

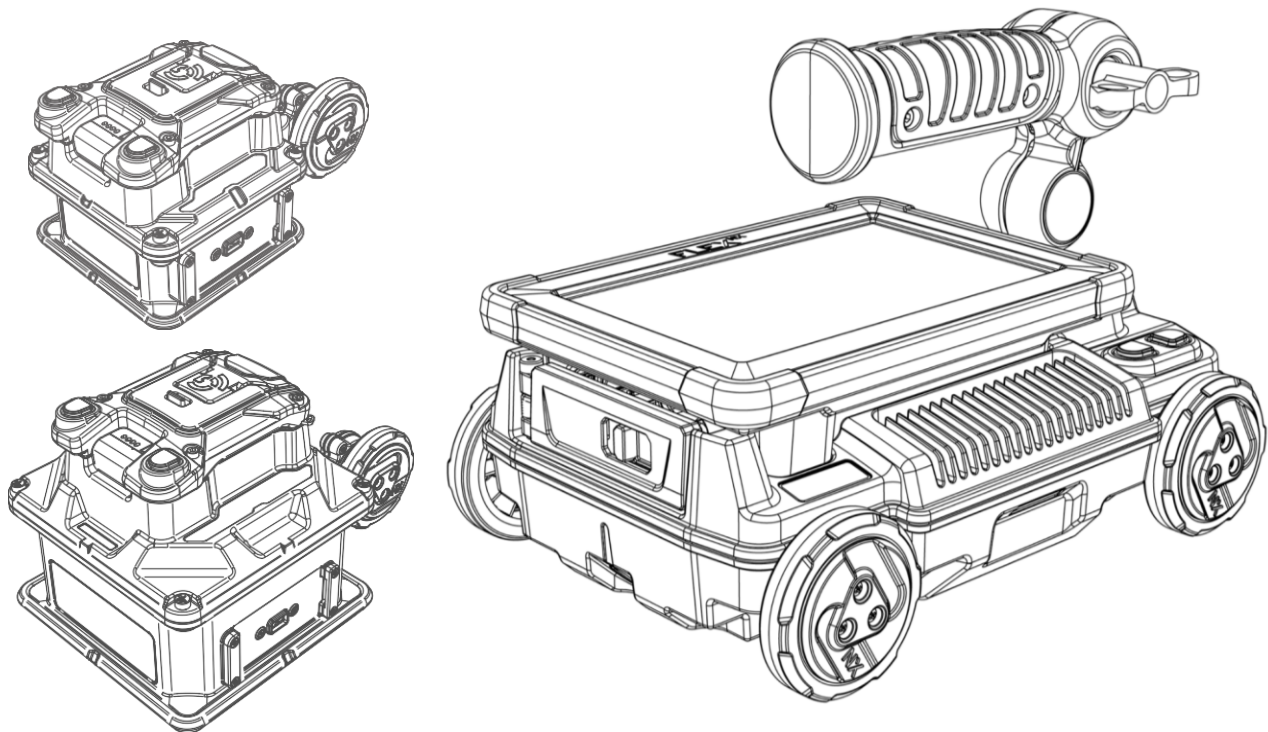
User Guide for Flex Systems

MN73-362 Rev G

FLEX^{NX®}

FLEX^{LT}

NEXUS
ELEMENTS



Geophysical Survey Systems Inc.

www.geophysical.com

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This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development [ISED] Canada's license-exempt RSS(s). Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

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Cet appareil contient des émetteurs/récepteurs exempts de licence qui sont conformes aux Spécifications sur les normes radioélectriques exemptes de licence d'Innovation, Sciences et Développement économique Canada. Son fonctionnement est soumis aux deux conditions suivantes : (1) cet appareil ne doit pas causer d'interférences nuisibles, et (2) cet appareil doit accepter toute interférence, y compris les interférences susceptibles de provoquer un fonctionnement indésirable de l'appareil.

Canadian Emissions Requirements

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada

GPR UWB Compliance Notice

The FCC has granted Geophysical Survey Systems, Inc a waiver of sections 15.503(d), 15.31(c) and 15.521(d) rules, certifying the Flex NX system, Flex LT system, and Flex NX accessories for GPR UWB transmission. This action was adopted and released by the Chief of the Office of Engineering and Technology (OET) on 31 July 2023 and is described in waiver DA 23-650. This waiver is subject to the following conditions:

1. The GSSI GPR device was certified by an authorized Telecommunications Certification Body. A copy of Waiver DA 23-650 was submitted with the application for certification.
2. The Flex NX, Flex LT, NX25, and NX15 systems operate with stepped frequency CW modulation in 1-40 MHz steps between 30-6000 MHz.
3. The Flex NX, Flex LT, NX25, and NX15 dwell time on any one frequency does not exceed 2 microseconds.

4. The dwell time during any Flex NX, Flex LT, NX25, and NX15 frequency step does not exceed 0.04 percent of the device's minimum scan/cycle rate.
5. For certification testing, the measurement of emissions from the Flex NX, Flex LT, NX25, and NX15 was conducted with the stepping function active for all possible frequency step sizes.
6. The Flex NX, Flex LT, NX25, and NX15 comply with all other technical and operational requirements applicable to UWB GPR devices under Part 15, Subpart F of the Commission's rules.
7. Operation of the Flex NX, Flex LT, NX25, and NX15 is limited to GPRs and wall imaging systems operated for purposes associated with law enforcement, fire fighting, emergency rescue, scientific research, commercial mining, or construction. Parties operating this equipment must be eligible for licensing under the provisions of part 90 of § 15.509.
8. Sales of the GSSI GPR device authorized under this waiver are subject to an annual limit of 5,000 devices for each of the first two years and 10,000 devices each year thereafter.

The Flex NX, Flex LT, NX25, and NX15 are not toys. The Flex NX, Flex LT, NX25, and NX15 cannot be used on ships or aircraft.

FCC Class A Compliance

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment or residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the introduction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

"Dead Man" Switch: In compliance with FCC regulations Flex NX, Flex LT, NX25, and NX15 are equipped with a "Dead Man" switch that disables the antenna transmitter after 10 seconds of inactivity.

Coordination Requirements

- (a) UWB imaging systems require coordination through the FCC before the equipment may be used. The operator shall comply with any constraints on equipment usage resulting from this coordination.

- (b) The users of UWB imaging devices shall supply detailed operational areas to the FCC Office of Engineering and Technology who shall coordinate this information with the Federal Government through the National Telecommunications and Information Administration. The information provided by the UWB operator shall include the name, address and other pertinent contact information of the user, the desired geographic area of operation, and the FCC ID number and other nomenclature of the UWB device. This material shall be submitted to the following address:

Frequency Coordination Branch, OET Federal Communications Commission, 445 12th Street, SW Washington, D.C. 20554 ATTN: UWB Coordination

- (d) Users of authorized, coordinated UWB systems may transfer them to other qualified users and to different locations upon coordination of change of ownership or location to the FCC and coordination with existing authorized operations.
- (e) The NTIA/FCC coordination report shall include any needed constraints that apply to day-to-day operations. Such constraints could specify prohibited areas of operations or areas located near authorized radio stations for which additional coordination is required before operation of the UWB equipment. If additional local coordination is required, a local coordination contact will be provided.

Notice: Use of this device as a through-wall imaging system is prohibited by FCC regulations.

Ground Penetrating Radar Coordination Notice and Equipment Registration (for U.S. Customers only)

Note: This form is only for domestic United States users. The Federal Communications Commission (FCC) requires that all users of GPR who purchased antennas after 15 July 2002 register their equipment and areas of operation. It is required that you fill out this form and fax or mail to the FCC.

Failure to do this is a violation of Federal law.

1. **Date:**
2. **Company Name:**
3. **Address:**
4. **Contact Information [Contact Name and Phone Number]:**
5. **Area of Operation [State(s)]:**
6. **Equipment Identification:**

Brand Name: Geophysical Survey Systems, Inc.

List all systems and antennas being registered.

Check Boxes for Included Models	Model	Serial Number	Center Frequency	FCC ID
☐	Flex NX		2500	QF7FLEXNX
☐	Flex LT		2500	QF7FLEXNX
☐	NX15		1500	QF7NX15
☐	NX25		2500	QF7NX25

7. **Receipt Date of Equipment:**

Fax this form to the FCC at: 202-418-1944 or mail to:

Frequency Coordination Branch, OET Federal Communications Commission, 445 12th Street, SW
Washington, D.C. 20554 ATTN: UWB Coordination

Do not send this information to GSSI.

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Introduction

Thank you for purchasing Flex, the new standard in concrete scanning. This manual covers the entire suite of product features for Flex NX, Flex LT, and the Nexus Elements Interface and offers many useful tips on data collection and interpretation.

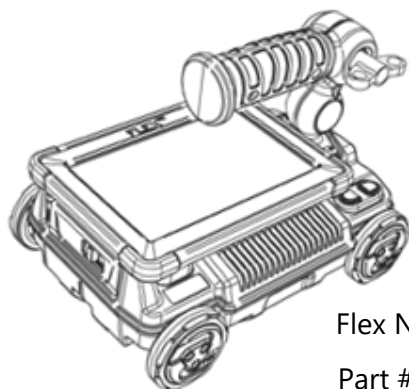
Our promise to you is to provide comprehensive training, unrivaled customer support and world-class expertise. That's why Flex systems include our industry-leading two-year warranty, complimentary training, and technical support access. For more information, visit us at www.geophysical.com.



Our team of dedicated technical trainers is ready to work with users of all experience levels, and GSSI Academy classes are offered on an annual schedule. Check out the GSSI Academy offerings at www.geophysical.com/gssi-academy or scan the accompanying QR code with your smartphone.

What's in the Box: Flex NX

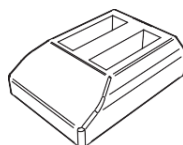
The standard Flex NX system ships with the following:



Flex NX Controller
Part #: **FGFLEX NX**



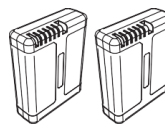
Flex NX Quick Start Guide
Part #: **MN73-190**



2-Bay Charger
Part #: **FGMODBC-NX**

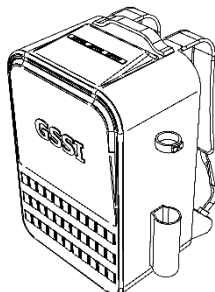


Wrist Strap
Part #: **FGNX-WRIST-STRAP**

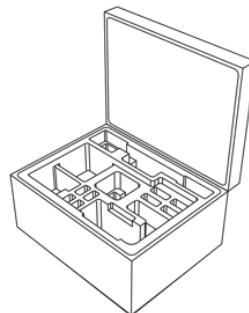


Lithium-Ion Battery (2X)
Part #: **FGNX-BAT-3 CELL**

And choice of one transport case:



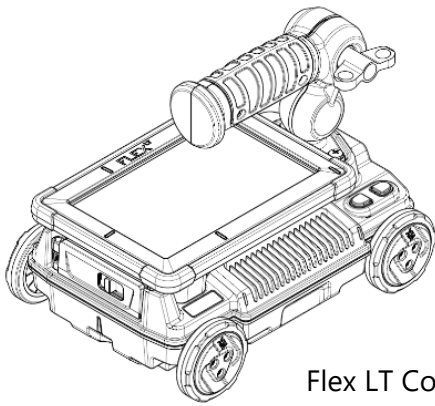
Backpack Transit Case
for Flex NX and Flex LT
Part #: **FGBACKPACK-FLEX**



Flex Transit Case for
Flex NX and Flex LT
Part #: **FGTC-FLEX**

What's in the Box: Flex LT

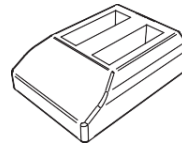
The standard Flex LT system ships with the following:



Flex LT Controller
Part #: **FGFLEX LT**



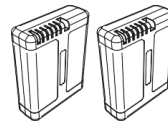
Flex LT Quick Start Guide
Part #: **MN73-254**



2-Bay Charger
Part #: **FGMODBC-NX**

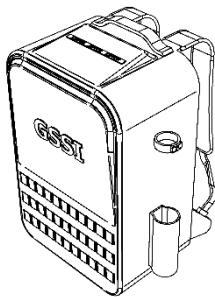


Wrist Strap
Part #: **FGNX-WRIST-STRAP**

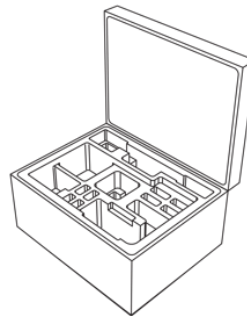


Lithium-Ion Battery (2X)
Part #: **FGNX-BAT-3 CELL**

And choice of one transport case:



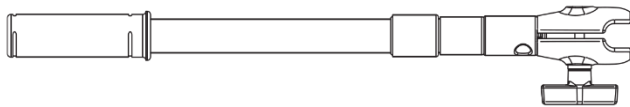
Backpack Transit Case
for Flex NX and Flex LT
Part #: **FGBACKPACK-FLEX**



Flex Transit Case for
Flex NX and Flex LT
Part #: **FGTC-FLEX**

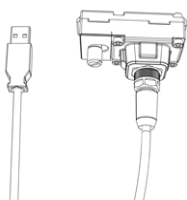
Optional Accessories: Flex NX and Flex LT

The following accessories are available for Flex NX and Flex LT and are sold separately or as part of a bundled kit. Satellite antennas are only available when sold as part of a Flex NX or Flex LT kit, or as a Nexus Elements kit, and cannot be purchased separately.



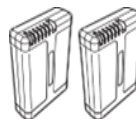
Telescoping Pole with RAM Grip for use with Flex NX, Flex LT, NX25 and NX15

Part #: **FGNX-POLE**



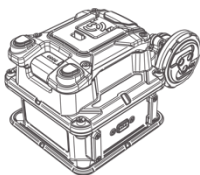
NX Tether Module

Part #: **FGNX-TETHER**

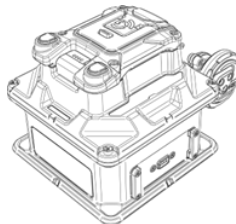


NX25/NX15 Lithium-Ion Battery

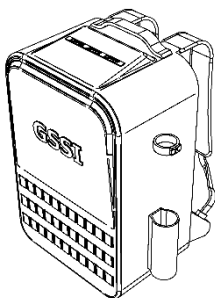
Part #: **FGNX-BAT-2 CELL**



NX25 Satellite Antenna*

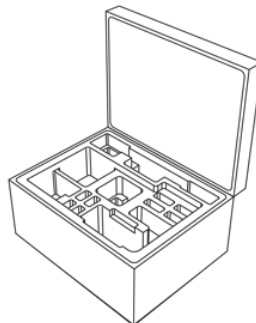


NX15 Satellite Antenna*



Backpack Transit Case for Flex NX and Flex LT

Part #: **FGBACKPACK-FLEX**



Flex Transit Case for Flex NX and Flex LT

Part #: **FGTC-FLEX**

*Can only be purchased as part of a Flex NX or Flex LT kit, or as a Nexus Elements system

System Specifications: Flex NX and Flex LT

Feature	Description
Unit Type	Self-contained all-in-one GPR system
Measuring Type	Ground Penetrating Radar (GPR)
Operational Modes	Single or dual channel (stacked) LineScan
Max Depth	0-75 cm (0-30 in)
Gain Mode	Configurable automatic gain
Dielectric Settings	Configured though concrete cure, manual entry, matching, set depth
Languages	English, Spanish, Japanese, Korean, Chinese, French, Italian, German
Display	178 mm (7 in) LED backlit LCD touchscreen display
Storage	Flex NX: 200 GB; Flex LT: 50 GB
Operating Temperature	-20°C to +50°C (-4°F to +122°F)
Storage Temperature	-40°C to +60°C (-40°F to +140°F)
IP Rating	IP65 (fully sealed against dust and low-pressure omnidirectional water)
Battery Performance	3 hours in ideal conditions
Dimensions	Flex NX / Flex LT: 25.3 x 13.2 x 18.9 cm (9.9 x 5.2 x 7.4 in)
Weight	2.2kg (4.9lbs) without battery; 2.45kg (5.3lbs) w/ battery and handle
Hardware Warranty	2 years from date of purchase

System Specifications: NX25 and NX15

Feature	Description
Unit Type	Wireless Satellite Antenna
Measuring Type	Ground Penetrating Radar (GPR)
Operational Modes	Single channel LineScan
Max Depth	NX25: 0-75 cm (0-30 in); NX15: 0-150 cm (0-60 in).
Gain Mode	Configurable automatic gain
Dielectric Settings	Configured though concrete cure, manual entry, matching, set depth
Languages	English, Spanish, Japanese, Korean, Chinese, French, Italian, German
Display	No integrated display
Storage	0.0 MB
Operating Temperature	-20°C to +50°C (-4°F to +122°F)
Storage Temperature	-40°C to +60°C (-40°F to +140°F)
IP Rating	IP65 (fully sealed against dust and low-pressure omnidirectional water)
Battery Performance	5 hours in ideal conditions
Dimensions	NX25: 11.2 x 11.2 x 10.4 cm (4.4 x 4.4 x 4.1 in) NX15: 13.9 x 13.9 x 13.2 cm (5.2 x 5.5 x 5.5 in)

Weight	NX25: 0.8kg (1.8lbs) with battery NX15: 1.2kg (2.8lbs) with battery
Hardware Warranty	2 years from date of purchase

Comparison of Flex NX, Flex LT, and StructureScan Mini XT

If you have experience with other GSSI products, you might wonder what new features Flex NX brings to the table. Flex NX retains many popular features of GSSI's previous generations of concrete scanners, while incorporating new technology and a completely redesigned user experience. Below is an overview of notable similarities and differences.

Operation	Mini XT	Flex NX	Flex LT
Locates metallic and non-metallic objects in concrete	X	X	X
High frequency, high resolution performance	X	X	X
2D scanning and data imaging	X	X	X
USB port	X	X	X
GSSI Fusion® compatible	X	X	X
Safety wrist strap	X	X	X
Quick start guide	X	X	X
Rugged transit case	X	X	X
Rugged Backpack		X	X
Powered by Nexus™		X	X
Adjustable handle		X	X
Remote display		X	
Wireless project transfer		X	
One-pass cross polarization data collection		X	X
Tap-to-Connect accessories		X	
Flex Vision Positioning System		X	
Flex Mode Collection		X	
Traditional Grid-Based 3D Collection	X	X	X
Warranty	2 years	2 years	2 years
Subscription required	No	No	No
Configuration Options	Mini XT	Flex NX	Flex LT
Standalone or in a kit	X	X	X
Wired accessory antennas	Palm XT	NX25, NX15	NX25, NX15
Wireless accessory antennas		NX25, NX15	
Extension pole compatibility	X	X	X
LineTrac®	X		

Flex NX and Flex LT are designed to be more customizable, mobile, and convenient than our previous concrete scanners due to software and hardware improvements. Flex systems are built

on GSSI's Nexus platform, and the first in a series of industry-defining and transformative GPR systems. These systems are what you've come to expect from GSSI – cutting-edge products that are Simple, Flexible, and Trusted.

What is NEXUS®?

NEXUS is GSSI's newest and most advanced technology platform, and it is the engine that will drive our future industry-leading innovations. A technological triumph, the core elements of Nexus facilitate a profound leap forward in GPR performance, data stream integration, and user experience. Nexus is the tangible representation of GSSI's Simple, Flexible, and Trusted mission, and its continual evolution will lead to vast improvements in system design, application relevancy, and interoperability of Nexus-cored technologies. We invite you to learn more about Nexus and its capabilities by contacting your GSSI sales representative.

Flex Systems and GSSI Fusion™

Flex systems, including the new Nexus Elements Interface, were designed with GSSI's Fusion platform at the forefront. Our vision was to create a comprehensive reporting platform that integrated with our field devices. Fusion is the culmination of that effort. As a quick and easy reporting tool, Fusion acts as an efficient organizational system for uploading scan data and screengrabs, adding results and descriptions, integrating field photos, and submitting a professional report branded with your company logo.

GSSI's mission is to make your scanning life as painless as possible. Our ultimate goal is the seamless interoperability of our hardware and software designs. We understand that, in most cases, a report is a procedural bottleneck that must be submitted before you leave the jobsite. To this end, GSSI Fusion's project management environment mirrors the project structure on Flex NX and Flex LT. Create new projects on Flex NX or Flex LT, create Areas of Interest and capture Results and then create a .FSN file and transfer your project to a mobile device (Flex NX only) or USB drive. Next, simply upload your .FSN to Fusion and your project will be set up just like you left it. Enter notes, rename and reorganize, add field photos, and generate a report. Then move on to your next job knowing that your polished and branded report will be digitally available to your client.

We invite you to learn more about GSSI Fusion, and how it can streamline your project reports, by contacting your GSSI sales representative. You can also register for a free GSSI Fusion account by visiting <https://fusion.geophysical.com/>.

GPR Theory Overview

Ground Penetrating Radar (GPR) is a geophysical method that uses radar waves to image subsurface materials. It is commonly employed in construction, geology, archaeology, civil engineering, and environmental studies. Nearly all GPR applications share a common goal: rapid and non-destructive assessment of subsurface targets for mapping, avoidance, or physical inspection. All GPR technology acts as a true remote sensing method, whereby imaging occurs before buried targets are visually inspected. In other words, we cannot know precisely what we

are imaging until it is directly observed. However, experience with GPR will improve your interpretation of the resulting data and knowledge of concrete construction techniques will provide even greater insight.

GPR operates on the principles of electromagnetic wave travel and reflection. Basic GPR theory involves an antenna transmitting short waves of electromagnetic energy into the ground, concrete, or other material. The waves travel through different subsurface materials, partially reflecting at boundaries with contrasting physical and chemical properties. The remaining waves travel deeper, reflecting from other boundaries until the waves dissipate. A receiving antenna records the reflections and plots them for display and analysis. The majority of modern commercial GPR systems use antennas containing both transmitter and receiver.

The depth penetration and resolution of GPR depend on several factors, including the frequency of the radar waves and the electromagnetic properties of a solid medium. Higher-frequency waves provide better resolution but have reduced penetration depth, while lower-frequency waves have greater penetration depth but lower resolution. Materials with high electrical resistance allow deeper penetration, such as air, concrete, and dry sand. Materials with high electrical conductivity, such as wet concrete and wet clay, dissipate the radar waves and vastly reduce penetration depth.

GPR measures the time elapsed between transmission and the return of reflections. The depth of targets or layers is based on the travel time and the speed of the radar waves. As an example, consider airplane detection using ground-based radar. The radar operator must determine the distance to an incoming airplane. To do this, they must use a distance, speed, and time calculation. To solve the problem, only two of the three variables are needed. The radar system records the time elapsed between the transmitted and received signals. Radar waves travel at a constant speed in air. The operator can then determine the distance using the time and speed values. A GPR system works in a similar fashion, though the depth calculation is a bit more complicated. The GPR system precisely records transmit and receive times, so we can easily constrain the time variable. In most cases, the depth of targets is unknown. We must therefore determine the speed of the radar waves to solve for depth. Here's the tricky part: GPR waves travel at different speeds depending on the material they pass through.

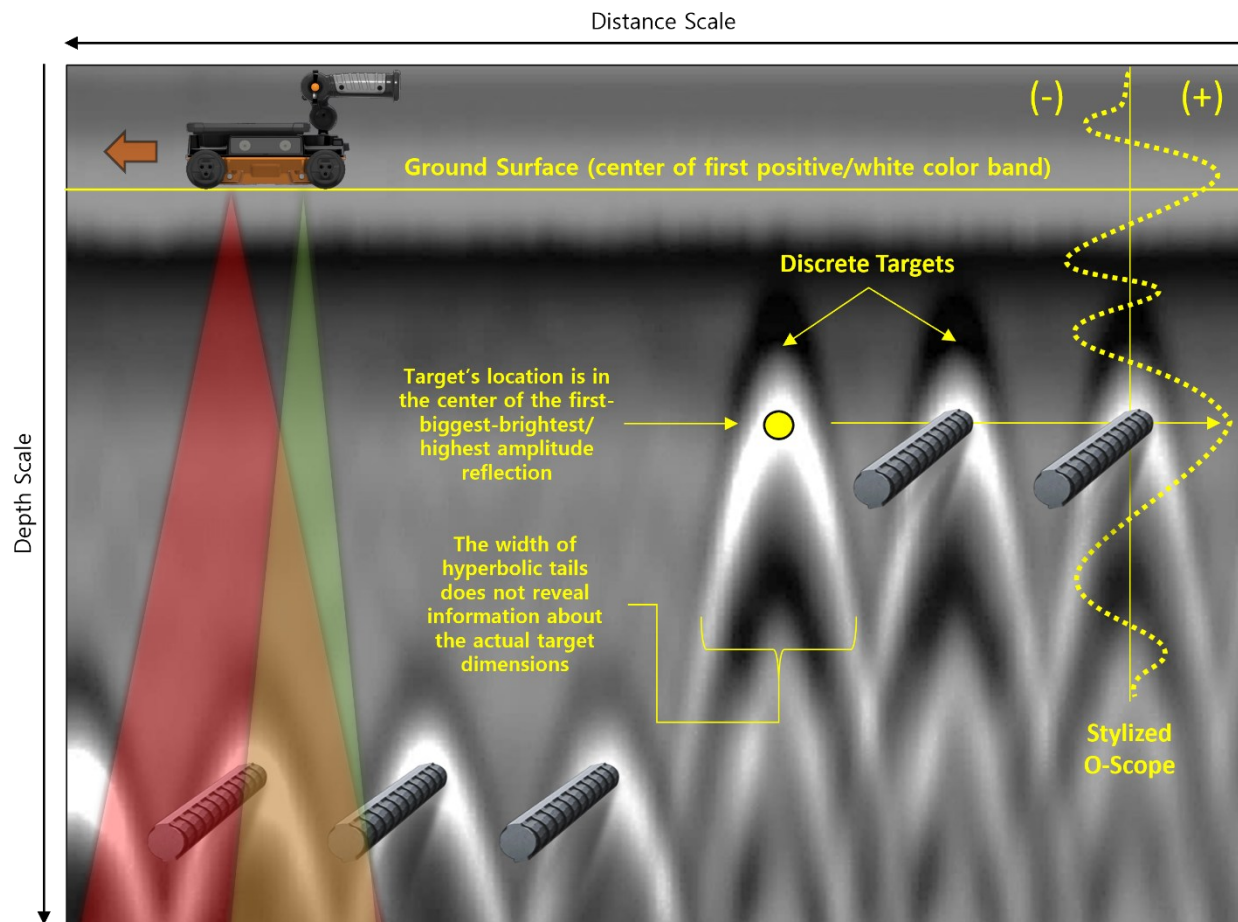
To calculate a precise target depth we must determine the speed of the radar waves using a dielectric constant value. Multiple methods are available, and in order of least to greatest accuracy these include tables of dielectric values for different materials, hyperbola matching using software, or setting a precise target depth from physical measurements. In most cases, hyperbola matching is the method of choice; picking a number from a table just isn't accurate, and knowing the true depth of a target is not common. Once the dielectric constant is determined the system calibrates the depth scale accordingly.

The Anatomy of a GPR Profile

GPR data are presented as vertical profiles (much like observing the side of a saw cut) displaying depth below surface and distance traveled. As discussed above, the depth scale is only as accurate as the current dielectric value. On the other hand, the distance scale is very precise because it is measured with integrated distance encoders. This distance precision ensures accurate markouts, whether collecting data in forward movement or using backup cursors when traveling in reverse.

As reflections return to the receiving antenna they are plotted against travel time and assigned a range of colors based on their phase and amplitude. The result is a single scan that is represented by the O-Scope. Additional scans are collected as an antenna moves forward, resulting in a continuous GPR profile. All GPR profiles exhibit a series of flat, high amplitude bands that appear at and around the ground surface. These reflections are the direct wave, and they are created when GPR energy travels from transmitter to receiver before it leaves the antenna. The center of the first positive (white) band is the position of the ground surface.

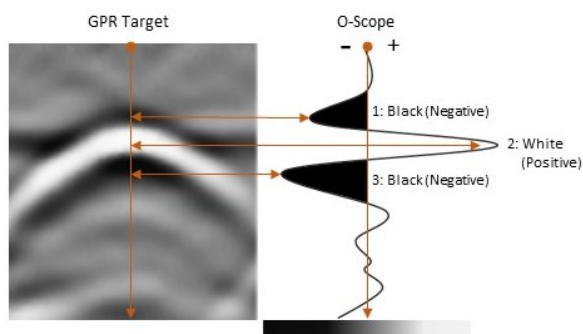
A typical GPR profile contains two categories of reflections: targets and layers. **Targets** are



expressed as hyperbolas representing discrete objects, such as rebar and conduit. These hyperbolas can vary in amplitude (reflection strength) based on the material of the object. Metallic objects produce high amplitudes, while air-filled PVC and other synthetic materials generate weaker hyperbolas.

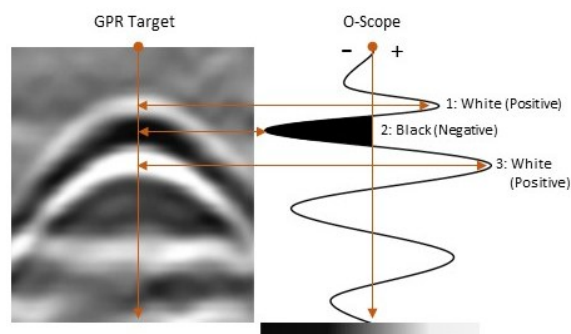
Target hyperbolas will widen with increased depth, and to the untrained eye these deeper targets could be mistaken for larger objects. However, the true diameter of a target cannot be derived from the shape of a hyperbola. **Layers** are continuous boundaries, like the base of a slab or an air void under the slab, that can be tracked along a profile. Like targets, layers can vary in phase and amplitude but their reflection characteristics are based on the nature of the overlying and underlying materials.

To an experienced GPR operator, the phase and amplitude of targets and layers reveal additional information to enhance data interpretation. Enabling the O-Scope display will assist with advanced interpretations. GPR energy cannot penetrate metallic targets, so a large amount of energy is reflected back to the antenna and registers as a high amplitude target. This is convenient for locating metal reinforcement and conduit, but solid metal structures like pan decking are impenetrable to GPR energy. Any features of interest on the other side of pan decking or beneath thick layers of metal reinforcement will not be resolvable. Nor can GPR image the contents of metal pipes. Metal targets exhibit white (normal phase) as their first-biggest-brightest peak. This pattern, along with high amplitudes, typifies metal targets and demonstrates that the energy decreased in speed as it passed from concrete to the metal.



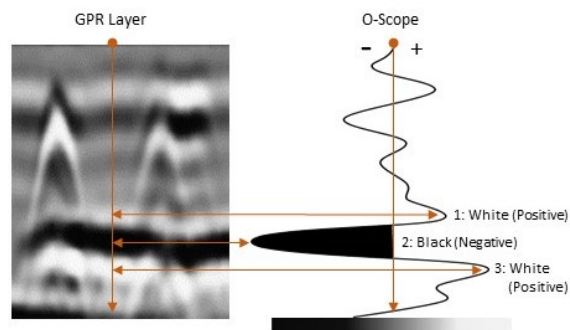
The first reflector is black (negative), but the **first-biggest-brightest** reflector is white (positive). This demonstrates that the GPR energy decelerated at the concrete/target contact. This target could be interpreted as metallic or possibly water-filled PVC.

Marking this and other targets on the slab surface would show the broader pattern, improving the interpretation.



The first reflector is white (positive), but the **first-biggest-brightest** reflector is black (negative). This demonstrates that the GPR energy accelerated at the concrete/target contact. This target could be interpreted as air-filled PVC or potentially as a small air void.

Marking this and other targets on the slab surface would show the broader pattern, improving the interpretation.



The first reflector is white (positive), but the **first-biggest-brightest** reflector is black (negative). This demonstrates that the GPR energy accelerated at the concrete/layer contact. This target could be interpreted as an air-filled void at the base of the slab.

Marking the extents of this layer on the slab surface would show areas of voiding, allowing targeted remediation efforts.

In other cases, the pattern of reflections will be reversed (black-white-black). This pattern suggests that the energy increased in speed at a material boundary, such as the air void in a PVC pipe or an air void within or beneath a concrete slab. These reflections will often exhibit lower amplitudes and could be masked by hyperbolas from reinforcement.

Common GPR Uses in Concrete Scanning

GPR is a non-destructive method that provides insight into the condition, composition, and structural characteristics of concrete elements. This helps in ensuring the safety, durability, and efficient management of concrete structures. The non-destructive nature of the method makes it a rapid, safe, and cost-effective means of identifying slab contents and potential hazards.

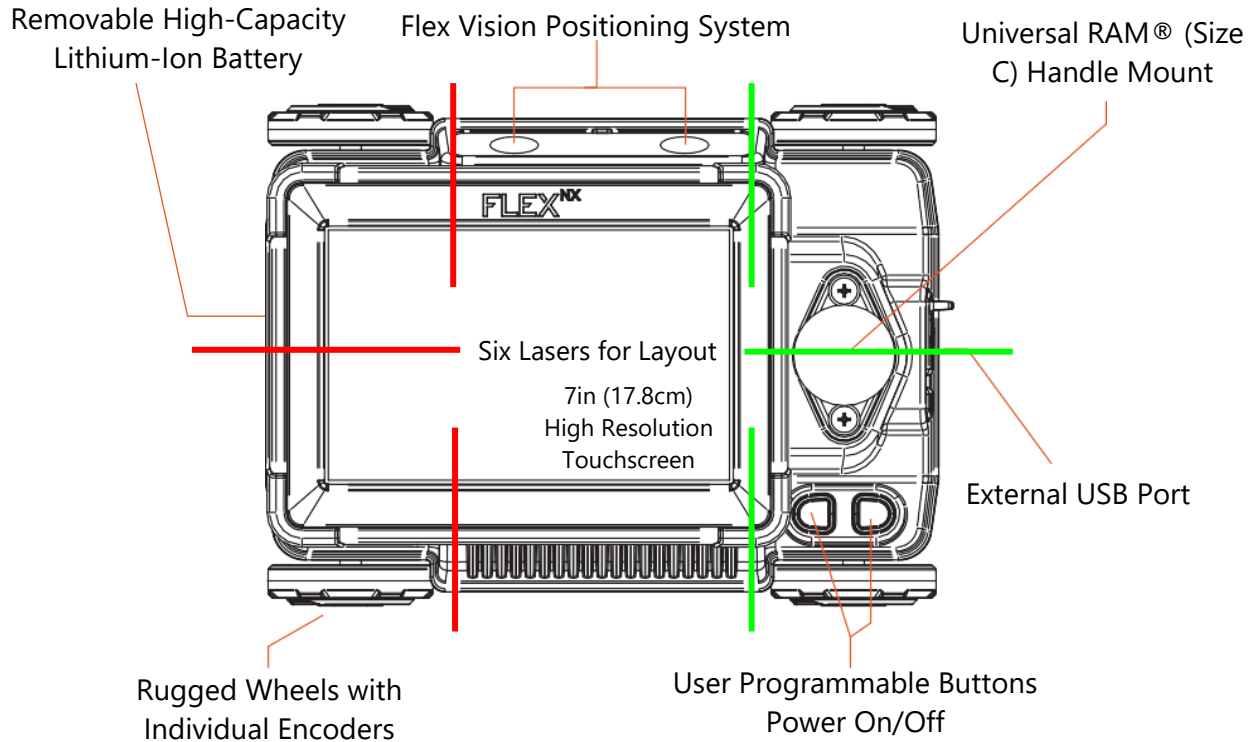
Concrete scanners typically use GPR to investigate concrete prior to saw cutting or core drilling. At predetermined cutting locations the operator marks out reinforcement, conduit, and structural elements such as beams, cables, and pan decking. This allows the cutting and coring crew to avoid damaging important, and potentially dangerous, elements in the slab.

GPR is also used for non-destructive testing (NDT) and structural forensics to assess the construction and health of existing concrete structures. In this application, inspectors employ GPR to ensure the reinforcement in the slab and slab thickness match the planned specifications. Commonly measured factors include rebar spacing, rebar depth in the slab, and the presence of post-tensioned cables and other forms of reinforcement. These measurements are also carried out when renovating older buildings, helping to verify that the concrete is strong enough to support the planned loading.

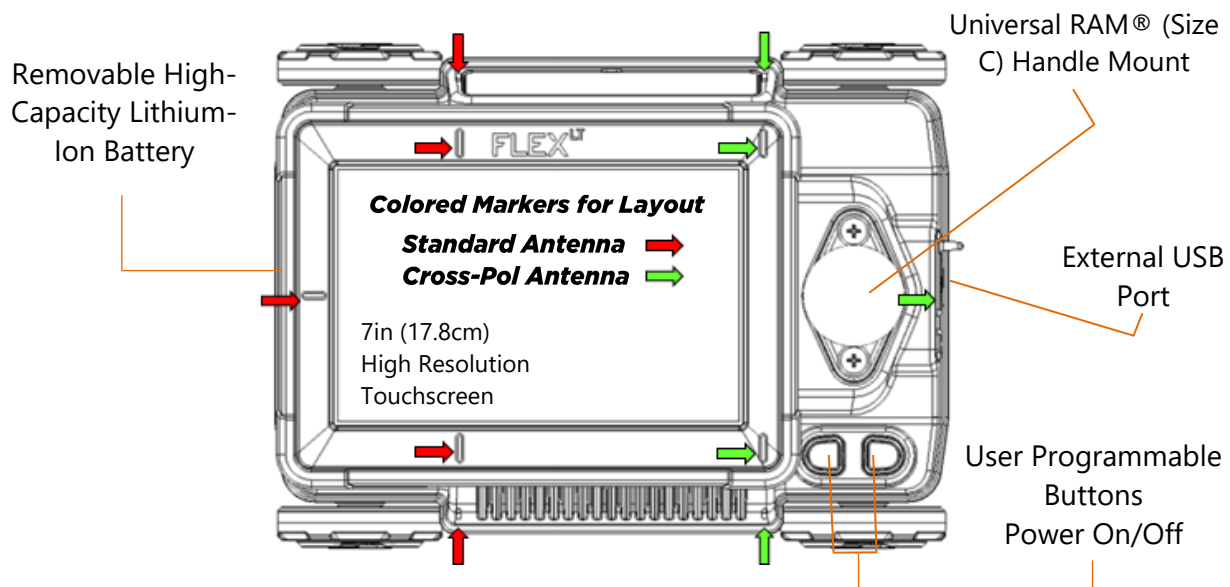
In some cases, voids form under concrete slabs due to erosion or soil compaction. Subgrade materials can be removed by water below the slab, and compaction occurs from soil settling or loading from above. In either case, the resulting void space poses a major risk to the integrity of the structure. GPR is sensitive to the transition from concrete to air and can determine the areal extent of void spaces. The slab can then be remediated, usually by injecting polyurethane foam through numerous tiny holes drilled in the concrete. GPR can help ensure that the holes are drilled safely, too.

Flex Systems: Hardware Overview

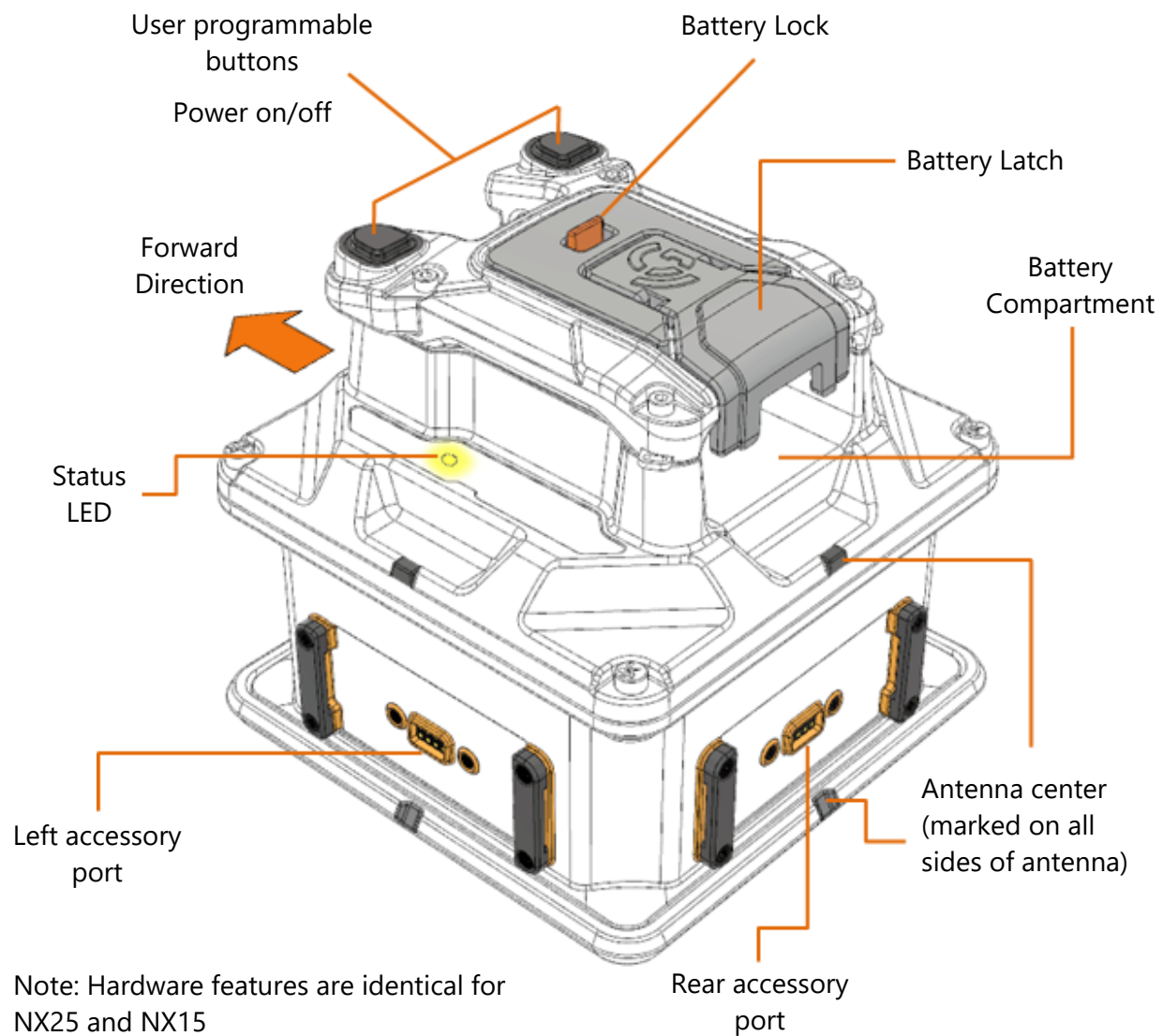
Physical Features: Flex NX



Physical Features: Flex LT

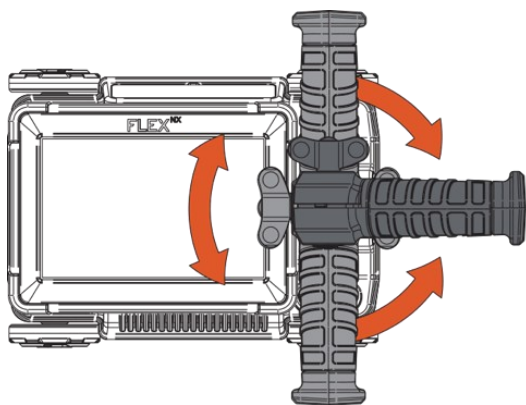


Physical Features: NX25 and NX15 Satellite Antennas

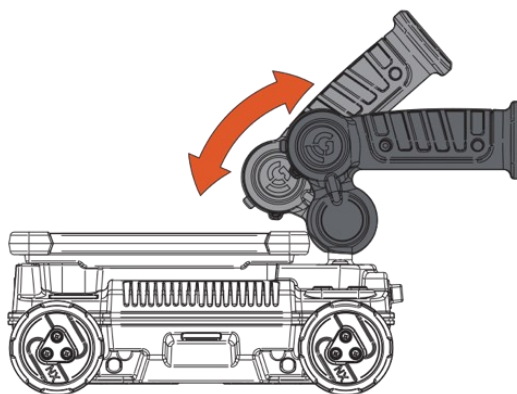


Flex NX and Flex LT Handle Configurations

The Flex NX and Flex LT handles are ergonomically designed to promote ease of use and maximum flexibility. The handle is highly configurable, with a wide range of adjustment angles and built-in safeguards to prevent screen damage. To adjust the handle, simply loosen the knob, reorient the handle, and tighten. To remove the handle, fully loosen the knob. Use the attached RAM Mount ball to connect an extension pole or a custom RAM solution.



Full range of horizontal rotation



Vertical movement limited to prevent display damage

Touchscreen Display: Care and Maintenance

Integrated into Flex NX and Flex LT are large (7.0-inch diagonal) multi-touch displays. These displays are not removable and should damage occur the entire Flex NX or Flex LT system should be returned to an authorized repair facility. To ensure proper care and maintenance of the touchscreen display, consider the following:

- ❗ Clean the screen regularly. Use a soft, lint-free cloth to gently wipe the screen surface. Avoid using abrasive materials, paper towels, or rough fabrics that may scratch the screen. If necessary, lightly dampen the cloth with water or a screen-cleaning solution.
- ❗ Turn off the display before cleaning. This allows for better visibility of smudges and reduces the risk of accidental actions on the screen.
- ❗ Avoid harsh chemicals. Chemicals, solvents, or ammonia-based cleaners can damage the screen's protective coating. Use only mild screen-cleaning products.
- ❗ Apply gentle and controlled pressure when interacting with the touchscreen. Excessive force or tapping can lead to cracks or damage.

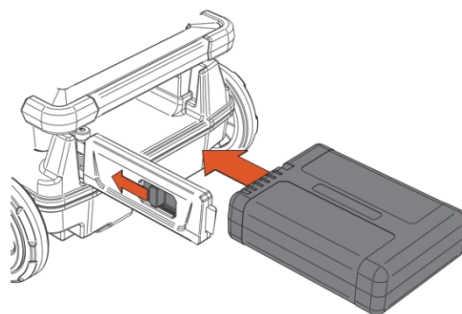
Battery Usage

Flex NX, Flex LT, NX25 and NX15 satellite antennas each include two Lithium-ion batteries. **Note:** Flex NX and Flex LT use the same battery, but these batteries are not compatible with NX25/NX15. However, both battery styles use the same charging station. Both NX25 and NX15 batteries are interchangeable.

Flex NX and Flex LT

To insert the battery, slide the battery door latch to the left and open the door. Insert the battery with the battery contacts facing upward and towards the Flex NX or Flex LT system. Ensure that the battery latch is fully engaged when closed.

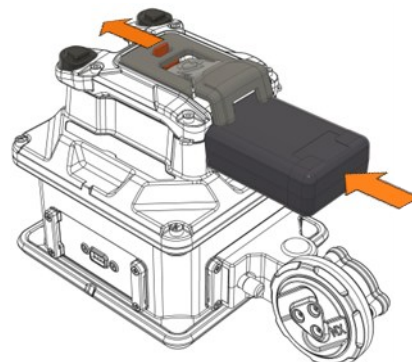
To eject the battery, simply slide the latch to the left and open the door. An internal spring will partially eject the battery.



NX25 and NX15

To insert the battery, orient the battery contacts downward and toward the antenna. Next, slide the battery latch lock forward and use the battery to push up on the battery latch. The latch will snap into place once the battery is fully inserted.

To eject the battery, use your index finger to slide the battery latch lock, then insert your thumb into the front access window and push the battery out of the latch.



IMPORTANT: Electronic devices may consume battery life when powered off. GSSI suggests removing batteries when Flex NX, Flex LT, NX25, and NX15 are not in use.

Battery Charging Station Instructions

The Flex battery charger will accept Flex NX, Flex LT, NX25, and NX15 batteries.

Assemble the battery charger's AC adapter by inserting the power plug into the AC adapter. Next, plug the AC adapter into the battery charger and then plug the AC adapter into an approved electrical outlet.

Insert a battery into one or both of the charger slots. Note that the battery must be inserted with the terminals facing downward and aligned with the receiving board in the charger slot.

LED Status	LED Color	Battery Status
NO LED	N/A	No Battery Detected
	Blinking Green	Fast Charging
	Solid Green	Fully Charged
	Blinking Yellow	Battery Recalibrating
	Blinking Yellow to Solid Green	Battery Recalibrated
	Solid Yellow	Standby or Suspend
	Blinking Red	Error

Flex NX, Flex LT, NX25, and NX15 batteries are equipped with a fuel gauge feature for quickly determining the remaining charge. Over time, the fuel gauge may become less accurate and will need to be recalibrated. To recalibrate, place a battery into one or both charger slots and press the button next to each occupied charger slot. For chargers with an Inspired Energy label, there is a black button near the front of each charger slot. Other charger models will have “Push to Recalibrate” buttons near the front of the charger. Regardless of the charger model the recalibration could take up to 9 hours; please plan accordingly.

For **LED status**, **LED color**, and related **system status** information please refer to the LED chart below.

Powering On Flex NX, Flex LT, and Satellite Antennas



Insert a fully charged battery, then press and hold the two power buttons to power on Flex NX, Flex LT, NX25, and NX15. To power down the system, hold both buttons until the screen or LED turns off. GSSI does not recommend ejecting the battery to power down.

Interface Options for NX25 and NX15 Antennas

Satellite antennas operate using two distinct Interfaces: Nexus, and Nexus Elements. The **Nexus Interface** requires connecting a satellite antenna to Flex NX or Flex LT as an accessory. This is the standard Interface and provides Flex-related capabilities such as project and file management and data display on the integrated display of NX and LT. The **Nexus Elements Interface** connects via mobile device and does not require NX or LT. This Interface offers a more streamlined experience for mark-and-go scanning and does not include project and file management. The Nexus and Nexus Elements Interfaces are installed with a software update and both are available on every NX25 and NX15.

Guidance for the Nexus Interface is included in the Flex NX and Flex LT User Guide sections. The Nexus Elements Interface is detailed in a separate chapter.

Satellite Antenna LED Indicators

NX25 and NX15 satellite antennas are equipped with an LED indicator displaying the current system status. Refer to the following table for an explanation of LED color states. Satellite antennas will power in in their last used state, so be sure to use the LED color table to identify which interface the antenna booted into.

Nexus Elements Interface (Wireless Connection)		Nexus Interface (Wireless and Wired Connections)	
LED Color	Status	LED Color	Status
	Powering On/Off		Powering On/Off
	Ready to Pair		Waiting to Pair
	Connected		Paired
	Collecting Data		Connecting
	Updating		Connected to Flex System
	Switching Modes		Collecting Data
			Updating
			Switching Modes

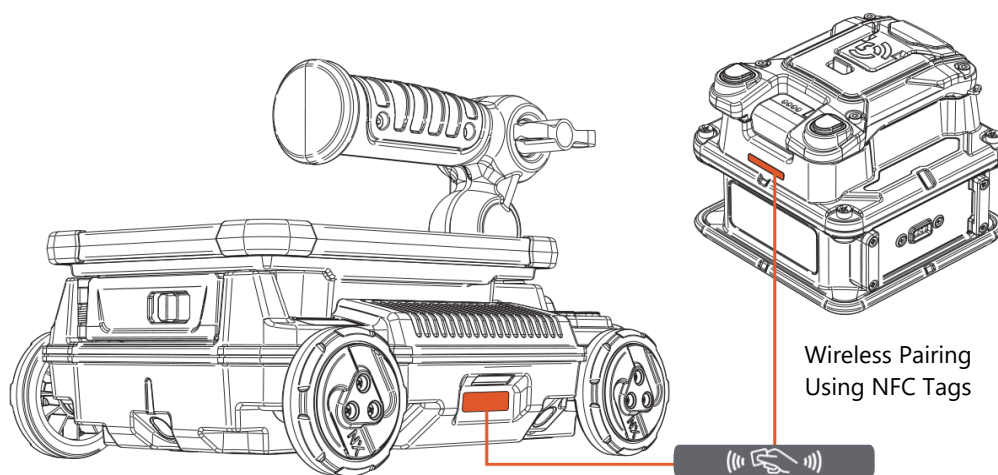
Nexus Interface: Pairing Satellite Antennas

Wireless Satellite Antenna Pairing (Flex NX Only)

Flex NX uses near-field communication (NFC) to pair with satellite antennas and Wi-Fi to communicate. Flex LT cannot wirelessly pair with satellite antennas.

Pairing a satellite antenna to Flex NX is simple. First, power on Flex NX and wait for the Main Dashboard to appear. Next, power on NX25 or NX15 and observe the flashing red LED. Wait for a flashing blue LED, indicating that the satellite antenna is ready to pair. Bring NX25 or NX15 close to Flex NX and make contact between the two NFC labels. The LED will transition to solid blue, then to flashing green, and finally solid green when the two units are paired. The satellite antenna will now appear on the Main Dashboard's carousel. For future scanning sessions simply power on Flex NX, then power on a satellite antenna and wait for the indicator light to turn solid green. When collecting data the LED will be flashing cyan.

Flex NX displays satellite antenna data and provides complete access to NX25 and NX15 configuration options, collect mode functions, and file saving. Note that NX25 and NX15 cannot collect Flex Mode scans. Alternatively, connect a Wi-Fi enabled smartphone, tablet, or computer to either control or mirror the data collection screen. See the 2D Remote Control (page 80) and Connecting a Viewing Device sections (page 52) for more information.



Wired Satellite Antenna Pairing (Flex NX and Flex LT)

Use the Flex Tether Module to establish a wired connection between a satellite antenna and Flex NX or Flex LT. The Tether Module is the only method for connecting a satellite antenna to Flex LT. Additionally, the Tether Module is invaluable for using satellite antennas in situations where Wi-Fi use is restricted.

To begin wired pairing, power on your Flex NX or Flex LT and connect the Flex Tether Module via USB. Wait for Flex NX/LT to display the Main Dashboard, then power on NX25 or NX15 and observe the LED color state. The LED will be initially red, and it will then transition to flashing blue

(Accessory Mode), yellow (Nexus Elements Interface), or flashing light blue (Wired Accessory Mode). If the LED color is flashing light blue, simply connect the Flex Tether Module without NFC pairing. If the LED color is flashing blue or yellow, tap together the NFC tags on the Flex Tether Module and the satellite antenna. Once the NFC tags communicate the satellite antenna's LED color will flash rose, indicating a change in connection state. Attach the assembled Tether Module to the **rear accessory port** of NX25 or NX15. The antenna will display a flashing blue LED when connecting, solid blue LED when paired, flashing green when the connection is secured, and solid green when the antenna is ready to use. The satellite antenna will now appear on the Main Dashboard's carousel, and to collect data it must be set as the active device and have an encoder connected. When collecting data the LED will be flashing cyan.

Flex NX and Flex LT display satellite antenna data and provide complete access to NX25 and NX15 settings, collect mode functions, and file saving. Note that NX25 and NX15 cannot collect Flex Mode scans, but they can be used with 2D Remote Control and Screen Mirroring on Flex NX.



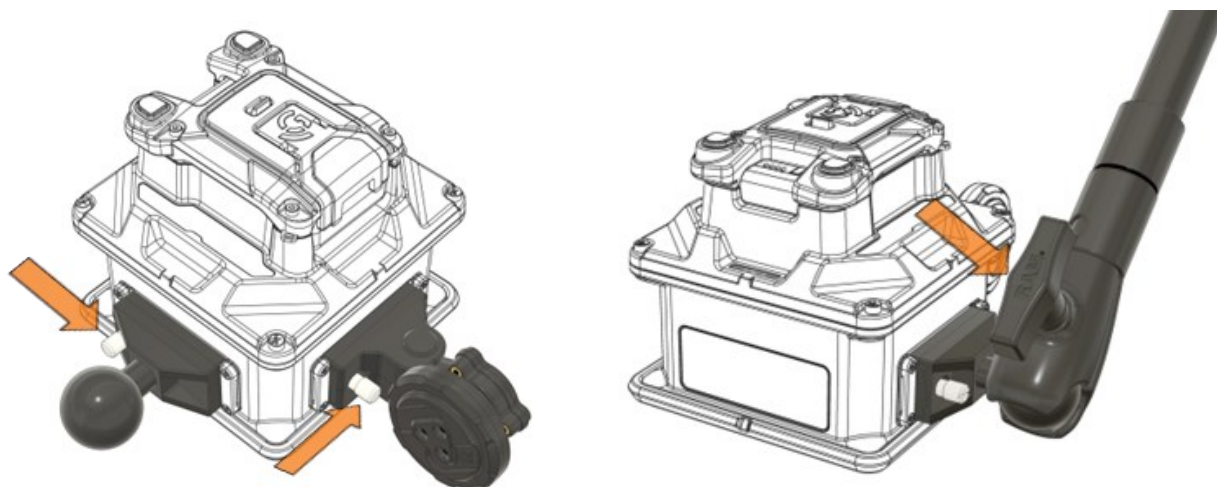
Attaching Accessories to NX25 and NX15

Satellite antenna accessory ports are located on the left and rear sides of the antenna. The ports are designed for attaching and securing a survey wheel (for data collection) or a RAM ball adapter (for attaching an extension pole or custom RAM solution). The Tether Module is only compatible with the rear accessory port.

A survey wheel can be attached to either port based on personal preference. In common practice, the survey wheel is attached to the rear port for typical scanning situations and attached to the left port for “side car” scanning next to walls. The survey wheel arm locks when the antenna is fully in contact with the scanning surface and can be moved 90-degrees counter-clockwise for cross-polarized scanning.

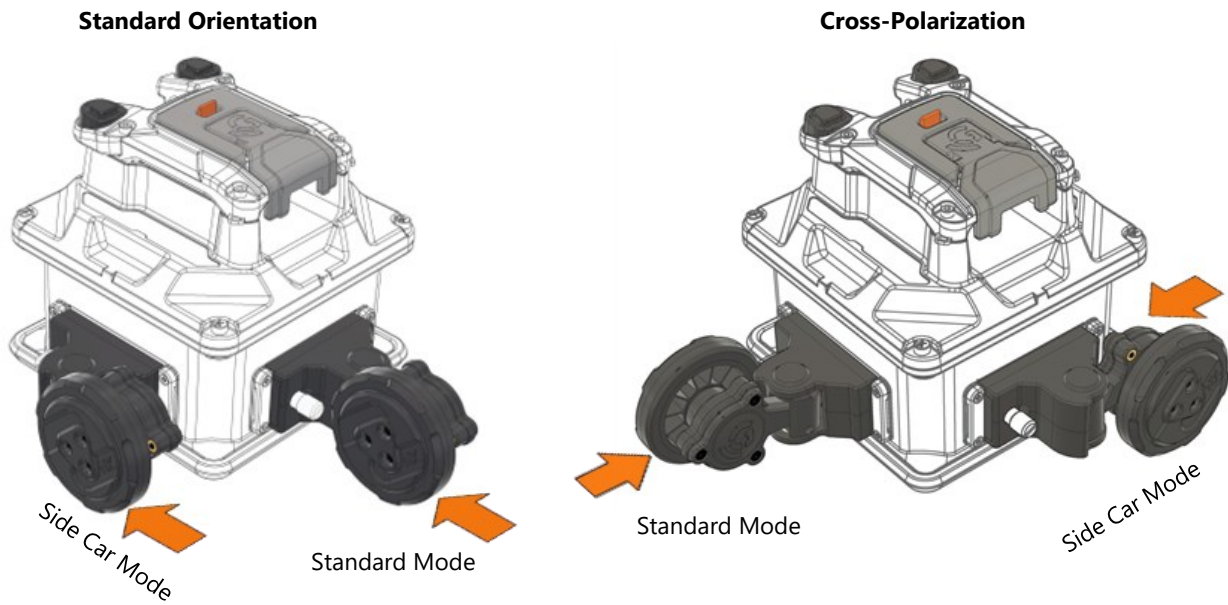
To attach accessories, slide the locking pin inward and insert the right side into the accessory port with the locking pin to the left. Next, insert the locking pin side and release the locking pin.

To attach the Telescoping Pole Accessory, loosen the knob, then slide the jaws over the RAM adapter ball and tighten the knob.



Encoder Configurations for NX25 and NX15

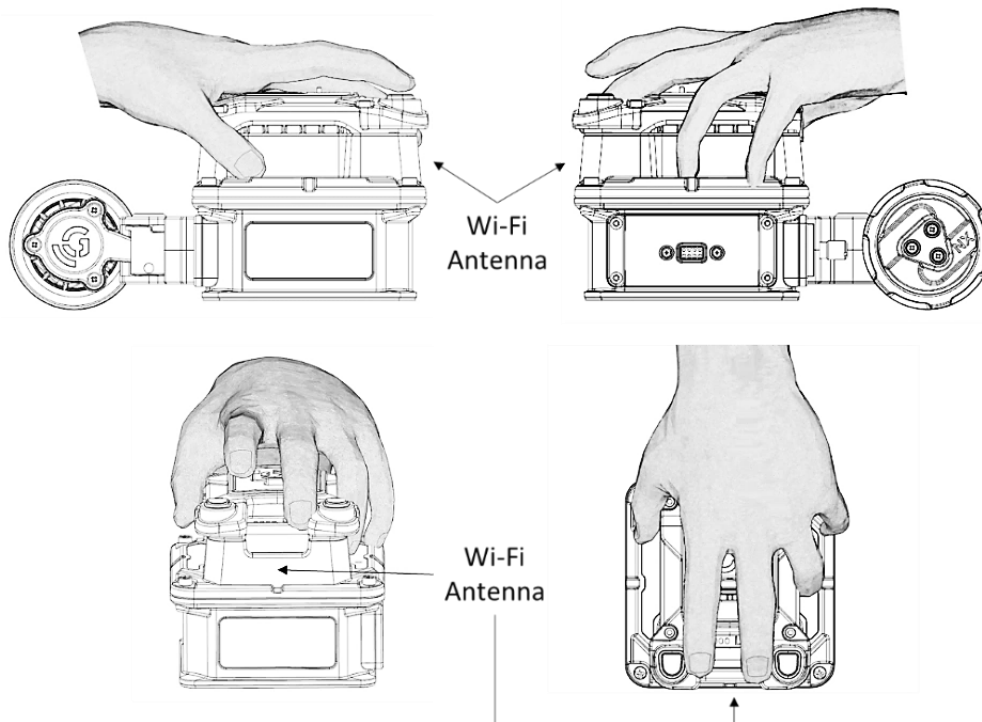
Survey wheels are highly configurable based on your current needs. For Standard Orientation scanning there are two options: rear accessory port with the arm fully extended, and side car mode using the left accessory port and the survey wheel arm folded to the side. For cross-polarization there are also two options: rear accessory port with the arm folded to the side, and side car mode using the left accessory port and the survey wheel arm fully extended. Note that for cross-polarized scanning the movement direction is not aligned with the front of the antenna. Refer to the orange arrows in the figure below to see which direction to move the antenna for each encoder configuration.



Wi-Fi Safety and Holding NX25 and NX15

The NX25 and NX15 satellite antennas connect to Flex NX via Wi-Fi, and GSSI highly recommends observing safe Wi-Fi exposure habits when using these antennas.

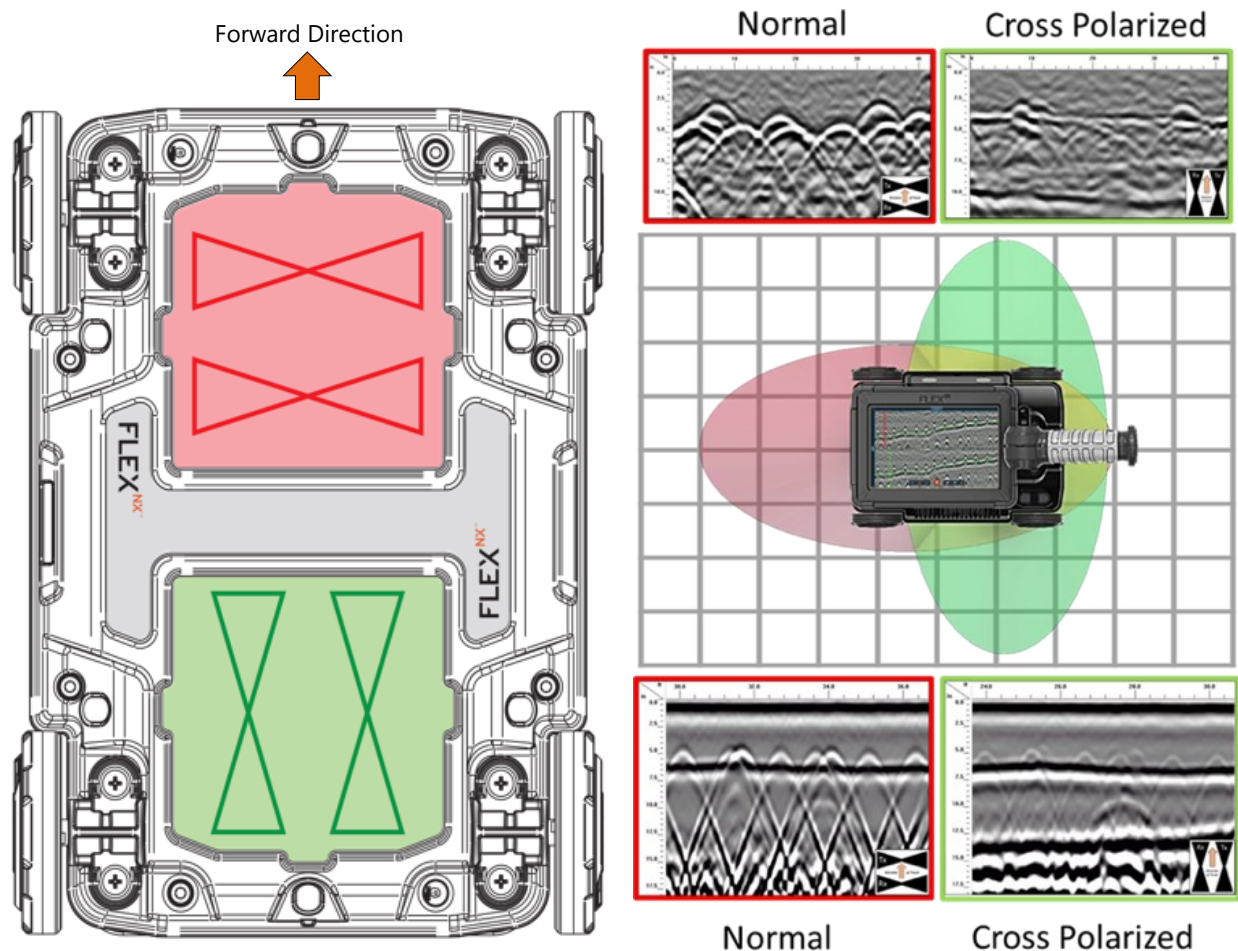
Please consult the following images and grip the satellite antennas according to our recommendation.



Using Two GPR Antennas: Standard and Cross-Polarized

Flex NX and Flex LT contain two separate antennas with their transmitter-receiver pairs in different orientations. The front antenna, with **red lasers** on Flex NX and **red markers** on Flex LT, is in the standard orientation for commercial GPR systems. The rear antenna, with **green lasers** on Flex NX and **green markers** on Flex LT, is cross-polarized. The side lasers mark the center of each antenna, as do the front and rear lasers.

When displaying both data channels in Stacked Mode the standard antenna (Channel 1) is the top profile and the cross-polarized antenna (Channel 2) is the bottom profile. You'll notice that the two channels do not align horizontally, nor do the two backup cursors, yet targets in both channels are aligned. Channel 2 is shifted to the right relative to Channel 1. The offset corrects for the physical distance between the antennas, as Channel 2 does not display data until it has passed the starting point of Channel 1.



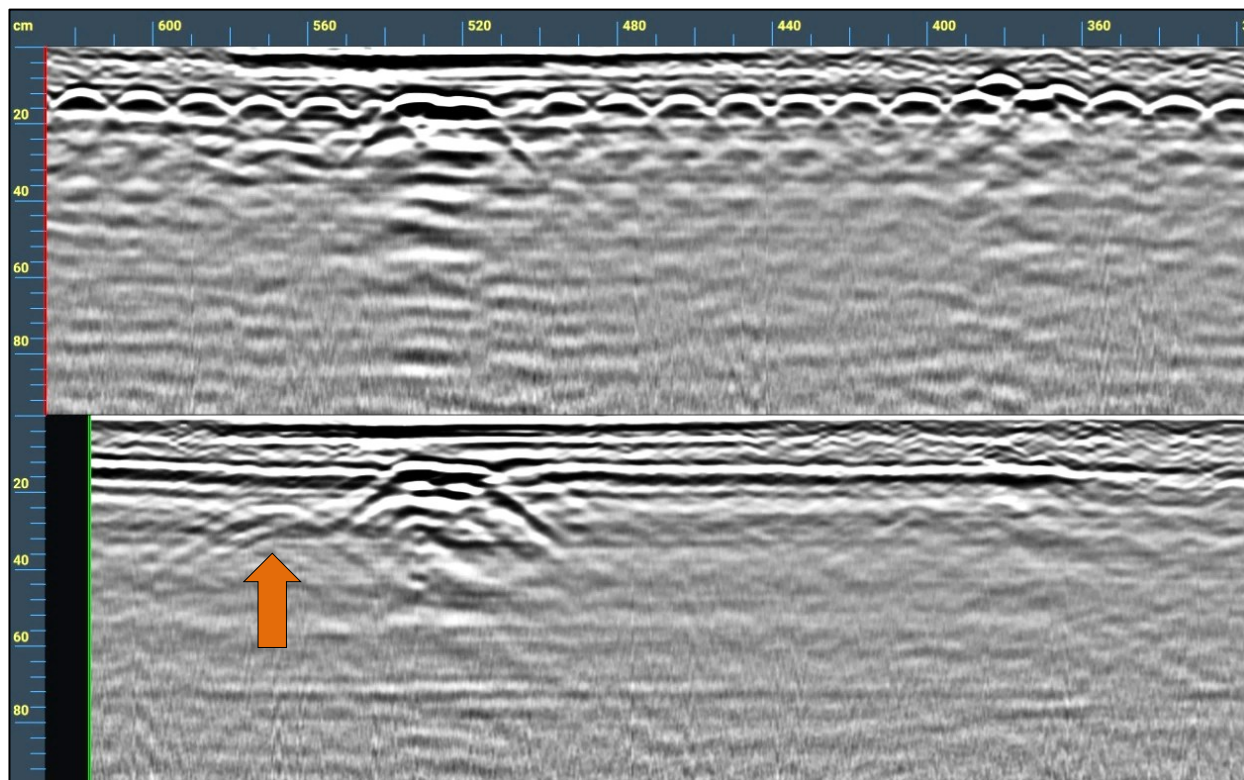
The two antennas are designed to work in tandem, providing an exceptional scanning experience employing one-pass cross-polarization. Both antennas have specific strengths. The standard antenna is aligned perpendicular to the path of travel, as is common for most commercial GPR systems. In this orientation it is optimized for imaging metallic targets that run perpendicular to the direction of travel. This means that rebar, metal conduit, and other metal targets will stand out, appearing as high amplitude (bright) hyperbolas with expansive tails.

The standard antenna orientation is the scanning workhorse, but some targets will be difficult to image due to the nature of concrete installations. This includes PVC and other synthetic materials that are 'overshadowed' by the amplitude of metallic targets. Additionally, the expansive hyperbolas from wire mesh, dense rebar, and other reinforcement often overlay and obscure deeper targets.

The cross-polarized antenna is not as sensitive to metallic targets, though they will still appear in the data. The main advantage is the reduction of amplitudes from metal targets and the muting, or sometimes altogether removal, of shallow and closely spaced hyperbolas and hyperbolic tails that obscure deeper targets. This leads to a more refined view of deeper slab elements, including conduits and the slab/grade contact where air voids may be present.

By utilizing data from both standard and cross-polarized antennas Flex NX and Flex LT can better discriminate between different types of objects or materials and improve overall data resolution and accuracy. GSSI recommends scanning with both antennas active so you can view a complete picture of the slab contents.

In the image below, the top profile (**standard orientation**) shows shallow wire mesh and a possible conduit bank. In the bottom profile (**cross-polarized**) the wire mesh is not visible, and the removal of hyperbolic tails reveals more details about the conduit bank and a previously obscured target to its left.



Nexus Elements

Introduction

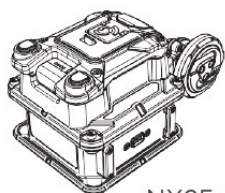
The Nexus Elements Interface is GSSI's newest operating mode. It is designed for rapid setup and deployment in support of mark-and-go scanning. This interface, along with the full-featured Nexus Interface, are both installed on NX25 and NX15 antennas. Nexus Elements is accessed through a Wi-Fi connection to a mobile device, such as a smartphone or tablet. The Nexus Interface requires pairing with Flex NX or Flex LT. For more information on the Nexus Interface, please refer to the relevant sections of this User Guide.

Nexus Elements Kits

Two Nexus Elements systems are available: 1) NX25 Small Area System; and 2) NX15 Deep Target System. The NX25 System is ideal for scanning coring and drilling locations, tight spaces, and overhead or elevated areas such as walls and ceilings. The NX15 System offers increased depth penetration and is perfect for thick concrete and targets in the subgrade below concrete slabs.

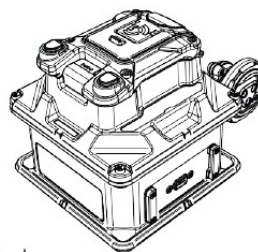
Nexus Elements kits include the following:

NX25 Small Area System



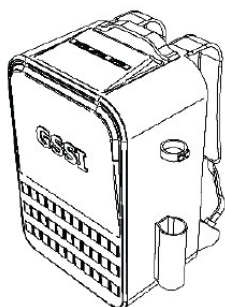
NX25 Antenna

NX15 Deep Target System

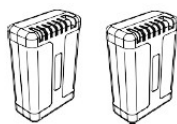


NX15 Antenna

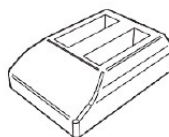
Accessories included with Small Area and Deep Target Systems



Nexus Elements
Rugged Backpack



NX25/NX15
Lithium-Ion Battery



2-Bay Charger



RAM Attachment



Wrist Strap



Quick Start Guide
MN73-380

Nexus Elements: NX25 and NX15 LED Status

The Nexus Elements Interface and the Nexus Interface each employ LED colors to indicate system status. **NX25 and NX15 will power on in the last mode used**, so an understanding of the LED status indicators is important. Please take a moment to familiarize yourself with the LED indicators for each interface.

Nexus Elements: NX25 and NX15 will display a flashing yellow LED when waiting to pair with a mobile device.

Nexus: NX25 and NX15 will display a flashing blue LED when waiting to pair with a Flex system.

Nexus Elements Interface (Wireless Connection)		Nexus Interface (Wireless and Wired Connections)	
LED Color	Status	LED Color	Status
 — 	Powering On/Off	 — 	Powering On/Off
 — 	Ready to Pair	 — 	Waiting to Pair
  	Connected	  	Paired
 — 	Collecting Data	 — 	Connecting
 — 	Updating	  	Connected to Flex System
 — 	Switching Modes	 — 	Collecting Data
		 — 	Updating
		 — 	Switching Modes

Switch from **Nexus** to **Nexus Elements** by allowing the antenna to power on, then wait 1 minute for the antenna to change modes.

Switch from **Nexus Elements** to **Nexus** by NFC pairing with Flex NX, or by using the Tether Module to connect to Flex NX or Flex LT.

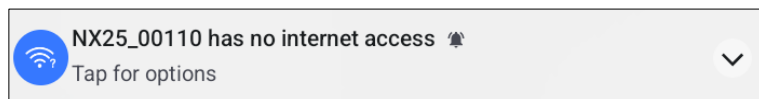
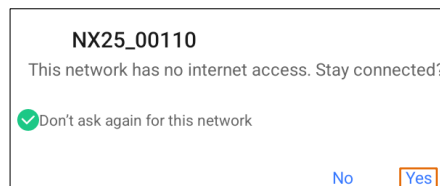
Nexus Elements: Connecting with a Mobile Device

Nexus Elements is compatible with modern Android and iOS smartphones and tablets that are Wi-Fi enabled and installed with up-to-date web browser versions. For Android devices we support the Chrome web browser, and for iOS devices we support the Safari browser. Other browsers may be compatible with Nexus Elements, but they are not supported by the GSSI software team and may experience performance issues. Before connecting to NX25 or NX15 we recommend updating Safari and Chrome to the latest version available for your device. Outdated browser versions may experience performance and compatibility issues.

Please follow these steps to connect a mobile device to Nexus Elements:

- 1) Power on NX25 or NX15 and wait for the flashing yellow LED. If the LED flashes blue, wait 1 minute for the antenna to switch to Nexus Elements and display a flashing yellow LED.
- 2) Open Wi-Fi settings on your phone or tablet. Tap on the wireless network name that matches your antenna's model number and serial number (e.g. NX25_00123; NX15_00456).
 - If prompted to enter a password, type in **geophysical**

- Android devices may display a notification when connecting to the antenna's Wi-Fi network, such as: "network has no internet access". The notification may or may not appear on the screen, so make sure to swipe down from the top left of the screen to view notifications. Tap the notification and then select "Don't ask again for this network" and tap "Yes" to stay connected.



- 3) Open the browser recommended for your operating system, then type **nx.local** into the address bar and tap enter.

When using Android and Chrome, you can make future connections faster. After connecting to nx.local you can tap the Chrome browser's three dot menu, select Add to Home Screen, and name the shortcut. We recommend naming the shortcut "Nexus Elements". The next time you use your antenna, simply connect to the antenna's Wi-Fi network and tap the "Nexus Elements" shortcut on your mobile device's home screen.

When using iOS and Safari, you can make future connections faster. After connecting to nx.local you can tap the Safari browser's three dot menu, select Add to Home Screen, and name the shortcut. We recommend naming the shortcut "Nexus Elements". The next time you use your antenna, simply connect to the antenna's Wi-Fi network and tap the "Nexus Elements" shortcut on your mobile device's home screen.

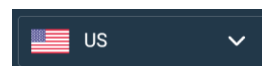
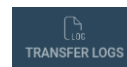
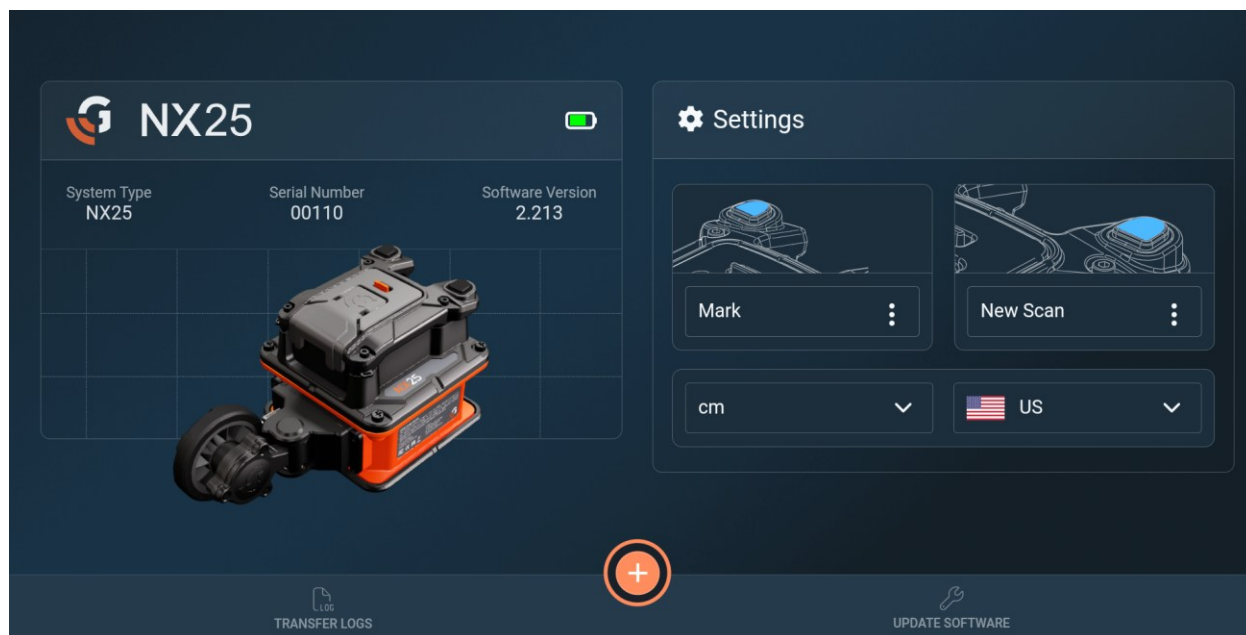
Nexus Elements: Main Dashboard

Nexus Elements will first display a startup screen featuring the GSSI logo, and will then quickly transition to the Main Dashboard. This is the control center for your antenna, where you can do the following:

- View the system type, system serial number, and software version
 - Flex systems should not be downgraded to older software versions. Before downloading a software update, compare your system's software version to the version listed on our website.
- Assign actions to the antenna's two integrated buttons
 - Tap the three dot icon to view a list of button actions. The actions assigned to buttons are only usable on the data viewing screen.
- Select measurement units and language preference
 - Measurement units are limited to inches and centimeters



- Choose from a list of languages, including English, Spanish, Japanese, Korean, Chinese, French, Italian, and German
- Download system logs and perform a software update
 - System logs can be downloaded and emailed to GSSI's Software Support Team if needed
 - The latest software updates are located on GSSI's Flex support page: <https://www.geophysical.com/support/flexnxsupport>.
- Tap the battery icon to display current battery charge
- Start a new scan using the Start New Scan icon



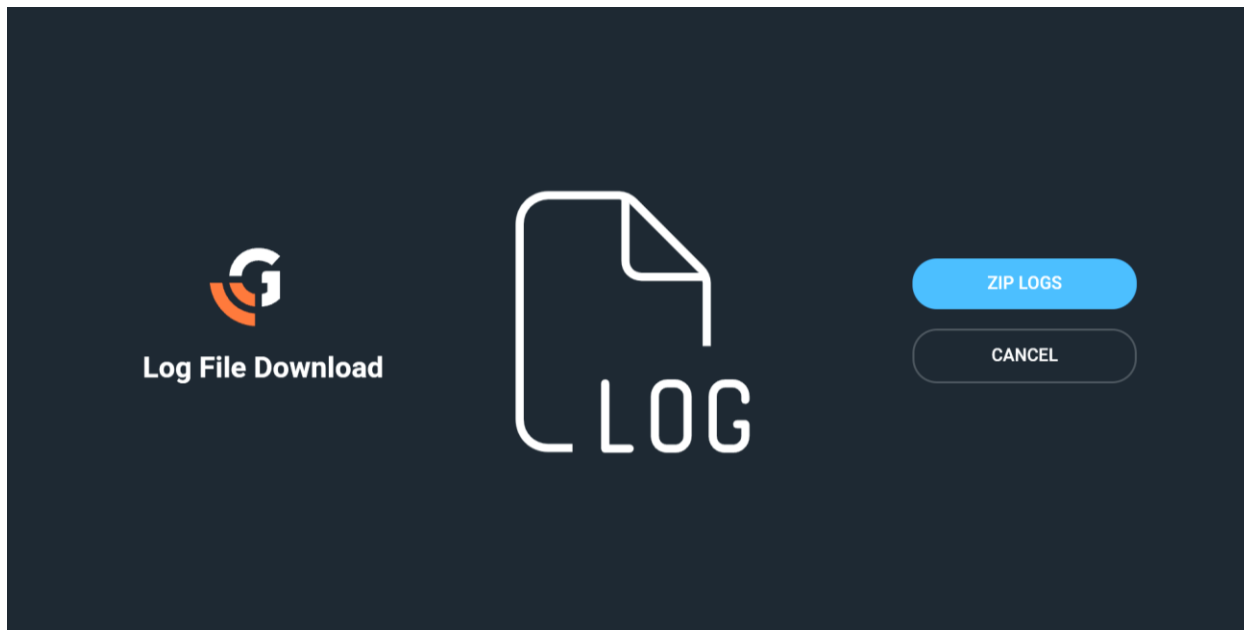
The Main Dashboard is viewable in portrait and landscape orientation. When using portrait orientation on mobile devices with smaller screens, such as smartphones, you may need to scroll down the page to see certain options.

Nexus Elements: Transferring Logs

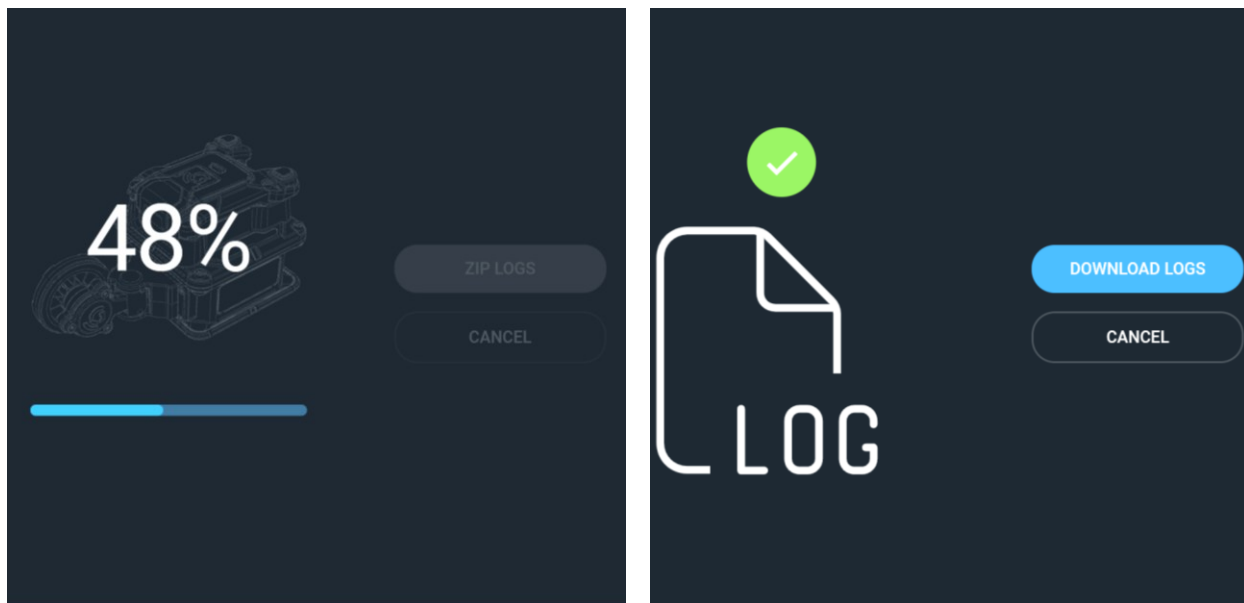
When contacting GSSI for technical support our team may ask you to download and email your antenna's system logs. These files contain vital records about system health, system behavior, and background information for errors or crashes. No personal information is stored in the system logs.

Tap the Transfer Logs icon to get started. On the Log File Download screen tap the Zip Logs button to prepare the logs for download. The system will create a download file that you can download to your mobile device, and will provide a percentage readout and a progress bar so you can monitor the process.

Tap **Download Logs** to save the logs to your mobile device. You may see a notification stating: "File can't be downloaded securely". If so, to continue downloading simply tap **Keep**. Your browser will save the logs to a Downloads folder unless you are prompted to choose a download location. This log file can be emailed to GSSI's Technical Support Team if needed.

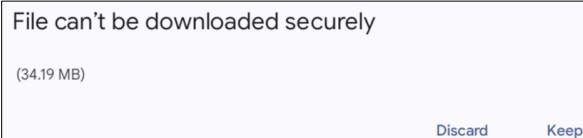


Tap Zip Logs to begin the download process.



The system will compress the logs into a .zip file. Tap Download Logs to save the file.

If you see this notification,
simply tap **Keep** to continue.



Nexus Elements: Updating Software

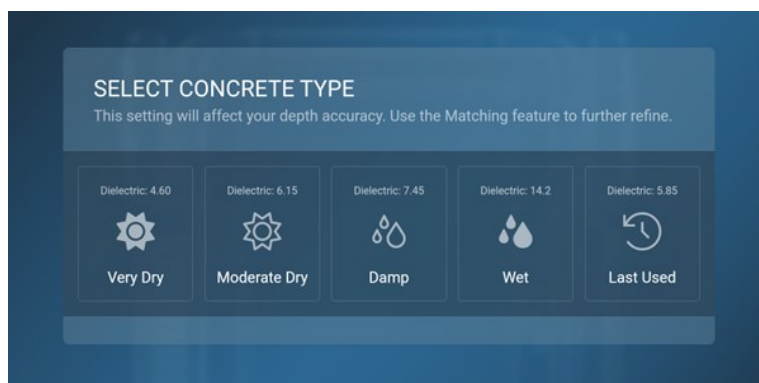
The Nexus Elements Interface is updated via mobile device. To get started, visit our Flex Support Page at <https://www.geophysical.com/support/flexnxsupport>. Navigate to the Software Updates area using your mobile device and find the current version of the Nexus Elements software update. Compare the published version with the version listed on your Main Dashboard, and download the update if it is a higher number than your version. We recommend immediately installing any new software updates to ensure you have the latest feature set. **NOTE:** it is not possible to downgrade your software version; please do not attempt to do so.

Tap **Update Software** on the Main Dashboard to get started. Tap the **Choose a File** button to browse your mobile device's storage and select the software update **.zip** file. Once an appropriate file is selected you can tap the blue **Next** button. The antenna's LED will be **flashing magenta**; please do not power down your antenna when you see this LED color. You'll then see a Transferring Install Package screen with a percentage readout and a progress bar. The next screen provides guidance on the remaining update process. Please follow the instructions carefully.

- 1) **Do not power down your antenna while the LED is flashing magenta**
- 2) Close the current web browser tab
- 3) Wait for the antenna to complete the update process and display a slow flashing yellow LED. The update process may require 5-10 minutes to complete; please be patient.
- 4) Connect to the antenna as you normally would. You may need to reconnect to the antenna's Wi-Fi network.

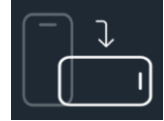
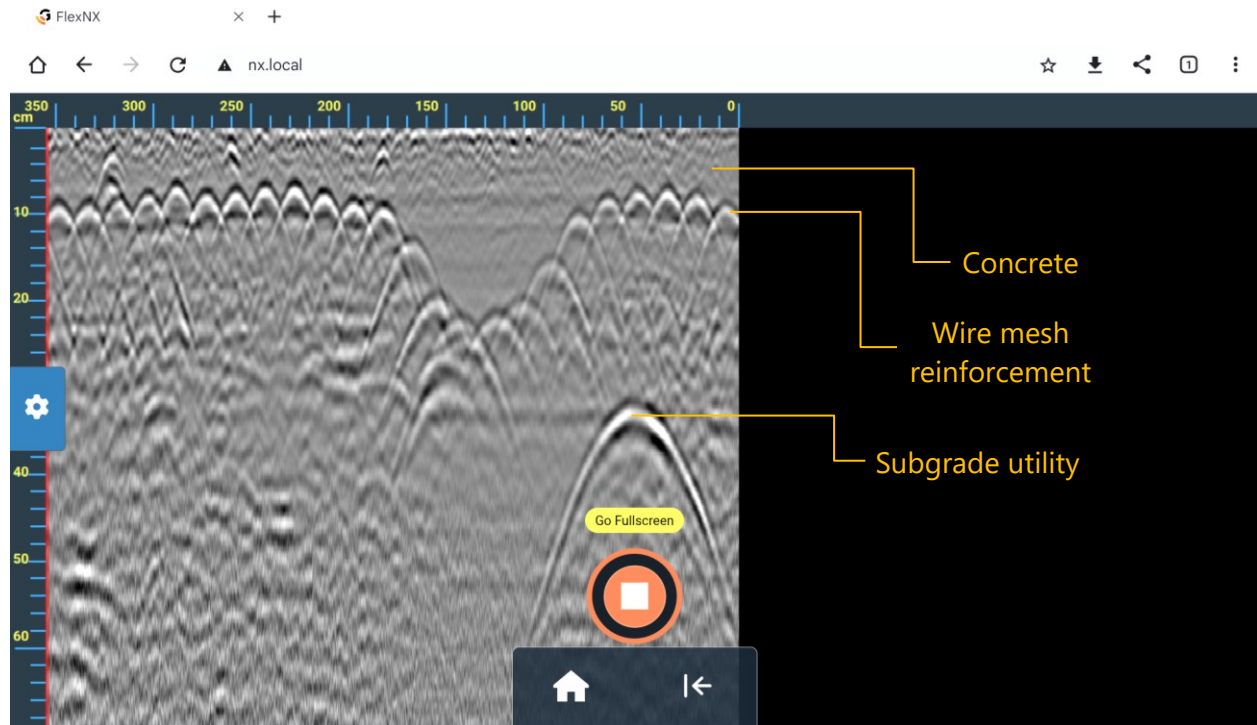
Nexus Elements: Data Viewing Screen

Tapping the Start New Scan icon will display the Select Concrete Type screen. Select a Concrete Type that best represents your working conditions. **Note:** this will affect your depth accuracy. This screen will only appear once during each scanning session.



Use your knowledge of the age of the slab to select from Very Dry, Moderately Dry, Damp, or Wet concrete types or select the last used dielectric value. By selecting a Concrete Type you are setting an estimated dielectric constant. If the slab's curing state is unknown, use the Concrete Cure screen for an initial benchmark and use the **Matching** feature (see Depth Panel sections) to refine the depth scale on the data viewing screen.

The system will then transition to an empty Data Viewing Screen. Your mobile device must be in landscape orientation to view scan data. If your device is in portrait orientation, you'll see a screen with a "change orientation" icon. We recommend using your device's rotation lock setting to lock the screen to landscape orientation.



Your system is ready to scan, so push the antenna forward and data will populate from left to right. A distance scale will be above the scan data and a depth scale is on the left side; the units for both scales are based on the measurement units selected from the Main Dashboard.

The Data Viewing Screen includes the following features:

Navigation Menus



Side Navigation Menu. Tap to access the Gain, Display and Depth panels. Tap the arrow icon to minimize the Side Navigation Menu.

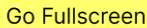
Data Viewing Screen Controls



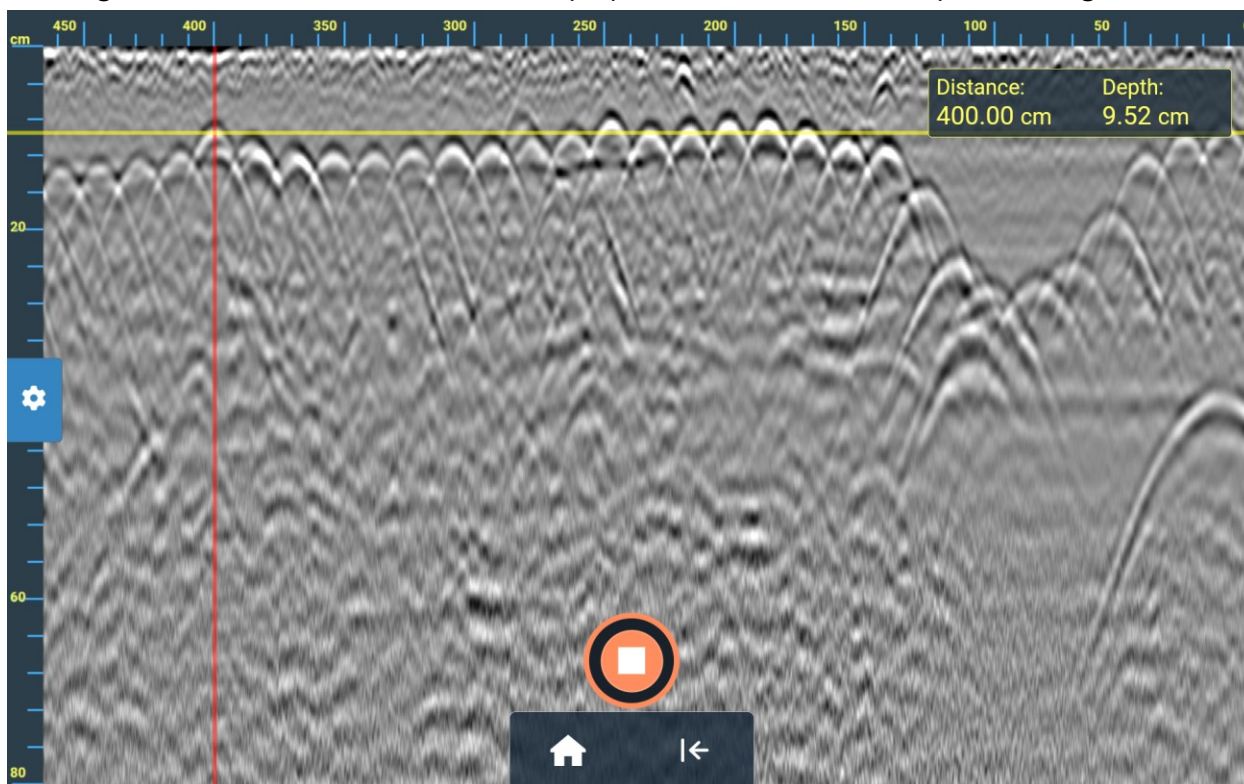
Start/Stop Scan. Tap to start collecting a new scan. Push your antenna forward to begin building a GPR profile. Tap again to stop file collection.



Home. Tap to return to the Main Dashboard.

	Reset Cursor. Move the backup cursor to the end of the scan. You can then resume collecting data without starting a new file or rolling the survey wheel.
	Go Fullscreen. Tap to force your web browser into fullscreen mode. This only appears once per session.
Gestural Controls	<p>Pinch Zoom and Pan. Zoom in on features by using two fingers. Return the screen to its original zoom level, or zoom in further, by moving your fingers together or apart. When zoomed, drag one finger to pan the display right, left, up, and down. Pan 2D profiles using one finger when the backup cursor is not displayed.</p> <p>Hide UI Controls. Swipe down on the Data Viewing Screen with two fingers to hide the UI controls. Repeat the process to show the UI controls.</p>

Move the antenna in reverse to see a vertical backup cursor that is aligned to the center of the antenna and the indentations on each side of the antenna's upper housing and skid plate. Use one finger to move a horizontal cursor and pinpoint the location and depth of a target.



Tap the Reset Cursor icon to move the cursor to the end of the scan. A dialog box displays the distance traveled at the backup cursor's location as well as the depth of the horizontal cursor. Note that the horizontal cursor's depth is only as accurate as the currently set dielectric.

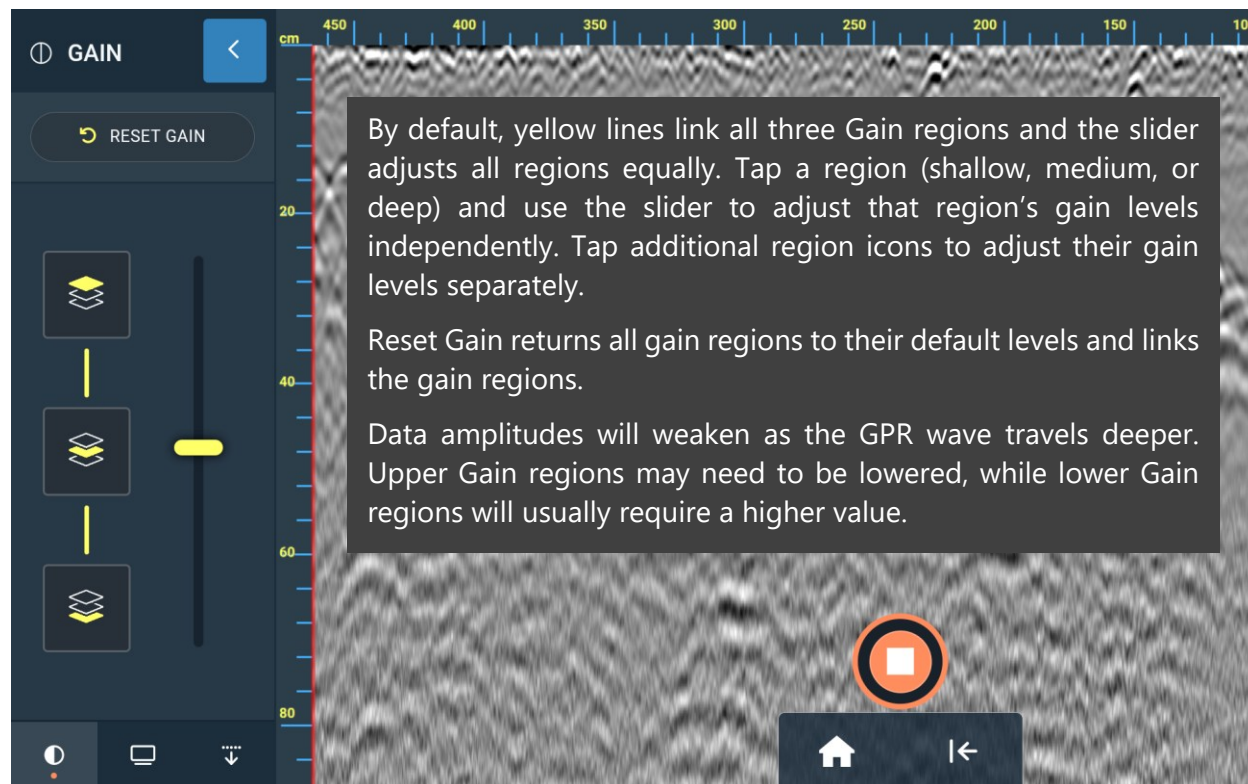
Nexus Elements: Side Navigation Panel

Activate the Side Navigation panel by tapping the gear icon on the left side of the Data Collection screen. This panel is accessible before, and during, data viewing. The Side Navigation panel contains the Gain, Display, and Depth panes. The icon for each pane is located at the bottom. Tap the arrow icon to hide the panel.

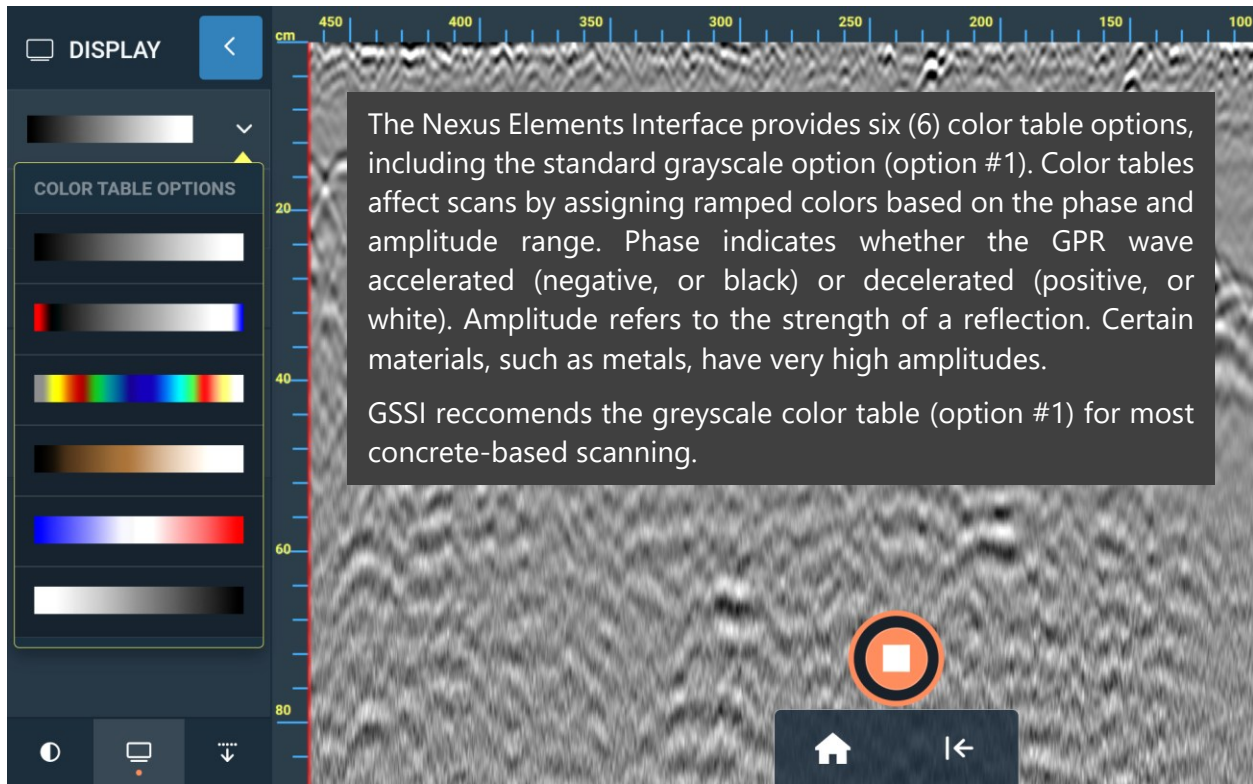


Nexus Elements: Gain Panel

Use the Gain Panel to adjust the visual contrast of your data.



Nexus Elements: Color Table Options

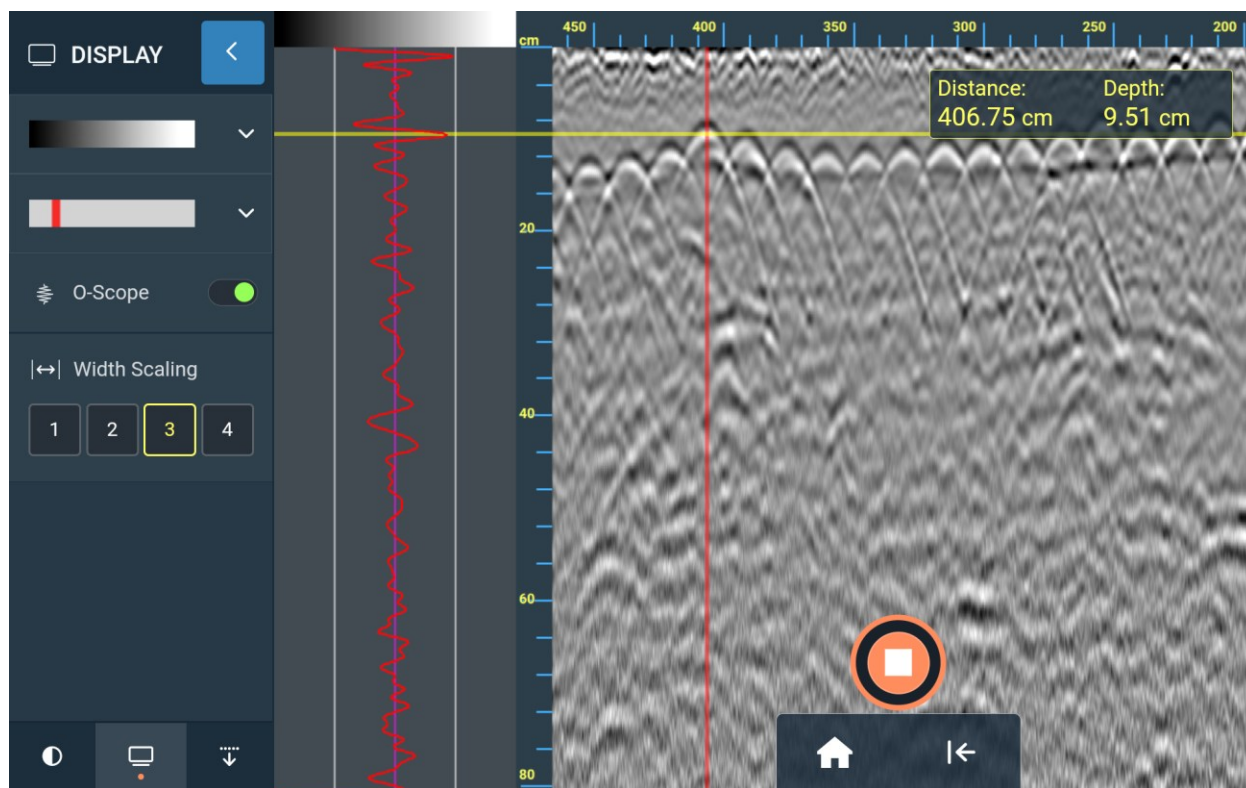


Nexus Elements: Oscilloscope

The Oscilloscope waveform, or O-Scope, can be toggled on and off. When on, it will be displayed on the left side of the profile. With experience, the O-Scope can be used for a more nuanced data analysis.

The O-Scope displays the individual GPR trace associated with the backup cursor's current location. The vertical axis mirrors the scan's depth scale, with increasing depth from top to bottom. The width of the O-Scope peaks represents amplitude. Stronger reflections, such as from metal, create larger O-Scope peaks on both sides of the centerline. Phase is represented by the peaks on either side of the centerline. Peaks to the right indicate normal phase, while peaks to the left indicate negative phase. GPR reflections always occur as a series of three peaks.

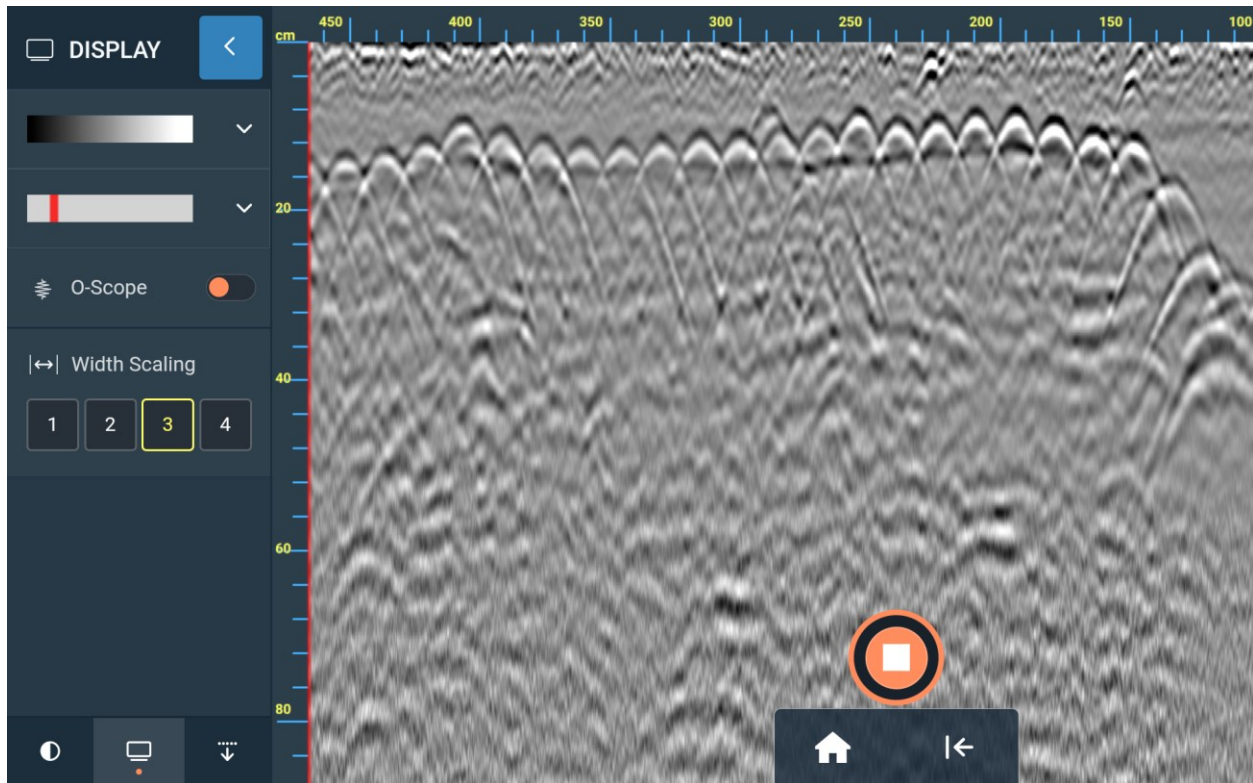
The O-scope is a visualization of the raw data collected by the antenna. With practice you will find that the O-Scope is essential for advanced analysis, such as estimating material type (like PVC vs. metal targets), as well as for accurately lining up the cursor for Matching and Set Depth. Lastly, the O-Scope can provide information on data quality, depth penetration, and the presence of external electromagnetic interference. Periodic external noise (such as cellular network communication) will make the O-Scope look 'jittery' and jagged, while continuous external noise (such as radio and television transmissions) can cause the O-Scope to shift off the centerline.



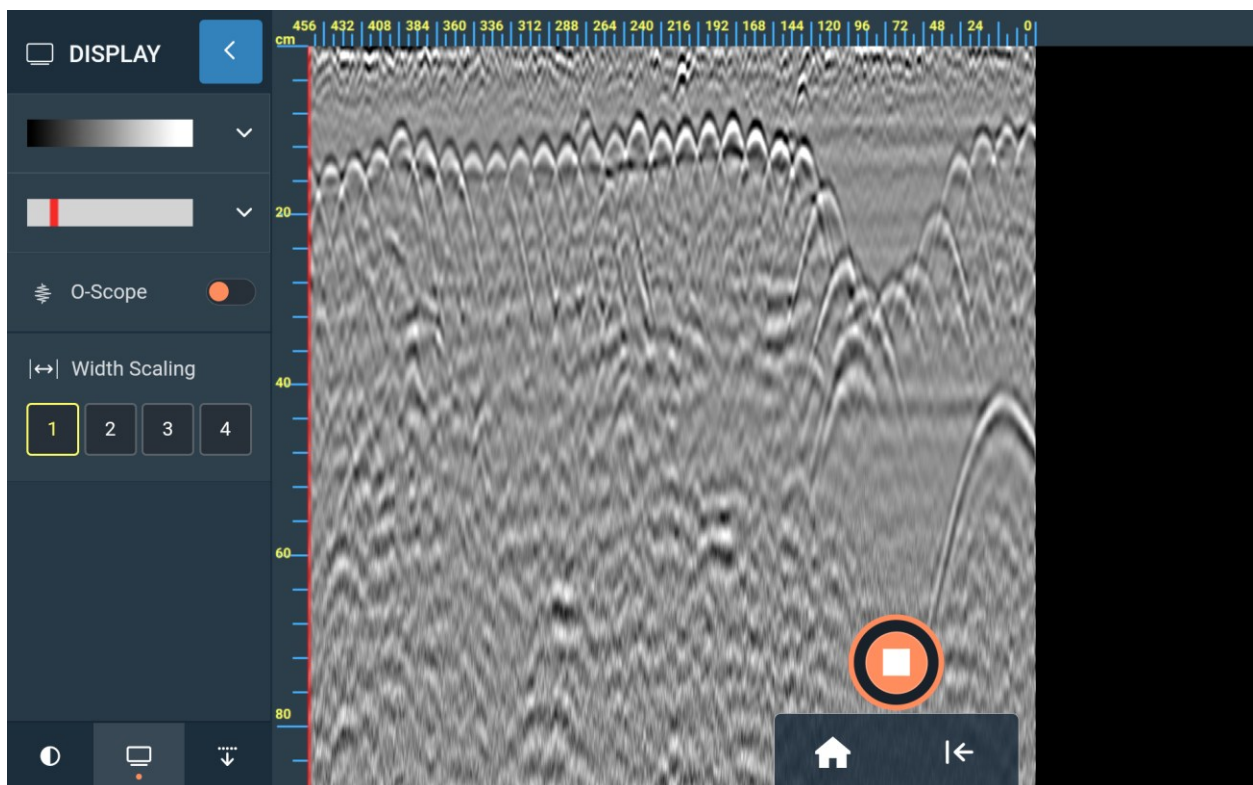
Nexus Elements: Width Scaling

Use the four Width Scaling options to compress or stretch 2D profiles. Option 4 represents the default horizontal scaling for NX25 and NX15 data, displaying a scan density of 4 scans/cm. Options 3, 2, and 1 compress the horizontal scale in increasing amounts. Width Scaling can be adjusted during data collection, and the last used scaling value will persist through reboot.

Width Scaling is a helpful data collection and interpretation tool. By compressing the horizontal scale you can observe subtle changes in layers that are more difficult to detect when stretched out, or compress longer profiles so you can view longer sections without panning. In contrast, stretching profiles can help to separate closely spaced targets and provide more visual detail. Alternatively, use the four Width Scaling options to fine-tune your preferred hyperbolic target width. Width Scaling option 3 is the most commonly used scaling factor.



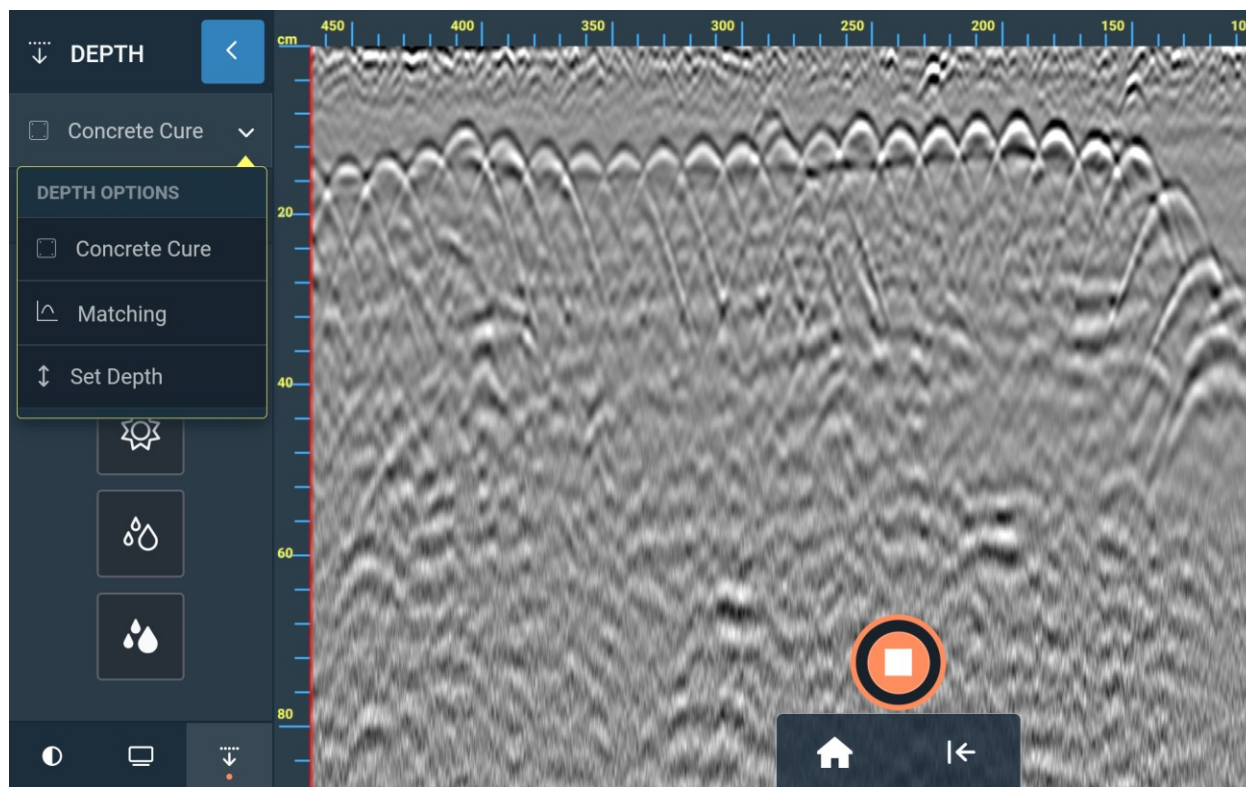
Width Scaling option 3 is the most commonly used scaling factor.



Width Scaling option 1 provides maximum compression.

Nexus Elements: Depth Panel

The Depth Panel provides three options for adjusting the dielectric constant and thereby refining your depth readings. From least accurate to most accurate, the choices are Concrete Cure, Matching, and Set Depth.



Concrete Cure applies a predefined dielectric based on established values. This can be an accurate method, but it relies on knowledge of the state of concrete curing.

Matching involves fitting a digital hyperbola to a target in your data. This is an accurate and widely used method for calibrating the depth scale.

Set Depth is the most accurate method, but it requires a physical measurement of the depth of a target. This information is not always available, so Matching will likely be a more appropriate choice.

Nexus Elements: Concrete Cure

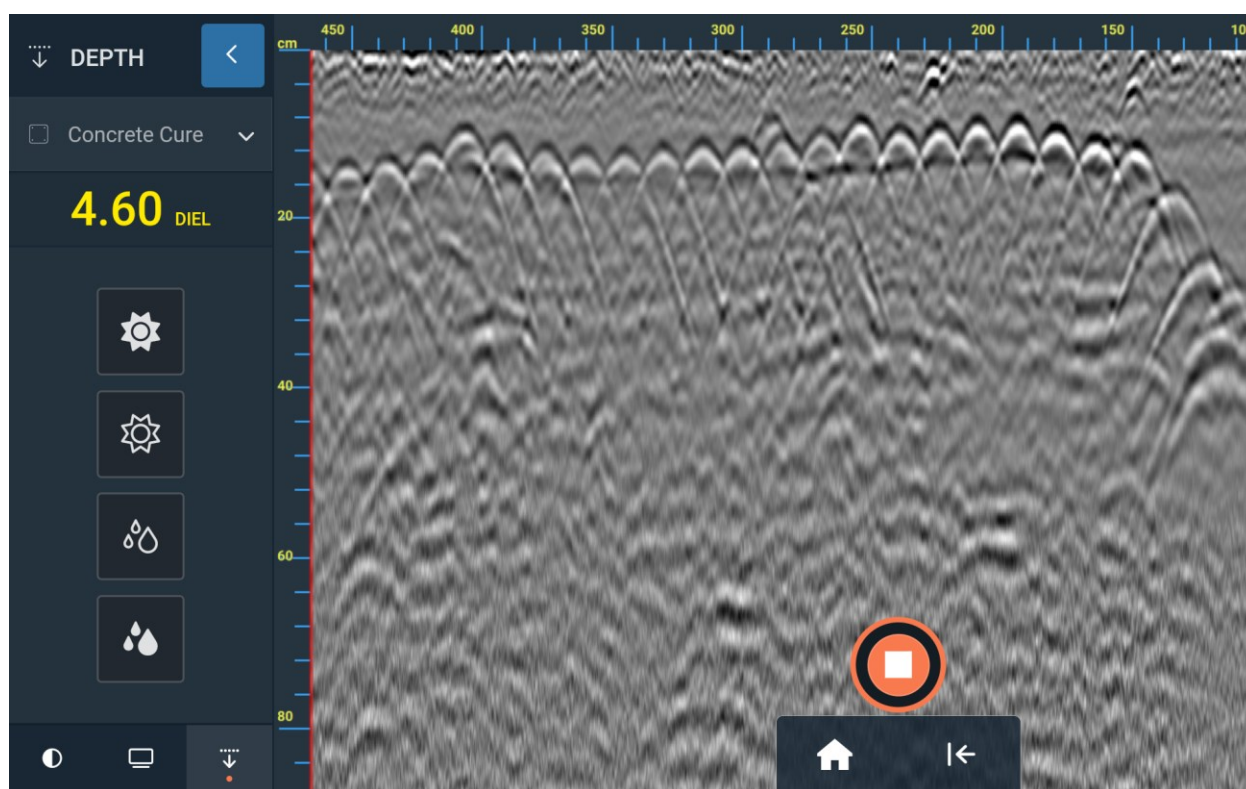
Concrete Cure is the simplest, yet least accurate method for calibrating the depth scale. Once per session you will be prompted to select Concrete Cure when starting a new 2D scan from the Main Dashboard or Project Profile screens. Use your knowledge of the age and condition of the concrete to inform your decision. Select a Concrete Cure by using preset dielectric values based on four standard concrete curing stages: Very Dry (4.6), Moderately Dry (6.15), Damp (7.45), and

Wet (14.2). Alternatively, select Last Used to import the most recently used dielectric from another scan or previous session.

Using one of the preset Concrete Cure types will only adjust your depth scale; it will not affect the GPR data quality.



We recommend starting with Moderately Dry (6.15 dielectric) for most concrete types. However, not all concrete slabs are the same. Consider using the Matching tool (Page 36) if you cannot readily determine the concrete curing state. Once an accurate dielectric is established, the targets will be displayed with a more accurate depth. We recommend using the Depth Panel options any time you are scanning a new slab.



As the dielectric value is increased the calculated depth of targets becomes progressively shallower. This effect is due to the slowing of the GPR wave in materials with a higher dielectric. For example, using a dielectric of 4.6 (Very Dry) a target is observed at 35 cm deep. Changing the dielectric to 6.15 (Moderate Dry) changes the target's depth to 30 cm. Dielectric values of 7.45 (Damp) and 14.2 (Wet) reduce the target's calibrated depth to 27.5 cm and 20 cm, respectively.

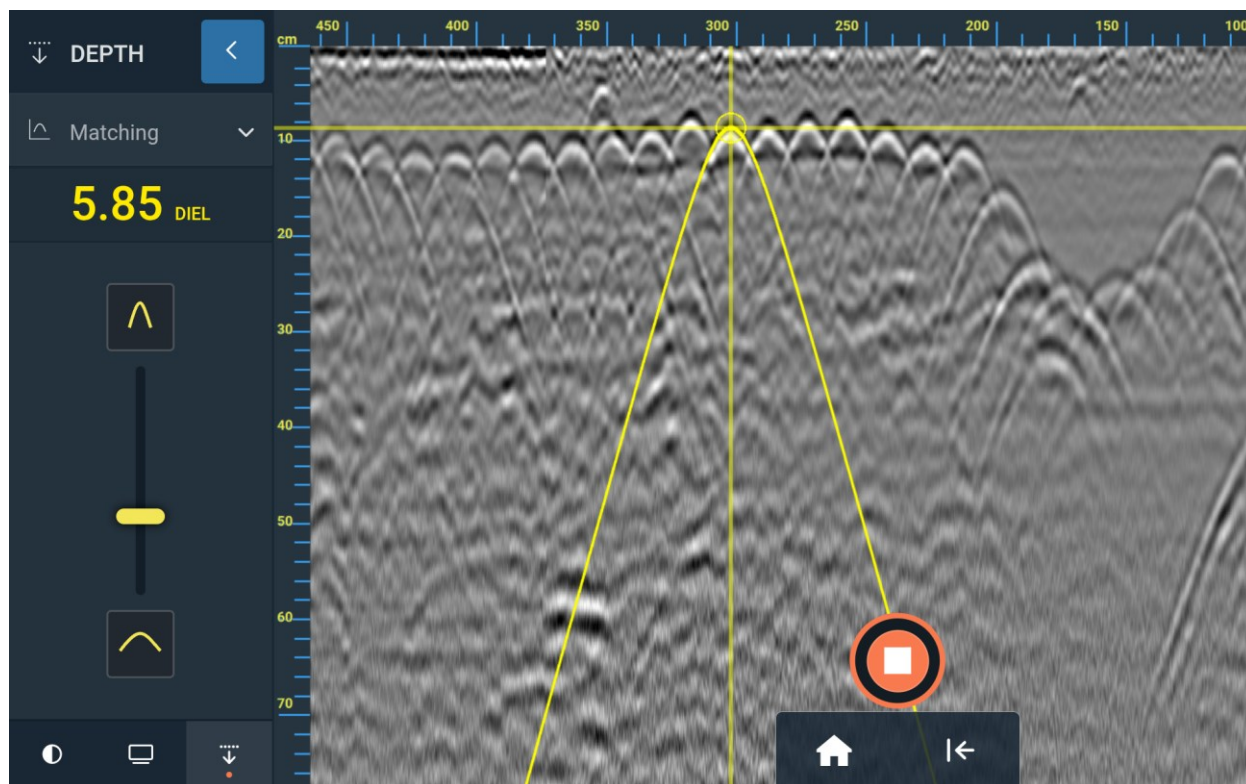
The takeaway point is that the dielectric value can dramatically change the depth reading for a given target. The target itself is not changing its true depth, but the system is using the available information to calibrate the depth scale. A more refined dielectric value will greatly improve the overall depth accuracy, leading to improved markouts and increased safety for cutting, coring, and drilling teams. Selecting a Concrete Cure Type is a good first step, but it should always be followed by Matching and Set Depth (when possible).



GPR effectiveness improves as concrete continues to cure. GPR depth and data quality are reduced when scanning green (uncured) concrete due to enhanced electrical conductivity.

Nexus Elements: Matching (Hyperbola Fitting)

Improve the depth accuracy of targets by using the Matching tool. During collection, locate a hyperbola in your profile. It must represent a target scanned perpendicular to its length. If you are unsure whether you are scanning perpendicular to the object, scan it at multiple angles and find the scan angle that produces the narrowest hyperbola.



Alternatively, locate a target and mark it on the slab. Collect an adjacent scan and mark the target again, then draw a line between the marks. Use this method to accurately determine a target's orientation.

To use the Matching tool, select it from the dropdown menu. Next, use one finger to position the crosshairs and the digital hyperbola overlay at the peak of the first brightest band of color. Use the O-Scope to assist with placement.

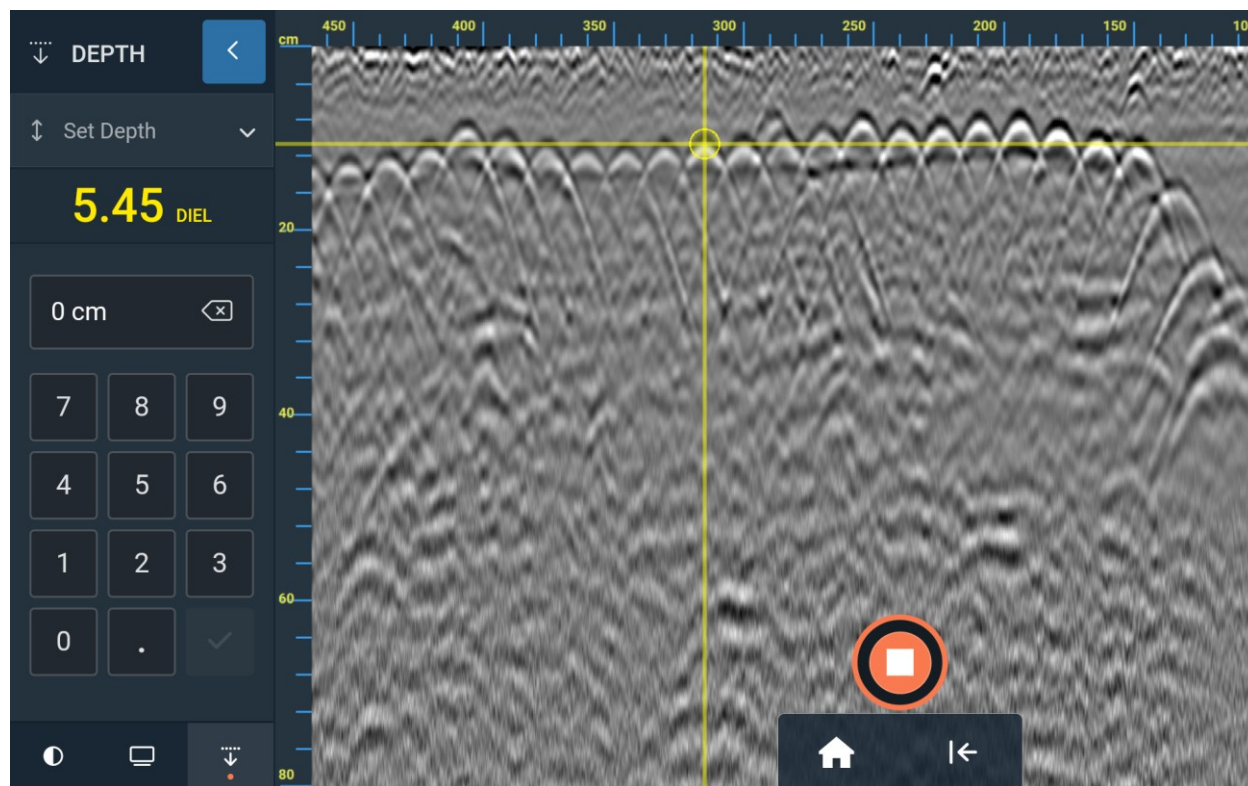
Use the vertical slider to narrow or widen the hyperbola overlay. As you reshape the hyperbola the dielectric value and depth scale will update in response. Match the shape of the hyperbola overlay to the tails of the target hyperbola. Target depths will now be more accurate, and the Last Used Concrete Cure will be updated to the new dielectric value.



Use the Matching tool on multiple hyperbolas to check your accuracy. If your results are inconsistent, you have likely crossed targets at an incorrect angle. In other cases, using Matching on a shallow target with a large diameter could skew the depth scale.

Nexus Elements: Set Depth

For homogenous materials, like most concrete, you can greatly improve depth accuracy by using the Set Depth tool. In some situations, the true depth of a target can be determined through drilling or observation of slab edges.



To use this feature, scan over a target with an established depth. Collect enough data on either side of the target to fully image the resulting hyperbola. Use your finger to tap the screen, then drag the crosshair to the top center of the hyperbola. Align the cursor with the first strongest band of color; this band corresponds with the top of the target. Use the O-Scope to assist with cursor placement. Using the number pad, type in the known depth of the target. This process will update the dielectric and calibrate the depth scale. Target depths will now be more accurate, especially in homogenous concrete.



The Set Depth tool is only applicable to a target of a known depth; it will not be useful in all cases. Avoid entering a depth based on assumptions or guesses. When in doubt, use the Matching tool instead of Set Depth.

Flex Systems: User Interface

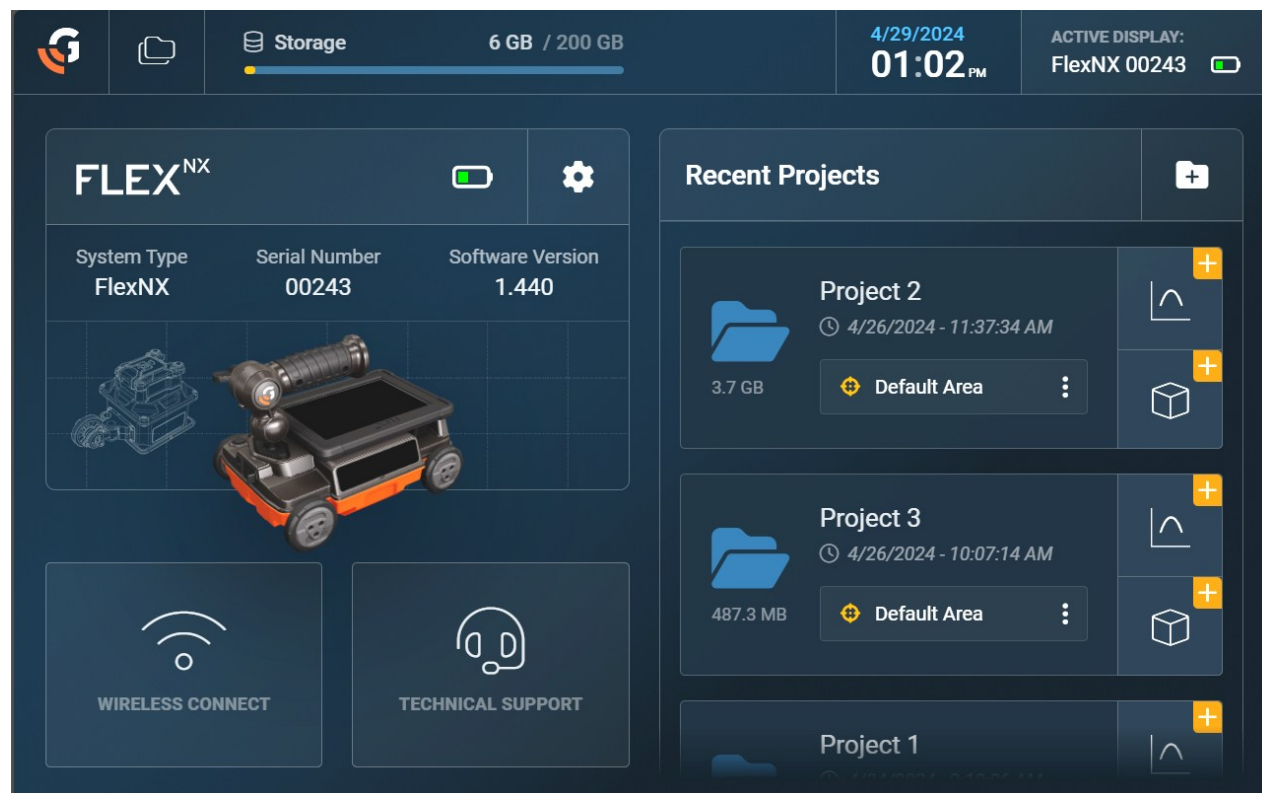
This section will familiarize new users with the Flex NX and Flex LT user interface. By the end of this section you will be able to navigate through the system, create and manage projects, and be ready to collect data.

Main Dashboard

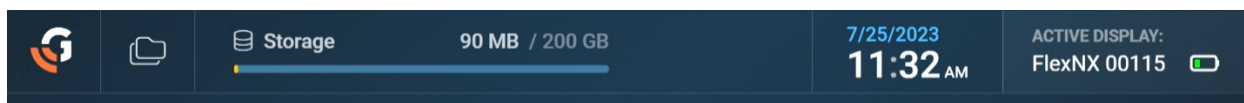
The Main Dashboard is the control center for Flex NX and Flex LT. From here, you can:

- Start a new 2D Scan or Flex Mode scan (**Flex NX only**)
- Access Projects
- Access System Settings
- Wirelessly connect to your personal device (**Flex NX only**)
- Access Technical Support
- Connect and configure NX accessory antennas

The Main Dashboard is separated into three panes: Top Navigation, System and Support, and Recent Projects. Keep reading for a detailed description of these panes and their features.



The Dashboard Top Navigation menu provides access to the Projects Portal, system storage information, date and time, and the currently active device. See below for a more detailed functionality overview.



Main Dashboard: Top Navigation Menu

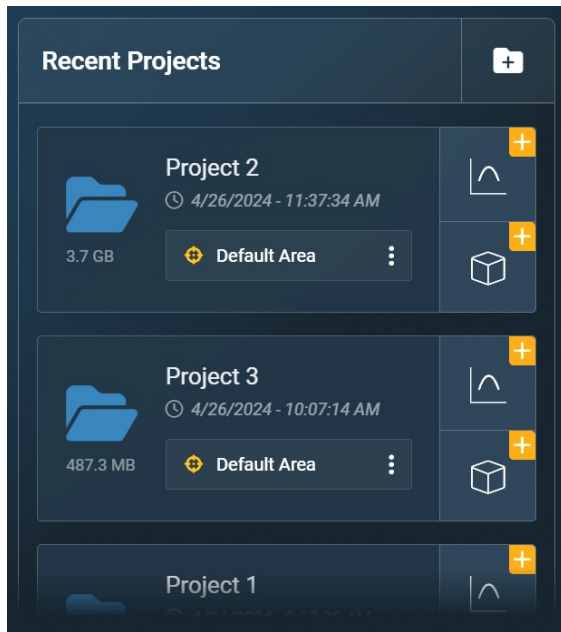
	Return to Main Dashboard. Tap this icon to return to the Main Dashboard. This icon is also available on the Data Collection, Projects Portal, and Project Profile screens.
	Projects Portal Icon. Tap the Projects Portal icon to access all project folders on your Flex NX or Flex LT. Click an individual project folder to access its Project Profile and view associated Results and Data.
	Current (orange) and Total (blue) Storage Bar. Displays the currently used and free storage space. Delete existing project folders to free up additional storage space but remember to download Results and Data from your Projects before deleting them.
313 MB / 200 GB	Current / Total Storage. Flex NX has a total storage capacity of 200 GB. Flex LT has a total storage capacity of 50 GB.
	Battery Life Indicator. Displays the charge state of the currently active device. This will usually refer to the Flex NX or Flex LT battery, though it will show satellite antenna battery status if it is the active device.
5/31/23 10:45 AM	System Date and Time. Set the current date and time for an accurate timestamp. The time and date will determine file naming.
ACTIVE DISPLAY: FLEX NX	Name of Active Device. If an NX accessory antenna is connected and activated, that antenna will be displayed as the active device. Switch between Flex NX or Flex LT and satellite antennas using the carousel on the Main Dashboard's System and Support pane.
	Battery Status for Active Device. This icon displays the battery status for the currently active device. Activating a satellite antenna, such as NX25 or NX15, will display its battery status.

The Main Dashboard System and Support pane features the device carousel, device serial number, current software version, and the System Settings icon. It also includes the Wireless Connect (**Flex NX only**) and Technical Support icons. See below for a detailed description of functionality.



Main Dashboard: System and Support Pane

	Battery Life Indicator. A fully charged Flex NX or Flex LT battery can provide up to 3.5 hours of use. Satellite antenna batteries deliver up to 6 hours of use. Tap to view a popup displaying precise battery life percentage.
	System Settings. Tap this icon to access the System Settings and Health Settings screens.
	Technical Support Portal. Tap this icon to display GSSI's Technical Support phone number and business hours, as well as a QR code linked to helpful resources.
	Wireless Connect (Flex NX only). Tap this icon to wirelessly connect a personal device, then mirror your collection screen using a web browser. Proceeding screens will walk you through the connection and display process.
	Carousel Menu. The currently active device is in the foreground and displayed in full color; connected but not active devices are shown in the background as a wireframe. Tap the wireframe image to make it the active device. Tap a device image or the System Settings icon to view System Settings or Health Settings information.
	Software Version. Displays the currently installed software version. Tap this icon to quickly proceed to the Software Update screen.



The Recent Projects pane displays a list of your most recently accessed project folders. When first used, your Flex NX or Flex LT will only have a Default Project folder. As you add more projects they will appear in this pane, ordered by most recent use. If many projects are listed, view previous projects by scrolling through the list or by accessing the Projects Portal.

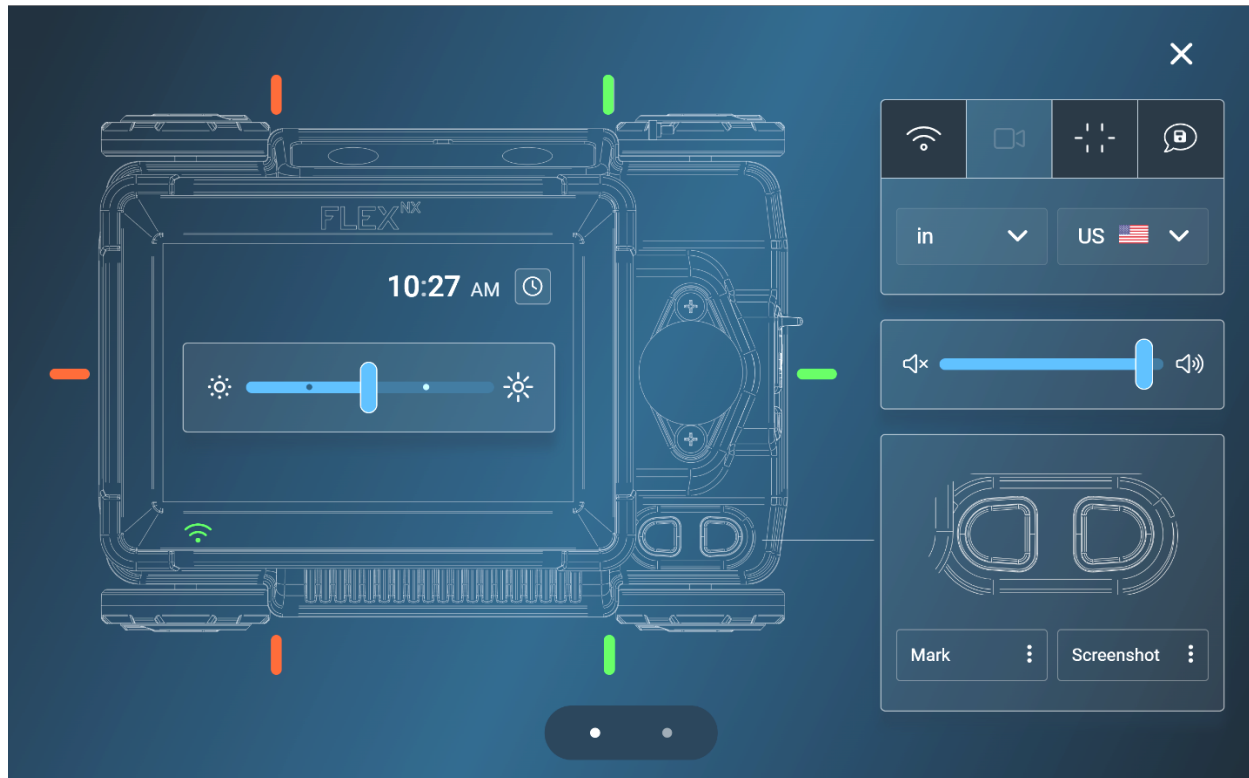
The main function of the Recent Projects pane is to quickly select a working folder and begin scanning. There are other useful features here, and they are outlined below.

Main Dashboard: Recent Projects Pane

	Create New Project. Tap this icon to create a new project. You can then save data and results to different Areas of Interest within the project.
	Start New 2D Scan. Tap this icon to start a 2D scan in the selected Project, and within the currently active Area of Interest.
	Start New Flex Mode Scan (Flex NX only). Tap this icon to start a Flex Mode scan in the selected Project, and within the currently active Area of Interest.
	Current Area of Interest/Switch Area of Interest. Change Areas of Interest to save data and results to a specific location within your work site or project.
	Project folder. Tap to access, view, and manage saved Results and Data. The total project size is also displayed.
	Project Name. This icon displays the Project Name and the last date and time the project was updated.

System Settings

Tap the gear icon on the Main Dashboard to navigate to the System Settings screen. Use System Settings to customize your Flex NX, Flex LT, or NX satellite antenna preferences. This portal is the command center for enabling or disabling Wi-Fi (**Flex NX only**), lasers (**Flex NX only**), and the Save Prompt. You can also modify system time and date, change the measurement units and language settings, adjust system volume and screen brightness, and assign quick actions to programmable buttons.



System Settings Controls

10:27 AM



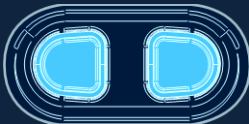
Date/Time. Tap the clock icon to set the current date and time of day. This will directly affect scan data file numbering.



Screen Brightness. Adjust screen brightness to reduce battery consumption or to improve screen visibility.

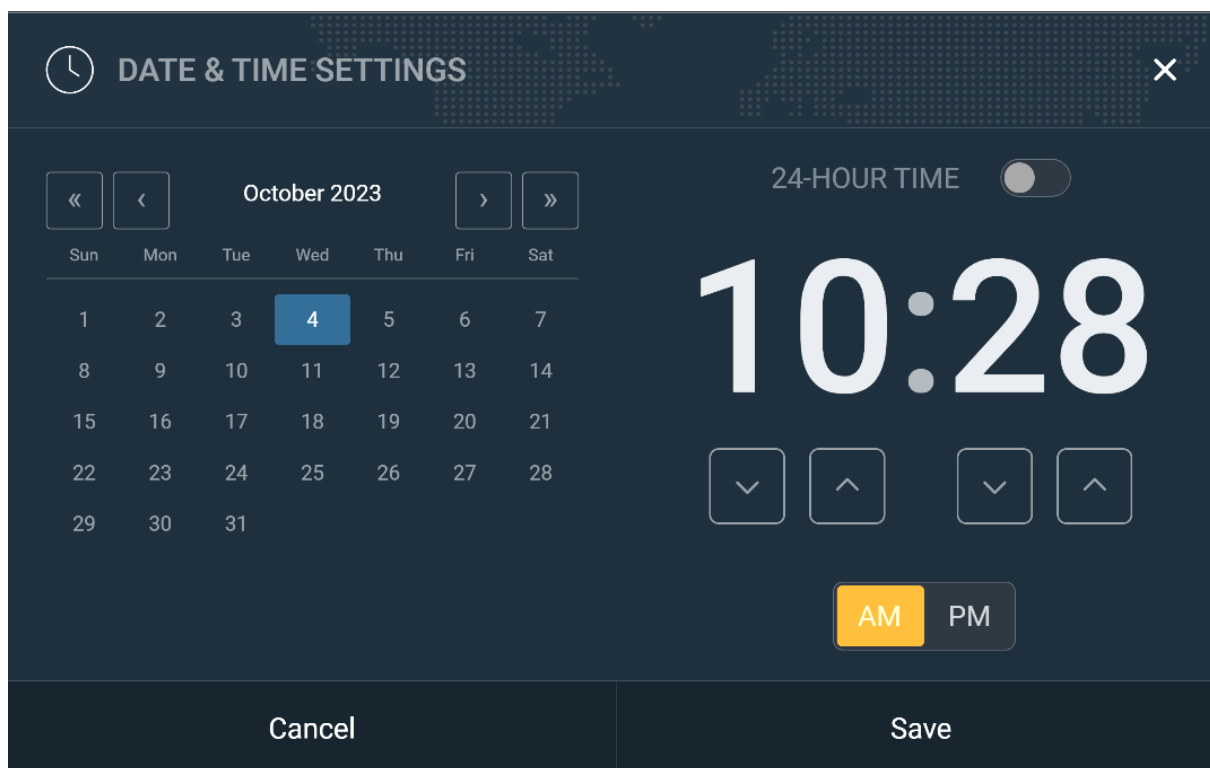


System Settings (Flex NX Only). Customize settings to toggle Wi-Fi connections, the Flex Vision Positioning System, side and front lasers, and the Save Prompt. The Flex NX graphic highlights enabled hardware features.

	<p>Units of Measurement/Language. Adjust units of measurement (cm, in) and select the display language (English, Spanish, Japanese, Korean, Chinese, and French, Italian, and German).</p>
	<p>Volume Adjustment. Adjust the volume to increase, decrease, or silence the system's audio cues.</p>
	<p>Button Functions. Flex NX, Flex LT, and NX accessory antennas each have two user programmable buttons. Available functions include Mark, Start New Scan, Delete and Screen Grab. Functions can be set to either button.</p>
	<p>System Settings/System Health Toggle. Located at the base of the System Settings and System Health screens. Switch between System Settings (left dot) and System Health (right dot) for Flex NX and Flex LT. NX satellite antennas do not have System Health settings.</p>

Date and Time Settings

Tap the clock on the Main Dashboard or in System Settings to update the Time and Date using the provided calendar and digital clock display. Flex NX and Flex LT incorporate the day/month/year into file naming, and thus an accurate date will lead to easier file management and record keeping.

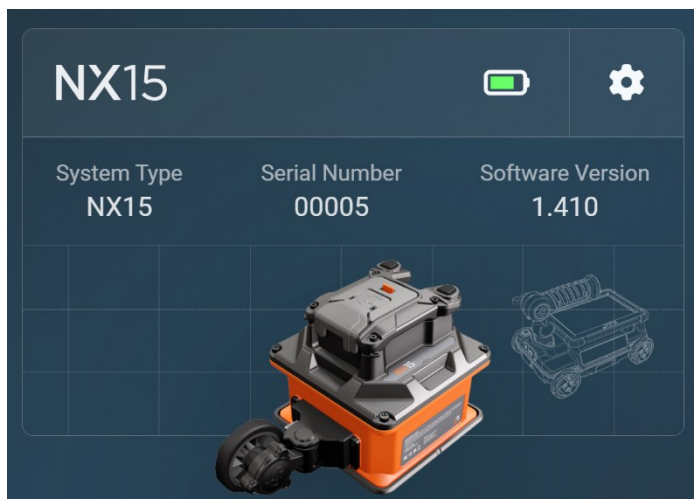


NX25 and NX15 System Settings: Nexus Interface

Connecting a satellite antenna to Flex NX or Flex LT via the Nexus Interface provides access to the satellite antenna's System Settings.

On the Main Dashboard carousel the currently active device will be in the foreground. Tap the wireframe in the background to activate another connected device, such as NX25 or NX15.

Tap the satellite antenna icon to advance to the System Settings screen or tap the gear icon next to the battery indicator.



Use the System Settings screen to customize the programmable buttons.

The available options include Mark, Start New Scan, Delete and Screen Grab. Additional functions may be added with future software updates.

Tap Disconnect NX25 or Disconnect NX15 to end the pairing session. Tap Software Update NX25 or Software Update NX15 to update the software; this procedure requires updating Flex NX first. For more details, see the Updating Software section below.



Health Settings

The Health Settings portal is the second screen in Flex NX and Flex LT System Settings. Access Health Settings by tapping the second dot at the base of the screen. This portal includes icons for updating software and downloading system log files. Log files are intended for GSSI technical support use and can be downloaded to a USB drive and emailed to the GSSI team when requested.

Health Settings: Software Update

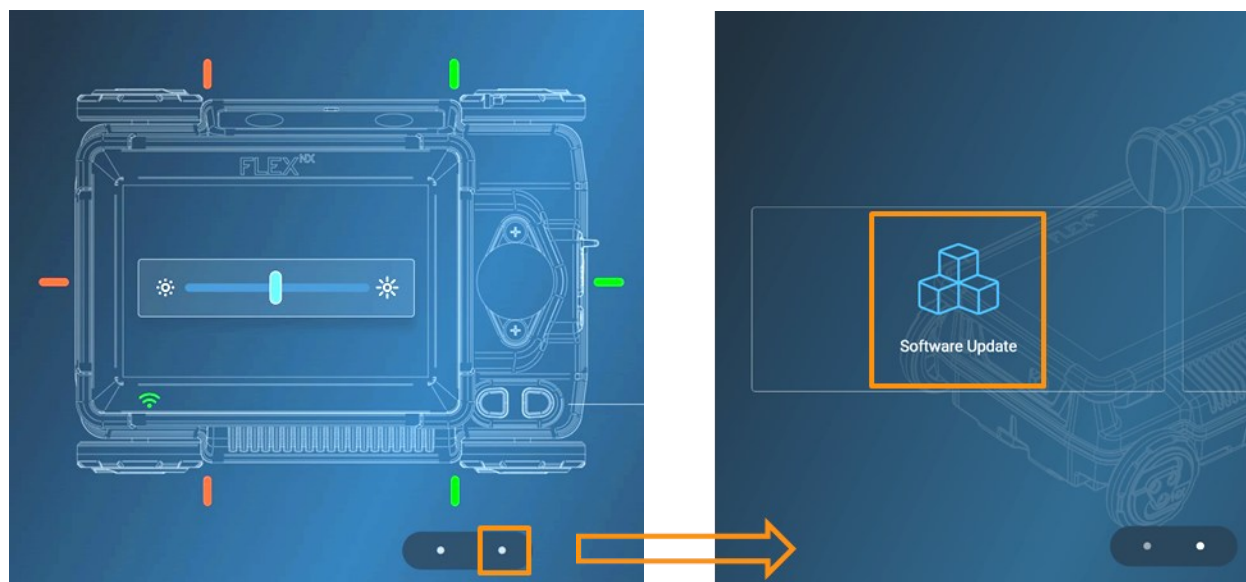
We will periodically release software updates for Flex NX, Flex LT, and NX satellite antennas. Updates will typically fix bugs and other software issues and implement new features. GSSI recommends regular visits to the Flex NX support page ([Flex NX Support Page](#)) to check for new software releases. You can also scan the QR code on the Flex NX, Flex LT, or Nexus Elements Quick

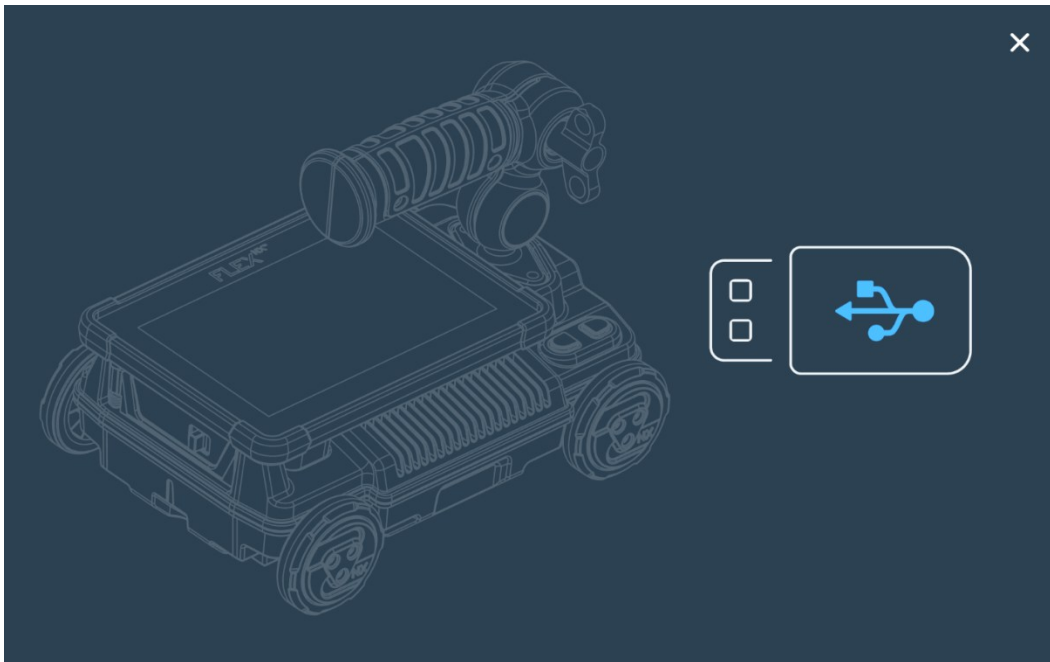
Start Guide's cover or use the QR code provided by the Flex NX or Flex LT Software Update function.

To update Flex NX, Flex LT, and NX accessory antennas via the Nexus Interface, visit the [Flex NX Support Page](#) with your computer and download the latest update (.ZIP file) to a USB drive. Consult the following procedure to initiate and complete the update process. **Note:** do not extract the .ZIP file; simply copy and paste it onto the root directory of the USB drive.

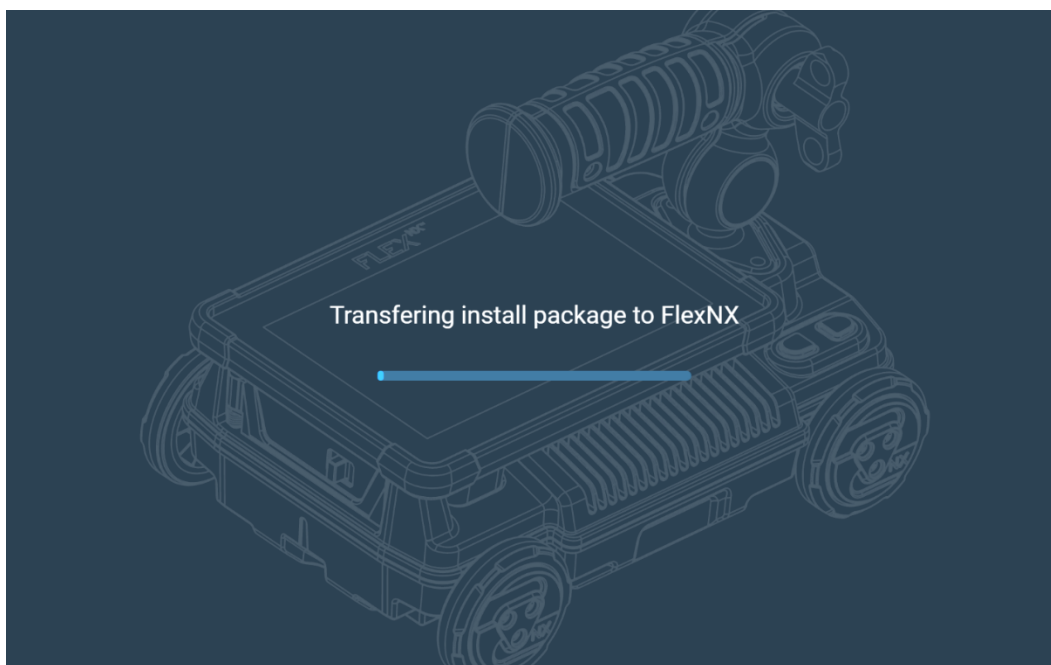
Health Settings: Updating Flex NX and Flex LT

- 1** Power on Flex NX or Flex LT and make sure the battery is near full charge. The system will not begin the update process if the battery is lower than 50% charged.
- 2** Insert the USB drive containing the installation package.
- 3** On Flex NX or Flex LT, navigate to the System Settings panel and then to the System Health screen. Tap Software Update to continue. Alternatively, to quickly access the Software Update screen you can tap Software Version on the Main Dashboard.



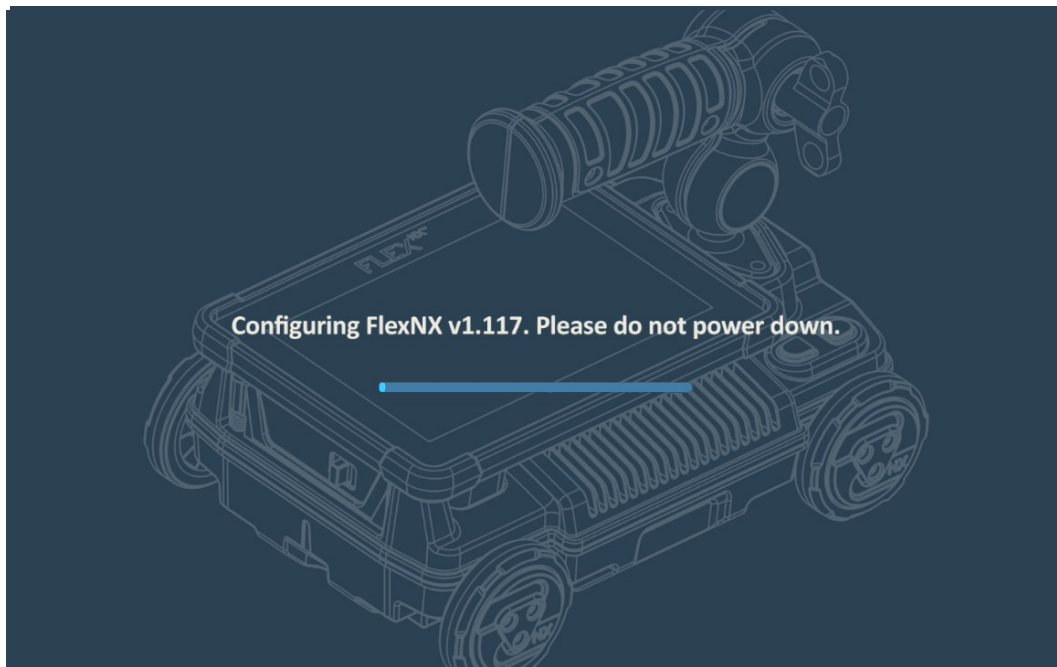


Flex NX and Flex LT will display a USB drive screen if a USB drive is not inserted or detected.



Flex NX and Flex LT will transfer the install package once a USB drive is detected.

A new screen will appear once the transfer is complete. Tap Confirm Install. Feel free to remove the USB drive; it is no longer needed.

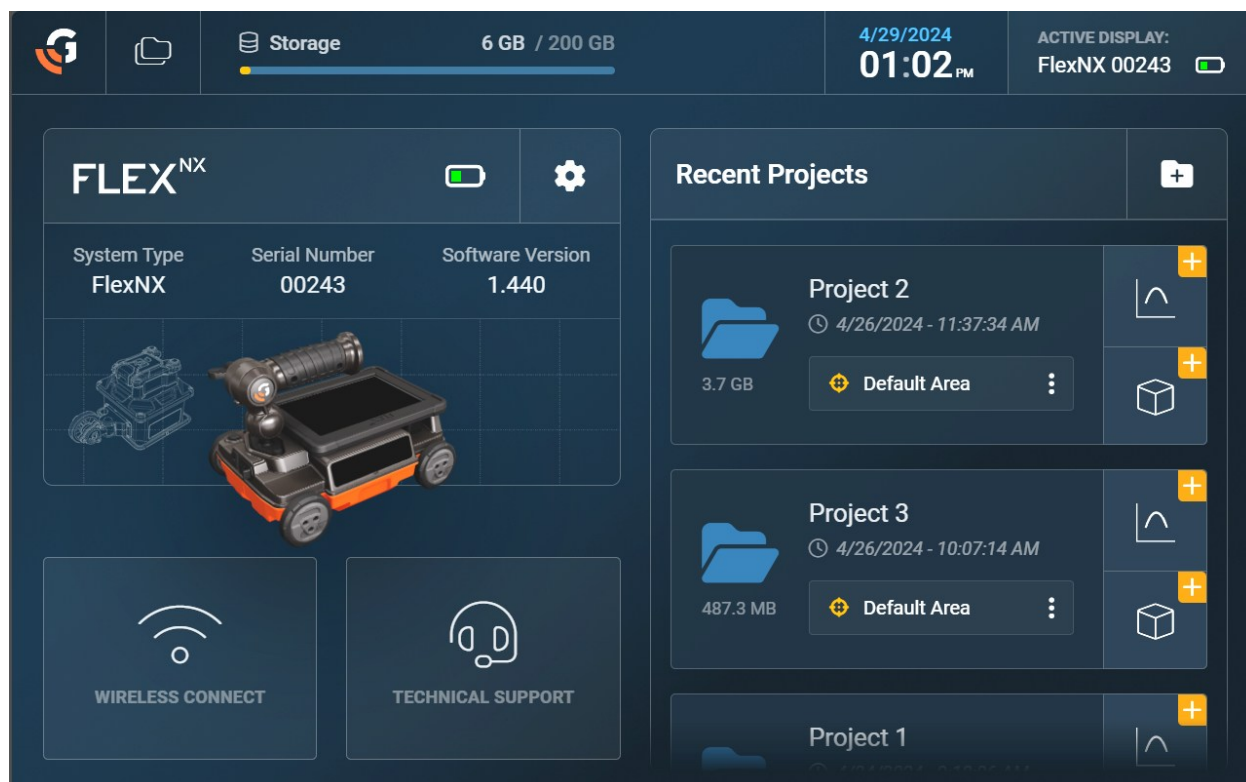


Flex NX and Flex LT will then install the software update and reboot once the progress bar is full. Do not power off the system during this process.



The system will reboot to a "Configuring Flex NX v..." screen. Do not power off the system during this process.

The system will reboot once more and then return to the Main Dashboard.



Health Settings: Updating Satellite Antennas Using the Nexus Interface

Software updates for the satellite antenna Nexus Interface are controlled by Flex NX and Flex LT, and therefore your Flex system must be updated prior to NX25 or NX15. Before continuing, confirm that your Flex NX has the latest software version.

Power on Flex NX and make sure the battery is near full charge.

Insert a fully charged battery into NX25 or NX15 and power on.

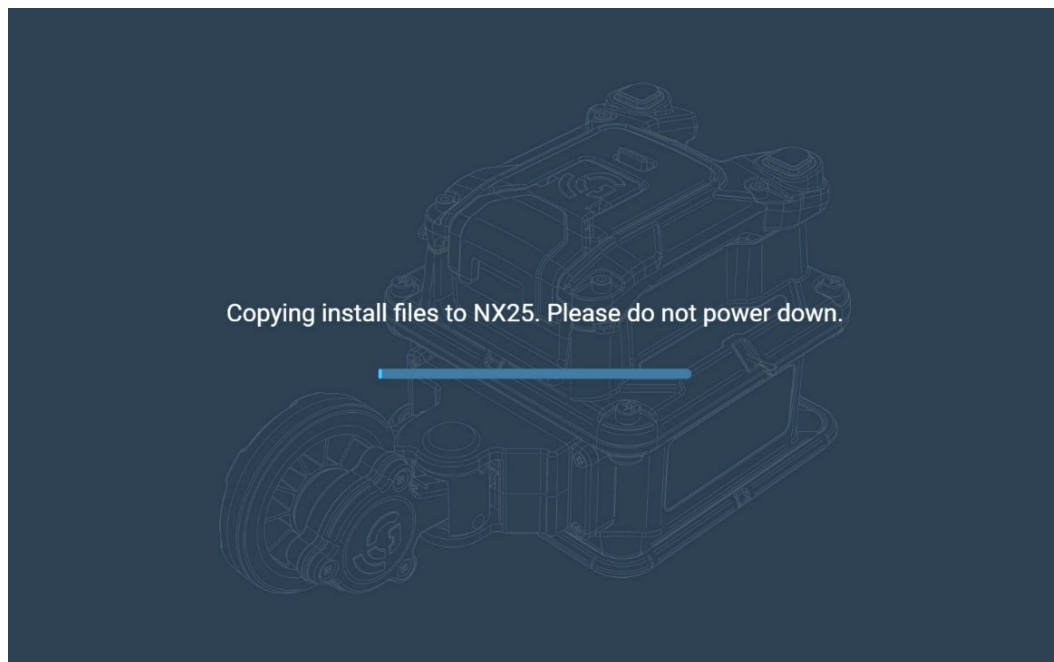
- If your Flex System and satellite antenna were previously paired they will automatically connect. Wait for the satellite antenna's LED to turn solid green.
- If your Flex system and satellite antenna have never been paired, or your satellite antenna was previously using with the Nexus Elements Interface, please refer to the Pairing Satellite Antennas section (page 16) and pair the units before continuing with the update process.

Once connected, Flex NX will detect the satellite antenna's current software version. Mismatched versions will automatically trigger the start of the update process. If you updated your satellite antenna using the Nexus Elements Interface, and its software version is higher than the one on your Flex System, you will have to update your Flex system first.

Tap Confirm Install to continue with the update. The Flex system will power down if this window is closed using the X in the upper right corner. Use the QR code to view update release notes.

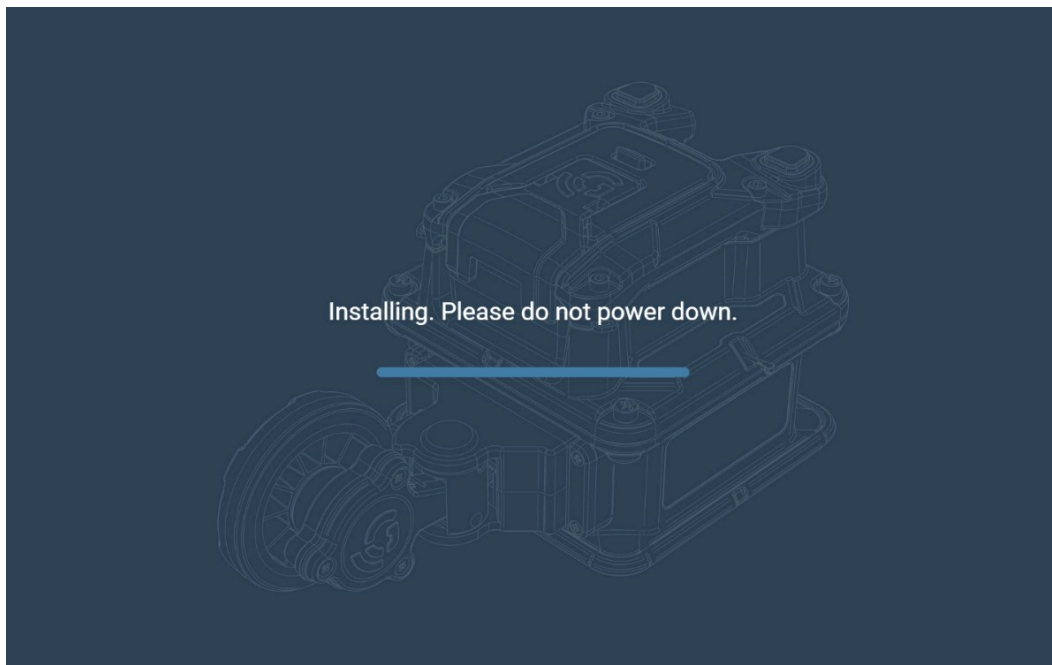


After tapping Confirm Install, the satellite antenna will display a flashing magenta LED. Do not power down the satellite antenna or remove the battery while the magenta LED is blinking.

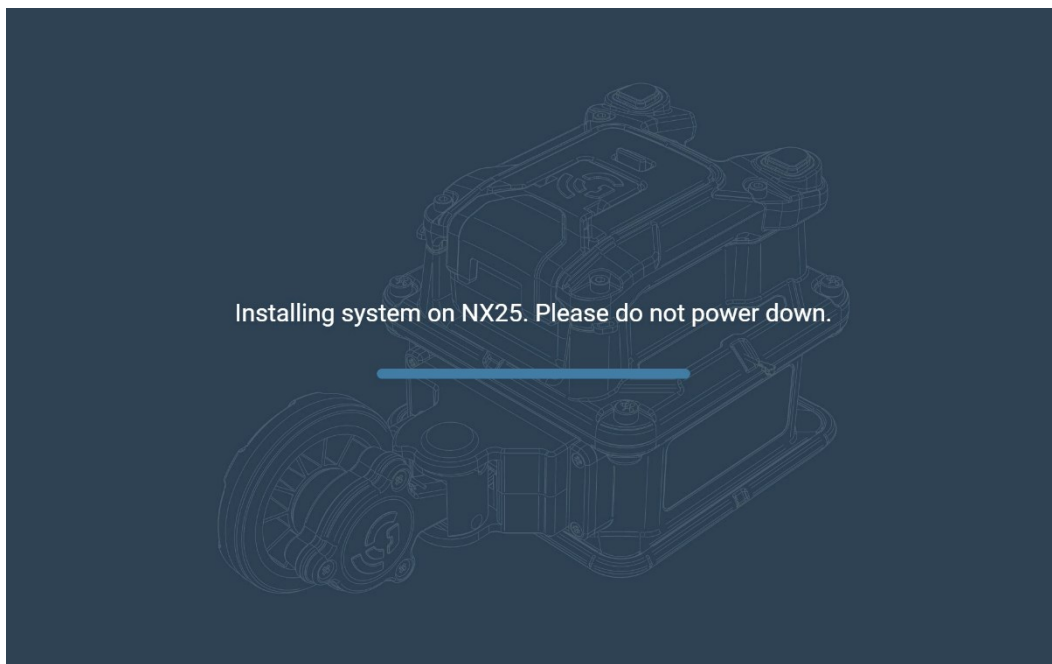


The screen will transition to a "Copying install files..." page. The satellite antenna will still display a blinking magenta LED.

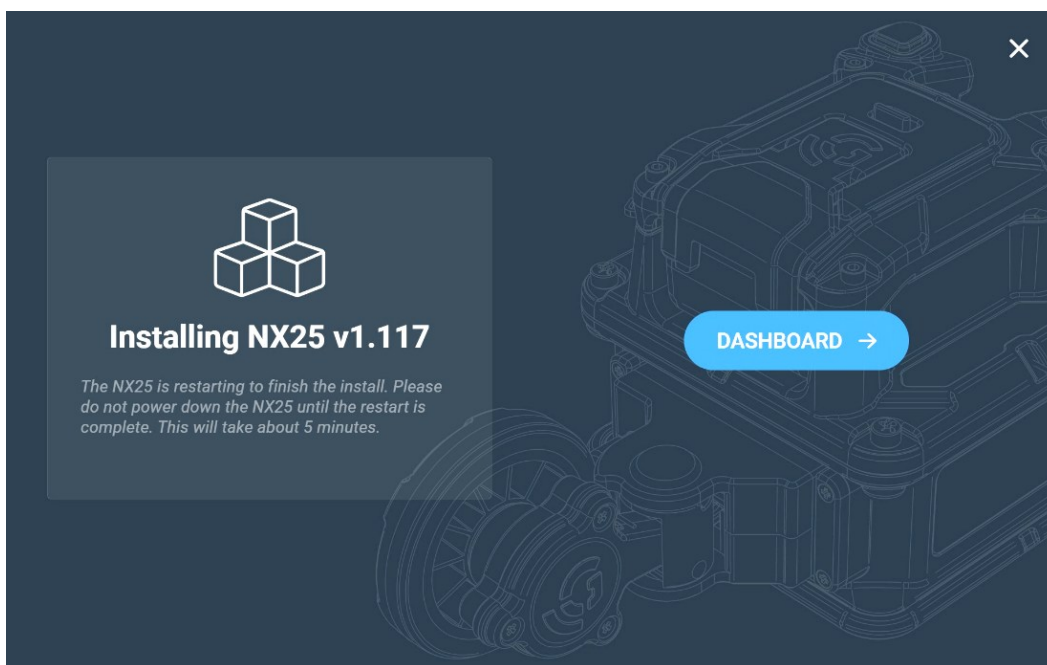
After install files are copied, the Flex system will show an "Installing..." page. The satellite antenna will still display a blinking magenta LED.



The next update screen shows an "installing system..." page. The satellite antenna will still display a blinking magenta LED.



The Flex system will then display an "Installing NXxx vX.XX" page. Tap Dashboard to return to the Main Dashboard. The satellite antenna will continue to display a blinking magenta LED.

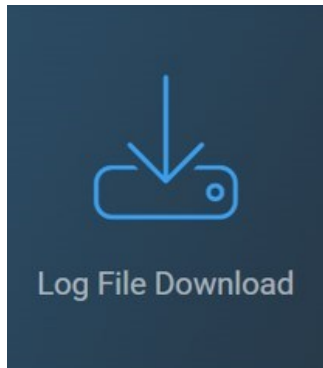


Monitor the satellite antenna and wait for the indicator light to turn solid green. Do not power down the satellite antenna or remove the battery until the indicator light is green. The update is complete when the satellite antenna appears as selectable on the Main Dashboard's carousel.



The satellite antenna's LED flashes magenta when updating. Do not power down or remove the battery until the indicator light is solid green.

Health Settings: Log File Download



The Log File contains system-related data to assist the GSSI technical support team.

Tap Log File Download to create a .ZIP file and then transfer via USB or to a wireless device. Refer to the Transferring Data section to review the steps for downloading from Flex NX and Flex LT.

You can then email the file(s) to our Software Support Team if instructed to do so.

When a satellite antenna is connected via the Nexus Interface its logs will be transferred and combined with Flex system logs.

Flex Systems: Collection Mode Settings

Flex NX and Flex LT save Collection Mode settings between sessions and after a reboot. These include:

- 1) O-Scope state (enabled or disabled)
- 2) Color table
- 3) Dielectric value
- 4) Display gain configuration
- 5) Channel display (stacked, Channel 1, or Channel 2)

Connecting a Viewing Device (Screen Mirroring; Flex NX Only)

Flex NX can cast its data collection screen to a personal device, such as a phone, tablet, or computer. You can then view your data on another device during data collection.

Note: this viewing mode does not provide data collection controls or access to settings menus. Refer to the 2D Remote Control section (Page 63) for remote viewing with full access to data collection controls.

Try pairing your Flex NX to a tablet for a larger viewing screen, or to a smart phone for a lighter and more portable display.



Step 1: Connect Mobile Device from the Main Dashboard



Tap the Wireless Connect icon.

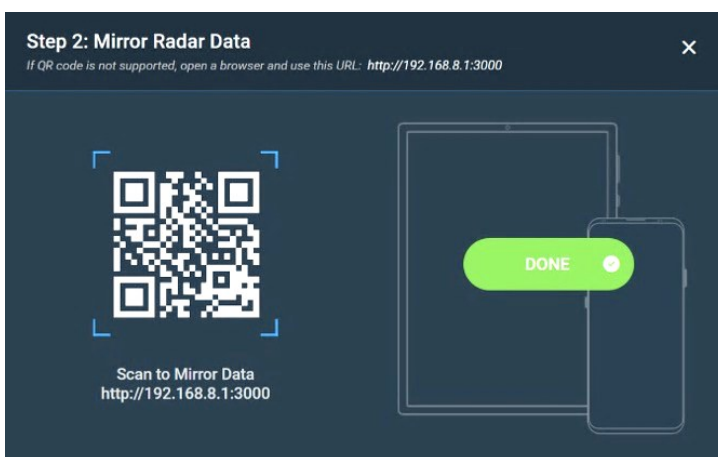
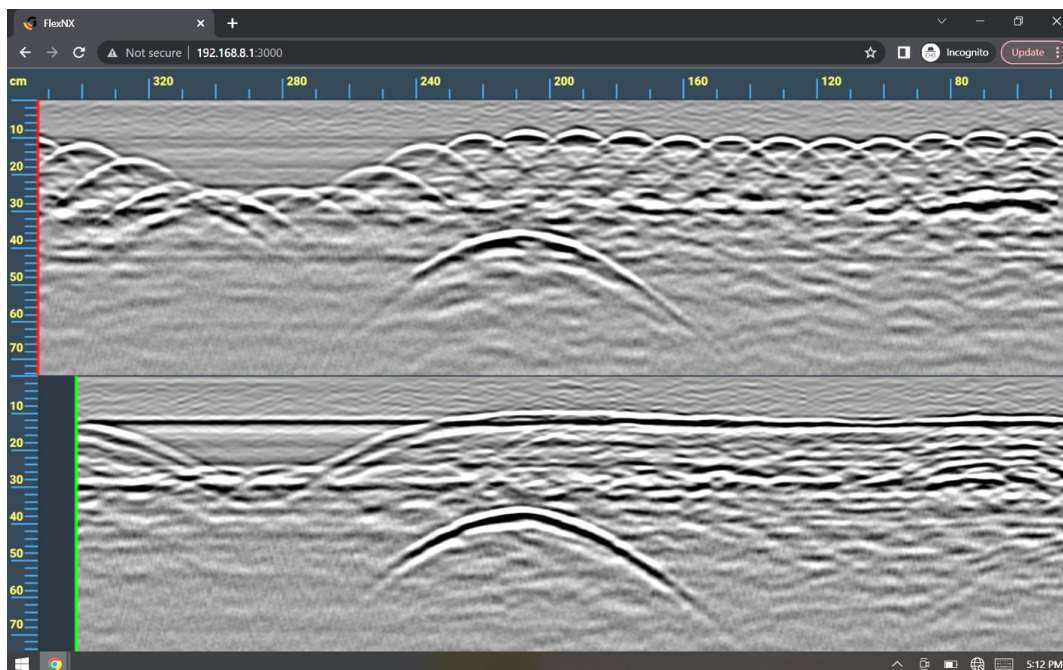
If using a computer or mobile device without a QR Code scanner, connect to the Flex NX Wi-Fi network using the device's network settings.

Step 2: Scan the QR code to connect to Flex NX's Wi-Fi network. Tap Next.

Step 3: Mirror Data Collection Screen

Scan the QR code to automatically open a web browser and the data mirroring IP address. The webpage will open to a blank Flex NX data collection screen. GPR data will not be visible until you enter Collection Mode and begin collecting data.

If using a computer connected to the Flex NX SSID, type the displayed URL (<http://192.168.8.1:3000>) into your web browser. Tap Done to return to the Main Dashboard.



Flex NX data collection mirrored to a tablet. Data mirroring will appear similarly on most devices.

The data collection screen simply mirrors the 2D scan data displayed on Flex NX, including Stacked Mode and Channel 1 or Channel 2 modes. Flex Mode data cannot be mirrored. Start and stop file functions and target marking are not possible. Backup cursors will be visible, and pinch/zoom actions are available.

Try hiding your browser's address bar (if supported) for an optimal viewing experience.



Data collection can be live-shared using an internet-connected device and a variety of 3rd party applications, such as FaceTime. GSSI does not guarantee the quality or performance of live streaming from 3rd party applications.

Technical Support

From the Flex NX or Flex LT Main Dashboard, tap the Technical Support icon. Scan the QR code to open the GSSI Technical Support page.

You may also call the number provided to speak with a member of our Technical Support Team.

Technical Support

Questions and concerns? Below you'll find information on how to contact our Technical Support Team.
<https://www.geophysical.com/support#helpful-resources>



Scan for Helpful Resources

PHONE:
603-836-9937

HOURS:
**Monday-Friday
8:30am – 5pm EST**

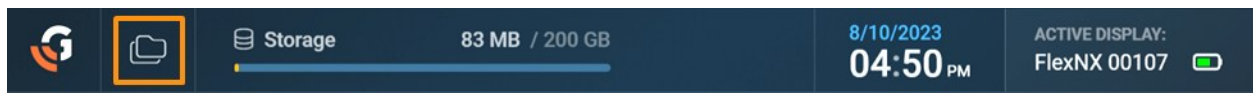
Please feel free to email training@geophysical.com with any questions, comments, or feedback.

Project Management

Flex NX and Flex LT Project Management features promote organization of Results and Data, and with seamless GSSI Fusion integration you can easily transfer Fusion-ready Results and Data from Flex system to your personal device. Flex NX, Flex LT, and GSSI Fusion projects are designed around a unique project folder, and the ability to create multiple Areas of Interest within a project. Use this to your advantage on job sites with multiple working areas. Keep projects organized by creating individual project folders and Areas of Interest, and save scan data and results into these areas. You can then upload your data to GSSI Fusion.

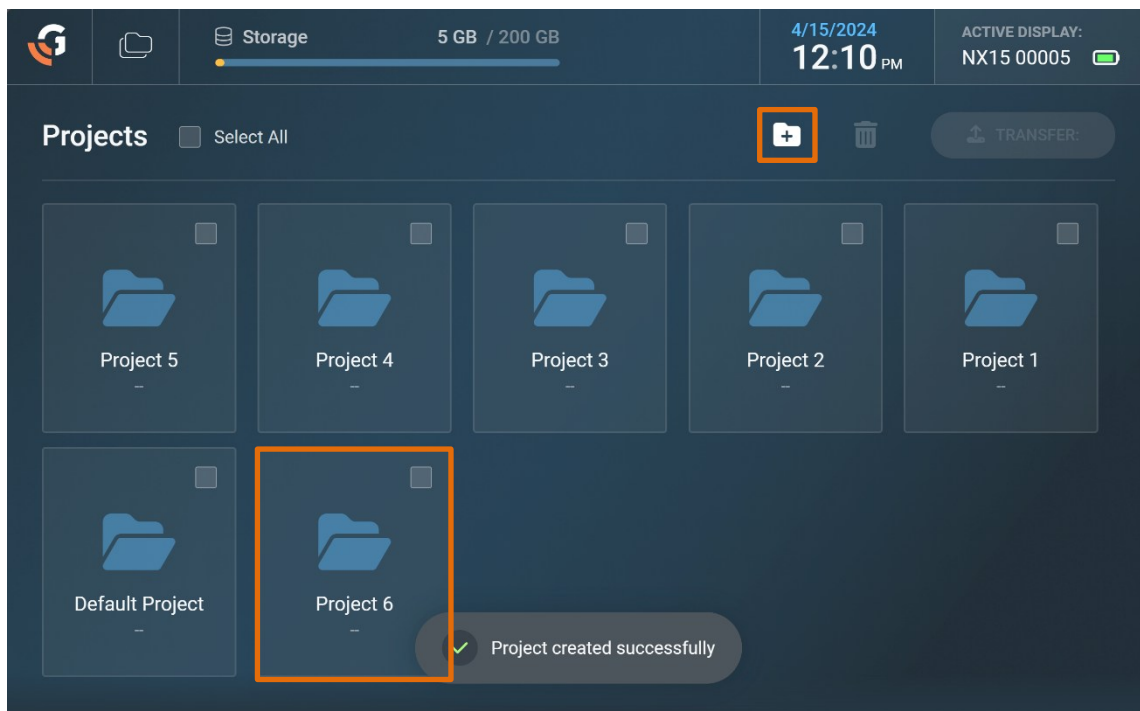
Projects Portal

Access the Projects Portal from the Main Dashboard's Top Navigation Menu by tapping the folder icon in the upper left corner.



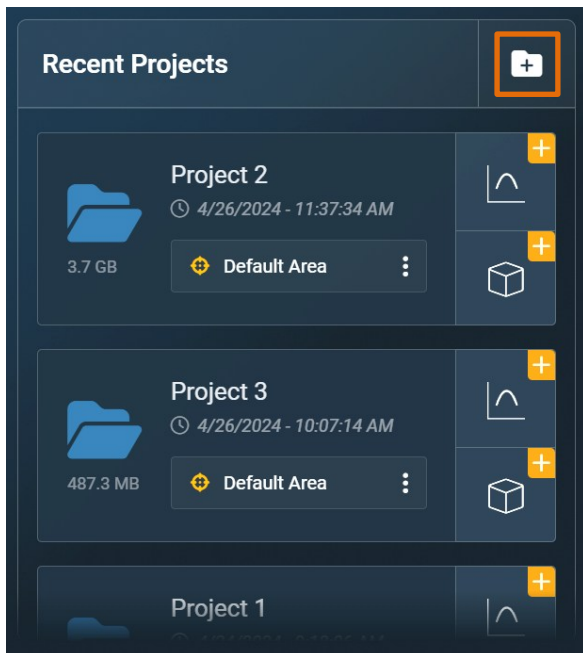
Creating New Projects

Open the Projects Portal to view saved projects. You may then open an existing Project Profile by tapping a folder or create a new project by tapping the Create New Project icon. A confirmation will appear once a new Project is created.

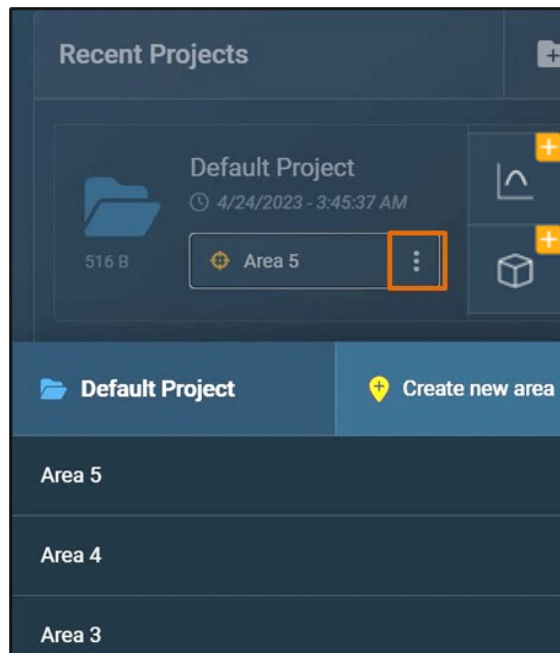


Alternatively, create a new project from the Main Dashboard's Recent Projects Pane.

From the Main Dashboard, tap the Create New Project icon. A new project will be generated.



To create a new Area of Interest in a project, tap the stacked 3-dot icon, then tap Create new area.



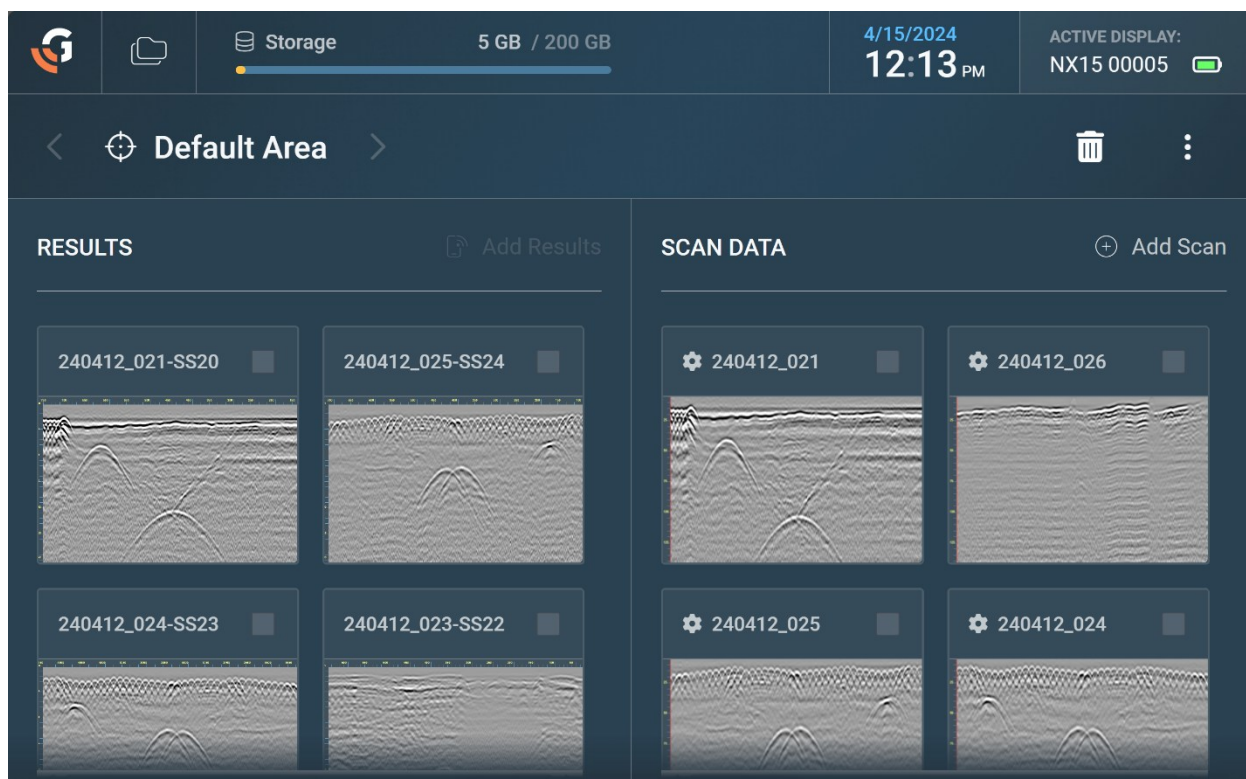
The Flex NX and Flex LT Project Management system streamlines report generation in GSSI Fusion. Make sure to spend the time organizing your projects around Areas of Interest. When you transfer .FSN files from Flex NX or Flex LT and upload them to Fusion your data will already be organized and ready for report creation.

Project Profile

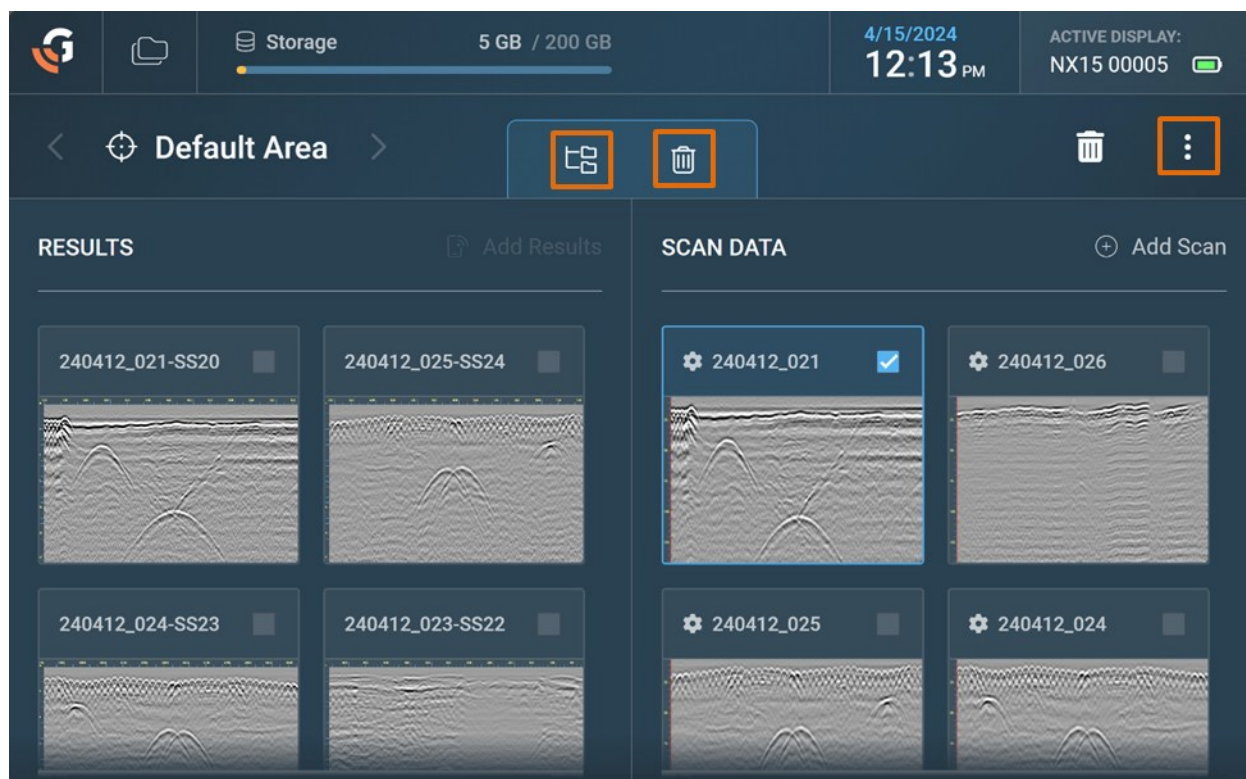
Tap any existing folder on the Projects Portal to open the associated Project Profile. Toggle between Areas of Interest to view saved Results and Scan Data.

Results will typically be screenshots taken during data collection. Select an image in the Results section to open it in a viewer.

Scan data include 2D profiles and Flex Mode scans that have been collected and saved to a Project and AOI. Tap Add Scan to collect a new data file within the current Area of Interest. You can also select a 2D profile or Flex Mode scan to open it in Playback Mode.



The Project Profile displays project-related Results (screengrabs) and Scan Data.



Select Results or Scan Data to perform file management. New icons appear once files are selected.

Select one or more data files to transfer to another Area of Interest, then tap the File Management icon.



You may also select one or more files and permanently delete them using the Trash Can icon.



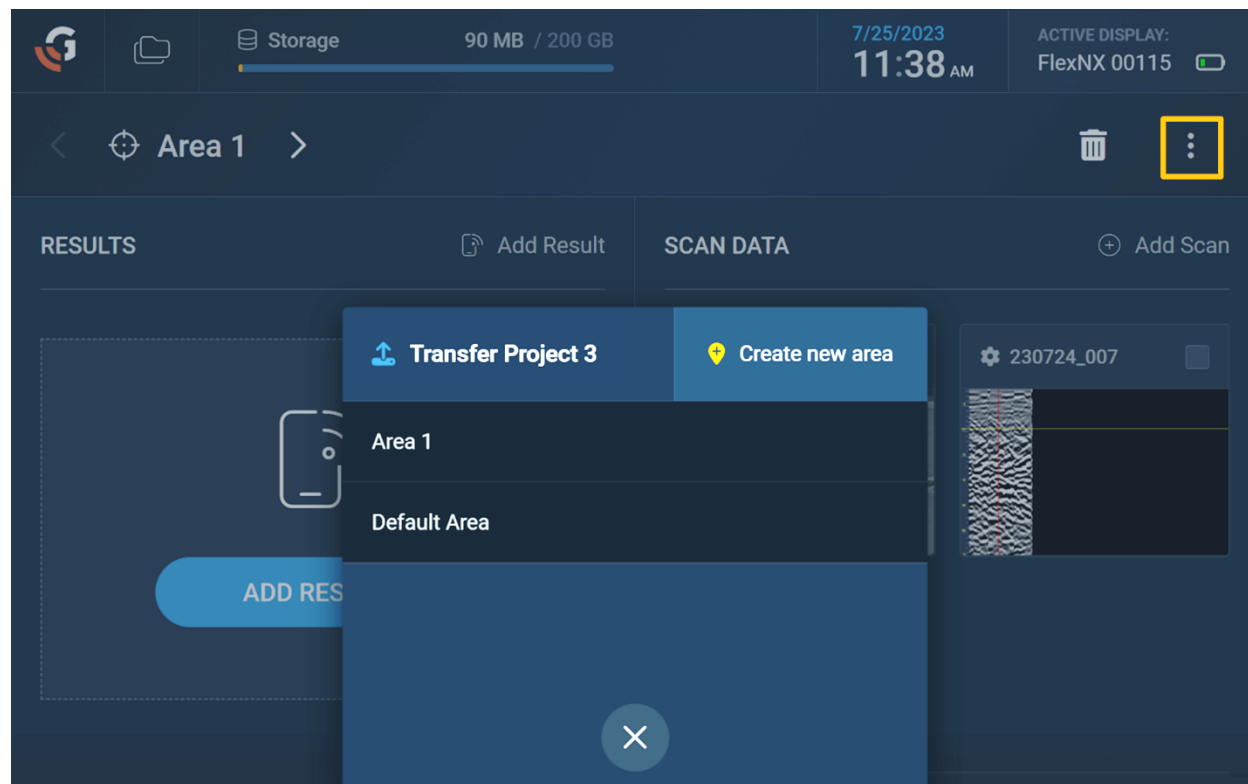
Please note that deleted files cannot be recovered.

Results and Scan Data cannot be moved to different Project folders; they can only be moved between Areas of Interest within a single Project. Use GSSI Fusion for greater organizational control.

To manage Areas of Interest, tap the stacked 3-dot icon in the upper right corner.

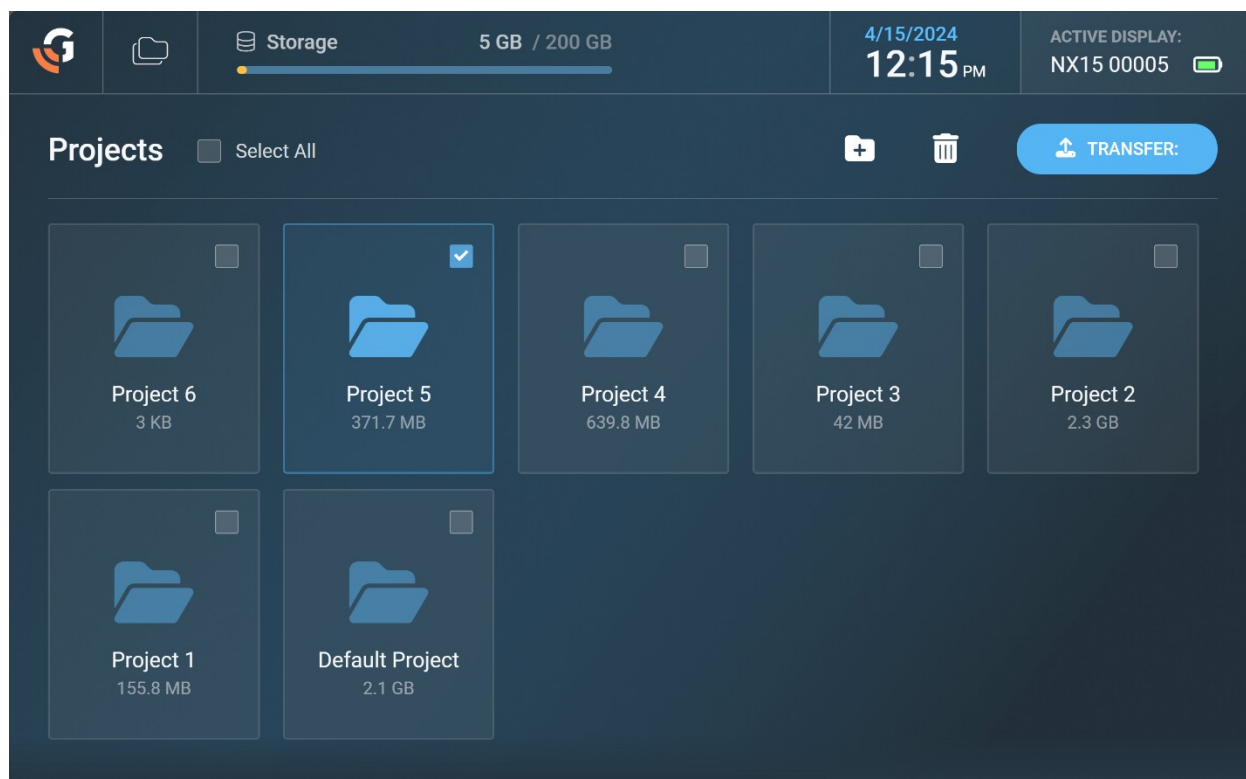
To change the Area of Interest, tap the three dot stack menu icon at the top right of the screen. Select an existing area of interest or tap Create New Area to add a new Area of Interest.

You can also delete an AOI by tapping on the Area and selecting Delete Area.



Transferring Data

You can transfer data from the Projects Portal (one or more Projects) or an individual Project Profile (a single Project) using a USB drive or via Wi-Fi (**Flex NX only**) to a smartphone or personal computer. Scan Data are transferred as .DZT files (raw GPR data), User Marks stored in .GSSI files, and Results (.PNG screengrabs) captured during data collection or Playback. User Mark files and screengrabs will have the same file number as the associated .DZT, but with different file extensions and SCREENSHOT or MARKDATA appended to the end of the file name.

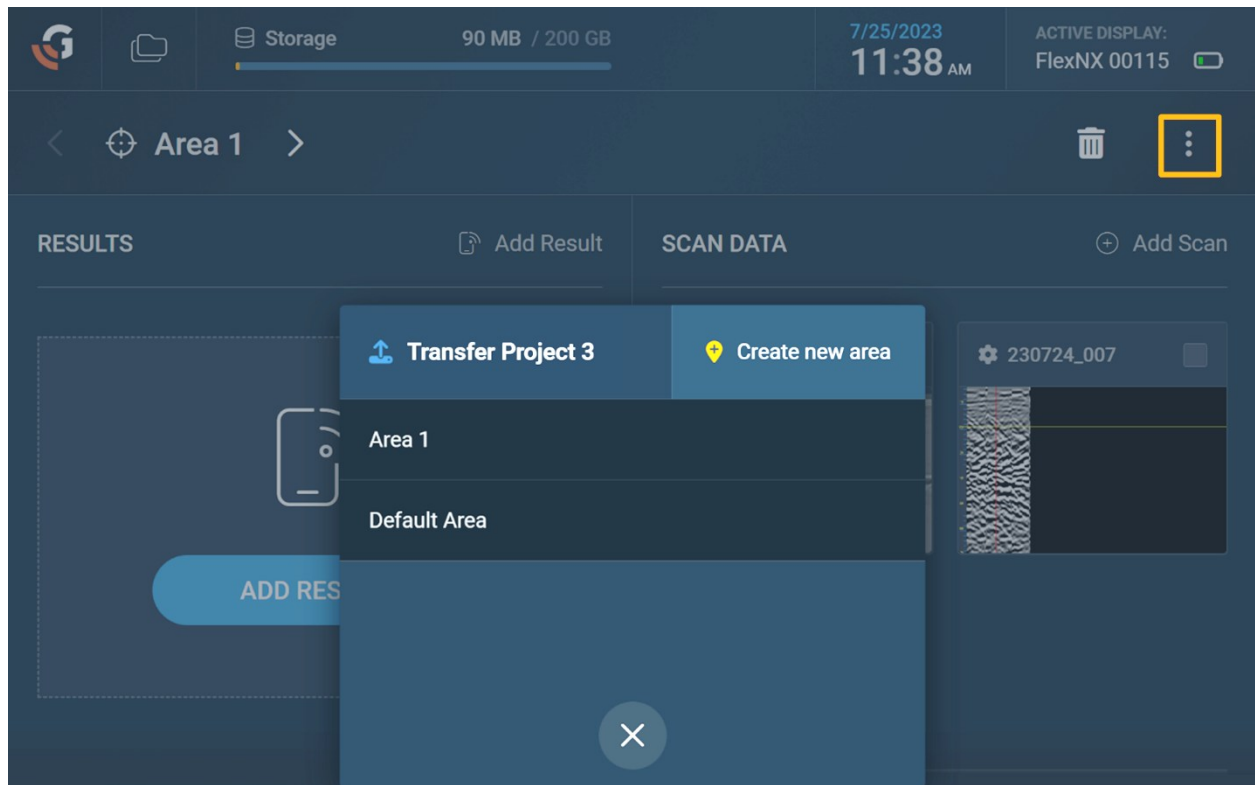


Flex NX and Flex LT also provide the .FSN file export option to optimize the import of Flex system projects into GSSI Fusion. Simply transfer the .FSN file to a USB drive or mobile device (**Flex NX only**), then then upload the .FSN file to GSSI Fusion. This will create a new GSSI Fusion project with the organizational structure from Flex NX and Flex LT, including Project Results organized by Area of Interest. Note that .FSN files only contain Results and do not include Scan Data files.

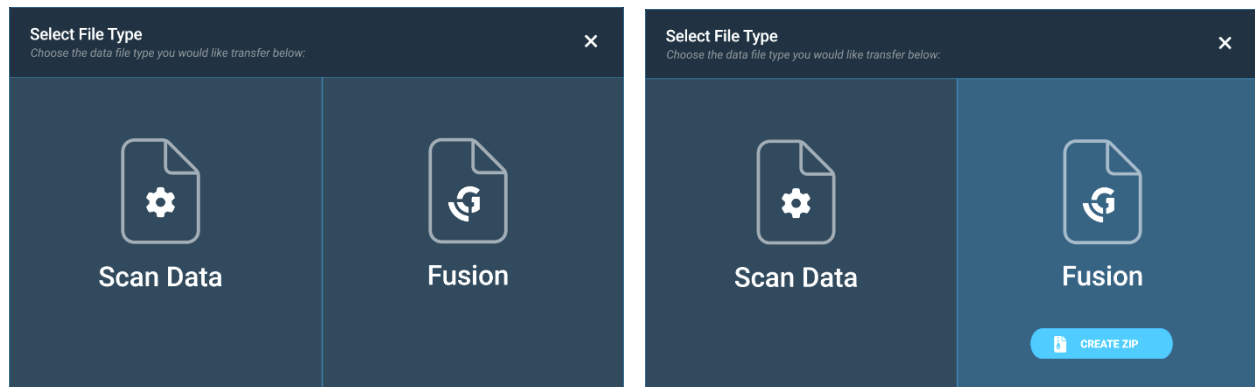
Option 1: Select one or more Projects from the **Projects Portal** to activate the Transfer icon.

You will then be prompted to choose between Scan Data and Fusion formatted data (.FSN file). Tap one of the formats and then tap Create Zip.

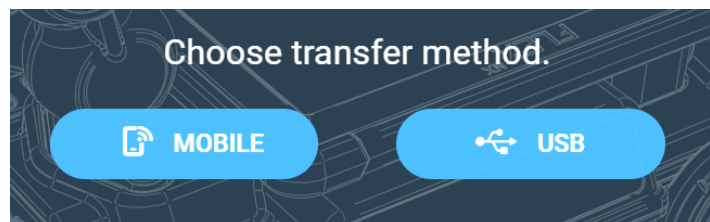
Option 2: Access a **Project Profile** by tapping a folder in the Projects Portal. Next, tap the three-dot stack menu icon at the top right of the screen, and then tap Transfer Project XX. You will then be prompted to choose between Scan Data and GSSI Fusion export (.FSN file).



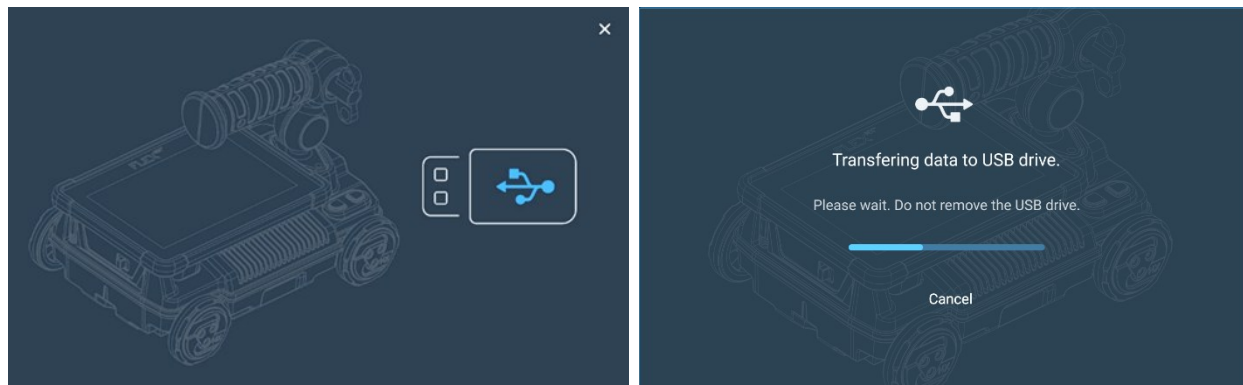
Continue data transfer by tapping one of the format options and then tap Create Zip.



On the next screen, select Mobile (**Flex NX only**) or USB.

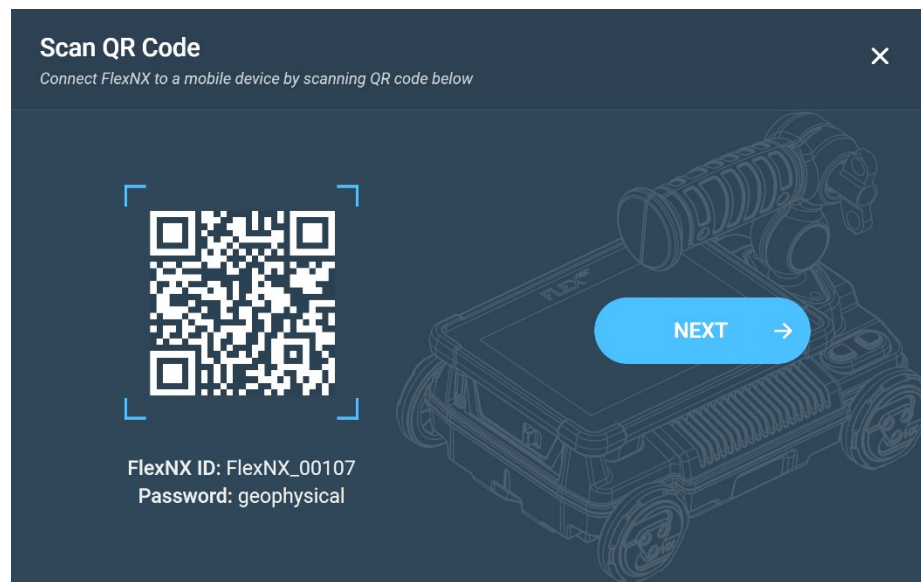


Tap USB to transfer the files to a USB device, such as a USB flash drive. A USB icon will appear if a USB device is not inserted or detected. This may also occur if your USB device is formatted incorrectly. Flex NX will begin transferring data once a USB device is detected. If you select Scan Data this process will create a new folder on your USB drive containing the transferred files, whereas choosing .FSN will place the .FSN file on the root directory of the USB drive. GSSI recommends checking the storage capacity of your USB device before transferring files.

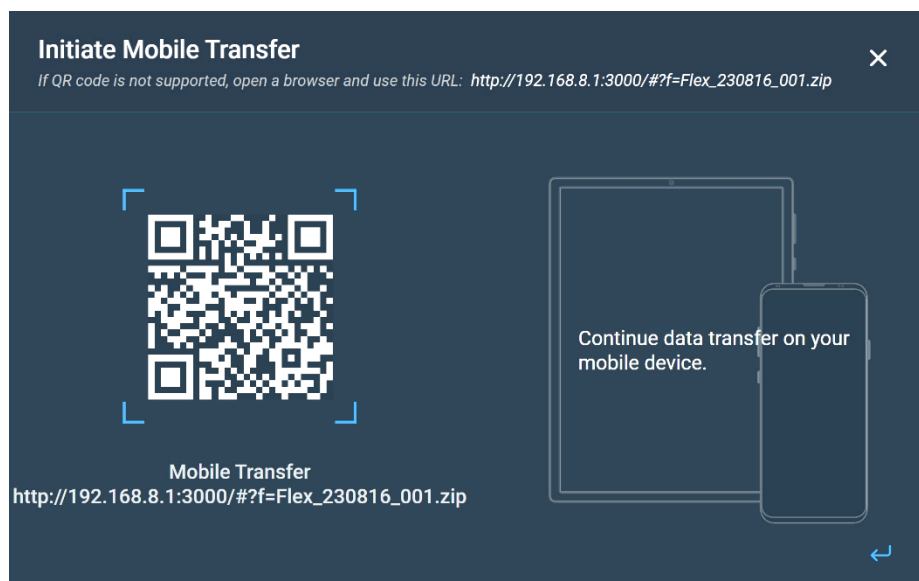


You can remove the USB device when data transfer is complete. Tap Done.

Tapping the Mobile option (**Flex NX only**) generates a QR code you can scan with a smartphone or another mobile device capable of scanning QR codes. Your device will then be connected to the Flex NX Wi-Fi network. Tap Next.

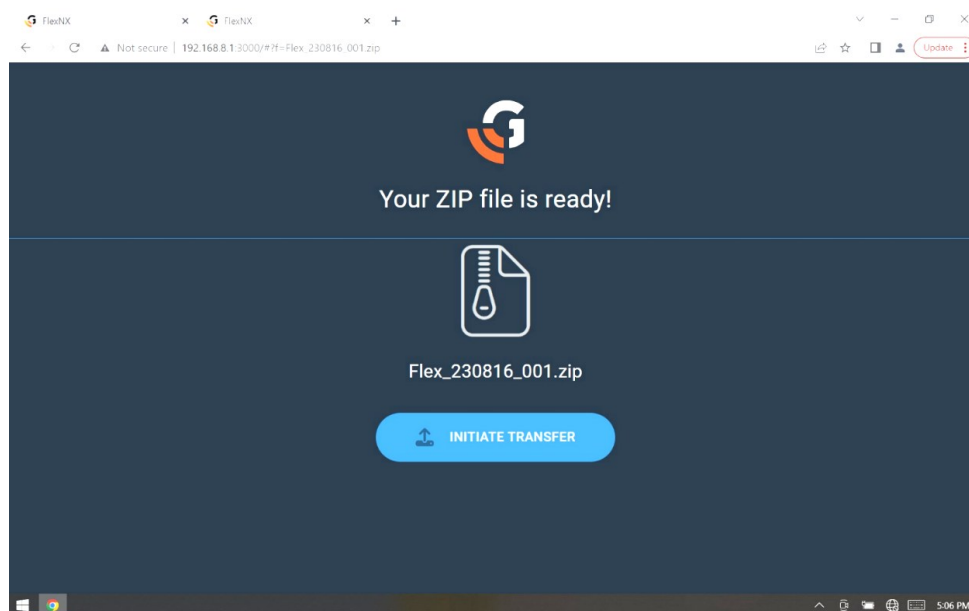


NOTE: If your device cannot scan QR codes, you must manually connect to the Flex NX network via your device's Wi-Fi settings. Once your device is connected, click Next on Flex NX.



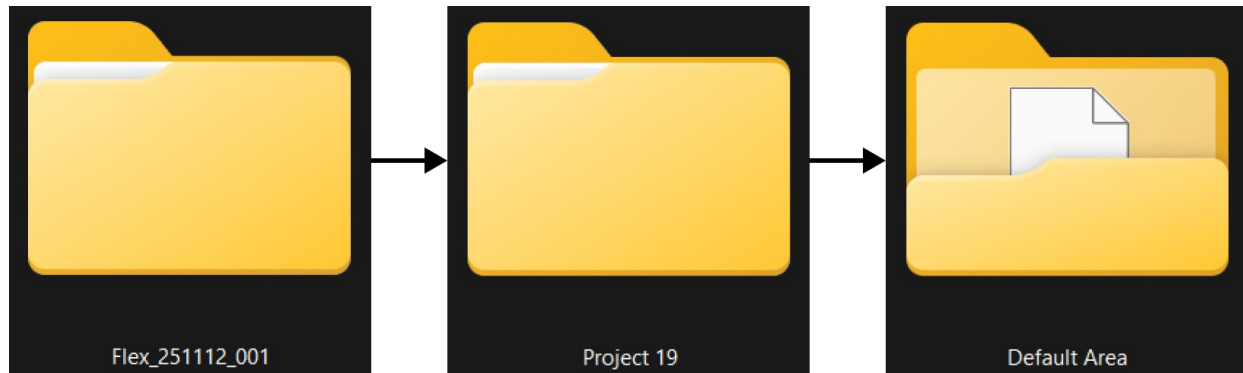
Scan the QR Code to open a web browser. The wireless transfer address will be added to the web browser's address bar, and the browser will open a new page. **Note:** If using a device that cannot scan QR codes you must manually type the address into your web browser.

Click Initiate Transfer on your mobile device to begin downloading the .ZIP file. The download behavior is just like any other browser download. Depending on your browser settings, the file may automatically save to a downloads folder or you might be prompted to choose a local directory. Extract the .ZIP file to view its contents.

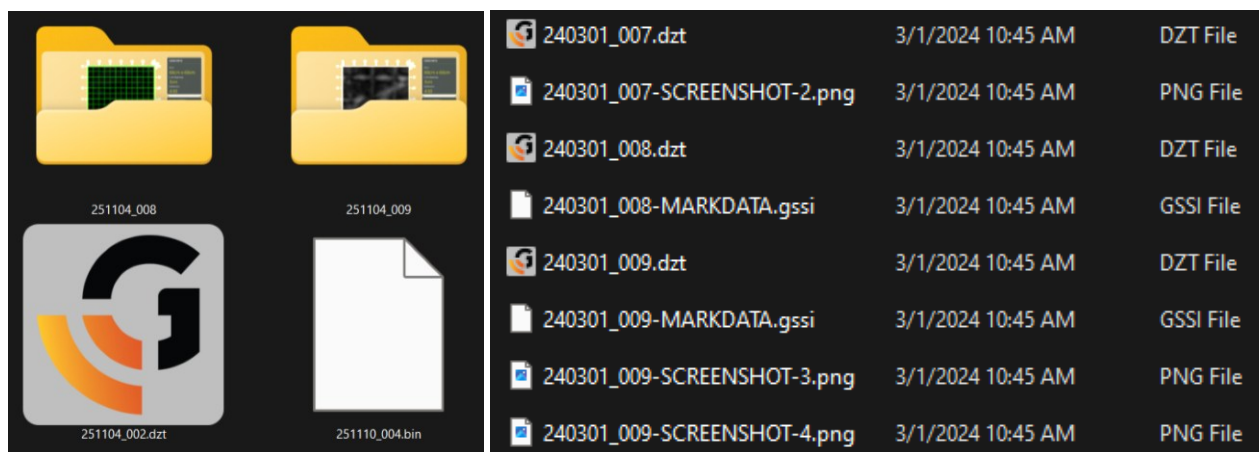


Exported File Organization

Regardless of the transfer method, exported files will be contained in a folder labeled using the Flex_YYMMDD_XXX format. The folder will have the Flex_ prefix, Year/Month/Day, and the export number. For example, Flex_251112_001 would be the first export on 12 November 2025. A second export on that day would be labeled Flex_251112_002. Inside a Flex_ folder are Individual Project folders, each containing separate folders for AOIs in the Project.



AOI folders store 2D scans and associated files (.DZT, .DZX, and .GSSI if applicable), along with screengrabs associated with the scans. The AOI folders also contain Flex Grid scan folders. See the Flex Grid section for more information on exported Flex Grid data.



The .DZT files contain GPR data and are intended for use in GSSI's RADAN® 7 software and Geolitix. When opened, RADAN will display a .DZT file as raw (unprocessed) data and as a "pre-processed" file based on your data collection settings. RADAN will also use the .GSSI files to add User Marks to the data. Geolitix will open .DZT files as raw, unprocessed data.

The .PNG files can be opened using any image viewer. Note that screengrabs display the data collection window at the time of the screengrab. They do not show the User Interface or other menus outside the data window, and they do not update if additional changes are made after a screengrab is collected.

Flex System File Formats

.DZT	A binary file format for exported GPR scan data.
.DZX	A text-based file format for use in post-processing software like Radan 7 and Geolitix.
.BZX	A batch file for automatically assembling Flex Grid scans in Radan 7.
.GSSI	A file that stores information for User Marks placed in scan data.
.PNG	An image file created when capturing screengrabs.

Collecting Data with Flex Systems

Scanning and Marking Overview

When using GPR to scan concrete, the objective is to identify objects within and below the slab and to accurately mark their location on the surface. This helps drillers and saw cutters avoid damaging reinforcement, utilities, and other slab and subgrade installations.

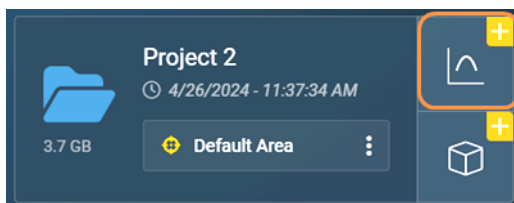
This is generally accomplished by collecting 2D profiles in a 2ft x 2ft or 2ft x 4ft grid pattern around each core penetration, or within a foot on either side of the entire linear distance of a saw cutting line. The lasers on the side of Flex NX, and the colored markers on Flex LT, show the center of each antenna so you can align the onscreen backup cursors with a target. You can then accurately translate the target's location onto the slab surface using chalk, tape, or a wood crayon. Mark linear features in at least three places so you can capture their layout.

You can also use Flex Mode (**Flex NX only**) to create a Top Down or 3D Volume View before or after 2D scanning. This will provide enhanced mission planning to inform the 2D markout or a means of verification after the markout. Refer to the Flex Mode section of this User Guide (page 68) for guidance.

GPR cannot reliably determine the diameter of targets, so be sure to include extra width when marking reinforcement, conduit, and other targets. GPR scanners often use black for reinforcement and red for conduit. You can use other colors as needed, but red should be reserved for conduit. When using non-standard colors, reserve a dedicated, bright and highly visible color for conduit markouts.

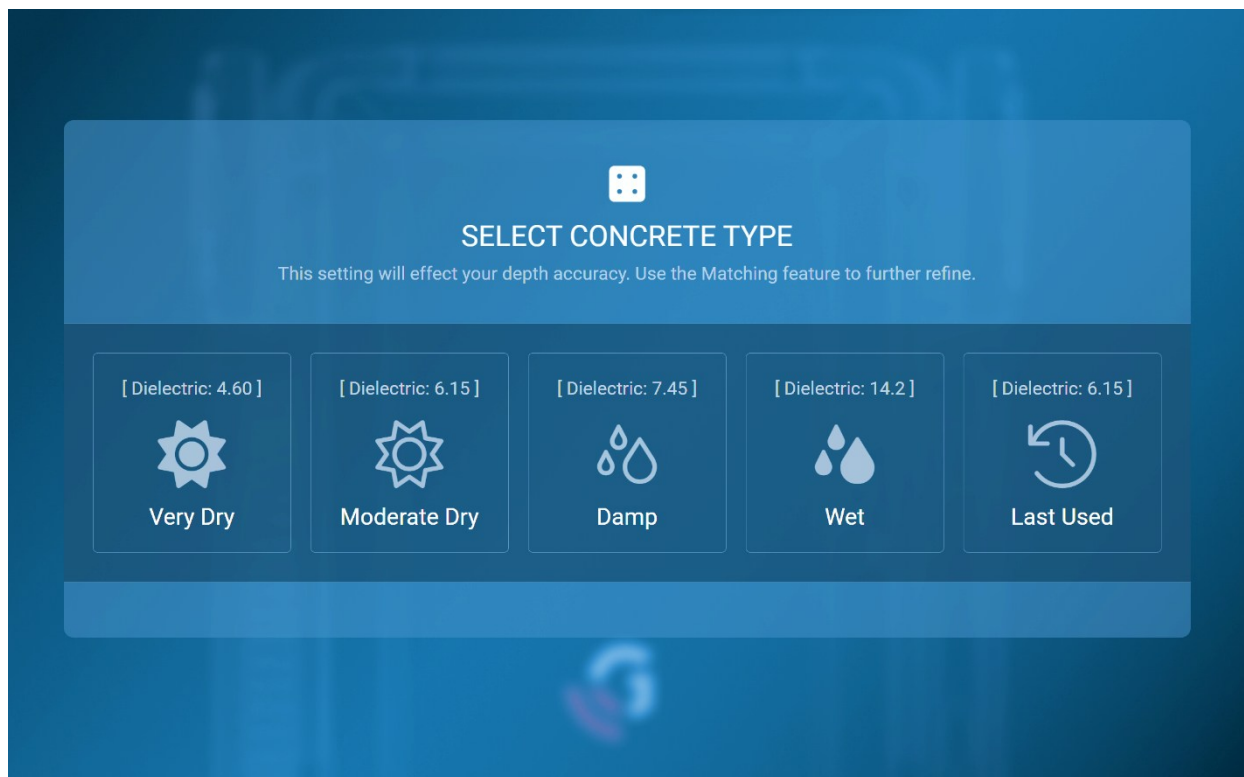
A more in-depth description of scanning and marking techniques can be found in the Additional Resources section (Page 93) of this user guide.

Before You Scan



To quickly start a new scan from the Main Dashboard, tap the Start New 2D Scan icon in the project folder of your choice. This action will bring up the Select Concrete Type screen.

You can also start a new scan by opening a Project folder from the Projects Portal. Tap Add Scan to proceed to the data collection screen.



Select a Concrete Type that best represents your working conditions. **Note:** this will affect your depth accuracy. This screen will only appear once during each scanning session.

Select from Very Dry, Moderately Dry, Damp, or Wet concrete types or select the last used dielectric value.

Use your knowledge of the age of the slab. If the slab's curing state is unknown, consider using the Matching feature (see Depth Panel sections) to refine the depth scale.



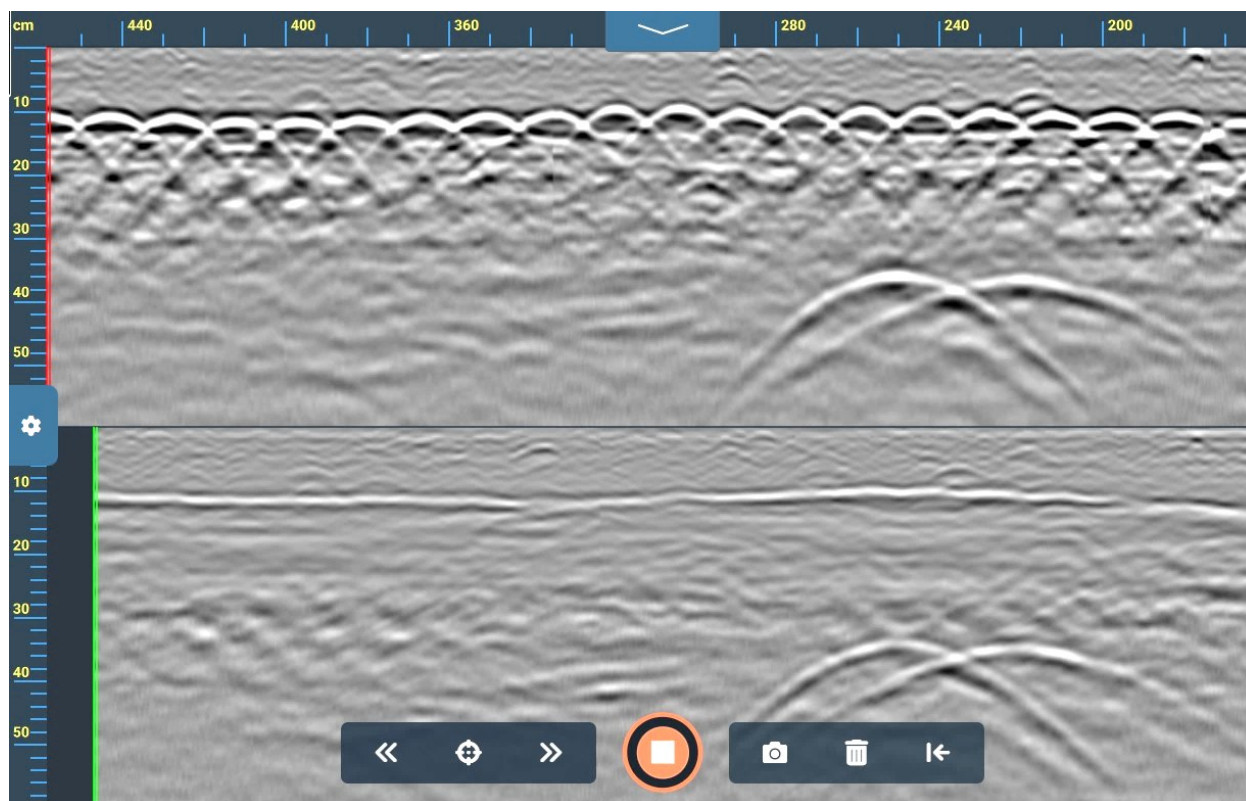
Dielectric constant, or relative dielectric permittivity [RDP], is a measurement of a material's ability to store, and then transfer, electromagnetic waves. By selecting a Concrete Type you are setting an estimated dielectric constant. Use the Concrete Cure screen for an initial benchmark, then further refine the dielectric (and your depth scale) using the Depth Panel options in Collection Mode.

Data Screen and Basic Collection

The Data Screen is where you collect 2D profiles, place user marks, and save screen grabs.

Tap the Start Scan icon to begin a new scan. The icon will now have a white square at its center. The data screen will remain blank until you push Flex NX, Flex LT, or a satellite antenna (**Flex NX only**) forward to begin collecting data. The profile will begin building from left to right on the screen. The filename is displayed in the Top Navigation Panel (minimized by default) and is named using the current date and an affix representing the file number.

Stacked Mode is the default display method, showing both the standard orientation antenna (top) and the cross-polarized antenna (bottom). As you collect data you will notice an offset at the end of the profiles. This offset represents the physical distance between the two antennas. Move the system in reverse to see backup cursors: **red** for standard orientation (front antenna) and **green** for cross-polarized (rear antenna). You'll notice that the backup cursors are offset but the targets in the profiles are aligned.



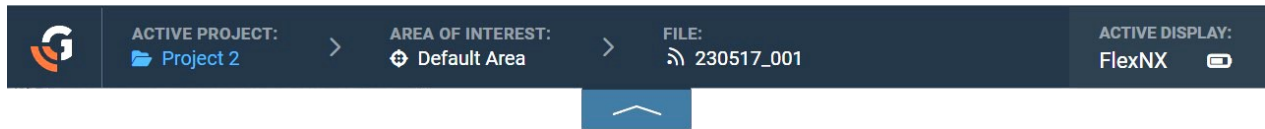
You can playback a file by opening it from the Project Profile screen. The playback and collect screens are identical and offer the same range of functionality. When finished with Playback, simply tap the New Scan icon to collect new data.

The Data Collection screen features the following functions:

Navigation Menus	
	Top Navigation Access Icon. Tap to access Return to Dashboard, Active Project options, Area of Interest options, File Information, and Current Display options. Tap again to minimize the Top Navigation Panel.
	Side Navigation Menu. Tap to access the Gain, Display and Depth panels. Tap the arrow icon to minimize the Side Navigation Menu.
Data Collection Controls	
	Start/Stop Scan. Tap to start collecting a new scan. Push Flex NX, Flex LT, or a satellite antenna forward to begin building a GPR profile. Tap again to stop file collection. If save prompt is enabled (see System Settings, page 42) you'll be asked to save or delete the file; if disabled, the file will save automatically.
	Previous Target/Next Target. Toggle between User Marks, displaying the depth and distance traveled. You can also edit or delete the User Marks.
	Target Marking. Tap the Target Marking icon, then use your finger to drag and place the crosshair on a feature of interest. Use the Target Marking menu to place a user mark. You can change the color of your user mark before saving it. Tap again to exit Target Marking mode.
	Screen Grab. Tap this icon to take a screen grab of the on-screen data. The Flex NX or Flex LT system will save the picture as a PNG image file for later transfer. Screen grabs are saved to the Results section of the current Project and Area of Interest, and they will transfer with other files during data transfer.
	Delete Current Scan. Tap to discard your current scan.
	Reset Cursor. This function will reset the cursor to the end of the current scan. You can then resume collecting without starting a new file or rolling the wheels.
Gestural Controls	<p>Pinch Zoom and Pan. Zoom in on features by using two fingers. Return the screen to its original zoom level, or zoom in further, by moving your fingers together or apart. When zoomed, drag one finger to pan the display right, left, up, and down. Pan 2D profiles using one finger when the backup cursor is not displayed. Pinch zoom and pan affect both channels in Stacked Mode.</p> <p>Hide UI Controls. Tap the Data Collection Screen with one finger to hide the UI controls. Repeat the process to show the UI controls.</p>

Top Navigation Panel

The Top Navigation panel, located at the top of the screen, can be accessed during data collection by tapping the upward arrow. Tap the arrow again to minimize the menu.

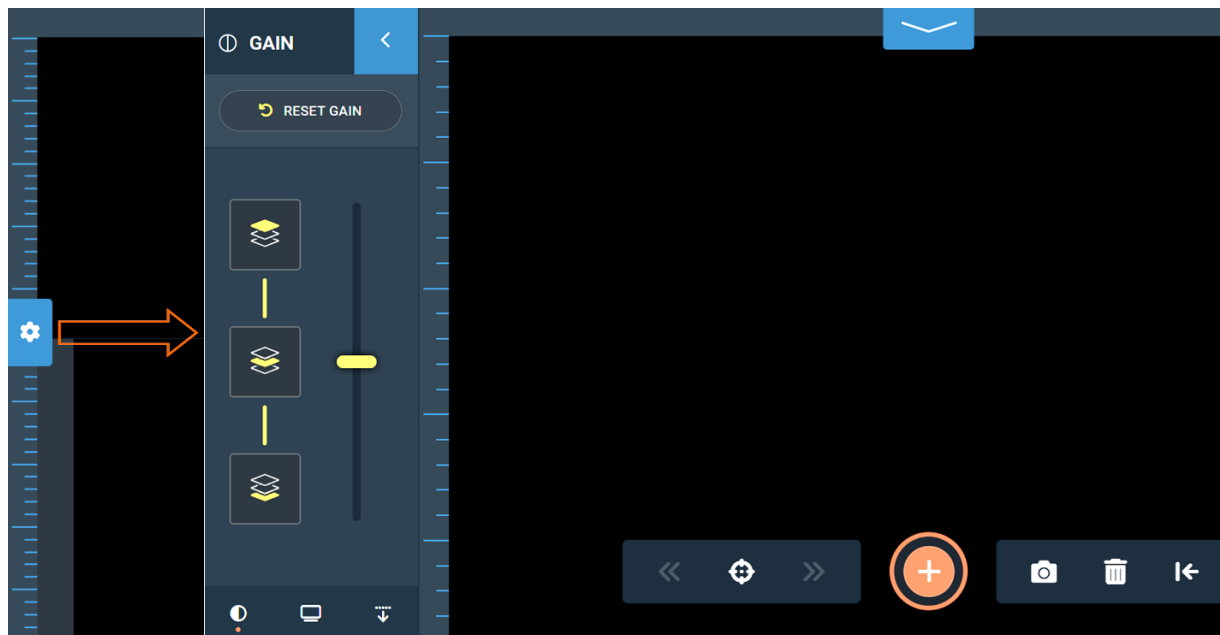


Tap the Top Navigation Access icon to display the following:

Top Navigation Icons and Controls	
	Return to Main Dashboard. Tap to exit Collection or Playback Mode and return to the Main Dashboard.
ACTIVE PROJECT: Project 2 >	Active Project. Tap the arrow icon to view the Project Profile for the current project. From here, you can access Results and Scan Data saved to Areas of Interest.
FILE: 230502_013	Current File. View the name of the current file. Data files are named incrementally based on the calendar date and the order of collection. The naming prefix uses two numbers each for year/month/day, followed by an underscore and the file number.
AREA OF INTEREST: Area 3 >	Area of Interest. Tap the arrow icon to change the Area of Interest. You will see Default if no Areas of Interest were created.
CURRENT DISPLAY: FlexNX  	Current Display. View the currently active device and its battery status.

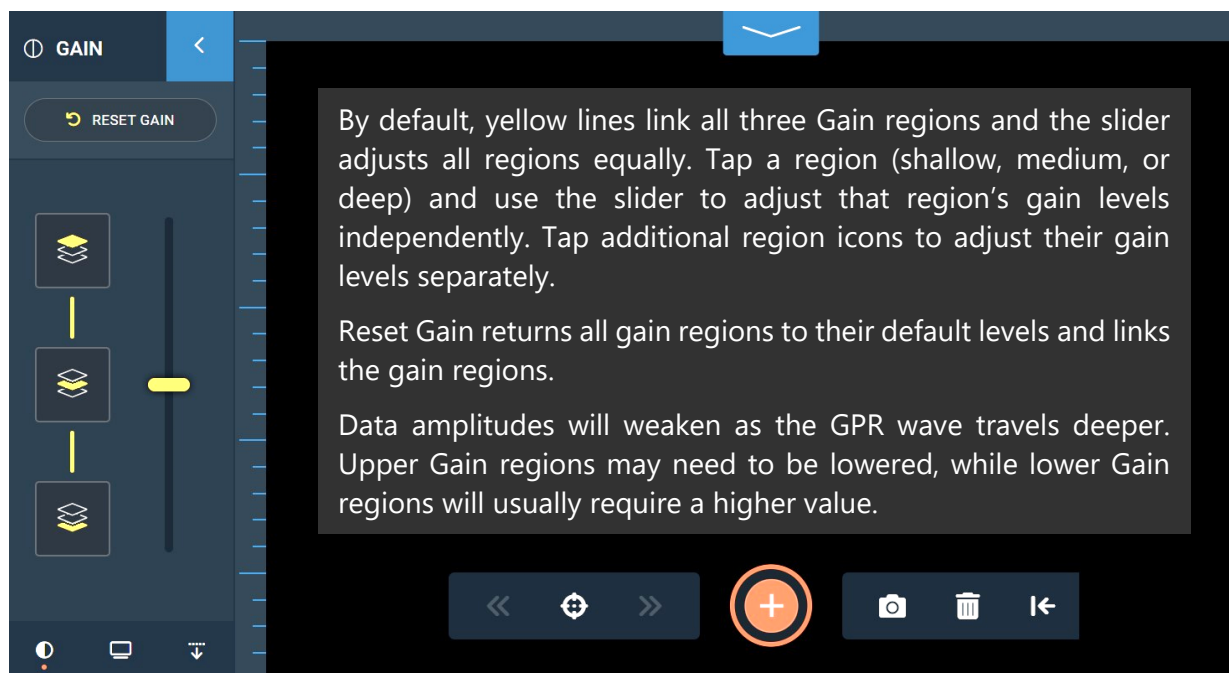
Side Navigation

Activate the Side Navigation panel by tapping the gear icon on the left side of the Data Collection screen. This panel is always accessible before, during, or after data collection or while in Playback Mode. The Side Navigation panel contains the Gain, Display, and Depth panes. The icon for each pane is located at the bottom of the panel. Tap the arrow icon to hide the panel.



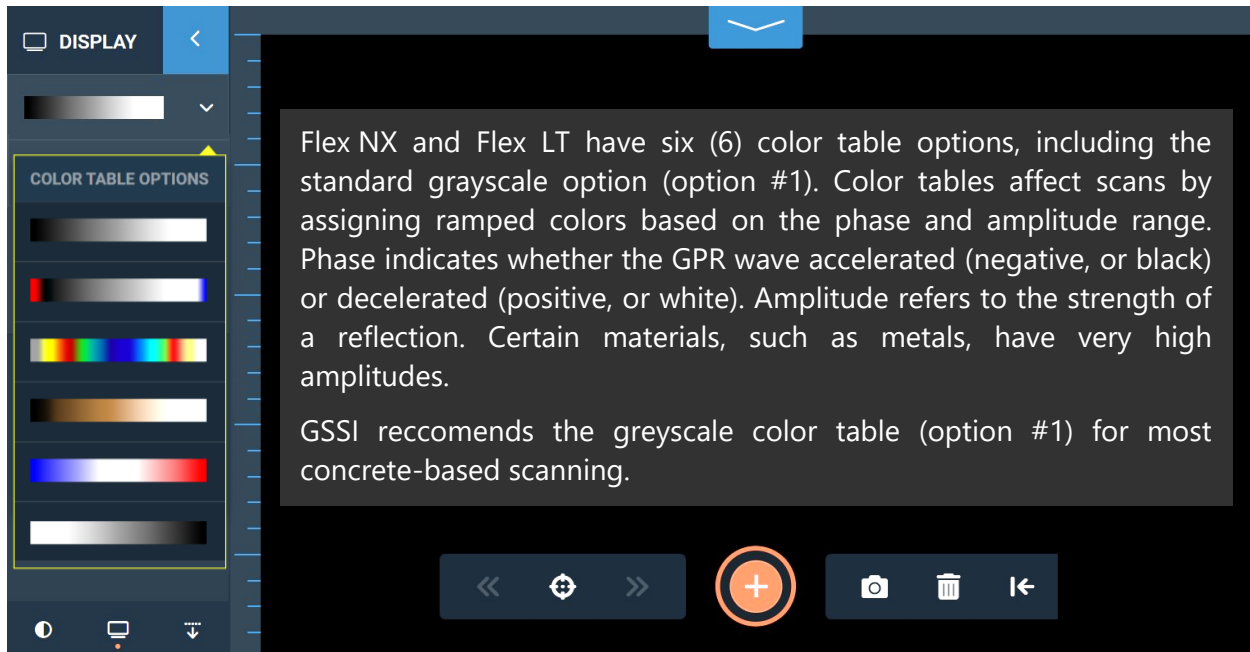
Side Navigation: Gain Panel

Use the Gain Panel to adjust the visual contrast of your data.



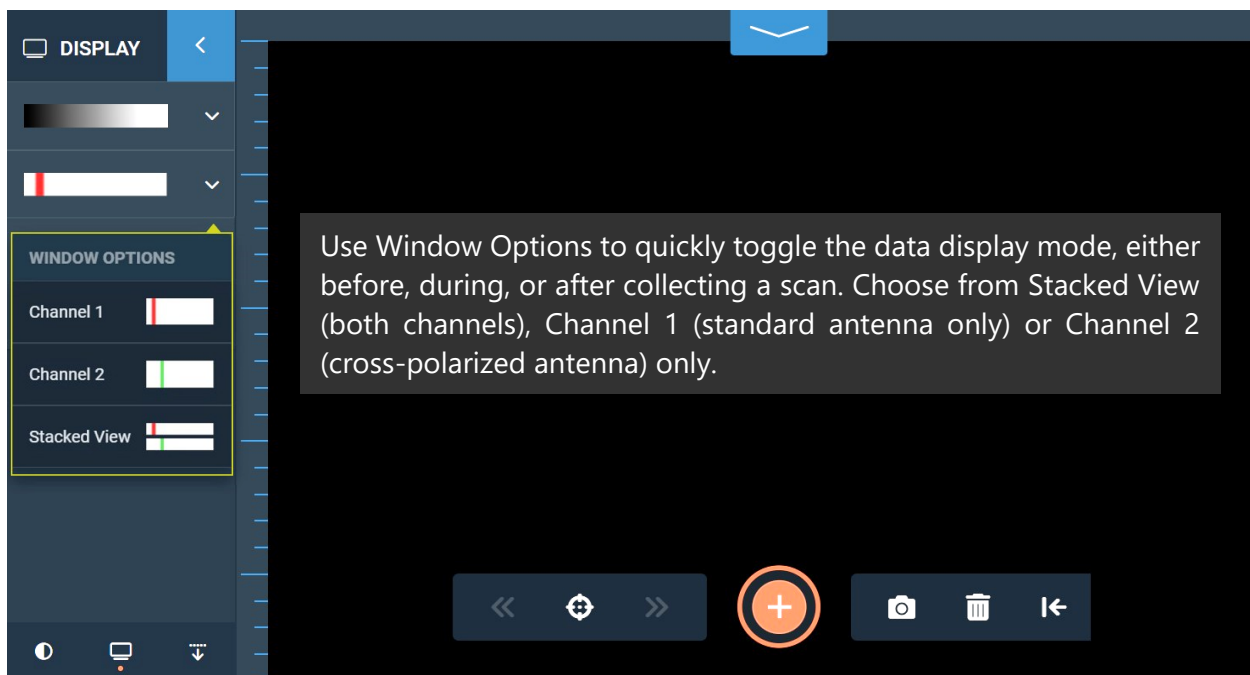
Side Navigation: Display Panel: Color Table Options Submenu

Use the Display Panel's Color Table Options submenu to select from a list of color tables.

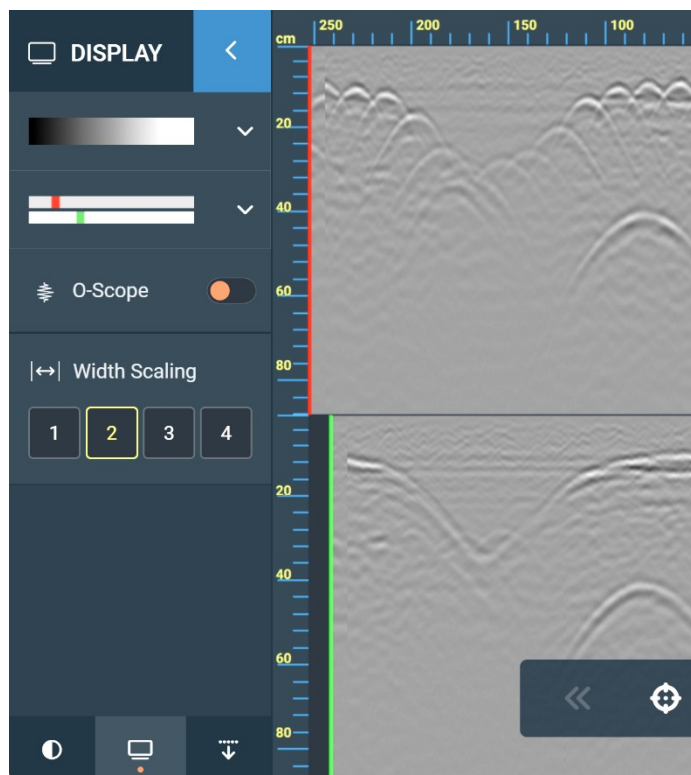


Side Navigation: Display Panel: Window Options Submenu

Use the Window Options submenu to access display modes, toggle the O-Scope, and select Width Scaling options.



Window Options Submenu: Stacked View



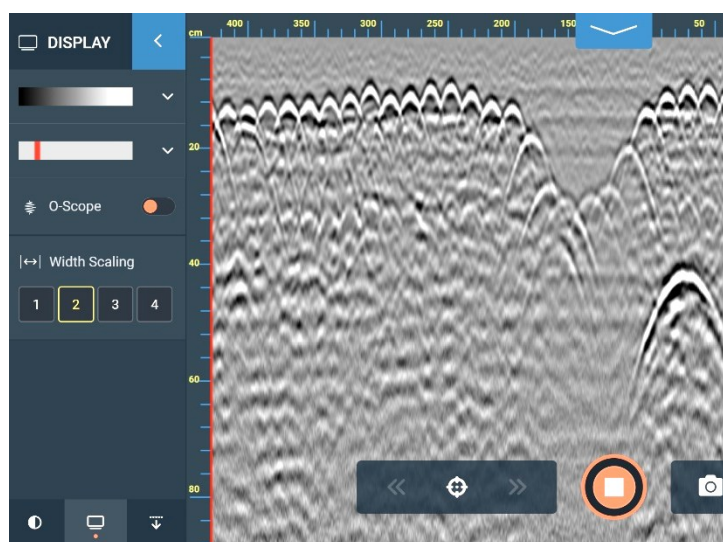
Stacked View displays both the standard antenna and the cross-polarized antenna

The front antenna (Channel 1, on top) is standard polarized and corresponds with the **red** backup cursor and **red lasers** (Flex NX) or **red markers** (Flex LT).

The rear antenna (Channel 2, on bottom) is cross-polarized and corresponds with the **green** backup cursor and **green** lasers (Flex NX) or **green markers** (Flex LT).

Use the Pinch Zoom function to zoom in on features of interest in both channels. Use one finger to pan non-zoomed data when the backup cursor is not present. When zoomed, use one finger to pan both profiles.

Window Options Submenu: Channel 1

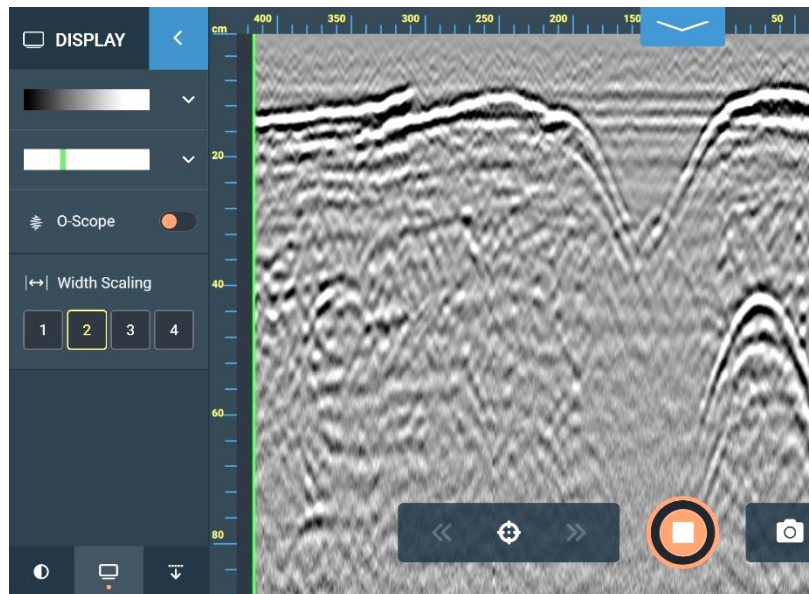


Selecting Channel 1 will only display data from the standard polarized antenna. Note the **red** back up cursor corresponds with the **red** side lasers (Flex NX) or **red** side markers (Flex LT) of the standard antenna.

Additionally, with Channel 1 activated you will only see the **red** side and front lasers on Flex NX.

Use the Pinch Zoom function to zoom in on features of interest. When zoomed, use one finger to pan.

Window Options Submenu: Channel 2



Selecting Channel 2 will only display data from the cross-polarized antenna. Note the **green** back up cursor corresponds with the **green** side lasers (Flex NX) and **green** side markers (Flex LT) of the cross-polarized antenna.

Additionally, with Channel 2 activated you will only see the **green** side and back lasers on Flex NX.

Use Pinch Zoom to zoom in on features of interest. When zoomed, use one finger to pan.

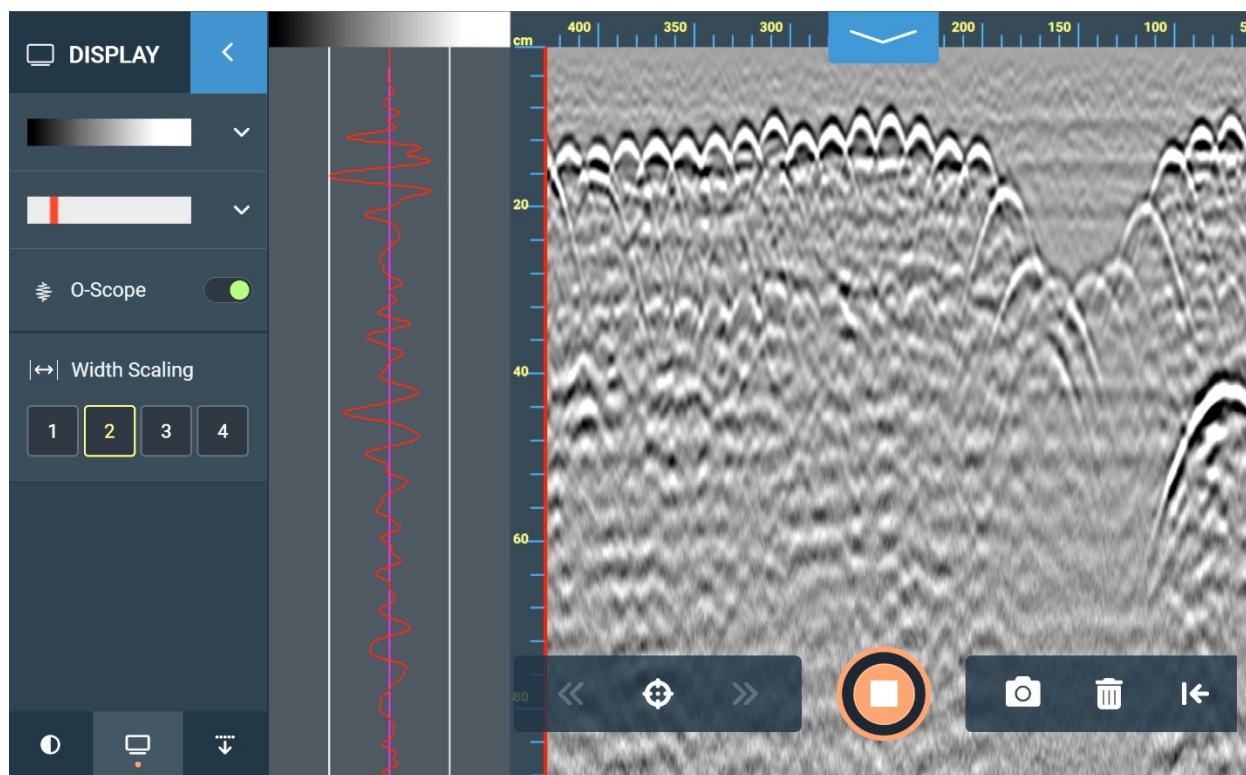


Each antenna has individual, yet complimentary, strengths. The standard antenna is more sensitive to metallic targets, while the cross-polarized antenna can make it easier to resolve non-metallic targets and targets/layers beneath reinforcement. Use both antennas to make informed decisions.

Display Panel: Oscilloscope

The Oscilloscope waveform, or O-Scope, can be toggled on and off. When on, it will be displayed on the left side of the profile(s). With experience, the O-Scope can be used for a more nuanced data analysis.

The O-Scope displays the individual GPR trace associated with the backup cursor's current location. The vertical axis mirrors the scan's depth scale, with increasing depth from top to bottom. The width of the O-Scope peaks represents amplitude. Stronger reflections, such as from metal, create larger O-Scope peaks on both sides of the centerline. phase is represented by the peaks on either side of the centerline. Peaks to the right indicate normal phase, while peaks to the left indicate negative phase. GPR reflections always occur as a series of three peaks.

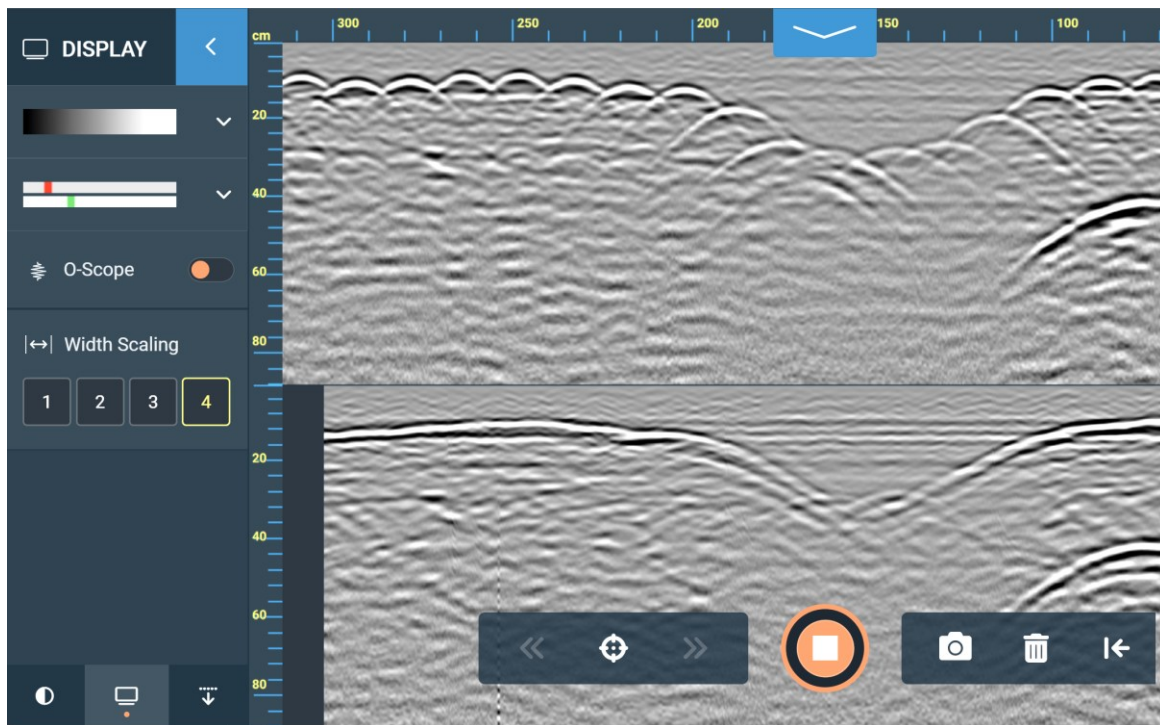


The O-scope is a visualization of the raw data collected by the Flex system. With practice you'll find that the O-Scope is essential for advanced analysis and aligning the horizontal Target Marking line with a target's highest amplitude peak. It is also helpful to use the O-Scope when performing functions like hyperbola Matching and Set Depth. Lastly, the O-Scope can provide information on data quality, depth penetration, and the presence of external electromagnetic interference. Periodic external noise (such as cellular network communication) will make the O-Scope look 'jittery' and jagged, while continuous external noise (such as radio and television transmissions) can cause the O-Scope to shift off the centerline.

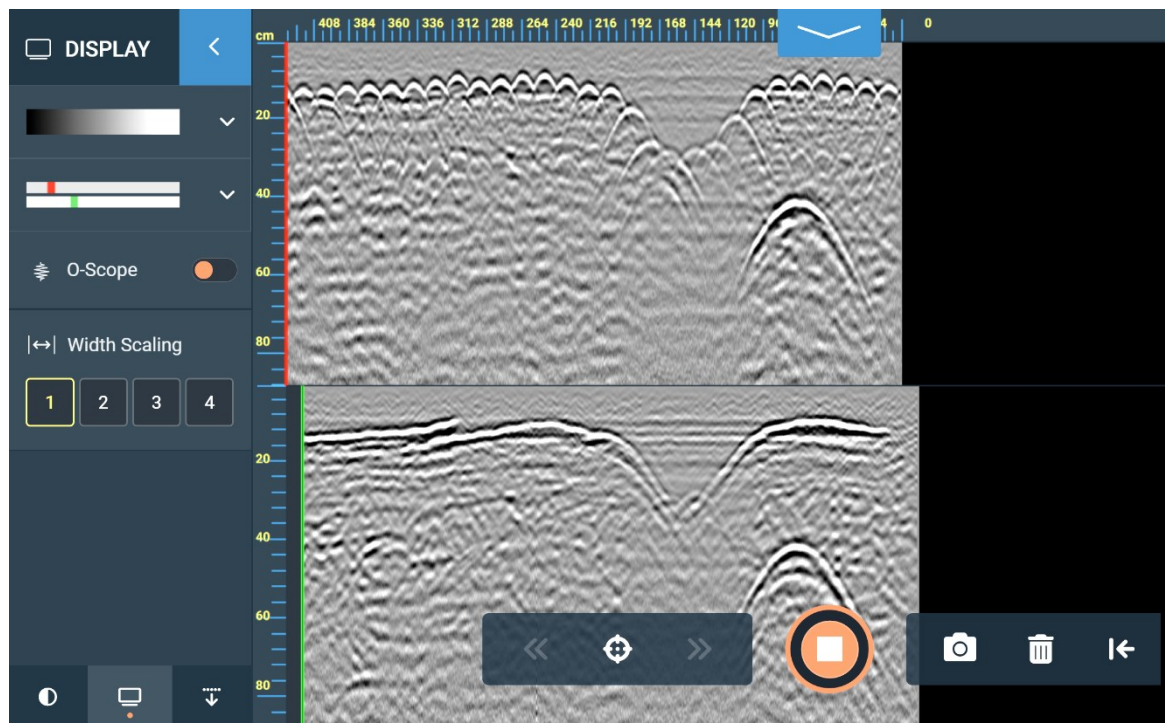
Display Panel: Width Scaling

Use the four Width Scaling options to compress or stretch 2D profiles. Option 4 represents the default horizontal scaling for Flex NX and Flex LT, displaying a scan density of 4 scans/cm. Options 3, 2, and 1 compress the horizontal scale in increasing amounts. Width Scaling can be adjusted during data collection and Playback, and the last used collection setting will persist through reboot. Note that Width Scaling only affects the display of 2D data; exported 2D data (in .DZT format) are not affected and will retain their original 4 scans/cm scaling.

Width Scaling is a helpful data collection and interpretation tool. By compressing the horizontal scale you can observe subtle changes in layers that are more difficult to detect when stretched out, or compress longer profiles so you can view longer sections without panning. In contrast, stretching profiles can help to separate closely spaced targets and provide more visual detail. Alternatively, use the four Width Scaling options to fine-tune your preferred hyperbolic target width.



Width Scaling Option 4: original scan density of 4 scans/cm



Width Scaling Option 1: maximum compression applied to the horizontal scale.

Side Navigation: Depth Panel

DEPTH OPTIONS	The Depth Panel provides three options for adjusting the dielectric constant and thereby refining your depth readings. From least accurate to most accurate, the choices are Concrete Cure, Matching, and Set Depth.
☐ Concrete Cure	Concrete Cure applies a predefined dielectric based on established values.
 Matching	This can be an accurate method, but it relies on knowledge of the state of concrete curing.
 Set Depth	Matching involves fitting a digital hyperbola to a target in your data. This is an accurate and widely used method for calibrating the depth scale.

Set Depth is the most accurate method, but it requires a physical measurement of the depth of a target. This information is not always available, so Matching is usually a more appropriate choice.

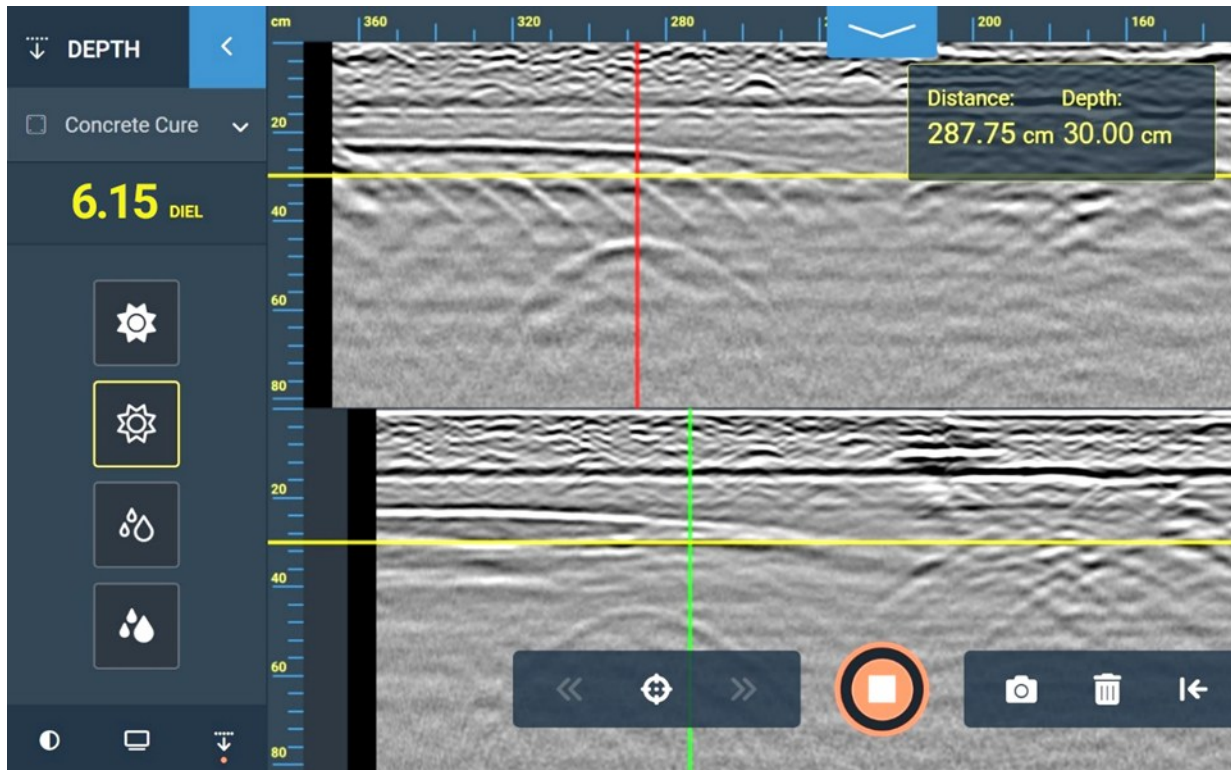
Depth Panel: Concrete Cure

Concrete Cure is the simplest, yet least accurate method for calibrating the depth scale. You will be prompted to select Concrete Cure when starting a new 2D scan from the Main Dashboard or Project Profile screens. Use your knowledge of the age and condition of the concrete to inform your decision. Select a Concrete Cure by using preset dielectric values based on four standard concrete curing stages: Very Dry (4.6), Moderately Dry (6.15), Damp (7.45), and Wet (14.2). Alternatively, select Last Used to import the most recent dielectric from another scan or session.

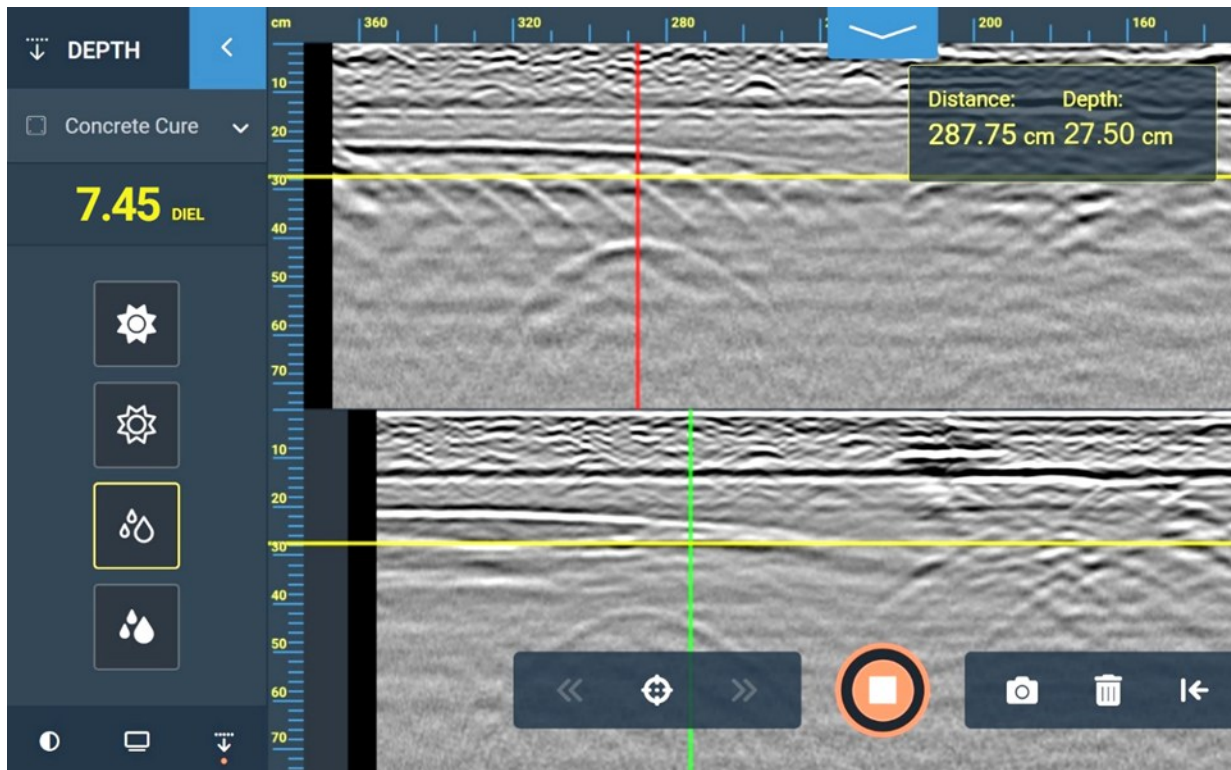
Using one of the preset Concrete Cure types will only adjust your depth scale; it will not affect the GPR data quality. In the images below, note how a change in Concrete Cure Type expands the depth scale but does not visibly alter the GPR data.



We recommend starting with Moderately Dry (6.15 dielectric) for most concrete types. However, not all concrete slabs are the same. Consider using the Matching tool (Page 58) if you cannot readily determine the concrete curing state. Once an accurate dielectric is established, the targets in the slab will be displayed with a more accurate depth. We recommend using the Depth Panel options any time you are scanning a new slab.



Concrete Cure set to Moderate Dry. The yellow cursor is placed at 30.00 cm below the surface.



Concrete Cure set to Damp. The yellow cursor is now located at 27.50 cm below the surface. The GPR data have not changed, but the depth scale has been updated.

As the dielectric value increases, the calculated depth of targets becomes progressively shallower. This effect is due to the slowing of the GPR wave in higher dielectrics. For example, using a dielectric of 4.6 (Very Dry) a target is observed at 35 cm deep. Changing the dielectric to 6.15 (Moderate Dry) changes the target's depth to 30 cm. Dielectric values of 7.45 (Damp) and 14.2 (Wet) reduce the target's calibrated depth to 27.5 cm and 20 cm, respectively.

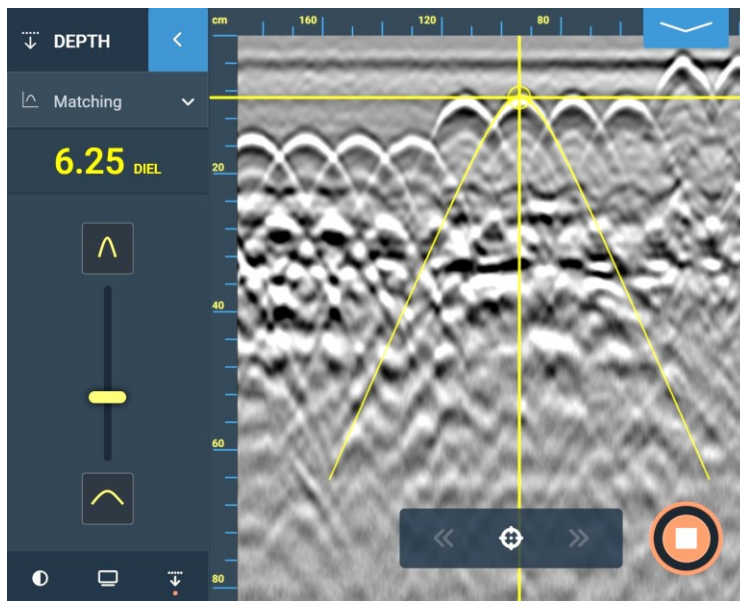
The takeaway point is that the dielectric value can dramatically change the depth reading for a given target. The target itself is not changing its true depth, but Flex NX and Flex LT are using the available information to calibrate the depth scale. A more refined dielectric value will greatly improve the overall depth accuracy, leading to improved markouts and increasing safety for cutting, coring, and drilling teams. Selecting a Concrete Cure Type is a good first step, but it should always be followed by Matching and Set Depth (when possible).



GPR effectiveness improves as concrete continues to cure. GPR depth and data quality are reduced when scanning green (uncured) concrete due to enhanced electrical conductivity.

Depth Panel: Matching (Hyperbola Fitting)

Improve the depth accuracy of targets by using the Matching tool. For best Matching results, we recommend using the standard antenna in single channel mode.



During collection, locate a hyperbola in your profile. It must represent a target scanned perpendicular to its length. If you are unsure whether you are scanning perpendicular to the object, scan it at multiple angles and find the scan angle that produces the narrowest hyperbola. This is the perpendicular scan.

Alternatively, locate a target and mark it on the slab. Collect an adjacent scan and mark the target again, then draw a line between the marks. Use this method to accurately determine a target's orientation.

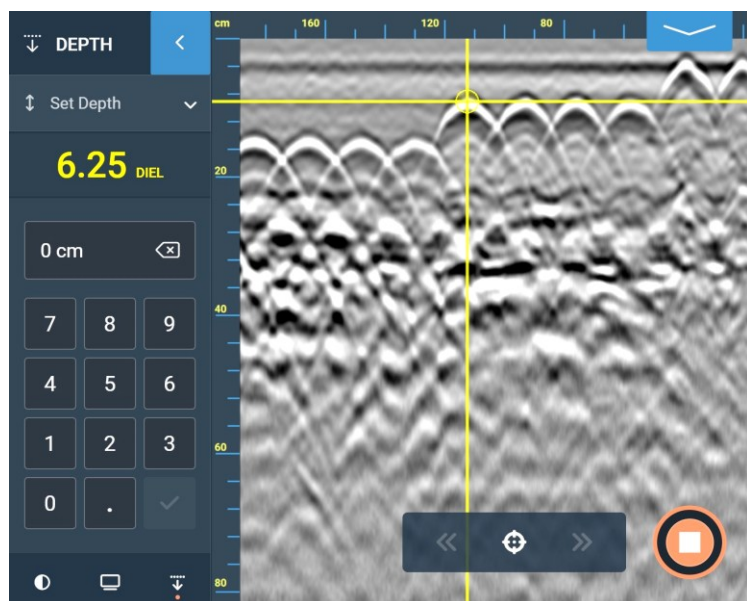
To use the Matching tool, use your finger to position the crosshair and the digital hyperbola overlay at the peak of the first brightest band of color. Use the O-Scope (see Display Panel, page 53) to assist with placement.

Use the vertical slider to narrow or widen the hyperbola overlay. As you reshape the hyperbola the dielectric value and depth scale will update in response. Match the shape of the hyperbola overlay to the tails of the target hyperbola. Target depths will now be more accurate, and the Last Used Concrete Cure Type option will be updated to the new dielectric value.



Use the Matching tool on multiple hyperbolas to check your accuracy. If your results are inconsistent, you have likely crossed targets at an incorrect angle. In other cases, using Matching on a shallow target with a large diameter could skew the depth scale.

Depth Panel: Set Depth



For homogenous materials, like most concrete, you can greatly improve depth accuracy by using the Set Depth tool. For best results, use only the standard orientation antenna in single channel mode. In some situations, the true depth of a target can be determined through drilling or observation of slab edges.

To use this feature, scan over a target with an established depth. Collect enough data on either side of the target to fully image the resulting hyperbola.

Use your finger to tap the screen, then drag the crosshair to the top center of the hyperbola. Align the cursor with the first strongest band of color; this band corresponds with the top of the target. Use the O-Scope to assist with cursor placement.

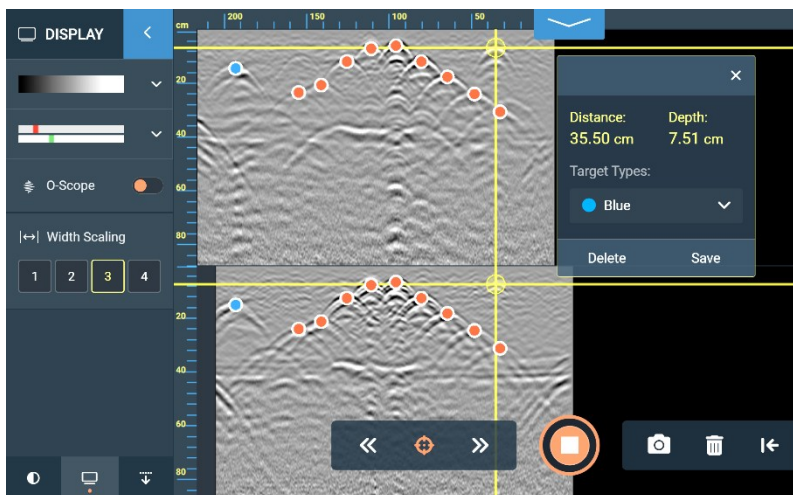
Using the number pad, type in the known depth of the target. This process will update the dielectric and calibrate the depth scale. Target depths will now be more accurate, especially in homogenous concrete.



The Set Depth tool is only applicable to a target of a known depth; it will not be useful in all cases. Avoid entering a depth based on assumptions or guesses. When in doubt, use the Matching tool instead of Set Depth.

Target Marking

Use the Target Marking feature to place user marks in your data. These points will assist in marking, referencing, or plotting the distance along the profile and depth below surface of features of interest. Consider using specific colors for target interpretations. Your on-screen marks will appear in screengrabs, as will target crosshairs if visible at the time, and can be useful additions to project Results.



Target Marking Icons

Disabled



Enabled



To mark a target, activate Target Marking by tapping the Target Marking icon. Tap the screen and then drag your finger to place the crosshair over a target of interest. As with other target-related functions, like Matching and Set Depth, place the crosshair at the center of the hyperbola and within the first strongest color band. Use the O-Scope to fine-tune crosshair placement.

In the accompanying popup window, you'll see the target's distance along the profile and its depth. Note that the depth reading is only as accurate as the current dielectric value. If in doubt, use Matching or Set Depth (where applicable) to refine the dielectric and improve depth accuracy. Reposition the popup by tapping and holding the top of the window with one finger, then moving your finger to drag it to a new location.

You can also select a target color from the dropdown menu. We recommend using designated colors for specific target types, such as red for conduit and blue for reinforcement. Press Save to place the mark or Delete to discard it.

Use the Previous Target / Next Target icons (found on the Bottom Navigation Bar) to quickly jump between multiple targets within a single scan.



In the System Settings screen, try assigning the Mark function to one of the Flex NX, Flex LT, or satellite antenna's programmable buttons. Using the assigned Mark button during 2D collection will place a dotted vertical line in your data, but it will not place discrete target marks as would Target Marking Mode.

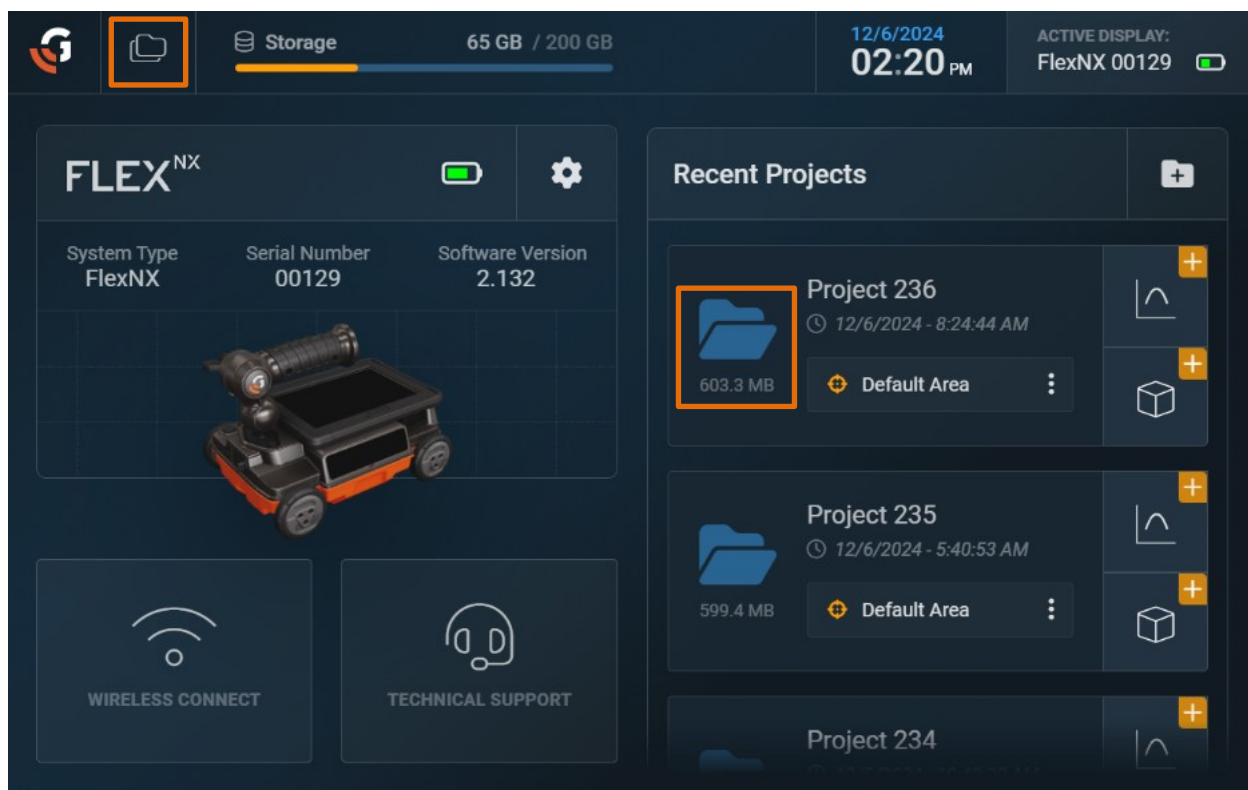
2D Remote Control (Flex NX Only)

2D Remote Control is an enhanced version of Screen Mirroring (Page 33), allowing display and control of 2D collection on a Wi-Fi enabled phone, tablet, or computer. Use this feature with Flex NX, or with a paired and active NX15 or NX25 satellite antenna.

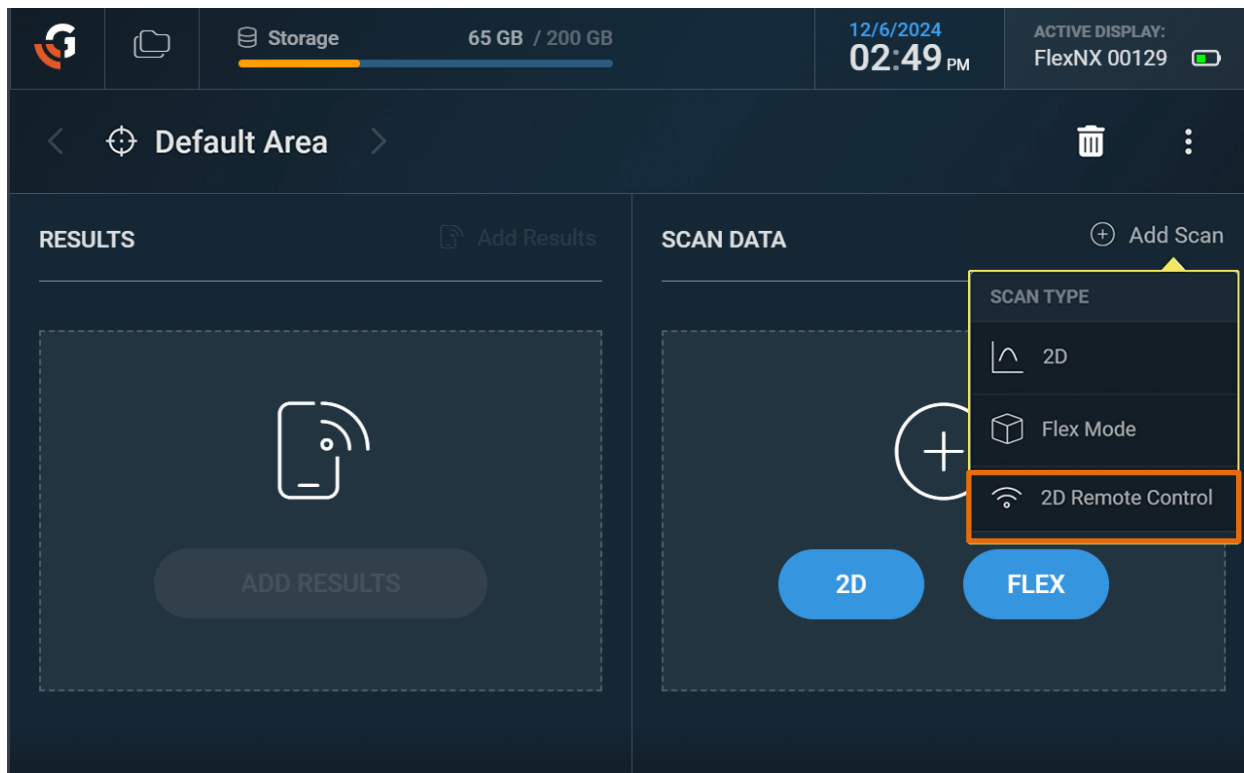
Try 2D Remote Control using a tablet for a larger viewing screen, or a smart phone for a lighter and more portable display.

Flex NX must remain powered on when using 2D Remote Control. However, as long as you are within 65 feet (20 meters) of Flex NX you can scan with a satellite antenna and mobile device without bringing Flex NX with you. This is especially useful when scanning on scaffolding or ladders, or in other dangerous, elevated, or confined situations.

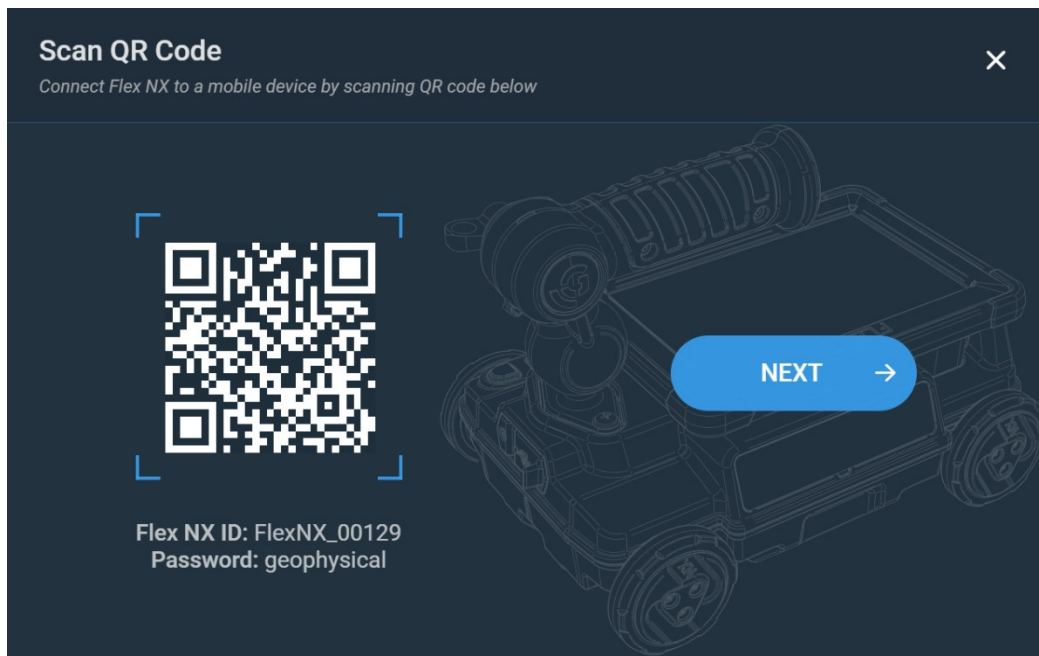
Step 1: Open a Project Profile from the Main Dashboard's Recent Projects Pane by tapping a folder icon, or from the Top Navigation Menu by tapping the double folder icon and on the next screen selecting a project from the Project Portal.



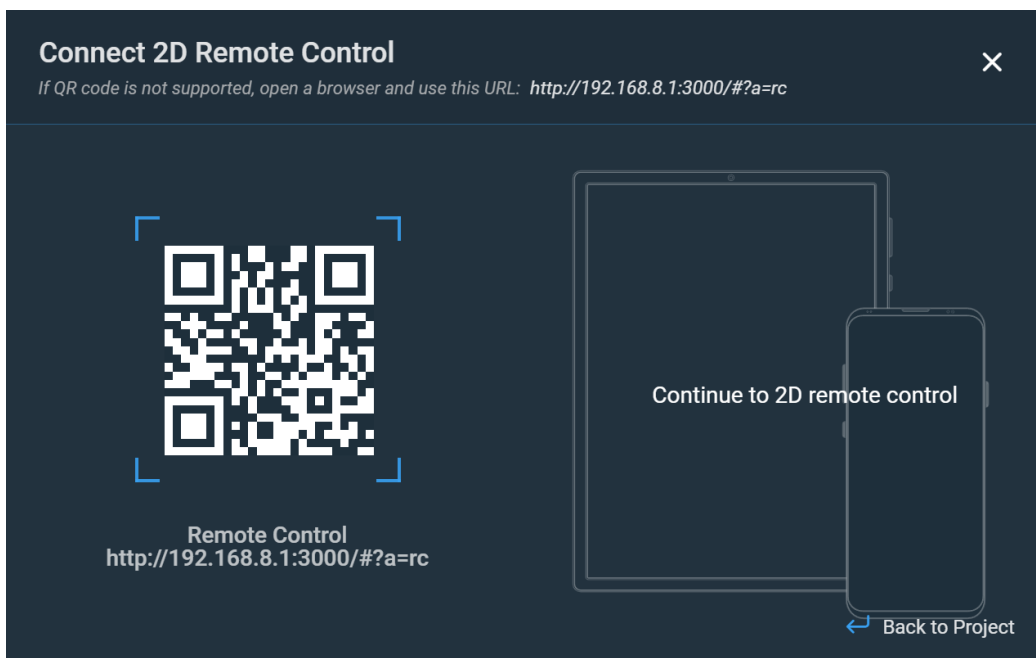
Step 2: Tap Add Scan and select 2D Remote Control.



Step 3: Scan the QR code to connect your mobile device to the Flex NX Wi-Fi network. Tap Next.

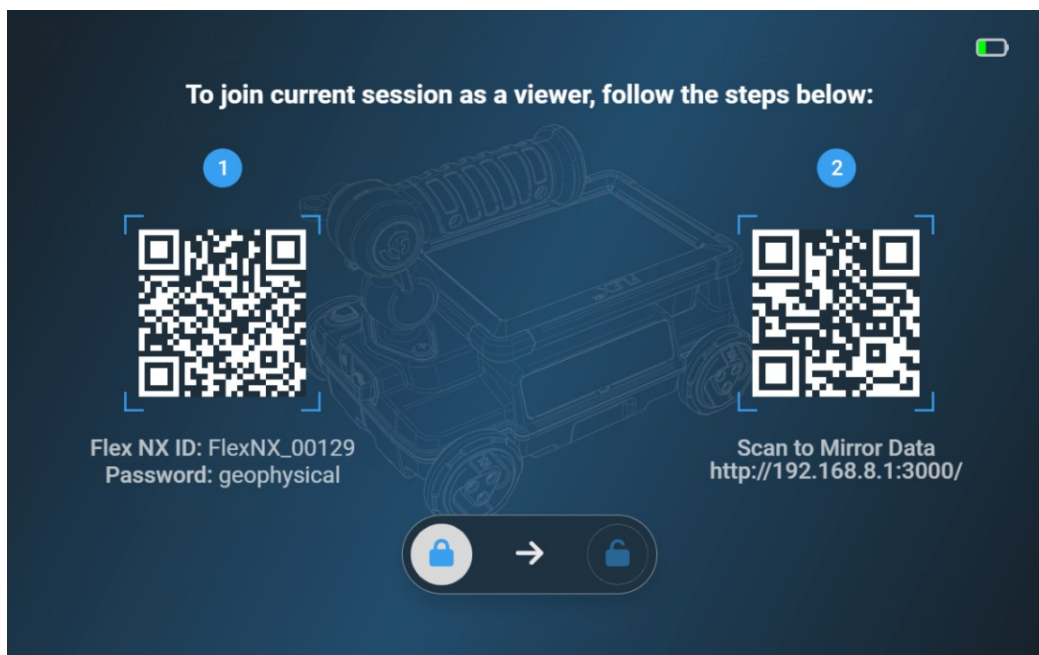


Step 3: Scan the new QR code. This will open a web browser on your mobile device and load the Flex NX 2D Data Collection screen. Flex NX is now ready to collect data and display live scans on your device.

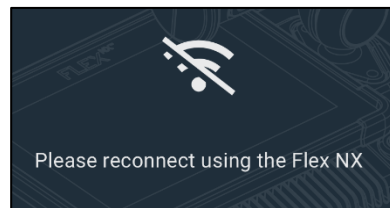


NOTE: If you are using a computer or mobile device without a QR Code scanner, connect to the Flex NX Wi-Fi network using your device's network settings. Additionally, you must open a web browser on your mobile device and type in the address shown below the second QR code.

When a remote device is connected Flex NX will display a lock screen and QR codes for Screen Mirroring (display only; no controls). Use these QR codes to allow other people to view data.



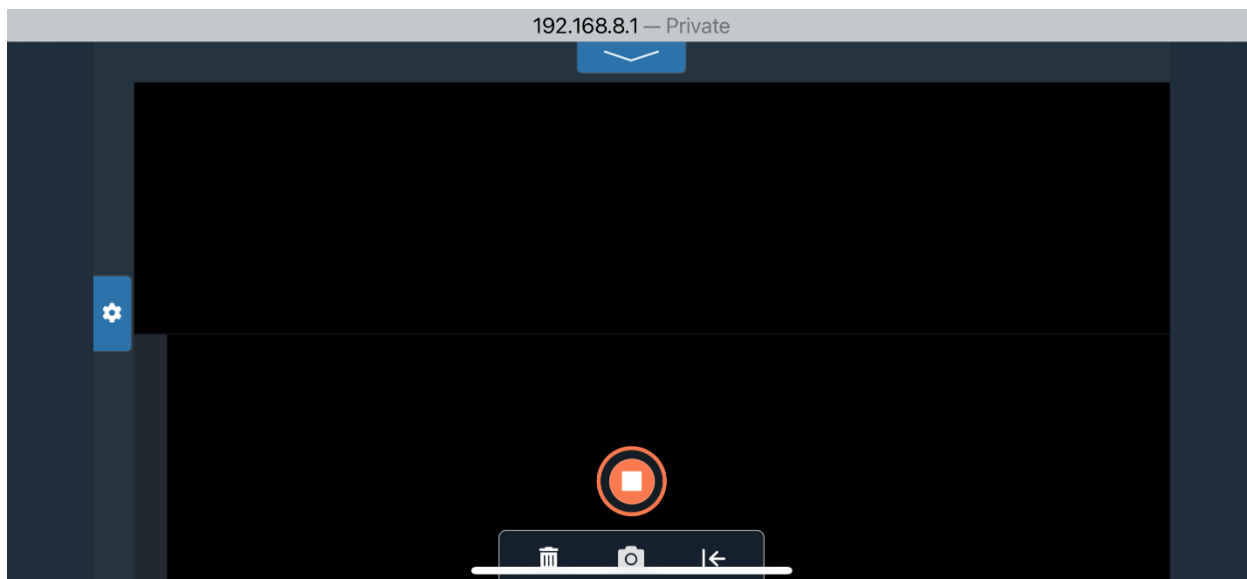
Use the slider to unlock Flex NX and access settings, project management tools, and other features. When Flex NX is unlocked your mobile device will display a screen notifying you to “Please reconnect using the Flex NX”. Your device will still be connected to the Flex NX Wi-Fi network, so you can access 2D Remote Control by following the steps outlined previously.



To better support smaller device screens (such as smartphones) 2D Remote Control requires your device to be in landscape orientation. If your device is in portrait orientation you will see an on-screen indicator prompting you to reorient the screen. We recommend using your mobile device’s rotation lock to maintain landscape orientation.

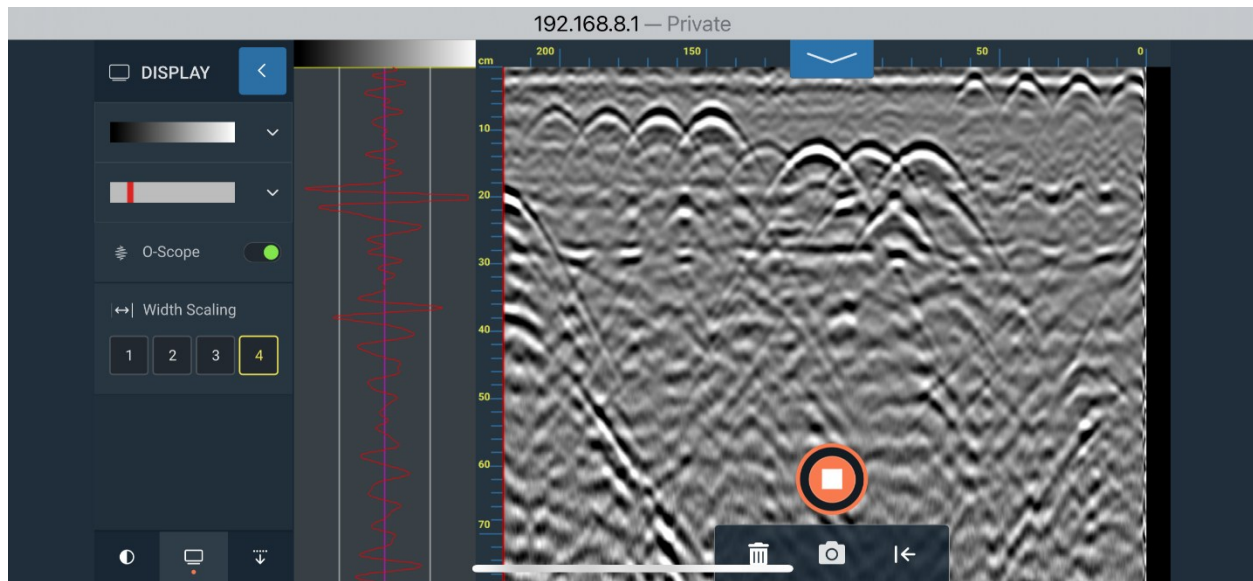


Once connected to 2D Remote Control, your device will display an empty 2D data collection screen with Start Scan already enabled. From this screen you can access the Top Navigation Menu, the Left Flyout Menu, Start/Stop Scan, and the lower control bar (Delete Scan, Screengrab, and Fast Forward). Target Marking is not available in 2D Remote Control.



Move Flex NX forward to begin collecting a scan. By default the display will show both data channels. For an optimal viewing experience GSSI recommends hiding your browser’s address bar to maximize the data display on smaller screens, though this may only be possible using certain web browsers. GSSI suggests using Safari on an IOS device, and Chrome for Android.

From here, the data collection experience is nearly identical to Flex NX. Use pinch zoom gestural controls to zoom in or out. Use the Top Navigation Menu to view Project and File information and battery status for Flex NX, NX15, or NX25. The Left Flyout Menu provides access to the Gain, Display, and Depth menus.



2D Remote Control data can be live-shared using an internet-connected device and a variety of 3rd party applications, such as FaceTime. GSSI does not guarantee the quality or performance of live streaming from 3rd party applications.

Flex Mode (Flex NX Only)

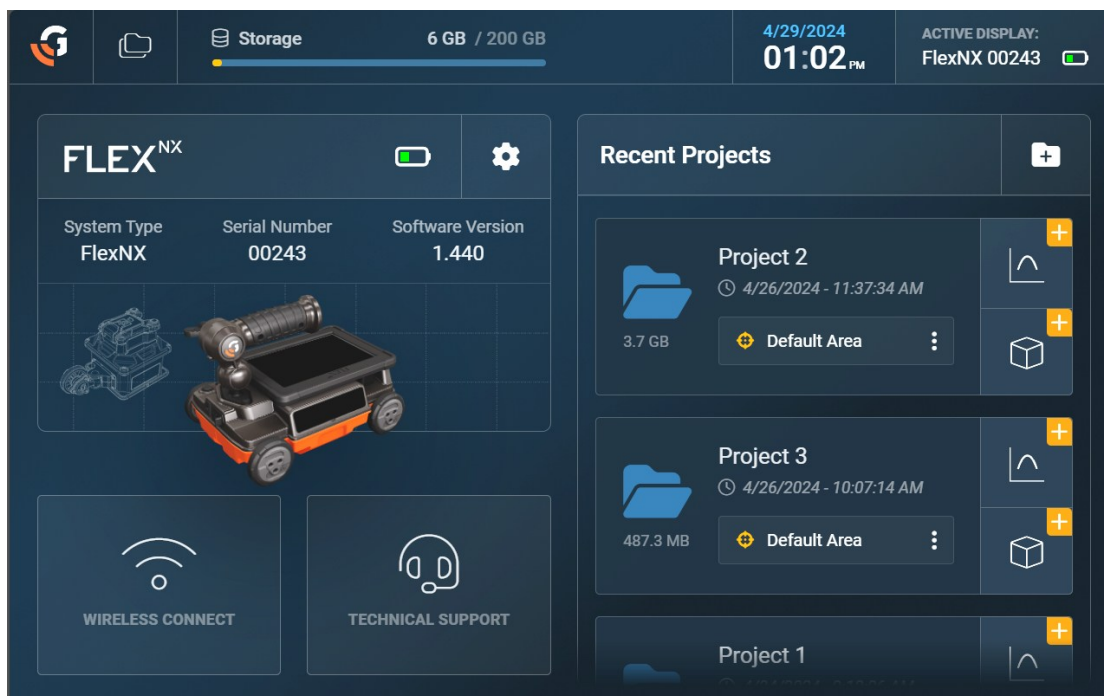
Flex Mode is a rough-out tool built around fast data collection and maximum flexibility. The main purpose is to quickly generate a detailed view of slab contents, thereby providing enhanced mission planning for traditional 2D markouts. A combination of slice-based and rotatable 3D volume views sets the stage for more informed on-slab marks and ultimately a more streamlined GPR workflow.

Marking targets within and below concrete typically requires real-time data interpretation. The best method for accurate target delineation is to use 2D GPR data, whereby target locations, depth information, and other characteristics are presented to the user. However, 2D data interpretation is difficult in complex situations such as congested slabs or when post-tensioned cables or electrical conduits are present. Flex Mode provides a top-down roadmap that adds additional visual information to augment, but not replace, 2D scanning.

Flex Mode incorporates a vision positioning system that replaces traditional grid layout and paper grid pads. In addition, Flex Mode uses both of the Flex NX antennas to generate 3D data.

Starting Flex Mode Collection

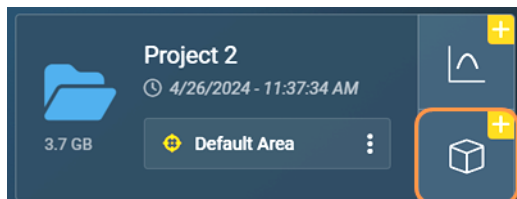
Much like starting a 2D scan, Flex Mode is accessed from the Main Dashboard. To begin, look for the Recent Projects pane on the right side of the screen. Each listed project will display 2D and 3D icons. Use an existing project or create a new project to get started.





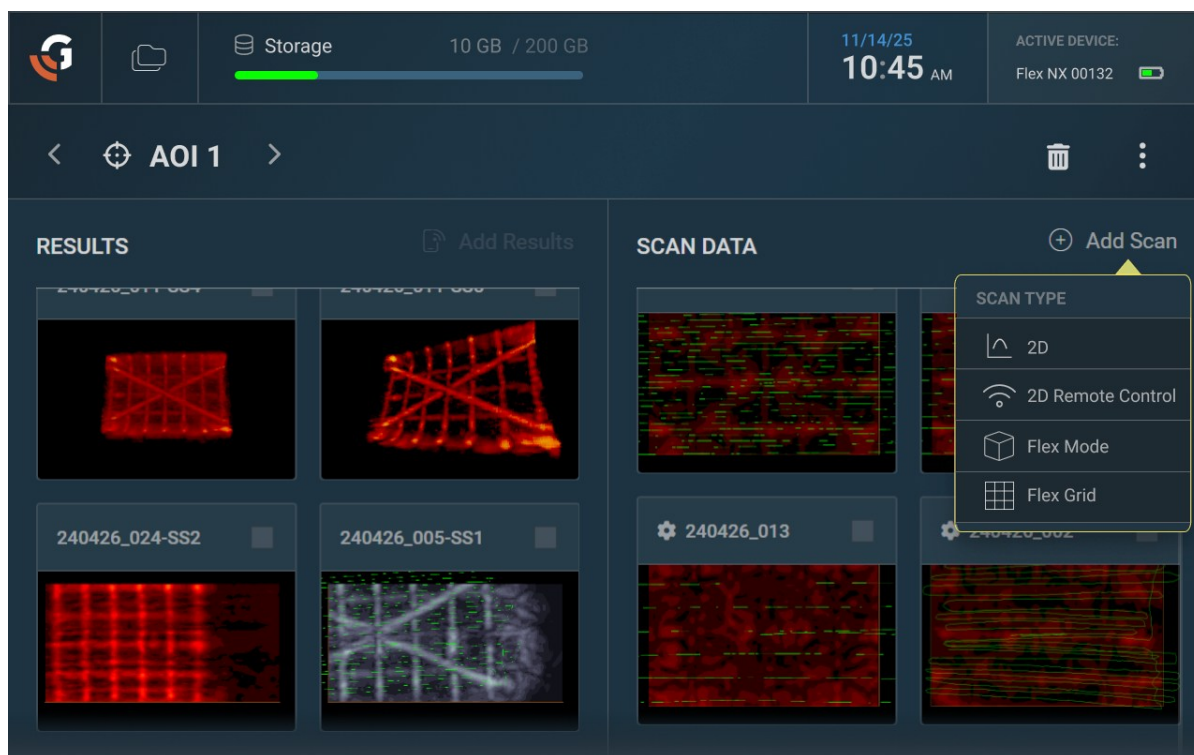
NOTE: Flex satellite antennas, such as NX25 and NX15, cannot collect Flex Mode data. When satellite antennas are the Active Device the Flex Mode icon will be inaccessible.

Before You Scan



To quickly start a new Flex Mode scan from the Main Dashboard, locate the Recent Projects pane and tap the 3D Cube icon on the project of your choice.

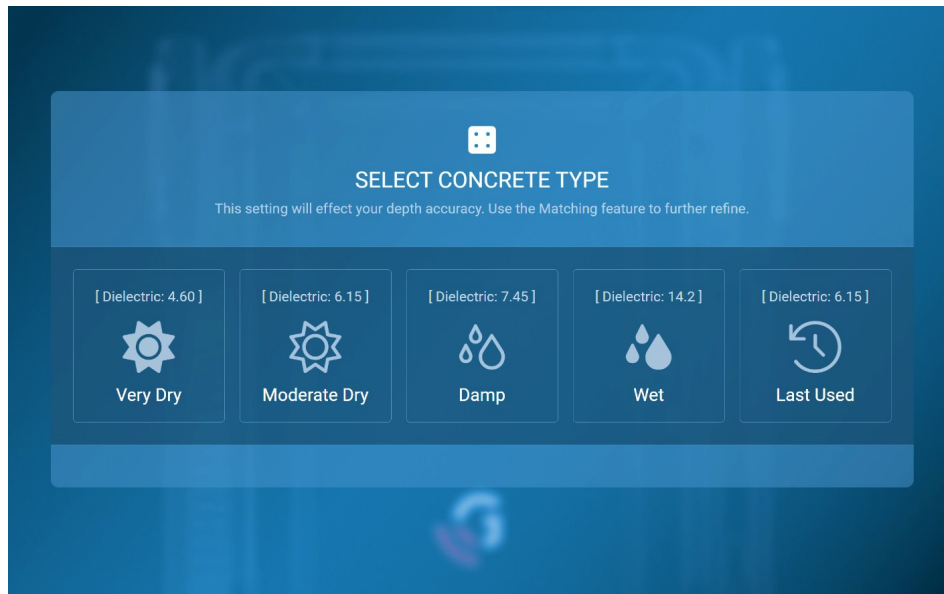
You can also start a new Flex Mode scan by opening a project folder from the Projects Portal. Tap Add Scan and select Flex Mode to proceed.



Tap the Flex Mode icon from either location to bring up the Select Concrete Type screen. Select a Concrete Type that best represents your working conditions. **Note:** this will affect Flex Mode image quality, and GSSI recommends selecting an accurate dielectric value.

Use your knowledge of the age of the slab and choose Very Dry (4.6), Moderately Dry (6.15), Damp (7.45), or Wet (14.2) concrete types or select Last Used. Flex Mode uses Dielectric constant for depth calibration and image quality. By selecting a Concrete Type you are setting an estimated dielectric constant, which could greatly impact your Flex Mode experience. GSSI recommends first

collecting a 2D scan and establishing an accurate dielectric using the Matching tool (Page 77). You can then start Flex Mode and choose Last Used from the Select Concrete Type screen.



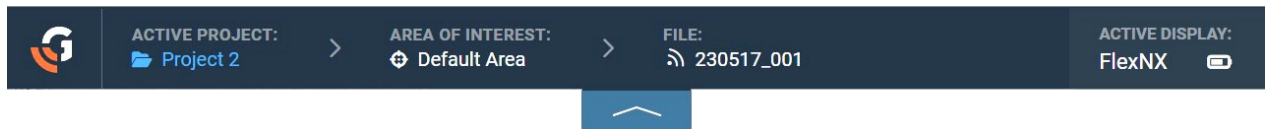
Flex Mode Data Screen and Basic Collection

When starting a new Flex Mode scan you'll see the calibration screen, with Flex NX in the center of the 60cm x 120cm (24in x 48in) orange scan area. The first step is to calibrate the vision positioning system, allowing Flex NX to locate its position within the physical scan area. Calibration is required for each new Flex Mode scan.



Top Navigation Panel

The Top Navigation panel, located at the top of the screen, can be accessed during data collection and playback. Refer to this panel for project, file, and AOI information and to return to the Main Dashboard



Tap the Top Navigation Access icon  to display the following:

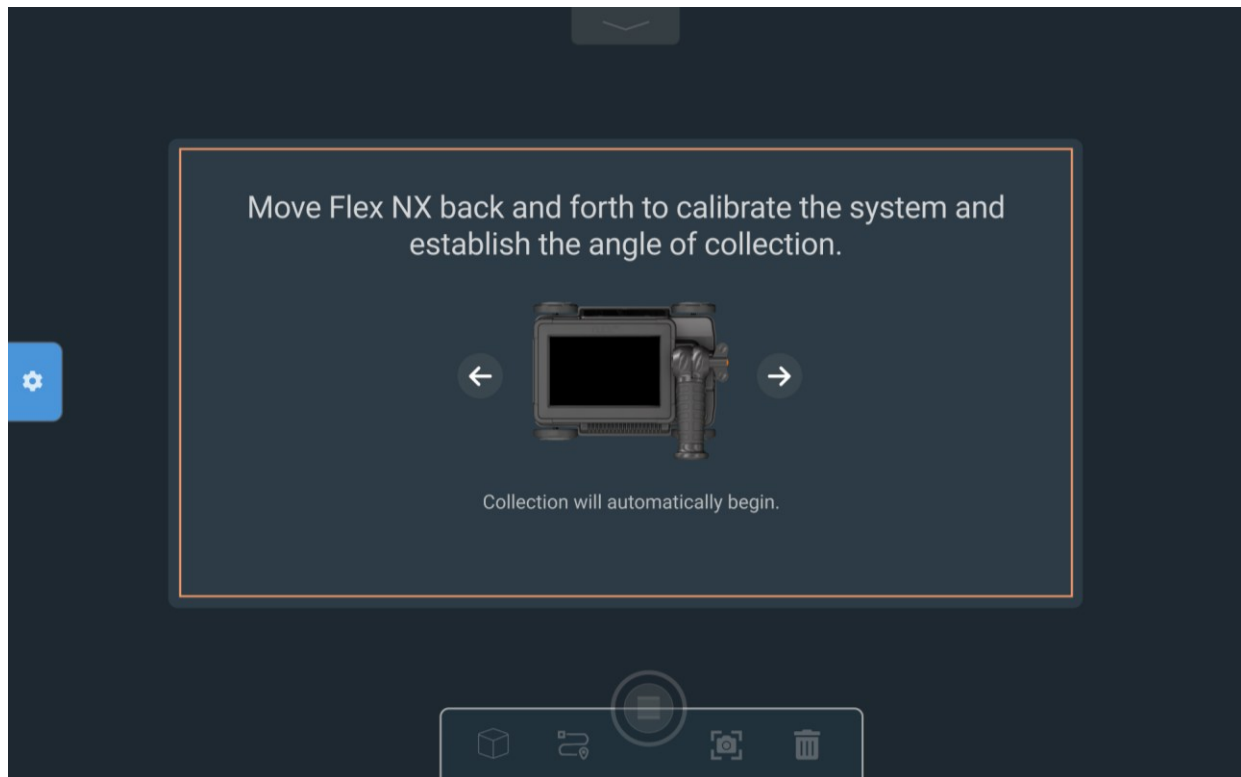
Top Navigation Icons and Controls

	Return to Main Dashboard. Tap to exit Flex Mode collection or playback and return to the Main Dashboard.
ACTIVE PROJECT:  Default Projec... >	Active Project. Tap the Project name to access the Project Profile and view the current project's saved content. From here, you can access Results and Scan Data saved to Areas of Interest or collect a new 2D or 3D scan.
FILE:  240426_015	Current File. View the name of the current file. Data files are named incrementally based on the calendar date and the order of collection. The naming prefix uses two numbers each for year/month/day, followed by an underscore and the file number.
AREA OF INTEREST:  Area 3 >	Area of Interest. Displays the current AOI. You will see Default if no Areas of Interest were created. Tap to open the Project Profile.
CURRENT DISPLAY:  FlexNX  	Current Display. View the currently active device and its battery status.

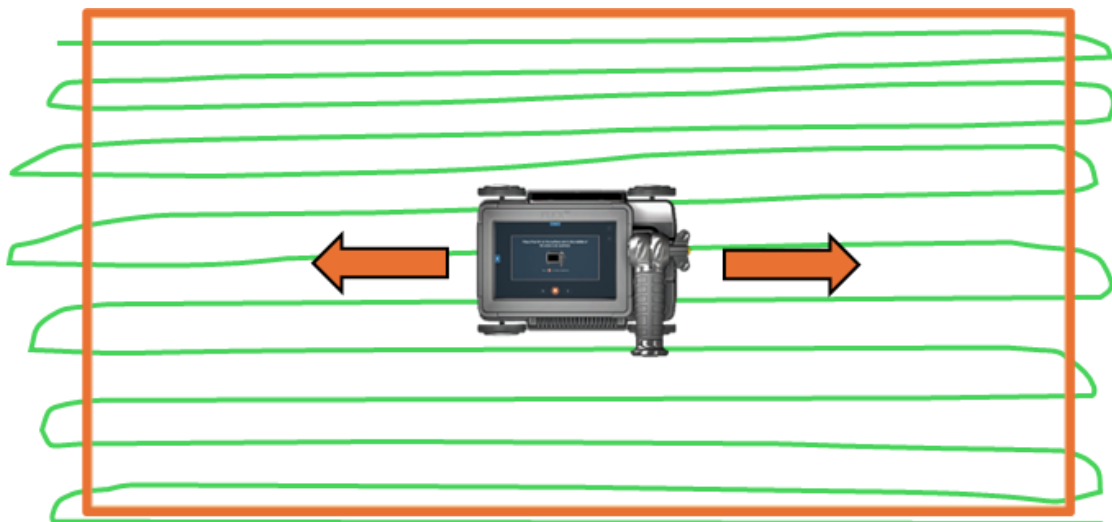
Calibrating the Flex Mode Vision System and Trackline Coverage

When you are ready to scan, place Flex NX in the **center** of your intended scan area. Note that Flex Mode incorporates a 2ft by 4ft (60cm by 120cm) bounding box representing the maximum viewable area. Flex NX will record tracklines outside this area but data will only be shown within the boundary. When calibrating the vision system, Flex Mode aligns the bounding box relative to Flex NX. To help explain this concept, imagine that Flex NX had laser lines creating a 2ft by 4ft box around the system. If Flex NX was rotated the box would rotate with the system. The 2ft sides of the rectangle are always facing the front/back of Flex NX, while the 4ft sides are always parallel to the left and right sides. The rectangle's orientation is locked once calibration is completed.

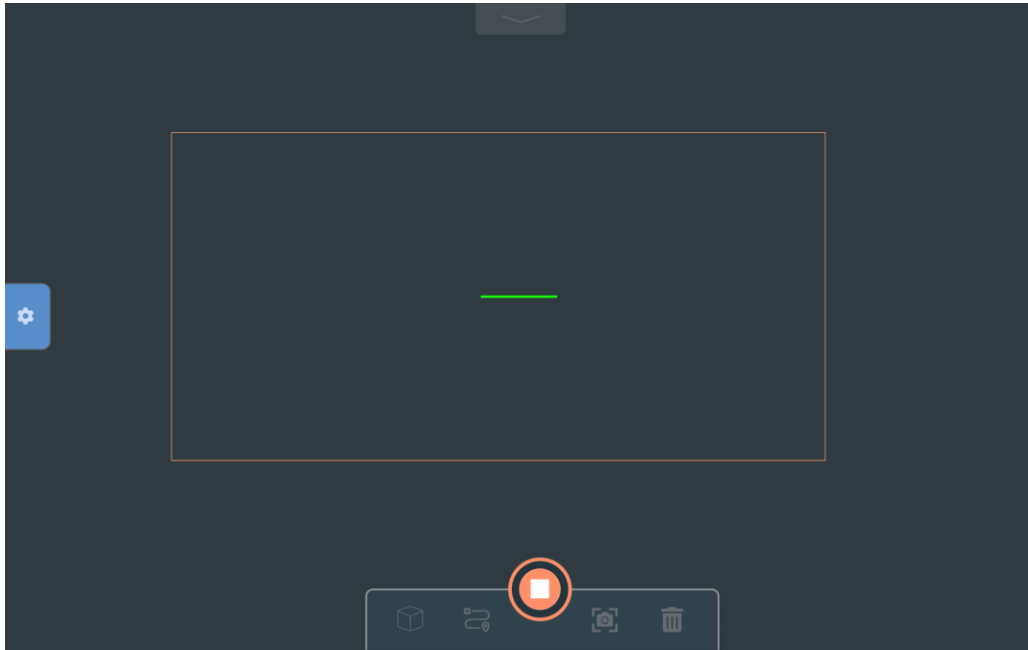
Tap the plus sign to begin Flex Mode collection and start the calibration process. You will then see a calibration instructions window prompting you to move Flex NX back and forth to calibrate the vision system. Wait for the window to disappear before moving Flex NX.



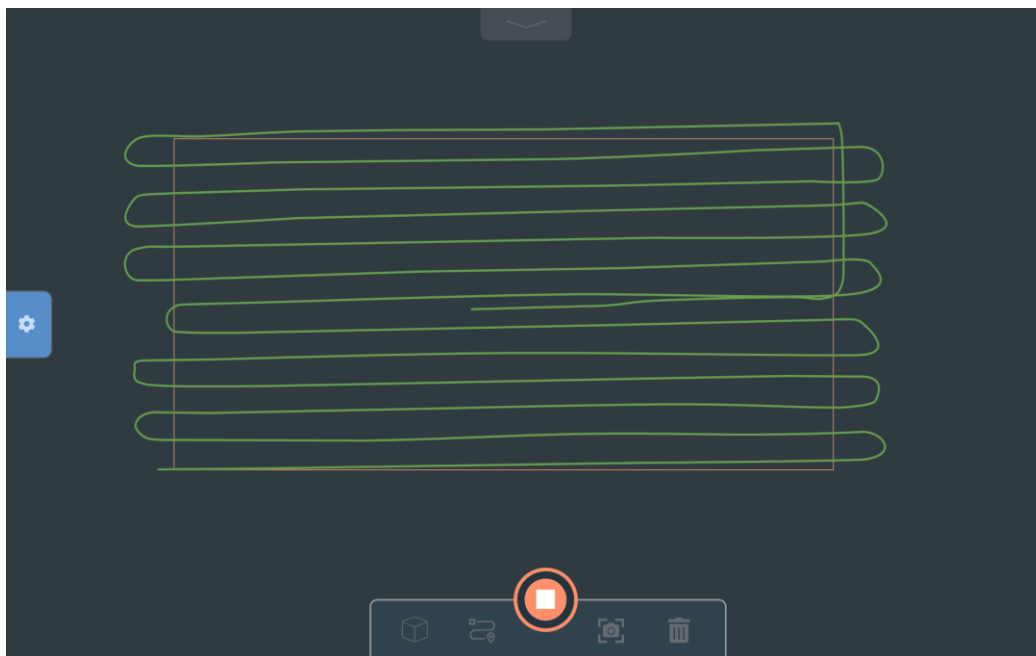
Calibration should follow the orange arrows, and data collection should follow the green tracklines.



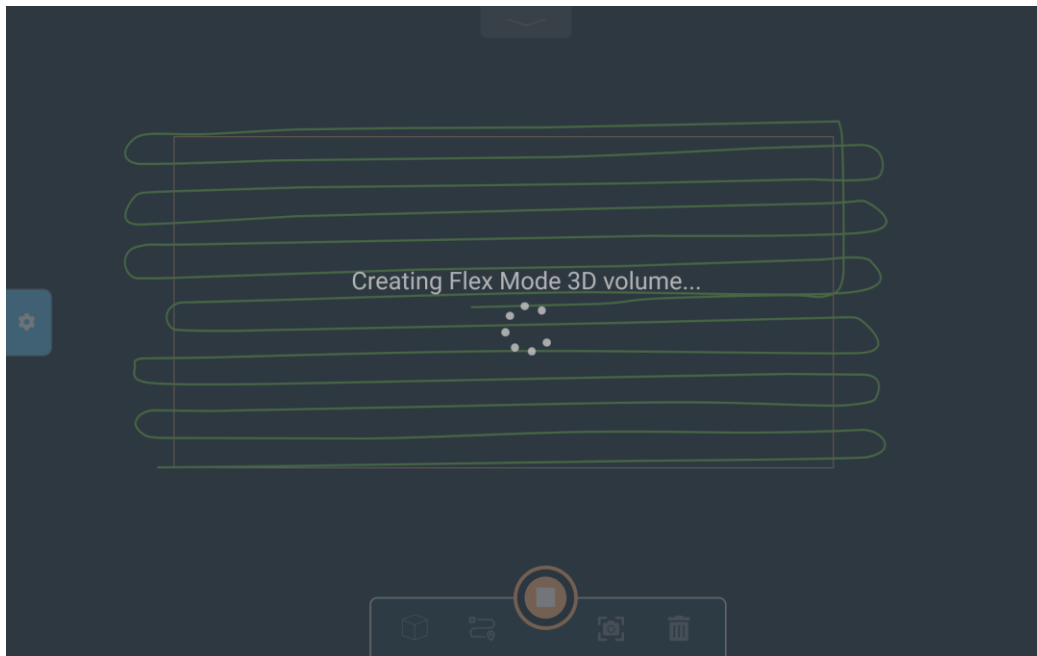
GSSI recommends quickly and repeatedly moving Flex NX forward and backward 1in (2.5cm) from Flex NX's initial position until the lasers activate and a green trackline appears on the screen. For best results, keep Flex NX in the center of the rectangle while calibrating. The green trackline indicates that the vision system is calibrated. Completely fill the 2x4ft rectangle by collecting tracklines parallel to the calibration direction. Do not lift Flex NX off the surface during collection and always maintain tight and even lines.



When you are satisfied with the trackline coverage you can tap the Stop Scan icon.

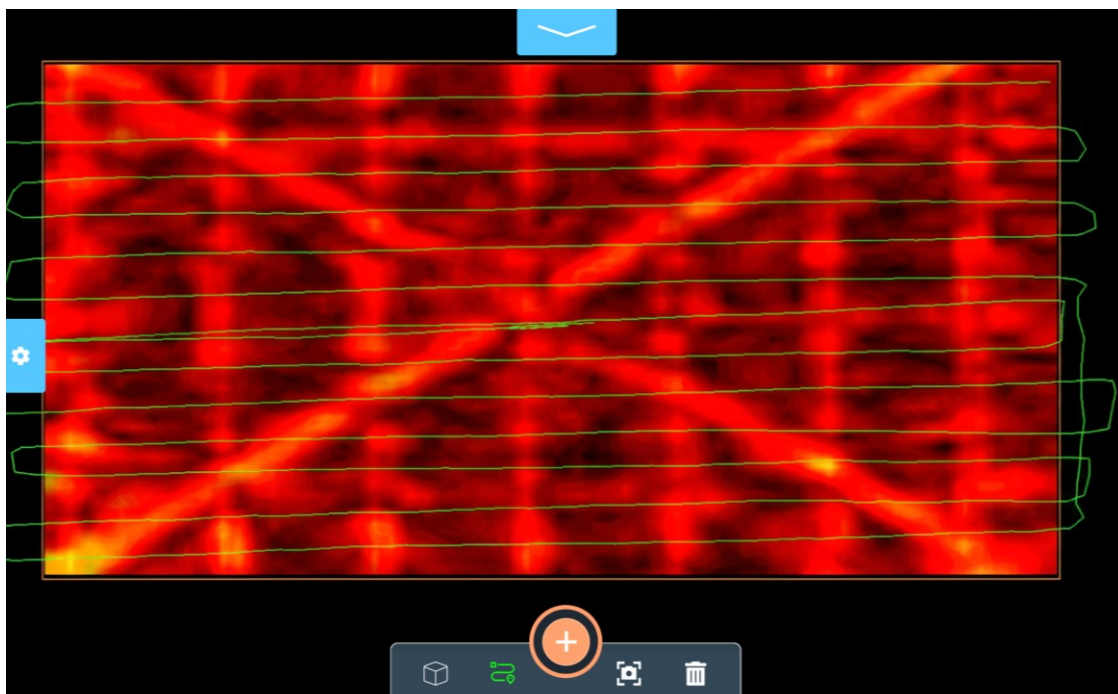


Flex NX will display "Creating Flex Mode 3D volume..." while the data are being processed.

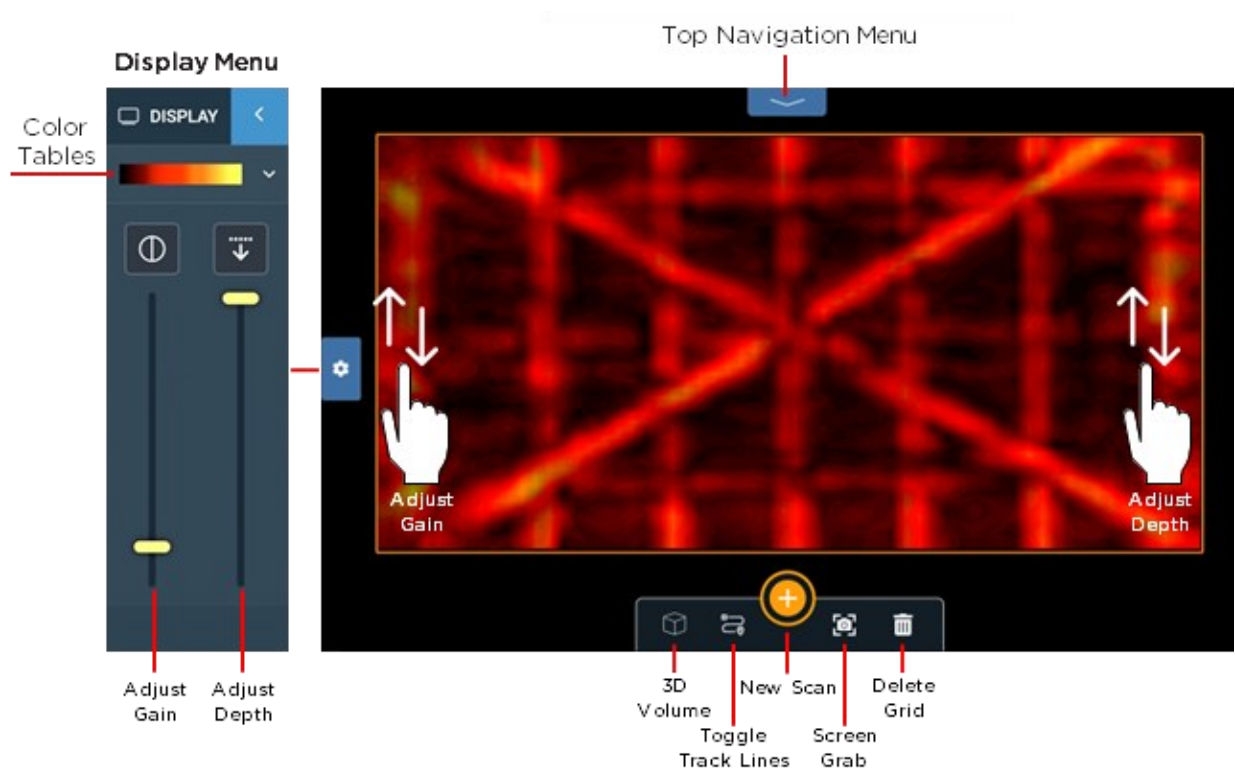


Using Flex Mode Top-Down View

After the data are processed you will see the slice data in Top-Down View, with a GPR slice in the background and green tracklines over the slice.



Interact with Top-Down View data using sliders in the Side Navigation Menu or gestural controls in the collection window.



Flex Mode Top-Down View features the following controls:

Flex Mode Navigation Menus: Top Down View



Top Navigation Icon. Tap to access Return to Dashboard, Active Project options, Area of Interest options, and File Information. Tap again to minimize the Top Navigation Panel.



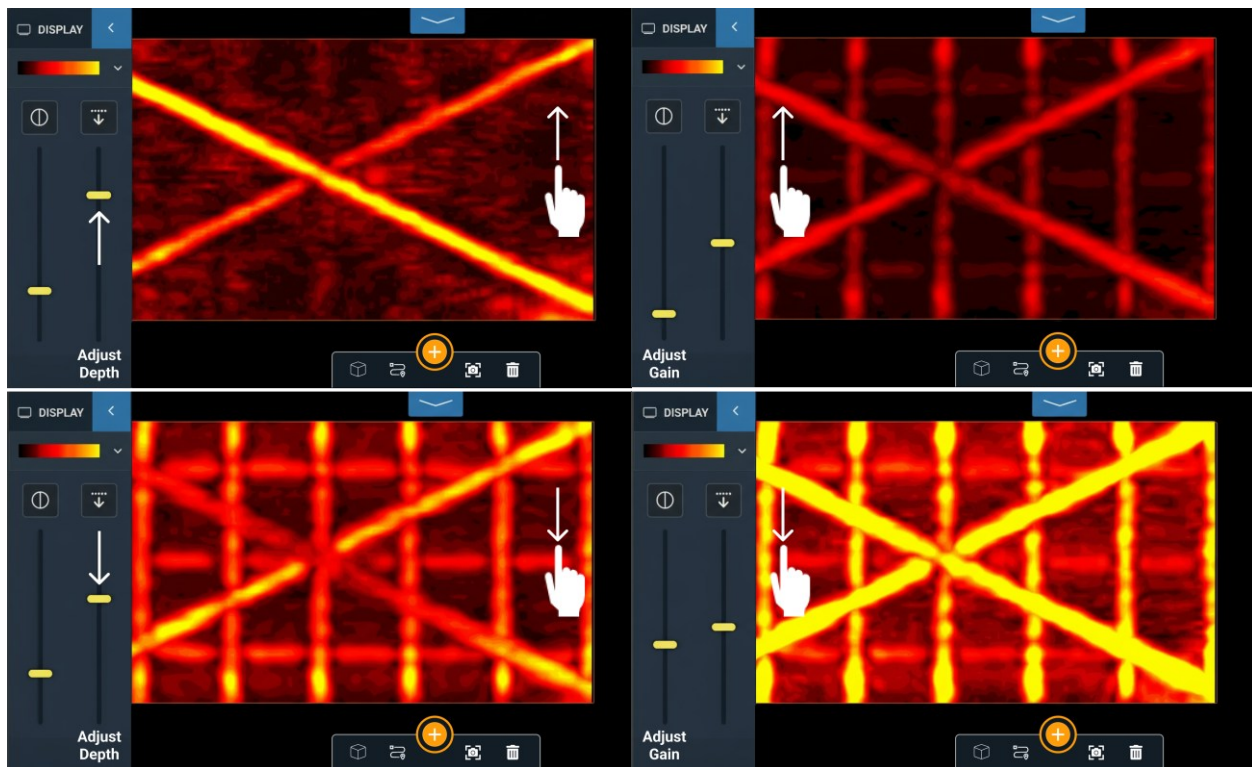
Side Navigation Menu. Tap to access color tables and the Gain and Depth sliders. Tap the arrow icon to hide the menu.

Flex Mode Collection Controls: Top Down View



Start/Stop Scan. Tap to start collecting a new Flex Mode scan. Tap again to stop file collection. Flex Mode scans are saved automatically.

	Toggle Tracklines: Tap to toggle tracklines off/on. Not available in playback.
	Toggle View: Tap to switch between Top-Down View and 3D Volume View.
	Screen Grab. Tap this icon to take a screen grab of the on-screen data. The Flex NX system will save the picture as a PNG image file for transfer. Screen grabs are saved to the Results section of the current Project and Area of Interest, and they will transfer with other files during data transfer.
	Delete Current Scan. Tap to discard your current Flex Mode scan.
Gestural Controls	Single and Multi-Touch Options: On right side of screen, slide one finger up/down to change slice depth. On left side of screen, slide one finger up/down to change gain levels.



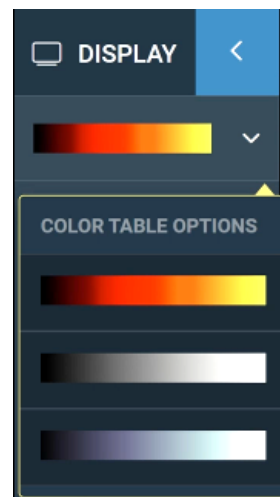
Adjusting Top Down View depth and gain with sliders and gestural controls.

To continue, toggle the tracklines off and use the settings menu or gestural controls to adjust the slice depth and gain levels. For depth slicing, navigate to the surface (shallowest slice) by moving the depth slider to the top or using one finger to swipe up from the righthand bottom of the screen. Next, slowly slice down through the data to visualize how targets are arranged vertically.

Use the gain slider to increase (move up) or decrease (move down) amplitude enhancement or use one finger to swipe up/down from the lefthand bottom of the screen. You might find that deeper slices require different gain adjustments. The ultimate goal is to increase gain to where targets are visible but not so bright that they overwhelm the others.

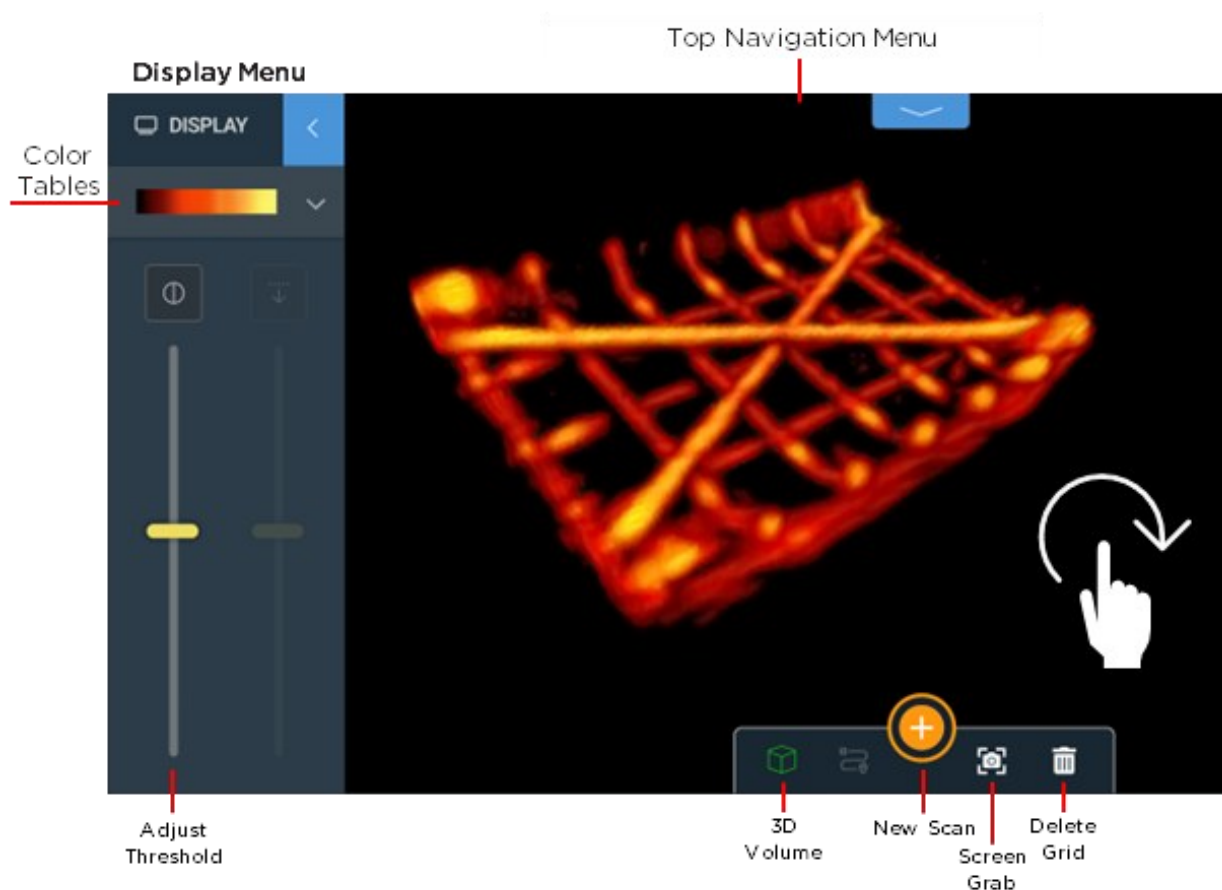
You can also collect screengrab images and save them to the current Project's Results, delete the current file, or start a new Flex Mode scan. Toggle the Top Navigation Menu to view project and file information or the Return to Main Dashboard icon.

The Side Navigation Menu provides access to three color table choices. Choose a color table by tapping the color table at the top of the menu, and then tapping a color table in the list.



Using Flex Mode 3D Volume View

Flex Mode includes a fully rotatable 3D Volume View that allows Flex Mode data to be viewed from any angle. From Top Down View, tap the 3D Volume View icon to access a 3D model of the current Flex Mode data. This feature is also available during file playback.



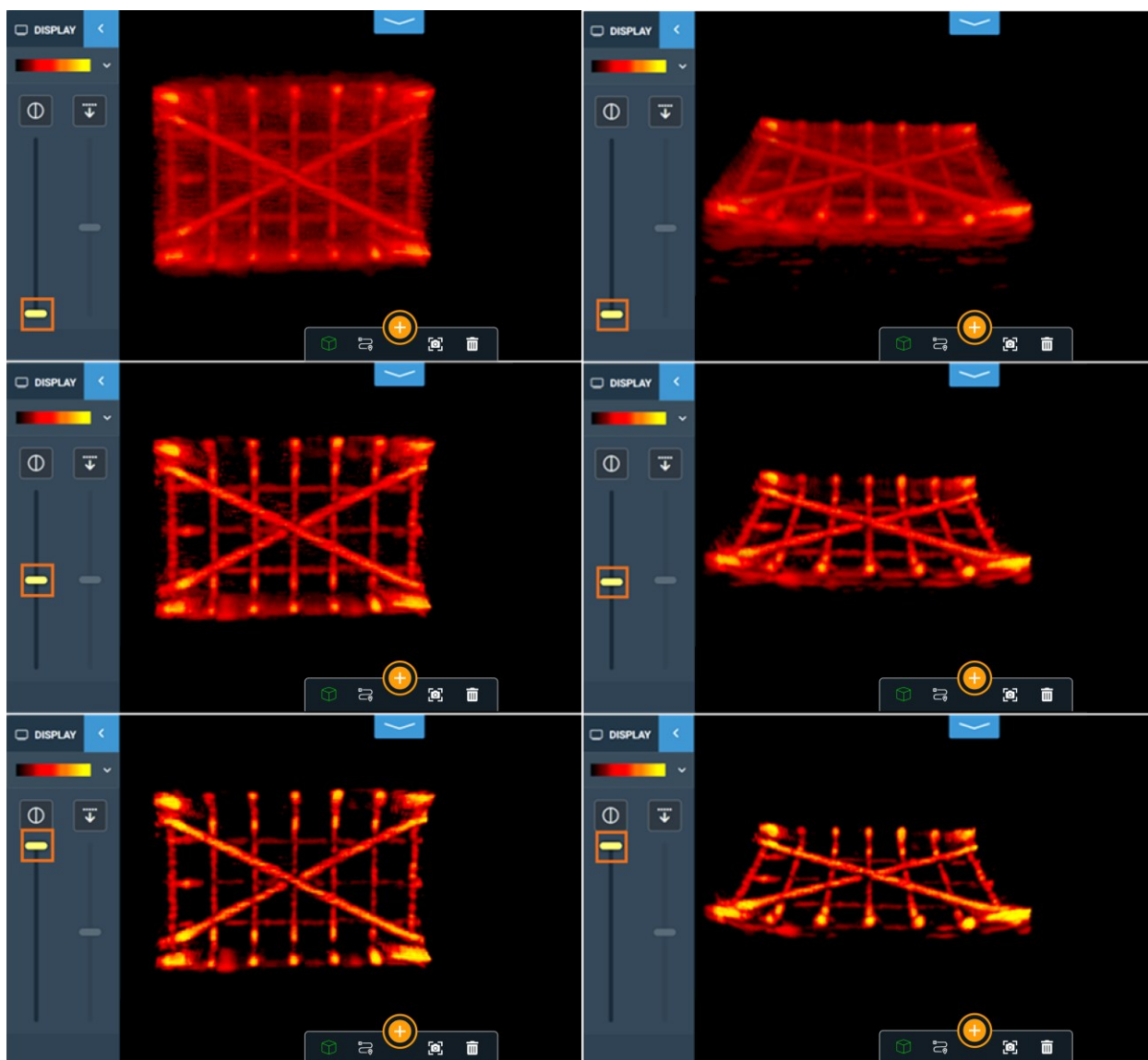
Flex Mode 3D Volume View features the following controls:

Flex Mode Navigation Menus: 3D Volume View	
	Top Navigation Access Icon. Tap to access Return to Dashboard, Active Project options, Area of Interest options, and File Information. Tap again to minimize the Top Navigation Panel.
	Side Navigation Menu. Tap to access color tables and the threshold slider. Tap the arrow icon to hide the menu.
Flex Mode Collection Controls: 3D Volume View	
	Start/Stop Scan. Tap to start collecting a new Flex Mode scan. Tap again to stop file collection. Flex Mode scans are saved automatically.
	Screen Grab. Tap this icon to take a screen grab of the on-screen data. The Flex NX system will save the picture as a PNG image file for transfer. Screen grabs are saved to the Results section of the current Project and Area of Interest, and they will transfer with other files during data transfer.
	Delete Current Scan. Tap to discard your current Flex Mode scan.
Gestural Controls	Single and Multi-Touch Options: Rotate the 3D view using one finger. The initial touch location acts as the rotation point. Use two fingers to zoom in (spread) and two fingers to zoom out (pinch).
	Toggle View: Tap to switch between Top-Down View and 3D Volume View.

The 3D Volume View does not use slicing like Top-Down View. Instead, it uses a threshold slider to accentuate the strongest reflections by incrementally reducing the weaker reflections. The result is a full volume model where targets of interest are highlighted and the unimportant details are minimized.

Open the side navigation menu to access the threshold slider. When the slider is at the bottom of the screen the 3D model displays all the data regardless of reflection amplitude. As the slider is moved toward the top of the screen the weaker reflections fade away, leaving the strongest reflections (like rebar and conduit).

Rotate the 3D Volume View using one finger. The initial touch location acts as the rotation point. Use two fingers to zoom in (spread) or zoom out (pinch).



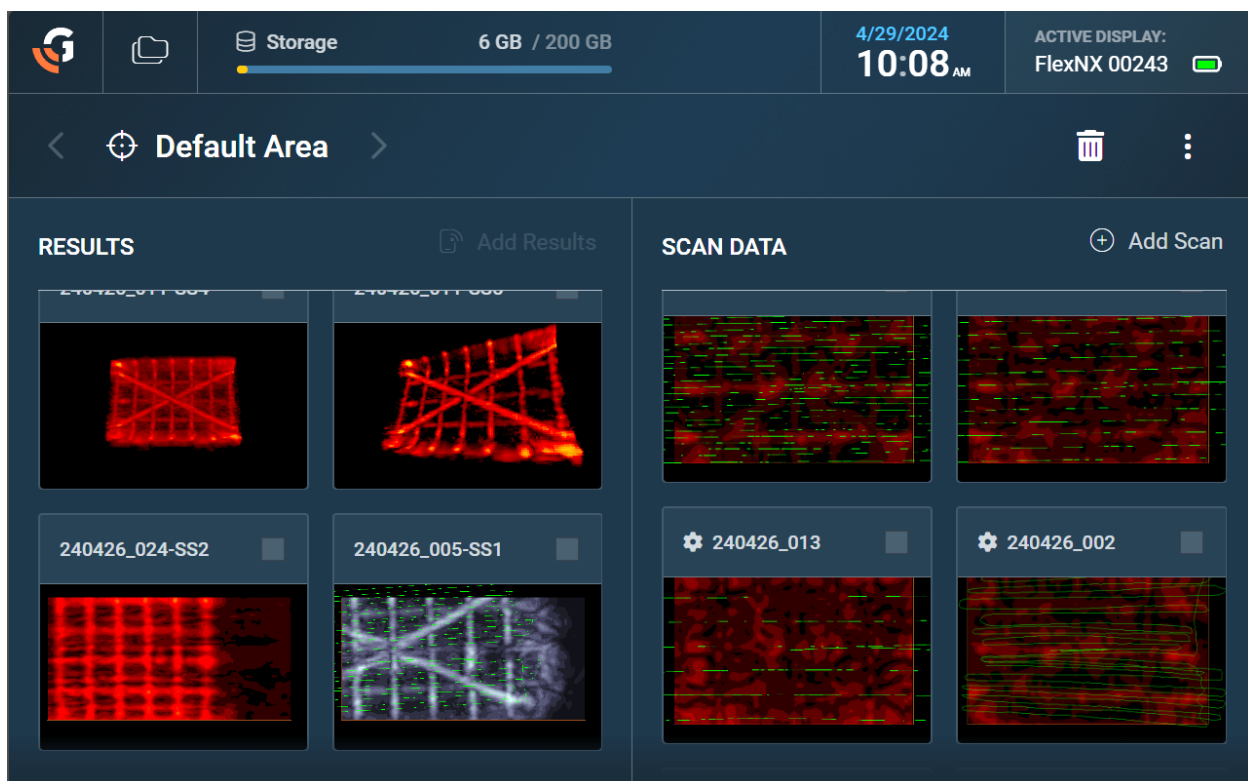
Flex Mode 3D Volume View examples. Left column: the visual impact of adjusting the threshold slider. Right Column: the visual impact of adjusting the threshold slider on rotated views.

The Side Navigation Menu also provides access to three color table choices. Choose a color table by tapping the color table at the top of the menu, and then tapping a color table in the list.

Make sure to capture screen grabs before leaving 3D Volume View. You can then return to Top Down View by tapping the Toggle View icon in the upper right corner. Alternatively, you can collect a new Flex Mode scan or return to the Main Dashboard or Project Profile using the Top Navigation Menu.

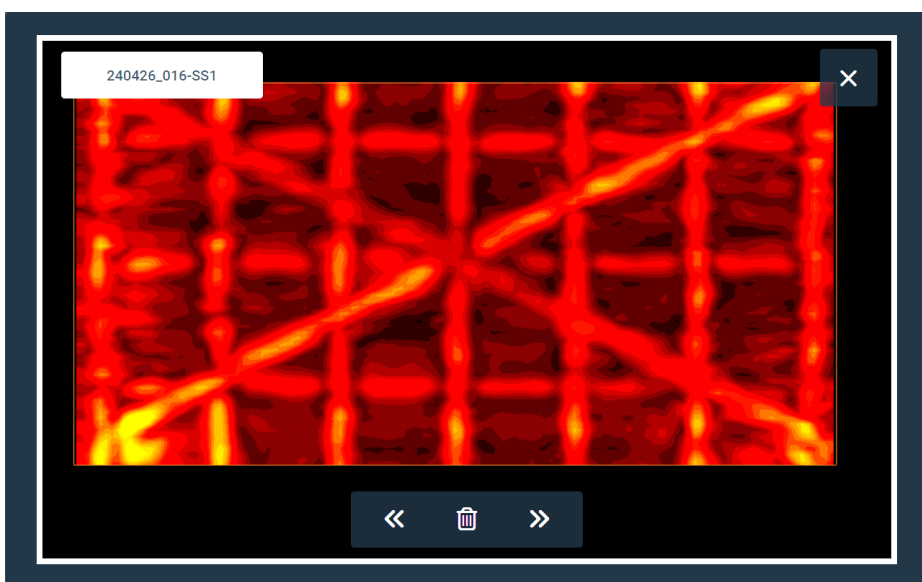
Viewing Saved Flex Mode Data and Screen Grabs

Flex Mode scans and screen grabs are saved and organized into Projects and Areas of Interest just like their 2D counterparts. However, when a Project is transferred to USB only Flex Mode screen grabs are included. Flex Mode scan data remains on Flex NX and can be accessed through playback. Access saved scans and screen grabs through the Project Profile, either by navigating from the Main Dashboard or while in Collect Mode by tapping the folder icon on the Top Navigation Menu.



Tap a screen grab in the Results area to view the captured image. Use the arrow icons to quickly scroll through other screen grabs or delete a screen grab using the trashcan icon.

To playback a saved Flex Mode scan, tap the file in the Scan Data area. The file will open and you will have



access to all of the controls and settings. **Note:** tracklines do not appear in Flex Mode playback, and the Toggle Tracklines icon is not visible.



You can playback a Flex Mode file by opening it from the Project Profile screen. The playback and collect environments are nearly identical and offer the same range of functionality. Note that playback of Flex Mode scans will not display the tracklines.

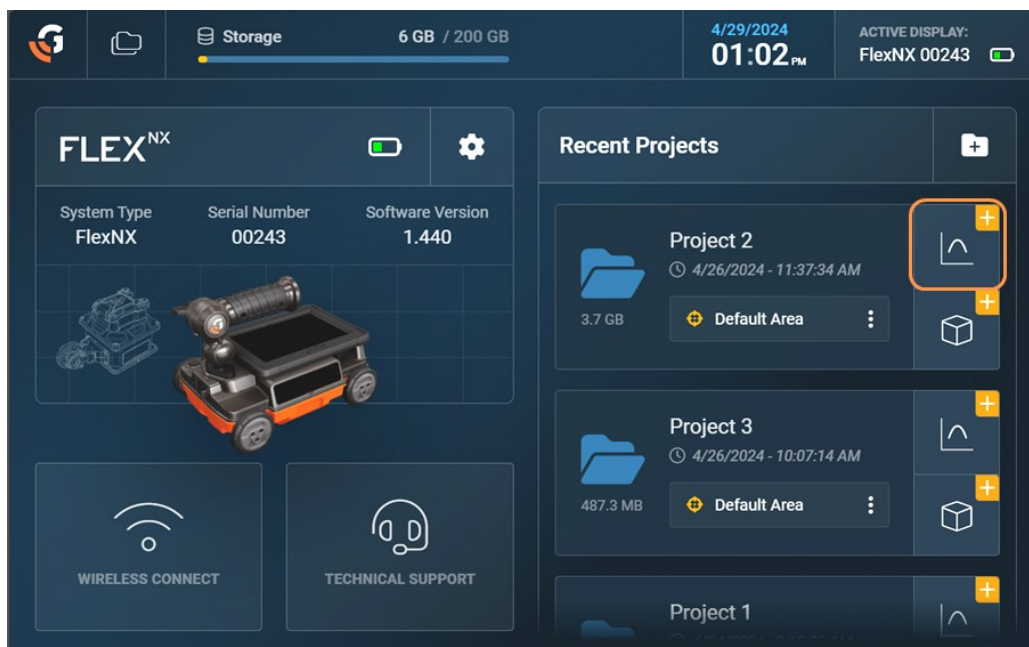
Flex Mode Best Practices

Flex Mode is a powerful visualization tool, but as with all aspects of GPR it can be improved by observing best practices and attention to detail. This section covers multiple ways of optimizing Flex Mode data collection so you can get better results right off the bat.

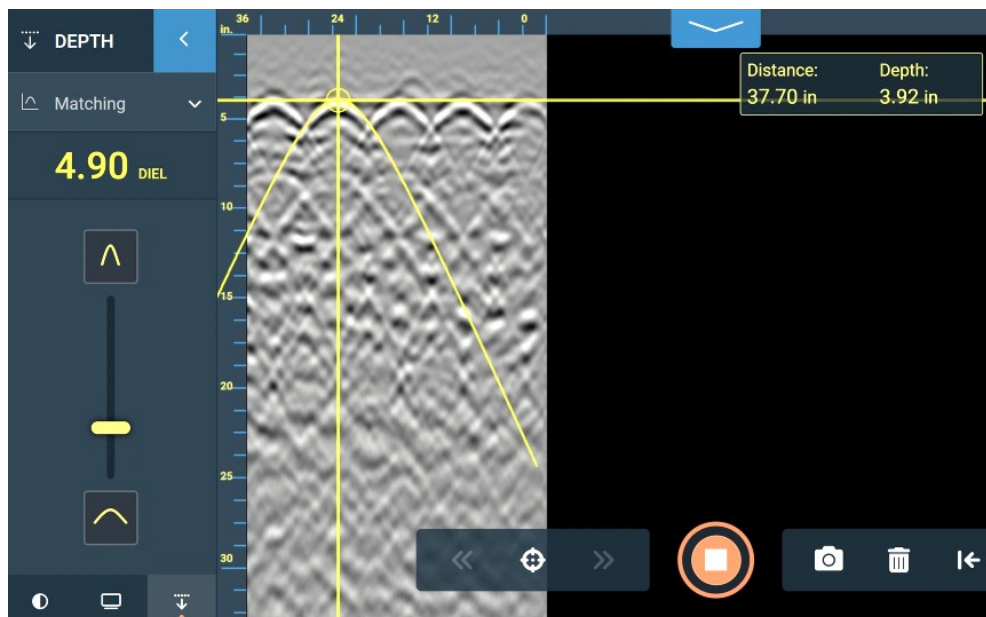
The Role of Dielectric In Flex Mode Scanning

Dielectric is important for 2D scanning because it directly affects the accuracy of the depth scale. In Flex Mode scanning, dielectric is also important for refining the depth scale. However, it is equally important for creating focused 3D targets and overall Flex Mode image quality. When starting a new scan you must choose an accurate Concrete Cure (dielectric) to optimize image quality. Your Concrete Cure selection could be correct, but what if it isn't?

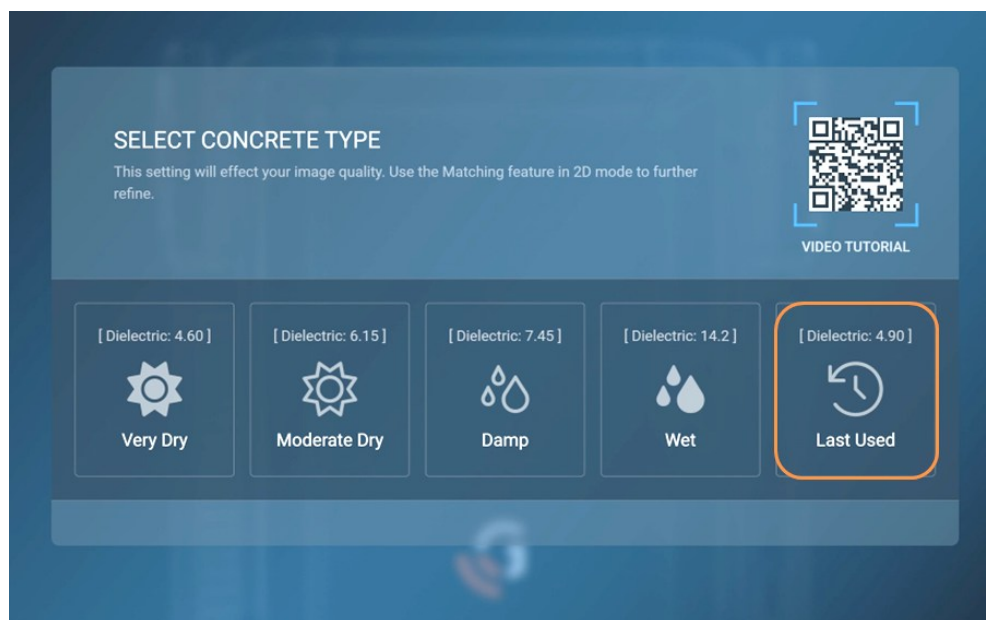
GSSI recommends collecting a 2D scan, and using the Matching feature, prior to Flex Mode scanning. The Matching feature will dial in the dielectric and ensure that your Flex Mode data are depth calibrated with outstanding image quality. Start at the Main Dashboard. and select an existing Project or create a new one. Tap the New 2D Scan Icon to continue and choose a Concrete Cure Type if prompted.



Collect a 2D scan in the area you want to scan with Flex Mode. Identify targets and draw a few on the slab to define their orientation. Cross one or more targets at an angle perpendicular to their length. Open the Side Navigation Menu and select the Depth tab at the bottom of the menu. Next, use the dropdown arrow at the top of the menu and select Matching. Use one finger to move the crosshairs and yellow Matching hyperbola and align them with the top of a target. Use the dielectric slider to fit the yellow Matching hyperbola to the shape of the target.

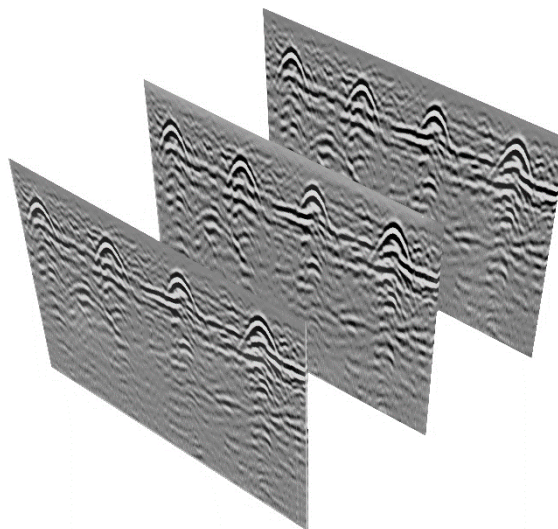


When finished, stop the file and return to the Main Dashboard using the Top Navigation Menu. Tap the New 3D Scan icon, and when prompted choose the Last Used Concrete Cure option. You'll now collect a Flex Mode scan with an accurate dielectric.

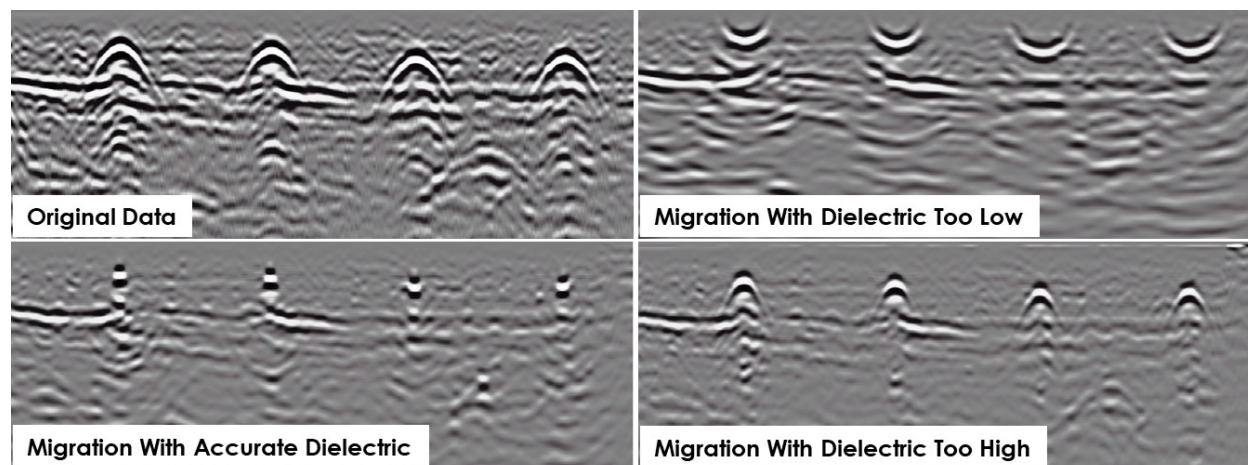


So, why does an accurate dielectric improve Flex Mode image quality? It's all about targets and the shape of the hyperbolas representing them, and how Flex Mode interpolates 2D GPR scans to create 3D images.

Similar to traditional grid-based 3D GPR collection, Flex Mode compiles locational data and GPR data and arranges profiles in vertical space. Unlike traditional 3D data, Flex Mode uses its Vision System to determine location rather than relying on a fixed grid. You can envision the profiles as being lined up vertically with their location dictated by the positioning data.

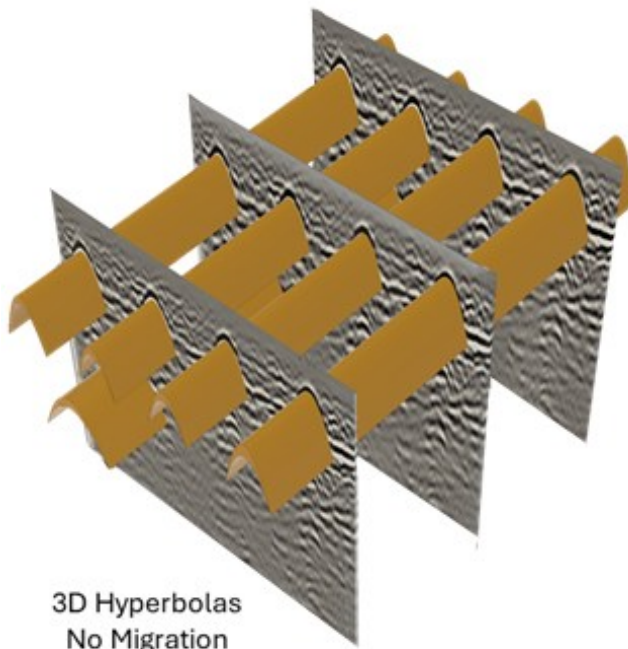
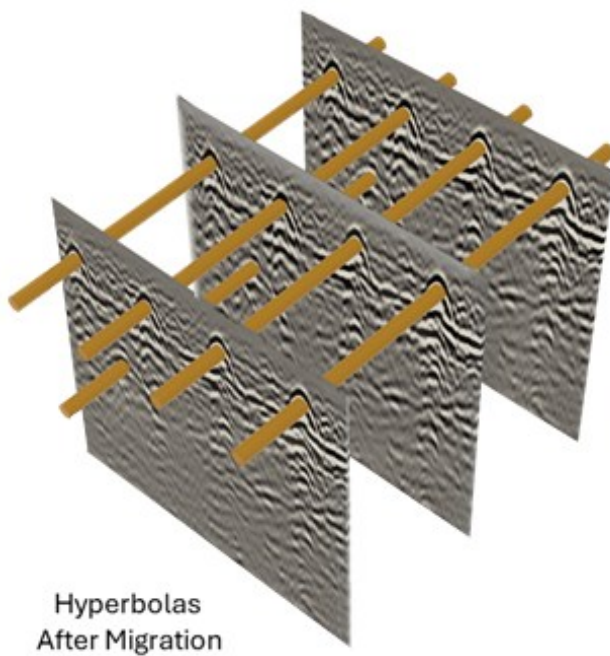


Flex Mode uses a Migration process to collapse the hyperbolas into a more realistic point source. Migration relies on dielectric, and a more accurate dielectric results in a more refined collapse of the hyperbolas' tails. If the dielectric is too low the hyperbolas invert and the tails point upward, whereas if the dielectric is too high the hyperbolas do not fully collapse.



The effects of accurate dielectric and Migration on 2D profiles.

Flex Mode then interpolates between the profiles to create a 3D cube of the dataset. This cube can be sliced from top to bottom to reveal the geometry (shape) of targets at varying depths. If the dielectric is inaccurate then targets in the resulting 3D model will not display an ideal geometry and will be difficult to interpret. As an example, consider a 3D model created from non-migrated data, where hyperbolas from rebar retain their original shape. If Flex Mode created a 3D model from these data the rebar would not look like rebar; when sliced through they would start as linear targets but then get wider with depth. Not only would this be confusing, but it would also obscure smaller and closely spaced targets.

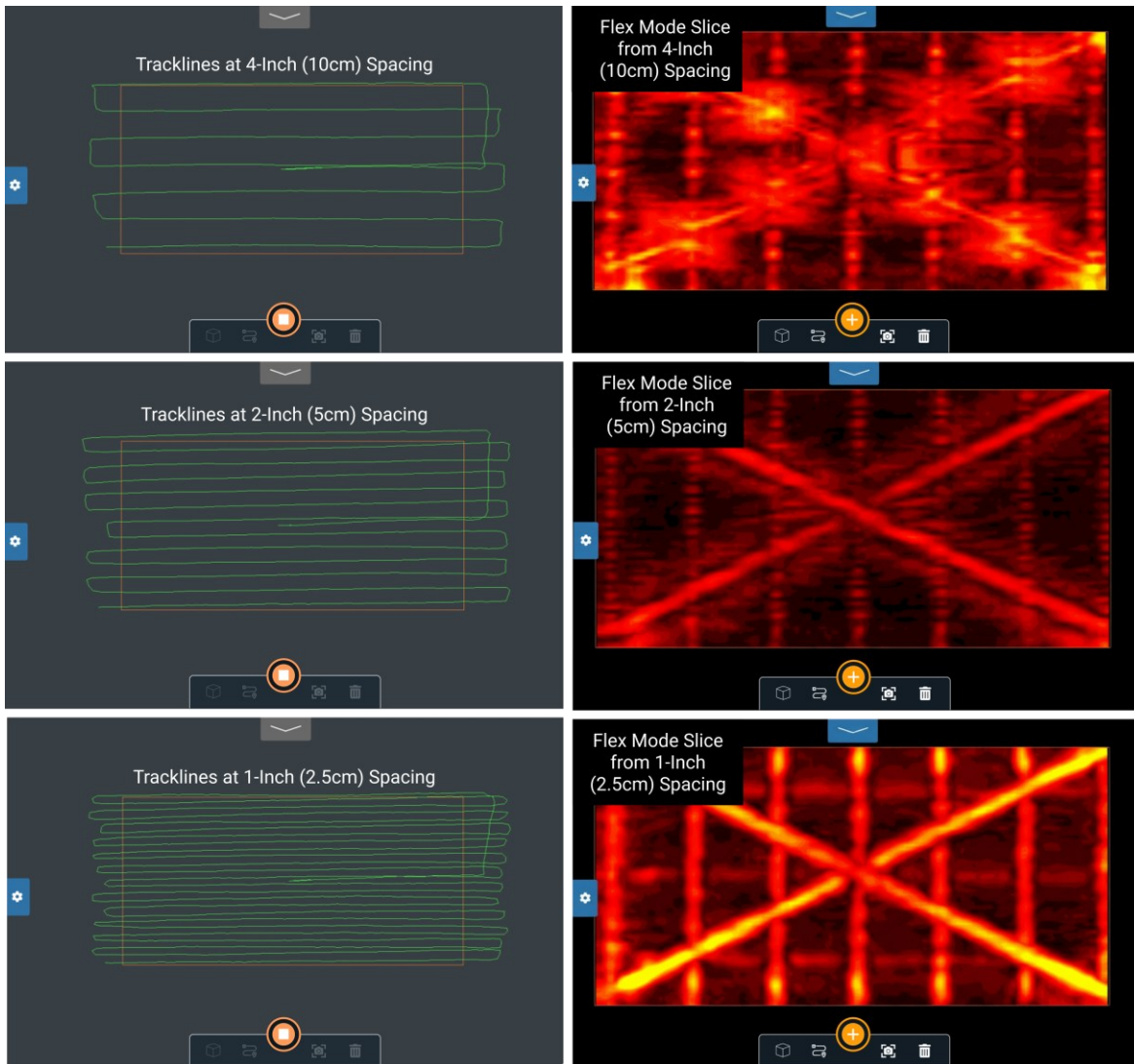


The effects of accurate dielectric and Migration on hyperbola shapes and 3D datasets.

Flex Mode Collection Strategies: Trackline Spacing

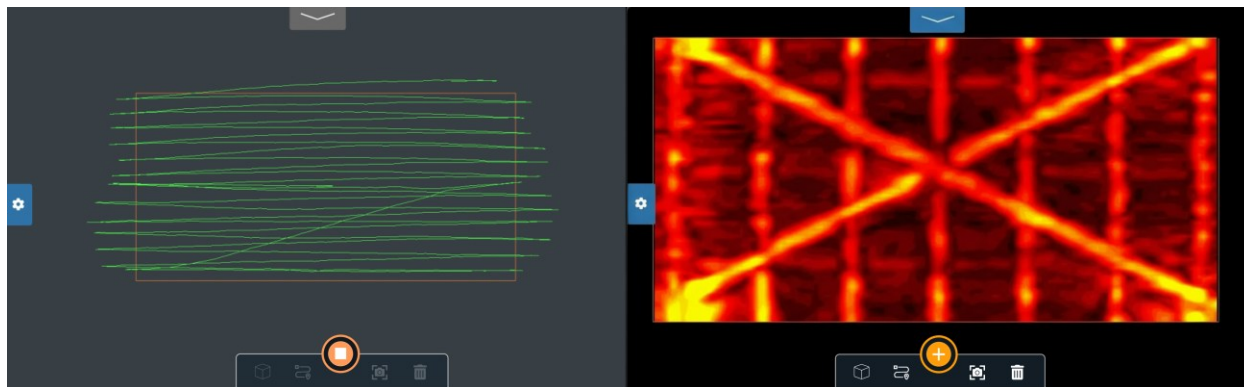
This section offers guidance on best Flex Mode collection practices. An earlier section (Calibrating the Flex Mode Vision System and Trackline Coverage) covered the basics of Vision System calibration and how best to proceed with trackline coverage. To summarize, Flex Mode tracklines should be parallel to the calibration orientation. Unlike traditional grid-based scanning there is no need to collect X-axis and Y-axis data; Flex Mode uses both antennas and can image both directions of a rebar mat by collecting in a single direction. Just be sure to align your collection direction perpendicular to one rebar direction and parallel to the other.

Trackline coverage is also an important collection factor. Strive to collect closely spaced and parallel tracklines by completely covering the 2ft x 4ft (60cm x 120cm) rectangle. To achieve decent Flex Mode image quality, GSSI recommends nominal trackline spacing of no greater than 2-inches (5.0cm), with 1-inch (2.5cm) line spacing being the ideal combination of speed and image quality. Tighter tracklines will always provide higher quality Flex Mode imaging. To understand the effect of trackline spacing, study the three datasets below.

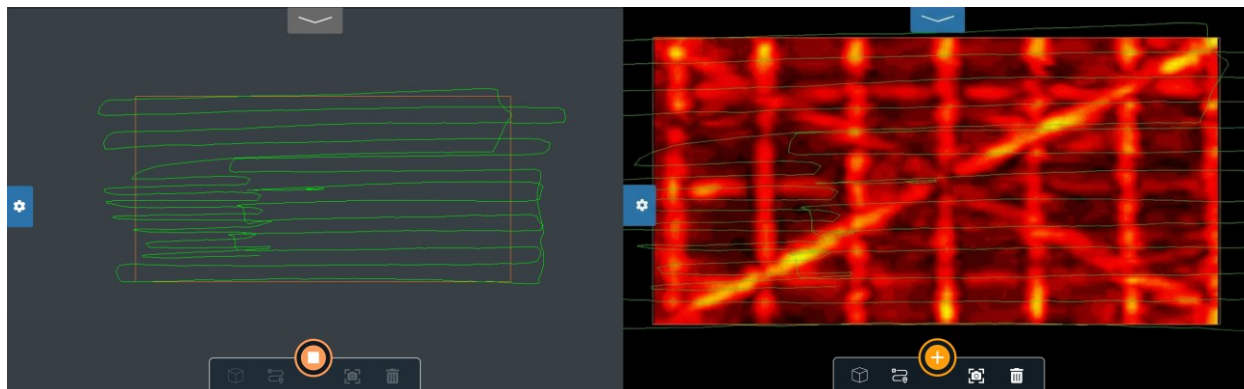


Comparing data from 4-inch, 2-inch, and 1-inch trackline spacing reveals an immediate boost in data quality between the 4-inch and 2-inch datasets. At 2-inch spacing the data show the geometry of the crossing conduits and rebar, while only the rebar is obvious in the 4-inch data. The 1-inch data exhibit much higher resolution, with easily identifiable conduits and both rebar directions.

The examples above were collected using grid lines for reference. Can the same image quality be achieved without reference lines? In the example below, around 1-minute was spent collecting Flex Mode data in a tight zig-zag pattern without a grid pad. Though some of the tracklines are not perfectly parallel, and there are a few relatively large gaps, the resulting data is comparable to 1-inch trackline spacing using a grid. Want better data? Collect more tracklines with tighter spacing; it's as simple as that!



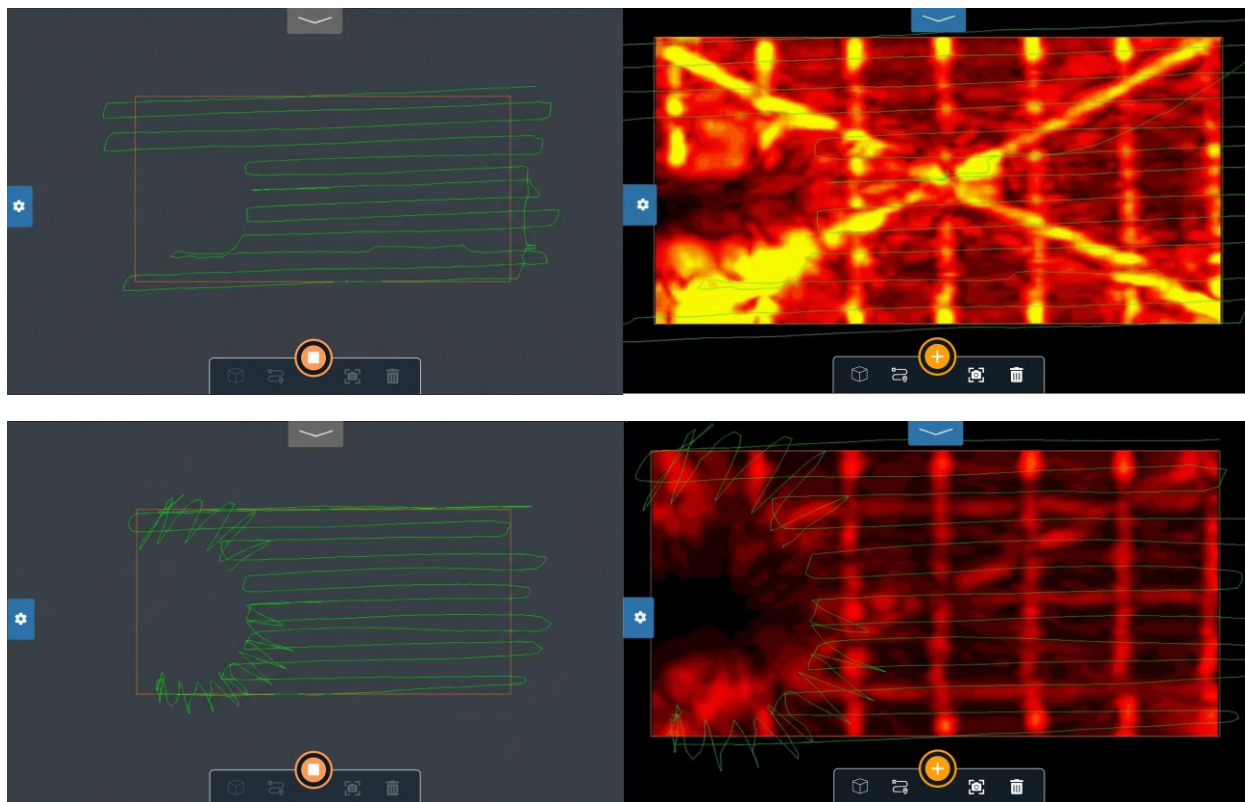
If there are larger gaps in Flex Mode tracklines you can simply fill them in with more data, or even collect a series of short tracklines in an area.



Flex Mode: Dealing with Obstacles

Let's face it: eventually you'll collect a Flex Mode scan with some kind of obstacle in it (like a column, a drain pipe, a belligerent cat, etc.). This section offers tips on dealing with inanimate obstacles, but you are on your own for the animate ones.

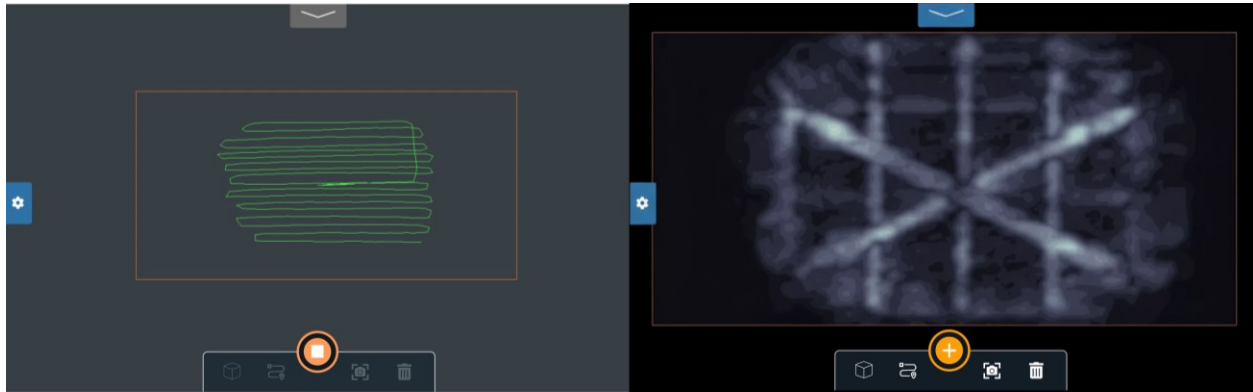
In general when dealing with obstacles, GSSI recommends following the same collection strategy as outlined above. Maintain parallel tracklines and try to avoid zigzagging at different angles around the obstacle. The images below show how these two strategies play out in Flex Mode data.



In the top image, the operator maintained parallel tracklines and was able to collect decent imaging up to the edges of the obstacle. In the bottom image the operator collected short, zigzagging tracklines around the obstacle and did not preserve image details.

Flex Mode: Collecting an Area Smaller than 2ft x 4ft (60cm x 120cm)

GSSI recommends collecting Flex Mode data across the full 2ft x 4ft (60cm x 120cm) rectangle; this is the best way to cover your target area and to place it within a broader context. However, Flex Mode is entirely capable of creating images from smaller areas and you are welcome to do so.



Just remember: the smaller the area covered, the tighter the trackline spacing should be. The image below shows Flex Mode data collected in an roughly 2.0 ft x 1.5ft (60cm x 45cm) area with a nominal trackline spacing of 1-inch. Smaller trackline coverage is also possible, though 3D data are much easier to interpret when collected across larger coverage areas.

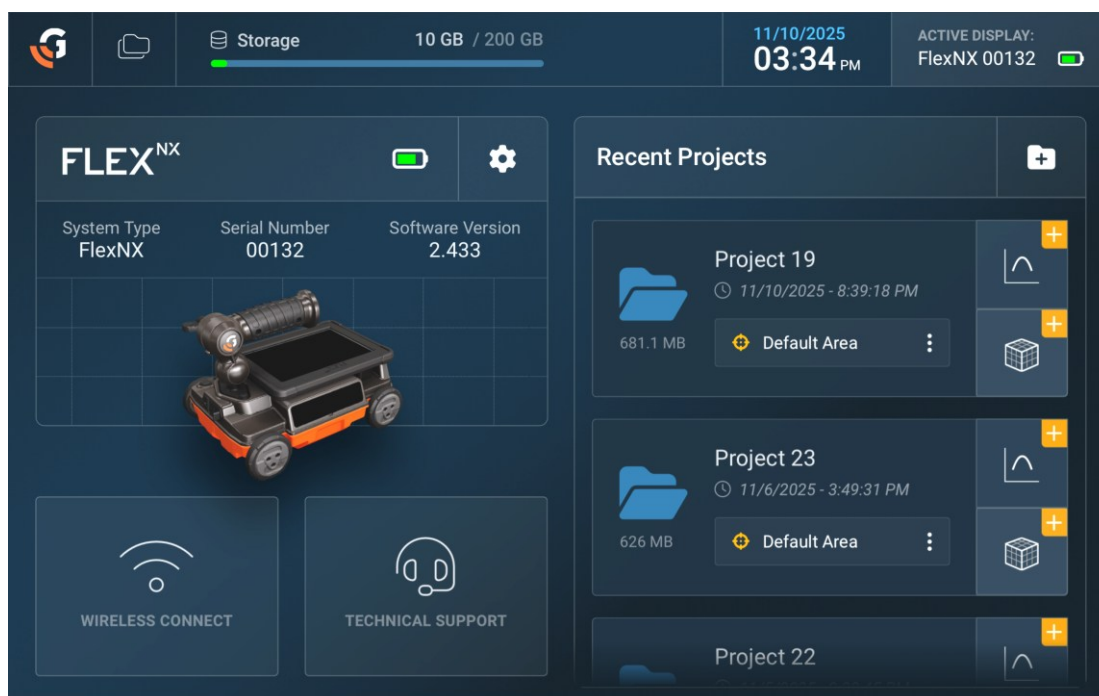
Flex Grid

Flex Grid is a Flex Mode variation for Flex NX and Flex LT that uses grid-based scanning instead of the Flex Vision System. Flex Grid does not support gridded data collection with NX25 and NX15. Like Flex Mode, Flex Grid combines both Flex NX/LT antennas to deliver high-quality 3D slices as a top-down roadmap that adds additional visual information to augment, but not replace, traditional 2D scanning. Flex Grid operates on a 60cm x 60cm (2ft x 2ft) grid and data collection is optimized for complete grid coverage with both antennas. On-screen guidance helps with keeping track of the collection process, and a combination of slice-based and rotatable 3D volume views sets the stage for more informed on-slab marks and a more streamlined GPR workflow.

Flex Grid is intended for two main uses: 1) to generate an easy-to-interpret 3D visualization of slab contents and assist with transferring target locations to the slab; and 2) to streamline the 3D data collection workflow for advanced analyses in post-processing software. Real-time markouts are enhanced by a cursor displaying X/Y coordinates that supports fast and accurate transfer of coordinates from Flex NX/LT to a physical grid pad. Data export is optimized for use in Radan and Geolitix, including a .DZX for each scan and a .BZX for automatic grid creation. On export, the GPR scans are split into separate profiles for each antenna and scans are clipped to the grid extents.

Starting Flex Grid Collection

Much like starting a 2D scan, Flex Grid is accessed from the Main Dashboard. To begin, look for the Recent Projects pane on the right side of the screen. Each listed project will display 2D and 3D icons. Use an existing project or create a new project to get started.

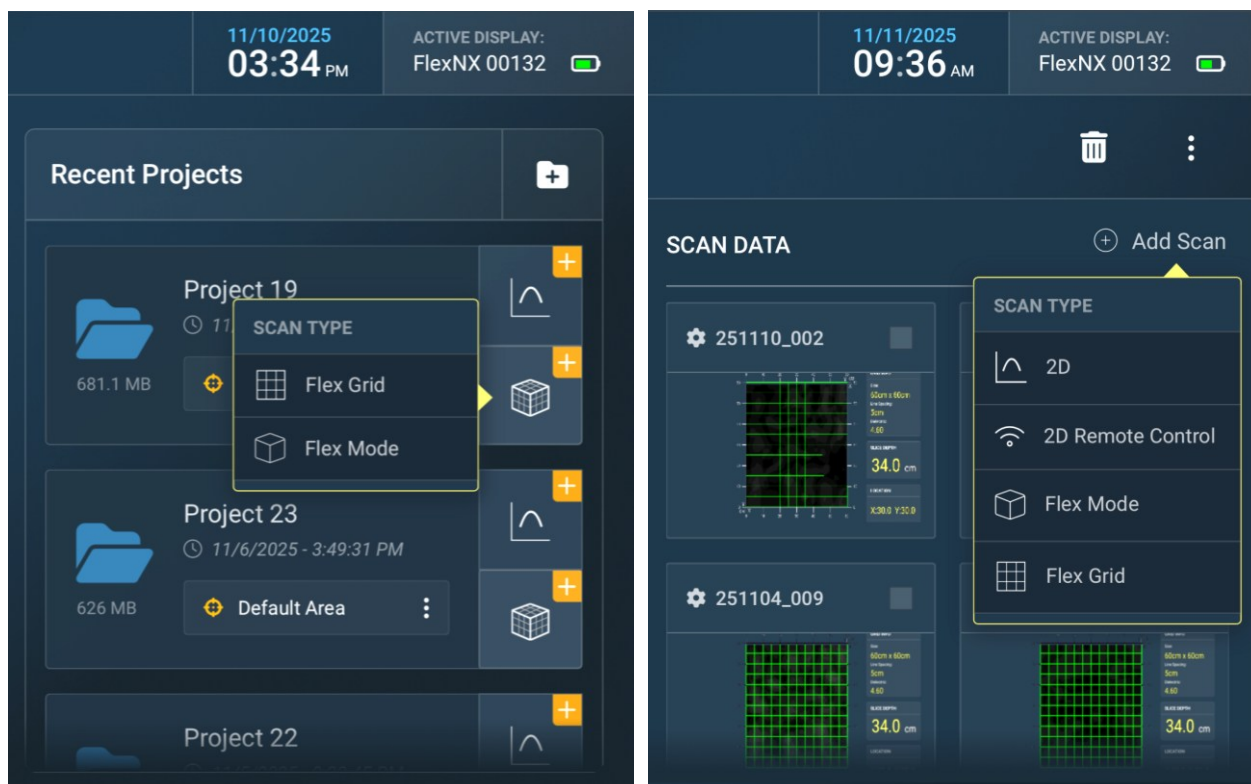




NOTE: Flex satellite antennas, such as NX25 and NX15, cannot collect Flex Grid data. The 3D Cube icon will not be visible when a satellite antenna is the Active Device.

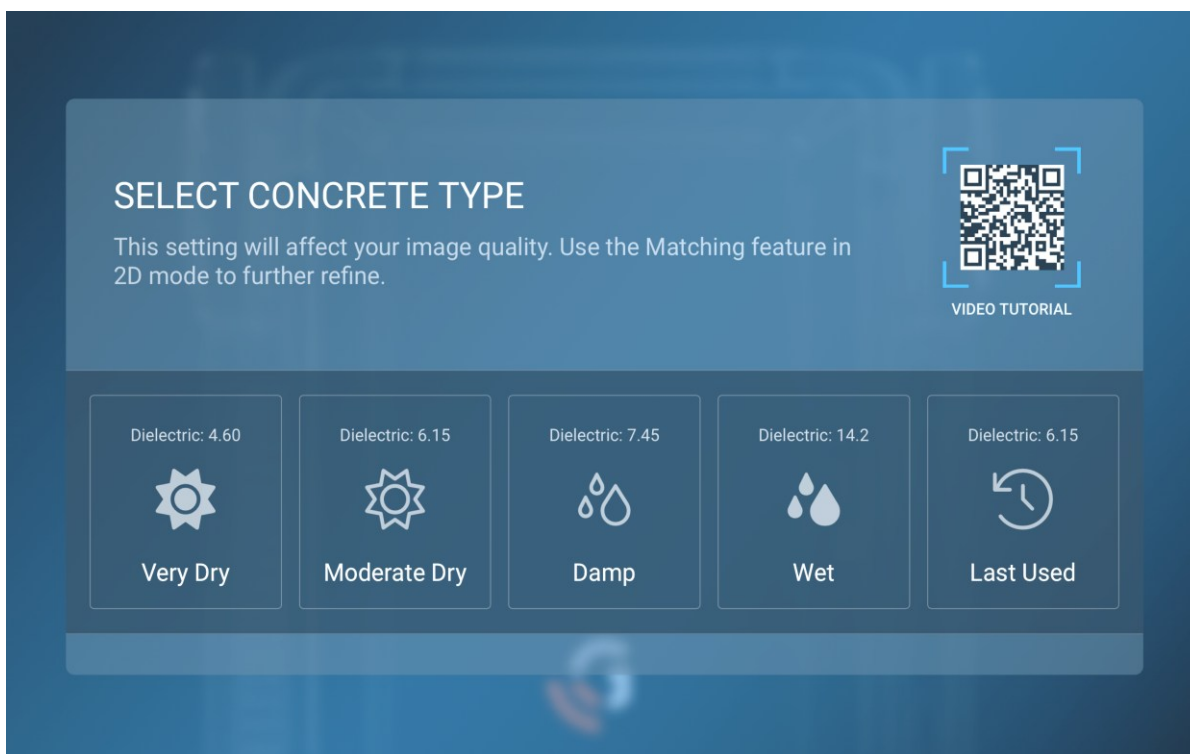
Before You Scan

To quickly start a new Flex Grid scan from the Main Dashboard, locate the Recent Projects pane and tap the 3D Cube icon on the project of your choice. You can also start a new Flex Grid scan by opening a project folder from the Projects Portal. Tap Add Scan and select Flex Grid to proceed.



Tap the Flex Grid icon from either location to bring up the Select Concrete Type screen. Select a Concrete Type that best represents your working conditions. **Note:** this will affect Flex Grid image quality, and GSSI recommends selecting an accurate dielectric value.

Use your knowledge of the age of the slab and choose Very Dry (4.6), Moderately Dry (6.15), Damp (7.45), or Wet (14.2) concrete types or select Last Used. If the slab's curing state is unknown, consider collecting a 2D scan and using the Matching tool (page 77) to refine the dielectric. You can then choose Last Used when starting Flex Grid.



Flex Grid uses Dielectric constant for depth calibration and image quality. By selecting a Concrete Type you are setting an estimated dielectric constant, which could greatly impact your Flex Grid experience. GSSI recommends first collecting a 2D scan and establishing an accurate dielectric using the Matching tool. You can then start Flex Grid and choose Last Used from the Select Concrete Type screen.

Flex Grid Data Collection

Choosing a Concrete Cure Type will open the data collection screen. A collection grid with X and Y lines is displayed in the center of the screen. This grid matches the style of paper grids offered by GSSI, with line numbers, X and Y axis indicators, and other helpful information to guide collection. The Flex icon always starts on line X:01, and a yellow arrow line indicates the direction of collection. Use the arrow icons on the lower Control Bar to cycle through X and Y lines, but remember that all X and Y lines must be completed before 3D slices can be created. Note that for **X lines the Flex system will move in reverse**; this collection style makes it easier to read the on-screen guidance and other information. **All Y lines are collected in the forward direction.**

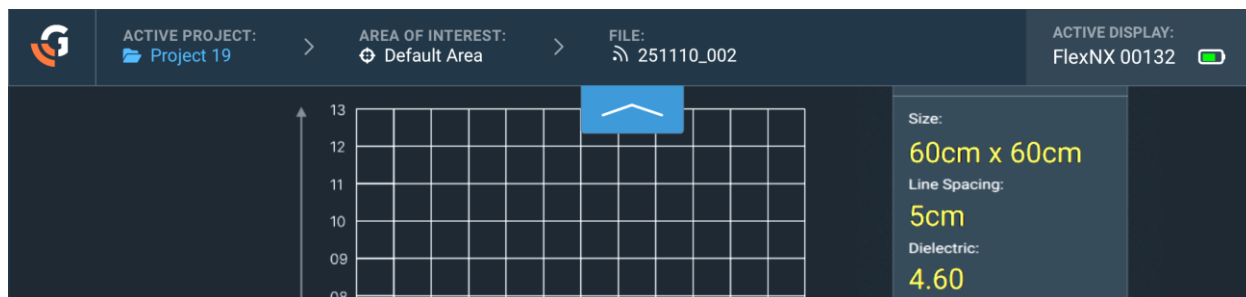
An information box in the upper right displays the grid parameters, including grid size, line spacing, and dielectric. Flex Grid uses one of two grid sizes (60cm x 60cm and 24in x 24in) based on the measurement units selected from System Settings. Line spacing is fixed at 5cm or 2in. Dielectric can be selected from the Concrete Cure Type screen; to improve depth accuracy GSSI

recommends first using hyperbola matching on a 2D profile and then choosing the Last Used option.

Two distance indicators track the total distance that each Flex NX/LT antenna travels during collection. The red number references the distance traveled by the normal polarized antenna (red lasers for Flex NX, red markers for Flex LT) in the front of the system. The green number references the distance traveled by the cross-polarized antenna (green lasers for Flex NX, green markers for Flex LT) in the back of the system.



Open the Top Navigation Menu to view the Project Number, Area of Interest, and file name. Tap the arrow icon to minimize the Menu. The Top Navigation Menu options are identical between the Data Collection and Data Viewing screens. The file name represents the entire grid of scans, not the current line number. On export, all of the scans associated with a grid will be combined into a folder with the file name.



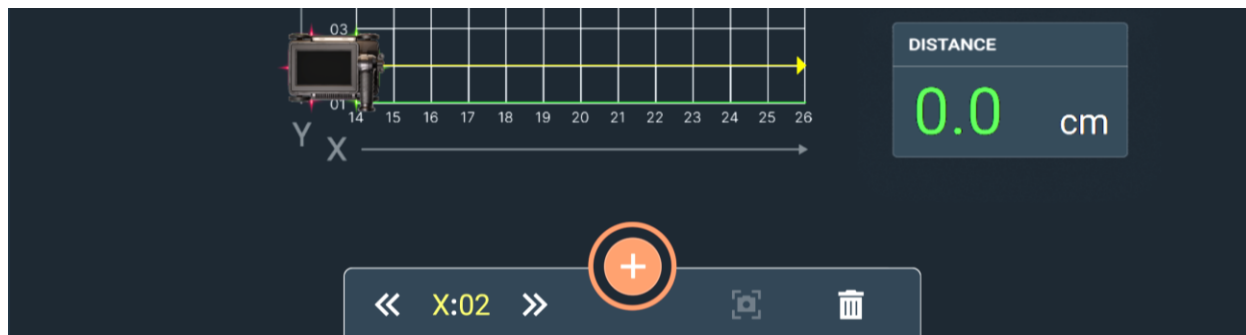
Tap the Top Navigation icon  to display the following:

Top Navigation Icons and Controls	
	Return to Main Dashboard. Tap to exit Flex Grid collection or playback and return to the Main Dashboard.
ACTIVE PROJECT:  Project 19	Active Project. Tap the Project name to access the Project Profile, view the current project's saved content, and add a new 2D or 3D scan.
FILE:  251110_002	Current File. View the name of the current file. Flex Grid file numbers represent the entire grid of scans, not just the current scan.
AREA OF INTEREST:  Default Area	Area of Interest. Displays the current AOI. You will see Default if no Areas of Interest were created. Tap to open the Project Profile.
ACTIVE DISPLAY: FlexNX 00132 	Current Display. View the currently active device and its battery status.

To begin collection, place your Flex System on line X:01. Tap Start Scan to begin collection. Wait for Flex NX/LT to “beep” before moving; this ensures that the system is ready for collection. The Flex icon will move as you move your Flex NX/LT, and the distance traveled for each antenna is displayed in the corresponding distance box. The scan will automatically close when both antennas have traveled the maximum distance (60cm/24in).



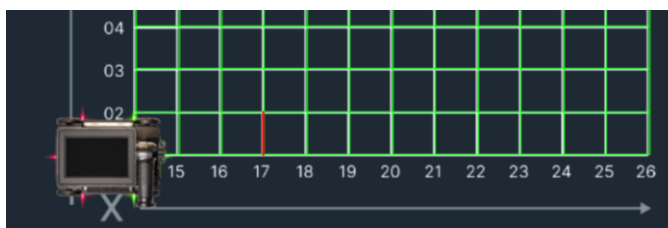
The Flex icon will then move to the next line in sequence. Tap Start Scan to collect the new line, then repeat this process until all X and Y lines have been collected.



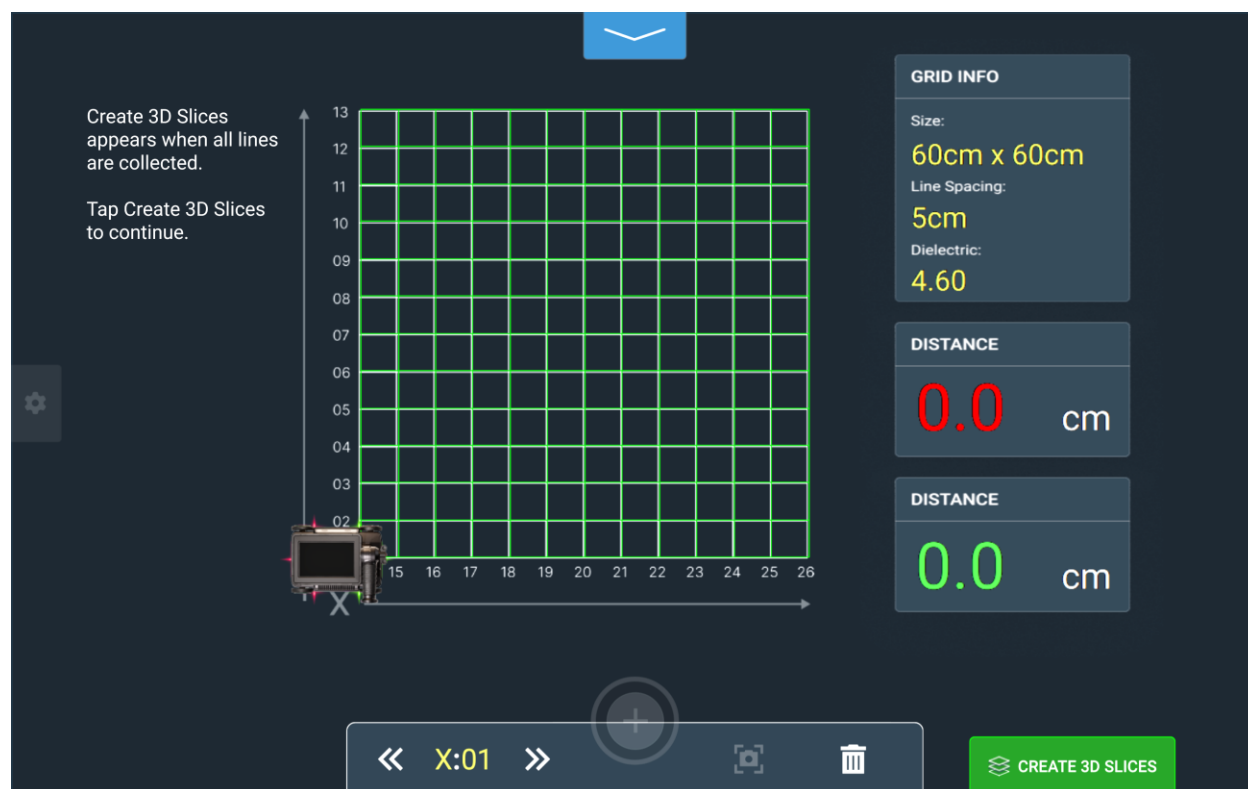
The Flex icon will move to line Y:14 after line X:13 is collected. Note that Flex NX/LT will move in the **forward direction** when collecting Y Lines.



During collection you may see a red overlay on one or more completed lines. This indicates that the Flex system was moved before the Start Scan "beep" and some scans may have been missed.



Create 3D Slices appears when all lines are completed. Tap to access the data viewing screen.



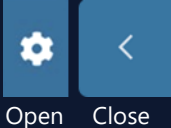
Interacting with Flex Grid Scans

The Flex Grid data viewing screen opens in Top-Down View, displaying a measurement grid defined by the current measurement units and the extents of X and Y axis scans. The Grid Info box shows the grid information from the data collection screen. Slice depth displays the depth below surface of the current slice. The location box initially displays the grid's center coordinates, but when the Location Cursor is activated the Location box will display the Cursor's location. A screengrab will capture the current slice view, grid lines (if activated), Grid Info, Slice Depth, Cursor location on the slice, and Cursor coordinates.

Open the Top Navigation Menu to view Project, AOI, and File information. Open the Display Menu to select one of three color tables and to adjust slice gain and slice depth.

The lower control bar contains icons for toggling Grid Lines and the Location Cursor, as well as a 3D Volume View toggle, Screengrab, and Delete Grid.

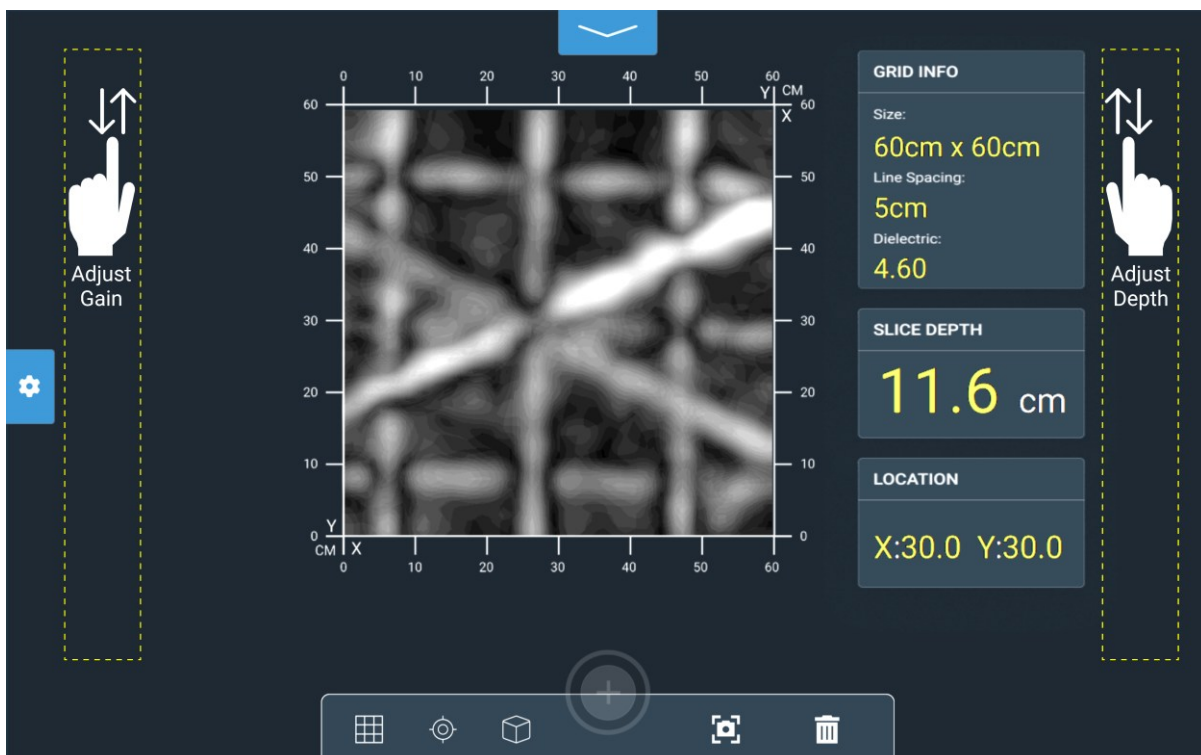
Flex Grid Top-Down View and 3D Volume View feature the following controls:

Flex Grid Navigation Menus: Top Down View and 3D Volume View	
	Top Navigation Access Icon. Tap to access Return to Dashboard, Active Project, Area of Interest, and File Information. Tap again to minimize the Top Navigation Panel.
	<p>Side Navigation Menu: Top-Down View. Access color tables and the Gain and Depth sliders.</p> <p>Side Navigation Menu: 3D Volume View. Access color tables and the Threshold slider. The Depth slider is disabled for 3D Volume View.</p>
	Start Scan. This function is disabled in Top-Down View and 3D Volume View.
	Toggle Grid Lines. Tap to show or hide green grid lines. This function is disabled in 3D Volume View.
	Toggle Location Cursor. Tap to show or hide the Location Cursor. When enabled, use one finger to move the Cursor within the grid limits. This function is disabled in 3D Volume View.
	Toggle View. Tap to switch between Top-Down View and 3D Volume View.
	Screen Grab. Tap this icon to take a screen grab of the on-screen data. Screen grabs include 3D slices and 3D volume images, the grid around 3D slices, Grid Info, Slice Depth, the Location Cursor's position, and the Cursor's coordinates.
	Delete Grid Scan. Tap to discard your current Flex Grid scan.
Gestural Controls	<p>Top-Down View: On right side of screen, slide one finger up/down to change slice depth. On left side of screen, slide one finger up/down to change gain levels.</p> <p>3D Volume View: Use one finger to rotate the 3D model. Use two fingers to pinch/zoom.</p>

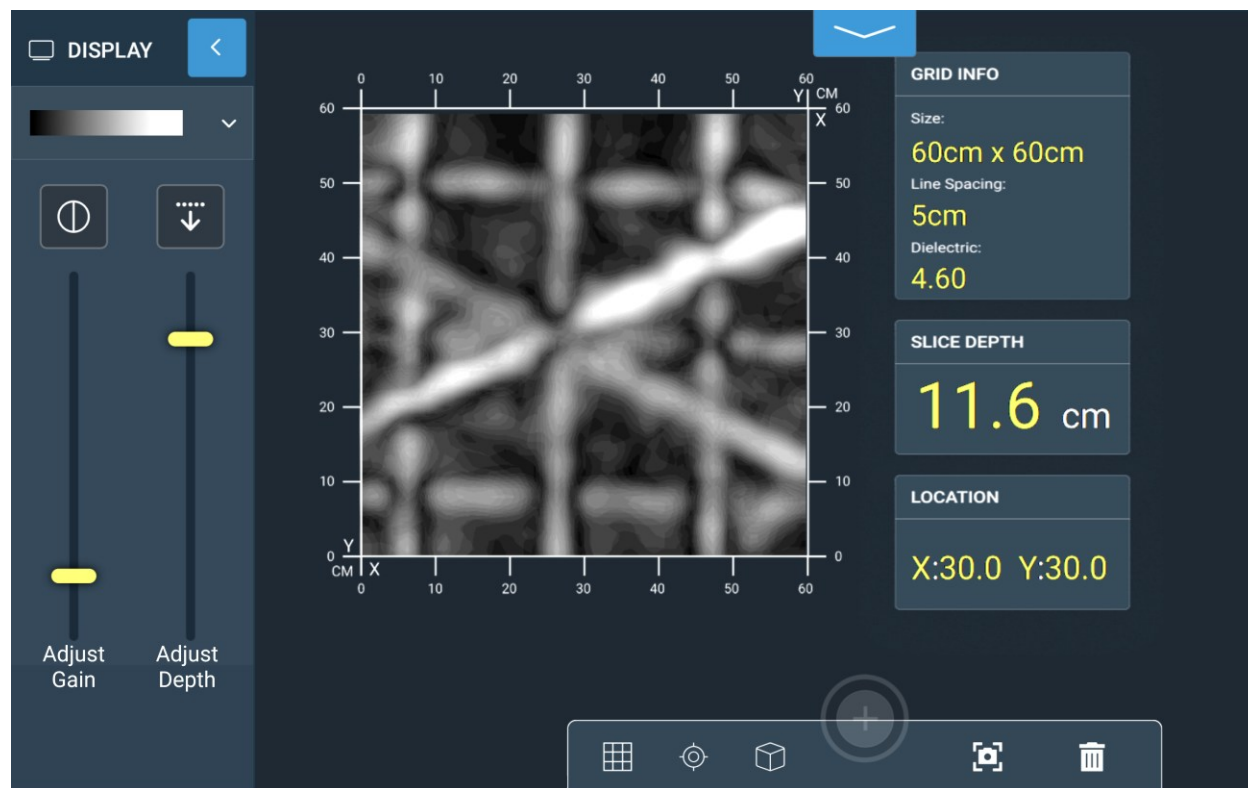
Top-Down view opens to a view of the grid area with tracklines overlaid on the slices.



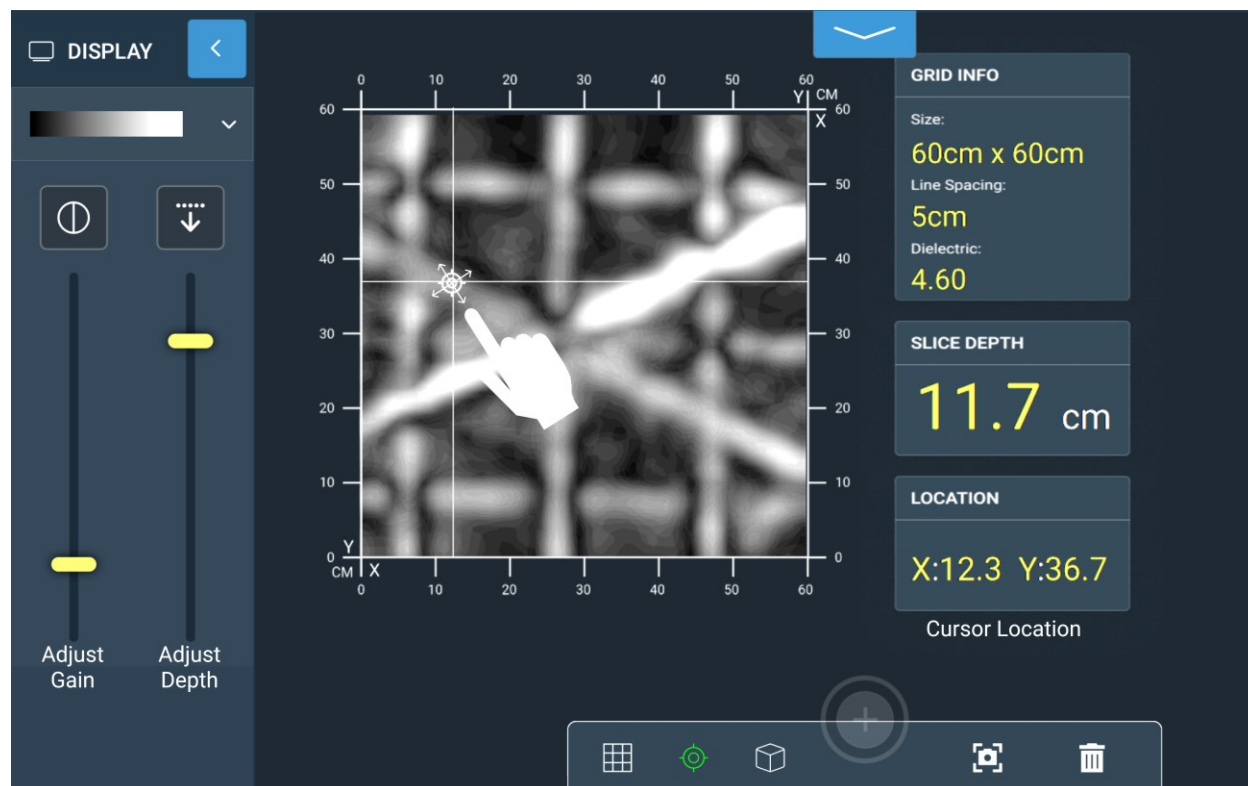
Toggle grid lines off to view the underlying 3D slice. Use gestural controls on the left and right sides of the screen to quickly adjust gain and slice depth. The Slice Depth info box will update as depth is adjusted.



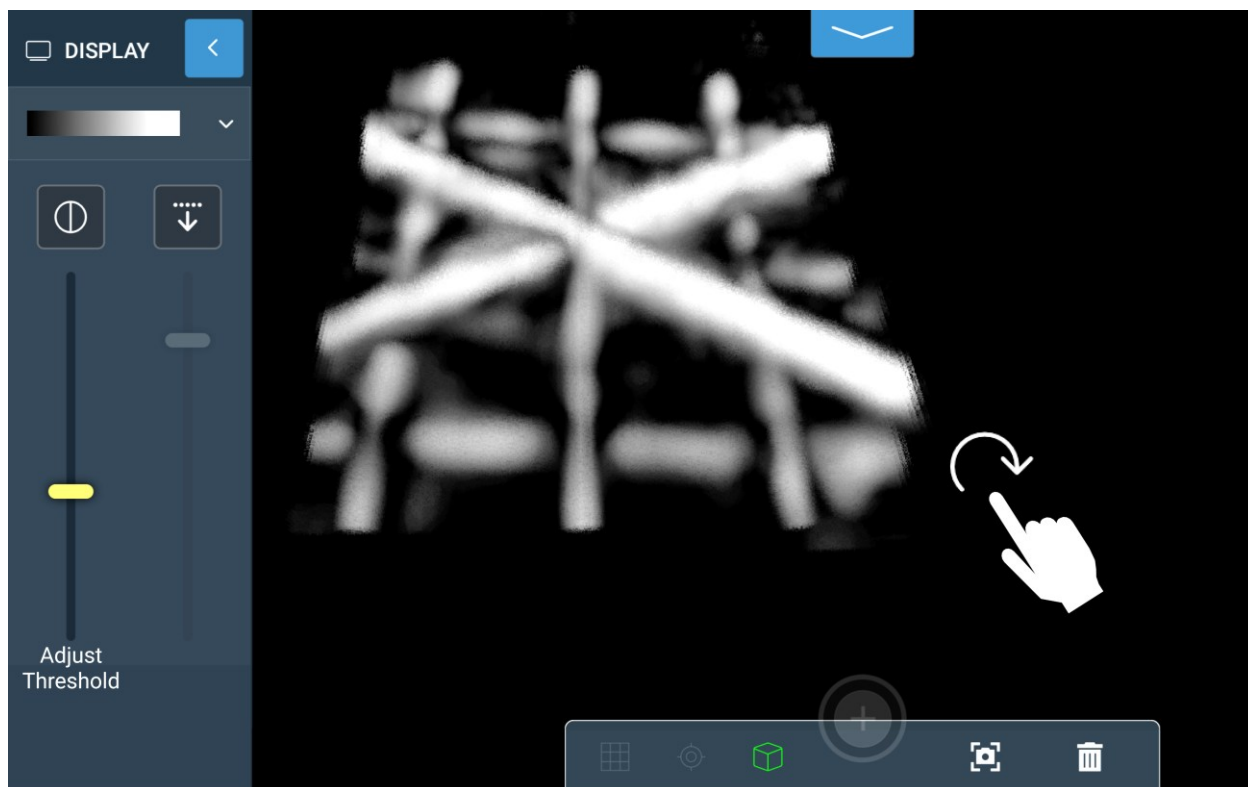
Open the display menu to access color table options and sliders for gain and slice depth.



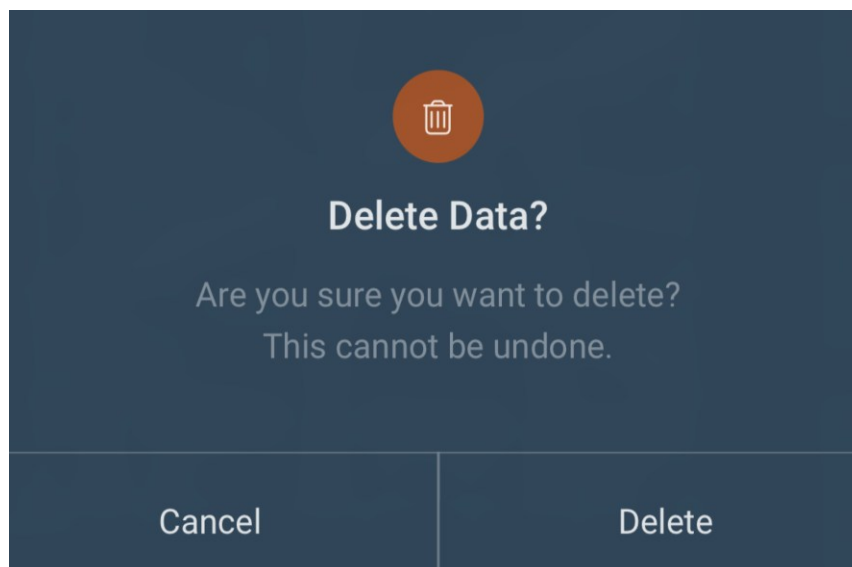
Enable the Location Cursor to view X/Y coordinates for the Cursor's position. Use one finger to move the Cursor within the grid boundaries.



Flex Grid includes a fully rotatable 3D Volume View that allows Flex Grid data to be viewed from any angle. From Top-Down View, tap the 3D Volume View icon to access a 3D model of the current Flex Grid scan. This feature is also available during file playback. Use the settings menu to change color tables, and use the threshold slider to highlight targets of interest by minimizing less important data. Use one finger to rotate the model or use two fingers to zoom in/out. Tap the Screengrab icon to capture an image and send it to Results.

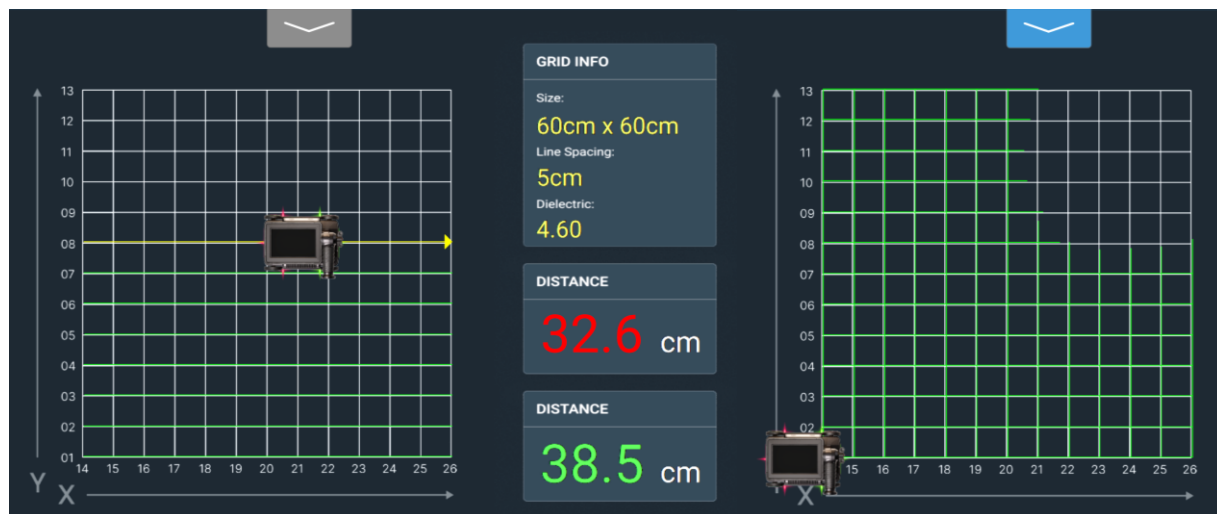


Flex Grid data can be deleted from the Data Collection and Data Viewing Screens, as well as from the Project Profile. Proceed with caution: this action cannot be undone!

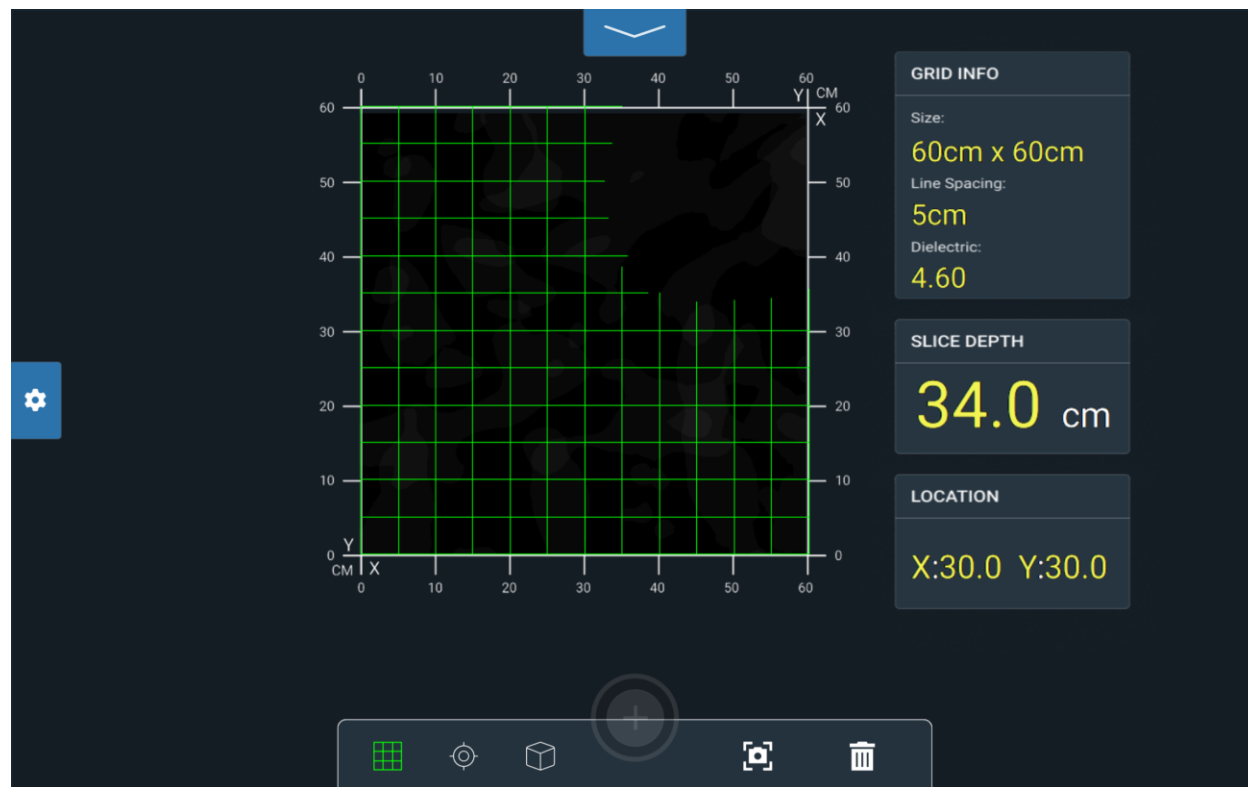


Flex Grid: Dealing with Obstacles

In a typical Flex Grid scan, all X axis and Y axis lines would extend to the maximum distance (60cm/24in). In some cases you might find that an obstacle is preventing full coverage along one or both grid axes. Flex Grid lines can be stopped early if needed. During Collection, start a scan as normal and tap Stop Scan when the Flex system encounters an obstacle. Collect the remaining lines as normal, stopping them early if you need to.

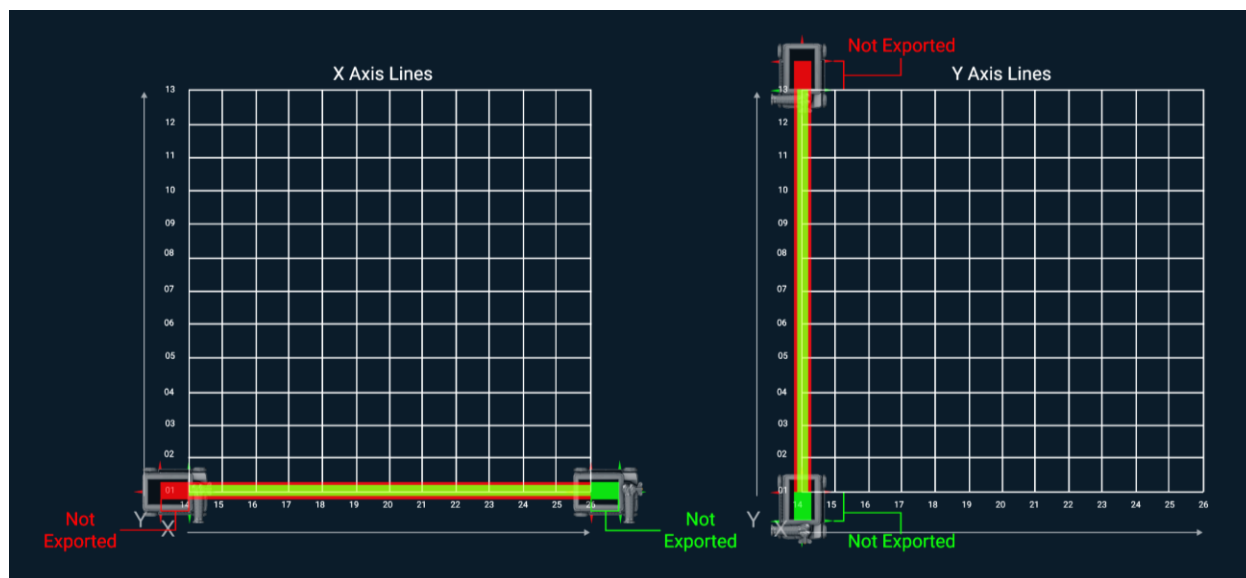


You can create 3D slices if all grid lines have some amount of coverage. Just remember: do not use data in the no-coverage area for data interpretation.



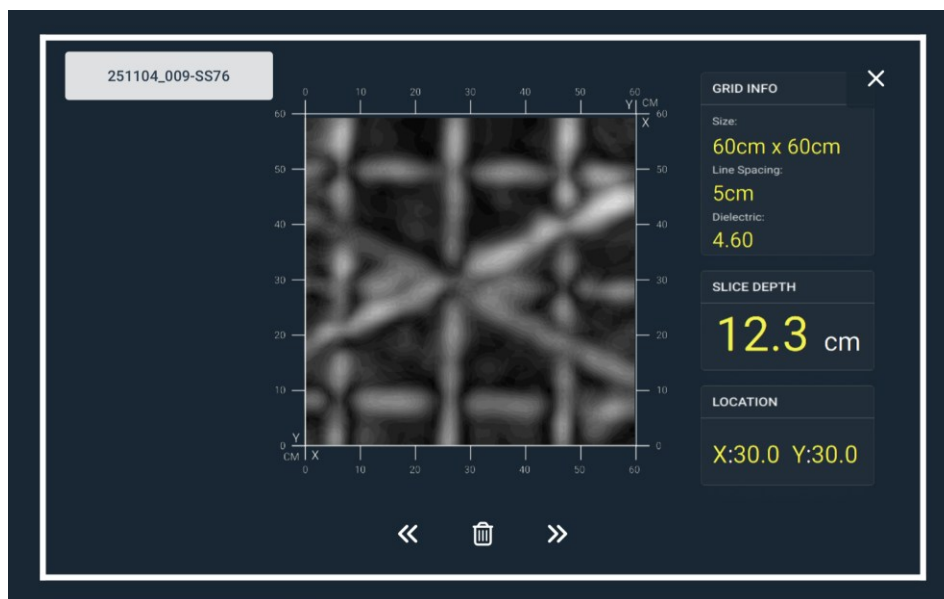
Flex Grid Data Export

Flex Grid supports post-processing of gridded data by exporting an organized dataset for use in Radan and Geolitix. During collection, Flex NX and Flex LT are positioned to capture complete grid coverage with both antennas. To do so, the Flex system must start on the leading antenna: cross-polarized (green) for X axis lines, and normal polarized (red) for Y axis lines. The Flex system moves along the grid, and then the leading antenna stops beyond the grid's baseline so that the trailing antenna can stop directly on the baseline. This means that both antennas collect data outside the grid for any given line, regardless of the axis of collection. To avoid confusion and irregular grid boundaries, exported scans from both antennas are clipped to the grid boundaries so that there are no data preserved from outside the grid. The result is a perfect overlap between both antennas and no extraneous data to deal with.



Flex Grid data are exported from the Project Portal or Project Profile screens. Open a Project Profile from the Recent Projects Pane by tapping the blue folder icon. Alternatively, enter the Project Portal from the Main Dashboard by tapping the double folder icon near the upper left corner of the screen, and either select one or more Projects to export or tap on a Project folder to open it. The Results section contains screengrabs from 2D profiles, Flex Mode, and Flex Grid scans. The Scan Data section contains 2D and 3D scan data; 2D scans appear as a 2D profile, while Flex Mode and Flex Grid scans are represented by a single file that displays a 3D slice and trackline coverage. Flex Grid scans are easy to distinguish from Flex Mode scans due to the regular grid pattern visible in the thumbnail. Tap any file in the Scan Data pane to open it in Playback Mode. Tap the check box on an individual Result or Scan Data file to select it and move to a different AOI or delete it.

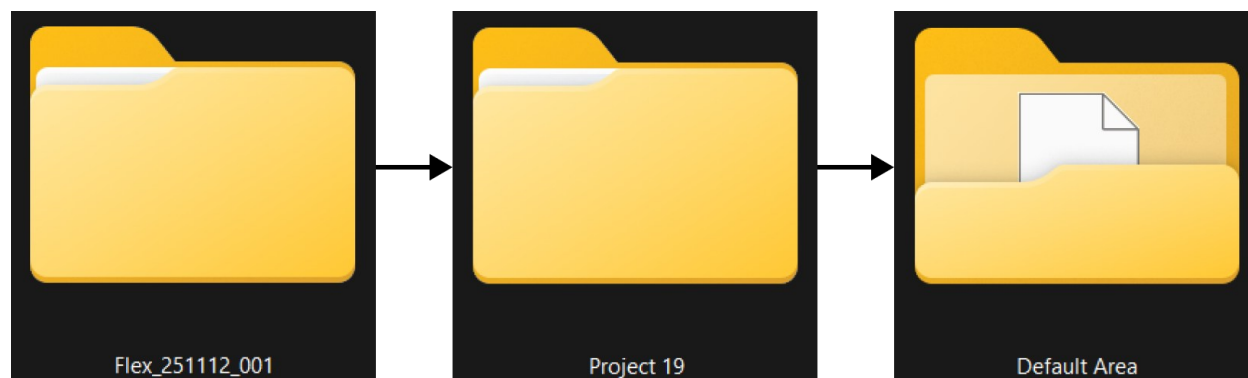
Tap any file in the Results pane to open and view the screengrab. The file name is displayed on the screengrab when viewed on your Flex system; when viewed on a computer or mobile device the file name will not be overlaid on the screengrab.



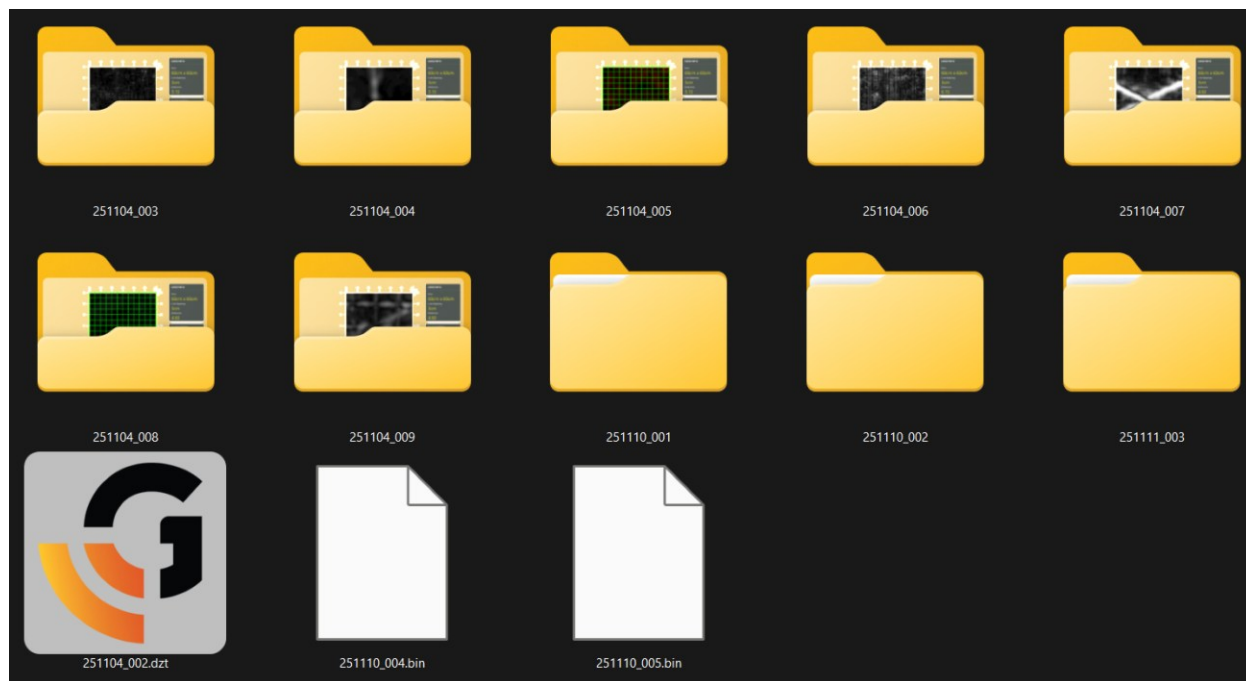
For additional guidance on the file export process, please refer to the Transferring Data section of this User guide (page 59).

The Export Format for Flex Grid Data

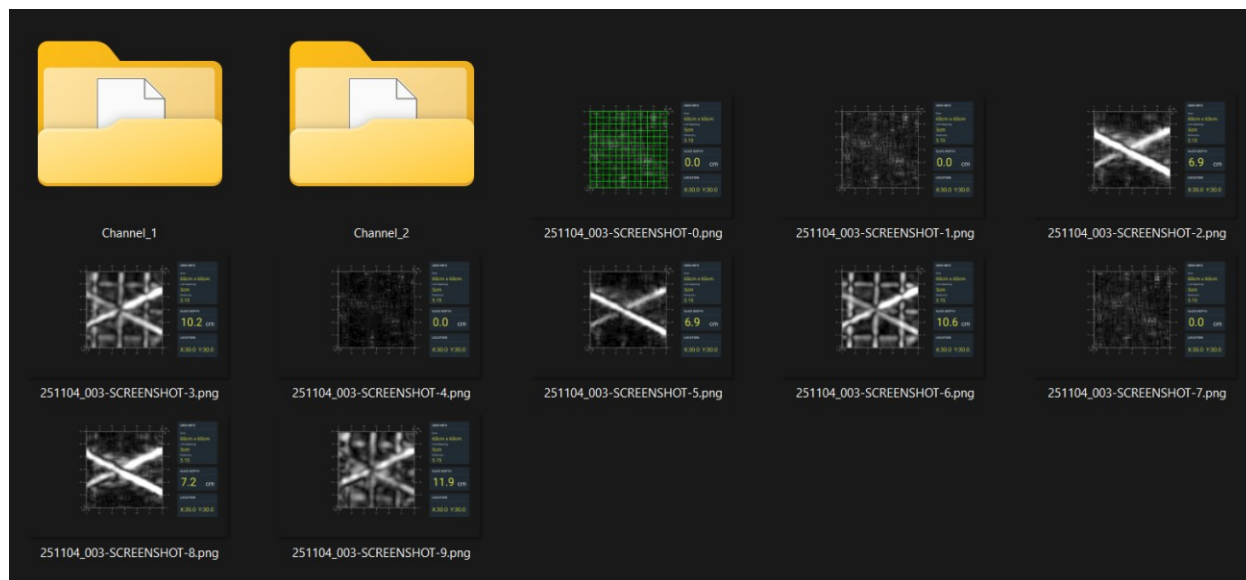
Like other exports from Flex systems, Project data will be contained in a folder labeled using the Flex_YYMMDD_XXX format. The folder will have the Flex_ prefix, Year/Month/Day, and the export number. For example, Flex_251112_001 would be the first export on 12 November 2025. A second export on that day would be labeled Flex_251112_002. Inside a Flex_ folder are Individual Project folders, each containing separate folders for AOIs in the Project.



The AOI folders contain 2D scans and a folder for each individual Flex Grid scan.



Flex Grid scan folders include Channel 1 and Channel 2 folders, along with screengrabs captured during collection or playback. Channel 1 is the front antenna (normal polarized; red lasers/markers) and Channel 2 is the rear antenna (cross-polarized; green lasers/markers).



Flex Grid scans are exported in a similar format to 3D scans from current and previous GSSI platforms, such as StructureScan MiniXT and SIR4000-based systems, with file numbering unique to Flex systems. Inside each Channel folder are the individual 2D profiles associated with the Flex Grid scan. File numbering for 2D scans uses the YYMMDD prefix, followed by the scan number, X or Y axis designation and the grid line number, followed by 1 or 2 (1 for normal polarized/Channel

1 antenna, and 2 for cross-polarized/Channel 2 antenna). For example, the first X axis line in a Channel 1 folder could be named 251104_003_X01_1 and the first Y axis line could be named 251104_003_Y14_1. For the X axis line, the file name indicates that the file was collected on 04 November 2025, it was the third scan of the day, it was the first X axis line, and it was created by the normal polarized antenna. For the Y axis line, the file name indicates that the file was collected on 04 November 2025, it was the third scan of the day, it was the first Y axis line (line 14, after the 13th X line), and it was created by the normal-polarized antenna. Channel 2 2D profiles would be named similarly, but they would have _2 at the end of the filename (instead of _1).

Name	Date modified	Type	Size
 251104_003_1.bzx	11/12/2025 7:18 PM	BZX File	2 KB
 251104_003_X01_1.dzt	11/12/2025 7:18 PM	DZT File	1,092 KB
 251104_003_X01_1.dzx	11/12/2025 7:18 PM	DZX File	2 KB
 251104_003_X02_1.dzt	11/12/2025 7:18 PM	DZT File	1,092 KB
 251104_003_X02_1.dzx	11/12/2025 7:18 PM	DZX File	2 KB
 251104_003_X03_1.dzt	11/12/2025 7:18 PM	DZT File	1,092 KB
 251104_003_X03_1.dzx	11/12/2025 7:18 PM	DZX File	2 KB

Name	Date modified	Type	Size
 251104_003_Y14_1.dzt	11/12/2025 7:18 PM	DZT File	1,092 KB
 251104_003_Y14_1.dzx	11/12/2025 7:18 PM	DZX File	2 KB
 251104_003_Y15_1.dzt	11/12/2025 7:18 PM	DZT File	1,092 KB
 251104_003_Y15_1.dzx	11/12/2025 7:18 PM	DZX File	2 KB
 251104_003_Y16_1.dzt	11/12/2025 7:18 PM	DZT File	1,092 KB
 251104_003_Y16_1.dzx	11/12/2025 7:18 PM	DZX File	2 KB

Each Channel folder will contain a .DZT file and a .DZX file for all 26 2D profiles, as well as a .BZX file. The .DZT file stores the GPR data, while the .DZX stores additional information for post-processing software. The .BZX is a grid assembly file used by Radan 7 software. Flex Grid data imported to Geolitic software do not need the .BZX file; the DZX files contain the necessary grid coordinate information to recreate the line order and grid dimensions.

Additional Resources

GSSI Academy Training



When pursuing mastery of concrete scanning there is no substitute for experience. Whether you are about to collect your first scan or your 100th, improving your knowledge of GPR is always time well spent.

Training and dedication are the keys to success, and our GSSI Academy classes are designed with all experience levels in mind.

We highly recommend enrolling in one of our live Flex NX or Flex LT classes at GSSI headquarters in Nashua, NH or our training location in Henderson, NV. If you can't get to a class right away, or you've already completed a class and want more information, this User Guide section provides guidance for scanning and identifying concrete reinforcement scenarios and other concrete-related targets like post-tensioned cables and air voids beneath slabs. The following discussion will walk you through selected concrete data examples, provide information on construction techniques, and offer tips to improve your scanning experience.

Need more information? You can visit our Flex NX support site by scanning the QR code on Flex NX's Technical Support panel or by visiting us at www.geophysical.com/support/FlexNXsupport. You can then download or share a PDF of this User Guide, browse other Flex NX or Flex LT documentation, access video tutorials, and download the latest Flex system software.

Scanning and Marking Best Practices

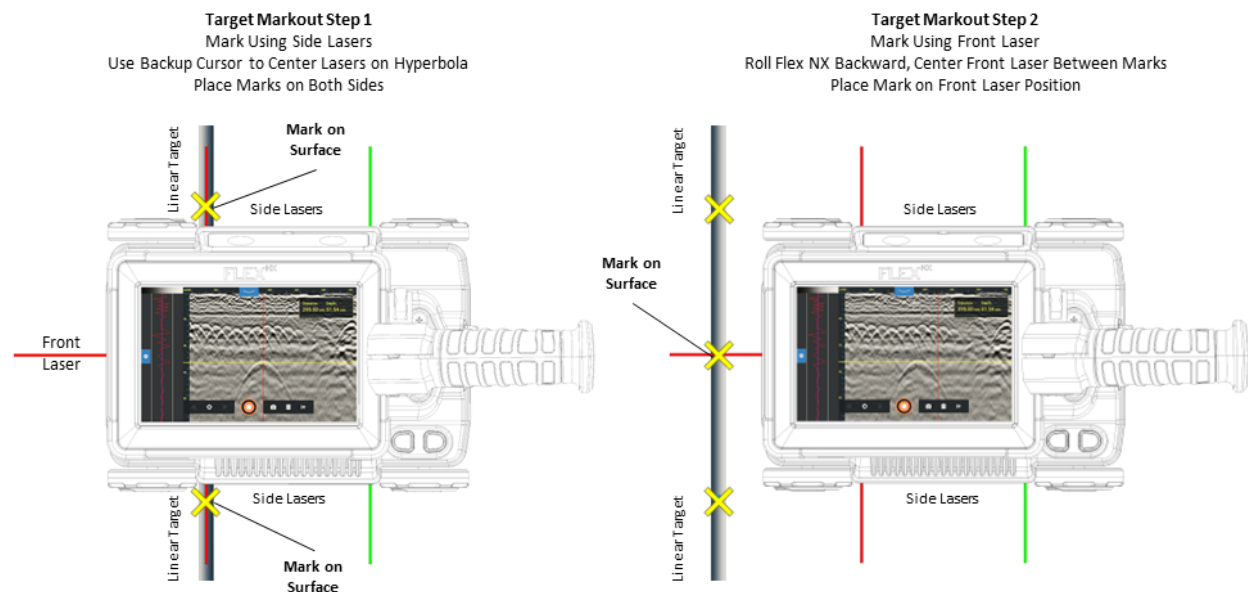
There is a wide variety of objects that may be present in a concrete slab, including reinforcement, conduits, post-tensioned and pre-tensioned cables, and other elements of slab construction. An exhaustive list is beyond the scope of this document but see below for an introduction to the basics of scanning concrete and identifying targets within and just below the slab.

Basic Scan and Mark Techniques

We recommend collecting as much data as possible to ensure you are making the most informed decision. When starting a scan, take a long scan of the area to get an idea of the general reinforcement and utility layout.

To mark a target on the slab, or on a data collection grid sheet, scan over and past it and roll the antenna backwards until the cursor is centered on the peak of the hyperbola. To avoid error, don't scan too far past the object, as you may not roll the antenna backward along the same path. In addition, do not lift Flex NX, Flex LT, or a satellite antenna off the marking surface. Place a small mark on either side of the antenna, both at the same distance from the antenna, using the sides lasers on Flex NX, colored markers on Flex LT, or the centerline indicators on NX25 and NX15 satellite antennas. Move the antenna and place a final mark in the direct center of the two small marks, or move Flex NX, Flex LT, or satellite antenna backwards until the front laser, colored

marker, or centerline indicators are centered between the two small marks. Try using a ruler or another straight edge to draw straighter lines.



This process results in a mark directly where the center of the antenna was when it crossed the center of the target. Repeat this process until you have at least three marks representing the object (if it is a linear object) and draw or mark out the object on the slab or grid sheet in accordance with [CSDA-BP-017](#), the Concrete Sawing and Drilling Association's best practices document on properly marking GPR findings.

Reinforcement should be marked in black (or a non-red color if black is not appropriate for the surface) using a permanent marker or wood crayon. Conduit should be marked in red, or another color if appropriate, but never mark conduit with the same color that you use to mark reinforcement. Mark at least a 1" exclusion zone on either side of the center point of the object, as GPR cannot reliably determine the size or width of embedded objects. If the object is much wider than this, such as a beam or duct bank, mark an exclusion zone of at least 1" beyond either end of the object. If the object is not travelling in a straight line, mark as many locations as necessary to properly capture its path of travel through your scan area. The owner or contracting agency should mark the extents of your scan area, though you might have to mark them if it is not done for you. If the scan area is free of non-reinforcement targets, mark "OK" within the scan area.

Keep in mind that you need direct access to the concrete slab in order to scan. Insulating foam, waterproofing plastic, wood, or an air gap between the antenna and the top of the slab will reduce depth penetration and data quality. These and other covering materials should be removed by the owner/contractor before you arrive. Standing water on the surface of the slab will also reduce the effectiveness of GPR.

See the CSDA best practices document available at www.csda.org for further details on properly marking GPR findings.

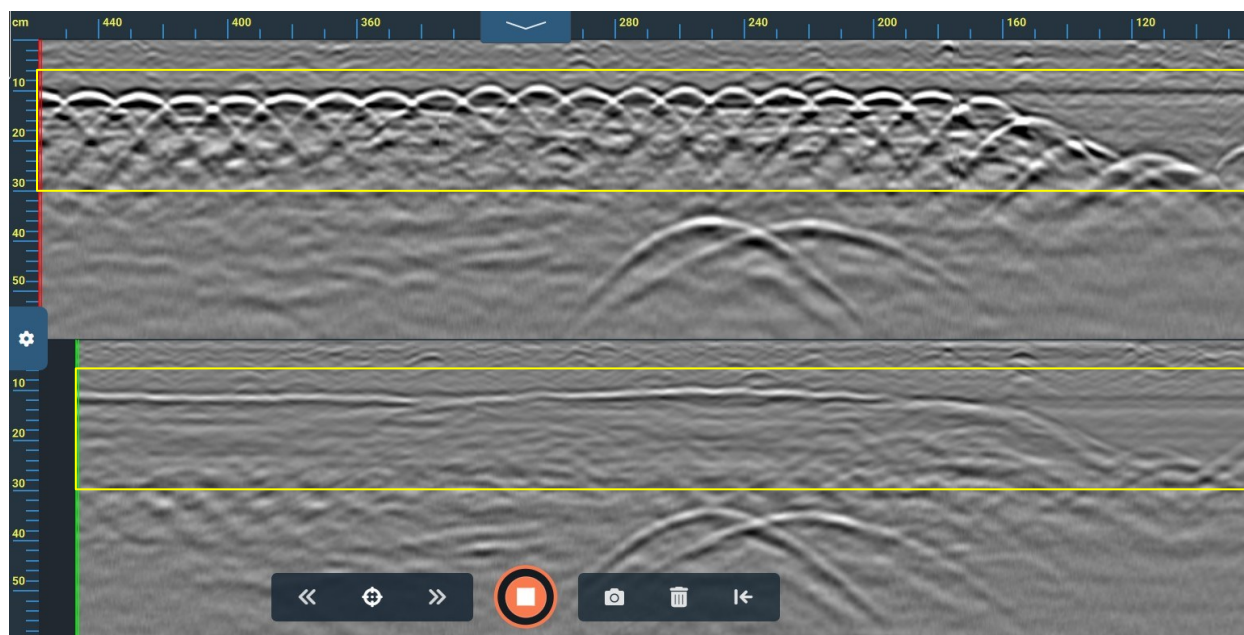
Data Examples

We have compiled Flex NX and Flex LT data examples covering some common concrete scanning scenarios. These examples are presented for general guidance; your data may look different from the data featured below. The following examples are no substitute for knowledge and experience, and they do not represent all conditions and scenarios. Please use your best judgment when scanning.



GSSI does not recommend scanning green (freshly poured) or uncured concrete. The conductivity of immature concrete dissipates the GPR energy, resulting in greatly reduced depth penetration and data quality.

Wire Mesh



Wire mesh, located near the top of the profiles. Note the following features:

- Dipping mesh at far right of the profiles.
- Close spacing of targets. The hyperbolic tails overlap due to the close spacing.
- The presence of two deeper and wider hyperbolas in the middle of the profiles.
- The standard antenna (top profile) shows abundant and shallow hyperbolas from wire mesh. These hyperbolas are not visible in the cross-polarized (bottom) profile.

Wire mesh is a metal mesh made by welding small-gauge wire into square or rectangular patterns. The mesh provides reinforcement to concrete slabs and prevents cracking. It is often installed just before the concrete is poured and is usually the shallowest object in the slab.

Mesh often retains some curvature when unrolled because it is stored and transported in tightly wrapped cylindrical bales. For this reason, the wire mesh in the slab may rise or sink at the ends of each mat. The entire mat may also deform under the weight of poured concrete, leading to the mat sinking deeper into the slab in some areas and rising to a shallower depth in others. When one roll of wire mesh runs out workers will overlap it with the next roll. As a result, in some locations you may find areas containing double mesh layers.

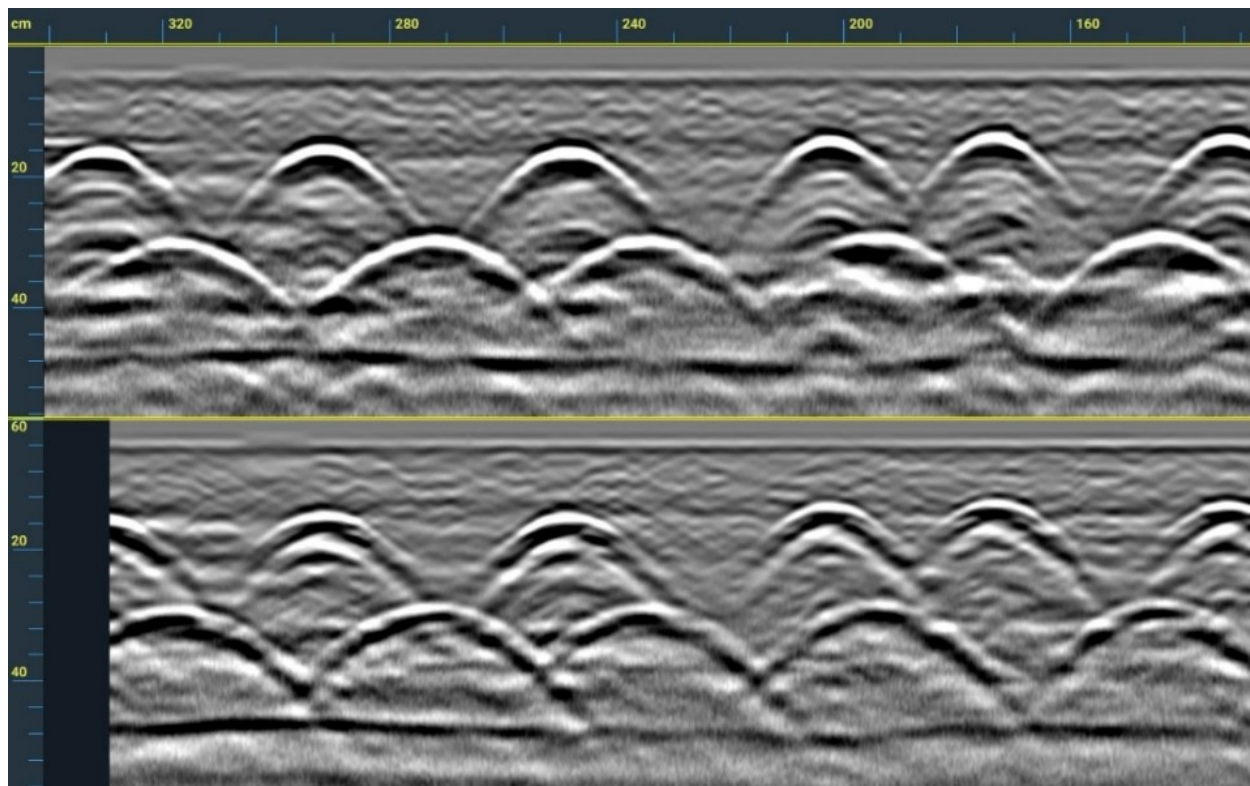
A wire mesh signature is like a small-size rebar mat. The GPR data will contain consistently spaced hyperbolic reflections from individual wires. While rebar is installed in the slab by hand and can have inconsistent spacing between each bar, wire mesh is a factory-made, prefabricated roll. This means that the spacing is perfectly consistent. When scanned with a cross-polarized antenna, mesh targets are typically not visible and are replaced by a flat reflector.

Wire mesh with smaller spacing, overlapping mesh layers, or closely spaced rebar may prevent or greatly inhibit GPR penetration. Conversely, mesh with a larger spacing, or wider spaced rebar, may allow for deeper penetration. Targets under mesh or rebar may be more difficult to identify. The cross-polarized antenna will remove, or at least reduce the impact of, the tails from the wire mesh hyperbolas. This makes it easier to image and interpret deeper targets. Similarly, cross-polarization will reduce the length of the 'tails' of the hyperbolas created by rebar reflections, as well as reducing the amplitudes of metal targets, which can aid in visualizing non-metallic objects beneath upper layers of reinforcement.

Rebar

Steel reinforcing bars (rebar) are, along with wire mesh, the most common targets in concrete structures. They are often the primary reinforcement for a slab, and typically run in two perpendicular directions in a grid pattern. In thicker slabs, or in slabs that will support considerable weight, there may be two layers of rebar: one closer to the top of the slab and one closer to the bottom. When oriented perpendicular to the survey line they produce clean and strong hyperbolas with long tails and are especially apparent in profiles from the standard antenna. The amplitude (signal strength) of rebar reflections increases with rebar diameter, though it is not possible to determine rebar size. Rebar will still create a hyperbola when scanned in cross-polarized orientation, but it will have lower amplitude and will be less expansive.

Rebar is used in most concrete structures, not just floor slabs. Rebar is typically present in jersey barriers, beams, retaining walls, above ground storage tanks constructed with concrete, columns, and any other concrete structures that require reinforcement. Rebar is also used when connecting a new section of concrete to an old section. These 'dowels' are short pieces of rebar and can be identified by scanning along the top to confirm their length, which can be as little as one foot. Check the surface of the slab for evidence of different aged sections of concrete, or obvious seams or saw cuts, which may suggest the presence of dowels used for patching, repair, or additions.

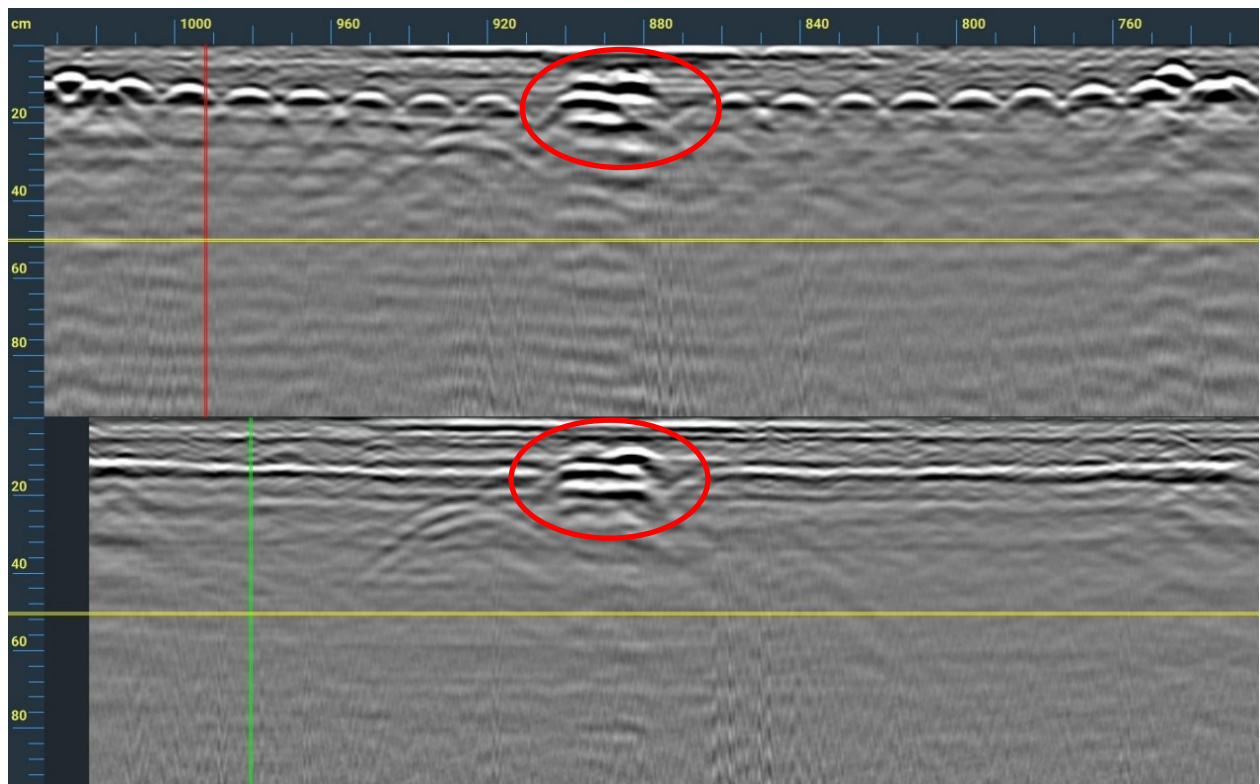


Top and bottom layer of rebar. Due to the increased width of the GPR's cone of energy, the lower rebar layer produces wider hyperbolas. The slab bottom is more obvious in the cross-polarized data, at a depth of 48 cm.

Conduit

Conduit refers to hollow, metallic, or non-metallic pipe installed inside a slab. It is one of the most important targets to precisely locate, as it can contain live power lines or data cables. It may be placed into the slab prior to the concrete pouring. Alternatively, it could be installed in a trench cut into cured concrete which is then backfilled with fresh concrete. A threading wire is used to pull power or data cables into and through the empty conduit. When placed prior to concrete pouring, a conduit may be tied directly to or underneath rebar which can increase the difficulty of locating it. Buildings are constructed with extra conduits for future expansion and renovation, so some conduits may be empty even in an active building.

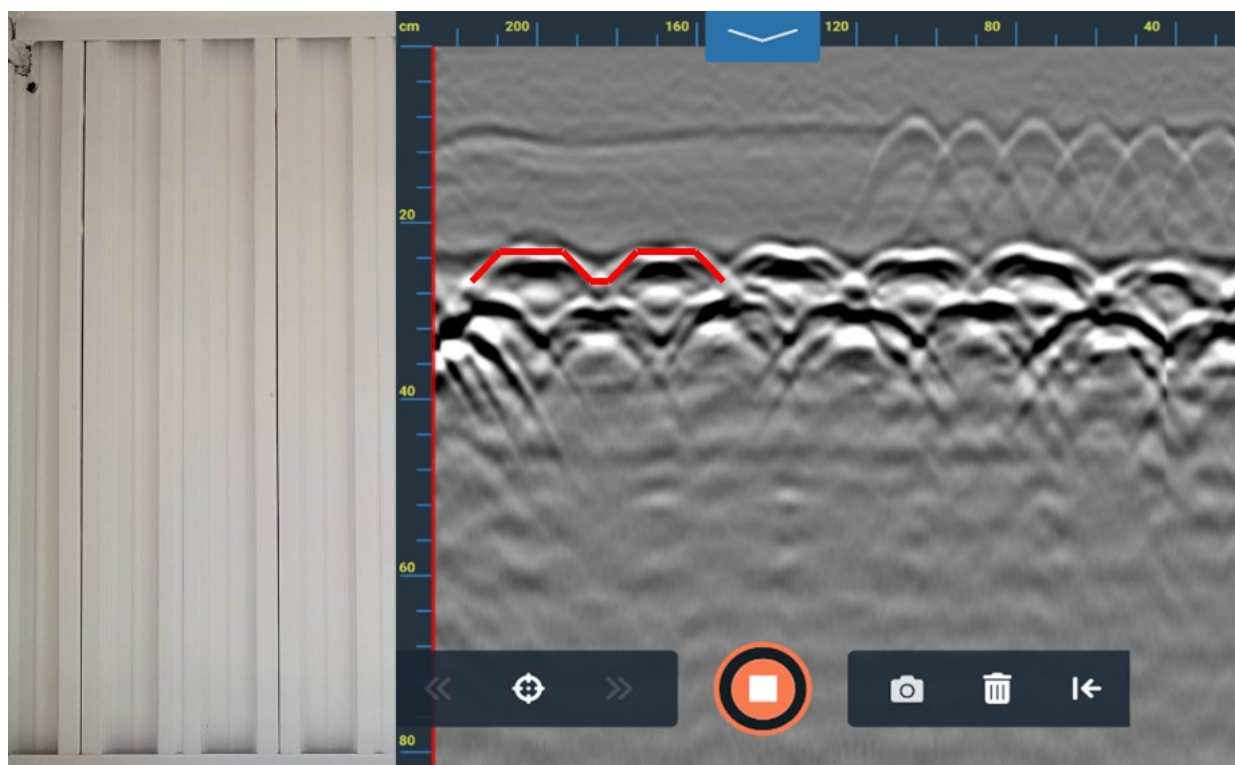
Steel conduit may appear identical to steel rebar of the same diameter, though rebar will exhibit a more predictable layout pattern. GPR energy does not penetrate metal, so there is no difference between reflections from a solid rod or a hollow metal pipe. In GPR profiles a large diameter conduit, duct, or pipe (over 2in or 5cm) will, relative to smaller diameter objects, produce a hyperbola that is noticeably larger. However, despite relative differences in hyperbola size the diameter of targets is not discernable with GPR. A non-metallic conduit will have a lower amplitude reflection and is more likely to change depth within the slab, bend side-to-side, or change directions and may be easier to identify on cross-polarized profiles.



Conduit located beneath a wire mesh layer. The wire mesh hyperbolas disappear in the cross-polarized data (appearing similar to a constant reflector) and further reveal the conduit beneath.

Pan Decking

Pan decking is a corrugated metal sheet supporting concrete slabs. The concrete is poured onto the decking, providing strength and durability to the slab above. Pan deck slabs will usually only contain wire mesh without rebar, as the decking itself provides most of the reinforcement. Conduits may be installed in the decking's bottom flanges (troughs) prior to pouring the concrete. The decking will create complex reflections at the flange shoulders that typically obscure targets set into the bottom flanges, creating a challenging environment for GPR. Try using the cross-polarized channel to reduce the impact of hyperbolas and in some cases provide better imaging of the bottom flanges.

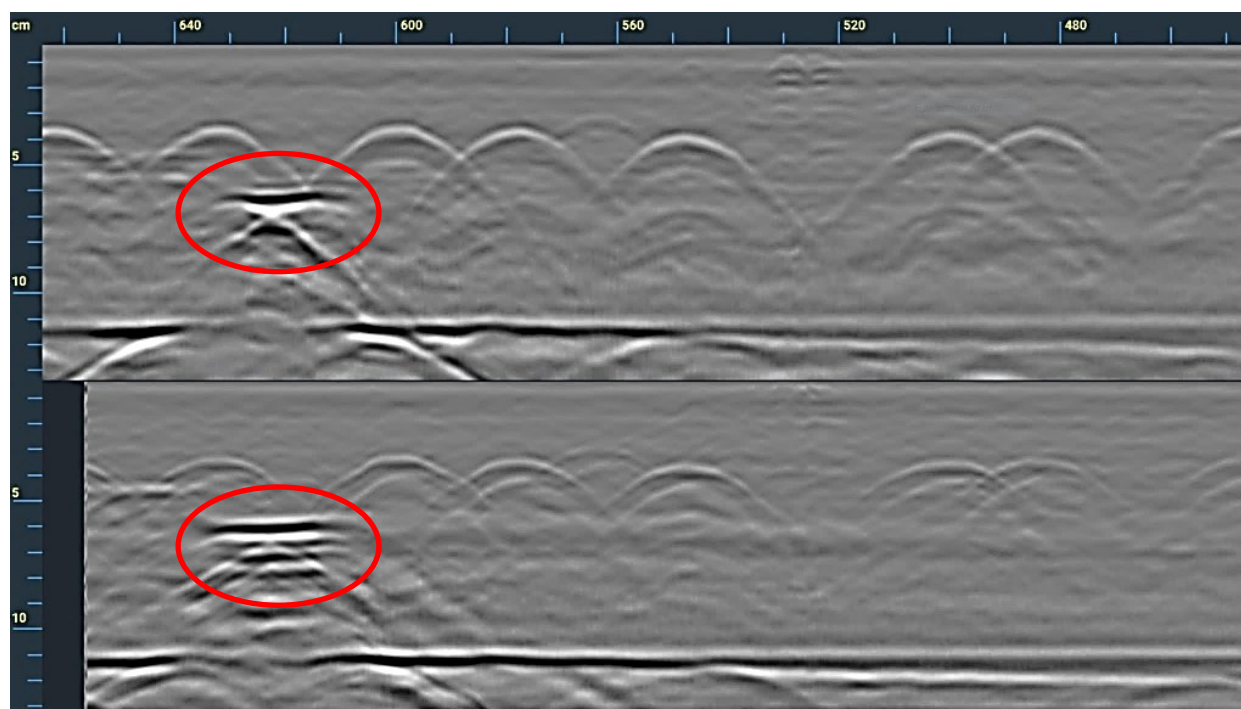


Left: Photo of pan decking from below. **Right:** pan decking running across the center of a GPR profile. The metal sheet alternates between higher and lower flanges and is visibly similar to the cross section of cardboard (red line overlay). Top flanges are resolved as elongated hyperbolas; bottom flanges (troughs) appear offset below as hyperbolas. The bottom flanges may have conduit installed within them, but the shoulders of the top flanges and sloping sides generate reflections that often prevent GPR from 'seeing' into the low points.

Beams and Objects Strapped to the Slab

Many concrete slabs have metal beams directly beneath them, and the beams may or may not be tied into the slab using vertical metal fastenings. Stud anchors and channel anchors are two such examples. It will not be possible to image beams below pan decking because the radar wave will not pass through the metal deck. If the beam is directly below the concrete it will usually appear as a strong, flat-topped and wide hyperbola at or just below the depth of the slab bottom.

Similarly, conduit or anchors may be attached directly to the bottom of a concrete slab. In this case, you will see a hyperbola – smaller than the hyperbola created by a beam – at or just below the depth of the slab bottom. It can be difficult to see objects strapped to the bottom of a very thick slab, as the radar wave must travel to the bottom of the slab and back, losing signal strength along the way.



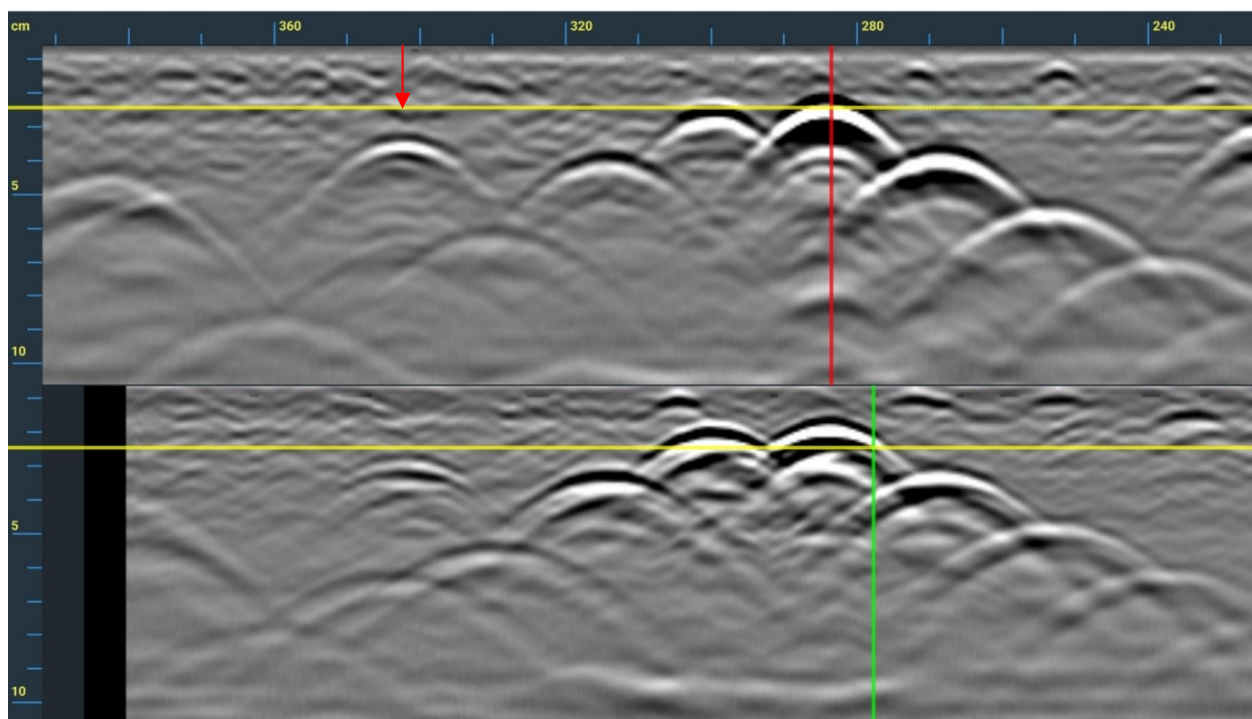
An I-beam in a wall observable as a flat, planar reflection at a depth of 6.5 cm. The other side of the wall appears as a planar reflection at a depth of 11.5 cm. The hyperbolas underneath this layer represent conduits strapped to the other side of the wall.

PVC vs. Metal Targets

A Polyvinyl Chloride (PVC) pipe or non-metallic conduit in concrete generally produces a hyperbola of the same shape as hyperbolas from metal targets. However, subtle differences in the phase and amplitude of the hyperbola can provide important interpretation clues. PVC is nearly transparent to GPR, so targets inside or underneath a PVC pipe can still be visible. This means that the GPR does not directly detect the PVC pipe; it detects the air, water, or other substance inside.

Air-filled PVC will create a lower amplitude target when compared with a metal pipe's hyperbola. It will also have black (negative phase) as its first-biggest-brightest reflection.

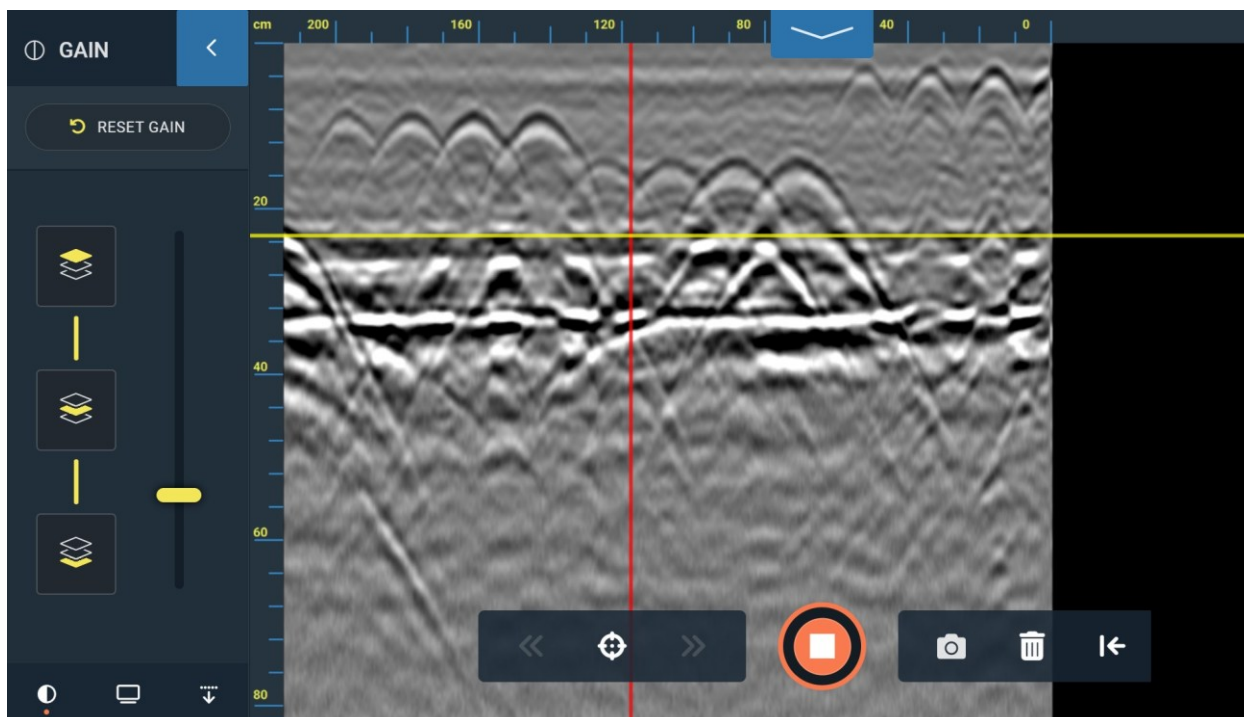
Water-filled PVC will create a target of similar (but not as high) amplitude when compared with a metal pipe's hyperbola. It will also have white (positive phase) as its first-biggest-brightest reflection.



Rebar located on the right side of the profile, visible as high amplitude hyperbolas. PVC targets are located on the left side of the profile, exhibiting lower amplitude hyperbolas compared to their metal counterparts. A single rebar on the left side (red arrow) obscures two conduits beneath it. The PVC pipes are more easily detectable in the cross-polarized channel due to the antenna's lower sensitivity to metallic targets. Hyperbolas in the cross-polarized data are less expansive, making it easier to see deeper targets.

Air Voids Under Concrete Slabs

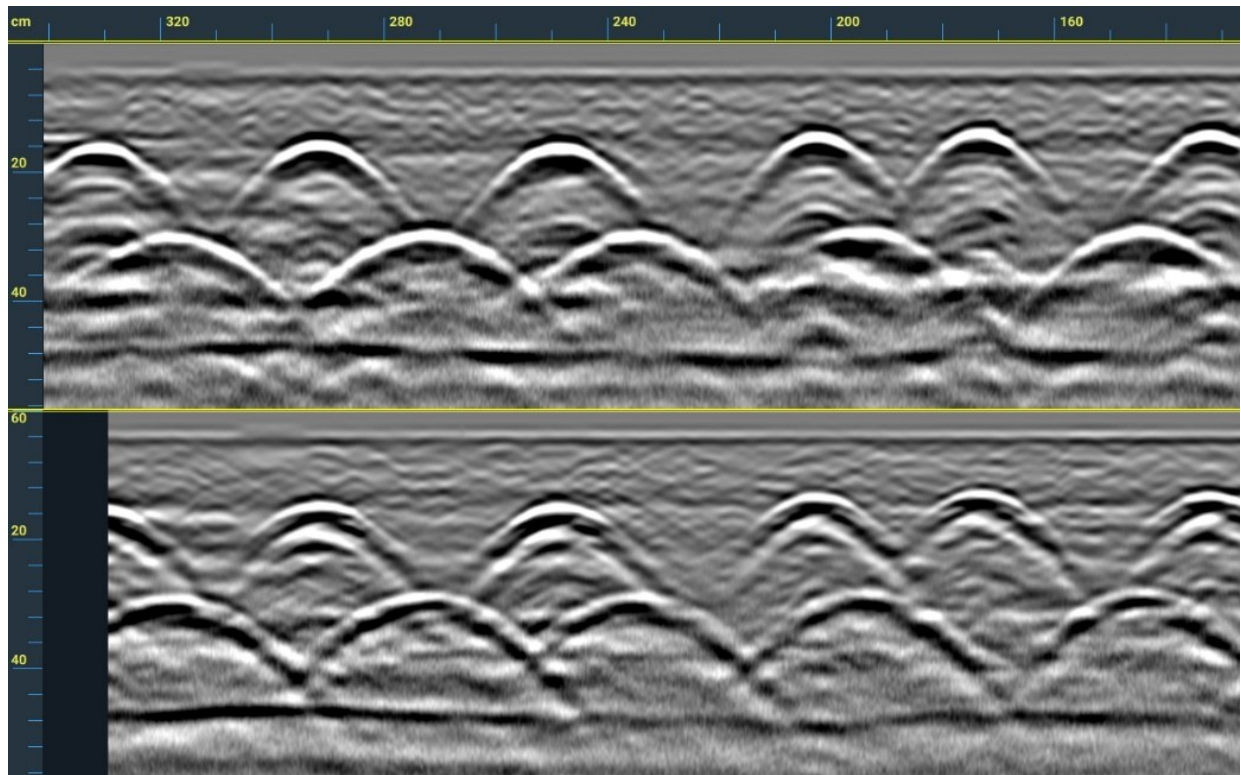
Voids in concrete, either air or water filled, produce observable targets (when small) and continuous layers (when large and expansive). An air-filled void below concrete will produce a moderately strong, white-black-white reflection pattern with the black (negative) peak exhibiting higher amplitude than the first white peak. Air voids exhibit a higher GPR velocity than concrete, causing the GPR energy to accelerate and reverse phase at the concrete/air boundary. In contrast, the slab/grade contact will often appear as a white-black-white reflection pattern because the GPR energy decelerates at the slab/grade contact (assuming typical water content in the grade materials). It is difficult to distinguish between the slab/grade contact and water-filled void spaces. Both should produce the same reflection pattern, though water-filled cavities should produce a higher amplitude reflection and will likely manifest as a more complex layer reflection.



Air filled PVC pipes and small voids in concrete appear as hyperbolas, and in most cases they produce low amplitude reflections with black as the first strongest band of color. Larger air voids appear as continuous or discontinuous layers with black as the first-biggest-brightest reflection. Use the O-Scope to assist with these determinations.

Multiple Reinforcement Layers

In structures with two layers of rebar, visibility of the second layer depends on the bar spacing in the first layer, slab thickness, state of concrete curing, and the amount of attenuation and scattering in the concrete. Staggered rebar are more likely to be visible, whereas a deeper layer of rebar aligned and set parallel with the top layer will be much less visible. If you have access to the bottom of a thick slab you can scan from below to mark deeper targets more easily.

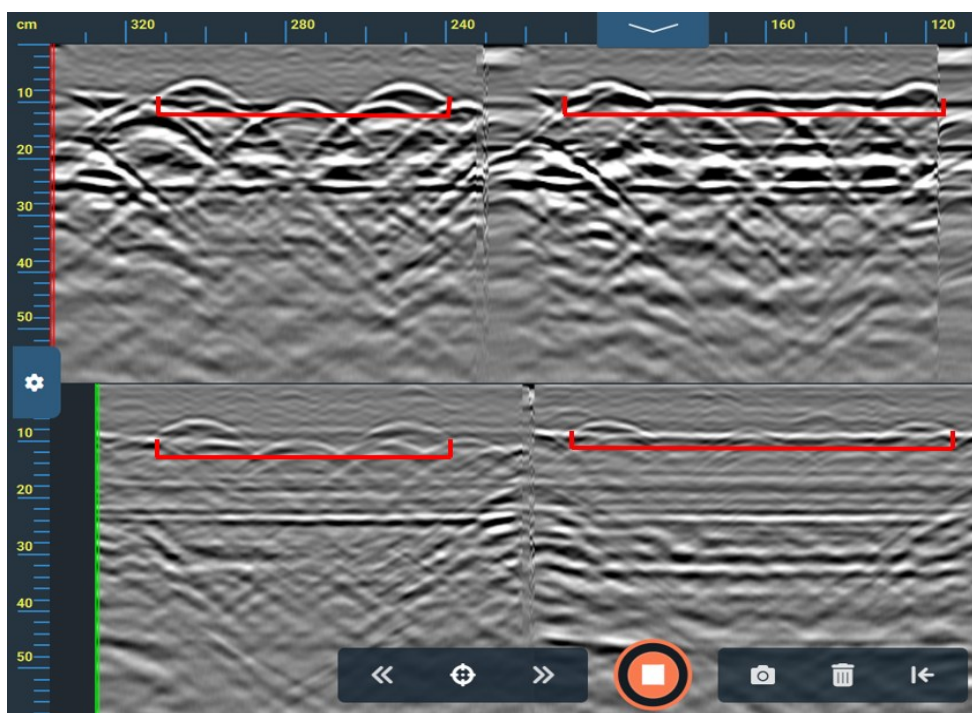


Two closely spaced layers of rebar. The lower rebar layer is often obscured by the top layer, usually resulting in incomplete or misshapen hyperbolas. The cross-polarized channel (lower profile) reveals a more defined slab/grade contact.

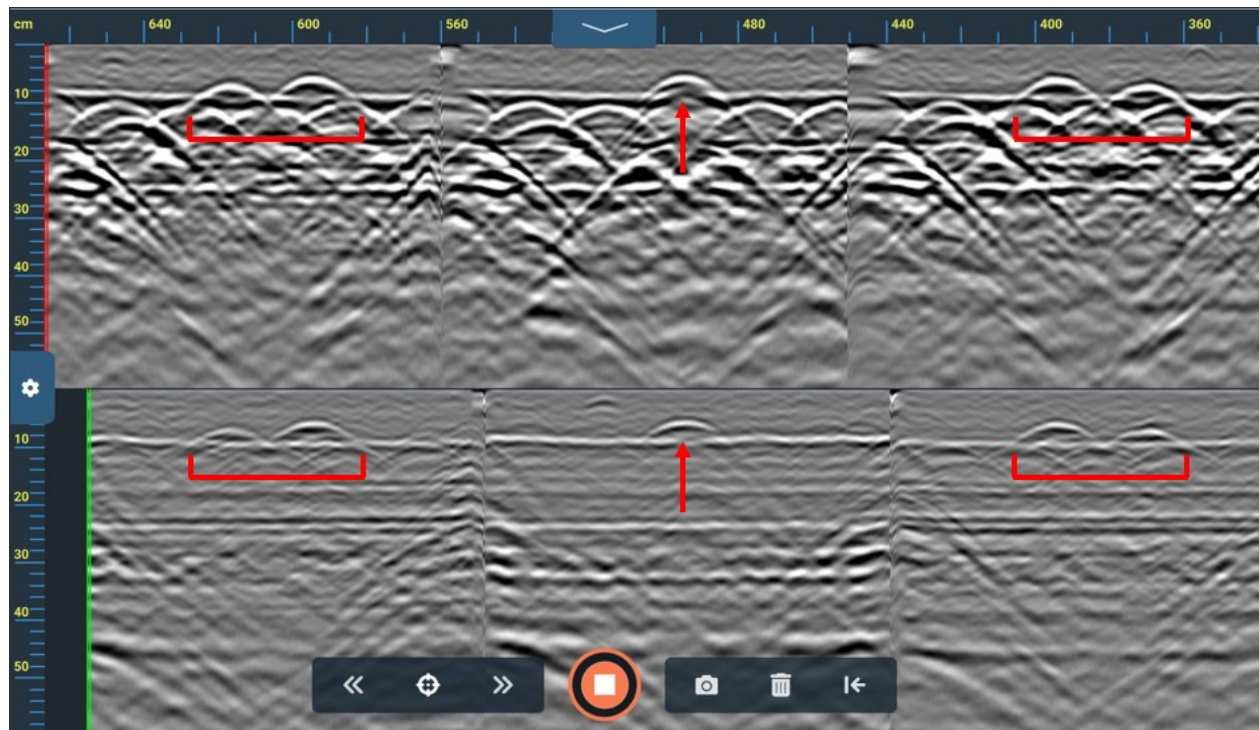
PT Cables

Steel post-tensioned (PT) cables are present in some structures along with reinforcing bars. The cable strands are housed in sleeves and are ratcheted to a high tension after the concrete has been poured, increasing the strength of the slab. Any damage to the PT from cutting, sawing, or coring could cause catastrophic failure, leading to loss of life and severe infrastructure damage. The cables are often laid in a fan pattern, where multiple cables are spread apart at either end of a slab and they move closer together toward the middle of the slab. They also change depth within the slab, rising and falling across the span and often ranging in depth from shallow on the sides to deeper in the middle.

Their typical appearance in a GPR profile is comparable to rebar. An uncoated steel cable and a rebar of the same size would produce identical hyperbolas. In practice, PT cables are placed into plastic conduits and/or coated with plastic, which may affect their reflection amplitude. When compared with rebar, PT cables may produce a weaker reflection on cross-polarized antennas. This, combined with the unique way that the cables are routed within the slab, allows for easier identification. PT cables show why it is important to collect long scans and understand the broader patterns around your target areas. Scanning at multiple locations could identify the changes in PT spacing and depth, and scanning along the top of potential PT cables will reveal if targets are rising and falling in the slab. In some cases, such as post-tensioned tennis courts, the PT cables will neither fan out nor change depth within the slab and may appear very similar to rebar or conduit.



Post-tensioned cables crossing a rebar mat at 45° angles. PT cables are visible in both standard and cross-polarized channels. Note the lower amplitude and greater clarity of the cross-polarized profile, where the hyperbolas from the PT cable are much more obvious.



A post-tensioned cable positioned above a rebar mat. In this example the PT cables converge until they 'cross' over, then they diverge further along the profile. These data were collected using a single file number, and Flex NX was moved to adjacent locations to track PT cable layout.