Honeywell’s Nitrogenous Fertilizer Solutions

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Honeywell Process Solutions

Executive Summary
Honeywell Automation and Control Solutions is a leading provider of complete automation and security solution for the nitrogen-based fertilizer industry. We operate in close to 100 countries globally with approximately 30% of global ammonia production being controlled by Honeywell automation solutions.
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Executive Overview
Honeywell Automation and Control Solutions is a leading provider of complete automation and security solution for the nitrogen-based fertilizer industry. We operate in close to 100 countries globally with approximately 30% of global ammonia production being controlled by Honeywell automation solutions.

Honeywell, with the Experion™ Process Knowledge System (PKS) as its foundation, enables fertilizer manufacturers like you to improve your business performance by offering solutions that increase safety, reliability and efficiency. Our solutions: provide multiple levels of protection that help reduce incidents and promote safe operation; increase automation reliability that improves process availability; increase efficiency by integrating the field, the control room, and the supply chain to allow for better and faster decision making.

Honeywell is like no other automation supplier to the fertilizer industry in that we are able to call on our deep domain expertise (Honeywell owns and operates an Ammonia plant) and our world class project execution capability to deliver automation projects on time and within budget. Our broad portfolio of offerings and global talent pool enables us to cost–effectively deliver solutions ranging from single unit DCS migrations, to large green-field projects with complex, diverse components including DCS, safety, security and advanced applications.

Honeywell recognizes the importance of automation in your business and how you expect automation to continuously provide sustainable benefits. We will stand by our solutions ensuring that they stay up and running at their best at all times.

Trust Honeywell to improve your business performance through improved safety, reliability and efficiency.

Benefits and Value
Key Benefit Areas
Honeywell’s broad automation and security solutions can have significant impact on the, safety, reliability, and efficiency of your fertilizer manufacturing facility. The table below highlights several key benefit areas:

<table>
<thead>
<tr>
<th>Area</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety and Security</td>
<td>Honeywell’s physical, cyber, and industrial safety and security solutions assure protection of personnel, data, and processes in a facility. The level of integration of Honeywell’s solutions allow for additional protection of people, processes, and equipment.</td>
</tr>
<tr>
<td>Faster Startups of new units</td>
<td>Honeywell simulation solutions can help to reduce control checkout time resulting in faster startups. Better trained operators mean getting to full production faster.</td>
</tr>
<tr>
<td>Throughput Efficiency</td>
<td>Increase throughput through the application of Advanced Control and Optimization to push your plant to a higher production capacity with existing capital resources. Increase effective capacity by improving reliability which in turn increases the number of days of production without a shutdown.</td>
</tr>
<tr>
<td>Yield Efficiency</td>
<td>Increase yield of ammonia and urea by increasing conversion in reformers and reactors by operating closer to constraints.</td>
</tr>
<tr>
<td>Energy Efficiency</td>
<td>Reduce costs of production by more consistent operation of steam and other utilities and improving heater combustion controls.</td>
</tr>
<tr>
<td>Improved Reliability</td>
<td>Honeywell’s solutions can help to improve equipment reliability by monitoring critical equipment, alerting to problems before they become severe, and by sensing problems using the combination of Honeywell’s portfolio of field sensors.</td>
</tr>
</tbody>
</table>
## Reliable and Consistent Practices
Increase automation of procedures for infrequent activities like shutdowns/startup/mode to capture best practices and increase consistency. Integrate procedural, manual and advanced automation solutions.

## Operational Reliability and Productivity
Improve the effectiveness of operators and production engineers by shifting the focus from collecting and entering data to using information. Ensure that operators are well trained in handling abnormal situations so that plants disturbances don’t become major incidents.

## Continuous Improvement
Collect information about plant performance to support continuous improvement. This information brings together production (including quality), procedural and process data to enable the plant to find anomalies and implement improvements.

## Customer Satisfaction
Improve the ability to respond to customer requirements and provide information when needed.

### Value Proposition
By implementing a comprehensive solution, you can see significant value in the following areas:

#### Quantifiable Value

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Benefit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutionalize best practices</td>
<td>Improve product consistency</td>
<td>Improve capacity by 1-5%</td>
</tr>
<tr>
<td>Support for continuous improvement</td>
<td>Reduce Cost of Production</td>
<td>Improve yields 1-2%</td>
</tr>
<tr>
<td></td>
<td>Improve yields of most valuable products</td>
<td>Reduce energy consumption 1-5%</td>
</tr>
<tr>
<td>Improved alignment with business</td>
<td>Reduce raw material costs</td>
<td>Quality variability reduction of 50%</td>
</tr>
<tr>
<td></td>
<td>Reduction in inventory</td>
<td>Improve availability 2-8%</td>
</tr>
<tr>
<td>Increase production by pushing closer to multiple constraints</td>
<td>Increase available capacity</td>
<td></td>
</tr>
<tr>
<td>Reduce time to achieve full production after unit startup</td>
<td>Improved reliability and available capacity</td>
<td></td>
</tr>
</tbody>
</table>

#### Qualitative Benefits

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make more timely, accurate information available</td>
<td>Spend less time collecting and scrubbing data, more time using the information</td>
</tr>
<tr>
<td></td>
<td>Free operating team to focus on business not ‘fire fighting’</td>
</tr>
<tr>
<td>Use supported applications and tools</td>
<td>Reduce cost of compliance and ownership (integrated tools)</td>
</tr>
<tr>
<td></td>
<td>Reduced maintenance cost</td>
</tr>
<tr>
<td>Increased capacity when market demand is there</td>
<td>Ability to meet more market opportunities with less impact on overall production</td>
</tr>
<tr>
<td>Improved reliability may enable the plant to run longer between shutdowns</td>
<td>Reduction in operating costs and avoidance of unplanned shutdowns</td>
</tr>
<tr>
<td>Institutionalize best practices</td>
<td>Prepare for loss of experienced workers through retirement and be able to quickly and effectively train new employees for new construction in developing regions</td>
</tr>
<tr>
<td>Support for innovation</td>
<td>Reduce time to absorb new technology into normal operation.</td>
</tr>
</tbody>
</table>
Introduction To N-Fertilizer

Nitrogen is one of the main building blocks for proteins and enzymes in living cells. It is important to the yield and quality of plants and as well as animal proteins. Nitrogen-based fertilizers are manufactured from ammonia which is most commonly produced from natural gas. Ammonia has a variety of uses but over 80% is consumed in the fertilizer industry. Urea is the most common fertilizer being applied as solid granules or in liquid form in a urea-ammonium nitrate mixture.

Figure 1 shows the flow scheme for a typical nitrogenous fertilizer complex.

![Flow scheme for a typical N-based fertilizer complex](image)

**Figure 1: Typical N-based Fertilizer Complex.**

The demand for fertilizer is closely linked to a country's population growth, its gross domestic product (GDP) and personal income levels. As disposable income rises people look to consume better quality food. This means more protein, primarily from meat which requires additional grain to feed more animals. Demand will be driven by greater meat consumption in Asia and Latin America as their economies improve.

The cost of production of fertilizers is driven primarily by the price of natural gas. At $7/mmbtu, natural gas represents 90% of the operating costs of ammonia plants. Hence critical factors influencing profitability and competitiveness of fertilizer producers include access to low cost gas, operating a world-scale modern ammonia facility that maximizes conversion efficiency and close proximity to end consumers (the agricultural business).

To maintain efficient operation of a fertilizer complex good automation and controls are vital. Key areas are control of the steam methane reformer and the ammonia converter. In Urea plants, key areas include being able to absorb variations in the generation of CO2 from the ammonia plant and controlling the NH3 to CO2 ratio at the urea synthesis reactor.
Industry Challenges

Many fertilizer producers like you are facing significant challenges while competing in a global marketplace. With increased competition and rising feed stock prices, there is renewed interest in improving and sustaining the performance of existing assets. For an established producer, the challenge comes from increased capacity coming on-line in regions with significant cost advantages, forcing you to focus relentlessly on reducing costs while serving your customers better. For new producers, the sudden availability of additional capacity occasionally outstrips demand, so you also have to operate your new plant very efficiently from the start in order to make sustainable operating margins.

Meanwhile, workforce reductions and increasingly complex technology are making it harder to retain the necessary skill sets in mature markets or to establish those skill sets in developing markets. You realize that you must continue to address ever more stringent environmental and safety mandates. To meet business demands, it is critical that your business and plants collaborate to squeeze as much agility and efficiency as possible out of the available assets.

The top tier manufacturing companies are responding to these challenges by addressing a variety of needs that will improve their safety, reliability and efficiency – as shown in Figure 2.
Safety

Plant managers consider safety to be their highest priority because safety-related incidents can cause injury to personnel, equipment, and the environment, as well as interrupting production. To mitigate these risks it is important to consider safety from all aspects of a plant’s operation. Plant safety today requires a comprehensive approach including managing operator effectiveness, constant monitoring of distress indicators, personnel tracking and mustering applications, and ongoing asset monitoring and maintenance for asset health.

Well designed procedures and well-trained operators help reduce human error that can cause plant upsets. On the rare occasions that an incident does occur, rapid detection followed by quick and decisive action is critical. You know how important it is that your safety system automatically acts to protect your plant and that everyone knows what they should be doing and where they should be. You need multiple layers of protection that can first help you avoid the incident, then, if that fails help mitigate the impact and in the final event help protect your people and assets.

In addition to the inherent risk associated with operating fertilizer facilities, in today’s challenging times, many have been identified as potential targets for terrorist activity. You have to be able to anticipate and respond to threats both against the physical plant and against the process control network. In terms of physical security, this means being able to monitor your perimeter and all access points including waterways – and be able to respond quickly to an intrusion. It means knowing where all your people and any visitors are at any time and being able to quickly get them to a mustering point in the event of an emergency.

In terms of cyber security, you realize that insufficiently protected networks can leave you open to attacks from viruses, denial of service attacks and other network issues. You have to think about security as an integral part of the network design; how the process control network can be protected from the broader business network without losing necessary communication links. Even though new technology such as wireless protocols make more data available at lower costs, so can these same technologies make your network less protected if they are not introduced with security in mind.

Reliability

In mature regions, like the US and Western Europe, companies like yours are facing the loss of experienced people, while in developing regions like China, India and the Former Soviet Union, you may find it hard to hire experienced staff. In all regions this makes it more difficult to achieve consistent, reliable, safe production. As a result it is critical to capture best practices that provide a foundation for future operations. As plants become more integrated in terms of heat and material balances, an upset in one area can quickly spill over to others. Therefore consistent execution of infrequent tasks such as a compressor start-up is vital to maintaining operational excellence.

You also recognize that maximizing and maintaining process and equipment availability is necessary to achieve your production targets. It is impossible to implement a quickly changing production plan if the changes in production rate in the reformer result in an upset in the syngas quality to the converter. Likewise, using optimization strategies to maximize throughput will not capture benefits if they also cause a compressor trip. You need to be able to recognize how hard you can push the unit without risking the integrity of key pieces of equipment and to be able to accurately plan for equipment turnarounds as they become necessary. This requires a tight connection between process data and equipment health monitoring so that boundary limits are recognized even though operating modes and equipment demands are constantly changing.

Efficiency

Manufacturers, like you, are focused on making the most effective use of the capacity they have at their disposal and delivering the lowest manufacturing cost per pound of product. New plants have much larger capacities to gain economies of scale and are often
located in regions where natural gas feed-stock is cheap and abundant. Existing plants add capacity incrementally and manufacturers focus on operational efficiency to minimize off-spec, minimize energy consumption and maximize yields of the most valuable products.

You have to make sure that you have a good plan to do the right things to impact your business results. Then you need to make sure that you execute that plan as efficiently as possible. But you know that the only way that you can compete with plants with, for example, feedstock cost advantages, is by constantly striving for improvement – measuring how well you have done and looking for ways to do it better next time.

As the industry focuses on driving down costs, rationalization of assets and consolidations have occurred so that only the larger plants can remain competitive. Since the price of fertilizer intermediate products like ammonia can depend upon the price of downstream end products like ammonium nitrate and urea, many producers are increasingly integrating their supply chain both upstream and downstream to make sure that they have a low cost source of feed-stock and that they can realize greater margins through the sale of end use products. The opportunity exists, but it requires a better understanding of your supply chain and improved workflow practices to really take advantage.

As the cost of raw materials increases, alternative routes to fertilizers are being resurrected. Regions such as China and India that have limited availability of natural gas are turning to other raw materials, such as coal, as a starting point for producing fertilizers. This requires different upstream techniques such as coal gasification to produce the hydrogen and CO2 but presents new problems such as the avoidance of excess greenhouse gas emissions. You have to use your increased focus on achieving operational excellence to manage the introduction of new technology; integrating and supporting it so that it helps achieve your operating goals.

**Honeywell Capabilities Overview**

Honeywell Automation and Control Solutions is a leading provider of automation and security solutions for the fertilizer industry. More than 30% of the world's ammonia production is controlled by Honeywell products. Honeywell's solutions, anchored by the Experion Process Knowledge System, allow fertilizer manufacturers to improve their safety, reliability and efficiency while maximizing the lifecycle of their automation assets. In the following section you can see how Honeywell translates your requirements into solution components that can help you meet your needs. Note that many of Honeywell's solutions can address more than one need depending upon how they are applied so it is important to realize that there is not only one solution for each requirement.
Field Solutions

Honeywell’s Field Solutions portfolio is focused on bringing you increased value through a variety of differentiated sensors and solutions. Whether this means using Honeywell’s technically advanced smart field devices such as corrosion sensors, or our OneWireless mesh network to connect low cost wireless sensors and handheld data collection devices into a larger process control network, Honeywell has solutions that enable you to turn more information into knowledge across the plant, leading to optimized productivity, improved safety and compliance and asset reliability.

Examples of field solutions most relevant for fertilizer producers include:

- **Smart Transmitters** – Honeywell offers a broad range of pressure and temperature transmitters that deliver exceptional reliability, accuracy, and stability along with the industry’s best warranty.

- **OneWireless Solutions** – Honeywell’s OneWireless universal mesh network supports multiple industrial protocols and applications simultaneously, providing a single wireless network that is simple to manage and efficient to operate. OneWireless helps optimize plant productivity and reliability, improve safety and security, and ensure regulatory compliance. Supporting both XZR 6000 and XZR 5000 wireless transmitters, this network delivers a global solution with robust security, predictable power management and multi-speed monitoring.

- **Corrosion Sensors** – Honeywell’s unique corrosion sensor can help you to avoid costly equipment problems, to relate corrosion and pitting rates to process variables, and ultimately, to avoid costly capital caused by increased corrosion rates. Now available as wireless sensor as part of the XZR 6000 family of transmitters, Honeywell can recommend the best locations in your fertilizer complex based upon our experience and understanding of the locations most prone to corrosion.
PKS Advantage Program – This industry-unique program delivers open, integrated process knowledge solutions to our customers. Working with best-in-class suppliers of field measurement and control valve solutions, Honeywell collaboratively delivers solutions that allow you to choose the best devices for the job.

Industrial Security

In today’s challenging times, many kinds of industrial facilities have been identified as potential targets, including fertilizer plants. That’s why comprehensive security strategies for these facilities and other critical infrastructure are escalating in urgency worldwide.

Given these realities, you need a strong partner who can stand with you through the maze of challenges that you face in providing an effective security solution for your industrial sites. Honeywell understands that when it comes to something as important and complex as the security of your industrial plant, your employees and perhaps even the surrounding community—the company that you choose to partner with is a critical decision.

Working across the various layers of protection, a plant or facility must operate in a secure and protected atmosphere, including protection of the perimeter, facility, people, and assets. With the correct work practices and technology in place, in the event that an abnormal situation occurs, disrupting safe operations, an emergency response plan can be executed, controlled and monitored to minimize the impact of the incident.

Honeywell is uniquely qualified to deliver industrial security solutions because we have broad and unprecedented expertise in this area. We also own ammonia plants and understand the importance of keeping these facilities safe and secure. We also appreciate the challenges you face when investing in security and meeting regulatory requirements. In addition, we have over three decades of experience in the process and automation control business and we are one of the world’s leading manufacturers of security products.

Honeywell’s Physical Security Solution includes a variety of solutions including:

- Security and Access Control
- Perimeter Monitoring and Fence line Detection
- Digital Video Monitoring
- Mustering Solutions
- Visitor Management and Access Control
- Waterway Security and Radar Video Surveillance
- Fire and Life Safety Solutions

With physical security, we understand the need to include the protection of key assets such as property, people, and the environment. With cyber security, our concerns are focused on the preservation of different sets of criteria such as maintaining confidentiality of information, integrity of data and availability of systems.

Cyber Security is particularly important to industrial and petrochemical companies like yours that are reliant on process control systems. You have long understood that there is a difference between protecting facilities and data, and protecting processes that are operated or controlled with information technology. Security measures that are appropriate for business data networks will likely not be sufficient, and could be disastrous if a compromised process control network threatens to damage productivity, capital assets, and possibly human life.
Honeywell Process Control Network Security Services suite evaluates system vulnerability and risk, recommends appropriate changes, develops the best design for specific requirements, and implements that design.

**Experion as a Foundation**

Process information truly comes to life when it's shared. We all know that having the right knowledge at the right time is the key to making the right decisions. For those of you with existing facilities, they have probably grown organically—creating valuable, but independent, information silos. As an inevitable result, you and your people only ever see part of the whole picture. Meanwhile, simultaneously maintaining efficient operations, while gathering facility-wide data, making sense of it, and performing analyses can take weeks or months—by which time, situations have probably changed. It’s this ability to turn data into information, to support knowledgeable decision-making that makes the difference to your business performance. For those of you contemplating an automation solution for a new fertilizer complex, you realize how important the ability to easily share information is for keeping your investment costs down and shortening your start-up time. The Experion Process Knowledge System from Honeywell makes sense of everything. As a technology break-through, Experion is a process automation system like no other— integrating an advanced automation platform and innovative software applications to improve your business performance and peace of mind.

The Experion platform provides the foundation for the Experion Process Knowledge System, integrating all process control and safety management (including non-Honeywell systems) into a single, unified architecture. Robust and scalable, the Experion platform is built on Honeywell’s 30+ years of experience in delivering process control and safety system expertise. It takes customers well beyond Distributed Control System capabilities by providing next generation automation control through embedded decision support and diagnostic technology that drives information to the decision maker. The safety component maintains the security of an independent environment from the mainline control system, increasing security and system dependability. The result is a **unified automation platform** that elevates safety and process availability, as well as production and profitability.
Experion Platform Architecture

Figure 4: Experion Architecture

Experion PKS delivers the following features that fertilizer producers like you find useful:

- **Common Protocol** – Experion’s ability to support redundant I/O for both Foundation Fieldbus and Hart DE devices provide investment protection for customers that have existing facilities.

- **Highly Scaleable Architecture** – Experion can be used for both small applications (such as a small unit or a utilities plant) or with Honeywell’s patented Distributed System Architecture (DSA), it can also cover very large petrochemical complexes - allowing thousands of points to be seamlessly and easily connected together.

- **C300 controller** – The C300 takes the highly-regarded C200 to even greater heights and is built with Honeywell’s typical attention to detail. Release 300 provides a faster, more powerful and robust controller and embeds Honeywell’s proven and deterministic Control Execution Environment (CEE) software. Together with the new vertically designed Series C I/O, Release 300 minimizes the control room footprint; reduces energy, installation and maintenance costs; and delivers optimum performance.

- **Control Firewall** – This protects critical systems from cyber security breaches and ensures system availability.

- **Integrated Safety System** – Safety Manager combines Honeywell’s proven Quadruple Modular Redundancy (QMR™) 2oo4D technology with over two decades of Honeywell process safety management expertise in integrating process safety data, applications, system diagnostics, and critical control strategies. Honeywell’s TUV IEC 61511 and IEC 61508 certified solution provides the optimal level of safety and process integration while still maintaining functional safety separation.
- **Embedded Procedural Operations** - This allows you to embed detailed process engineering knowledge such as unit startup/shutdown procedures, directly into Experion system, to ensure that these infrequent tasks are executed safely, consistently and efficiently every time.

- **Integration of Experion with TPS** – While always well renowned for backwards compatibility to its older DCS, Honeywell, in focusing on continuous evolution, provides significant advantages in the completeness and simplicity of its seamless integration with TPS. All TPS data, events, and operator messages are incorporated into Experion, such that TPS appears as an extension of the Experion architecture.

Unifying people with process, business, and asset management, Experion helps process manufacturers increase profitability and productivity. It’s the only automation system that focuses on your people—making the most of the knowledge they hold. It’s a coordinated effort of better connecting your assets, optimizing your process, involving your people, and increasing your business agility.

Experion applications are a broad portfolio of advanced software applications designed to improve business performance and peace of mind. You can realize annual sustained benefits in the millions of dollars. Applications are uniquely configured to capture the domain knowledge of your people and display it in a systematic and useful way. Applications are tightly integrated with the Experion platform to create a best-in-class Process Knowledge System. Tight integration allows process knowledge to be shared across your organization for better decision-making, breaking down the silos of knowledge that can exist in a facility. Many Experion applications are platform independent to meet the diverse needs of customers around the world. Experion applications continue Honeywell’s 30+-year tradition of providing best-in-class advanced software to help improve your overall business performance.

**Asset Effectiveness Applications**

Honeywell Asset Effectiveness Solutions are aimed at one thing...increasing process availability. One of the primary ways to achieve this is to use your Experion system to pull asset, process and operator information into a common view to help identify problems early. This process-centric approach to asset management helps make Experion truly unique. Experion breaks down barriers and proactively manages the health of all your assets. Not only does it monitor your equipment in real time, it also helps you discover the areas most likely to negatively impact performance, and in greatest need of repair.

Asset Manager provides a best-in-class infrastructure that allows your plant personnel to make key decisions that increase uptime and improve production quality. As a comprehensive decision support component of the Experion unified architecture, Asset Manager connects the right people across the supply chain with the right knowledge when it is needed, improving operational effectiveness and reducing maintenance costs.

Examples of asset effectiveness applications that are embedded into this infrastructure are:

- **Asset Scouts** – Honeywell’s Loop Scout service monitors your DCS based control loops, detects and prioritizes problems, intelligently diagnoses and resolves root causes, and proactively notifies appropriate personnel to take action.

- **Mobile Tools** – Honeywell’s Intelatrac system employs wireless technology to deliver reliable field data faster and more reliably to the right people. Intelatrac allows operators to perform computer guided field inspections and, instantly, make available, to the Experion system, data that was previously stored on paper. Honeywell can help you design operator rounds that will allow you to collect data, via Intelatrac, from your fertilizer complex that can help improve availability of critical
People Effectiveness Applications

Another key method of improving plant availability is avoiding human errors. You already know that your people are the best source of knowledge for improving business performance. Capturing and sharing it is what adds up to real results. Often however, significant legacy and anecdotal data resides locked-up in your personnel’s experiences. And in the absence of a facility-wide system, people are prone to focus knowledge exclusively on the area most familiar to them. Worse still, studies show 25% of plant incidents are caused or made worse by operators who simply didn’t have access to the data they needed to succeed.

Experion helps everybody have the information they need to be most effective. It is the only automation system that embeds advanced application technologies based on research by the Abnormal Situation Management (ASM®) consortium. Our open, collaborative decision support tools help to prevent abnormal situations and minimize disruptions by allowing your operators to reliably and systematically make sense of alerts, detect faults and probable causes, and implement corrective measures early.

Inevitably, though, incidents do occur and it is then that the operator needs to get the right information as quickly as possible. Honeywell offers solutions that reduce the number of alarms that require operator intervention and help to maintain and enforce alarm limits. These applications work with the control system to ensure that the correct alarm limits are enforced for the current production order. At the same time they are linked to the process so that they are consistent with production safety limits, equipment constraints, operational targets, corrosion limits and other limits for each mode of operation or product in your plant.

Whether you are operating an existing plant with an aging workforce about to retire or starting up a brand new facility and looking to hire new operators, making sure that you have a skilled workforce with the right qualifications and domain knowledge is critical to improving and sustaining plant profitability.

Honeywell’s UniSim Operations Suite provides a dynamic simulation solution that can help you train and develop operators on procedures and systems that are safe, tested and optimized prior to being exposed to the real plant. Honeywell’s experience and technology have enabled us to develop a high fidelity model of an Ammonia and Urea complex that is unmatched in the industry. It includes fault models that represent suitable training scenarios for new fertilizer operators. For example, common training scenarios include loss of the ammonia compressor, loss of reformer fuel gas pressure, unit start up /shutdown, and many others. Our dynamic simulations and learning management systems assess an individual operator’s readiness by testing against tailored exercises representing real process upsets. In this way an operator can practice responses to abnormal situations such as a methane breakthrough from the methanator into the ammonia converter. Such assessment will give your team the confidence that your procedures have been validated against the dynamic behavior of your process and controls.
Process Performance Applications

Optimization can often mean running the plant outside of your operator’s comfort zone. More than simply pushing your facility to its current limits, Experion addresses your entire manufacturing process, and identifies ways to safely enhance production results through facility wide process optimization. More than likely, there are hidden opportunities in your system. Honeywell can help take advantage of them, achieving optimal process control and profitability. Achieving peak performance safely is the overall goal. As a result of actively managing and raising process performance through Experion, you’ll improve efficiencies, maximize production, and optimize the return on your investment.

To improve plant process performance you must first achieve consistent product quality and then drive for improvement. If economics demand increased production, advanced process control and optimization applications can work to remove bottlenecks in the reactors, reformers, absorption towers, etc. At other times, advanced controls can improve the production yields or reduce energy consumption - for example, tighter reformer control to minimize methane slip. In addition to increasing production and reducing operating costs, advanced process control strategies also control the purity of products and by-products.

Honeywell’s Advanced Process Control (APC) and Optimization solution (Profit Suite) employs a unique layered approach to advanced control and optimization—an approach that effectively matches your plant needs with the appropriate, scaleable optimization solution. Profit Loop is a single input/single output (SISO) model predictive control application specifically designed with the operating simplicity of a standard PID controller. Because Profit Loop is tightly integrated with Experion, you can incorporate Profit Loop into complex and custom control strategies, driving better control of your processes. Profit controller is based upon Honeywell’s patented Robust Multivariable Predictive Control Technology (RMPCT) and it is ideal for unit-based advanced control such as steam reforming control or quality control around the ammonia converter. At the upper level, Profit Optimizer can link several multivariable controllers to cover a broader process area stretching across multiple units like the ammonia and urea plants. Combined with a first principles process model, this optimization level can provide non-linear dynamic optimization for large fertilizer plants.

Even where advanced control applications are not justified, Honeywell provides Operations Monitoring tools for your operations department to establish the engineering limits and constraints, to monitor performance against those limits, and to follow-up on performance problems. This allows you to see how well the plant is performing and categorize deviations that have occurred in order to support a continuous improvement process.

Procedural Operations integrates best practices for batch turnarounds, system startup, and shut downs to improve operator performance and reduce cycle times. Designed with members of the Abnormal Situation Management Consortium, Procedural Operations software and services prevent downtime by capturing knowledge gained by your operators over years of performing cyclic procedures – knowledge that would otherwise be lost as the workforce transitions.
Business Agility Applications

Improving your business performance means not only running your plant more efficiently but running your whole business more efficiently. As you try balance your customers’ requirements with your inventory levels you realize that when you act on timely and accurate information, you get better results. You need to be able to decide quickly whether your plant can profitably make a newly submitted order and how that will impact the rest of your production schedule. You also need to be able to get that information to the plant on time. Experion helps make your facility a true business engine that’s tuned to proactively respond to opportunities as they arise. With Honeywell’s set of business agility applications, you have access to comprehensive performance data in real-time. Our applications also tightly interface with business software, to deliver robust business analysis and execution. We’ll help you manage the manufacturing process from planning and scheduling through the entire supply chain.

Many fertilizer plants make relatively few high purity commodity products such as ammonia, urea, ammonium nitrate, UAN solution, etc. Honeywell’s planning solutions allow you to select the right combination of feed-stocks at the right price to make the optimal mix of products. As prices change or customer demand alters, you can quickly adjust your production mode to meet the new requirements.

Once the production plan has been determined, it now has to be scheduled into the plant operation. Honeywell’s Production Scheduler automatically calculates a set of logistically feasible solutions that will meet constraints associated with inventories, production limits, receipts and withdrawals, and finished product qualities. Instead of being satisfied with finding a single feasible solution, you can now look to see which of the feasible solutions is optimal.

At the same time, it is vital that changes in the plants capability to produce particular products are reflected back into the production schedule. A shutdown in a unit, or a drop-off in yield caused by a process upset can be readily incorporated and may result in a new production schedule being generated.

As you focus on operational excellence, you realize that you must strive for continuous improvement. Honeywell can help you collect the appropriate metrics around your operation to help you perfect your performance. KPI Manager automates the collection of both target and actual values from a wide-variety of production and business systems; then calculates and reports the actual performance throughout the business – via intranet. KPI results can be calculated and reported on an ongoing basis – even before the official measurement period is complete. Production Balance and Production Analyst enable the comparison of planned production versus actual. This leads to an improved planning model and a better understanding of the plant’s true capabilities.

Aftermarket Services

To truly improve your business performance, you know that whatever automation solution you choose that it must sustain and increase benefits throughout its lifecycle. Honeywell Process Solutions is a trusted service provider to fertilizer industry, offering the needed expertise to improve safety, reliability and efficiency. We can provide you with the competitive advantage you need by improving your asset and operator effectiveness, and deliver superior process automation solutions.
Honeywell’s Nitrogenous Fertilizer Solutions

What’s more, Honeywell pioneered the co-sourcing structure within the automation industry. Our proprietary methodologies both sustain and accelerate the benefits of your automation investments—yielding results up to five times faster than under a traditional bid-project structure.

No one makes your automation investments pay off like Honeywell Process Solutions. Honeywell is the only automation services provider that continues to support products developed and installed over 30 years ago—third-party systems as well as previous Honeywell products. Honeywell’s unique combination of Experion technology and continuous lifecycle support lets you decide how much longer you want to maintain your existing system and what new components you want to invest in.

When you do decide to migrate, Honeywell’s focus in delivering the solution is to understand the areas of opportunity for our customers and tailor the solution to deliver value. Most plants have existing applications in place. Honeywell will work with the customer to assess the value opportunity, determine the components of the solution that have the most value and determine an implementation plan to achieve and sustain the value.

![Figure 5: Capital vs. Value Project relationship](image)

Figure 5 indicates an ideal value curve. Some key characteristics worth noting:

**Scope** – Honeywell will work with you to determine the best implementation plan to minimize time to value and optimize the use of capital. Honeywell’s innovative co-sourcing program combines your staff’s process knowledge with our automation industry experts to design solutions, based upon Six Sigma best practices that will improve efficiency and maximize your plant’s profitability.

**Delivery** – Honeywell is able to leverage deep domain expertise on a global basis to help deliver consistent solutions. With more than two thousand trained and experienced engineers around the globe, Honeywell has completed successful control system installations in nearly 100 countries. Honeywell's Project Engineering Services can provide the planning, design, construction management,
Honeywell’s Nitrogenous Fertilizer Solutions

implementation and startup services needed to deliver complex process control projects on-time and on-budget, with minimal
downtime. Our documented track record of 98% on-time and on-budget delivery says it all.

Sustained Value – Honeywell provides services to help you sustain the value from your installed solution. Frequently, without this
support, the value will decay over time. Preventing equipment failures and resolving problems quickly are the keys to consistent
performance. Honeywell can help with proactive component monitoring and maintenance services that boost performance, extend
component lifecycles, and lower your overall cost of ownership. Installations supported by Honeywell typically experience maintenance
cost reductions as much as 30%. Experience such as ours can only advance your business if it’s backed by a dedication to excellence.
That’s why we invest heavily in the knowledge development of all Honeywell personnel serving our customers, and why we staff our
support centers around the world with technical experts who average more than 20 years of experience in the business of process
automation. Honeywell also provides applications and support to help sustain your software applications. For example Profit Expert
monitors the performance of your Profit Controller applications, determines whether they are working towards maximizing unit
profitability and can identify when controller models need revising.

Continuous Improvement – by providing better information, Honeywell’s integrated solution enables you to build on the
improvements made and look for additional areas of opportunity. Many companies have made significant improvements based on the
heroic effort of individuals. Sustaining these gains without improved tools and processes can be very difficult and time consuming –
leaving little time for additional efforts. We can think of a continuous cycle of planning, execution (perform) and improvement (perfect).
To make this more systematic, we need additional information such as Key Performance Indicators (KPIs) that cover business metrics
such as sales, customer service metrics, delivery metrics, safety, etc and manufacturing metrics such as availability, production rate,
energy consumption, product quality, etc. Using tools developed out of our infused Six Sigma culture, Honeywell helps you move from
collecting and scrubbing data to using information that can help you institute best practices and achieve operational excellence.

Fertilizer Solution Examples

In the following section, you can see examples of how Honeywell has solved a variety of fertilizer industry problems.

Indo-Gulf chose Honeywell Experion PKS for Ammonia and Urea migration
Indo Gulf Fertilizer of India decided to upgrade and revamp the Ammonia and Urea sections of a fertilizer plant to the latest control
system technology available. The Indo Gulf Fertilizers was operating the Ammonia and Urea sections of plant with third party single
loop and multi-loop controllers. The plant activities of the project needed to be performed in a short shutdown duration where major
tasks such as, removing existing cables, installation of around 40 DCS panels and integration of all third party subsystems and devices
needed to be completed. Plant work could not be disrupted and had to go on round the clock which required meticulous resource planning.

Honeywell installed their latest Experion PKS C300 based redundant controllers and data acquisition system to allow Indo-Gulf to achieve improved operational efficiency from better integration of the Ammonia and Urea plants. The Experion system provided improved operator performance through an enhanced Human Machine Interface (HMI) and improved process performance through more effective logging of events and generation of alarms. The seamless third party interface solution allowed ready connection to Hart protocol devices, and other third party devices for vibration monitoring, gas chromatography analysis, etc.

In addition, Honeywell implemented its state-of-the-art, quadruple redundant, TUV approved (TUV SIL3) Safety Manager System for emergency shutdown protection on the Ammonia plant. This provided Indo-Gulf with multiple layers of protection that can first help avoid the incident, but, if required, a system that protects people and assets.

Indo-Gulf Fertilizers were very pleased “with the excellent efforts put in by the Honeywell Team right from execution stage. It was a challenging task and Honeywell Automation India Ltd (HAIL) site team has delivered as per Indo-Gulf expectations. HAIL’s efforts in execution of the job at various stages….have been commendable.”

**QAFCO implemented MES solution on their world’s largest fertilizer site**

Qatar Fertilizer Company (QAFCO) needed to keep up with its rapid growth and update its business manufacturing systems to stay ahead of the times in both a challenging and competitive environment. The existing systems developed in-house were no longer viable and the volume of manual data input was enormous, compromising both time and quality of data collected. QAFCO turned to Honeywell and its integrated Manufacturing Execution Solution (MES) to help eliminate the manual procedures thus ensuring accuracy and enabling better decision making.

Honeywell’s solution needed to be able to span all five Uhde-based license technology Ammonia and Urea plants of the largest single site Urea producer in the world.

The MES solution incorporated Business FLEX®, Workcenter and Uniformance® products all integrated with Honeywell’s Experion control system company-wide. As part of the PIMS/LIMS project, all control systems were connected to the Plant Historian Database (PHD) and provided QAFCO a strong foundation to build and sustain its manufacturing competitiveness.

Lessons were learned and challenges faced including handling timezones and language barriers, but Honeywell stayed focused and worked with QAFCO to resolve all of them. The MES solution has provided QAFCO with better access to more accurate information on a timelier basis, enabling faster, better decision making.

**RCF achieves 6 month payback from APC on an Ammonia plant**

Due to a shortage in natural gas supply, Rashtriya Chemicals & Fertilizers (RCF) of India needed to reduce energy costs associated with their 1,500 TPD Haldor-Topsoe Ammonia Plant. Frequent changes in both feed rate and composition made the existing advanced control solution ineffective. RCF chose to upgrade with Honeywell’s Advanced Process Control (APC) solution because of its superior technology and Honeywell’s commitment to success.

With limited availability of natural gas, the ammonia plant is configured to handle dual feeds of natural gas and naphtha. Whenever there is enough natural gas available, the objective is to make sure that this feed is maximized in preference to naphtha. The naphtha feed has to be desulphurized before being fed to the reformer.

Honeywell provided steam to feed ratio controls for both feeds which acted as inputs to an overall steam to carbon ration to the reformer. Using Profit Controller multivariable control technology, Honeywell’s application minimized the desulphurizer hydrogen to
naphtha ratio and the tower stripping steam ratio. In the reformer, Profit Controller maximized naphtha feed while continuously minimizing steam to carbon ratio. In addition the controller minimized methane slip by manipulating the primary reformer outlet temperature.

The project enabled RCF to achieve a 3% reduction in steam to carbon ratio and a reduction in flue gas O2 of 20%. The overall advanced control solution reduced specific energy consumption by 0.6% and increased the stability of the plant operations. This has provided RCF with a project payback of less than 6 months.

**Fertinitro Chooses Honeywell for APC and Operator Training Simulators On Their Ammonia And Ur**

Fertinitro had been experiencing significant difficulty in maintaining stable operation of their fertilizer complex. They had found that sudden changes in the ammonia plant feed-rate resulted in severe upsets in the urea plant due to variations in CO2 flow. In some cases, this resulted in one or both plants tripping and getting shutdown. Fertinitro were looking for some support to help stabilize operations by providing better training for their operators and advanced control to help maximize plant profitability.

After a exhaustive analysis of various vendor offerings, Fertinitro has chosen Honeywell to supply a series of advanced applications solutions for their Ammonia and Urea plants at the Fertilizer complex in Jose, Venezuela. The scope of supply includes Advanced Control on the Ammonia and Urea plants, an Operating Training Simulator on their Snamprogetti licensed technology Urea plant, Intelatrac on both units and process training. This follows on from a project awarded earlier in 2007 for an Operator Training Simulator on their two Haldor-Topsoe ammonia trains.

The plant at Jose consists of two parallel production trains of Ammonia and Urea that produce a total of 1.5 million tones of urea fertilizer per year. The site, which uses Haldor-Topsoe Ammonia and Snamprogetti Urea license technology, is the largest urea production facility in South America.

Honeywell will use its best-in-class Profit Suite applications to implement the solution on an APP node installed on the existing Honeywell TPS architecture. Unisim Operate will be used for the Urea Operator Training Simulator, similar to that used for the Ammonia simulator.

**Conclusion**

The unique combination of Honeywell’s automation technology (Experion PKS) and process experience is unmatched in the fertilizer industry and has enabled us to become a leading supplier of automation and security solutions in almost 100 countries around the world.

Honeywell’s deep domain expertise and world class project execution capability enables us to cost-effectively deliver solutions ranging from single unit DCS migrations, to large green-field fertilizer complexes with diverse components including DCS, safety, security and advanced applications.

Find out how Honeywell can help increase safety, reliability and efficiency at your plant today.
Appendix – Honeywell Products

The following sections describe some of the products used by Honeywell to provide solutions to the Fertilizer Industry.

Field Solutions

Honeywell Pressure and Temperature Transmitters

Honeywell’s pressure transmitters encompass a complete line of differential pressure, absolute pressure, gauge pressure, draft range, remote seals, and level transmitters. Honeywell’s new Lifetime Transmitters™ for pressure measurement offer unsurpassed accuracy, stability, reliability, and rangeability as well as the industry’s best warranty.

Self-diagnostics and two-way communications greatly reduce the time and expense associated with start up and maintenance. Honeywell’s technically advanced instruments offer big advantages for improving a process, meeting regulatory compliance, and attaining high quality standards.

Honeywell’s Smart Temperature Transmitters meet a broad range of temperature measurement needs. With three product lines — STT350, STT250, and STT150 — the STT 3000 portfolio can meet the price/performance requirements of almost any application. Honeywell’s top-of-the-line Lifetime Transmitters™ for temperature measurement deliver exceptional reliability, accuracy, and stability along with the industry’s best warranty.

Wireless Sensors

Honeywell has a broad suite of differentiated sensors. Honeywell’s XYY 5000 suite of wireless sensors can help you to reduce the cost of installation of new sensors, allowing you to improve process efficiency and to reduce cost – all without wiring or external power.

XYR 5000 Wireless Transmitters break down the barriers to monitoring variables in areas where traditional hard-wired transmitters are too costly, difficult or time consuming to implement. These instruments are designed for applications with no access to power, that are remote or difficult to access, that require frequent changes in instrumentation schemes, or where manual readings are typically taken.

The Honeywell XYR 5000 family includes instruments for accurately monitoring gauge pressure, absolute pressure, differential pressure, temperature, and ultrasonic noise (for detecting steam and gas leaks). The line also includes an analog input interface for adding wireless capabilities to 4-20 ma devices, a discrete inputs and outputs option and optional external antennas.

Honeywell Corrosion Sensors

Another differentiated sensor that Honeywell provides is our unique Honeywell corrosion sensor. The process industry spends an average of US$50 billion a year on corrosion problems that can hinder their abilities to operate at optimal levels. Honeywell’s unique corrosion sensor can help you to avoid costly equipment problems, to relate corrosion and pitting rates to process variables, and ultimately, to avoid costly capital caused by increased corrosion rates.
PKS Advantage Program

With the PKS Advantage Program, Honeywell and its program participants work together to identify, understand, apply and integrate the domain knowledge of field devices and plant assets with Honeywell’s Experion systems. This industry-unique program delivers open, integrated process knowledge solutions to our customers. Working with best-in-class suppliers of field measurement and control valve solutions, Honeywell collaboratively delivers solutions that allow customers to choose the best device for the job. When adding a PKS Advantage Partner device to Experion, the device is automatically discovered and added to Experion’s asset information. Then, fault and symptom models can be automatically uploaded to the Experion Asset Management System, Asset Manager.

Honeywell’s PKS Advantage partners are shown below:

Advantages for Honeywell customers include the freedom to choose from a wide number of vendors and the assurance that devices from PKS Advantage partners will integrate into Experion easily.

Control Systems

Experion PKS is a process automation system like no other — integrating an advanced automation platform and innovative and integrated software applications to improve your business performance and peace of mind. Unifying people with process, business, and asset management, Experion helps process manufacturers increase profitability and productivity. It’s the only automation system that focuses on your people — making the most of the knowledge they hold.

By integrating disparate data across your facility, making the most of your resources and people, and feeding it all into a unified automation system, you can achieve an operation that’s more proactive, efficient, and responsive. It’s a coordinated effort of better connecting your assets, optimizing your process, involving your people, and increasing your business agility.

Process information truly comes to life when it’s shared. We all know that having the right knowledge at the right time is key to making the right decisions. But like most facilities, yours has probably grown organically—creating valuable, but independent, information silos. As an inevitable result, you and your people only ever see part of the whole picture. Meanwhile, simultaneously maintaining efficient operations, while gathering facility-wide data, making sense of it, and performing analyses can take weeks or months—by which time, situations have probably changed. It’s this ability to turn data into information, to support knowledgeable decision-making that makes all the difference in your business performance. The Experion™ Process Knowledge System (PKS) from Honeywell makes sense of everything. As a technology break-through, Experion is a process automation system like no other— integrating an advanced automation platform and innovative software applications to improve your business performance and peace of mind.

The Experion™ platform provides the foundation for the Experion Process Knowledge System (PKS), integrating all process control and safety management (including non-Honeywell systems) into a single, unified architecture. Robust and scalable, the Experion platform is built on Honeywell’s 30 years of experience in delivering process control and safety system expertise. It takes customers well beyond Distributed Control System capabilities by providing next generation automation control through embedded decision support and diagnostic technology that drives information to the decision maker. The safety component maintains the security of an independent environment from the mainline control system, increasing security and system dependability. The result is a unified automation platform that elevates safety and process availability, as well as production and profitability.
Experion is extremely scaleable – it can be used for both small applications (such as a small unit or a utilities plant) or with Honeywell’s patented Distributed System Architecture (DSA), it can also cover very large systems - allowing thousands of points to be seamlessly and easily connected together.

Experion Release 300. Experion™ R300 is a reshaped and enhanced version of the field-proven automation and control platform hardware and software of the Experion™ Process Knowledge System (PKS). This latest release is another example of Honeywell’s ongoing commitment to continuously innovate and provide best-in-class solutions that protect customers’ existing investments.

Safety Systems
Safety Manager combines Honeywell’s proven Quadruple Modular Redundancy (QMR™) 2oo4D technology with over two decades of Honeywell process safety management expertise in integrating process safety data, applications, system diagnostics, and critical control strategies.

Honeywell’s TUV IEC 61511 and IEC 61508 certified solution provides the optimal level of safety and process integration while still maintaining functional safety separation. Through operational integration with Experion, safety systems are unified into one safety system architecture, assuring a unique opportunity to improve both safety and process availability.

Experion provides unprecedented connectivity through all levels of process and business operations to optimize work processes, improve routine maintenance efficiencies, enhance
safety management, and release personnel from manual processes. Safety Manager delivers the following benefits:

- **Safe and Secure** – Every Safety Manager includes a safety firewall to protect the critical Safety Instrumented System (SIS) layer of protection from cyber attacks and disruption of service.
- **High Availability Architecture** – Honeywell’s field proven QMR 2oo4D architecture provides the highest availability with a fail-to-safe architecture. Applying the proven-in-use QMR technology allows uninterrupted process operation in the event of any system degradation.
- **Easy, Intuitive, Error-Free Engineering and Modifications** – Safety Builder, an intuitive and comprehensive configuration tool, provides plant-wide management of safety-critical databases and application programming with safety built inside. Designing safety networks has never been easier. TUV-approved, menu-driven online modifications prevent errors while maintaining the systems.
- **Operational Integration** – Experion Safety Manager delivers best-in-class integration developed with over a decade of experience in providing integrated safety systems.
- **Defense-in-Depth** – SafeNet™ and remote distributed Safety Manager provide the ability to design unparalleled defense-in-depth safety strategies that maximize safety and security while minimizing risk and scope-of-loss concerns that come with traditional remote I/O technologies.

**Plantwide Historian**

Honeywell’s Uniformance® Process History Database (PHD) collects, stores and replays historical and continuous plant process data, which makes timely data visible at the production level and enterprise-wide. PHD’s timely data empowers plant staff to better align, plan, execute and improve business performance.

The Uniformance PHD infrastructure supports integrating existing control systems and applications across multiple plants and sites. Its seamless data interfaces, data collection fail-over and automatic history recovery ensure maintenance of vast amounts of data in long-term history to enable user access and application integration.

In addition to collecting and consolidating potentially massive amounts of process data, PHD provides the rich historian features needed to transform data into knowledge. PHD’s calculated tags allow users to apply engineering and business knowledge to current and historical data, while built-in engineering unit conversions help users view data in a format that makes sense to them. Process data may be combined with business data to provide a view of the entire operation.

Uniformance PHD release 210 integrates with Honeywell’s Experion® Process Knowledge System (PKS) R300 to create a solution that requires less administration and greater data integrity than is possible with any other plant historian.

**Experion integration features include:**

- Tag synchronization ensures the right data is being collected, without the need for costly, error-prone manual configuration.
- Integrated PHD/Experion links ensure that operator history data and advanced history data is consistent, while creating minimal data collection load.
- A new PHD system can be installed, have its tags automatically built and be collecting data all in the same day.

**Benefits of Uniformance PHD include:**

- **Scalable**: PHD’s distributed architecture ensures that data may be collected from disparate data sources into a single consistent database. A PHD database may start out small and be expanded to handle hundreds of users and hundreds of thousands of tags.
- **Secure**: PHD provides support for commonly required firewall configurations and protects historical records from unauthorized access.
- **Robust:** PHD provides data collection and history recovery features to ensure availability of complete data records, even after data collection interruptions.

- **Open:** PHD has interfaces to collect data from numerous Honeywell and third-party data providers.

Meeting the external regulatory demands placed upon process industries can be costly and time-consuming. Unif ormance PHD helps meet regulatory expectations by allowing the uninterrupted collection of all critical data and securing data from unauthorized tampering.

**Process Performance Applications**

Optimization means more than running in your comfort zone. More than simply pushing your facility to its current limit, Experion addresses your entire manufacturing process, and identifies ways to safely enhance production results through facility wide process optimization. More than likely, there are hidden opportunities in your system. Honeywell can help take advantage of them, achieving optimal process control and profitability. Achieving peak performance safely is the overall goal. As a result of actively managing and raising process performance through Experion, you’ll improve efficiencies, maximize production, and optimize the return on your investment.

To improve plant process performance you must first achieve consistent product quality and then drive for improvement. If economics demand increased production, advanced process control and optimization applications can work to remove bottlenecks in the reactors, feed purification towers, cracking furnaces. At other times, advanced controls can improve the production yields without affecting furnace run-lengths, through tighter control of furnace conditions. In addition to increasing production and reducing operating costs, advanced process control strategies also control the purity of products and byproducts.

**Advanced Process Control and Optimization**

Honeywell’s Advanced Process Control (APC) and Optimization solution (Profit Suite) employs a unique layered approach to advanced control and optimization—an approach that effectively matches your plant needs with the appropriate, scaleable optimization solution.

**Advanced Regulatory controls**

Profit Loop is a single input/single output (SISO) model predictive control application specifically designed with the operating simplicity of a standard PID controller. This technology, which is tightly integrated into Experion PKS, is a Smith Predictor, gap controller, and optimizer all in one that is used to control discrete analyzers, tank levels, long process delays, and more. Profit Loop can reduce valve travel and wear, give you better control, and reduce the possibility of controller windup. Because Profit Loop is tightly integrated with Experion, olefins and polyolefins users can incorporate Profit Loop into complex and custom control strategies, driving better control of their processes. With such versatility you may never build another PID controller again.

**Model –based predictive control (MPC)**

Model based predictive controllers such as Profit Controller. Based upon Honeywell’s patented Robust Multivariable Predictive Control Technology (RMPCT), Profit Controller is ideal for controlling the cracking in the furnaces or the quality and production leaving the purification section.

**Dynamic optimization**

Profit Optimizer can link the MPC level applications to cover a broader process area(s). Combined with a first principles plant model, the optimization level can identify the different effects of increased cracking depth or increased throughput on conversion across multiple furnaces and as the plant pushes up against
capacity limits such as furnace firing limits, light ends purification column limits, etc.

Honeywell’s Advanced Control Solution for Olefins combines some or all the control layers listed above into a complete integrated package designed to maximize a plant’s profitability.

APC applications for an ethylene plant include those for the cracking furnaces, the primary fractionator and cracked gas compressor, the De-methanizer and cold box, the De-ethanizer, the Acetylene converter and the C2/C3 product purification section.

An example of how Honeywell’s Profit Suite applications achieve improved process performance is shown below.

In the cracking furnaces Profit Controller:

- Controls the overall feed rate to the multiple furnaces in operation.
- Controls the steam to hydrocarbon ratio in each furnace
- Controls ethylene production by controlling to a target severity whilst honoring constraints such as maximum tube metal temperatures.
- Controls excess O2 in furnace flue gas to minimize furnace fuel consumption.

On top of the APC provided by Profit Controller, Profit Optimizer provides closed loop dynamic optimization to the overall olefins plant. The optimization strategy incorporates a rigorous kinetic model, SPYRO from Technip, which provides predictions of severity and product yields in each of the furnaces.

To achieve optimization benefits, Profit Optimizer:

- Maximizes production up against the plant’s physical constraints. This may be in the furnace, the cold box or in the back-end separation section.
- Optimizes product yield by maximizing the yield of the most valuable products while maintaining furnace run length.
- Optimizes energy consumption by trading off energy costs against product recoveries and capacity.

Procedural Operations

Procedural Operations integrates best practices for batch turnarounds, system startup, and shutdowns to improve operator performance and reduce cycle times. Designed with members of the Abnormal Situation Management (ASM®) Consortium, Procedural Operations software and services prevent downtime by capturing knowledge gained by operators over years of performing cyclic procedures -- knowledge that would otherwise be lost as the workforce transitions. Preserving this knowledge is critical: An ASM Study concluded that 14 percent of all incidents were partly attributed to improper execution of operating procedures as a contributing factor; one site even reported a $12 million loss during four years.
**Procedure Analysis**

Honeywell’s Procedure Analyst provides reporting and analysis for Procedural Operations. It is focused on providing key process operations benefits:

- Comprehensive procedure execution reporting for quality and tracking
- Continuous process improvement through identification of procedure execution issues
- Early identification of quality problems or deviations from golden procedures for consistent execution and operational effectiveness
- Timely comparison and analysis across procedure executions for improved process performance, optimization and adherence to operational best practices

Procedure Analyst uses events generated by the phases within transition procedures to track progress. In addition, process history can be related to these events to provide a comprehensive view of operating conditions as the procedure was executed.

These tools allow the plant to define a “golden” execution that serves as a baseline for performance that other similar executions can be measured against. Reports can also be generated to show differences between batches or key batch steps.

**Business Agility Applications**

When you put accurate information to work, you get better results. What good is productivity information that arrives too late to act on? Or what good is a business decision if it takes too long to effectively implement? When opportunity knocks, you want to respond quickly. Experion helps make your facility a true business engine that's tuned to - proactively react. Forget about having monthly or quarterly reporting periods as your only insight. With our set of business agility applications, you have access to comprehensive performance data in real-time. Which means you can assess and capitalize on opportunities faster and more intelligently. Our applications also tightly interface with business software, to deliver robust business analysis and execution. We’ll help you manage the manufacturing process from planning and scheduling to the entire supply chain.

**Supply Chain Solutions**

This solution enables the customer to visualize inventory through the supply chain and make both tactical and strategic decisions to improve the performance of the supply chain and business.

The Picaso solution, comprised of a series of modules, enables visibility and improved decision making across the enterprise. The main components of the solution are described below.

The **Demand Management** module generates and manages sales forecasts that are seamlessly integrated into the Supply Chain Simulator. Powerful statistical techniques create projections of future sales that can be reviewed and updated by sales, marketing, and planning personnel based on market knowledge and product availability. Forecast additions and overrides are recorded so that you can track the accuracy of each participant in the planning process. Forecasts can be distributed to remote sales force users via a variety of systems infrastructures, including the Internet. Through the Internet, the system can reach your customers—and their customers—to gather the data needed for the most accurate forecast possible.
The **Production Scheduling** module combines industry-specific models of a wide range of production processes with a powerful memory-resident simulator to provide a rich environment for developing, reviewing, and communicating production plans and schedules. Production schedule changes are instantly propagated throughout the supply chain so that effects on feedstock availability, distribution plans, and order fulfillment can be quickly identified and evaluated. Planners can develop schedules that best balance customer service requirements, inventory targets, and plant operational constraints.

The **Raw Material Planning (MRP)** module dynamically monitors raw material and feedstock needs as planners develop production plans and schedules. It highlights expected raw material shortages and creates purchasing plans based on actual production schedules or based on expected needs driven by finished product forecasts.

The **Supply Chain Event Monitor** performs an inventory simulation of the company’s extended supply chain including plants, company supply locations, customer demands and supplier procurement options. The Event Monitor makes use of customer orders, stock transfers, planned purchases, inventory levels, production schedules, forecasts and supply chain constraints to predict future inventory positions over a user-selected horizon. The model is used to predict pending stock-outs, late shipments and inventory levels that violate minimum and maximum target levels. This tool is used by planners, customer service representatives, sales representatives, product managers and plant schedulers to monitor all pending supply chain events and identify variations to plan that require attention.

The **Distribution Replenishment Planning (DRP)** module gives planners the vision to analyze planned material movements, future inventory levels, and potential distribution bottlenecks. This module predicts material needs at all plants and supply points and determines if planned replenishments meet projected needs. Integrated into the Supply Chain Event Monitor, DRP uses standard formulations for each final product and replenishment algorithms compute and recommend just-in-time replenishment orders for raw materials to meet unsatisfied demand. These replenishments consider the lead-time and typical lot size from each provider. Raw materials inventories and replenishment orders are automatically linked to the supply chain simulator. Therefore, inventory projections for raw materials are handled in the same way as with final products. If a change in the production schedule turns infeasible the raw materials plan, then the algorithms re-plan the orders for optimal replenishment.

The **Inventory Targeting** module is used to strike the right balance of safety stocks and inventory target levels with customer service levels at distribution locations based on forecast accuracy. This is typically used to determine the right strategic balance of these key parameters.

For cycle-based production environments, **Cycle Optimization** determines optimal production plans and most profitable cycle characteristics, such as cycle length and frequency. The optimizer considers product-to-product transitions and off-grade production costs and balances these costs with those of carrying safety stock and cycle inventories to meet customer service goals. It clearly demonstrates the cost sensitivities of varying production cycles.

The **Advanced Planning** module provides the capability to support Sales and Operations Planning (S&OP) activities and analyses. The tool provides a highly visual way to optimize supply chain performance. It can be used to find the optimal production and sourcing policies that reduce costs and maximize profitability. The tool provides a means of rapidly determining not only what portion of the
forecast is feasible to produce, but what product mix is most profitable to produce. In situations where capacity exceeds demand, the tool identifies opportunities to increase profits by recommending expanded production and sales of key products. Like all of the PICASO modules, the Planning and Optimization suite presents its results in an easy-to-understand user interface. The user can explore the solution interactively, and can modify the solution to include additional constraints as necessary. The Advanced Planning module blends the best of a shrink-wrap software product with the flexibility of programming language. Since it was built for the chemical and polymer industries, the solution is ready to optimize complex, multi-site chemical supply chain problems with minimal configuration. And when unique problems arrive, it uses the power of Picaso’s model formulation language combined with the ILOG Optimization Engine to build quick solutions.

The Customer Service Available-to-Promise (ATP) Console brings all of the integrated information needed to the CSR to improve customer service and satisfaction. Based on the updated inventory projections provided by the Supply Chain Event Monitor, ATP is a powerful tool for supporting day-to-day activities of the Customer Service personnel. It provides accurate estimations on the future availability of a particular product. The available-to-promise analysis uses updated inventory, current production schedule, orders and forecasts to compute availability at any moment in the future. It also gives alternate sources, like the availability in other locations.

Operating Instructions

With a framework established of advanced controls and automating common procedures, it is important to be able to consistently align all of the operating conditions that go with each grade with the schedule being produced.

Production Orders represent the schedule within the plant and allows everyone within the plant to see what will be produced, when. A production order is used to define what product should be made, the amount of production and when production should begin. The application maintains a list of production orders and transitions in accordance with the schedule determined by the business. In addition, operating instructions are associated with the production order that define the operating conditions and limits for the plant while the product is being made.

Transition parameters are maintained within Operating Instructions to support the Transition Management solution. These transition parameters are associated with a production order which defines the required transition between products. This allows key transition parameters to be maintained, verified and updated in advance based on anticipated operating conditions. This greatly simplifies the process of updating these as part of a continuous improvement process.

Operating Instructions also coordinate with the Alarm Management solution to define the operating envelope and corresponding alarm limits.

Operations Monitoring

Operations Monitoring provides the tools for an operations department to establish the engineering limits and constraints, to monitor performance against those limits, and to follow-up on performance problems.
Operations Monitoring allows the organization to see how well the plant is performing and categorize deviations that have occurred in order to support a continuous improvement process.

**Operator Log Book**

Operator Logbook provides an electronic logbook to gather relevant operating data – performance, current operating limits, deviations from operating limits and LIMS data. In addition the logbook allows operations to record observations, track a daily to do list and provide information for shift handover.

The log is historized to provide a convenient way to look at performance over several shifts and understand issues that have arisen.

**KPI Manager**

KPI Manager is Honeywell’s solution for managing an integrated KPI System. KPI Manager automates the collection of both target and actual values from a wide-variety of production and business systems; then calculates and reports the actual performance throughout the business – via intranet. KPI results can be calculated and reported on an ongoing basis – even before the official measurement period is complete.

**Production Explorer**

Production Explorer provides the tools for an operations department to capture, review and analyze batch information. The tools are intended to help process engineers understand the correlation between product properties and raw material properties and process conditions during production. In addition, it allows a broad community of users (including operations personnel, process engineers, development groups, and customer service representatives) a convenient way to review all information associated with a production batch.

This application automatically collects the required data, including LIMS data, and provides a convenient set of tools for selecting and analyzing the desired batches.

**Business Hiway**

Business Hiway integrates ERP systems with Honeywell Unified Manufacturing Solutions. Using Business Hiway, automation of the customer’s business processes can effectively be extended from the ERP & Supply Chain Management environment down to plant production management and operations, and vice versa.

Business Hiway offers comprehensive support for integration with SAP R/3 – included certified interfaces, as well as providing a generic XML interface for integration with other ERP and Supply Chain Management systems.

**People Effectiveness Applications**

When you connect better, you work better. Your people are the best source of knowledge for improving business performance. And capturing and sharing it is what adds up to real results. Often however, significant legacy and anecdotal data resides locked-up in your individuals’ experiences. And in the absence of a facility-wide system, people are prone to focus knowledge exclusively on the area most
familiar to them. Worse still, studies show 25% of plant incidents are caused or made worse by operators who simply didn’t have access to the data they needed to succeed.

Experion helps everybody have the information they need to be most effective. It is the only automation system that embeds advanced application technologies based on research by the Abnormal Situation Management (ASM®) consortium. Our open, collaborative decision support tools help to prevent abnormal situations and minimize disruptions by allowing operators to reliably and systematically make sense of alerts, detect faults and probable causes, and implement corrective measures early on—long before alarms are triggered. Plus, by using our UniSim™ simulation solutions, operators can put their skills to the test in a variety of difficult situations.

**Operator Training Simulation**

Whether you are operating an existing plant with an aging workforce about to retire or starting up a brand new facility and looking to hire new operators, making sure that you have a skilled workforce with the right qualifications and domain knowledge is critical to improving and sustaining plant profitability.

Honeywell’s UniSim Operations Suite provides a dynamic simulation solution that can help you to:

- Identify and correct weaknesses in the automation system design before commissioning and operation
- Begin startup of a new or modernized unit sooner, and complete it faster
- Train and develop operators on procedures and systems that are safe, optimized, and environmentally friendly
- Enjoy improved operating rate and product quality for your process on an ongoing basis
- Avoid or minimize incidents, and recover faster from abnormal situations
- Satisfy government regulations for operator certification and environmental operations
- Provide simulation applications for improving realtime operation and control
- Continue the return on your investment through sustained simulator use by other personnel who contribute to the operation of your business.

The Unisim Plant Simulator provides a dynamic simulation of your plant and supports a variety DCS interfaces for training and checkout. Learning Management systems assess an individual operator’s readiness by testing against tailored exercises representing real process upsets. In this way an operator can practice responses to abnormal situations such a furnace shutdown or a chlorine breakthrough in the chlorination unit. Such assessment will give your team the confidence that your procedures have been validated against the dynamic behavior of your process and controls.

Once your plant is commissioned, Honeywell’s UniSim ProcessSync can also initialize the dynamic simulator to assess historical incidents that have been captured by the plant or mill information system. Training programs can then be extended with remedial exercises to address chronic incidents and to avoid subsequent occurrences. In this manner, peers can learn from the mistakes of others.

Advanced control strategies such as Profit controller applications can be tested against the process simulator before commissioning on the live process.
Unisim Process Monitor can be used to dynamically assess the performance of a piece of equipment. Using a Unified Real-Time (URT) bridge, real-time data can be “played” through the dynamic simulator and alert the operator to a discrepancy that may indicate potential process problem.

**Boundary Management**

Boundary Management can help you to maintain all of your plant limits. Store and track alarm limits, safety limits, equipment constraints, application limits, operational targets, corrosion limits, and other limits for each mode of operation or product in your plant.

**Alarm Configuration Management**

Honeywell offers a solution to maintain and enforce alarm limits. This application works with the control system to ensure that the correct alarm limits are enforced for the current production order. It also works with the Operations Monitoring solution to ensure that alarm limits are consistent with the operating envelope that has been defined and is being monitored for the current production order.

**Advanced Alarming and Alerting**

Honeywell’s alarm management solution features integrated products and services to deliver the following benefits:

- Protect plant uptime and safety by reducing losses caused by ineffective alarming.
- Increase operator effectiveness by reducing the number of alarms that require operator intervention.
- Reduce time and effort to develop, deploy and maintain an alarm system that is consistent with Abnormal Situation Management® (ASM®) Consortium best practices.

Experion PKS, at the base level has a sophisticated and rich alarm and alerting system, capable of handling alarms and alerts for your process. In addition to Experion’s rich base capabilities, tools like User Alert add help to off-load your alarm system in order to make sure that your operators are taking appropriate actions, especially during abnormal situations.

User Alert, which integrates with Experion Station to provide lower-priority alerts as opposed to alarms, is capable of providing a complex set of alerts for informational purposes. Each operator may have his own alerts, if desired, and these alerts can be time based, multiple condition based, and, with Boundary manager installed, based on approach to a critical boundary.
Event Analysis

Events happen, and the Experion PKS system has a feature rich set of integrated tools to allow operators, engineers, and plant supervision to view and analyze events. With the release of Experion R300, a plant engineer could look at recent history and process data, view associated events, alarms, and other activities, and store, and configure trends for future event analysis. One could view process data and events for a given reactor or furnace, look at trends and events and analyze the variability within a given time frame.

Asset Effectiveness Applications

Proactively manage your assets in real time. If you can count on the assets in your system to perform, you can focus on optimizing the performance of your entire facility. Experion breaks down barriers and proactively manages the health of all your assets. Not only does it monitor your equipment in real time, it also helps you discover the areas most likely to negatively impact performance, and in greatest need of repair. As well, it goes further to help you understand how well a device is performing in the context of a control loop or a process unit. This process-centric approach to asset management helps make Experion truly unique. Proactively identifying and preventing potential failure is key to consistent performance.

Asset Management

Asset Manager provides a best-in-class infrastructure that allows plant personnel to make key decisions that increase uptime and improve production quality. Functioning as a significant productivity tool for releasing hidden plant profitability, Asset Manager improves business performance and profitability, decreases incidents, and increases plant availability. As a comprehensive decision support component of the Experion unified architecture, Asset Manager connects the right people across the supply chain with the right knowledge when it is needed, improving operational effectiveness and reducing maintenance costs.

For More Information

For more information about Honeywell’s solutions for Fertilizer, visit our website at www.honeywell.com/ps or contact your Honeywell account manager.