



A comprehensive overview of

ALARM ANNUNCIATORS AND ALARM MANAGEMENT SYSTEMS





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Alarm annunciators have a long history and remain a vital tool in the management of safety on all industrial plants today, and the alarm annunciator is a key component of these safety systems ensuring the processes remain safe. Omniflex has manufactured and supplied alarm annunciators and alarm management systems since 1965 and, in this whitepaper, we outline the continued importance of these systems and why upgrading your obsolete alarm systems doesn't need to be as costly or disruptive as many would expect.

What is an Alarm Annunciator

Alarm annunciators are devices which accept inputs from field sensors, which are typically hard-wired switches in the plant, arranged to operate when a process condition enters an abnormal state, such as high temperature, low pressure, loss of cooling water flow, high vessel alarms and many others.

They also provide visual indication, such that each illuminated light on the annunciator can be immediately and uniquely associated with a specific process condition. Defined flashing of the alarm windows and the sounding of an audible device gives the operator quick and simple indication of the state of the alarm.



Why are Alarm Annunciators separate devices?

The purpose of an alarm annunciator is to provide a reliable indication to the operator of the state of critical aspects of the process under any failure condition.

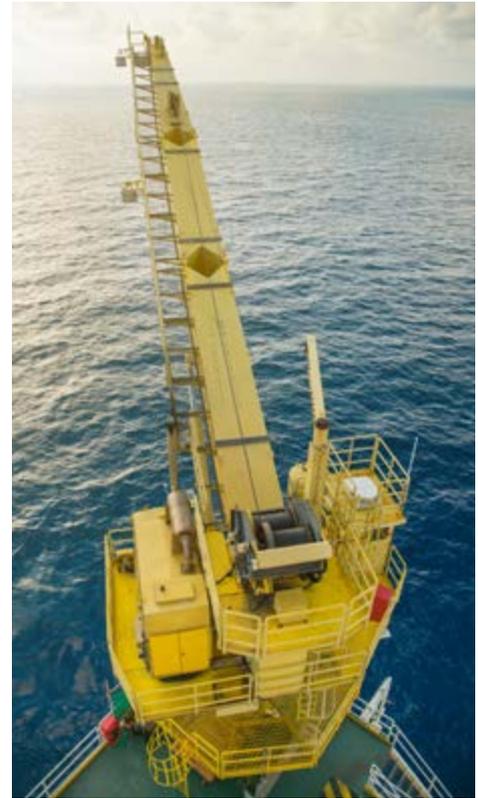
Alarm Annunciators need to be relied upon to always alert the operator when any abnormal condition occurs that can affect safety, including the failure of the control system. The alarm annunciator is considered an additional and independent layer of protection, and is vital when considering the overall safety of the plant.

The regulatory landscape

All industrial or manufacturing facilities should have up-to-date alarm systems because even the slightest abnormal change in the process parameters can cause a dangerous situation to occur effecting plant safety as well as the costly loss of production and plant downtime.

Having a fully functional, operational alarm monitoring system is therefore essential, no matter the industry.

The regulatory environment varies across the world, However international standards, such as IEC 61508 which is used in many countries seek to make the risk “as low as reasonably practicable” (ALARP).



Incorporating alarm annunciators

Many industrial sites rely on their control systems filled with complex visualisations to warn operators in the event of imminent danger. Furthermore, these systems often contain an assortment of critical and non-critical alarms with no clear distinction between the two.

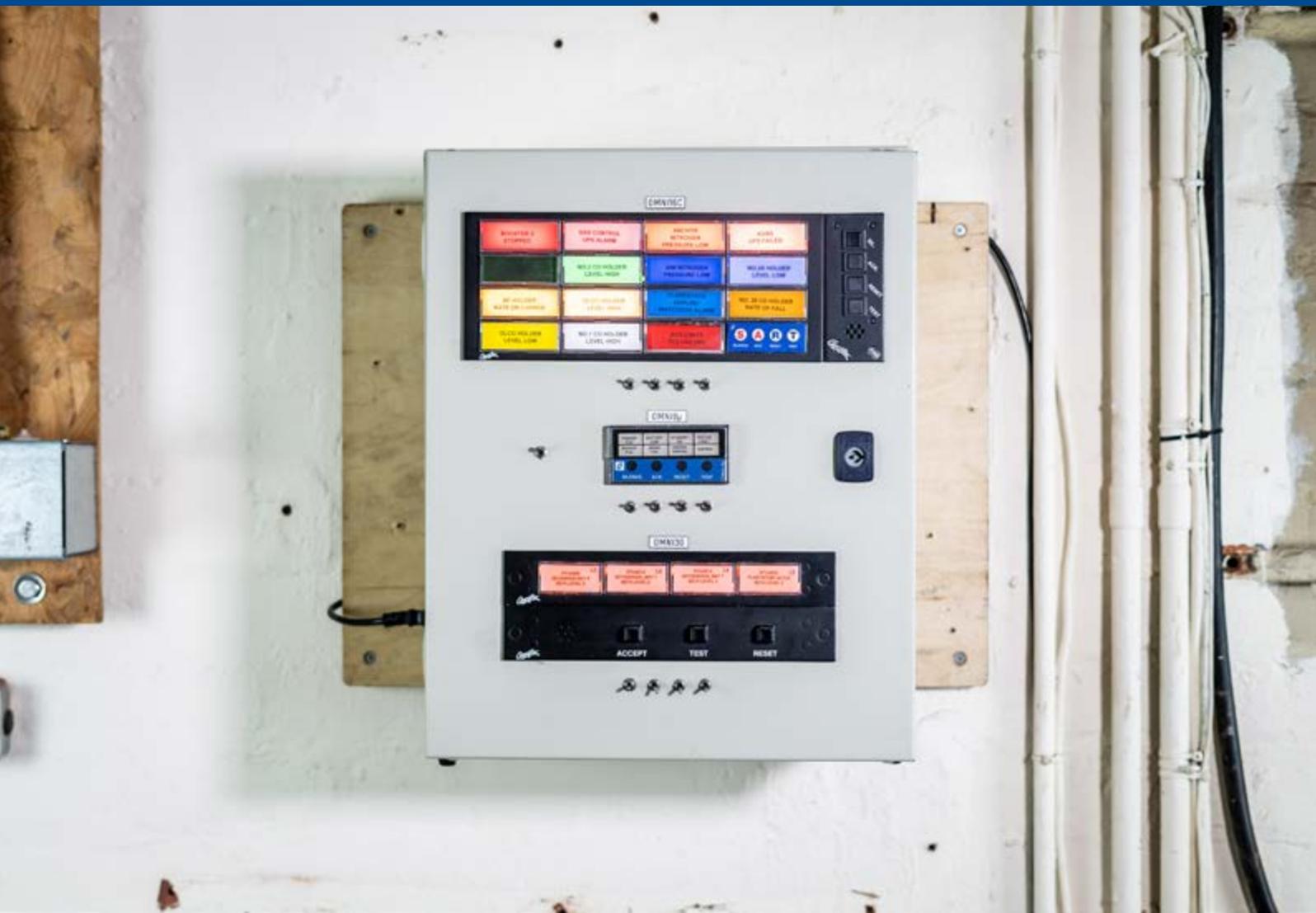
This approach can often be overwhelming to the operator, slowing down their response times and has been cited as the reason for several high-profile incidents, including the fire at the Buncefield oil storage depot in Milford Haven and the Texaco oil refinery plant explosion in Pembroke, both in the UK. In the event of imminent danger, it is imperative that safety systems alert operators of the threat quickly and efficiently, so that they can take all necessary action as soon as possible. Alarm annunciators provide the most effective alternative for these safety critical alarms.

Alarm annunciators are panel-based alarms that are hardwired directly into relevant safety-critical processes

Alarm annunciators are panel-based alarms that are hardwired directly into relevant safety-critical processes, where each window relates to a fixed alarm point from the sensor.

If an abnormal event is detected, the relevant window on the panel lights up and the alarm emits a sound, immediately giving operators the necessary information to act.

However, it is common to still see alarm annunciators in use that were first installed in the 1980s and 1990s, such as Highland, Rochester, Robinson, Bristol Babcock, Clifford & Snell, Sentry and Londex systems, which are all no longer manufactured or supported and do not meet the current IEC 61508 safety integrity levels (SIL). As a result, many sites suffer from obsolescence and support issues.



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The three key considerations

The three key considerations for plant managers to bear in mind when it comes to updating their alarm annunciators.

1

Firstly, it is crucial that they determine which alarms are classified as SHE safety alarms and that these are directly hardwired into the processes.

This is essential because networked alarms can be susceptible to network or power outages, meaning, if the network goes down, you lose all the alarms on that network. If alarms are individually hardwired, and you lose one wire, you only lose one alarm, and if this alarm is detected from a normally closed alarm contact then a wire break would still be seen as an alarm on the annunciator window.

2

The second consideration is the importance of having each of the alarm windows on the annunciator panel permanently dedicated to a specific process, providing pattern recognition and familiarity for the operator, and, ultimately, improving responsiveness.

Operator response times are an important part of the SIL-rating, making it vital that alarms maximise, rather than impede, the operator's ability to respond and act quickly and this is a vital step in achieving this.

3

Finally, all alarms should be suitably prioritised using an easy-to-understand system, such as colour coding each window to match the severity of the alarm it represents.

This means that, in situations where multiple alarms go off, operators have the order of priority in place to address the issues, further aiding their chances of responding quickly and effectively.

Adding another layer of protection

Unfortunately, installing local alarm annunciators might not be enough to overcome all potential problems.

In safety-critical applications, it is crucial that plant managers add extra layers of protection to their systems by installing remote monitoring technology to monitor the status of local alarm annunciators. This provides some key benefits for site managers looking to increase the ability of operators and engineers to respond quickly and effectively in the event of an alarm alert.

Firstly, it offers peace of mind for facility managers worried about on-site safety because they can access all live and historical alarm data whenever necessary from any location. Modern industrial alarm systems often come equipped with in-built alarm logging to record all alarms and operator pushbutton actions meaning that, in addition to monitoring operator actions, they also monitor and record the time taken for alerts to be actioned.

This alarm logging functionality drastically improves post-event analysis, something which is extremely valuable when communicating with bodies like the Health and Safety Executive (HSE) or the Environment Agency. It provides a quick and convenient way of producing an accurate data trail of all alerts, actions and time stamps.

Next, alarm annunciators equipped with remote monitoring functionality can be set up to automatically send SMS and email alerts directly to any relevant personnel when there is an alarm alert. This means all necessary personnel are aware of the problem immediately and can ensure action is taken without leaving it to chance that a local operator has seen and responded to the alarm.



Tackling alarm obsolescence issues in Nuclear, petrochemical, oil and gas applications

Obsolescence management of critical alarm systems continues to be a major problem for many businesses in the nuclear petrochemical, oil and gas sectors who are required to use annunciator systems under best practice guidelines like the EEMUA 191 standard. This is made more difficult by the fact that, in many cases, facilities are still equipped with alarm annunciator systems that are no longer supported because the manufacturers went out of business decades ago.



Globally, nuclear, petrochemical, oil and gas facilities follow the best practice for critical safety, health and environmental (SHE) alarms outlined by EEMUA 191, which was developed in 1999 with input from the British Health and Safety Executive to provide comprehensive guidance on designing, managing and procuring effective alarm systems. The international standards for the management of alarm systems for the process industries, ISA 18.2 from the International Society of Automation and IEC 62682:2015, are aligned with EEMUA 191.

One of the key conclusions of the EEMUA 191 guidance is that critical alarms should be easy to understand, promoting quick and effective operator responses. This is where the traditional hardwired alarm annunciators come in.

Sullom Voe oil terminal a customer case study



Enquest's Sullom Voe oil terminal is situated at the northern end of the largest of the Shetland Islands and is one of the largest oil terminals in Europe.

Its primary purpose is to facilitate the continuous offshore production of oil, even in the harshest weather. As a result of its remote location, the terminal must operate in an entirely self-sufficient manner, even where emergency services are concerned. This means that all on-site safety systems must always be fully operational, and workers must be fully aware of relevant safety-critical systems and procedures.

When the legacy Panalarm alarm systems at the Sullom Voe terminal needed to be replaced because they are no longer supported, Enquest engaged Omniflex who

was able to provide the solution in the form of IEC61508 SIL-1 certified annunciators. The new system was a direct retrofit, based on the latest technology, designed to fit existing on-site panel space. This meant that there was no need to carry out major infrastructure work, plus, because most of the testing is done off-site, there was minimal downtime associated with installation of the new alarm systems.

The alarm systems that we provided for Sullom Voe exceed the latest safety requirements and include an Ethernet interface to the top-end system, as well as built-in local alarm logging to record all alarms and operator pushbutton actions. Furthermore, the annunciators were supplied with individual hardwired repeat relay outputs which allow for further connection possibilities.

Alarm systems for the nuclear industry

Arguably, there is no industry as highly regulated as the nuclear sector and none where mission-critical safety systems matter more. In a nuclear plant, acting decisively in the moments following an emergency can mean the difference between averting danger and a major catastrophe.

Systems designed for use in the nuclear industry must adhere to regulations set by the Health and Safety Executive (HSE) and the Office of Nuclear Regulators (ONR).

When Sellafield Ltd. Had a requirement to install new and upgrade its on-site alarm annunciators to SIL standards, in accordance with the requirements of the Nuclear Installations Inspectorate, it turned to Omniflex for help. The Omni range of alarm annunciators, which was supplied to Sellafield, is the world's first range of alarm annunciators substantiated by EMPHASIS for use in SIL applications across the UK's nuclear industry.

The EMPHASIS project was adopted by NISIWIG (Nuclear Industry Smart Instruments Working Group) comprising of all the major companies from the UK's Nuclear Industry. The EMPHASIS project is based upon a lifecycle approach as specified in IEC61508, and provides an evidence gathering tool in the form of a comprehensive set of questions covering all relevant aspects relating to the company and the product under review.



Did you know?

Due to the popularity of the Omniflex Omni range of alarm annunciators in use across most of the UK's nuclear sites for safety critical alarm monitoring this was one of the first instruments chosen to be substantiated. It was the first range of Alarm Annunciators to be substantiated in the world.

Industry-certified alarm annunciators

Omni8 μ

The Omni8 μ is the smallest integral LED alarm annunciator available.

It is a fully self-contained DIN sized panel-mount alarm annunciator with integrated power supply, push-buttons and audible device and is well-suited for applications where space is limited. It accepts eight contact inputs and these can be configured as a one-way, two-way, four-way or eight-way annunciator.



Omni8C

The Omni8C provides both an 8 way LED integral or remote logic alarm annunciator in a compact panel-mount housing.

The integral logic/window version can be equipped with optional integral test, silence, acknowledge, reset pushbuttons by sacrificing one alarm window or by using a C1415 externally wired pushbutton/audible station. It can be interconnected with Omni16C annunciators to provide alarm annunciation up to 256 points.



Omni8P

The Omni8P is an 8 way LED integral alarm annunciator the size of an Omni16C alarm annunciator,

but also comes equipped with four in-built pushbuttons and audible device below the 8 annunciator windows.



Omni16C

The Omni16C is a 16 way LED integral or remote logic panel-mount annunciator.

The integral logic/window version comes with optional integral test, silence, acknowledge, reset pushbuttons by sacrificing one alarm window or by using a C1415 externally wired pushbuttons/audible station. It can be interconnected with Omni8C systems to provide annunciation up to 256 points.



Omni16EX

The Omni16EX is essentially an Omni16C integral unit that has been purpose-built for use in explosive atmospheres.

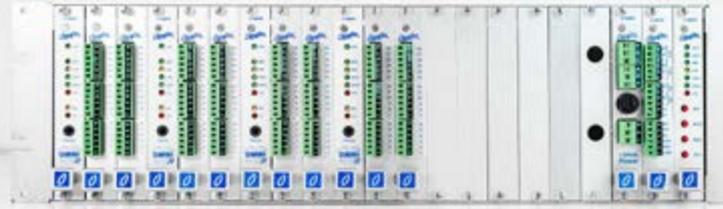
It is ATEX-rated: II 3G EX IC IIC T4 GC suitable for use in Zone 2 hazardous environments.



Omni16R

Omni16R remote logic offers a repackaged version of the Omni16C as a rack mount construction with card slots, ideal for larger systems these can interface to the OmniX range of LED window displays.

Each Omni16R Alarm Card is a complete stand-alone 16 point alarm annunciator in its own right with its own watchdog and alarm processor. This reduces single points of failure in the system and increases system reliability.



OmniX

OmniX remote LED displays provide 8 to 124 annunciator windows in a stand-alone panel-mount package.

These combine with the Omni 8C Remote Logic Units, Omni 16C Remote Logic Units and Omni16R range to display safety-critical alarms and can also be used to connect to your PLC system for a simple, easy-to-understand display of essential alarm information.

Omni30

The Omni30 annunciator series is designed as a replacement for the Old Highland/Rochester Instruments UC30 series of products.

It provides state-of-the-art annunciation and is well-suited to fit existing installations.



The Maxilarm Alarm Annunciator

The Maxilarm Alarm Annunciator

The Maxilarm alarm annunciator system offers a complete distributed modular alarm management system for critical plants.

Incorporating features such as submillisecond time stamping at source, integrated analogue logging and remote Omni X alarm fascias all to meet EEMUA 191 guidelines, the Maxilarm system provides a dependable layer of plant protection and early diagnostics of fault transients in real time.



Omniflex also supplies industry-certified door warning alarms and slave alarm units to the UK's nuclear industry

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Door warning alarms

Omniflex also supplies door warning alarms for the UK's nuclear industry. The Omni2 door warning alarm is a compact, wall-mounted visual alarm annunciator designed for radiation and airborne contaminant warnings and has been designed to meet the requirements of SIL-2 safety systems as defined by IEC61508.

It serves as a safeguard against personnel inadvertently entering plant areas where abnormal radiological and other hazardous conditions are present.

Operators should position the Omni2 on the wall adjacent to the entrance of an environmentally segregated area and connect it to the local radiation monitors. If airborne contamination or high radiation conditions are present in the area, a bright flashing visual is displayed, warning local operators of the hazard and deterring entry to the contaminated area.

The Omni2 features full dual redundant design for each of the two alarms, solid state logic and visual display, providing a highly reliable alarm system, meeting or exceeding the functional safety requirements of these critical applications.

Slave alarm units

Generally, workers in a nuclear facility always know the condition of the area where they are working at a given moment, however they do not always know the status of adjacent areas.

This is why slave alarm units play a vital role in maintaining safety levels. For example, if you are in a cleanroom with a contaminated area next to it, local slave alarms, which are connected to the monitors in the adjacent section, will alert you that the room is not safe to enter and you can stay safely in the cleanroom.

Omniflex supplies the Omni2S slave alarm unit for the UK's nuclear industry. Unlike the door warning sign that is equipped with

inscriptions, the Omni2S instead features a simple red and green beacon that directly matches the condition of the connected radiation monitors. If airborne contamination or high radiation conditions are detected, a flashing LED beacon provides a visual warning of the hazard, to deter entry to the area. The sounder tone can be selected to indicate type of contamination.

Once an alarm has occurred, the red LED beacon light will continue to flash, and the audible alert will continue to sound until muted by the pushbutton. The alarm warning turns off and the mute pushbutton resets if the alarm condition returns to normal. The internal audible warning will give a warning of a dangerous condition, even if the display is out of sight of the personnel.



Remotely monitoring all local alarms, door warning alarms and slave alarms is best practice in nuclear facilities because, if a central control room can have access to all the real-time on-site alarm information, it promotes better decision making without relying on people physically checking the alarms in contaminated areas

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Alarm upgrade consultancy service

There is often a reluctance to prioritise upgrading legacy alarm systems. Convincing senior level plant management to invest in replacement alarm systems can be difficult, especially because the financial return isn't immediately obvious.

However, the financial benefits are immediately recognised once the system has helped circumnavigate a production loss by alerting operators about an issue at the facility.

Despite what many plant managers might think, upgrading out of date alarm systems doesn't need to be a costly or disruptive process. Modern industrial alarm specialists can engineer all alarm upgrade solutions off-site and design them specifically to fit into an existing alarm envelope, drastically reducing installation time and any associated production downtime.



For those in need of help, **Omniflex offers a free consultancy service** where one of its specialist engineers will visit your site to perform a free survey and evaluate your existing obsolete and legacy alarm systems before discussing the most suitable replacement options with you

The logo for Omniflex, featuring the word "Omniflex" in a white, stylized, cursive script font with a thin underline.



Industry approved

Omniflex has over 55 years of experience specialising in remote monitoring and safety-critical alarm systems. All its alarm annunciators exceed the latest safety requirements and include RS232/485 Modbus and Ethernet interfaces to the site's top-end system, as well as built-in alarm logging to record all alarm alerts and operator pushbutton actions. Furthermore, they're supplied with individual hardwired repeat relay outputs that facilitate further connection possibilities.

By upgrading your safety-critical systems with hardwired alarm annunciators fitted with remote monitoring technology, you are ensuring that, even if nobody is around when an alarm annunciator sounds the alert, the alarm alert will be heard and acted on.

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**To find out more, head over to our website
and read more of our technical whitepapers,
covering topics such as cathodic protection
and wireless telemetry systems**