



GuardIAN Intelligence Network

Protect. Defend. Guide.

Designed to provide integrated intelligence through diagnostics, tracking and communications; each product within the GuardIAN Intelligence Network is purpose-engineered to provide cost reductions, greater efficiency during maintenance runs and improved operational safety onsite.



Company Profile

MineARC Systems is the global leader in the manufacture and supply of emergency safe refuge solutions for the mining, tunnelling, chemical processing and disaster relief industries.

With over 25 years' experience, our dedication to ongoing research and development is driven by our key focus to continually offer the best and most advanced safety solutions on the market.

Our team of qualified engineers, electrical designers and technical experts form a global network across several international locations including;

- Perth, Western Australia
- Johannesburg, South Africa
- Dallas, Texas
- Santiago, Chile
- León, Mexico
- Beijing, China
- Reading, UK

This allows MineARC to provide 24 hour service and engineering support to our expanding list of clients in over 80 countries across the globe.

All MineARC Refuge Chambers and Safe Havens comply with the highest international regulations and recognised 'world's best practice' industry guidelines. Our key focus on quality control and product advancement has meant that MineARC Refuge Chambers have successfully saved lives in multiple real life industrial emergencies around the globe.

www.minearc.com



The GuardIAN Intelligence Network

In response to client requirements for cost reductions, greater efficiency during maintenance runs and improved operational safety on-site, MineARC has developed a suite of technologically advanced products, collectively known as the **GuardIAN Intelligence Network**.

Designed to provide integrated, site-wide intelligence through diagnostics, tracking and communications, each product within the GuardIAN Network is purpose-engineered to embrace five main principles, whilst taking standards in industrial safety to the next level.

- Improved personnel safety
- Increased operational activities
- Better cost efficiencies
- Ease of application
- Integration into wider site network

GAS MONITORING PG 4

- ✓ Real-time monitoring of site-wide gas levels
- ✓ Enables faster re-entry processes, reducing downtime
- ✓ Remote diagnostics of refuge chamber atmosphere

LIGHTING PG 8

- ✓ Provides navigational assistance to nearest safe refuge
- ✓ Alerts based on gas levels detected via the Gas Node
- ✓ Integrated UWB tracking technology

TRACKING PG 10

- ✓ Replaces outdated tag-boards with an automated system
- ✓ Remotely monitors location of all underground personnel
- ✓ Provides navigational assistance to nearest safe refuge

GUARDIAN INSTALLATION PG 14

- ✓ Simple four stage process
- ✓ Implementation plan
- ✓ Server requirements

CHAMBER MONITORING PG 16

- ✓ Remote, real-time monitoring of vital operating systems
- ✓ Diagnostics of the atmospheric integrity of the chamber
- ✓ Live video streaming and VOIP Video Phone connection

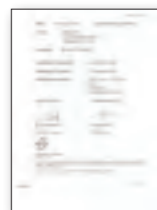
NETWORK CONNECTION PG 18

- ✓ Distributes reliable, standard-compliant power
- ✓ Full speed native Ethernet communications
- ✓ Inter-operable with a site's preferred network equipment

The GuardIAN Intelligence Network is designed to provide site-wide integration; allowing real-time monitoring of the underground environment, site assets and personnel via any PC, tablet or mobile device.



Bureau Veritas ISO 9001:2015 Quality Management Systems



MineARC® HRM Refuge Live Risk Assessment Testing



Australian C-Tick Standards: AS4100-1998, AS3570.1-18, AS2208, AS3000, AS1716-15



Canadian Standards Association (CSA)



United States National Electrical Code (NEC) 2013/14



European CE Certified to Machinery Norms

GuardIAN Gas Monitoring

Sensor technology within each Node monitors gas levels in surrounding areas; designed to facilitate efficiency and safety during re-entry and in an emergency.

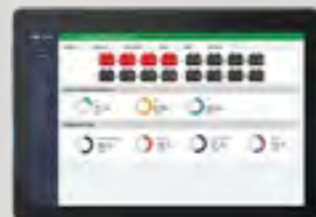
RADIO SIGNAL FOR
PERSONNEL TRACKING
& DATA TRANSFER

VISUAL ALERT FOR
DANGEROUS GAS
LEVELS

SPACE FOR UP TO
4 GAS SENSORS

GuardIAN Tablet

Upgrade your safety solution to include a GuardIAN tablet; allowing personnel sheltering in a refuge chamber to monitor live external gas levels via the GuardIAN Gas Node.



GuardIAN Gas Monitoring

GuardIAN Nodes can form an expandable network; allowing increased coverage and accuracy of data transmitted between MineARC **Refuge Chambers**, underground personnel and above-ground control.

The network expands across the site, aiding communications and data transfer between the **GuardIAN Server**, nodes, and personal devices.

One of the biggest advantages of the GuardIAN Node System is the in-built Aura-FX Fixed Gas Monitoring technology; providing sites the ability to continuously monitor gas levels throughout the mine.



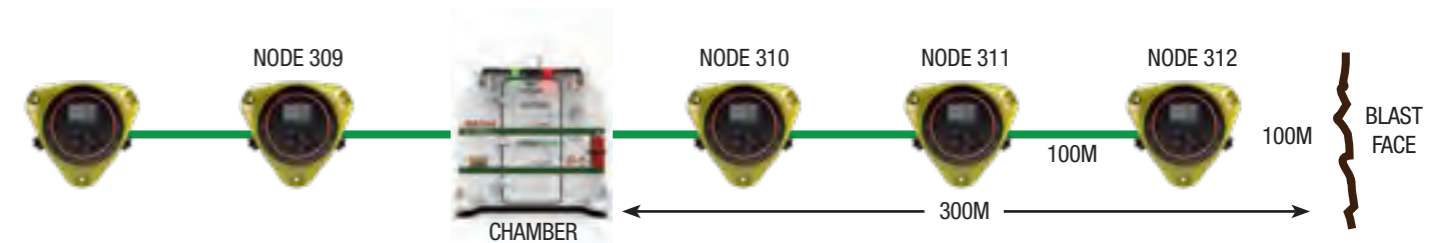
Improving Re-Entry Processes

Underground gas monitoring via the GuardIAN Node Network is particularly useful during re-entry; allowing personnel to view falling gas levels in real time following a blast, and ultimately reducing wasted time spent on the surface or in the refuge chamber.

Personnel sheltering in a MineARC Refuge Chamber during a blast can

monitor gas levels in their immediate surrounds via a GuardIAN tablet; receiving an automated all-clear as soon as the environment is safe.

Alternatively, personnel waiting on the surface will also receive a safe entry alert via any personal device, allowing them to quickly and safely re-enter the mine, minimising delays.



GuardIAN

Gas Monitoring

Aura-PT Handheld Gas Monitor

The **Aura-PT handheld gas detector** has been designed to provide underground personnel with the ability to continuously monitor up to six gases within their immediate surroundings. Aura-PT automatically communicates dangerous gas levels back to the **GuardIAN Server** via the **GuardIAN Nodes**.

- ✓ **Digitally monitor up to six gases at any one time, with visual and vibration alerts**
- ✓ **Automatically feeds gas readings through to the GuardIAN Server via the closest GuardIAN Node**
- ✓ **Triggers visual alerts on surrounding GuardIAN Nodes in the event of dangerous gas levels**

The Aura-PT can also be used as a redundancy during re-entry, allowing personnel to easily and accurately monitor gas levels as they are driving back down the decline.



Gas Sensors Available



GuardIAN

Gas Monitoring

The Aura-PT Handheld Gas Detector can transmit readings to the surface via any GuardIAN Node.



Trigger Stench Gas Release

When integrated with MineARC's **Stench Gas Emergency Alert System**, the release of stench gas can be triggered remotely via the GuardIAN Dashboard, in addition to the **Stench Gas Master Controller** or **Sub-Controller** onsite.

GuardIAN's remote activation provides an alternative and immediate trigger for **Electric Stench Gas** release in an emergency situation.



GuardIAN Smart Lighting

ROBUST DESIGN FOR THE MINING ENVIRONMENT

TRACKING VIA UWB

DIRECTS PERSONNEL TO THE NEAREST AVAILABLE REFUGE CHAMBER

GuardIAN Smart Lighting integrates with the wider GuardIAN Intelligence Network to provide directional assistance based on gas levels in the area.

GuardIAN Smart Lighting

Underground Smart Lighting from the GuardIAN Node range provides sites with the ability to provide a visual alert when evacuation is necessary, and assist in guiding personnel safely to the nearest available refuge chamber.

The Smart Light also doubles as a UWB tracking device, reporting on the location of all personnel underground.

Controlled and monitored via the GuardIAN Network, the Lighting Nodes can also be utilised alongside GuardIAN Gas Monitoring Nodes and GuardIAN Tracking Nodes; providing a complete safety solution for underground mines.



RED



GREEN



AMBER



REFUGE CHAMBER



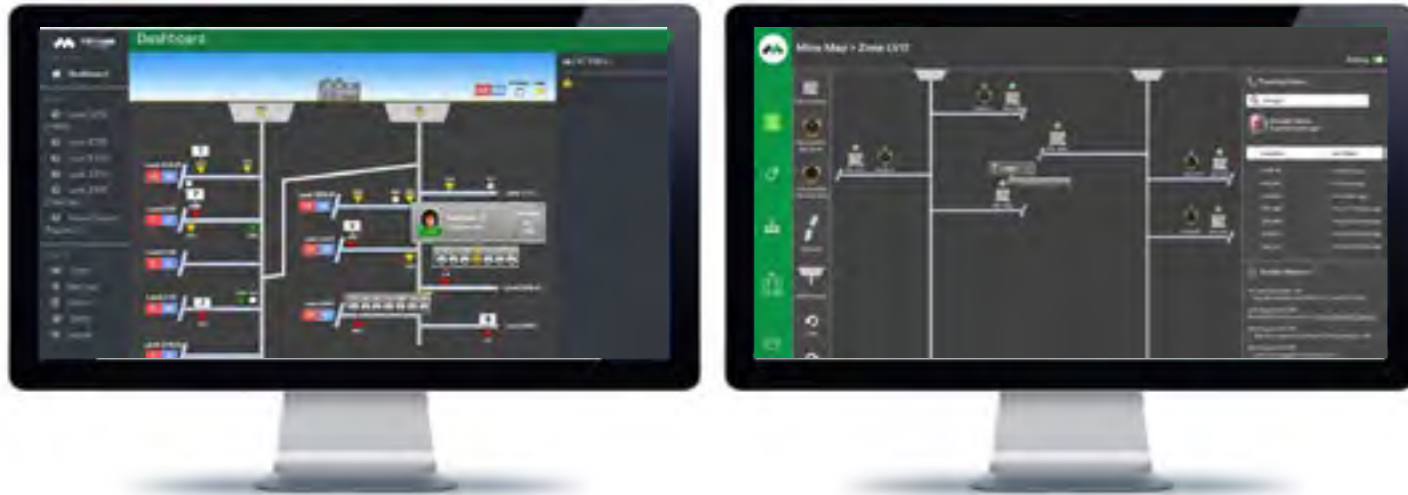
GuardIAN Smart Lighting aids in personnel navigation during an emergency scenario; marking a clear visual path to the closest safe refuge. Controlled by the complete GuardIAN Intelligence Network, the lighting nodes will change colour to indicate safe or dangerous routes based on gas levels detected in the area.



GuardIAN Tracking

GuardIAN Tracking Technology has been specifically designed to integrate with the GuardIAN Intelligence Network, allowing sites to remotely monitor the location and well-being of all underground personnel.

A small UWB tracking chip located within MineARC's SiriUS-LUX Cap Lamp communicates via wireless with the nearest GuardIAN Node, providing location information back to the GuardIAN Network.



Defining the future of the humble cap lamp, the **SiriUS-LUX Corded Cap Lamp** boasts greater efficiency, interchangeable batteries, improved illumination, automatic light adjustment and advanced tracking capabilities via the **GuardIAN Nodes**.

- ✓ **UWB Tracking technology allows all personnel to be accounted for and safely located by rescue teams during an emergency or hazardous event**
- ✓ **RFID Chip allows cap lamp to be assigned to a personal ID**
- ✓ **Unique light sequence to indicate initiation of emergency response procedures**



GuardIAN Tracking



With site-wide integration in mind and an expandable range within the GuardIAN Intelligence system, it allows sites to further enhance their safety standards through the use of additional nodes.

Gas Nodes:

- Gas monitoring solution for sites
- Monitors up to 6 gasses of your choosing
- Temperature monitoring

Smart Lighting Nodes:

- Acts as a visual guidance system during critical times of need by illuminating pathways to safe refuge.
- Integrates with gas monitoring and changes colour depending on gas levels detected in the area.

In addition, all Node variants have built-in, real-time personnel tracking and are accessible via the GuardIAN Dashboard.

GuardIAN Tagboards

Tagboards by MineARC will compliment any tracking and tagging system.

Designed as a plug-and-play unit, the tag board allows personnel to pair their MineARC personal devices to their unique ID number and digitally tag on for the day.

The Manual and Hybrid models have the benefit of a manual redundancy, utilising the traditional method of hanging the ID tag to a hook. Available in an 80-person configurations with expansion modules available to suit any size site.

The Digital Tagboard provides a fuss-free way to track personnel throughout site and monitor various zone capacities at a glance with multi-zone monitoring via the GuardIAN Intelligence system.



MANUAL, HYBRID AND DIGITAL MODELS AVAILABLE, AS WELL AS CHAMBER TAG READERS

Tracking Corded Cap Lamps

Tracking Corded Cap Lamps from the SiriUS-LUX range improve on-site safety by determining the current location of personnel or assets. Pair each device with an ID number to monitor personnel throughout varied scenarios to support more efficient operations and emergency response. Location tags transmit the information as each device or person is scanned by receivers. All location information can be recorded and viewable through the Guardian dashboard.

Redefining wearable LED lighting designed for underground environments, the SiriUS-LUX Tracking Corded Cap Lamp is engineered to improve efficiency and visibility to ensure safe operations. MineARC's own designed and manufactured cap lamp provides a quality and reliable lighting solution; combining dual beams, superior colour rendering and a robust design. The cap lamp can emulate natural light and conserve power.

The SiriUS-LUX Corded Cap Lamps are available in two models - L3 and L5. The **Green L3** and **Pink L3** Corded Cap Lamps each produce a sharp spot for concentrated light in mixed mode. The **Orange L5** Corded Cap Lamp produces a broad reaching, high intensity flood light effect with improved dispersion in mixed mode.

Tracking Features

All SiriUS-LUX Cap Lamps are supplied with an RFID Chip, allowing sites to utilise this wearable device as part of a greater tagging system.

In addition, SiriUS-LUX Cap Lamps can be fitted with a number of different tracking technologies that allow for more accurate location tracking and can be easily integrating into existing site infrastructure.



Standard Features

- Dual beams for a variety of modes and functions; including spot, wide and mixed
- > 90 Colour Rendering Index
- Boost mode for short-term, high intensity light
- Automatic light adjustment based on object distance
- Low power mode at 80% depletion for longer battery life
- Lightweight curly cord that reduces risk of pull
- Universal cap lamp attachment
- 10.4Ah modular, quick connect battery included (spare batteries available)
- Can be charged by included USB cable and wall adaptor (included)
- RFID tracking chip included (13.56MHz, ISO 15693 & ISO 18000-3)
- Site's preferred tracking technology
- Water resistance: IP68

Duration	Up to 18 hours
Charge Time	Maximum 8 hours
Colour Render Index	CRI 80 (spot) / CRI 90 (wide)
LEDs	XP-E2 (spot) / XP-G2 (wide)
L3 LED LIGHT / L3 LED LIGHT	3° (spot) / 110° (wide) Sharp spot effect (mixed beam) 2,873 lux (mixed beam) 5,861 lux (spot beam)
L5 LED LIGHT	5° (spot) / 110° (wide) Flood light effect (mixed beam) 1,263 lux (mixed beam) 2,627 lux (spot beam)
Buttons	4
Cable Length	1m (1.5m when stretched)
Electronic/PCB Manufacture	Australia
IP Rating	IP 67
Battery	4 x 18650 Li-Ion, 9.62Wh @ 3.7V
Weight	Approx 160g
Rated Capacity	10.4Ah
Rated Voltage	3.7V
Rated Current	2A



SiriUS-LUX Charger Racks



Constructed from robust, hard-wearing powder coated steel, the new MineARC Charger Rack's unique design offers optimal flexibility; allowing you to order a rack specific to your needs and products on site.

The option of a double-sided rack is available, or alternatively, multiple racks can sit flush side-by-side for a larger charging station.

Mix and match your modules to suit a variety of MineARC devices, or choose from the standard configurations shown below. Depending on device quantity, a two- or three-module high rack might be most suitable.



MIXED RACK CONFIGURATIONS
2- and 3-MODULE OPTIONS

- | SIRIUS-LUX
CORDED (BATTERIES) | SIRIUS-LUX SEMI-CORDED
/ SIRIUS CORDED | SIRIUS-LUX /
SIRIUS CORDLESS | AURA-PT
2, 4, 6 GAS |
|--|--|---|---|
| <ul style="list-style-type: none"> • Batteries per row: 8 • Single sided max: 40 • Double sided max: 80 | <ul style="list-style-type: none"> • Cap lamps per row: 8 • Single sided max: 40 • Double sided max: 80 | <ul style="list-style-type: none"> • Cap lamps per row: 20 • Single sided max: 100 • Double sided max: 150 | <ul style="list-style-type: none"> • Monitors per row: 10 • Single sided max: 50 • Double sided max: 100 |



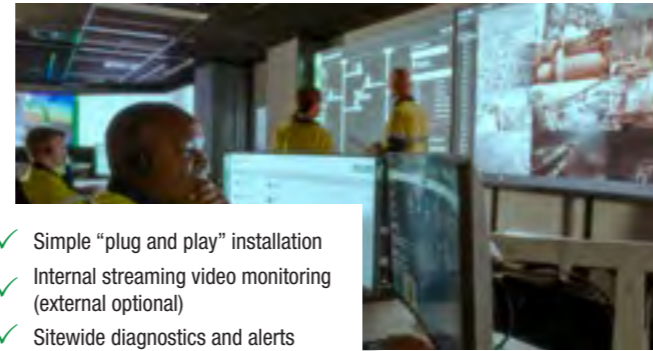
GuardIAN

Installation Process

01 Refuge Chamber Monitoring

Your complete overview of the MineARC Refuge Chamber fleet and overall operational status, with the ability to drill down to a detailed report of each chamber.

01



- ✓ Simple "plug and play" installation
- ✓ Internal streaming video monitoring (external optional)
- ✓ Sitewide diagnostics and alerts
- ✓ Improved safety and emergency response actions

02

External Gas Monitors

Monitor gas levels in the immediate surrounds of the refuge chamber with an external gas node. Gas readings can be viewed clearly through the GuardIAN dashboard via a secure local webpage.

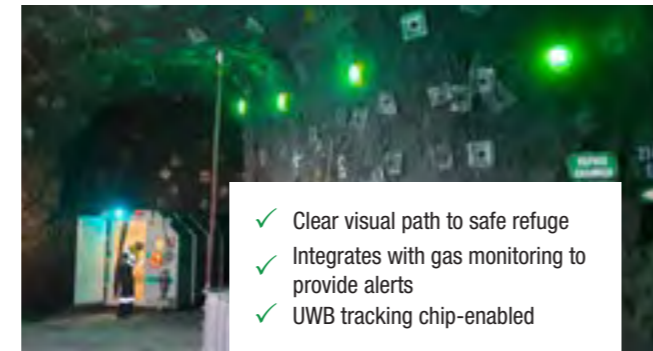


- ✓ Clear digital interface
- ✓ Multiple gas options, plus temperature
- ✓ Visual alerts
- ✓ Tracking at the chamber

03

03 Lighting & Navigation

Using data through the GuardIAN network, the control room can close off areas, redirect underground workers and assets, and initiate safety protocols using the smart lighting system.



- ✓ Clear visual path to safe refuge
- ✓ Integrates with gas monitoring to provide alerts
- ✓ UWB tracking chip-enabled
- ✓ Improve personnel and asset safety

04

Tracking

Small tracking chips within the GuardIAN Nodes link with personal smart devices, such as cap lamps and handheld gas monitors, to calculate the current location of personnel or assets.



- ✓ Real-time location data
- ✓ Support ERT processes
- ✓ Improved safety and security
- ✓ Tagboard, SiriUS-LUX Cap Lamps, Aura-PT, and GuardIAN nodes

GuardIAN

Installation Process

Adopting New Technology

Investing in technology focuses on a few critical areas; significantly improve operations and safety through automation and digitalisation, bringing data together from across the value chain, and refining support processes.

The GuardIAN Intelligence Network (GuardIAN) allows organisations to understand conditions and have the data available to make informed decisions to resolve issues and prioritise actions.

The real-time situational awareness of people, assets, and the environment can create safer practices, more efficient emergency response, and project impacts across the entire operations.

Accelerating data processing and real-time integration through GuardIAN will help deliver step-change improvements. Through

advanced analytics and on-hand information, organisations are making faster, better decisions. These ensure safer practices streamline workforce allocation, use and safety, allow remote management of resources, and maximise assets' efficiency.

A GuardIAN implementation plan compares current operations to the ideal vision, identifying gaps within the system to change, improve or remove.

Some of the main questions when installing GuardIAN as part of a digital transformation initiative are:

1. Is the GuardIAN installation to optimise or transform?
2. What are the key stages and activities?
3. Which leaders and teams need to be involved?



GuardIAN Server Requirements

If you require a server for your GuardIAN Network, MineARC can offer a range of options to suit any site's existing infrastructure. Our in-house Software Engineers will work closely with your IT department to provide the most cost effective solution that can be integrated into a site's current comms set-up, and have the ability to be expanded upon over time.

MineARC can offer either a traditional physical server or virtual server options, alongside our GuardIAN Central Server Software. Speak to your local MineARC representative for more information.

When is a Server not required?

GuardIAN Refuge Chamber Monitoring does not require a server, as it operates off its own single-board computer installed within the Refuge Chamber controller. This also means that a Master Node connected to the chamber with a string of Satellite Nodes does not require a separate server.

When is a Server required?

A stand-alone string of GuardIAN Nodes spread throughout a mine will require a server in order to provide data to surface operations. In addition, when multiple Refuge Chambers are to be monitored, the amount of data produced and consolidated requires a server.

Refuge Chamber Monitoring

MineARC's **GuardIAN Refuge Chamber Monitoring System** is an exciting development in refuge chamber technology. GuardIAN enables real-time monitoring; providing confidence that an operation's fleet of refuge chambers are emergency ready at all times.

GuardIAN Refuge Chamber Monitoring is an on-board system that continuously monitors all vital refuge operating systems. During standby mode GuardIAN checks for component faults and monitors refuge chamber usage or entry to the chamber.

The GuardIAN Chamber Monitoring system is hosted on an internal server within the refuge chamber so that no client software installation is required. The responsive webpage is easily accessible from any computer, tablet or smartphone and features a summary of your entire refuge chamber fleet and overall operational status, with the ability to drill down to a detailed report of each chamber.

GuardIAN Chamber Monitoring provides the added advantage of remote troubleshooting assistance by MineARC Engineers, who can login to view the chamber diagnostics dashboard with sites' permission.



Chamber Integrity Monitoring

The Compressed Air Management System (CAMS) communicates vital information relating to the integrity of the internal refuge chamber via the GuardIAN Network.

An increase in CAMS activity would indicate a breach of the refuge chamber seal, thus sending an alert to designated personnel that the chamber is compromised.

Refuge Chamber Monitoring

Event Logging & Fault Diagnostics

MineARC's Series IV Digital Controller links directly to the GuardIAN Network, streaming real-time system data, including automated system checks, fault logging (battery, scrubber, temperature and inverter), system diagnostics, internal and external temperature measurements, and system actions such as scrubber activation. MineARC's Aura-FX also provides real-time gas monitoring data and analysis via the GuardIAN Network dashboard.

Live Video Monitoring & VOIP Video Phone

Internal video monitoring is provided by a remote controlled, motion activated GuardIAN IP camera. When activated, the camera will send out a live, recorded stream of the interior of the refuge chamber to the GuardIAN Network.

To assist occupants during an emergency or safety drill, chambers are also equipped with a VOIP video phone, facilitating face-to-face communication between the refuge chamber and the surface.

UPS Battery Management

When used in conjunction with GuardIAN, the MineARC Satellite UPS System allows for real-time, remote monitoring of each individual battery. Battery faults can be identified immediately via the GuardIAN Dashboard and Alert Feed, with auto-generated event notifications sent directly to any personal device. Voltage and temperature diagnostics for each individual battery within a string can also be viewed via a graph, highlighting any fluctuations over the past 24 hours.



Complete your network with GuardIAN Connect

GuardIAN Connect is a high speed, fit for purpose, linear access layer network, allowing the connection of the GuardIAN Nodes, Smart Lighting and Refuge Chamber to the GuardIAN Intelligence Network.

Designed specifically for an underground mining environment, GuardIAN Connect uses a single coaxial cable to carry both power and data.

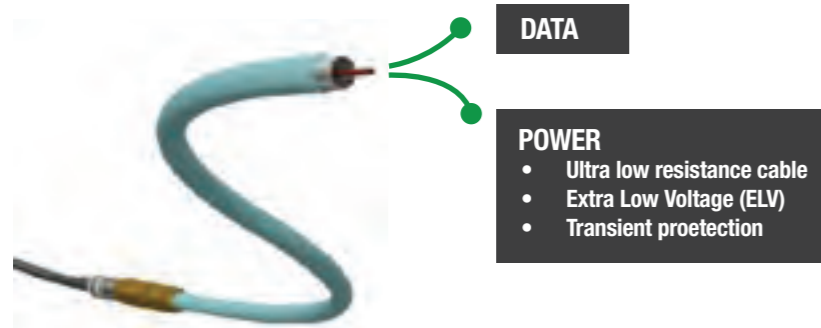


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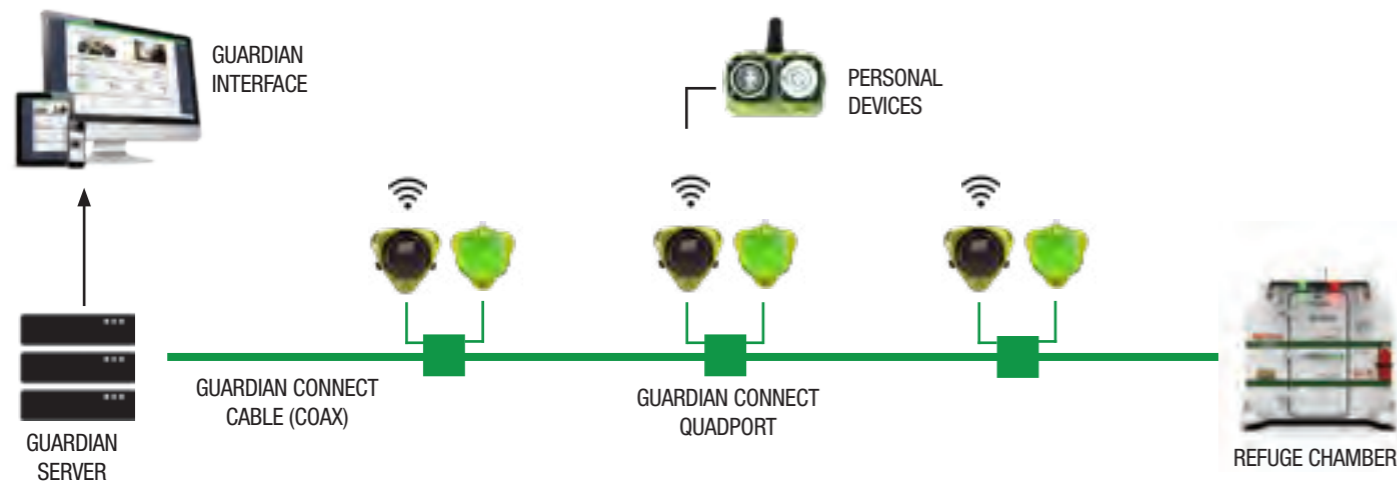
- ✓ Distributes reliable, standard-compliant power
- ✓ Full speed native Ethernet communications
- ✓ Inter-operable with a site's preferred network equipment
- ✓ Can be installed & maintained by UG trades - as easy as leaky feeder



GuardIAN Connect eliminates separate distribution by enabling power to be carried over the communications cable with the data. Power centres can be consolidated every 1-2km.

Power over Ethernet (PoE+) outlets can be tapped off the GuardIAN Connect Cable wherever endpoint devices (such as the GuardIAN Node and Lighting) are required.

Device Connection



GuardIAN Connect is easy to install as a leaky feeder system, whilst at the same time providing a full-speed native Ethernet network. It overcomes the challenges of underground networks with a cost effective solution.

Underground trades can advance and branch the network easily, allowing additional ports to be added as required. Damage can be readily repaired with basic tools in wet, dirty conditions.



Nodes are best positioned within 100m of each other, although can be further if sites wish. The closer the spacing, the greater the accuracy.

GuardIAN Connect

Types of Cable

ULR COAXIAL CABLE



The ULR coaxial cable is a semi-rigid aluminium cable that can extend for distances up to 1km.

FLEXIBLE COAXIAL CABLE



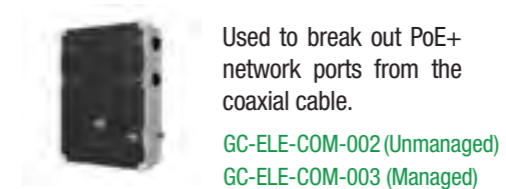
The Flexible half-inch coaxial cable is a more cost effective option, designed to extend for distances up to 600m.

Main Devices

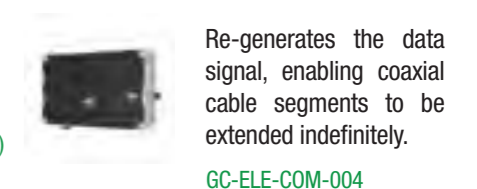
PORTAL



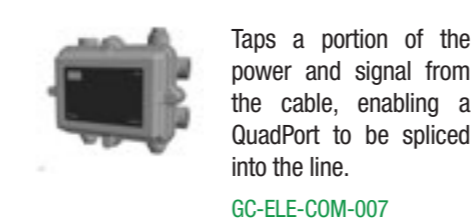
QUADPORT



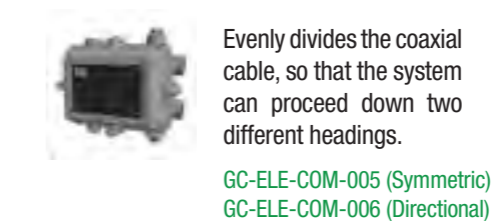
REPEATER



BRANCH



SPLITTER



POWER INSERTER



Comparison to Other Systems

FIBRE/COMPOSITE FIBRE

- ✗ Expensive to deploy and maintain
- ✗ Repair is impractical
- ✗ Poor flexibility
- ✗ Power required at each Ethernet outlet, or sent along a separate cable

CABLE MODEM

- ✗ Complex to maintain
- ✗ Headend (CMTS) is a single point of failure
- ✗ Data rate is shared across all endpoints
- ✗ Breaking out an Ethernet port and powering it is complex and expensive

LEAKY FEEDER

- ✗ Limited data rates
- ✗ Only viable for a small number of Ethernet endpoints



MineARC Systems - Built for Safety.

www.minearc.com

