Notice for U.S. Customer

Canadian Requirements for RSS-220

Declaration of CE Conformance

Laser Cautions and Warnings

Please see the full StructureScan Mini LXT manual for important laser cautions and warnings.

Introduction

Thank you for purchasing the StructureScan Mini LXT by GSSI. StructureScan Mini LXT is the very latest product from GSSI's line of cutting-edge GPR concrete inspection tools. The Mini LXT is designed with today's busy concrete professional in mind. It's a tool that packs a ton of simple to learn functionality into a ruggedly reliable package. The Mini LXT will turn in a solid day of work and be back on the job first thing in the morning with no complaints.

What Comes in the Box

- StructureScan Mini LXT
- StructureScan Mini LXT transit case
- Two (2) rechargeable lithium ion batteries
- Battery charger with AC power adaptor and set of international plugs
- Tool to remove the LXT's handle
- Safety wrist strap
- Quick Start Guide (this document)

About this Quick Start Guide

This document is provided to get you up and running with your new Mini LXT right out of the box. It details field setup and use of two of the Mini LXT's applications: Scan EZ (for simple 2D collection) and Scan 3D (for 3D collection). The Quick Start Guide is not a replacement for the full Mini LXT manual. The LXT manual contains full information on the other modes as well as some tips and tricks for processing and presenting your data. You can download the full manual from GSSI's public website: www.geophysical.com. Navigate to Support → Download Resources.

GSSI also recommends that you take advantage of one of the training opportunities provided for the Mini LXT. GSSI offers a full suite of webinars, videos, and live training classes for you to deepen your knowledge of GSSI products and GPR applications. Please visit www.geophysical.com or contact training@geophysical.com for more details.

StructureScan[™] Mini LXT

Front/Top View



- 1 Ergonomic removable handle and controls
- 2 Easy to use operator interface with color display screen
- 3 Survey wheel encoder
- 4 Guiding laser for locating

Back View



- 1 Power button
- 2 Battery slot
- 3 USB port
- 4 Battery release

Section 1: Getting Started

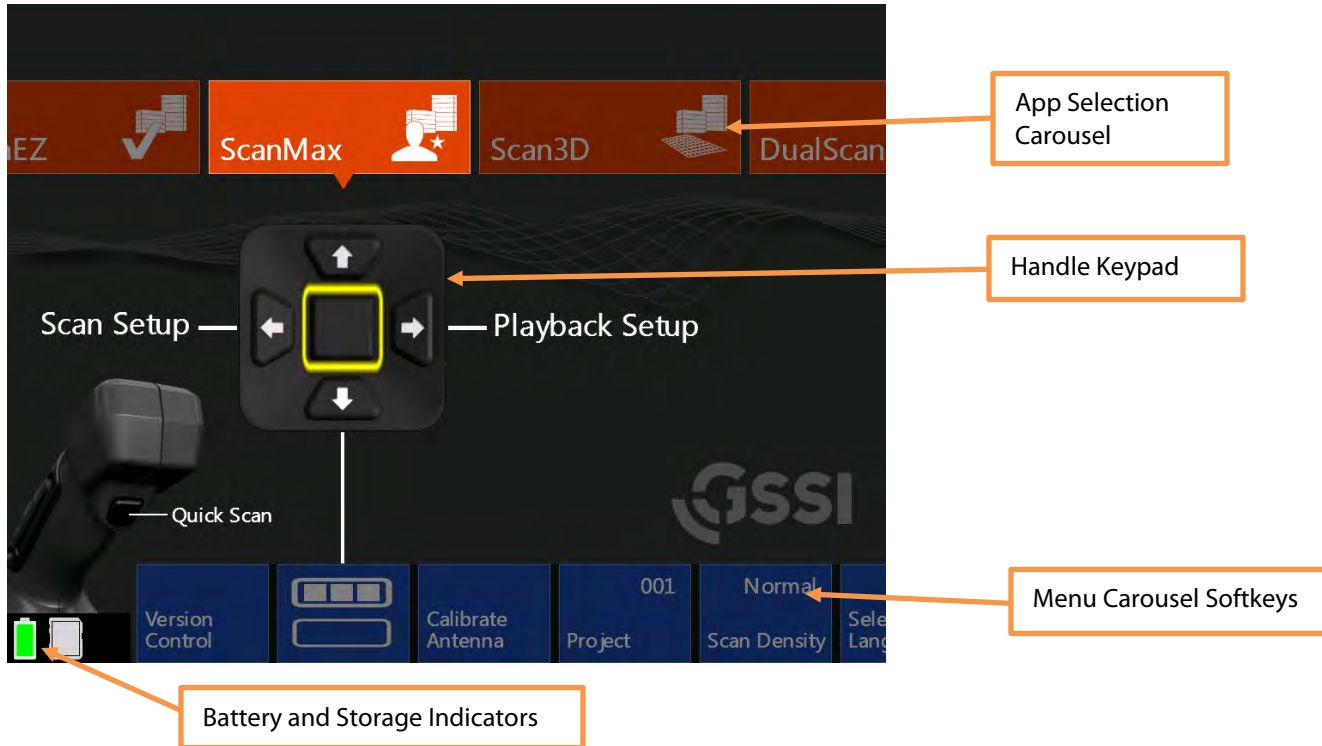
- 1** Remove any protective tape from the wheels.
- 2** GSSI recommends fully charging the batteries prior to use.
- 3** Insert a fully charged battery into the battery slot. The battery should be inserted with the small plastic tabs pointing down. Gently push the battery in until the plastic battery release clips on the Mini LXT catch on the battery tabs.



- 4** Push the Power Button to turn on the Mini LXT. The Mini LXT is powering up and on when the Blue ring on the button is illuminated. After a few moments the Mini LXT Main menu screen will appear.

Note: The Mini LXT incorporates a power-saving Sleep feature. The Mini LXT is asleep when the screen goes black and the blue ring around the power button pulses. Pushing any of the buttons on the handle control keypad will wake the Mini LXT. You can modify the sleep settings and power management plan in the ScanMax App. Please see the full Mini LXT manual for details.

The Main Menu Screen



First Time Setup

Note: The Mini LXT incorporates a touch screen. You can use the handle keypad or touchscreen to access most of the menu items.

- 1 Set Language:** Make sure that the Mini LXT is in ScanMax App. Click the Down arrow to highlight the Menu Carousel and then the Left/Right arrows to choose Select Language. Click the middle keypad button or press the softkey on the carousel to select. Choose your desired language. This may cause the Mini LXT to restart.
- 2 Set Units:** In the ScanMax App, choose Units from the Menu Carousel. Click the middle handle keypad button to press the softkey to toggle between English (Imperial) and Metric units.
- 3 Calibrate Antenna:** In the ScanMax App, select Calibrate Antenna from the Menu Carousel. Follow the onscreen instructions. Calibrating will set appropriate gain levels.
- 4 Set Date/Time:** In the ScanMax App, choose the secondary menu softkey: Click the middle handle button or push the softkey to toggle to the ScanMax secondary menu carousel. Follow the onscreen instructions to set the appropriate date and time.



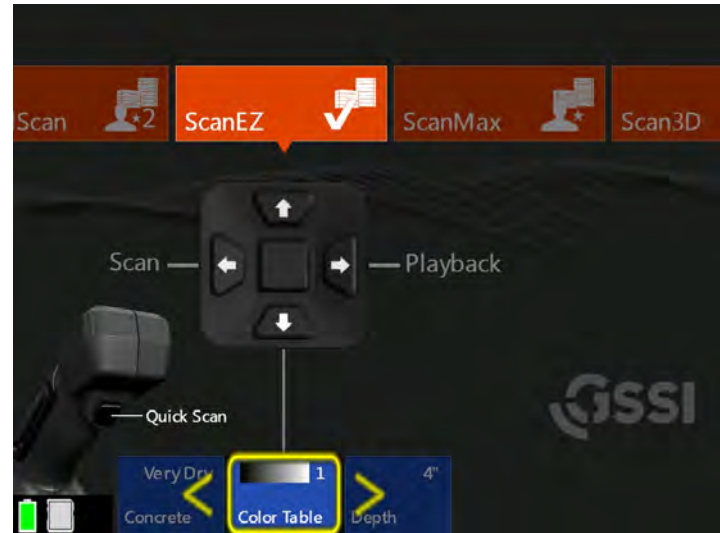
Secondary Menu Softkey

The choices you have made here will carry over to the ScanEZ and the Scan3D Collection Apps.

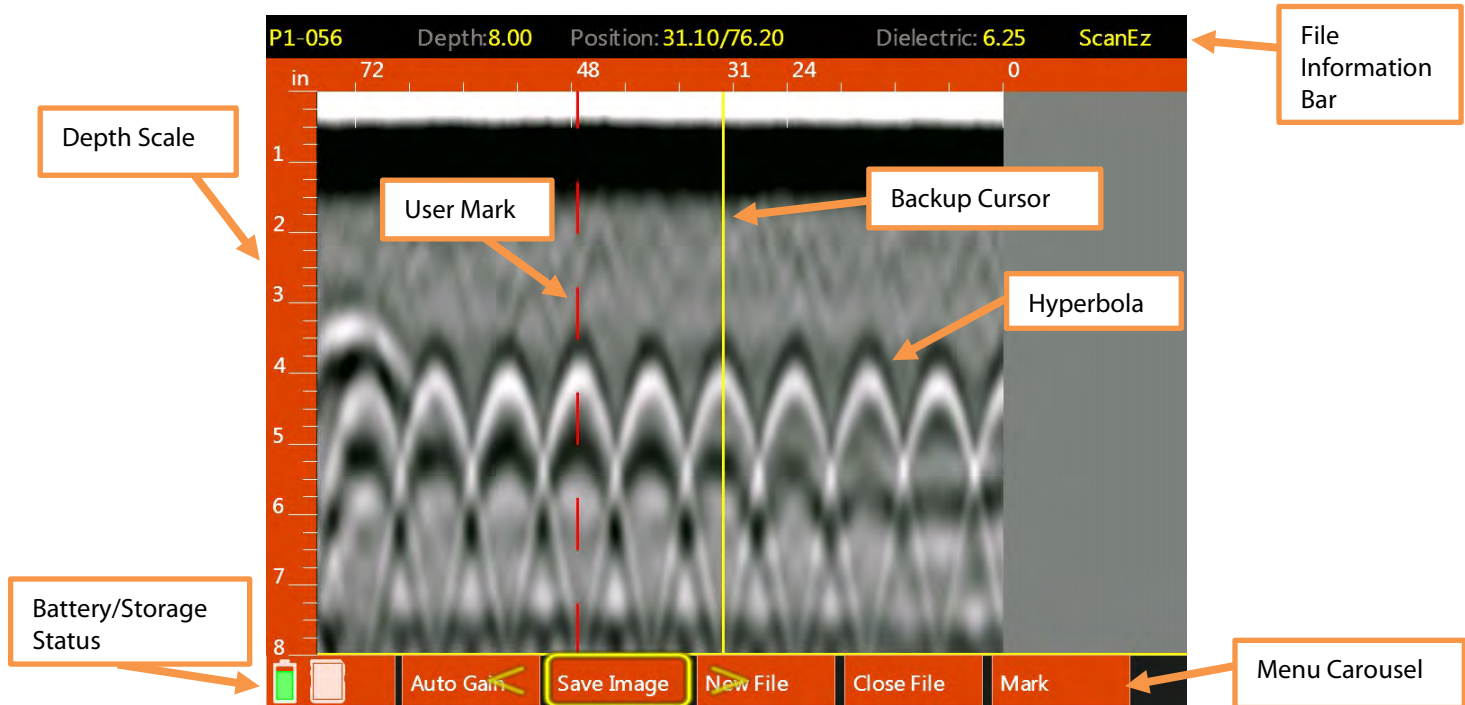
Section 2: Using ScanEZ Mode

Before collecting any data, you may want to configure your Mini LXT. Choose ScanEZ from the App Carousel.

- 1 Choose Inspection Depth:** Possible options are 4, 8, 12, 16, 20, 24 inches or 10, 20, 30, 40, 50, 60 cm. GSSI recommends setting the inspection depth a little deeper than required.
- 2 Set Concrete Curing Level:** GPR energy travels at different speeds through concrete which is at different cure levels. Setting this accurately will allow for more accurate depth readings. These names refer to the concrete's cure, not any surface water. See Appendix A in this guide for details.
- 3 Choose Color Table:** This will set the data display color. GSSI recommends that new users choose Color Table 1.
- 4** Once you have configured the LXT, pull the trigger or select Scan from the handle keypad to begin collecting data.



Understanding the Mini LXT Screen



- 5** If you haven't done so already, pull trigger to begin collecting data and roll the Mini LXT across the concrete. The data image will be displayed in real time.
- 6** The project and file number will be displayed at the top-left corner of the screen. The Menu Carousel will display different options depending on whether the Mini LXT is adding new data to the screen or using the Backup Cursor to review data already collection.

While adding new data, the Menu Carousel will have the following options:

- **New File:** This will stop and save your current file and begin collecting a new one. The file number in the top-left corner will advance by 1.
- **Mark:** This will write a red-dashed user mark to the scan that is being written when the option is pushed. This is useful to note the location of something you want to remember. You can also pull the trigger to add a user mark.
- **Close File:** This will stop and save the current file and return you to the ScanEZ menu screen.

While using the Backup Cursor, the Menu Carousel will have the following options:

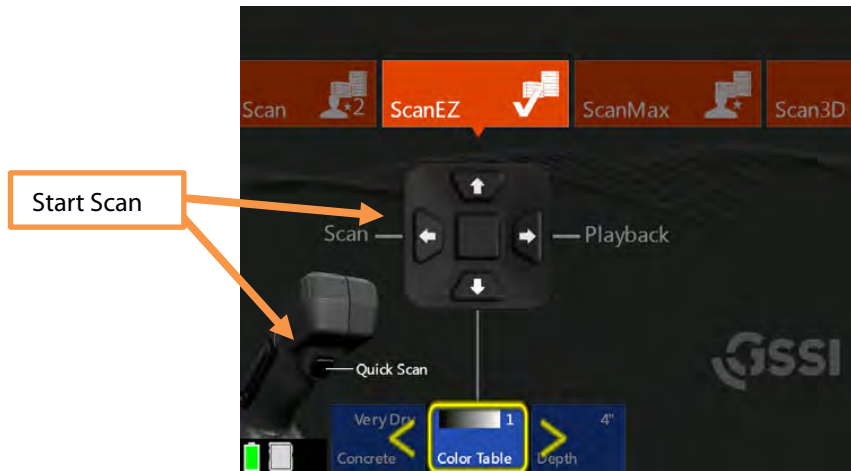
- **Auto Gain:** This will adjust the screen brightness to either brighten up under-gained (weak) images or dampen over-gained (saturated) images.
- **Save Image:** This will store a screen shot as a PNG image format. Each image will have the same name as the GPR data file. Multiple images of the same GPR file will have a letter tag added. For example: FILE__056A, FILE__056B, etc. You will need to save and transfer the GPR file to get the image. See Section 4 for data transfer.
- **New File:** This will stop your current file and begin collecting a new one. If you decide to save the file, the file number in the top-left corner will advance by 1.
- **Close File:** This will stop the current file and return you to the ScanEZ menu screen.
- **Mark:** This will write a red-dashed user mark to the Backup Cursor location when the option is pushed. This is useful to note the location of something you want to remember. You can also pull the trigger to add a user mark.

Collecting Data and Marking Targets

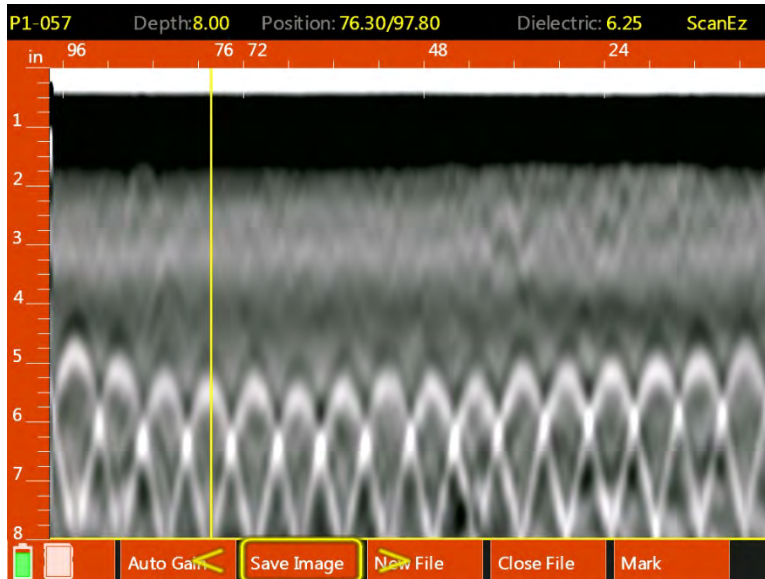
This section covers the steps to locate and mark out objects in 2D.

- 1 From the ScanEZ Main menu, pull the trigger or select Scan from the handle keypad to begin.

Roll the Mini LXT along the area to be scanned. The system will display data in real time as you are rolling it.

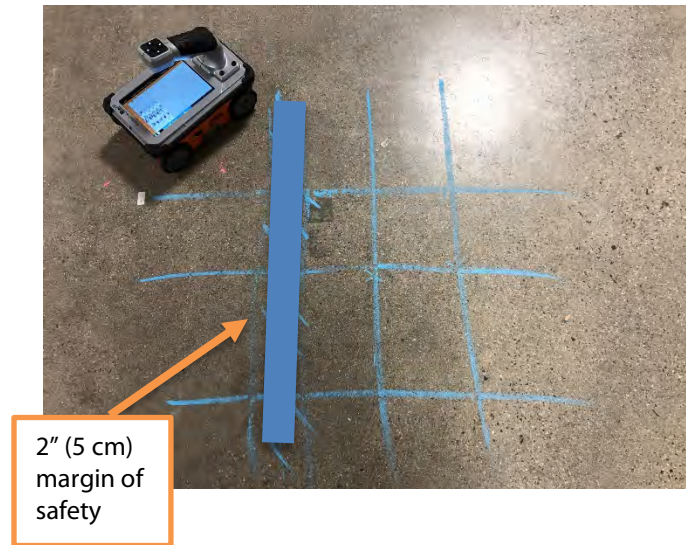
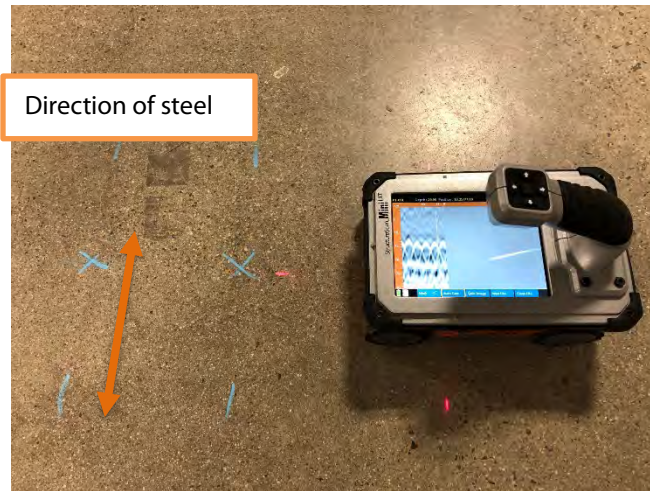


- 2** Back the Mini LXT up in a straight line. You will see a yellow vertical line (the backup cursor) appear on the screen. The position of this cursor is tied to the Mini LXT's survey wheel. Stop when the cursor bisects a hyperbola.
- 3** Mark the survey surface at both side laser points, and then back the Mini LXT up a little further and make an "X" in the middle between those laser marks. Note that objects you are imaging run perpendicular to the track of the Mini LXT. After each line, select New File to collect a new line.



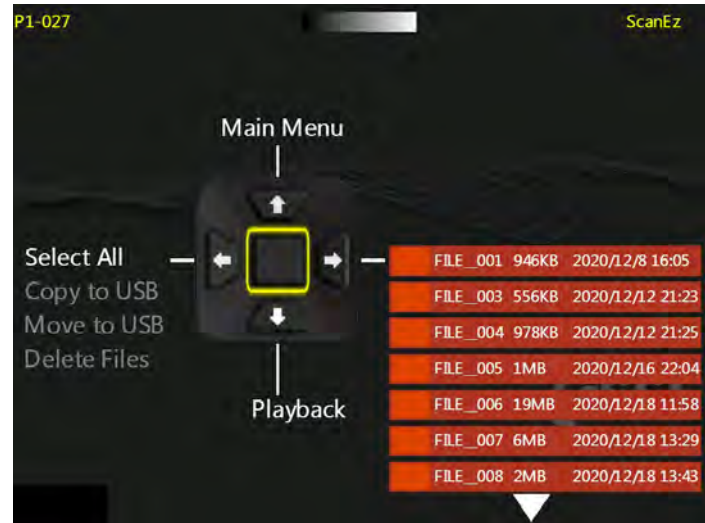
- 4** Take a minimum of two survey lines in each direction and connect your marks to draw what is in the slab on the slab.
- 5** When you are finished with a survey line, select New or Close File from the Menu Carousel. The Mini LXT will ask you if you want to save the file. Click Left to save or Right to discard.

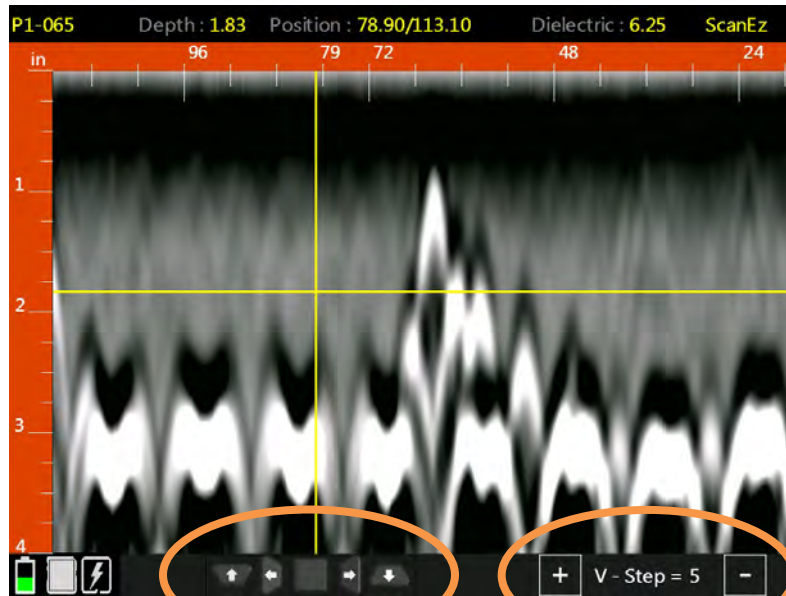
Note: GPR does not provide object size so GSSI recommends that you draw 2 inch (5 cm) thick line covering your drawn markouts so as to provide a safe margin near any objects.



Playing Back 2D Data

- 1** To play back previously saved files, select Playback from the ScanEZ Main menu using the handle keypad. This will open the Playback and File Transfer menu (at right).
- 2** Click the Right arrow on the handle keypad to activate the file browser. You can either click the Up and Down arrows or swipe the touchscreen to browse files.
- 3** Select the file(s) you want scrolling them to the top of the list and clicking the center handle keypad button or touching the box to the left of the file name.
- 4** Display the file by clicking the Left arrow to activate the handle keypad and then down to play back the data.
- 5** To scroll through very long files, select Cursor from the Menu Carousel. You will see crosshairs on the screen. You can move the crosshairs with either the arrow keys or by touching the screen and dragging your finger. If you prefer to use the arrows keys, you can change the distance interval per key push by changing the V-Step. Tap the +/- icons on the touchscreen to change between 1, 3, 5, 10, and 20. The value here is “scans” so if you collect 10 scans/inch and set this to 10, then each key push will move the vertical crosshair by 1 inch. Push the middle keypad button to exit the cursor menu.





Navigation Buttons

V-Step Scan Toggle

Section 3: Using the Scan3D App

Scan3D is used to collect and view sections of 3D GPR data.

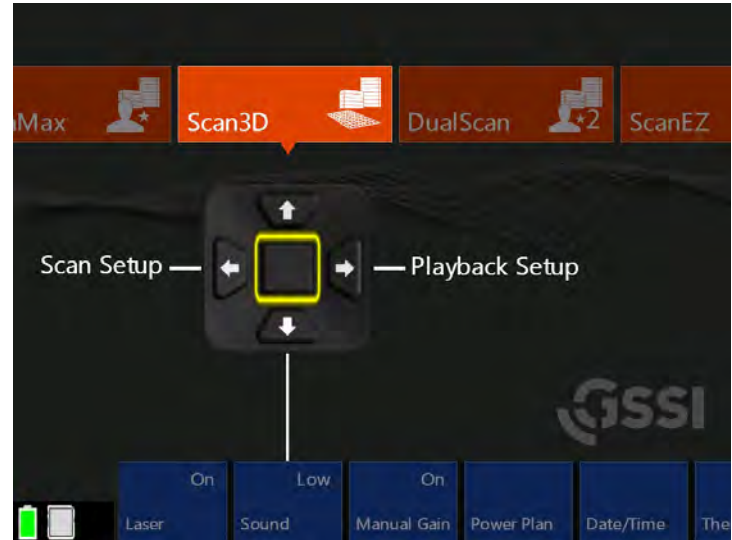
You can collect grids of three preset sizes: 1x1, 2x2, and 2x4 feet (30x30, 60x60, and 60x120 cm).

You can use one of the paper scan pads supplied by GSSI as a template, create your own, or even draw a grid on the survey surface. If you create your own or draw a grid, it must be one of the three preset sizes and the grid lines must be 2" (5 cm) apart.

Tape your scan template securely to the concrete. If using a GSSI supplied pad, mark the concrete at the holes in the corners. This will make it easier to draw objects onto the concrete during data interpretation.

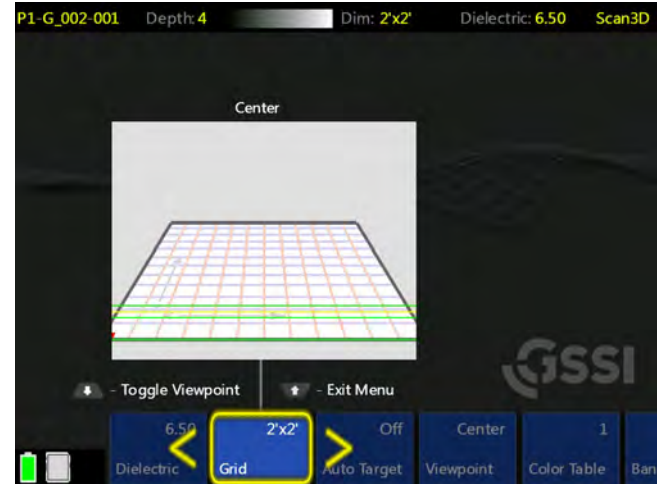
To begin, select Scan3D from the App Carousel and then select Scan Setup from the handle keypad.

Data Collection Grids are free to download. Go to www.geophysical.com, select Products > StructureScan > StructureScan Mini XT. Scroll down the page until you see “Resources.” You can find the 1x1, 2x2, and 2x4 foot (30x30, 60x60, and 60x120 cm) grids available for download.



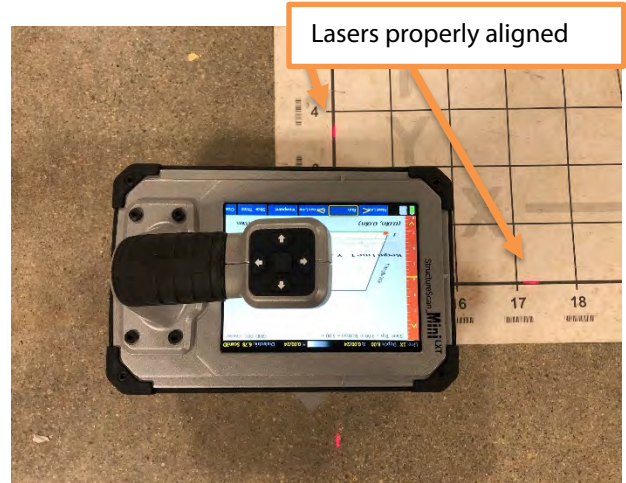
Setting up Collection Parameters

- After selecting Scan Setup from the Scan3D Main menu, click the Down arrow on the handle keypad to activate the Menu Carousel. You will see the screen at the right. Select the following parameters:
 - Grid size:** Choose the desired grid size.
 - Auto Target:** The Mini LXT will attempt to auto-locate objects. GSSI recommends leaving this Off during collection. It can be applied during Playback if desired.
 - Viewpoint:** This determines how the onscreen template grid will be viewed during collection.
 - Color Table:** Choose the desired color palette. GSSI recommends Color Table 1 for beginners. This can be changed in Playback.
 - Band Filter:** Turning this on will filter out horizontal banding. If you leave this off, you can decide later to apply it in Playback.
 - Depth:** Select the maximum depth of investigation.
 - Dielectric:** Setting this correctly results in a more accurate depth reading on your objects as well as a cleaner 3D image. Please see Appendix A for details on setting the dielectric. GSSI recommends using one of the tools available in ScanMax to accurately gauge your dielectric so that you can enter that value during 3D setup.
- Once you have selected the proper parameters, click the Up arrow to return to the Scan3D Main menu.



Collecting a Grid

- 1** Position the Mini LXT on the first line in the “X” direction on the scan template. Take care that the side lasers are lined up on the thick, black start line and that the front laser is aligned with the line you are scanning.
- 2** Using the handle keypad, click the arrow in the direction of Scan. The Mini LXT will switch to the collection screen and you will see an overview of the grid template. Pull the handle trigger to start the Mini LXT recording. Wait for the Mini LXT to beep before moving.
- 3** Roll the Mini LXT in a straight line to the end of the scan pad to just beyond the edge of the printed grid. The Mini LXT will beep twice and stop recording when it receives enough data.
- 4** Pick up the Mini LXT and position it at the beginning of the next line. Pull the handle trigger to start the Mini LXT recording. Wait for the Mini LXT to beep before moving.
- 5** When you are finished with the final “X” direction line, move on to the “Y” direction and continue the process until you have collected all of the lines.
- 6** Select Close Grid from the Menu Carousel when finished.

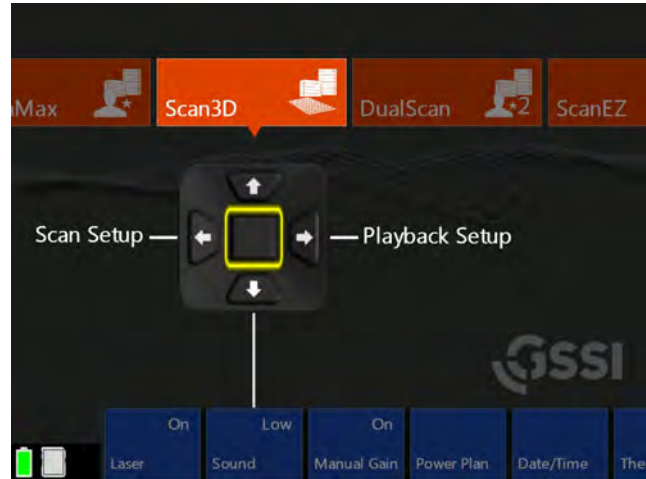


- You will see the screen at the right while you are collecting a grid. The bar at the top will display the current line and axis. Take note of the data display. Features in the concrete will begin to show and may help to identify any positioning errors so that you can recollect a line before finishing the grid.
- If you need to redo a line, finish the current line and select Previous Line from the menu carousel. You can then collect that line as normal and it will overwrite the earlier version of that line.



Recalling a Grid for Review

- 1** After you have finished collecting a grid and selected Close Grid, you will see the Scan3D Scan Setup screen. Click Up on the handle keypad to return to the Scan3D Main Menu (at right).
- 2** Click Right to go to Playback Setup.
- 3** Click Right to go to Files.
- 4** Click Right to activate the file list and then Up/Down or scroll with your finger to line up the desired Grid file with the yellow selection arrow.
- 5** Click the middle handle keypad button or tap the empty box next to the Grid file to select it.
- 6** Click Left to activate the handle keypad and then Down to select Playback. You will see a status bar which says “Loading Grid.” The grid will automatically display once it is finished loading.



Analyzing 3D Data

The menu carousel will have the following options once the grid displays:

Cursor: Toggle the crosshairs On/Off.

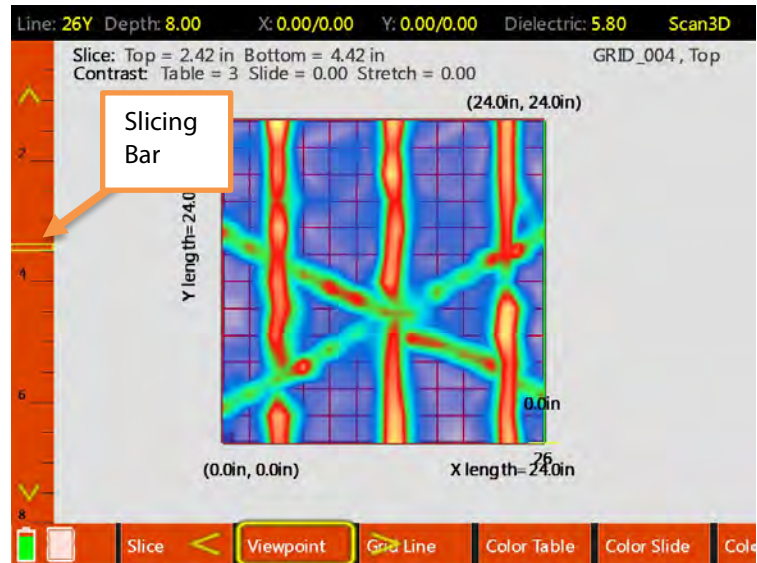
Position: Selecting this option will allow you to use the Up/Down keypad arrows instead of running your finger along the Slicing Bar to change your slice position.

Slice: This toggles between three horizontal plane slice thicknesses: Thin: 1/2" (1 cm), Thick: 2" (4 cm) and Full thickness. A full thickness slice has the top locked at the surface and you can move the bottom of the slice. This is useful if you want to core all the way through the slab and need to see everything in one view (like an X-ray image).

Viewpoint: Toggles through the multiple grid views plus the 2D linescan image.

Grid Line: Toggles to the individual lines in the grid which are then viewed in the 2D linescan and the oblique 3D views. The currently selected line is noted at the top-left corner of the screen.

Contrast: Allows you to change the distribution of the color table along the amplitude scale. This is useful for highlighting certain areas of the data such as bright reflection from metals. The current color values are displayed above the grid image.



Save Image: Take a screenshot and save it as a PNG image file for later transfer off of the Mini LXT.

Drill Hole: Allows you to position and “drill” a hole into your data set. The hole will display green if considered safe, and red if the system expects the hole to contact a high amplitude signal which could represent a target. This should not be considered as a definitive answer, but rather as an interpretive tool. Do not rely solely on this feature for your interpretations. Please refer to the StructureScan Mini LXT manual for details.

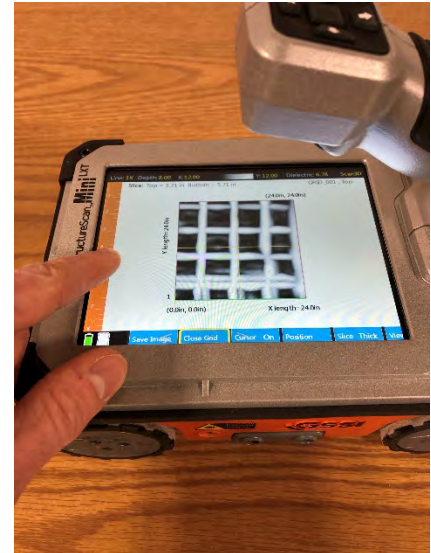
Slicing

To slice through the data, select a viewpoint which shows a clear image of the horizontal plane. Move your finger along the Slicing Bar to drag the view slice through the data. To jump to a particular depth, just tap the slicing bar at point corresponding to the desired depth.

As you slice, note the slice depth information displayed above the grid view. You will see the Slice Top depth and Bottom depth. This means that everything between those two values is displayed in the current view. In full thickness Slice mode, the Top value will be fixed at the surface (0).

Press the screen to reveal a crosshair you can then manipulate with your finger.

Alternatively, you can select “Position” from the menu carousel and use the Up/Down keypad arrows to change your slice.



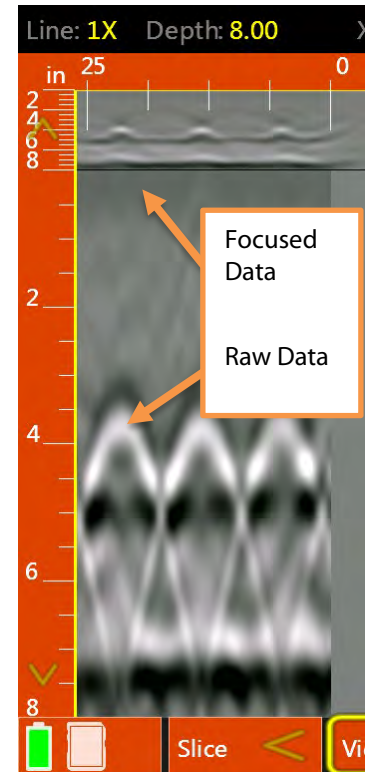
Refining the Image

The grid data are being processed with a technique called “migration.” Migration will remove the tails from the hyperbolas and collapse them back to the target’s central point. It is very useful as a tool for tightening up the 3D image. Migration requires you to have the correct dielectric value of the concrete. The best way to do this is to take a test scan in the ScanMax app and use one of the depth calibration methods to calculate the correct value. Please see the ScanMax section for details.

If you do not know the dielectric, then you can modify it during while playing back data. Toggle to the 2D linescan viewpoint. You will see an image like the one at the right. This shows a single grid line with raw hyperbolas on the bottom and processed, focused targets on the top.

The top data focus quality depends on the using the correct dielectric. The goal is to have the top image show as a series of small dots at the locations of the hyperbolas. The image at the right shows a correct value. If the top image contains hyperbolas, or upside-down hyperbolas, use your finger to drag the left scale bar up and down until the shapes collapse into tight dots.

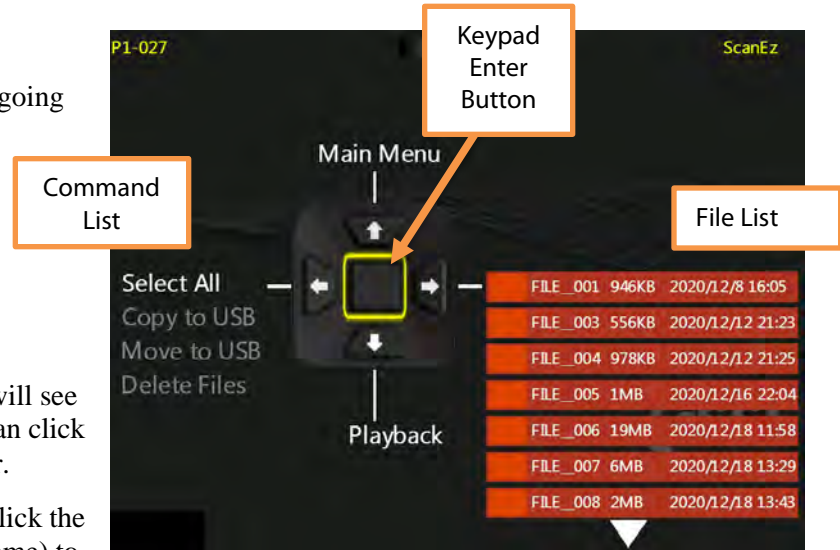
When you are satisfied with the result, click Viewpoint to return to the grid view. It will take a few moments to regenerate the grid image, so please be patient.



Section 4: File Management

This section contains instructions on data transfer and deletion. The File Management screen is accessed by going to Playback.

- 1** Select Playback in any of the scan apps. You will see the screen at the right.
- 2** Insert a USB thumb drive into the Mini LXT. Note that the Mini LXT will not accept an external hard drive.
- 3** Click the Right arrow to access the file list. You will see a yellow arrow appear next to the first file. You can click up/down to browse files or swipe with your finger.
- 4** Align the desired file with the yellow arrow and click the Right arrow (or tap the box to the left of the filename) to select.
- 5** Once all desired files are selected, click the Left arrow twice to the command list. Use the arrow keys to choose the desired command and then click the Right arrow to return to the keypad enter button. Click the keypad enter button to apply.



Appendix A: The Dielectric Constant.

What is it? The dielectric constant is number used in GPR to describe how fast the GPR energy moves through a non-metallic material. GPR waves move so fast (almost the speed of light) that it is not practical in most cases to use familiar units like miles or kilometers per hour, so we use the dielectric as an easier method. The range of values goes from 1 (air, the fastest) to 81 (water, the slowest). All of the concretes, asphalts, rocks, soils, and sediments fall between those extremes.

Why is it important? GPR doesn't record depth. It records time of flight. That is the elapsed time between the antenna sending out the RADAR pulse and then receiving the reflection. Since we know for how long the pulse traveled, if we can calculate the speed at which it traveled, we can calculate how far (deep) it went.

How do I know the Dielectric Constant? You can start off by estimating the number based on the age of the slab. That is what the chart below is for. The Mini LXT also has a function in ScanMax mode which will automatically calculate the value for you. A third way is to use input ground truth. This allows you to calibrate the dielectric by inputting a known depth. Please see the full Mini XT manual for details on the auto-calculation and the ground truth method.

Concrete Type	Dielectric Constant (Approx)	Concrete Age (Approx)	Comments
Very Dry	4.59	5 years +	The driest slabs
Mod. Dry	6.25	At least 1 year	Most slab on grade will be Mod. Dry
Damp	7.44	3-12 months	
Moist	9	1-3 months	Slab under water all of the time (swimming pool, water tank)
Wet	14.06	Less than 1 month	

Appendix B: Data Interpretation and Examples of Common Features

This section presents some data images of some common targets. While the GPR cannot differentiate different types of metal (rebar vs. metal conduit vs. post-tensioned cables) on the basis of the signal alone, the depth, spacing, and direction of the object often gives us clues as to its identification.

Welded Wire Mesh

This image shows a section of 6" wire mesh. There are two main clues here:

- The even spacing.
- The change in depth.

Since mesh is produced in a factory to have a constant spacing (6" is typical) the spacing between the hyperbolas which denote the wires will be constant. Mesh is installed in long rolls and tends to depress as it is weighted down by heavy concrete during the pour. The result is often a wavy appearance.

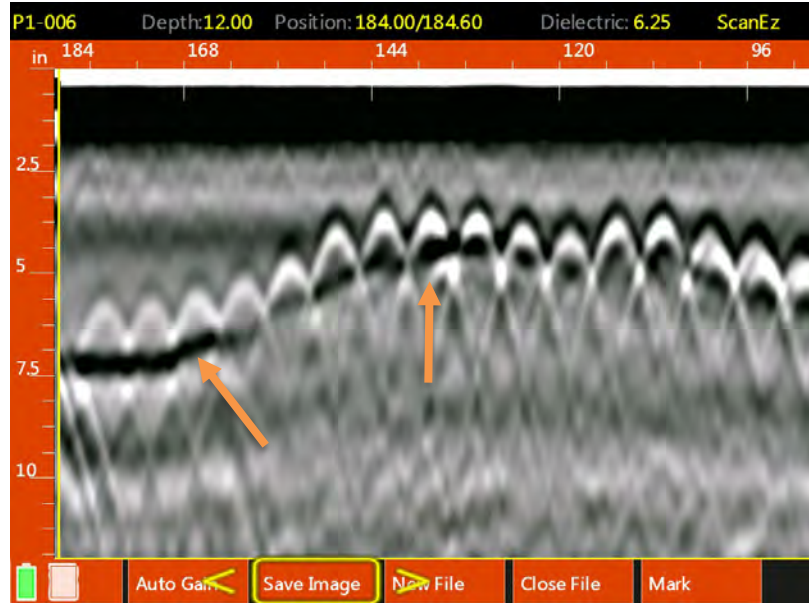
Note the bright white dot shown by the orange arrow. This is caused by the energy reflecting off two adjacent pieces of mesh. The reflections get added together and show as brighter than a single piece. This is not an additional target.



Potential Void under Slab

This image shows a wire mesh reinforced slab. Note the heavy black band below the wire mesh and shown by the orange arrows. The black band results from a pronounced high to low dielectric change as in concrete to air. While we do not know how thick the void might be we can tell the starting and ending point by locating where the black band starts and ends. Once we know the location, the next step is to drill a small hole in the concrete for confirmation.

When searching for voids behind slabs it is best to collect a long file so that any change (such as the black band at the right) will be more readily visible.



Rebar

This image is of #8 (1" diameter) rebar spaced 12" (30 cm) apart. Compare this image to the previous two examples. Notice that while there is a constant spacing, the spacing is too wide for normal wire mesh.

Also, when surveying over suspected rebar, take two profiles at right angles to each other. You will notice that the two directions of rebar hyperbolas will show at slightly different depth while wire mesh hyperbolas will be at the same depth. This is because mesh is welded together as a screen.

Also note the back of the slab as a black band at approximately 8" depth.

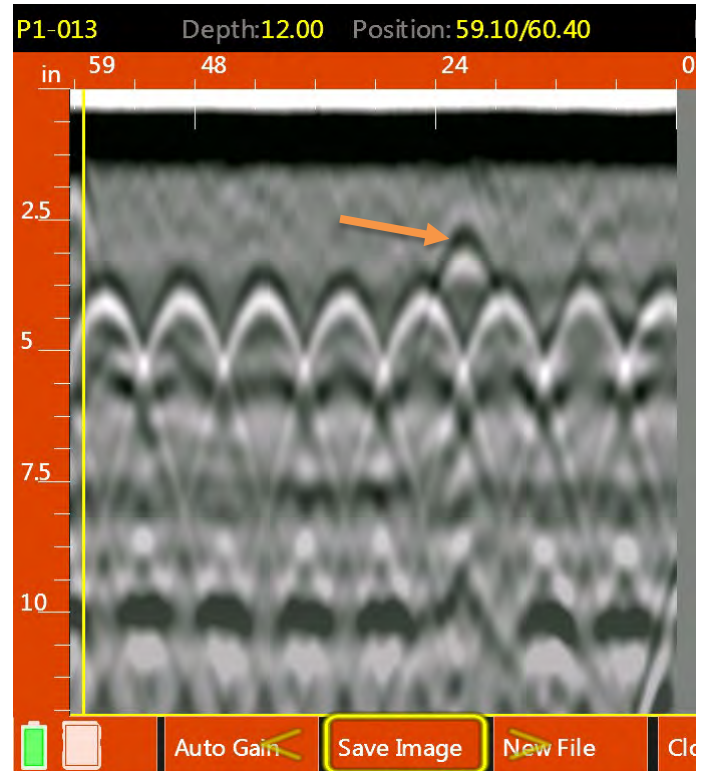


Empty PVC Conduit

The hyperbola identified by the orange arrow is an empty PVC conduit above a row of rebar. Note that the dominate color for the PVC hyperbola is black while the rebar is white. The PVC wall is too thin for GPR to image so we are reflecting off of the air void within the conduit. This produces a negative (black) response since the energy is traveling from a higher dielectric (concrete) to a lower dielectric (air) in the same manner as the void example earlier.

If the PVC conduit were filled with wire or liquid the image would more closely resemble the rebar image since there is now less air by volume in the conduit.

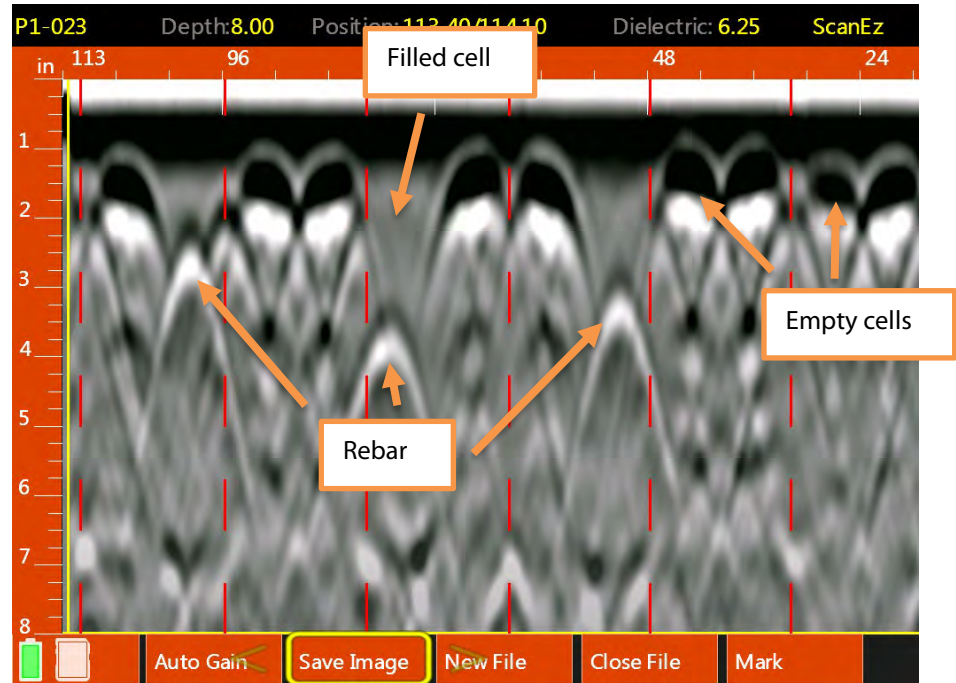
GSSI recommends exercising extreme caution when clearing out areas known or suspected to contain conduits.



Cinder Block/CMU

The Mini LXT is an effective tool for non-destructively checking for proper CMU construction. The data at the right was collected by running the Mini LXT horizontally along a course of CMUs. The Mark button was pushed each time the center of the Mini LXT (side laser) crossed the joint between two adjacent blocks. The marks show up on the right as the vertical red dotted lines. Between each pair of marks is one block.

Each CMU has two open cells. Those show as the large black areas near the top of the image. Blocks with two empty cells have a pair or black areas between the marks. Filled cells do not have a black area since the fill material is close in dielectric to the block itself, and thus no reflection is produced. Each of the filled cells has a rebar as reinforcement. Those show as the hyperbolas in the filled cells.



Notes:



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