

INSTRUCTION MANUAL

Model AS550A

Ground Penetrating Radar PC

Copyright February 22, 2008, Revision 3

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1.0 Introduction

The AS550A Ground Penetrating Radar PC (GPR PC) system consists of the GPR PC unit, an optional power supply and battery backup unit and cables to connect to two Noggin radar units and an encoder on a distance wheel. The system provides real-time monitoring of stratigraphic roof and floor clay mapping in potash mines.

The GPR PC is located in the cab of a mining machine to provide the operator with a real-time display of stratigraphic roof and floor clay mapping. Two Noggin GPR units are located on the mining machine, one in contact with the roof and the other in contact with the floor. A distance wheel is located adjacent to the roof GPR unit to provide a measurement of linear distance traveled. Cables are supplied with the GPR PC to connect to 12 Volts DC power or the power supply unit, the two Noggin units and to the encoder on the distance wheel.

The GPR PC contains a VIA EPIA series Mini-ITX motherboard, which interfaces with a separate 800x600 VGA flat-screen monitor equipped with a touch screen. Also mounted in the enclosure are a 12V to ATX power supply, a quadrature-to-RS-232 converter, and a 2.5" hard drive. Terminal block connections are provided for DC power distribution. Connections are provided on the bottom panel for DC input power, Roof GPR (com 1), Floor GPR (com 2), and the Distance Wheel (com 3) Also located on the bottom panel are the main power switch, Dust and Water tight circular connectors for keyboard and Flash stick connections, and an IP67 RJ-45 Ethernet connector. On the left side panel is the main power switch for the GPR PC unit. The GPR PC enclosure measures 15.7" wide x 11.7" high x 5.1" deep and weighs 25 lbs.

The Power Supply unit for the GPR PC contains a Meanwell 12 Volt power supply, and a Power stream DC-DC UPS. The UPS provides battery backed up 12 volt power for both the GPR PC unit and also charges the 12 Volt Battery. For further information on the battery backup unit and its operation, please consult the AS551B manual.

2.0 Specifications

Model: 550A-12V GPR PC

Mainboard

Model:	EPIA EK 8000 EG
Processor:	VIA Luke 800 MHz CoreFusion
RAM:	256M DDR400 DIMM
Hard Disk:	60 GB 2.5" IDE HDD
USB Flash Disk:	256 MB.
O/S:	Linux v 2.4.2
Back Panel I/O Ports:	1 DB9 Female, 4 USB (Female A), 2 PS2, 2 RJ-45, 1 VGA, 1 Parallel, 3 RCA Audio
Ethernet Card:	10/100 Base T-Ethernet
Keyboard:	101 key, PS2 type.
Power Requirements:	12VDC, (5A @ 12VDC)
Dimensions:	17cm wide x 17cm deep.
Weight:	0.25 kg.

COM Port Settings

COM1:	Noggin GPR Unit (Roof): 3F8/IRQ4
COM2:	Noggin GPR Unit (Floor): 2F8/IRQ3
COM3:	Distance Wheel Encoder: 3E8/IRQ10
COM4:	ELO Touch Screen Controller: 2E8/IRQ5

LCD Display

Display Type:	12.1" TFT LCD
Max. Resolution:	1024 x 768 (800 x 600 default)
I/O Ports:	1 DB9 Male, 1 VGA, 1 DVI, 1 2.1mm Power Jack
Power Requirements:	12 V, (45W max)
Viewing Angle:	Vertical
Dimensions:	42.7cm wide x 5.7cm deep x 33.5cm high
Weight	4.92 kg

Touch Screen

Type:	Analog Resistive
Chipset:	AV-9350 Touchkit v4.3.6
Bit Stream Length:	10 bytes
Controller:	RS-232 Interface (COM 4)
Power Consumption:	<70mA @5V
Durability:	1 million touches

ATX Power Supply:

Model: Morex 60W ATX Power Converter
Type: DC/ATX Converter
Input: 1.6A, @12VDC
Output: ATX Power
Power Rating: 60W

Quadrature Adapter:

Model: US Digital AD4-B
Input: 180mA, @12 VDC
Power Rating: 6W

Cabling:

GPR Cable Assembly: Male DB37- 6 pin Bulkhead; 35'
Distance Wheel Assembly: Female 6 pin circular – 5 pin Bulkhead; 35'

Enclosure:

Dimensions: Height, 38cm, Width 48.7cm, Depth 13.7cm
Weight: 8.4kg
Power: 12VDC@ 5A

3.0 Installation and Operation

1. The Ground Penetrating Radar PC (GPR PC) should be mounted vertically on a wall in the control cab of the mining machine.
2. With the GPR box turned off, plug in the DC Power cable to the bottom Panel of the GPR PC Unit. The DC power connector includes a screw-terminal block for easy field termination. See the attached DC power cord drawing for the cable pin out configuration. The GPR PC unit requires a +12V DC power source with at least 5 amperes of current capacity.
3. Run the provided Roof GPR cable and the Distance Wheel cable from the GPR PC to the location of the Roof GPR and the Distance Wheel. Run the provided Floor GPR cable from the GPR PC to the Floor GPR unit. The supplied cables feature 20 AWG, 2-pair, twisted, individually shielded wire.
4. Plug one of the two 256MB USB Flash memory sticks into the USB port located on the bottom panel of the GPR PC. This USB Flash stick **must** be plugged in prior to turning the power on. The USB Flash sticks will be used to transfer the day's data to a surface computer for analysis and backup.
5. Push the main power button, located on the bottom panel. The PC should power up and perform the power on self test, then it will load the Linux operating system and automatically start the GPR PC data logging and display program. If the PC doesn't start then refer to the troubleshooting procedure shown in chapter 4.0.
6. The data logging and display software will automatically start after the GPR PC is powered. The GPR PC logs data to an external USB Flash stick that must be plugged in prior to powering the GPR PC. Do not remove the USB Flash stick when the GPR PC is powered as all data on the stick could be lost. A dust resistant connector cover is provided and should be kept closed at all times to minimize dust entering the connector.
7. The GPR PC Data Recorder software (written by Kosteniuk Consulting Ltd.) has been installed on the GPR PC. Refer to the GPR PC Data Recorder Software operating manual for instructions on the proper use of the software.

4.0 Design Details

4.1 Ground Penetrating Radar PC

The GPR PC contains a VIA EPIA series Mini-ITX motherboard, which interfaces with a separate 800x600 VGA flat-screen monitor equipped with a touch screen. Also mounted in the enclosure are an ATX power supply, a quadrature-to-RS-232 converter, and a 2.5" hard drive

4.2.1 Motherboard

The Motherboard is a VIA model EPIA EK 8000. The board features a low-power, fanless design with a VIA Luke 800 MHz processor, 256 MB of SODIMM RAM, a 2.5" IDE Notebook Drive with 60GB capacity, 4 COM ports, 1 LPT port, built-in video and sound interfaces, 4 USB ports and 2 Ethernet ports.

Several computer connections are brought out to the motherboard. These include a female PS2 bulkhead connector for use with a PS2 keyboard; IP 67 USB connector and an Ethernet connector all mounted on the bottom panel of the GPR enclosure. Three of the motherboard's four RS-232 ports are brought out through 9 pin headers located on the board. The one other RS-232 port is located on the back panel I/O of the motherboard.

4.2.2 Power Supply

Most of the components of the GPR PC have the capability of operating off of 12V DC power and require a 12 Volt DC supply with a minimum of 5A capacity to operate (see section 3.2.5). A battery backup power supply unit can be purchased from ASI if an adequate supply is not available, and can handle a wide range of input voltage input in either DC (9-72 Volts) or AC (88-264 Volts)

The Motherboard and the Hard Drive require ATX power. A 60W Morex 12Volt DC to ATX power supply with is located in the GPR PC enclosure directly adjacent to the motherboard.

4.2.3 Battery Backup

An American Power Conversion UPS, with 900 VA is provided inside the power supply unit. The battery will operate the PC for approximately 45 minutes and is used as an uninterruptible power supply (UPS) in the event of a DC supply power failure. The battery only supplies power for the panel PC and will not power either of the Noggin GPR units or the distance wheel encoder. The battery is provided to allow data to be saved prior to the safe power down

of the PC. Power switches from the DC input to the battery automatically. Once DC supply power is restored the PC will automatically switch back to AC power and then battery will be charged.

4.2.4 Quadrature to RS-232 Converter

A model AD4-B quadrature to RS-232 adapter is mounted in the GPR PC enclosure. This unit provides a simple plug-in method for connecting a single-ended quadrature encoder directly to a RS-232 serial port. The AD4-B contains a 5 VDC power supply for the encoder, an LS7166 quadrature counter and a microprocessor that provides the serial interface. The AD4-B is powered from the 12 VDC power supply and requires up to 185mA of supply current.

4.2.5 Opening the GPR PC Enclosure

**CAUTION: LETHAL VOLTAGES ARE PRESENT WITHIN THE GPR PC.
DISCONNECT INPUT POWER BEFORE OPENING THE CABINET.**

Under normal operating conditions there is no reason to open the GPR PC enclosure. However if the enclosure must be opened for checking power supplies or making changes to the panel PC (for instance replacement of the touch screen) then use the following procedure to open the enclosure. Photo 1 shows the completed GPR PC. Photo 2 shows the GPR PC open with the enclosure cover and the attached panel PC lying in front of the main enclosure.



Photo 1 Closed Clay Mapper GPR Controller

To open the GPR PC enclosure, first disconnect all connections from the outside of the enclosure (DC power, Roof and Floor GPR cables and the Distance Wheel cable). Ensure that the **input power is disconnected BEFORE opening the cabinet**. Loosen the four screws holding the top cover onto the enclosure base. These screws are captive and it is not necessary to remove them from the plastic grommets. Once the screws are loose grasp the top cover and lift it off of the enclosure base and place it face down in front of the enclosure as shown in Photo 2. Ensure that the area in front of the enclosure is free of tools and other objects that could damage the touch screen. The cables connecting the PC to the enclosure are only long enough for the cover to be placed in the position shown in Photo 2. Do not attempt to place the cover and the PC in any other location as this will put strain on the connections.

If the touchscreen monitor must be removed completely then first disconnect all wires from the back of the monitor and then loosen the eight M3 screws located around the edges of the monitor. Once these screws are undone then the enclosure lid can be lifted off of the monitor.

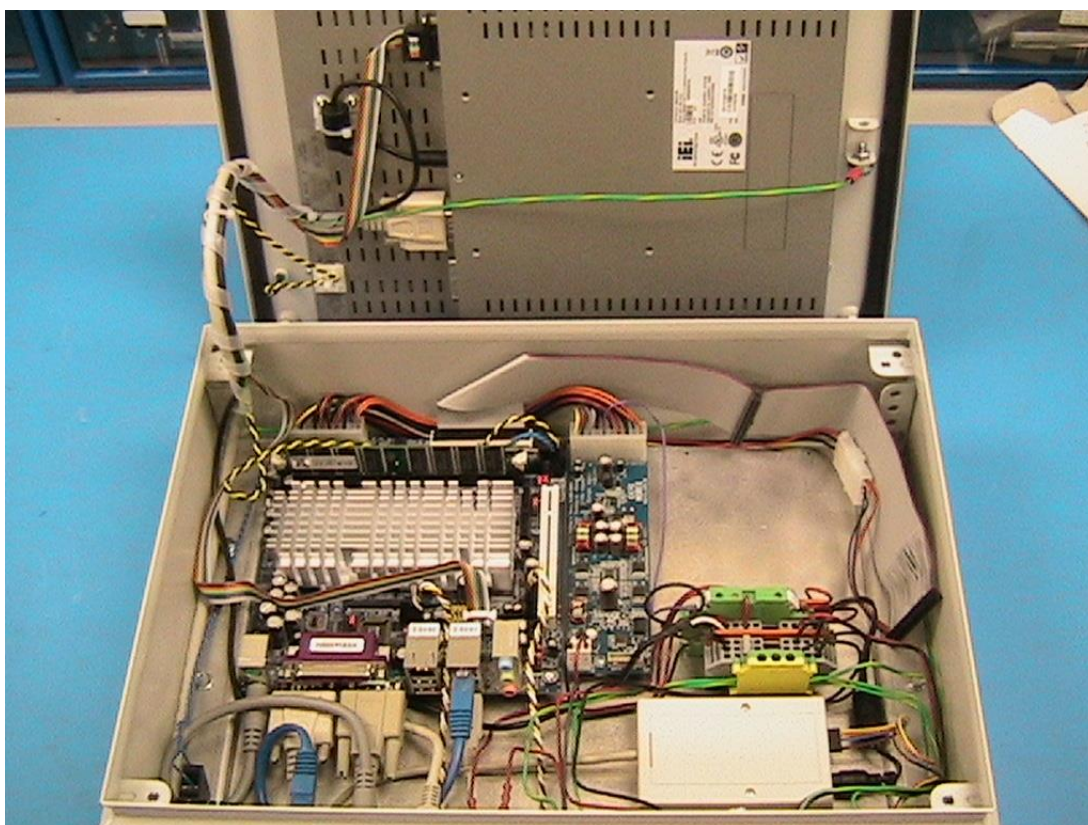


Photo 2 Open Clay Mapper GPR Controller

4.2.6 DC Input Power

The GPR PC requires 12 VDC, power with a current rating of at least 5 amperes. A 10-foot long power cord with a mating 3 pin plug can be attached to the GPR PC. Drawing AS550A-E001 is an interconnection diagram for the GPR PC. Within the GPR PC the input line connects to a 5A Fast Blow fuse and then to a terminal block for distribution, and to a DIN mount relay which switches power to the monitor, encoder, and Noggin units when the power switch on the bottom panel is pressed. The output from the switch is brought to a header on the mother board which also switches on the computer and its power supply. The main power switch is a momentary contact switch which can be used to cut power to the GPR PC unit, by holding for 4 seconds.

The DC common wire connects to a similar terminal block. The GPR PC case is connected to the earth ground shield wire in the cable, via a Phoenix Contact DIN mount ground block, and grounding distribution lugs. The supplied DC power cord can be replaced with field wiring if desired. The mating power plug for the DC input connector that is located on the GPR PC enclosure includes a screw terminal block to make field termination simple. Drawing AS550A-E004 provides a cable drawing for the DC power cable. If the GPR PC is being used with the ASI 551B Power Supply, the DC power cable will be captive to the power supply unit.

5.0 Trouble Shooting

The following troubleshooting information can be used to solve most common problems encountered with the AS550A GPR PC.

Table 4.1 Troubleshooting

PROBLEM	RECOMMENDED ACTION
(A) GPR PC does not switch ON.	<ol style="list-style-type: none"> 1. Ensure DC power cord is firmly plugged into a DC supply. 2. If plugged into a UPS then ensure the cable is connected and plugged into an appropriate supply. 3. Ensure the 5-amp fuse on the bottom panel of the GPR PC is not blown. 4. Ensure the power switch is in the ON position. 5. Ensure the line voltage is 12 VDC.
(B) GPR PC ON but the Noggin GPR units are off.	<ol style="list-style-type: none"> 1. Ensure the DC power is available since the Noggin GPR units are only powered when the DC is on. Refer to problem (A). 2. If the DC power is off the battery in the GPR PC will keep the GPR PC on for up to 60 minutes. However neither the Noggin GPR units nor the distance wheel encoder will function without DC power present. 3. Ensure the GPR PC software is operating correctly. Refer to the software manual. 4. Check cabling from the GPR PC to the Noggin GPR units.
(C) No data present on USB Flash stick.	<ol style="list-style-type: none"> 1. The USB Flash stick must be plugged into the USB port before the GPR PC is turned on. 2. Incorrect format for USB Flash stick – format for FAT32.
(D) Software problems with the GPR PC program.	<ol style="list-style-type: none"> 1. Refer to software manuals. 2. Contact Kosteniuk Consulting Ltd. (Tel: 306-343-1557).
(E) Other hardware problem.	<ol style="list-style-type: none"> 1. Contact Aurora Scientific Inc.; see contact information in section 4.1.

5.1 Technical Assistance

Technical assistance is available by regular mail, email, phone, or fax. Use the information below to contact Aurora Scientific Inc.

Address: Aurora Scientific Inc.
 AS550A Technical Assistance
 P.O. Box 2724
 Richmond Hill, Ontario, CANADA
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Phone: 1 905 727-5161
 Toll Free: 1 877 878-4784
 FAX: 1 905 713-6882
 Email: info@AuroraScientific.com
 Web site: www.AuroraScientific.com

6.0 Warranty

The 550A GPR-PC system is warranted to be free of defects in materials and workmanship for one year from the date of shipment. Aurora Scientific Inc. will repair or replace, at our option, any part of the 550A system that upon our examination is found to be defective while under warranty. Obligations under this warranty are limited to repair or replacement of the instrument. Aurora Scientific Inc. shall not be liable for any other damages of any kind, including consequential damages, personal injury, or the like. Damage to the system through misuse will void this warranty. Aurora Scientific Inc. pursues a policy of continual product development and improvement therefore we reserve the right to change published specifications without prior notice.

Bill of Material

This section contains a complete bill of material for the GPR PC.

Drawings

This section consists of the following drawings:

<u>Title</u>	<u>Drawing No.</u>
1. Interconnection Diagram	AS550A-E001
2. Cable Drawing – GPR Cable Assembly	AS550A-E002
3. Cable Drawing – Distance Wheel Cable Assembly	AS550A-E003
4. Cable Drawing – DC Power Cable Assembly	AS550A-E004
5. Outline drawing of GPR PC Enclosure	AS550A
6. Solid Model drawing of GPR PC	