

Performance-proven highly reliable and uniquely adaptable to meet your individual criticality detection needs.



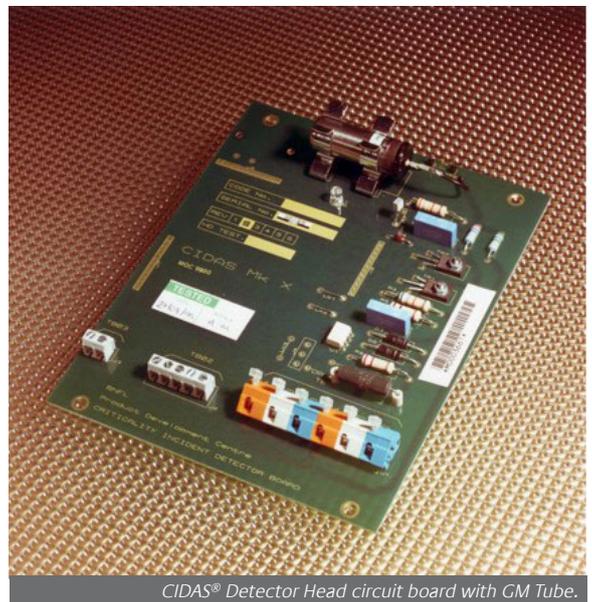
PRODUCTS AND SERVICES: CIDAS[®] Mk XI

OVERVIEW

With 50 years' experience in criticality incident detection and alarm systems, Cavendish Nuclear is a world-leading provider of Criticality Incident Detection and Alarm Systems. More than 60 CIDAS[®] systems have been installed in major nuclear facilities in the UK, USA and Canada.

SUMMARY

- Proven performance
- Rapid response time
- Highly configurable for small or large facilities
- Redundant detector and alarm circuits
- Low cost, low maintenance and reliable detectors
- High fault tolerance
- Use of digital electronics provides easy setup and configuration



CIDAS[®] Detector Head circuit board with GM Tube.

OUR PRODUCT IN DETAIL

The first Criticality Incident Detection systems were developed and installed in the 1950s and have evolved as better technology became available. The latest model, CIDAS® Mk XI, builds on the performance-proven CIDAS® concept incorporating comprehensive automatic self-testing and diagnostic routines. The result is a versatile system offering exceptionally high reliability and a comprehensive detection and alarm capability that can be tailored to meet the individual requirements of any plant, large or small, where a criticality may occur.

Features and Benefits

- Proven high reliability in the detection of criticality incidents
- Rapid time to alarm and extremely low spurious alarm rates
- Simple detector placement allows cost-effective wide area coverage
- Design readily adapts to large or small facilities
- Redundant detector and alarm circuits for increased reliability
- Three detectors per monitoring area
- Low cost, low maintenance, reliable gamma detectors
- Use of digital electronics provides easy setup and configuration
- High fault tolerance and low maintenance
- Status information optionally available for each detector
- Warning lights to prevent re-entry to evacuated areas

- Integrated building evacuation system with audio and visual alarms
- Complete 'turnkey' packages with lifetime service and support
- Proven to function in a criticality (reactor testing)
- Compliant with technical requirements of all relevant international standards
- ANSI/ANS-8.3 (1997); IEC 60860 (1987); ISO 7753 (1987); 10.CFR70.24 (2004); Regulatory Guide 3.71 (2005); Fully CE marked to relevant LV and EMC directives, and meets FCC emission regulations.

How CIDAS® works

Gamma detectors are deployed which are designed specifically to detect the excessive radiation dose which occurs during all criticality events. These detectors are arranged in triplicate rings around the areas to be monitored where a criticality is deemed possible. Once in position the detectors are wired back to the CIDAS® logic panel. Trip signals from the detectors are processed by the CIDAS® solid state based logic system, with no software used in the alarm path.

Tripping of at least two out of the three detector rings automatically initiates the building evacuation system's audible and visual alarms throughout the criticality evacuation area to allow immediate evacuation of personnel in compliance with the plant's own emergency procedures.

Optional "Keep Out" warning lights (KOWLs) are located at entrances to deter re-entry and "Noisy Area Warning Lights" (NAWLs) are available for areas with high noise levels such as plant rooms are available.

The building evacuation system is a dual redundant system with loudspeakers and lights on two ring circuits. Each circuit operates independently but one loudspeaker and one NAWL from each circuit are co-located at each location.

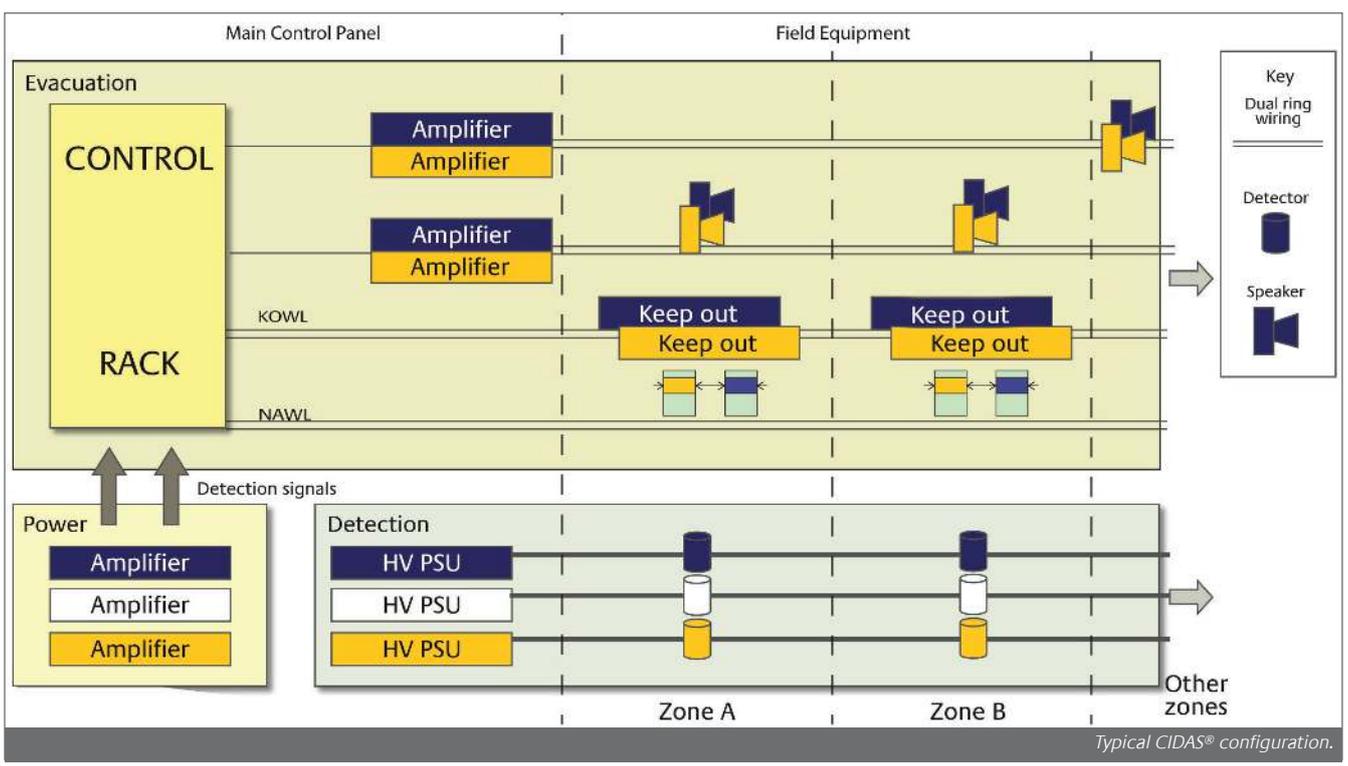
During normal plant operating conditions an optional confidence pip tone can be sounded to indicate that the system is operational. If a system fault is detected the pip tone will be silenced, providing an instant indication that the system diagnostics have detected an abnormal condition.

Alternatively, this tone can be muted and only sound when there is a system fault, or it can be disabled and not play a role in the system diagnostics.

The CIDAS® logic and building evacuation panel are housed in a standard swing frame enclosure. Plant operators can interface with the system via an optional remote access unit that incorporates a public address function.

System Configuration

CIDAS® is a versatile modular system with a range of components which can be selected and configured to meet the requirements of individual facilities,



TRIP CHARACTERISTICS

Dose Rate	Time to Respond
<150 μ Cy/hr	does not trigger•
1 mGy/hr	< 1 sec
1 Gy/hr	< 1 msec

'CIDAS@ is designed not to trigger at dose rates < 150 μ G/ hr, so normal plant operations can be undertaken

whether large or small. A system can readily be increased or reduced in size by the addition or removal of detectors, loudspeakers and lights.

All components of the CIDAS® Mk XI system are modular in concept. Discrete units such as detectors, speakers, lights and the control panel can be installed independently of each other and allows installation to progress in a way that minimises interference with the activities of the plant.

The system consists of the following modules:

- Detectors
- Logic and Control System
- Output devices such as loudspeakers, optional Noisy Area Warning Lights (NAWLs), optional Keep Out Warning Lights (KOWLs).
- Uninterruptible Power Supplies (UPS)

Additional features:

- Public Address (PA) system can operate via the CIDAS® loudspeakers, but the alarm tone takes precedence.
- Other alarm function can be routed through the CIDAS® system, for example activity in air alarms.
- Back compatible with CIDAS® MkX enabling the front end cabinets to be upgraded whilst keeping the existing field equipment and cabling.

Detectors

Detector Features

The detector is based on a Geiger Muller tube and a simple integrating electronic circuit. When the accumulated count reaches a preset value then the detector will latch into its tripped state and send a digital signal to the relay logic unit. Detectors are added to the system in a "daisy chain" fashion and up to 50 detectors per ring can be connected to a single logic unit. The detectors can be placed over 1km away from the main CIDAS® control panel.

Optionally, extra signals can be taken off the detectors back to the CIDAS® panel to provide additional functionality:

- Identification of which detector or group of detectors has tripped
- Constant checking that the detector is still functional. This requires additional circuitry on the detector board and the installation of a small "keep alive" radioactive source in the detector case.

The design provides the following trip characteristics:

Detector Placement Determination

Accurate positioning of the detectors is necessary to ensure they do not trigger during normal plant operations, but are guaranteed to trigger in the event of an incident. Where required Cavendish Nuclear experts will determine the number and position of detectors, involving modelling of the plant to prove detectors would trigger should a criticality occur. Under normal circumstances detectors will be placed out of cell enabling easier testing and maintenance.

System Reliability

System Self Checks

CIDAS® has the built in capability to provide checks on its system parameters. These include detector, NAWL and loudspeaker cables, power supply continuity status, building evacuation tone generator faults, amplifier faults and fuse failures.

The system includes a "hot spare" amplifier so in the event that an amplifier fails the hot spare automatically replaces the failed amplifier. These extensive diagnostics ensure excellent system availability with fewer plant shutdowns due to loss of protection and false alarms. Any faults revealed by the self-checking will be annunciated on the



CIDAS® control panel

main panel and silence the confidence pip tone, if present, ensuring that personnel are alerted.

Probability of Failure and Spurious Alarm Rate

The probability of failure to alarm when required is strongly dependent on the proof test interval, i.e. the time between full system tests. In addition to a high probability of alarming when required the system requires a low probability of alarming spuriously as this will cause unnecessary evacuation of the monitored area.

RELIABILITY AND FALSE ALARM RATE

CIDAS	Probability of Failure to Alarm in Demand
1 year proof test interval	2.2E-3
1 month year test interval	2.0E-4
Spurious CID Alarm	9.7E-06 per hr (=0.08 per year)

For a typical large system (160 pair of loudspeakers, 3 rings of detectors with 40 detectors each) the reliability and false alarm rate are calculated above.

Comprehensive reliability studies have been undertaken on the CIDAS® Mk XI and the probability of failure to alarm and the rate of spurious alarm calculated and shown in the above table.

Radiation Tolerance

The CIDAS® MkXI system has undergone testing to assess the tolerance of its components to radiation, an essential requirement to ensure that the system will operate at the high dose rates which occur during a criticality.

The system was tested in a Fast Burst Reactor (FBR), an unmoderated, unreflected bare critical assembly of the Godiva II type at the White Sands Missile Range in New Mexico.

Building Evacuation Systems

The BES sub-system of the CIDAS® system when used as a public address / general alarm system can be supplied as either a simplex or a duplex system.

Lifetime Support

Cavendish Nuclear has nearly 50 years of experience and expertise in the design and supply of CIDAS® systems giving customer access to a highly responsive and adaptable team of experts in criticality incident detection.

Cavendish Nuclear works closely with its customers to provide the most cost-effective and practical solution, encompassing project management, system configuration, design, installation including integration with other alarm systems, commissioning, training, service, maintenance and parts.

With a large and growing customer base, Cavendish Nuclear is committed to providing long term support to all CIDAS® users, providing the resources and personnel to ensure that installed systems remain fully functioning at their optimum level throughout their lifetime.

CIDAS® is supported by fully trained service and maintenance teams, based in the UK and USA. They can supply individually tailored service, maintenance and technical support packages geared to individual plants and budgetary requirements.

Cavendish Nuclear offer formal training services with the objective of ensuring that customers are fully capable of providing front line maintenance and identification of faults. Training packages can be configured to meet individual needs.



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