Penetradar GPR Catalog 2017

PENETRADAR CORPORATION

2509 Niagara Falls Boulevard, Niagara Falls, New York 14304 U.S.A.
TEL: 716-731-4369 FAX: 716-731-5040 EMAIL: info@penetradar.com www.penetradar.com

Penetradar™ Ground Penetrating Radar Systems

2017

GPR Systems Overview

Thank you for your inquiry regarding Penetradar IRIS GPR systems. The IRIS GPR is offered in four versions, which are described below. A complete GPR system typically consists of a control unit, antenna(s), cables, software and other optional accessories, which may include GPS, vehicle mounting structure and/or transport cart.

A general description of Penetradar's GPR systems are provided below.

The ***IRIS-P*** is a single channel GPR which can be configured for many applications, ranging from pavement inspection (airport and roadway) to site inspections of various types. The IRIS-P control unit is installed in a ruggedized carry case and can be used on construction sites for manual site surveys or installed into a vehicle for pavement evaluation or used with our transport cart on site surveys. This system can be used with any of our contacting (2GHz - 300MHz) or non-contacting antennas 2.5GHz - 500MHz).

The ***IRIS-L***, is a low cost, dual channel GPR. It is portable and can be used on-site for manual type site surveys or installed into a vehicle. A typical vehicle-based IRIS-L configuration consists of a dual channel IRIS-L GPR control unit, one or two antennas, (typically one 1GHz Model 30AGC antenna, and one 2GHz Model 30AGC antenna), data collection and analysis software and vehicle installation/mounting system (VIS-1) if installed into a vehicle. The IRIS-L is compatible with all of our contacting antennas (2GHz - 300MHz) and non-contacting antennas (2.5GHz - 500MHz).

The ***IRIS-MP*** is a man-portable GPR. It is a single channel GPR available in 1GHz or 2GHz non-contacting versions and can be used for near-range inspection up to 3 feet in depth. It is also available in a lower frequency version (300MHz, 400MHz or 500MHz) for utility and UST detection. The IRIS-MP is a self contained GPR and includes a 8 inch touchscreen and IRISDAQ-MP software for control and operation.

The ***IRIS*** is a high-end, multichannel GPR that is recommended for high-speed, pavement layer mapping, subsurface voids and moisture detection, as well as bridge deck condition evaluation. The IRIS can be configured in many different ways according to the application, with up to four antennas, either of the same type or of different types. The IRIS is well suited for single pass, full lane inspection at highway speeds and can be installed with interchangeable air-coupled and ground-coupled antennas for an inspection depth of up to 4 meters.

The IRIS-P, IRIS-L and IRIS-MP operate on 12VDC and the IRIS can be provided with either 12VDC or 120/220VAC input. The VIS-1 and VIS-2 (vehicle installation/mounting system) are used to interface the GPR to a vehicle, and there is a transport cart available for manual surveys. All IRIS systems are fully GPS compatible and a GPS subsystem can be provided as an option. If needed, we can send our experienced staff to your location to provide on-site installation and training, and we can also provide turn-key solutions, which include both GPR systems and vehicle.

For more information on Penetradar products please visit us at www.penetradar.com, or contact us by email at info@penetradar.com.

WHY SELECT PENETRADAR ?

For over 35 years, Penetradar Corporation has been a leader in the development and utilization of NDT technology. We have been serving the engineering community, specializing in the development, manufacture and application of Ground Penetrating Radar (GPR) for nondestructive evaluation of the civil transportation infrastructure, geotechnical and subsurface environmental investigations

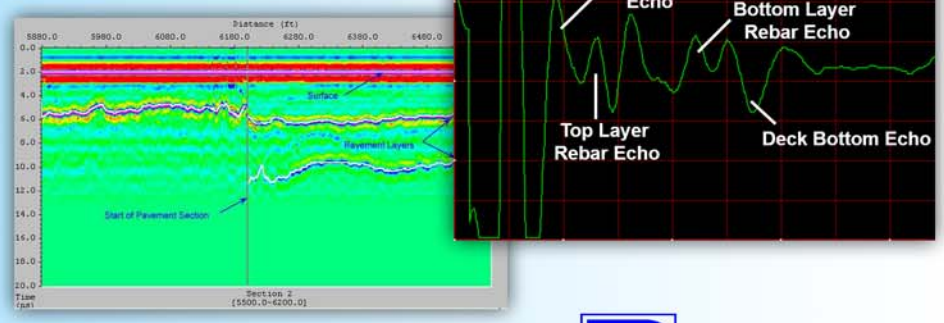
Unlike other GPR companies, Penetradar is both a developer and manufacturer of GPR technology, and also a provider of GPR inspection services. We invented the air-coupled GPR antenna in the 1970's which has made modern, high-speed pavement and bridge deck evaluation possible

Penetradar's High Performance IRIS Ground Penetrating Radar Technology is unique in the industry and the only equipment available today that it has the ability to cover an entire traffic lane width, while traveling at highway speeds and at the same time collecting data at an ultra high scan rate sufficient to identify small subsurface features such as delaminations in bridge decks, voids beneath highway joints or buried subsurface objects and utilities.

- ***Four Channel High-Speed Array (operational speed of 50 MPH)***
  Allows for complete lane coverage, reducing scanning time

- ***Non-Contacting Horn Antennas (2ns, 1ns, 0.75ns, 0.5ns pulse widths)***
  High Speed Antennas Exhibiting Ultra Wideband Performance & High Directivity Beam minimize distortion and interference.

- ***Software Analysis Tools: Color Profile & Waveform Analysis***
  Complete and comprehensive, advanced analysis software for GPR data including ColorPro for graphical analysis and WavePro for analytical measurement of radar waveforms.



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GPR Selection Guide

Application	GPR Component Systems	GPR Subcomponent
Highway Inspection • Bridge Deck Inspection • Pavement Inspection • Runway Evaluation • Tunnel Inspection	GPR Control Unit	IRIS-P with single channel (single antenna) or IRIS-L with single or dual channel (one or two antennas) or IRIS with up to four (4) channels (one, two, three or four antennas)
	Antennas	0.5ns (2.5 GHz) Horn Antenna - Model 30AGC-0.5 0.75ns (2.0 GHz) Horn Antenna - Model 30AGC-0.75 1ns (1 GHz) Horn Antenna - Model 30AGC-1.0 500 MHz (2ns) Horn Antenna - Model 60AGC-2.0 500 MHz (2ns) Contacting Antenna - Model 501BP
	Software	IRIS Software Data Acquisition - Data Collection ColorPro - Color Profile Analysis WavePro - Waveform Analysis (Power and Voltage) IRISMap - Mapping Software - Color Topographical Mapping Profile Display - 2D & 3D Profile Display
	Vehicle Installation System	VIS-1, Single antenna mounting system or VIS-2, Multiple antenna mounting system
	GPR Vehicles & Transport	Standard IRIS Vehicle Basic IRIS Vehicle IRIS Utility Vehicle IRIS Hyrail Radar Transport Cart
	Options	Submeter GPS Remote GPR Control (External LCD Display & Keyboard) GPR Processing Station Additional Software Site License

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GPR Selection Guide

Application	GPR Component Systems	GPR Subcomponent
Geotechnical • UST • Utility detection, • Voids • Subsurface profile • Buried Foundation • Object detection	GPR Control Unit	IRIS-P with one (1) antenna or IRIS-L with one (1) or two (2) antennas or IRIS-MP with 301B/401B/501B contacting antenna
	Antennas	300 MHz Contacting Antenna - Model 301B 400 MHz Contacting Antenna - Model 401B 500 MHz Contacting Antenna - Model 501B 500 MHz Contacting Antenna - Model 501BP 500 MHz (2ns) Horn Antenna - Model 60AGC-2.0
	Software	IRIS Software Data Acquisition - Data Collection ColorPro - Color Profile Analysis WavePro - Waveform Analysis (Power and Voltage Measurement) IRISMap - Mapping Software - Color Topographical Mapping Profile Display - 2D & 3D Profile Display FocusCell - Imaging Software
	GPR Vehicles & Transport	IRIS Vehicle Utility Vehicle Radar Transport Cart Portable Power Unit (for IRIS-P)
	Options	IRIS-P/ IRIS-L Battery Pack Portable Power Unit (for IRIS-P) Submeter GPS Remote GPR Control (External LCD Display & Keyboard) Antenna Extension Cables GPR Processing Station Additional Software Site License

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GPR Selection Guide

Application	GPR Component Systems	GPR Subcomponent
Concrete Inspection • Rebar Detection • Electrical Conduit • Depth Measurement	GPR Control Unit	IRIS-P with one (1) contacting antenna or IRIS-L with one (1) or two (2) contacting antennas or IRIS-MP with Model 32 AGC non-contacting antenna
	Antennas	2.5GHz Contacting Antenna - Model 2501B 2GHz Contacting Antenna - Model 2001B 1GHz Contacting Antenna - Model 1001B
	Software	IRIS Software Data Acquisition - Data Collection ColorPro - Color Profile Analysis WavePro - Waveform Analysis (Power and Voltage Measurement) IRISMap - Mapping Software - Color Topographical Mapping Profile Display - 2D & 3D Profile Display FocusCell - Imaging Software
	Options	Telescoping Handle External DMI Wheel IRIS-P/ IRIS-L Battery Pack or Battery Belt Portable Power Unit (for IRIS-P) Submeter GPS Remote GPR Control (External LCD Display & Keyboard) Antenna Extension Cable GPR Processing Station Additional Software Site License

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Ground Penetrating Radar Systems 2017

Integrated Radar Inspection System (IRIS)

The Penetradar Integrated Radar Inspection System (*IRIS*) is an automated radar based system for high-speed, non-destructive surveys, solving the problem of radar data interpretation and ease of use. The *IRIS* consists of ground penetrating radar, data acquisition hardware and IRIS Software, integrated into a highly automated, turn-key inspection system that requires little knowledge of radar signal interpretation to operate effectively.

Designed for use at speeds of 60 MPH (100KM/H) the *IRIS* "sees" into the ground, automatically acquiring and storing digitized radar data on hard disk for subsequent processing. IRIS Software simplifies the task of data analysis and consists of automated and computer assisted programs which require limited user input and provide 2D & 3D subsurface profiles and plan-view subsurface mappings of the area inspected.

The *IRIS* utilizes all Penetradar antennas and can be installed with up to four antennas in an array for maximum transverse coverage. A complete *IRIS* system consists of the following components:

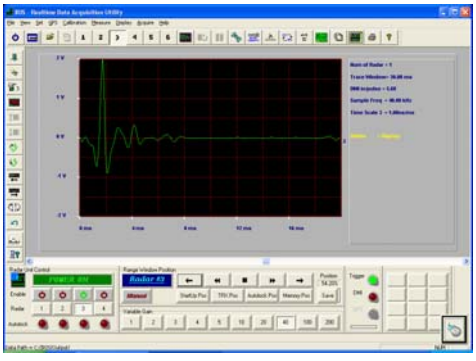
- IRIS DRC (1, 2, 3 or 4 channels)
- Antenna(s) & Cables
- IRIS Software for Windows

IRIS DRC

- ***Digital User Interface with Touchscreen-Based Radar Control***
- ***Four Antenna Operation***
- ***High Speed Acquisition***
- ***AC or DC Power***

Features

- *Complete, integrated and automatic, radar/data acquisition/data processing system for high-speed inspection applications.*
- *Installed with up to four contacting or non-contacting antennas.*
- *Advanced Windows based Data Acquisition and Processing software providing quantitative output in graphic and numerical format.*
- *Rugged, design for vehicular installation.*
- *Full touchscreen interface for GPR control*
- *Uses include the high-speed evaluation and testing of pavements, bridge decks, runways.*
- *GPS Compatible*



Virtual Touchscreen Control Panel

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Ground Penetrating Radar Systems 2017

Integrated Radar Inspection System Version L (IRIS-L)

The Penetradar Integrated Radar Inspection System Version L (*IRIS-L*) is a lower cost, dual channel GPR system with features and performance similar to the standard IRIS GPR.

Designed for applications that require the simultaneous use of up to two antennas, the *IRIS-L* is the system of choice. This system combines portability, low power and multiple antenna operation while maintaining compatibility with all Penetradar software.

The *IRIS-L* utilizes all Penetradar antennas and can be installed with up to two antennas in any configuration. A complete *IRIS* system consists of the following components:

- IRIS-L DRC (1 or 2 channels)
- Antenna(s) & Cables
- IRIS Software for Windows

IRIS Version L DRC

- ***Digital User Interface with Optional Touch screen Radar Control***
- ***Two Antenna Operation***
- ***High Speed Acquisition***

Features

- *Complete, integrated and automatic, radar/data acquisition/data processing system for high-speed inspection applications.*
- *Installed with up to two contacting or non-contacting antennas.*
- *Digital User Interface with Standard 19" External LCD or Optional Built-in LCD Touchscreen.*
- *Advanced Windows based Data Acquisition and Processing software providing quantitative output in graphic and numerical format.*
- *Rugged, design for vehicular installation or portable field use.*
- *Full touchscreen interface for GPR control (with optional 7 inch touchscreen LCD) or operation with standard keyboard/mouse.*
- *Uses include the high-speed evaluation and testing of pavements, bridge decks, runways, site surveys and general applications.*
- *GPS Compatible.*
- *Battery Operated.*

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Integrated Radar Inspection System Version P (IRIS-P)

The Portable Integrated Radar Inspection System - IRIS Version P is a self contained, low cost single antenna ground penetrating radar system designed for applications requiring field portability. The IRIS-P includes a digital GPR control unit and real-time data acquisition/processing system with high intensity 12 Inch SVGA data display, touch screen control and internal hard disk storage. This system was designed to operate with all of Penetradar antennas and IRIS software. Standard features of the IRIS-P include DMI input for distance tagging, USB data ports for data download and connection of peripherials, GPS port and IRIS Software.

Features

- *Complete Integrated Radar Inspection System - Includes GPR, Data Acquisition/Processing Computer and Software*
- *Built-in High Intensity (Sunlight Readable) SVGA Display, Touch Screen Control and Internal Hard Disk Data Storage*
- *Low Cost and Easy to Use*
- *Rugged Design for Man-Portable Use in the Field or Vehicular Installation*
- *Digital GPR Control Unit with Interchangeable Antenna and Transceiver Units*
- *External SVGA Display for Vehicle Installation (Optional)*
- *GPS Compatible*

IRIS Version P

(shown with Model 1001B antenna)

- ***Digital User Interface with Touchscreen***
- ***Software Based Radar Control***
- ***Single Antenna Operation***
- ***Compatible with all Penetradar antennas***

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Integrated Radar Inspection System Version MP (IRIS-MP-32AGC)

The Man-Portable Integrated Radar Inspection System - IRIS Version MP is a self contained, low cost single antenna ground penetrating radar system designed for applications requiring high mobility and field portability. The IRIS-MP includes a digital GPR control unit and real-time data acquisition/processing system with high intensity, sunlight readable 7 Inch SVGA data display, full touch screen control and internal hard disk storage. This system uses a non-contacting mini-horn antenna and was designed to operate with all of Penetradar IRIS software. Standard features of the IRIS-MP include real-time IRISDAQ data collection software, DMI input for distance tagging, USB data ports for data download and connection of peripherials and serial port for GPS input.

Features

- *Complete Integrated Radar Inspection System - Includes GPR, Data Acquisition/Processing Computer and Software*
- *Built-In High Intensity 7" SVGA Display, Touch Screen Control and Internal Hard Disk Data Storage*
- *Digital GPR Control Unit with 1ns/1GHz Horn Antenna (2GHz and 2.5GHz Optional)*
- *Low Cost and Easy to Use*
- *Designed for Man-Portable Use*
- *Noncontacting Horn Antenna*

IRIS-MP MAN PORTABLE GPR

- ***Full Touchscreen User Interface***
- ***Software Based Radar Control***
- ***Non-contacting Antenna***
- ***One Person Operation***

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Integrated Radar Inspection System Version MP (IRIS-MP-301B/401B/501B)

The Man-Portable Integrated Radar Inspection System - IRIS Version MP is a self contained, low cost single antenna ground penetrating radar system designed for applications requiring field portability. The IRIS-MP includes a digital GPR control unit and real-time data acquisition/processing system with high intensity LCD data display, touch screen control and internal hard disk storage. Standard features of the IRIS-MP include DMI input for distance tagging, USB data ports for data download and connection of peripherials, GPS port and IRISDAQ Software. The IRIS-MP is suitable for all types of terrain and can be used in a wide variety of environments for detection of underground utilities, measure subsurface layers, UST's and objects up to 4 meters in depth.

Features

- *Complete Integrated Radar Inspection System - Includes Man-Portable GPR, Data Acquisition/Processing Hardware & Software*
- *Built-in high intensity (sunlight readable) LCD Display, touch screen control and internal hard disk data storage*
- *Low Cost and Easy to Use (Windows based)*
- *Rugged Design for Man-Portable Use in the Field*
- *Inspection depths of up to 4 meters*
- *Available in 300MHz, 400MHz and 500MHz versions*

IRIS-MP-301B Man-Portable GPR (shown)

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Antennas 2017

Antennas

Available is a complete and comprehensive line of non-contacting and contacting antennas, covering a broad range of depth and resolution for pavement and bridge deck inspection applications, geotechnical and site surveys.

Model 30 AGC Monostatic Non-Contacting Antenna

Non-Contacting Antennas

The Model 30AGC and 60AGC antennas are lightweight and compact, high performance TEM mode horn antenna/transceiver combinations designed for non-contacting GPR operation. These antennas exhibit ultra wide band performance and very low VSWR, with minimal distortion throughout the bandwidth of the applied signal. Its high directivity beam minimizes interfering clutter sources. These antennas are optimized for applied signals within the range the range of 0.5 ns to 2.0 ns and are available in both monostatic and bistatic configurations. Transceiver units are interchangeable depending on desired pulse width. Penetradar non-contacting antennas are constructed of low dielectric material with a hard plastic outer covering for durability and high speed (60MPH/100km/hr) operation. When ordering specify antenna and transceiver pulse width.

Antenna	Type	Pulse Width Range (ns)	Maximum Depth
Model 30AGC	Monostatic	0.5 - 1.25	1 meter
Model 30AGC-BX	Bistatic	0.5 - 1.25	1.5 meter
Model 60AGC	Monostatic	1.5 - 2.0	2 meter

Model 30 AGC-BX Bistatic Non-Contacting Antenna

Model 60 AGC Monostatic Non-Contacting Antenna

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Antennas 2017

Ground Contacting Antennas

The 2 nanosecond (500MHz) Model 501B, 2.5 nanosecond (400MHz) Model 401B and 3 nanosecond (300MHz) Model 301B are mid-frequency and low frequency contacting-type ground penetrating radar antennas with penetration depths of approximately 6 feet (2 meters), 9 feet (3 meters), and 12 feet (4 meters), respectively. These antennas are optimized for ground contacting operation and can be pulled manually or towed by a vehicle. The Model 401B/501B can also be suspended from a vehicle in close proximity to the ground and when properly installed can be operated at speeds up to 35MPH (55km/hr). These antennas are a shielded, broadband dipole design that optimize bandwidth and minimize distortion resulting in superior subsurface detection capability. Uses for these antennas include detection of subsurface pipes and utilites, measurement of thick pavement layers, geotechnical applications including detection of underground storage tanks (UST's) and for a wide variety of general site inspection applications. The 501B/401B/301B antennas are housed in a rugged plastic enclosure for high durability and incorporate removeable wheels for maximum mobility. These antennas are compatible with all Penetradar GPR systems and software.

Antenna	Type	Pulse Width (ns)
Model 501B	Bistatic	2.0ns
Model 401B	Bistatic	2.5ns
Model 301B	Bistatic	3.0ns

Model 401B/501B
Mid Frequency Contacting Antenna

Model 301B
Low Frequency Contacting Antenna

Hand-Held (Contacting) Antennas

The Model 1001B, Model 2001B and Model 2501B are shielded, hand-held contacting type antennas used for near range (shallow depth) inspections. These antennas emit 1ns (1GHz) and 0.75ns (2001B) and 0.5ns (2501B) monocycle pulses at high PRF. This family of antennas are optimized for near range and high resolution with maximum depth range of 1m (1001B), 60cm (2001B) and 45cm (2501B). The 1001B/2001B/2501B antennas are housed in a light weight aluminum enclosure. Typical applications include rebar location & mapping, rebar depth measurement, electrical conduit location, void detection and thickness measurement. For remote inspection an optional telescoping handle is available, and for subsurface "imaging" Penetradar's *FocusCell* software is available.

Antenna	Type	Pulse Width (ns)
Model 1001B	Bistatic	1.0ns
Model 2001B	Bistatic	0.75ns
Model 2501B	Bistatic	0.5ns

Model 1001B/2001B/2501B
High Frequency Contacting Antenna (shown with DMI Wheel)

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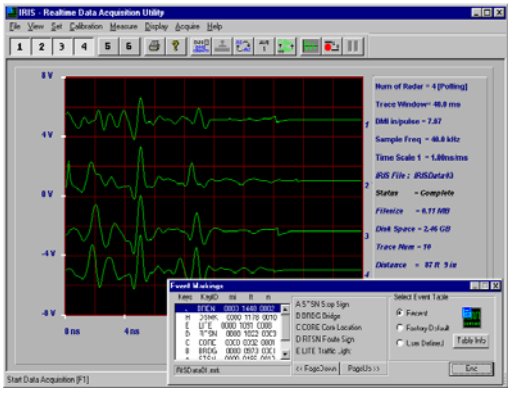
Software 2017

Software

Penetradar IRIS Software is a complete, Windows based software suite designed for the *IRIS* family of ground penetrating radar systems. *IRIS Software* manages all radar data acquisition, storage, display and analysis to provide a comprehensive, end to end solution in support of *IRIS* Ground Penetrating Radar hardware.

Data Acquisition Software - RDA

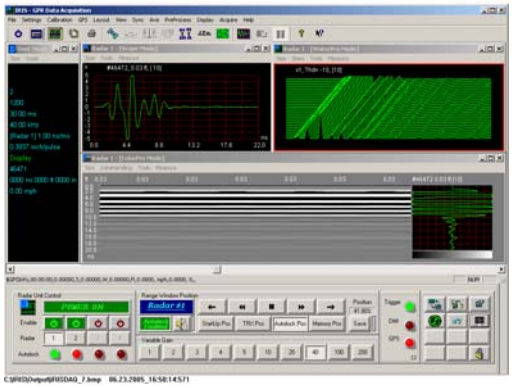
The *Radar Data Acquisition (RDA)* software is a Windows based data acquisition application designed to manage real-time collection, viewing and storage of radar data in IRIS GPR systems. The RDA software permits the user to view radar signals in waveform format, while simultaneously collecting and storing to hard drive up to 4 channels of GPR data (6 channels optional). GPR data collection is started and stopped with a single keystroke. Data acquisition parameters are software programmable allowing the adjustment of the signal sampling rate, sampling time and the number of radar data channels to be digitized. Data acquisition is continuous and is only limited by the size of the GPR internal hard drive. The RDA software has numerous “oscilloscope-type” features for adjustment of display settings, including signal gain, DC offset and timebase. Also included in the RDA module are calibration functions for GPR time base and distance measuring instrument (DMI), and utilities for acquiring free space and flat metal plate signals for use in data analysis. RDA software is GPS compatible and logs both GPS coordinates and DMI information into collected radar data files. Real-time signal enhancement functions, such as Penetradar’s “Clutter Cancellation”, random noise suppression, surface decorrelation, signal filtering and echo alignment, can be selected to improve overall signal quality. A real-time thickness measurement function is also included for analysis of individual waveforms or for back calculation of material dielectric constant. Voltage and time cursors can be utilized for measurement of signal peak-to-peak voltage or the time difference between two signals of interest. An event marking feature is also provided to allow the user to designate different events or log locations of interest during data collection. The marked events, saved in a text file, are also time stamped and tagged with DMI and GPS readings for later use. RDA software is provided as standard operating software with all IRIS GPR systems.



Data Acquisition Software (RDA)
(for real-time data collection/display/storage)

Data Acquisition Software - IRISDAQ

IRISDAQ data acquisition, multi-view software offers features and performance that are similar to the RDA software but also provides multiple viewing formats from up to 4 channels of IRIS radar data. Waveform view, color profile view and waterfall view data can all be displayed either individually or together from up to 4 channels simultaneously, thereby permitting easy identification of objects and events. Fully GPS compatible.



Data Acquisition Software (IRISDAQ)
(for real-time data collection/display/storage)

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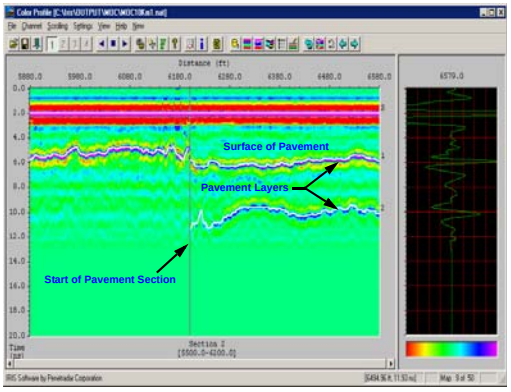
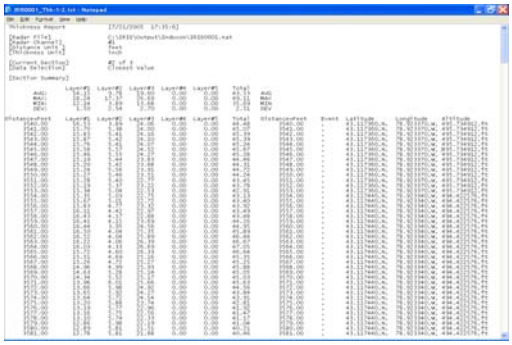
Software 2017

Analysis Software - ColorPro

The *ColorPro* color profile software is a combined display and analysis program which displays acquired raw radar data in a colorized and/or gray-scale format, showing signal amplitude as color bands versus signal transit time and distance traveled. The amplitude of the signal determines the color or intensity displayed, and with the amplitude settings, signal gain, DC offset and sensitivity time control, the color threshold voltage range can be varied using either a linear or exponential color mapping mode. A full set of preprocessing functions are available with this and all IRIS software, which include signal alignment, clutter cancellation, decorrelation, and filtering. Various gain-weighting compensation functions are also available to improve detection of small echoes from deep targets or layers. The radar data are referenced relative to time and distance scales and it is possible to scroll continuously in either direction through a data file, auto-align with respect to the surface echo while concurrently displaying the original radar waveform in the side screen. The *ColorPro* software is ideal for identifying subsurface anomalies or disturbances and for rapidly measuring the thickness of layers. For *ColorPro* accomodates data segment marking where date with similar structure can be marked as a section. It also permits manual marking of layers by the user with a mouse, and automatic layer tracking which pinpoints the exact interface layer. Layer thickness can then be computed based upon the time delays between different layers and the dielectric constant of each respective layer of material, either by direct entry or by calculation. Once layers are marked and thickness analysis is complete, the user can easily go back to the profile view to obtain the depth measurement at any point on the ColorPro plot. ASCII output files are also produced of layer thickness -vs- distance (and GPS coordinates), as well as files for use in IRIS Mapping Software which produces plan-view, CAD mappings.



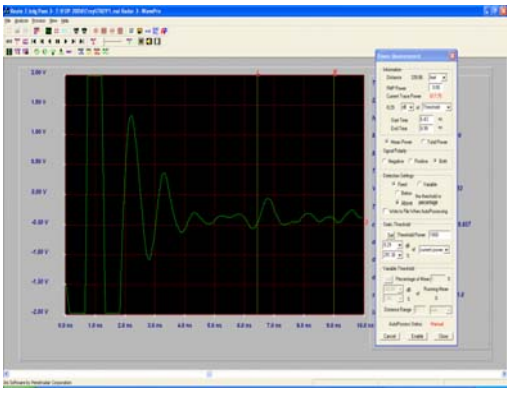
ColorPro - Color Profile Software
(Showing the Layer Marking Screen)



ColorPro - Layer Thickness Output
(Showing the Layer Thickness in ASCII Format)

Analysis Software - WavePro

WavePro software is a combined display and analysis program developed to measure GPR signal characteristics, including power level and signal voltage. A user applied range gate measures signal polarity, voltage or power for each waveform and signal magnitudes are stored relative to distance for later output in ASCII format or for later mapping using IRIS Mapping software. The WavePro software contains tracking algorithms and several detection options including mean or total power detection, signal feature detection, fixed or variable threshold type & threshold level. The WavePro software operates in a batch mode and is ideal for large volume (multi-pass) analysis of GPR data. Multiple scan passes can be analyzed while simultaneously viewing neighboring passes. This software was developed as a general analysis tool and is particularly useful for bridge deck (delamination & scaling) and pavement (voids and moisture) detection, subsurface object detection, such as UST's, pipes or foundations.



WavePro - Waveform Analysis Software
(Analysis Screen and User Interface)

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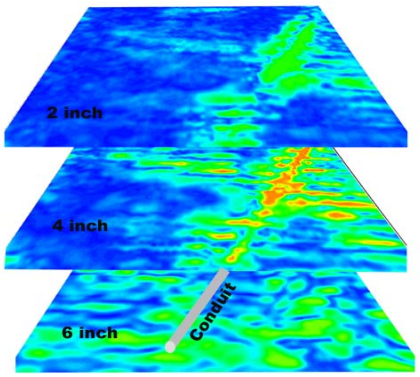
Software 2017

Analysis Software - FocusCell

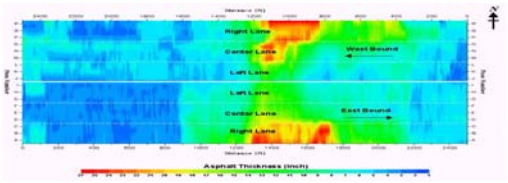
FocusCell is an imaging analysis program, that is used with Penetradar contacting and hand-held antenas to produces subsurface “radar images”. This software will produce a series of 2D depth slices at a user defined depth range to identify conduit and rebar in concrete, pipes and utilities as well as many other subsurface objects. The subsurface image is produced by collecting data in a series of closely space passes with Penetradar data acquisition software and then applying FocusCell analysis software. FocusCell image analysis is based upon time domain synthetic aperture processing which improves spatial resolution. FocusCell requires IRIS Mapping software for output.



FocusCell Imaging Software

Display & Output Software - IRIS Mapping

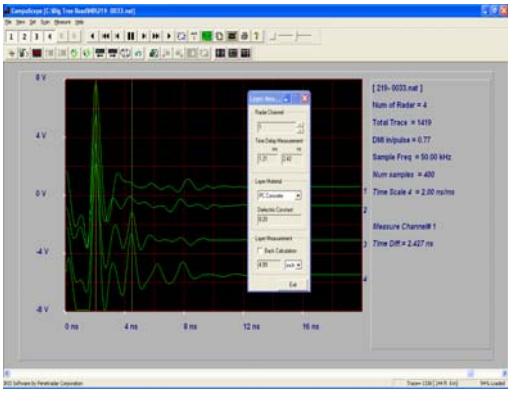
IRIS Mapping software is used to create a plan-view, colorized mappings of processed radar passes. Subsequent to analysis of GPR data with ColorPro, WavePro or other Penetradar analysis programs, plan-view mappings of subsurface features and detections can be made when parallel GPR passes are analyzed. IRIS Mapping software assembles post processed files, corresponding to each scan pass, into a 2D subsurface mapping. IRIS Mapping software has many display and output features, such as fully adjustable color scale settings, continuous color or bicolor, and monochrome settings. Map dynamic range can be adjusted as well as map scaling. Maps can also be displayed in a 3D format.



IRIS Mapping Software

Display & Output Software - CompuScope

The CompuScope waveform display program is used for viewing previously acquired raw radar data files in an “oscilloscope” format. The radar waveforms can be displayed by continuous scrolling or manually stepping through the data file at various playback speeds in a forward or reverse direction. The pause button is used to freeze the display on the computer screen for detailed examination and measurement individual waveforms and hardcopy output. For data files containing multiple GPR data channels, the user can view data from any number of selected channels by toggling the channel selection buttons. The program permits user adjustment of display features, such as signal gain, DC level, time scale, and vertical/horizontal position, from the display control panel or through the display properties menu. Time and voltage cursors are available for analytical measurement of radar signals. A real-time thickness measurement function is also included for analysis of individual waveforms or for back calculation of material dielectric constant. The GPR signals can be converted to ASCII format for export to spread-sheet based analysis programs and the entire screen display can be saved as a Windows bitmap (.bmp) file for hardcopy records.



CompuScope - Waveform Display Software

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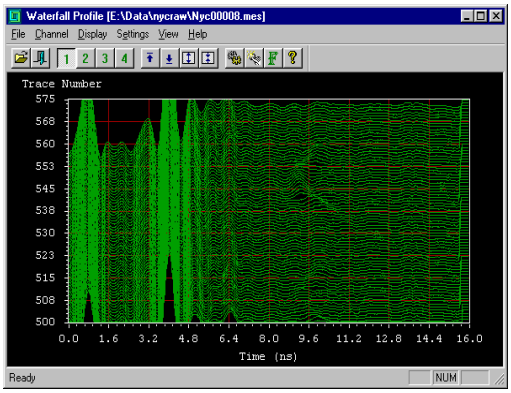
Software 2017

Display & Output Software - WaterPro

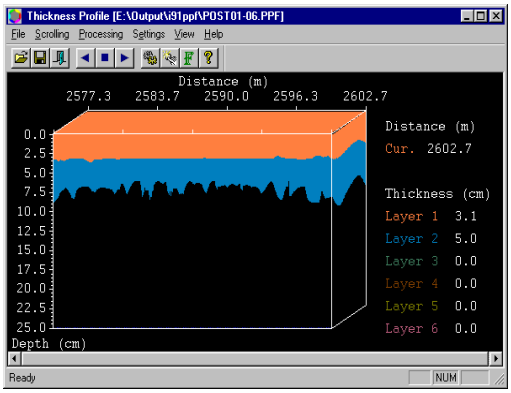
The *WaterPro* waterfall plot provides an effective and convenient way to view raw radar waveforms. Analogous to a “strip chart” output, this program displays an ensemble of GPR waveforms in a stacked manner permitting the user to observe layer boundaries, disturbances and anomalies or other waveform features only detectable when observing multiple successive waveforms. The display settings, such as the trace length, number of display traces, trace spacing and the axes setup, can be conveniently modified through menu commands. The screen displays can be converted to Windows bitmap files for additional editing or hardcopy records



WaterPro - Waveform Display Software

Display & Output Software - ThickPro

The *ThickPro* thickness profile program displays layer thickness data in a 2-D or 3-D profile format showing depth, longitudinal distance and transverse dimensions (3-D only). The profile provides a graphical representation of each layer thickness as generated by ColorPro or other Penetradar thickness analysis programs. The *ThickPro* display is a cut-away view of the actual layers as measured by the IRIS GPR and is capable of showing a continuous, horizontal scrolling output depicting layer depth versus traveled distance. It is possible to scan through the data file and examine each layer thickness at desired locations as it actually exists. For transverse thickness measurements, it is necessary to employ multiple antennas or multiple antenna scans. (Maximum resolution is obtained for transverse measurements by using four antennas).



ThickPro - Layer Thickness Profile Software

Utility Software - IrisUtil

IrisUtil consists of a number of useful utilities for file conversion, data handling, preprocessing and noise suppression. This program can convert IRIS based .NAT files to ASCII or matlab file format, read data file headers, modify DMI constant, parse and combine files and reverse passes. Advance decorrelation algorithms can be applied to remove steady-state or transient background noise.

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GPR Accessories 2017

Power Subsystems

Four AC Power (ACP) Subsystems are available for use with the IRIS GPR system supplying 110/220 VAC 60/50Hz and/or DC power to the system components. The ACP units are all solid state, DC/AC inverter based system with an output power of 2500, 1500/750 or 500 watts.

ACP2500

The ACP2500 (PS-24-ACP2500) is a 2500 watt output AC power subsystem. The ACP 2500 was designed for high-end vehicular installations and is powered by auxiliary storage batteries in combination with the vehicle alternator. This unit consist of two components: the PS-24IPU Inverter Power Unit, and the PS-24 ICU Inverter Control Unit. The Inverter Power Unit, is a self contained rack unit, housing the inverter and high current power busses with forced outside air ventilation to cool the internal components. All power cables are housed in waterproof, metallic electrical conduit in accordance with the US National Electric Code (NEC). The Inverter Control Unit provides input/output power controls, inverter and battery status indicators, and circuit breaker protection for all AC and DC circuits. . All ACP units comply with U.S. National Electric Code standards for safety. The ACP2500 is recommended for use with the IRIS or vehicular systems with larger AC power requirements. Specify output voltage and frequency.

The ACP2500 power subsystems include:

- *(1) PS-24ICU Inverter Control Unit*
- *(1) PS-24ICU Inverter Control Unit*
- *All interconnect wiring, electrical conduit and auxiliary storage batteries*.

ACP1500/750/500

The ACP 1500 (PS-24-ACP1500) and ACP750 (PS-24-ACP750) are lower cost AC power subsystems, delivering 1500 and 750 watts of power, designed for both portable and vehicular use. They are contained in a transportable standalone unit that includes an internal storage battery and all necessary front panel input/output power controls, inverter and battery status indicators and circuit breakers. The ACP1500/750 can also be connected to a vehicle battery for continuous system operation. The ACP 500 (PS-24-ACP500) is a 500 watt, low cost power supply for use only in vehicle systems, and is normally connected to a vehicle battery for operation.

ACP-PPU

The ACP-PPU is a low cost transport cart/power source for the IRIS-P which provides both autonomous AC and DC power. The mobile ACP-PPU can be taken into the field and will operate with the IRIS-P for up to six continuous hours between internal battery recharge. The IRIS-P installs directly onto the ACP-PPU in operation.

Model ACP2500 AC Power Subsystem

ACP1500/750 AC Power Subsystem

ACP500 AC Power Subsystem

ACP-PPU Portable Power Unit

(Shown with IRIS-P)

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Penetradar GPR Catalog

GPR Accessories 2017

Installation Accessories

Vehicle Installation System 1 (VIS-1)

This is a complete, low-cost vehicle installation system for use with the IRIS or IRIS-P GPR. The VIS-1 will permit the IRIS/IRIS-P and antenna(s) to be used on a vehicle. The VIS-1 will install on most light vans, pick-up trucks and SUV's that have an existing 2 inch frame mounted receiver hitch. The system can be installed in a few hours and comes with complete installation instructions. The VIS-1 will support up to 2 non-contacting antennas or 1 contacting antenna.

The Vehicle Installation System 1 (VIS-1) includes the following components:

- PS-24-PRMS Portable Radar Mounting Structure. An easy to install antenna mounting structure that installs into existing 2 inch frame mounted receiver. The PS-24-PRMS suspends up to two Model 30AGC/60AGC horn antenna(s) or one Model 301B/401B/501B. Specify the number of antennas.
- Distance Measuring Instrument (DMI). An electronic DMI interface unit that connects to vehicle ABS or VSS output. This provides high resolution distance information for direct interface to the IRIS-P.
- DC power cable.

VIS-1 Vehicle Installation System
(Shown with Model 30AGC Antenna)

VIS-1 Vehicle Installation System
(Shown with Model 301B Antenna)

Vehicle Installation System (VIS-2)

This is a complete vehicle installation system which includes an antenna mounting structure, Distance Measurement Instrument (DMI) and Power Interface. This system can be used with the IRIS/IRIS-P and up to four antennas installed in a lateral array on a vehicle. The VIS-2 supports up to four non-contacting antennas or two contacting antennas on the front or rear of a vehicle and allows lateral movement of the antenna to cover all parts of a traffic lane. Typical uses include single pass inspection of pavements, bridge decks and runways. The VIS-2 is for permanent installation and can be installed on many vans, light trucks and SUV's. Complete installation instructions are provided.

The Vehicle Installation System (VIS-2) includes the following components:

VIS-2 Vehicle Installation System
(Shown with Model 30AGC Antennas)

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- Radar Mounting Structure – PS-24-RMS, Front or rear mounted radar mounting structure for installation of Penetradar antenna(s). The PS-24-RMS suspends the antenna(s) and permits a 30 cm variable height adjustment (non-contacting antennas only) and 215 cm transverse antenna position adjustment. Antenna installation is manual, typically requiring less than a few minutes per antenna. Designed to fit Ford & GM vans but also can be installed onto many other types of truck, van or SUV's. Please note that some custom installation may be necessary depending on the vehicle used. The PS-24-RMS consists of:
  - Radar Mounting Rail PS-24-RMS-RAIL
  - Vertical Extension Mount PS-24-RMS-TSK
    Note: one RMS-TSK required for each antenna

- Distance Measuring Instrument (DMI). An electronic DMI interface unit that connects to vehicle ABS or VSS output. This provides high resolution distance information for direct interface to the IRIS-P.

- DC power interface includes wiring installation kit to vehicle +12VDC power.

Penetradar GPR Catalog

GPR Accessories 2017

Radar Transport Cart (PS-24-RTC)
Used for manual operation of IRIS and IRIS-P systems. The Radar Transport Cart carries one 30AGC, 60AGC or 401B/501B antenna and incorporates the IRIS high resolution DMI for distance measurement and logging.

Radar Transport Cart
(shown with IRIS-P & Model 30AGC antenna)

GPR Remote Control, PS-24-RMK
External 17 inch LCD Display & SVGA output for IRIS or IRIS-P. Allows the use of a remote external monitor. Includes SVGA Interface and 17 inch color LCD display and Keyboard/Mouse.

Remote Processing Station (PS-24-RPS)
The PS-24-RPS is a remote station for processing IRIS GPR data in the office and includes a notebook computer, copy of IRIS Software for Windows (RDP and RDD software) and additional user license.

Antenna Setup Box (PS-24-BOX1)
This unit is used for easy setup of radar controls when interchanging antennas.

Battery Pack, PS-24-BPC-P
12 volt battery pack & charger, for IRIS-P.
Also available as a battery belt (PS-24-BPC-B)

Battery Pack
PS-24-BPC-P

Antenna Cables
Extension and replacement cables are available for portable and vehicle baed GPR installations.

Main Cable (25ft/7.6m) PS-24-CH-25
Radar Control Unit to Antenna Cable, 25ft/7.6m

Main Cable Extension (25ft/7.6m) PS-24-CH-25EXT-B
Radar to Bulkhead Cable, 25ft/7.6m - for vehicle installations

Main Cable Extension (25ft/7.6m) PS-24-CH-25EXT-S
25 ft/7.6m Extension Cable for Ground Contacting Antennas and Remote Inspections

Main Cable Extension (10ft/3m) PS-24-CH-10EXT
10 ft/3m Extension Cable Connecting PS-24-CH-25EXT-B or S to Radar Antenna

Antenna Cables

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Penetradar GPR Catalog

IRIS GPR Vehicles 2017

IRIS GPR Vehicles

IRIS Vehicles are a turn-key solution to GPR inspection of highway pavement, bridge decks, runways, tunnels and for a number of general site inspection applications. IRIS Vehicles incorporate ground penetrating radar, data acquisition hardware and software into a highway-speed vehicular inspection system. Several configurations are offered which address specific application, performance and budgetary requirements.

Standard IRIS Vehicle

The Standard IRIS Vehicle is built on a full size one-ton Ford or GM van and can support up to four antennas. In addition to factory installed equipment the Standard IRIS Vehicle is outfitted with a 72 inch (183cm) roof extension and additional auxiliary air conditioning and heating. The interior walls and ceiling are covered with plastic and fabric for laboratory functionality and appearance. A vinyl floor, three captains chairs and dual high intensity strobe safety lights are also included. A fully functional operator's control console is provided. The VIS-2 and 2500Watt AC Inverter Power Subsystem (PS-24-ACP2500) are standard equipment with this vehicle. With the optional Remote Monitor and Keyboard (PS-24-RMK), the IRIS vehicle and GPR equipment can be operated by one person. Also available as an option on the standard IRIS vehicle is a multi-camera high resolution video system and/or Infrared Thermographic camera for pavement surface inspection.

Standard IRIS Vehicle
shown with 4 Model 30AGC Antennas

Basic IRIS Vehicle

The Basic IRIS Vehicle is a low cost GPR vehicle that is fully equipped for high speed pavement and bridge deck inspection. This system uses a full size Ford/GM Van and up to four antennas can be installed. The system maintains all the standard IRIS vehicle functionality but to reduce cost, many of the extra features found in the other IRIS vehicles have been eliminated. The Basic IRIS vehicle includes the installation of the IRIS system of choice, and all interior furnishings, such as fabric covered interior walls and ceilings, vinyl tile floor and standard seats. The VIS-2 and 1500 Watt AC Power Subsystem PS-24-ACP1500 are included with this vehicle.

Basic IRIS Vehicle
Installed with one Model 30AGC antenna

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Penetradar GPR Catalog

IRIS Vehicles 2017

Specialty GPR Vehicles

IRIS Minibus

Specially configured GPR vehicles are available and include the IRIS-Minibus, installed with four radars for high speed, one-pass inspection of bridges and pavements. The IRIS-Minibus is similar to the Standard IRIS Vehicle but built on a larger Ford minibus chassis and includes front and rear control areas and seating for multiple passengers. This IRIS vehicle is ideally suited as a long range, high speed GPR test vehicle, mobile GPR laboratory, GPR classroom or demonstration platform. IRIS Minibus Vehicle shown with four antennas.


IRIS Minibus Vehicle

IRIS Utility Vehicle

The IRIS Utility Vehicle includes a portable IRIS installed on an all terrain 4WD utility vehicle. This IRIS vehicle is particularly useful for utility and buried waste site surveys, project level inspections of bridges and pavements and in remote locations where manual GPR inspections are difficult or impractical. The IRIS Utility Vehicle includes a self contained power supply, DMI and can be outfitted with both non-contacting horn and ground-contacting antennas. IRIS Utility Vehicle shown with Model 60AGC antenna.

IRIS Utility Vehicle

IRIS Hyrail

The IRIS-Hyrail includes a portable IRIS installed on an hyrail vehicle. This IRIS vehicle is used for rapid GPR inspection of rail and roadway tunnel walls, liners, abutments and concrete fascia. The IRIS Hyrail vehicle is installed with a portable IRIS, power supply, DMI (GPS) and a special electromechanical antenna positioning device. The GPR antenna is suspended at the end of an antenna positioning device which can be rotated to cover the sides and top of tunnel walls and the motorized boom can be retracted to avoid obstructions. The electromechanical antenna positioning device and controls can also be purchased separately. IRIS Hyrail shown with Model 30AGC antenna.


IRIS Hyrail

Custom Configurations

Penetradar will install the IRIS, IRIS-L or IRIS-P GPR equipment into your vehicle at your facility or ours. This includes any combination of antennas, accessories such as GPS and vehicle installation systems, etc. for roadway inspection or geotechnical site surveys. Shown is an IRIS-3 configuration with three Model 301B antennas for deep profiling.


Custom Configurations

PENETRADAR CORPORATION

Penetradar GPR Catalog

Terms and Conditions of Sale 2017

ORDERING: A written and signed purchase order is required on all orders.

PRICES: All prices are in U.S. Dollars, F.O.B. Penetradar Corporation factory. Prices are subject to change without notice. Penetradar will provide written quotations at customer's request which shall be valid for 60 days. Other costs, including but not limited to taxes, insurance, customs charges, import and/or export duties, and costs for shipping to and from Penetradar Corporation are the responsibility of the customer.

TERMS OF SALE: Payment terms for customers in U.S.A. with approved credit is NET 30 days. For all other orders payment is required in full prior to shipment unless otherwise stated by Penetradar Corporation in writing.

DELIVERY & SHIPPING: Delivery schedule depends on quantity and products purchased. Typical delivery times for equipment range from 30 to 90 days ARO. Penetradar Corporation will provide delivery information upon receipt of purchase order. The customer shall specify the means of shipment.

TRAINING & DEMONSTRATION: Training courses are offered to customers purchasing equipment. All training courses are conducted at Penetradar Corporation facilities. Travel and living expenses are the responsibility of the customer. Optionally, training courses can be conducted “on-site” at the customer's facility for a fee plus travel and living expenses. Penetradar Corporation will provide a firm price quotation upon request. Demonstrations can be provided at Penetradar Corporation facilities at no charge, or at the customer's site for a fee plus travel and living expenses. Please contact us for a price quotation.

LIMITED WARRANTY: Penetradar Corporation warrants products of its manufacture to be free from defects in material and workmanship under conditions of normal use. Penetradar at its option and expense will replace or repair any defective or faulty product which results directly from defects in material or workmanship provided, however, that Penetradar first be given written notice of such defects and shall have authorized the return. Items claimed defective must be returned to Penetradar and all transportation charges prepaid. The existence of a defect or fault shall be determined by Penetradar and its determination shall be conclusive. This Warranty is limited to a period of one year after delivery to the original buyer. This Warranty does not apply to products which have been disassembled, modified, altered, physically or electrically damaged, or subjected to conditions exceeding the applicable specifications or ratings. A fee will be charged to the buyer to cover testing and processing costs for units returned and subsequently found to have no defects or to be faulty for reasons which are not Penetradar's responsibility.

Penetradar GPR Catalog

Terms and Conditions of Sale 2017

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PENETRADAR CORPORATION ASSUMES NO LIABILITY FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR INJURIES CAUSED BY PROPER OR IMPROPER OPERATION OF ITS PRODUCTS, WHETHER OR NOT DEFECTIVE.

Extended Warranty - An optional extended warranty can be provided on equipment manufactured by Penetradar Corporation. Extended warranties on Penetradar manufactured equipment are in addition to the standard one year warranty. For warranty service, equipment or components must be returned to Penetradar FOB Niagara Falls, NY for repair or replacement. Extended warranty years can be purchased at any time prior to start of a warranty year provided that equipment has been continuously covered under warranty during previous years.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Penetradar Corporation
2509 Niagara Falls Boulevard
Niagara Falls, New York 14304
U.S.A.

TEL: (716) 731-4369
FAX: (716) 731-5040
email: info@penetradar.com
website: www.penetradar.com

PENETRADAR CORPORATION