



**A more direct, straightforward  
and profitable way to control  
your automated processes.**

**From IEC 61131-3 to a certified  
bidirectional interface to SAP® R/3 using  
zenon from COPA-DATA.**



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Control your automated processes more profitably.  
**zenon can take you from IEC 61131-3 to a certified  
bidirectional interface for SAP® applications.**

## Overview

This white paper is intended to show how our HMI/SCADA software zenon communicates with or integrates a wide range of different devices and applications on different levels. It explains zenon's vertical integration and focuses in detail on its direct communication with SAP applications.

### **The starting point:**

Many automation environments suffer from inadequate cohesion between the various levels with no useful communication between them, or with cooperation achieved only by circuitous means.

### **The solution:**

zenon, in combination with straton, its integrated and flexible IEC 61131-3 programming environment, delivers an overview and cooperation with all manner of hardware as well as direct links using standard and proprietary interfaces.

At the field level, straton is able to address and manage controllers directly.

At the HMI/SCADA level zenon functions as an information gateway.

At the ERP level, SAP applications communicate directly with the process control system via a certified bidirectional interface. Other applications too are integrated using the general linking facilities provided by an SQL interface.

## Are modern automation systems truly integrated yet?

Nearly all providers of automation solutions wax lyrical in their promotional materials about how their products function in a seamlessly integrated environment; the reality, however, is often quite different: The norm for automation systems throughout all sectors of industry remains the proprietary stand-alone solution. In some cases, the only way forward is bound up with one single supplier and their business strategy; the only alternative is often a variety of solutions that function more independently and in parallel rather than in tune with one another.

Equipment from different manufacturers includes a variety of different control systems, and old equipment does not really work well with new; data is shared either not at all or to only a limited extent, consisting of lists maintained manually or even by verbal communication. Planning, control and analysis are separated, and can only come together using circuitous means.

Off-the-peg solutions often revolve around a central database system. As a result:

- Either: an add-on system is grafted onto the existing infrastructure "from above". Systems of this type exist under a range of names as widely varied as the functions they feature; the best-known of these systems are those known as MES systems. Still more different systems are deployed in the IT industry, including ERP and MIS. Their databases are in turn integrated via MES in a production environment.
- Alternatively: an attempt can be made to extend an existing system "from below", developing it into a system similar to an MES. Many well-known manufacturers have "expanded" their product range with a central database structure and a web interface; essentially all they are doing is dressing up the same old thing in new clothes.

This leaves the inevitable fundamental problem of this kind of intermediate layer: how can 'high-level' database systems access data from all kinds of different stand-alone automation stations? Consistency is not synonymous with a web interface – and OPC is anything but a high-performance direct communication tool. The quasi-scaleability and pseudo-openness of such 'high-level systems' are difficult to reconcile with flexible everyday operation. This leads to:

### The 'cul-de-sac risk'

A lack of systematic thought and insufficient overview will result in unsatisfactory situations: people will be working with old data, will receive important information too late, not at all, or in the wrong place.



Rather than operating proactively, people will be spending their time troubleshooting and responding to problems.

Central solutions are also highly complex, difficult to maintain and require a lot of expertise. They are often costly and relatively inflexible. Standards could be of some help, but standards alone cannot really enable systems to be fine-tuned for your own specific processes. So what's the answer?

## **Automation that is more direct, straightforward and profitable**

Of course it would be great to have a system that:

- can be used flexibly on any level and scaled freely according to preference
- has an open structure and can interface to any automation solution now or in the future
- is so simple to use that there is no need for any specialist knowledge
- is sparing in its use of resources, but still powerful
- can adapt in line with developments in the company

Such systems do exist, and can be found in almost every manufacturer's brochure. Occasionally they can be found in the real world too: the difference lies in the detail. This white paper aims to illustrate the three steps by which we can make the process of automating your plants more sustainably direct, straightforward and profitable based on our HMI/SCADA system zenon.

### **zenon: HMI /SCADA system and communication platform**

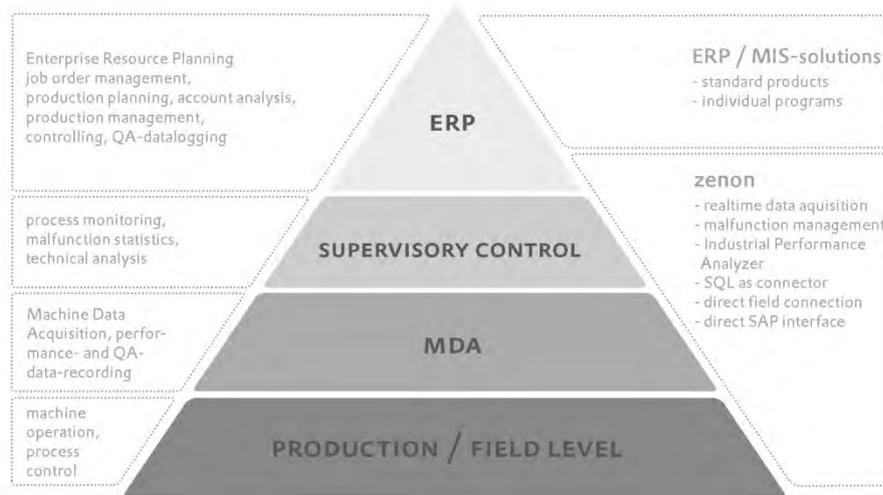
zenon is an open-design, object-oriented industrial automation application. It is used by many companies around the world for process visualisation, as a human/machine interface (HMI) and as a process control system (SCADA). Its openness makes possible fast, efficient interfaces with any hardware or software.

zenon communicates via standard interfaces such as COM, ActiveX, XML or zenon's own process gateway. It can also communicate with many proprietary interfaces, including, for instance, PI-PCS as used by SAP®. All the control connections are programmed in-house at COPA-DATA, fine-tuned for the target system and then exhaustively tested.

zenon and straton offer an integrated solution for all levels in the automation pyramid.

1. *Field level*  
*straton used near a PLC*

2. *HMI/SCADA level*  
*zenon as an information gateway*
3. *ERP level*  
*zenon linked directly with SAP applications and general interfacing facilities using the SQL interface*



zenon has even more than this to offer. Its open design offers a great deal more potential than there is to be found in a pyramid. The system is so flexible that it can be adapted to suit any automation structure. Because who can say that a pyramid will always be the best structure? Not all relationships can always be represented strictly in accordance with a pattern. zenon can be adapted to suit existing structures and key elements.

It's easy to see how COPA-DATA settled on the slogan 'Do it your way!'

## Automation with zenon

On the following pages we show how zenon can be used to optimise existing automation solutions and bring them up to scratch for the future, or to easily implement new solutions. zenon can achieve this through standard solutions with flexible structures, and with no need for any complicated special approaches or costly hardware.

We explain how the universal control system straton can be used advantageously on all levels of the automation process, how the worlds of HMI and PLC can be integrated, and what the user stands to gain from this. You will also discover how easily a direct, certified interface to SAP applications can be set up.

1. So, bring on the data!  
The field level: straton and zenon used near a PLC.



## 1. So, bring on the data! The field level: straton and zenon used near a PLC.

Modern automation solutions employ all kinds of different means for integrating machines with systems: PLCs, bus terminal controllers, soft PLCs on DIN rails, PCs with a direct I/O interface, programmable automation controllers (PACs) and PC-based RTUs.

How can control logic, visualisation, data management and data analysis all be reconciled with one another whilst at the same time retaining an overview of the engineering aspect?

After all: where there is a variety of different systems, there usually also need to be many different tools to perform the necessary engineering and maintenance operations. But how many editors can be controlled by a single engineer, and how well do they work together? The radical course of using only dedicated software and hardware from one single provider has the effect of restricting freedom of movement in business terms and slowing down innovation.

For those who wish to avoid using a restrictive proprietary DCS solution, an independent system represents a preferable option. Independent systems can interface to all manner of hardware. In conjunction with straton, zenon can also provide an integrated open solution and totally new approaches to data processing.

### Integrated logic

straton is a high-performance IEC 61131-3 environment; it is an open system that is also embedded in many control systems and represented in programmable automation controllers (PACs).



straton can be used as soft PLC or SCADA logic, but is equally well-suited as a bus terminal controller. In this capacity it communicates via nearly all the current protocols including Profibus, Profinet, Modbus and CANopen. It can operate as master or slave, as server or client. Its strengths include IEC 60870 and IEC 61850 as well as cross-communication with IEC 61850 GOOSE.

At the **I/O level**, straton functions as an intelligent fieldbus controller. straton reads in physical inputs directly, and likewise writes directly to physical outputs. straton is also already included in a ready-to-run form

## 1. So, bring on the data!

The field level: straton and zenon used near a PLC.



in many components used by well-known hardware manufacturers like Wago or Advantech, and has a wide range of different communication protocols for interfacing to all kinds of different systems.

At the **control level**, straton operates as a real-time compatible controller in the form of a soft PLC. Data is transferred from the field level to straton via field buses. At the same time, connections to a higher-level SCADA system or a central remote control station are also possible.

The straton Soft PLC will run on all Windows operating systems – from Windows CE and XPe to XP and Vista, and also supports residual data maintenance. Its online change facility allows the PLC program to be modified whilst in operation without any need for the ongoing process to be interrupted.

On the **SCADA level** straton becomes a central calculation station integrated into zenon. A powerful interface between zenon and straton ensures optimum real-time behaviour and enables large volumes of data to be processed very quickly. straton supports spontaneous, event-controlled data transfer in addition to cyclical scanning. Like zenon, straton can also be operated redundantly without any problem.

The straton **Workbench** supports all five languages defined in IEC 61131-3. This means that programming can always be performed in whichever language is preferred in the given instance since the straton program conversion utility enables one language to be switched or translated to any other IEC 61131-3 programming language at any time.

straton and zenon alike feature distributed engineering, which keeps configuration times to a minimum. Application teams thus have the opportunity to work on the same project at the same time and, for instance, to program the PLC application in parallel with configuring the SCADA application. In this way, a single data set is used, and as a result tasks need to be performed only once where before they may have had to be duplicated, and thus be prone to error. straton also provides extra interfacing possibilities and additional platforms for logic calculations in the HMI/SCADA system.

Even if the control level takes on more and more tasks, and the PLC and HMI are often combined in a single device, this still does not form a complete visualisation system. The minimum approach of adding colourful images to a PLC system is not enough; it may appear more informative, but it fails to actually do the job.

## 2. New possibilities every day! HMI/SCADA level: zenon as an information hub.

Helpful solutions achieve more than merely combining PLC and HMI configurations in an integrated solution. They also offer the freedom of working on a wide range of different platforms ranging from classic HMI tasks like operating and observing processes through to SCADA tasks such as archiving data, trend analysis or recipe management.



This also involves accessing all kinds of different systems, both vertical and horizontal, in other words connecting separate islands and combining the old with the new. As the information hub, HMI is the key technology for open integration and quick, flexible action.

### zenon as an information gateway

In terms of exchanging data, the integrity, resources and security depend on the reliability of interfaces and connections. zenon exhibits great versatility in this respect.

Different types of device are easily integrated, ERP applications benefit from direct data access and support real-time operations. It makes no difference to zenon whether an automation system's intelligence resides in the controller, in the control system or on the ERP level; it works in a distributed way regardless.

A distributed system not only enables intelligence to be distributed; the other side of the coin is that networking increases productivity. Another aspect of a distributed system is that a database failure cannot disable the entire system.

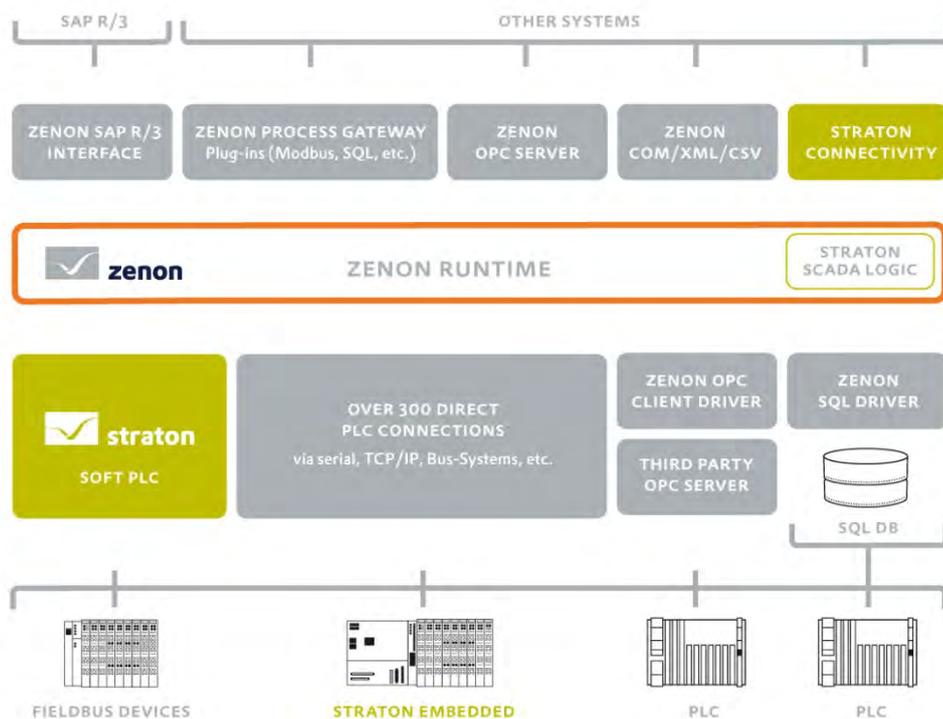
2. New possibilities every day!  
HMI/SCADA level: zenon as an information hub.



Whether the hardware is a controller or a control computer, data is moved around and used securely and quickly. zenon makes OPC and all other current standards available at all times. At the same time zenon also offers more than 300 high-performance interfaces. These are developed individually by COPA-DATA, and function in accordance with the 'plug-and-play principle': easy to connect and to process, compress and monitor data, with regulation of quality and efficient data transmission.

Open COM, XML and ActiveX interfaces enable data to be combined from all manner of different sources. zenon also features an integrated Microsoft SQL Server 2005, which functions as a data hub.

zenon has a process gateway, providing an elegant solution to another problem that represents a challenge to most control interfaces: zenon allows other systems to address it as a PLC. This, for instance, enables direct communication via Modbus or with network management software via SNMP.



New opportunities for direct communication and flexible integration have no particular value per se. They do, however, lead on to some significant benefits: they enable companies to pursue their own automation strategy in a focused and consistent way, ultimately bringing about a measurable increase in productivity.



### **3. Do it right! zenon with a direct interface to SAP R/3®.**

Corporate success depends on a variety of factors, including detailed information on competitors and on the company's internal processes. Accurate, up-to-date analyses and intelligent compression of information enable data to be gathered from all departments at the right time. In this way processes can be optimised and trends identified in good time. The more concentrated and accurate the information, the more precise is the resulting overview. This is why a lot of companies opt for ERP systems even if their sphere of influence does not reach as far as the process level.

Until now a lot of companies have invested in three different systems in order to represent all the processes from procurement through production to sale. ERP systems for administration, SCADA for production, and programs for capturing operating data and machine data, or manufacturing execution systems (MES) as additional links.

Companies developing ERP systems like SAP have for some considerable time been developing an ever-increasing number of modules for taking on MES tasks. These perform tasks such as drawing up production plans for products, oversee processes, manage production resources and the acquired production and product data and provide interfaces to materials handling, engineering or order management. Communication with the process often represents a stumbling block. Manual data transfer is still used, just like the route via SQL interfaces and third-party products with all the side effects like additional costs for external specialists, error-proneness, high maintenance overheads, adverse effects on performance and high costs.

We believed there was no need for additional interfaces or workarounds, and looked for a simpler, secure way of linking the process with the management level to save every separate company the trouble of discovering and implementing their own little solution.

SAP leads the world market in this area, and many companies regard SAP applications as more or less industry-standard in terms of corporate management. These applications feature well-documented interfaces. zenon also includes certain modules that are not supplied with SAP. These include tracking and tracing, clear analyses and representations of process states, as well as tried-and-tested design tools for maintenance and commissioning.

**SAP® Certified**  
Integration with SAP Applications

Our many years of experience with horizontal and vertical solutions have led us to a very direct and clear solution. There is now a certified bidirectional interface linking the zenon HMI/SCADA system with SAP® ERP. Users of zenon and SAP thus have two homogeneously



interacting systems that render investment in intermediate layers superfluous.

### **Closed information loop from zenon to SAP® applications**

In order to link the ERP and process levels, zenon interacts with SAP applications via a bidirectional interface. SAP users are thereby able to access the process level directly. This function is not offered by manufacturing execution systems as a matter of course.

zenon sends messages about processes to the SAP application and also receives control instructions from that application. In this way companies are able to link their process level directly with the ERP level via a closed information loop, which gives them a continuous overview of all processes from order management, recipes and production through to delivery. This enables storage, for instance, to be monitored in real time since zenon supplies accurate data on the real consumption of resources from the SCADA level. This provides the company with important basic data for just-in-time production as well as for long-term planning.

zenon utilises the widely-used PP-PI interface, which allows it to communicate easily with many different versions of SAP applications. Alarm messages (known in SAP as fault messages) are passed directly from SCADA to SAP. In batch mode, zenon receives control recipes from the ERP level in return.

#### **Technical aspects: underlying principles and implementation.**

When ERP and the process level are linked up, there are two basic scenarios for data exchange:

1. Measured values, counter values and fault messages are forwarded from zenon to a SAP system.
2. zenon is coupled bidirectionally with SAP applications (closed information loop).

### **Step one: data transfer to SAP application**

#### **a) Measured values**

In SAP applications, measured values describe a particular status of the production system at a particular point in the process sequence. Any process variable that exists in the zenon system can be defined as a measured value. Thus, data from the real-time process that is independent from any protocol can be passed to the higher-level management level.

In many cases it would appear sensible to pre-compress the process data on the process level to enable the accumulated data to be passed



to the SAP system for analysis. The SAP system thus receives specific mean values or statistical characteristics from zenon. These are calculated from an entire string of values. This prevents the management system from being unnecessarily overloaded with raw data.

Also, to minimise the strain on the system, an individual decision can be made for each measured value that is to be transferred about the cycle time that is to be used when communicating the value. Following a successful transfer, the data is evaluated in the SAP system and stored in measurement documents. After this, the data is available to all other SAP modules for further analysis.

### **b) Counter readings**

Especially in the area of production planning and monitoring, measurement documents are often not enough. In this case the management system must also be kept updated on the latest counter values such as parts produced and material consumed. A counter is thus a tool that represents the consumption, the duration of usage or the reduction in a supply. A counter reading generally changes by either decreasing or increasing at a steady rate. For that reason zenon also provides a facility for forwarding the exact counter values to the SAP system. Any process variable or individually spontaneous or cyclical data communication can, of course, also be chosen for the counters. In the SAP system, the data transferred in this manner is evaluated, stored in measurement documents and used in the PM module (maintenance) for the purpose of maintenance planning.

### **c) Fault messages**

For the planning system it is also important to keep informed about faults that have occurred, down time, etc. Key productivity figures can only be meaningfully calculated if the associated run times and down times are known. For this purpose the messages known as fault messages are used in the SAP system. Any alarm for a process variable defined in zenon can be specified as a fault message. The user can decide whether the selected alarms are transmitted to the higher-level system automatically as they occur, or not until they are released manually. Related messages, i.e. messages that can only be cleared using maintenance tools, are generally documented in SAP.

## **Step two: Linking directly to PP-PI via PI-PCS.**

In many industrial plants, process control systems are used which transfer target data (control recipes) to the process control module and read data from the process. Many production parameters – customer orders, product recipes, stock levels, goods movements, quality indices – are measured and managed in the company's business management data processing system. When this system is linked with the process



control system, data (e.g. production-related data and quality indices) can be exchanged consistently between all the sections of the company.

For the process industry, SAP has implemented certifiable linking modules for process control systems (PCS). COPA-DATA decided on the tried-and-tested and widely-used PI-PCS interface for linking to the PP-PI module.

The PP-PI module enables control recipes to be downloaded to the process control system, and process and consumption data to be uploaded in the form of process messages. The control recipes contain production orders (process orders) and consist of product recipes and production rules as well as information on deadlines. Information on raw material consumption, production quantities, production errors and production times generated during the production process is made available to the SAP application in the form of process messages for the purpose of business management and quality analyses.

In addition, the PP-PI module allows general data about the characteristics that make up control recipes and process messages to be downloaded. Technical communication between the PI-PCS interface and the process control system is implemented by means of remote function calls (RFCs).

### **Advantages for users of zenon and SAP applications**

The linking of SAP applications with the process control system integrates the business management process reliably and on-line with production. This connection gives rise to production processes that are necessarily clear and reproducible. Stocks of goods and raw materials are monitored at extremely regular intervals, and raw materials can be procured on a just-in-time basis. Up-to-date information on operational processes and production can be accessed clearly and quickly. With regard to the consumption of material and time, a comprehensive production calculation can be carried out, and any changes are detected promptly and in keeping with the market.

zenon includes a number of modules that enable the user to obtain an overview and carry out planning that is sensible in economic terms. Two such modules are the "Industrial Performance Analyzer" IPA and the "Industrial Maintenance Manager" IMM.

The direct link between the SCADA level and ERP brings companies a number of benefits. The direct exchange of data has the effect of moulding two previously separate levels to form a single cohesive system with a firm grasp on every step from the order being placed through to delivery. Specific responses to everyday requirements, and flexible structuring of the production process are thus just as easy to achieve as optimised resource planning through real-time feedback.

This interface enables a manufacturing process to be designed and defined even in the SAP system. The SAP system thereby has access at all times to all the latest stock data and production orders, while on the other hand intelligent interfacing means that it also knows the latest process statuses. The linking of this data means that users are able to



intervene selectively and actively in the shaping of a process, e.g. a production process from a central system.

zenon is sufficiently intelligent to implement the control commands it receives and to map them onto the process. In this bidirectional communication the two systems are continuously exchanging information and control commands. Immediately following the conclusion of a phase or production cycle the management system already has the updated data and may, for instance, initiate other downstream logistical processes.

### **Automation that is more direct, straightforward and profitable**

In order to be really productive, a modern automation system must efficiently integrate islands in the automation landscape and utilise both old and new jointly. Here, existing systems must be maintained and all kinds of different components must be seamlessly integrated. As a rule, and with the appropriate system, hitherto hidden and unused potentials come into play. Those who maintain freedom of action and ensure an overview by following clear, direct paths can react more quickly and surely to new challenges: Another aspect of improving one's own automation expertise is gaining momentum in innovation, increasing productivity and safeguarding the company's future.



## About COPA-DATA

COPA-DATA is a European company specialising in automation, and a leading innovator in the field of HMI/SCADA software. For more than 20 years its successful process control system, zenon, has been automating, controlling and visualising production processes and distribution of resources in companies from the widest imaginable range of sectors including automotive engineering, mechanical engineering, pharmaceuticals, energy, and food and beverages. COPA-DATA is an independent company that works in a quick, flexible way, constantly creating new standards of functionality and ease of operation, thus leading the way in its field. The COPA-DATA sales network includes subsidiaries in Germany, Italy, France, the Middle East, UK and USA as well as partners in many other countries around the world. COPA-DATA currently employs more than 130 people, and its list of customers features numerous internationally successful companies including Festo, Swarovski, BMW and Audi.

## About zenon

zenon is the easy-to-operate, powerful software for industrial automation from COPA-DATA, leading European player in the HMI/SCADA field. It is used by many companies around the world for process visualisation, as a human/machine interface (HMI) and as a process control system (SCADA). zenon's main strengths lie in its simple object-oriented configuration, its total compatibility from terminal to control room, and its high level of security. Its openness makes it possible to make connections with any hardware or software, e.g. ERP programs, rapidly and efficiently. zenon delivers first-class performance to industrial PCs running any of the latest Windows operating systems, and equally to any other hardware operating under Windows CE. Companies from many different sectors including mechanical engineering, automotive, foodstuffs, process engineering, building control systems or power supply reap the benefit of using zenon.



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