

GAS CLOUD IMAGING DETECTION SOLUTIONS

Highly advanced hyperspectral gas imaging systems to help keep industries safe and more environmentally conscious.

Honeywell's Rebellion
Gas Cloud Imaging
(GCI) Systems



Honeywell

GAS CLOUD IMAGING DETECTION SOLUTIONS FOR THE OIL AND GAS INDUSTRY

When a gas leak occurs, Your Organization needs to act immediately to preserve the safety of personnel, the site, and the environment. Honeywell's hyperspectral gas cloud imaging systems provide automated, visually verified, accurate gas leak information that allows Your Team to formulate data-driven mitigation plans and drive safe, efficient resolution.

TRUST REBELLION GCI TO PROVIDE YOU THE RIGHT INFORMATION, WHEN YOU NEED IT

As a global leader in the Industrial Internet of Things (IIoT), Honeywell delivers the future now.

The Rebellion GCI:

- Continuously monitors, 24-7-365
- Detects in <1 second

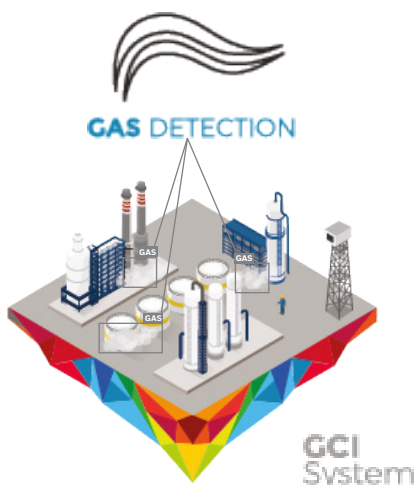
- Provides automated leak alerts via:
 - MQTT (Message Queuing Telemetry Transport) protocol
 - Modbus/TCP-IP
- Pinpoints leak location

Through the application of machine learning analytics, Rebellion GCI:

- Interprets GCI data to render a data-rich, easy-to-understand, visual interpretation of the

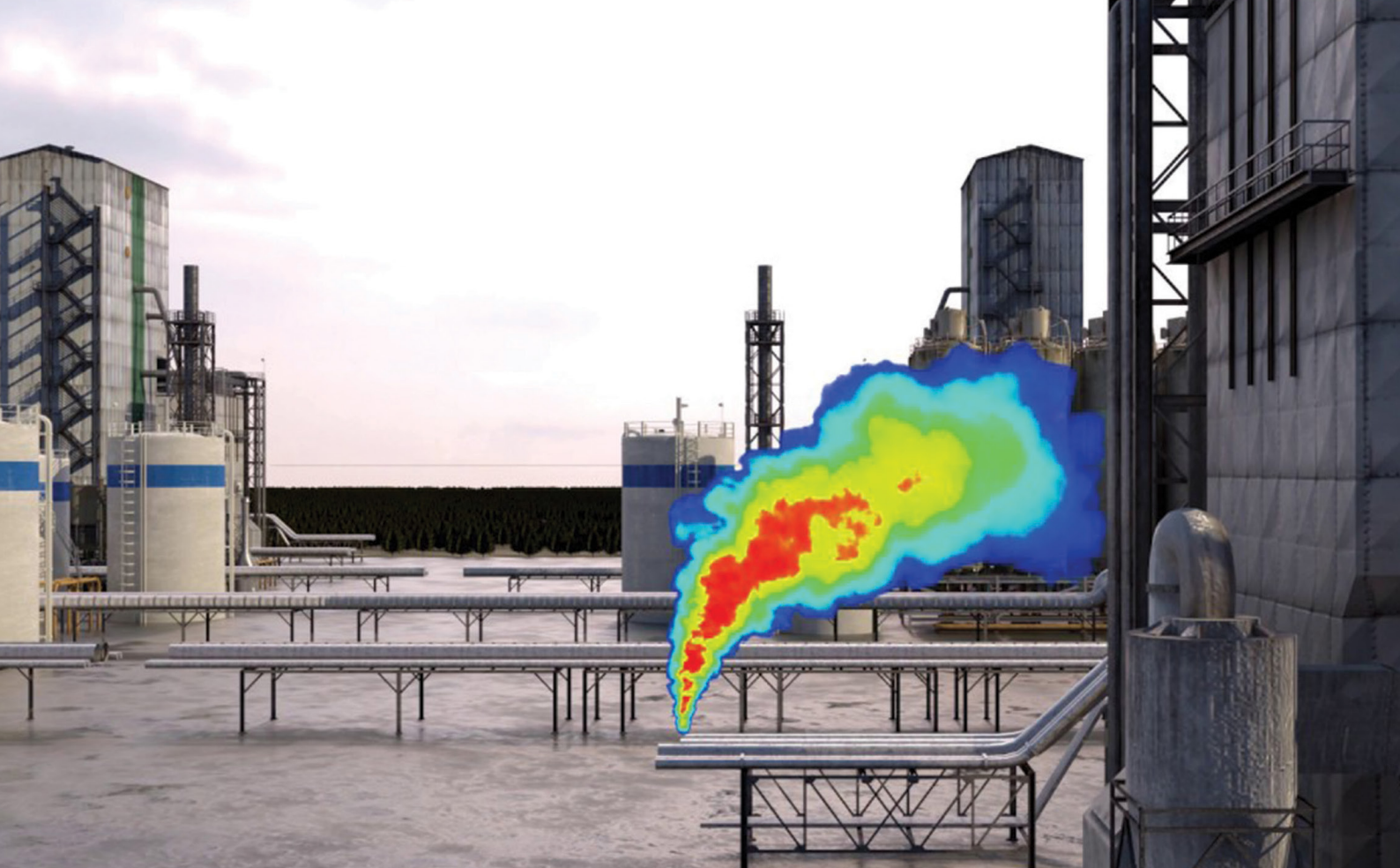
leak through the Rebellion software interface

- Identifies the fugitive molecule(s)
- Quantifies the volume and size of the leak
- Shows the leak source location and direction of the gas plume



CHOOSE HONEYWELL GAS CLOUD IMAGING (GCI) SYSTEMS FOR A CUTTING-EDGE, ROBUST SOLUTION IN THE HARSHEST ENVIRONMENTS

Rebellion GCI continues Honeywell's innovation brand promise to Our Customers across a wide variety of industries. With Rebellion, Honeywell offers the most advanced hyperspectral gas cloud imaging systems for the upstream, midstream, petrochemical, refinery, and commodity chemicals industries. We build on our reputation of over a century of extensive research, application expertise, and a heritage of safe and efficacious solutions to optimize safety, environmental stewardship, and profitable enterprise.



HOW IT WORKS

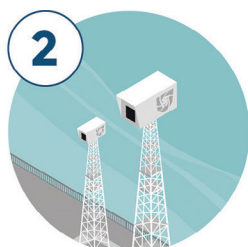
Because each gas has a unique emissions / absorption signature in its fingerprint region, it is possible to identify and differentiate gases. Rebellion's patented optics design captures leak emissions data, while the system's powerful hyperspectral output identifies specified gases for every pixel in real time. Once alarm sensitivity is tuned to meet an enterprise's needs, Rebellion can begin

automated monitoring for gas leak incidents. If a fugitive gas leak occurs, Rebellion Gas Cloud Imaging (GCI) alerts Operators via (a) MQTT (Message Queuing Telemetry Transport) protocol, and / or (b) Modbus/TCP-IP. Operators can view the incident as interpreted through Rebellion's machine learning analytics software which displays the incident as a visual cloud – and provides contextualized

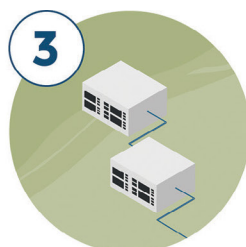
information of leak source, size, and direction of movement of the leak plume. Real Time visualization – supported by Rebellion's GCI system's video recording functionality - allows Operators to review and analyze the incident to create and execute a data-driven mitigation plan. The DVR records can later be accessed for documentation and reporting.



1 EVENT
A gas leak occurs at a facility.



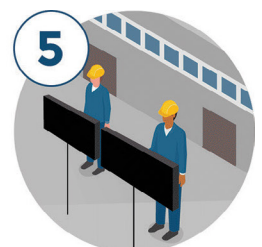
2 DETECT
Rebellion GCI Hardware captures the leak.



3 ANALYZE
Analyzers process the data in real time to identify, quantify, and track.



4 STORE
A DVR records the gas leak and sends the live results to Operators.



5 MONITOR
Operators can "see" the gas leak and plan an appropriate response.

HONEYWELL REBELLION GAS CLOUD IMAGING COMPONENTS & SERVICE

Honeywell Rebellion Gas Cloud Imaging (GCI) Systems feature innovative gas cloud imaging through hardware monitoring devices, machine learning analytics, and visual interpretation software. Each Honeywell Rebellion Solution includes installation, set-up, and technical support services.

HARDWARE MONITORING DEVICES

Rebellion Gas Cloud Imaging employs a proprietary hyperspectral imaging technology which scans the infrared spectrum for specified gases. Rebellion can be pre-programmed to cyclically monitor assets with the highest leak probability-and-consequence - or allow an operator to quickly pan and tilt the GCI's field of vision to an area of interest. Rebellion GCIs are self-calibrating and operate 24-7-365 in all weather conditions to quantify, display, and notify operators of incidents, if and when they arise.

MACHINE LEARNING ANALYTICS

Combining recent advancements in data science, optical physics, and artificial intelligence / machine learning, our real-time monitoring analytics that delivers smarter, faster, and more actionable information. Rebellion's analytics may be customized to meet the unique needs and situations of Customers, allowing them to confidently understand, make, and defend their activity decisions.

VISUAL INTERPRETATION SOFTWARE

Honeywell Rebellion's proprietary software platform displays clear, real-time video footage and manages the analytics through its own user interface. Its dedicated server stores up to five (5) million detection events and may be customized to auto-erase. If incidents arise, fully automatic system information and actionable alerts are provided to operators via live visual display in the Rebellion software, MQTT (Message Queuing Telemetry Transport) protocol, and / or Modbus/TCP-IP.

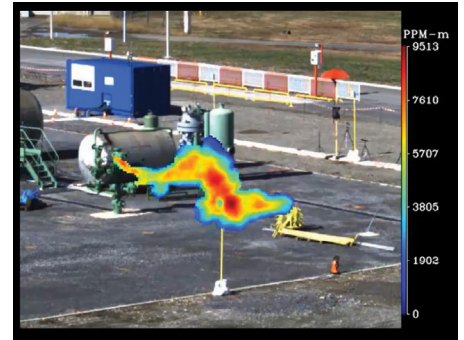
INSTALLATION, SET-UP, AND TECHNICAL SUPPORT SERVICES

From a customer list of assets they wish to monitor, Honeywell consultants model and discuss deployment locations of Rebellion Gas Cloud Imaging at elevated positions in nonhazardous areas; recommended positions seek to optimize the most effective coverage, integrating considerations for worker safety, physical obstructions, and environmental conditions. Proper installation results in a fully functioning and accurately configured system on a dedicated server.

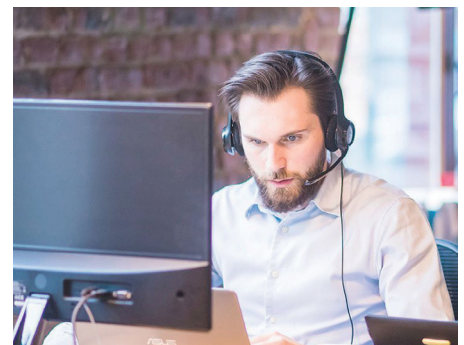
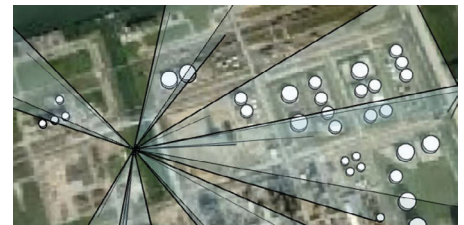
A complete training package accelerates onboarding and promotes understanding and mastery, while Honeywell's technical support is with your company every step along its emissions reduction journey. An optional annual maintenance service pack ensures the system maintains peak uptime and performance.



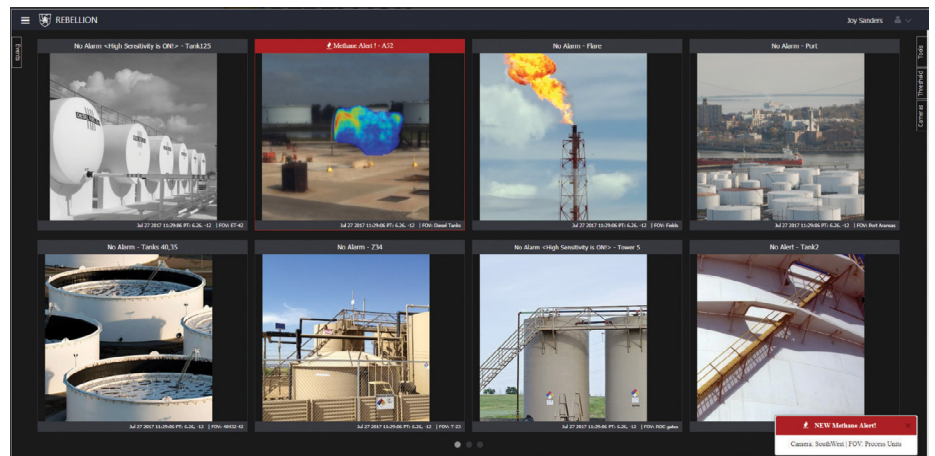
Hardware monitoring devices installed.



Advanced real time visual monitoring.



Honeywell supports your initial planning to installation and set-up, providing ongoing support.



Edge computing with extraordinary processing power and storage.

BENEFITS

The Honeywell Rebellion Gas Cloud Imaging Solution is a platform of intelligent, automated, visual monitoring that assists industries become more business resilient.

WORKER & COMMUNITY SAFETY

Our solution provides a timely and clear visual indication of previously invisible gas clouds, adding an additional layer of Operator safety. Honeywell Rebellion System instantly identifies the gas or mixture, location, and quantity of a leak, enabling personnel to respond rapidly with an effective, targeted plan where early intervention reduces risks of escalation. Honeywell promotes safety by enabling organizations to:

- Set emissions limits and operational goals to drive leak alerts within the Rebellion software
- Monitor assets in real-time, 24-7-365
- Detect indoor and outdoor leaks
- Acknowledge alerts with minimal delay
- Pinpoint leak sources
- Develop more thoughtful and effective responses to leak events
- Mitigate impact resulting from delayed incident awareness.

ENVIRONMENTAL STEWARDSHIP

Rebellion's 24-7-365 monitoring supports personnel in developing a more data-driven approach to achieving net zero greenhouse gas emissions. From the daily steady-state of environmentally sound operations to minimizing the impact of harmful emissions through the reduction of time between incident, awareness, and response, Honeywell promotes environmental responsibility by enabling organizations to:

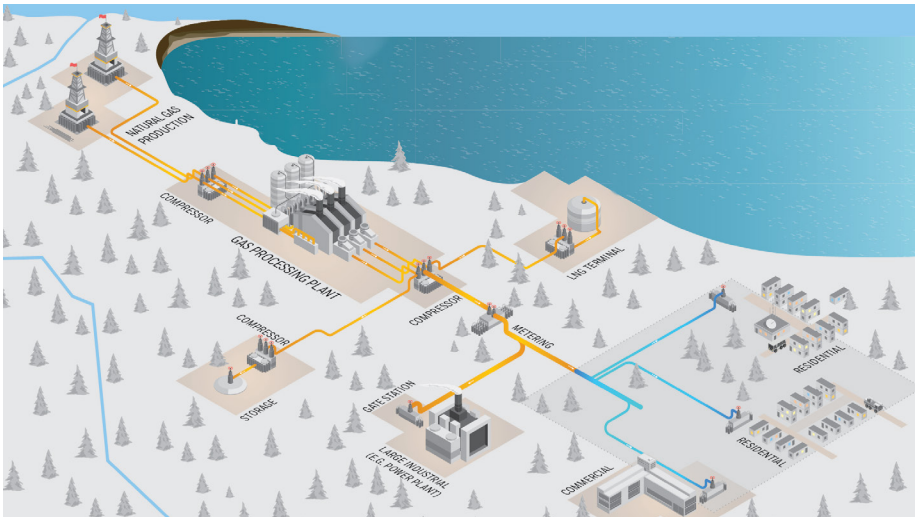
- Align organizational enterprise mission with mandatory environmental regulations
- Measure and monitor quantifiable emissions safely, consistently, cost-effectively
- Establish a baseline for operational reference and progress
- Capture and archive real-time emissions with data visualization and storage
- Provide a total emissions profile and evaluation of assets over time
- Initiate actions to reduce methane intensity
- Reduce Your Company's emissions.

BUSINESS IMPACT

Organizations must plan and execute better than before with greater emphasis to weave people and planet considerations into profit, heightened regulatory requirements, greater scrutiny from investors and the public, and escalating prices and uncertain access to energy. Honeywell facilitates resilient business operations by helping organizations to:

- Decrease reactive maintenance, unplanned safety, and emissions intervention costs
- Minimize in-process material loss; maximize yield and finished products
- Reduce workplace risks, thereby creating a safer working environment
- Create financial optionality into more favorable capital markets, access to Sustainability linked loans, and participation in carbon credit markets
- Offer a more robust product portfolio that meets an ever increasing market for low-carbon products
- Remain globally, innovatively, financially relevant.

REBELLION GAS CLOUD IMAGING SOLUTIONS: INDUSTRIES AND APPLICATIONS



THE HONEYWELL REBELLION PORTFOLIO ADDRESSES A WIDE RANGE OF SAFETY AND EMISSIONS APPLICATIONS

Oil and Gas Upstream - Onshore

- Exploration
- Production
- Drilling
- Extraction

Oil and Gas Midstream

- Gathering
- Processing
- Transportation
- Storage

Oil and Gas Downstream

- Distribution
- Liquefied Natural Gas (LNG)
- Petrochemicals
- Refineries
- Chemicals

Heavy industrials such as

- Power & Utilities
- Cement
- Pulp & Paper

APPLICATIONS INCLUDE:

- Gas processing plants
- Gas transmission and distribution
- Compressors and metering skids
- Pipelines
- Tank farms
- LNG / LPG transportation
- Petrochemical plants
- Refineries
- Chemical plants
- Power plants

REBELLION GAS CLOUD IMAGING SYSTEMS

PRODUCT SPECIFICATIONS

REBELLION GAS CLOUD IMAGING (GCI) SYSTEM - LONG RANGE		
PROPERTY		
System	SYSTEM COMPONENTS: <ul style="list-style-type: none"> Long Range GCI Umbilical cable assembly Pan/Tilt (PT) unit Pan/Tilt to Junction Box cable assembly Junction Box (JB) & Mounting Pole Facility Interface Panel (FIP) Analyzer computer & Power Cord (EU, UK, & North America provided) 	WEIGHTS OF MAJOR COMPONENTS: Long Range GCI: 48.1 kg (106 lbs.) Pan/Tilt: 39.9 kg (88 lbs.) P/T Weights: 20.4 kg (45 lbs.) Pole: 15.9 kg (35 lbs.) Junction Box: 5.9 kg (13 lbs.) FIP: 81.6 kg (180 lbs.) Total: 211.8 kg (467 lbs.)
Sensor Type	Hyperspectral Infrared Imaging	
Detection Parameters	Detection Time: < 1 second	Running Time: Continuous (24/7, 365 days)
Self-Calibration	Every 7 and 22 minutes	
Area of Coverage	Distance, US: Up to 5577 ft Distance, Metric: Up to 1700 m	Field of View: 5.0° x 5.0°
Position Control	Tilt Max, Up or Down: +45° Pan: ±180° Rotation: full 360°	
Alert / Alarm & DCS Integration	Fully automatic alarm with live visual display in the Rebellion software or by: <ul style="list-style-type: none"> MQTT (Message Queuing Telemetry Transport) protocol, and / or Modbus/TCP-IP 	
Video Output	Infrared: 200 x 200 pixels	Visible: 600 x 600 pixels
Temperature Range	Temperature, US: -40°F to +131°F	Temperature, Metric: -40°C to +55°C
Electrical Requirements	CAMERA: Peak: 24 VDC, 10 A Continuous: 5.0 A	PAN/TILT: Peak: 48 VDC, 12 A Continuous: 6.4 A Idle: 0.5 A
Network Connections	GCI Connections: Two (2) CAT 6; Three (3) Multi-mode Fibers with LC Connectors.	Overall System: Consult with Honeywell as cable requirements depend on variables of system components and distance between components.
Analysis & Data Storage	Analyzer: Enhanced Analyzer Dell R450	DVD (Video Storage): Dell Poweredge R540 or equivalent. Stores up to 5 million detection events with custom auto-erase settings.
Size, Assembled System	Dimensions, US: 71.3" (h) * 18.4" (w) * 36.0" (l)	Dimensions, Metric: 181.1 cm (h) x 46.7 cm (w) x 91.4 cm (l)



REBELLION LONG RANGE GAS CLOUD IMAGING

The Long-Range GCI System is designed to cover large sites and extended areas and:

- Is designed to be installed at elevated positions
- Can be programmed to monitor a repeated sequence of assets
- Allow for manual control over scanned areas
- Provide 24-7-365 monitoring with <1 second detection time
- Detect-identify methane and other common hydrocarbons
- Detect-identify many toxic and / or flammable industrial gases
- Offer real-time alerts
- Display live videos of an incident
- Pinpoint leak location
- Quantify gas leak size and volume
- Store up to 5 million detection events for review, analysis, documentation, and reporting

REBELLION GAS CLOUD IMAGING SYSTEMS

PRODUCT SPECIFICATIONS

PROPERTY	REBELLION GAS CLOUD IMAGING (GCI) SYSTEM - MINI	
System	SYSTEM COMPONENTS: <ul style="list-style-type: none"> Mini GCI Camera to Pan/Tilt cable assembly Pan/Tilt (PT) unit Pan/Tilt to Junction Box cable assembly Junction Box (JB) Facility Interface Panel (FIP) Analyzer computer & Power Cord (EU, UK, & North America provided) 	WEIGHTS OF MAJOR COMPONENTS: Mini GCI 3.0 GCI: 5.5 kg (12.1 lbs.) Pan/Tilt unit: 35.0 kg (77.2 lbs.) P/T Weights: (N/A) Pole: (N/A) Junction Box: 2.5 kg (5.5 lbs.) FIP: 40.0 kg (88.2 lbs.) Total: 83.0 kg (183 lbs.)
Sensor Type	Hyperspectral Infrared Imaging	
Detection Parameters	Detection Time: < 1 second	Running Time: Continuous (24/7, 365 days)
Self-Calibration	Every 7 and 22 minutes	
Area of Coverage	Distance, US: Up to 328 ft Distance, Metric: Up to 100 m	Field of View: 42.0° x 42.0°
Position Control	Tilt Max, Up: +15° from neutral Tilt Max, Down: -45° from neutral Pan: ±180° Rotation: full 360°	
Alert / Alarm & DCS Integration	Fully automatic alarm with live visual display in the Rebellion software or by: <ul style="list-style-type: none"> MQTT (Message Queuing Telemetry Transport) protocol, and / or Modbus/TCP-IP 	
Video Output	Infrared: 160 x 160 pixels	Visible: 640 x 640 pixels
Temperature Range	Temperature, US: -40°F to +131°F	Temperature, Metric: -40°C to +55°C
Electrical Requirements	CAMERA: Peak: 24 VDC, 10 A Continuous: 5.0 A	PAN/TILT: Peak: 24 VDC, 12 A Continuous: 6.4 A Idle: 0.5 A
Network Connections	GCI Connections: Three (3) CAT 6 with Ethernet Connection	Overall System: Consult with Honeywell as cable requirements depend on variables of system components and distance between components.
Analysis & Data Storage	Analyzer: Enhanced Analyzer Dell R450; Standard Analyzer Dell R450; Rugged Analyzer Nuvo 8034.	DVD (Video Storage): Dell Powerededge R540 or equivalent. Stores up to 5 million detection events with custom auto-erase settings.
Size, Assembled System	Dimensions, US: 44.5" (h) x 14.5" (w) x 14.4" (l)	Dimensions, Metric: 133.0 cm (h) x 36.8 cm (w) x 36.6 cm (l)



REBELLION MINI GAS CLOUD IMAGING

The Mini GCI System is designed for panoramic views of asset-dense areas with additional analytics for leak detection of refrigerants and:

- Is designed to be installed at elevated positions
- Can be programmed to monitor a repeated sequence of assets
- Allow for manual control over scanned areas
- Provide 24-7-365 monitoring with <1 second detection time
- Detect-identify methane and other common hydrocarbons
- Detect-identify many toxic and / or flammable industrial gases
- Offer real-time alerts
- Display live videos of an incident
- Pinpoint leak location
- Quantify gas leak size and volume
- Store up to 5 million detection events for review, analysis, documentation, and reporting

For more information

process.honeywell.com/us/en/solutions/sustainability/emission-control-and-reduction/gas-cloud-imaging

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