PROCESSVUE
Alarm Management Without Limits

February 2022

WHITE PAPER

Industrial Alarm Management Without Limits

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Executive summary

There is no doubting the importance of alarms to the safe operation of countless industrial systems. Alarms, and the subsequent discipline of Alarm Management, have come a long way from the very first analogue alarms wired directly to control rooms to offer warning of impending crisis to managers of big oil and gas plants or nuclear facilities. In the digital age, Alarm Management can offer much more.

The journey of alarms from a necessary hardware cost for the safe operation of big plants to a value driving software for almost any industrial environment tracks closely with the digitalisation of industry over the past thirty years or so. Yet relatively few industrial applications have considered what Alarm Management software could do for them if they removed the traditionally perceived limitations associated with it.

In fact, when viewed through a Digital Transformation lens, Alarm Management has the potential to play a central role in a continuous improvement philosophy that drives efficiency and profitability. Central to realising the full potential of Alarm Management is re-framing the way we think about alarms, understanding the immense power of the data created and analysed by Alarm Management software, and putting it to work on the right side of the ledger.

Let's be honest, industrial alarm management is not, traditionally, the sort of topic that inspires kids to buckle down in STEM subjects and become an engineer. Dig beneath the surface though and there's a fascinating story of development and evolution that makes it a hugely powerful tool for forward-looking industrial enterprises in a range of sectors.

Right now, if you mention industrial alarm management to operators and engineers at organisations that use it, their blood probably runs a degree or so colder. In its traditional role, alarm management is a thin buffer of warning between normal operations and taking precipitant action to avoid a disastrous failure that could have health and safety ramifications and cause huge downtime. Many in industry only interact with alarm management software when they must, and, outside of regular compliance requirements, only when there is a problem. Serious and dangerous failures are mercifully rare, and this causes some of the worry – if things really started to go wrong, would the alarm system help you, the user, to take the right action and avert a disaster?

This is not to say that those responsible for alarm management are not familiar with the system under normal operation – alarms are extremely common and filtering out the 'noise' to take the actions that are necessary is often a day to day and week to week annoyance for industrial operations teams.

In fact, in the world of industrial alarm management there are so many alerts, alarms, potential failures, known unknowns, and unknown unknowns that it's hard to stay on top of it all unless that is your only focus, and for many, alarm management is a part of a broader operations or management role.

Alarm management is also a cost. And another system amongst many to be familiar with. All of this means that there are few people in industry who are truly comfortable – let alone happy - when the conversation turns to alarm management. It is seen, by most, as a costly, complex, and necessary burden in the safe operation of a facility.

But not by everyone. Some, at the progressive end of alarm management use, are leaning in to the topic and getting the conversation onto a more positive footing. They are talking about alarm management without limits, and alarm management is beginning to gain a foothold in new industry sectors such as manufacturing. It all starts with a perception shift.

Alarm Management: Reframing the Way We think

At MAC Solutions, we believe it is time to completely reframe how alarm management is perceived. The digital transformation era has done so much for alarm management that, apart from continuing to serve that core function of managing alarms, it is almost unrecognisable. At least – it should be. For those at the front of the curve, alarm management is a cornerstone of digital transformation strategy. Alarm management is not limited to its core function any longer, it takes alarm data and makes it work much harder to provide various value-add benefits. For the initiated and enlightened, it is no longer just a necessary cost to be safe and meet compliance requirements, it is a route to optimisation, a productivity boon, a downtime killer, and a window into operations data and continuous improvement potential. It is a value-add, a revenue driver. It has crossed the Rubicon from cost centre to profit centre.

Many people reading this will not recognise that picture. Others will question, in the era of digital transformation with software driven MES and SCADA that offer some alarm management functionality, whether proprietary, purpose-built software is even necessary. To this second point, until and unless such software is capable of managing alarm data input from the range of existing proprietary systems and bring them all together on a purpose-built Alarm Historian while sending automated reports for compliance, yes – dedicated alarm management is the best choice.

But before we get technical and before we get stuck into how early adopters are reframing how we should be thinking about a new kind of alarm management - an alarm management approach and philosophy that fits with a holistic understanding of the overall health and wellbeing of a business to help drive continuous improvement - I want to take the time to understand how we got here.

Back to Basic Principles

Most of us wake up to an alarm every morning. Few people like to hear that alarm, but we accept how useful it is. Alarms are such an intrinsic part of life that the only time we are likely to think about them is if they fail (or we forget to set/change them – human error).

The basic principle of an alarm in the industrial setting is exactly the same as the morning alarm that gets us out of bed. The existence of the alarm means that we don't need to switch our focus from what we are doing in order to continuously monitor something – we can forget about it, knowing that if and when the moment for action comes, we'll be alerted. In a small way, the morning alarm reduces the cognitive workload of day-to-day life and, quite literally, helps us sleep at night. The same goes for industrial alarms.

Okay, all obvious and simple so far – let's go a step deeper.

Alarms in the digital age

Nowadays, many of us have a digital calendar, and an unobtrusive alert will appear on a screen we regularly use in plenty of time to take an action. Let's add in alerts we might get for a text message, breaking news, emails, a new podcast we follow being published, someone at the front door, movement picked up by a home security camera, low battery notifications, reaching a step-count goal. It's a list without limits.

For most of us, the computer we carry in our pockets – our mobile phone – controls our alarms, alerts and notifications, and we all undertake some alarm management, even if we don't realise it. In order to actually be asleep when the morning alarm goes off, we might have a designated period when we are not aurally alerted to certain notifications. We might decide that we don't want to hear or see certain 'nuisance' alerts at all, so just toggle them off. We set the morning alarm to skip the weekend. Similarly, we often ignore and swipe away certain notifications without taking an action – we recognise that we might have wanted that alert, but push it away when it comes without taking an action. Many alerts and alarms will group themselves too. Rather than getting a new alert for each email or message, there's an alert for the first and then every subsequent alert is added to that initial one until it they are dealt with (like unread message counters). The point here is that in day-to-day digital life, we've all become pretty good at alarm management and at removing nuisance alarms altogether (no thank you, BBC News, I don't want a breaking news alert, life is stressful enough!).

You might say then – that the cause of a huge uptick in alarms and alerts (digitalisation) also provides the means by which to manage them (your phone/computer settings) and preserve that simple, original intention of the morning alarm – it's there when you need it, so you don't have to think about it.

Traditional Alarm Management in Industry

Unlike missing the alert for Aunt Maud's birthday, the stakes in industry for missed alarms are often (but not always) much higher; likewise, the cognitive load on operators. And there is another key difference. When it comes to industrial applications, when things start to go wrong, more alarms will start flooding in. Outside of industry, missing Aunt Maud's birthday won't mean that other events in your diary are suddenly more pressing. Uncle Ron's birthday alert doesn't start to sound because you missed Aunt Maud's – the two alerts are unconnected and stable. At times of incident in the industrial setting the opposite is true – if a piece of equipment fails, for example, it is likely to cause other stresses on the system, other alarms are caused to sound, and so on. The usual, manageable trickle can quickly turn into a flood that overwhelms operators. This deluge endangers how effective the response is. Put simply, some alarms matter more than others at times of major incidents. Knowing which alarms are most important and reacting appropriately can be the difference between life and death; between an environmental near-miss and an environmental disaster or, in a manufacturing environment between a batch that has to be scrapped and one which isn't.

As mentioned, there are any number of alerts and alarms that come in from equipment and systems, and most, if not all of them are very well intended and fundamentally useful – potentially to the safety of humans or the environment, and potentially to the quality of the product. Is a pump about to blow up? Is a flow rate too low to cool critical machinery? Are levels of a certain gas too high? Pressure, temperature, flow, capacity, speed – any number of sensors, any number of alarms and alerts, and any number of potential consequences or combinations of consequences. Alarm management without limits means extending the value of alarm management beyond its principle function to manage the vast quantities of alarms, and, for example, to correlate alarm incidents with outputs and highlight any relationship between alarms and product quality. This approach, which will likely require a software-based MES system to offer the required level of insight into the production facility, means that alarm management becomes a value-adding function that helps to drive continuous improvement.

This level of control and insight was not always possible. Back when alarm clocks were analogue and at the pre-set time a coiled spring released a hammer to ring a pair of bells and wake you up, industrial alarms were similarly clunky. Sensors would be physically wired to a control room where some sort of equipment topology would be laid out like a scale diagram of the operation, and lights and sirens would give early warning of hazardous changes to operating parameters. By their nature, such systems required physical infrastructure, while the limited space in the control room, as well as cost of installation or change, meant that a relatively small number of alarms served large and complex systems. Think about the control room of a 1970s nuclear plant and you have an idea about the load and importance placed on just a few alarms and a relatively small staff.

When computers started coming into industry in the 80s and 90s all of this quickly changed. It became possible to have more alarms, more visibility, and much safer systems. The computer screen became the medium for viewing operations and, in a relatively short period of time, alarms that had numbered in the tens numbered in the hundreds.

The problem here, of course, is that what was designed to help reduce the cognitive load by helpfully offering a timely reminder (the morning alarm analogy) can easily get out of control, and end up becoming a dangerous fog through which it is almost impossible to see what is going on, especially when things start to go wrong, and alarms start to flood in.

The Advent of Alarm Management Software

The problem became acute enough that in the 90s, following multiple high-profile accidents and incidents, several large process industry companies worked together on how to better manage the deluge of alarms needed for the safe operation of heavy industrial equipment and processes.

Over the years since then, various protocols, technologies and standards have been introduced to help make operations safer. Powerful alarm management software, the most established of which today have been around for 20 years or more, is the most effective and comprehensive tool in the box.

Modern, cutting-edge alarm management software works on four basic principles – those of alarm data collection, alarm data rationalisation, alarm data analysis, and alarm data visualisation. It covers three important levels of alarm management – collation and consolidation, analysis, and historian functions.

The foundation software level collects alarm and event messages from multiple disparate systems and consolidates them into an industry standard database. An easy to use yet powerful web-based client is used to view, search, and filter the messages in a unified view of alarm and event data. Functionality built into such software allows simple export of information, the ability to conduct frequency analysis to quickly find problem areas, and the power to recognise important alarms and events and configure set responses – such as automated emails to certain personnel and/or third parties.

The next level is to add analysis software, which enables reporting to all relevant international standards and guidelines and automates much of what is possible at the foundation level, including enabling KPI-based presentations via inbuilt dashboards. It is exactly this level of functionality which means that traditional understanding of alarm management software, for most industrial applications, needs to be revised. I'll expand on that in some detail shortly, but it's worth adding the third level – that of rationalisation and documentation - since that also plays a significant role in reshaping how we think about alarm management.

The third level then, provides a comprehensive capability to manage and track changes to the plant alarm assets in a single common repository, the Master Alarm Database. The resulting database records all operator changes to authorised configurations, giving an accurate and complete understanding of the alarm conditions at all times and allowing for full and effective auditing. Importantly it also offers the capacity to compare live parameters with the authorised alarm settings so the state of alarm management can be understood on a continuum over time, and best performance levels can be laid against current ones to understand the overall health of both the plant's assets and the alarm management philosophy. In addition to this, for enterprises that maintain different alarm systems across different sites or different lines within a single site, the Master Alarm Database offers the capability to identify and replicate alarm conditions that are associated with best performance.

Alarm Management Without Limits

A fundamental perception change is required to get the best from the latest alarm management software. And it is a big deal. As mentioned, what we're talking about is moving something from a historic cost centre for a business, tied up with servicing compliance requirements, into a value driver that reduces or removes the compliance burden. Moreover, in the era of big data and digital transformation, the endless supply of data from almost any industrial environment means that the need for, and benefits possible from, alarm management software is becoming more widespread.

Removing the constraints in how we think about the value of alarm management is a significant step towards digital transformation. Moreover, an alarm-management-without-limits mindset requires some digital transformation thinking – since the real insight here is that alarm data, like any data being produced in an industrial facility, can and must be used to empower better decision making.

It starts with understanding how alarm management software can benefit a business. For many companies that operate in the traditional heavy industries, the compliance need for alarm management comes from the huge potential exposure to poor alarm management and the sheer volume of alarms that are required to operate safely. Moving from this position to embrace the limitless potential benefit of alarm management software is a fairly simple step. That simple step involves a mind-shift away from thinking of alarm management as something that you must service in order to be compliant and safe, to a tool that services you in maintaining optimal operational parameters for equipment that you already take the trouble to monitor. Modern alarm management software, as I've mentioned, provides an array of tools to help achieve this, all that is required is to remove the preconceived limitations on what alarm management can do, and invest in time or expertise to make the alarm management system an important tool in reducing downtime and elevating OEE. It almost goes without saying that for the heavy industries that have some form of alarm management software and philosophy in place, the potential benefits in reduced downtime will pay for the costs of implementing and maintaining modern alarm management software many times over.

For those outside of the traditional heavy industry homelands of alarm management software, the shift in mindset is different. More and more companies across a variety of sectors are starting to realise the potential benefits of dedicated alarm management software. This modern evolution of alarm management might be seen as a direct result of the era of the Industrial Internet of Things (IIoT). You don't hear people talking about IIoT so much nowadays, largely because the term has been superseded by Digital Transformation. There's good reason for this – the effect of connecting industrial 'things' to the internet has huge ramifications for most businesses, and the result of strategic management and control of the new data flows in an organisation invariably leads to transformational benefits. But let's stick with IIoT for a moment, because it is a very good way of getting to the granular change that brings alarm management into the thinking of a much wider range of industrial enterprises.

What we're talking about here is the proliferation of sensors in the industrial setting. Sensors have become very cheap – they can usually be added to legacy equipment, offering a deeper understanding of existing architecture and thereby offering pre-emptive capabilities to the alarms associated with it. Put more simply – smart sensors on old machines means that the alarming capability of those machines is improved and alarms can be introduced to offer more granular detail and help take more precipitant action that is less likely to be the result of a spurious, nuisance alarm. When it comes to new equipment, it is hard to buy any that is not already bristling with such sensors. A similar parallel might be drawn in consumer technologies, from the addition of light sensors to e-readers that help set the brightness, to accelerometers, GPS, heart rate monitors, fingerprint scanners and all manner of sensors in mobile phones and fitness accessories.

So, production facilities, or even building management systems, that might previously have had very limited compliance requirements and quite basic alarm management duties, can now employ alarm management software to take advantage of the huge increase in incoming data. Much of the benefit in this instance lies in increased productivity, and it's here that the mind-shift needs to happen with this type of installation. Knowing what is happening in the plant or building is the first step to continuous improvement, so connecting the sensors to the alarm management software helps, but by thinking of the alarm management software as a productivity tool, appropriate steps can be taken to use the capabilities of alarm management software to completely change how incidents are responded to, and who responds. The simplest example of this might be setting up alarms to automatically contact the right type of maintenance or engineering professional – whether in-house or outsourced – to respond. A significant reduction in the time taken to get the right engineering support to the right place could significantly shorten a shut down. It could isolate an issue and avoid shutdowns altogether, and, depending on the parameters and alarm management philosophy, it could become a fundamental part of a more predictive and proactive maintenance strategy.

The only question that remains, then, concerns the advantages of proprietary alarm management software over other digital transformation software – such as cloud based MES solutions or advanced SCADA-type control systems. To be clear though, it's not one or the other, it's more a case of why have an alarm management system as well as an all-singing, all-dancing, digital transformation platform, if there are no compliance requirements to do so. The answer to this is about functionality. While a world-class MES system can alert you to issues and alarms, what it can't offer is the insight to improve your alarm management. The right alarm management software will not only integrate perfectly into any MES system, it will also work with any existing systems in the field, and offers the crucial capacity to highlight problem areas so that changes can be made in the alarm system to reduce the number of alarms, improve operator awareness, reduce operator stress and respond to adverse conditions in a timely manner.

What Alarm Management Without Limits Really Means

It is this sort of data enabled, transformational thinking and approach that is coming to define the present era of industry. It is becoming central to driving the productivity improvements seen as critical to competitive sustainability in industry. It is also proof, if proof were required, that the technology exists – and is already widespread – to undertake digital transformation. That it is, in fact, as much a mindset as it is a technology revolution. As much about maximising what you have, as about new technology implementation.

Add in the reduction in cognitive workload for operators, the reduced time spent servicing alarms and the peace of mind, and the full picture emerges. Operators and engineers enabled by modern alarm management systems are more productive, safer and much better equipped to help drive a business forward.

All it takes is a shift in mindset when it comes to alarm management. And that is very interesting.

Is alarm management software a part of your digital transformation strategy? If it's not, it might be time to take the brakes off and consider what alarm management without limits could do for you.

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About the author

James Fox is Product Manager for the ProcessVue suite of alarm management products from MAC Solutions. James has worked in the alarm management arena for over 20 years in both technical and commercial disciplines. Prior to his current role within the ProcessVue team he held positions at Honeywell, Matrikon and IMAC.

Contact ProcessVue for more informatiion about Industrial Alarm Management Without Limits

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