CX Series

The MALÅ CX Concrete Imaging System is designed for the non-destructive investigation and imaging of concrete structure.

Construction professionals involved in the cutting, coring or drilling of concrete structure require a safe and reliable means of inspecting work areas to locate and identify hidden features that could cause damage to machinery, or pose a danger to the operator or the structure itself during these activities.

The CX system allows you to scan concrete structure simply and safely and present data clearly for real-time and in-the-box data acquisition, display and analysis. It is a quicker, safer and more cost effective option than competing systems or traditional radiographic testing methods and is available in two options CX10 and CX11.

The CX system was the world's first to combine GPR with the more common Electro-Magnetic (EM) technology by way of a fully integrated 50/60 Hz sensor. This combination allows the detection of both metallic and non metallic objects and features, but also aids in the detection and location of metallic conductors energized with 50/ 60 Hz within the structure under investigation; thereby offering an additional element of safety to the system.

CX System

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The CX System allows the accurate inspection of concrete structure such as floors, walls, balconies, bridge decks etc. and the detection of metallic and non metallic objects and features within, i.e. rebar, post tension cables, metallic/ non-metallic conduits and pipes, voids and the measurement of slab thickness.

Applications include:

- Cutting
- Coring
- Drilling
- Inspection and
- Quality Control

The CX System comes as standard in a CX Shipping Case, but can also be used in conjunction with an optional PC/Monitor holder for greater portability and flexibility of use, depending on the application and user requirements.

The CX System fully supports MALÅ's range of High Frequency (HF) Shielded Antennas allowing the user to choose the best antenna for their given application and obtain unsurpassed accuracy and data clarity.

Concrete

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MALÅ's range of high frequency antennas offers the best imaging solution with the highest resolution available. These high frequency antennas offer a reliable and non-destructive way of gathering subsurface information accurately, efficiently and in real time, for both metallic and non-metallic features such as rebar, conduits, wiring, plastic pipes, post-tension cables, voids and more.

Main applications within the Concrete market:

- Concrete inspection – locating metallic and non-metallic targets in ceilings, floors and walls, i.e. rebar, tension cables, conduits, PVC pipes and more
- Structure inspection – bridges, towers, tunnels, balconies, garages, decks, columns, slabs, monuments
- Condition assessment – map concrete condition for rehab planning
- Measure slab thickness
- Void location

Concrete NDT & Civil Engineering

Non Destructive Testing (NDT) professionals routinely use GPR for a number of applications. Prior to the evolution of high frequency GPR transducers of 1 GHz and above the primary tool for imaging structural embedment's in concrete was x-ray methods. GPR is replacing the x-ray method in many instances as the preferred approach for a number of reasons. The x-ray method is expensive, time consuming, poses major health risks during operation and suffers limitations on what surfaces can be imaged. For example slabs on grade or other surfaces where both sides cannot be accessed may not be scanned with x-ray. GPR on the other hand requires minimal training, poses no health risks from emissions, and can be used on any surface. Also, results such as with MALÅ's CX series are obtained in real time in the field.

GPR as an imaging tool allows the operator to gather the following information:

- Rebar and tension cable location and depth
- Slab thickness on grade and suspended
- Location of non-metallic and metallic conduits and other embedded non-structural features such as fiber networks, in-floor heating elements, and plumbing
- Detection of voids and variations in the concrete matrix

Condition assessment is a growing field with GPR. Bridge decks, parking decks, and other structures may be scanned to non-destructively evaluate the amount of deterioration of these structures. Areas of degraded or compromised concrete from corroded rebar and delamination are detectable with GPR as areas of low propagation velocity due to the higher dielectric properties from infiltrated water and chlorides.

- Inspection of other reinforced concrete structures
- Measure slab thickness
- Measure bridge deck thickness
- Void detection and location
- Concrete inspection
- Structure inspection
- Bridge deck condition assessment
- Condition assessment
- Determining concrete cover depth on new structures

Technology Explained

Ground Penetrating Radar (GPR) Technology Explained

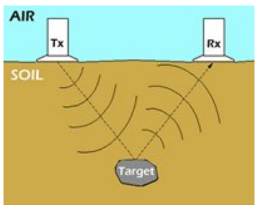
What is Radar?

Radar is a system that uses electromagnetic (EM) waves to identify the range, altitude, direction, or speed of both moving and fixed objects such as aircraft, ships, motor vehicles, weather formations, and terrain. A transmitter emits radio waves, which are reflected by the target and detected by a receiver, typically in the same location as the transmitter. Although the radio signal returned is usually very weak, radio signals can easily be amplified. This enables radar to detect objects at ranges where other emissions, such as sound or visible light, would be too weak to detect.

The term Radar was coined in 1941 as an acronym for **Ra**dio **D**etection **a**nd **R**anging.

What is Ground Penetrating Radar (GPR)?

Ground penetrating radar (GPR) is a geophysical method that uses radar pulses to image the subsurface. This non-destructive method uses electromagnetic (EM) radiation in the microwave band (UHF/VHF frequencies) of the radio spectrum, and detects the reflected signals from subsurface structures. Applications for GPR include locating buried voids/cavities, underground storage tanks, sewers, foundations, ancient landfills, pipelines and cables. It can also be used to characterize bedrock, ice, the internal structure of floors/walls, water damage in concrete, and the internal steelwork in concrete.

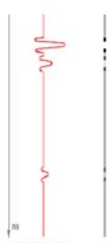


GPR uses transmitting and receiving antennae. The transmitting antenna radiates short pulses of the high-frequency (usually polarized) radio waves into the ground. When the wave hits a buried object or a boundary with different dielectric constants, the receiving antenna records variations in the reflected return signal.

The depth range of GPR is limited by the electrical conductivity of the ground, and the transmitting frequency. Higher frequencies do not penetrate as far as lower frequencies, but give better resolution. Optimal depth penetration is achieved in dry sandy soils or massive dry materials such as granite, limestone, and concrete where the depth of penetration is up to 15 m. In moist and/or clay laden soils and soils with high electrical conductivity, penetration is sometimes only a few centimeters.

The GPR Method

The waves travel from the transmitting antenna into the ground where they are reflected by and diffracted from non-homogeneous. The receiver records the electric field returning from the subsurface as a function of time. Such a recording is known as a trace. A set of traces collected along a line is known as a profile. A plot of a profile is known as a radargram and resembles a vertical slice through the ground. There are several methods to transform the profile (distance versus time) to a true depth section (distance versus depth). The basic principle is, however, always the same. If we know the radar wave velocity and the time it takes for the radar wave to travel along the path transmitter – reflecting point – receiver, it is possible to calculate the depth to the reflecting point in the ground.



- GPR Trace
  - A single GPR trace is a reflected EM wave.
- GPR Scan
  - A trace with a color or gray scale
- Scans placed side-by-side form a Display Profile, creating a two-dimensional (2D) cross-section.