

**ZERO.ONE ENABLES A SIGNIFICANT
INCREASE OF PLANT USE
WHILE REDUCING RISKS
AND UNPRODUCTIVE HOURS**

INTELLIGENT CONNECTION



**SCHMIDTSCH
SCHACK**



We are at the start of the 20th century. The world economy is booming. In the previous 40 years, the weight of world trade has doubled to become one third of total global output. In the same period, Germany has advanced from being a no-name economic entity to become the second largest industrial nation after the USA. In just the last 15 years of this growth period, the value of goods and services produced in Germany increases by 43.6 percent – measured in constant prices.

And then Wilhelm Schmidt enters the scene and brings a whole new form of energy to the situation. He not only makes use of steam – which has been driving the machines powering this global industrial revolution – but adds super-heated steam into the process, thus increasing performance by more than a third. In 1910, he establishes the company "Schmidt'sche Heissdampf-Gesellschaft mbH" for super-heated steam applications in Kassel, Germany, with branches in New York, London and Paris.

Schmidt thinks in terms of systems and subsystems. He doesn't want to do everything differently, but rather to make existing processes work more effectively. The engineer comes up with a system that can be integrated into larger existing technical systems – regardless of the manufacturer – so as to produce an optimized new global system, as in the transport sector, for example.

Schmidt thus does not build a new locomotive. He accepts the established system. He does not want to build locomotives that are larger or heavier than those currently being built. The track gauges, the load capacity of bridges, the dimensions of the railway vehicles particularly in tunnels – all these factors are givens that cannot be altered. Schmidt looks for the variables that can be optimized so as to achieve an optimization of the overall system, without having to alter its basic form. He provides

a solution that can be integrated into every steam engine, regardless of the complexity and size of the overall engineering design.



One of the first super-heated steam locomotives using Schmidt'sche Technology built by Henschel Kassel

Perhaps thanks to Wilhelm Schmidt, the steam engine survives and thrives for decades beyond the initial early phase of the industrial revolution. Indeed, the grand epoch of steam locomotives does not come to an end until the mid-20th century. Diesel locomotives and e-mobility then take their place on the rails. At this juncture in the mid-20th century, the chemical and petrochemical industry are coming to be a major factor in the world economy.

Schmidt's successors in his company think about this development in the same way as their company founder had a half century before. They ask the question: "How can we use our knowledge and skill to achieve critical improvements in the overall system of existing industrial processes?" With this approach, they are again able to make a decisive contribution. Instead of super-heating, the Schmidt'sche Technology is now used to optimize or to enable chemical reaction processes. The engineers at SHG (Schmidt'sche Heissdampf-Gesellschaft mbH) devise a process for extreme cooling of cracked gas by 450 °C in 40 milliseconds to facilitate hydrocarbon processing. And so the transfer line exchanger was born. There is a simple reason why the basic approach is the same here as it was in 1910 – physics remains the same. Natural laws don't change. Engineers simply need to find increasingly precise ways to make use of these basic building blocks of the natural world.



Now, another half century later, the technological revolution that began with the steam engine has entered a new phase. The digital transformation is generating information in unprecedented abundance. This multitude of data is the new variable of our current age. And at SCHMIDTSCHESCHACK, we see our next challenge in identifying the relevant data and putting them to productive use in all their complexity. We don't only talk about digitalization, about Industry 4.0 and the Internet of Things (IoT), we are creating a new dimension of transparency in the existing technical systems of our customers.

We have more than 100 years of experience and expertise in heat transfer solutions and are developing this further with a new goal: With our sensors, we measure data precisely at the critical points in our equipment, we correlate and aggregate these data to develop new algorithms which put us in the position to see and to understand more. By combining knowledge and expertise on an interdisciplinary basis, we are able to measure and record technical conditions better than ever before. This lets machines learn, provides a basis for forecasting, and generates added value. Physics, chemistry and engineering have not reached their limits. Established and proven processes are retained. We don't eliminate these processes but rather optimize them through ingenious inventions – as with the steam superheater or the transfer line exchanger in the past. With Zero.One we are taking the next step – of finding a new connection between the "old" world and a new, digitalized world – in the same way that Wilhelm Schmidt did a century ago.

WHO KNOWS BETTER THAN US HOW TO BRING EXISTING SYSTEMS INTO A NEW FUTURE OF OPTIMIZED USE?



Wilhelm Schmidt was born on 18 February 1858 in Wegeleben in the Harz district of Germany. He did not have an easy time at school. Dealing with written texts was difficult for him. But perhaps it was just this experience of a personal weakness that sharpened his view for ways to make things easier in everyday life. After an apprenticeship as a machinist, he studied engineering at the Technical University Dresden with Gustav Zeuner as a specialist in locomotive technology. With this knowledge – combined with an exceedingly strong work ethic – Schmidt set about revolutionizing steam engine technology with his super-heated steam patents following its discovery by Denis Papin in 1690 in Kassel. Schmidt's innovations went on to change steam drive technology around the world.



**ZERO.ONE - THE DIGITAL
SERVICE PLATFORM
FOR COMPONENTS OF CHEMICAL
PRODUCTION PLANTS**

BRINGING TRUSTED TECHNOLOGY TO THE NEXT LEVEL.

Our record of achievement over the past century makes it clear: Where others come to a halt, we take the next step. That does not mean that existing processes have to be changed. On the contrary, just as Schmidt improved locomotive technology around the world with the steam superheater, SCHMIDTSCHESCHACK continues to advance and transform existing systems with revolutionary inventions.

START LISTENING TO YOUR HEAT EXCHANGER

For the first time, SCHMIDTSCHESCHACK has connected existing heat exchangers with the Internet of Things (IoT). Zero.One is a system for the sensor-based analysis of the components of an industrial plant. The specially developed sensors for the system give real-time readings of the process heat exchanger's operating parameters and the status of its components. On this basis, Zero.One's algorithms show, for example, whether threshold values are being exceeded, give recommendations concerning optimal utilization of the process heat exchanger, and schedule service work to ensure minimum downtime. With this functionality, Zero.One increases the efficiency of the system as a whole.

HOW DOES ZERO.ONE WORK?

The special sensors developed by SCHMIDTSCHESCHACK measure temperatures, pressures, mass flows, material thicknesses and other critical values as they are occurring in the high-temperature gas-conducting segments of heat exchangers. On a continuous basis, algorithms automatically analyze the current status and performance data of the system and compare these data with historical system data and product design information. In customized dashboards, Zero.One then provides key information on the exchanger's current status, performance data, risks and gives system prognoses in clear, easy-to-understand displays. In addition, recommendations are given that give customers a true added value in the management of their plant equipment.

WITH ZERO.ONE, SCHMIDTSCHESCHACK HAS SUCCEEDED IN DIGITALIZING INDIVIDUAL PROCESS HEAT EXCHANGERS THUS FACILITATING OPTIMAL PLANT USAGE IN KEEPING WITH INDUSTRY 4.0 STANDARDS.



**ZERO.ONE MINIMIZES
UNPRODUCTIVE DOWNTIMES AND REDUCES
RISKS IN THE PRODUCTION PROCESS**



**NETWORKED FOR BETTER RETURNS.
REDUCING DOWNTIMES.
IMPROVING UTILIZATION.**

With Zero.One you improve the utilization for a direct increase in the Return-on-Invest of your plant. Detailed, product-specific information on the condition of heat exchangers minimizes the loss of time during planned downtimes and reduces disturbances in the overall process.

OUR GOAL FOR YOU - MORE OUTPUT WITH LOWER COSTS

Through the use of Zero.One, time savings of up to 75% with maintenance work can be achieved. In addition to this, time is saved through the extension of service intervals and the avoidance of unplanned downtimes. All in all, the application of Zero.One pays off very fast.

WITH ZERO.ONE - DOWNTIME ONLY WHEN INEVITABLE

Zero.One reports needed service, including an analysis of what will be required and a material order

Material specified by Zero.One is readily available, followed by installation and maintenance
Start-up of the plant



WITHOUT ZERO.ONE - MORE FREQUENT REGULAR MAINTENANCE WITH 4x LONGER DOWNTIMES

In the past:
Regularly scheduled maintenance

Analysis of requirements, inspection of wear, ordering of material
Material is available, followed by installation and maintenance
Start-up of the plant



**ZERO.ONE ENABLES
DECISIONS BASED ON HARD
FACTS AND REAL-TIME DATA**

**SYSTEMATICALLY NETWORKED.
COMPLETE HEAT EXCHANGER MONITORING.
WHENEVER – WHEREVER.**

With Zero.One it's simple to prepare availability forecasts and to check the necessity of upcoming service and maintenance work. The life-cycle monitoring makes it possible to detect deterioration and wear of the heat exchanger at an early stage and provides a clear and reliable rationale for maintenance decisions. Sufficient lead time for the procurement of replacement parts is taken into account.

KNOWLEDGE IS POWER – IF IT CAN BE ACCESSED AT ANY TIME AND AT ANY PLACE

With Zero.One the condition of the exchanger is digitally documented and compiled. The system gives exceptional insight into relevant data and delivers exclusive information – whenever and wherever a user accesses the dashboard.

CUSTOM INTEGRATION SOLUTIONS

Zero.One operates as a wholly independent predictive maintenance system that individually adapts itself to your equipment via machine learning algorithms. It is primarily designed to collaborate with new and existing SCHMIDTSCHESCHACK heat exchangers.



ZERO.ONE NETWORKS
MAN AND MACHINE - FOR MORE SAFETY
THROUGH GREATER TRANSPARENCY



NETWORKED FOR EASE OF USE.
BRING EMPLOYEES ON BOARD.
FROM THE VERY START.

With Zero.One, a whole range of events can be predicted. In daily business that means: relaxed planning horizons and less crisis management. You know what is going to happen and when. At each point in time and from every location. You put service teams to work only when they're really required.

DIGITALIZATION NEEDS PEOPLE WITH PASSION TO MAKE PROGRESS TOGETHER

Zero.One is easy to operate and provides added value in the qualification of employees. Knowledge development that brings real benefits – for the strengthening of employee expertise and the improvement of proficiency and sustainability in teams and locations – today and tomorrow.



OUR OFFER. THREE LEVELS. A MULTITUDE OF POSSIBILITIES.

Our three levels let you choose among various possibilities that are suitable for most requirements, depending on factors such as plant type and organization structure. Together with you, we will be happy to develop your individual Zero.One structure – customized exactly for your requirements, plants and structures.

A crucial step here is to fully involve your team and partners in this structure. Regardless of all the technical progress that is being made, it is still people who make the decisions. Even precise and automated tools cannot be used to best effect without technically adept handling and the right sort of motivation.

PREMIUM – Includes the sensors, the technical connection, the provision of the dashboards, the report including diagnosis and prognosis (component status, maintenance, performance) and action recommendations on the basis of current and forecasted data.

ADVANCED – Includes the sensors, the technical connection, the provision of the dashboards and the report including diagnosis and prognosis (component status, maintenance, performance).

ZERO.ONE SYSTEM – Starts with sensors especially developed and designed for heat exchangers – for monitoring temperatures, pressures, mass flows and material thicknesses.



SERVICE DESCRIPTION		BASIC	ADVANCED	PREMIUM
SERVICES				
CONSULTING SERVICES	Zero.One implementation consulting, especially in the field of industrial heat exchangers	🟢	🟢	🟢
DATA				
DATABASE MODEL	Database model design is part of the Zero.One implementation activity	🟢	🟢	🟢
BIG DATA	All data gathered by all sensors connected to the Zero.One Platform	🟢	🟢	🟢
BASIC SMART DATA	Data evaluated by basic analysis algorithms and shared by Basic Data Reports	🟢	🟢	🟢
ADVANCED SMART DATA	Data evaluated by advanced analysis algorithms and shared by Advanced Data Reports		🟢	🟢
PREMIUM SMART DATA	Data evaluated by premium analysis algorithms and shared by Premium Data Reports			🟢
ALGORITHM APPLICATION	Zero.One uses simple algorithms as well as advanced machine learning technologies		🟢	🟢
TECHNOLOGY				
REAL-TIME MONITORING	Implementation of a real-time monitoring solution based on IoT technology	🟢	🟢	🟢
INTERFACE TO PLC / SCADA	If technically possible, a connectivity to local PLC / Scada systems can be implemented	🟢	🟢	🟢
DIAGNOSTIC & PROGNOSTIC SOLUTION	Diagnostic and prognostic based on performance and reliability monitoring		🟢	🟢
SENSOR TECHNOLOGY	As part of the heat exchanger equipment exclusively connected with the Zero.One Platform	🟢	🟢	🟢
NETWORK AND COMMUNICATION SERVICES	Technology depending on individual requirements (LAN, WiFi, mobile telephony / SIM cards)	🟢	🟢	🟢
CLOUD SERVICES	Services such as IoT Hub, data storage, security management, algorithms	🟢	🟢	🟢
ARVOS SERVER SYSTEM	Server system provided by ARVOS exclusively for Zero.One customers, shielded and secured	🟢	🟢	🟢
PRESENTATION				
DASHBOARDS	Customized dashboards providing transparent heat exchanger information such as status, events, locations etc.	🟢	🟢	🟢
RECOMMENDATIONS & REPORTING	Fleet and/or product related recommendations based on real-time and historical data on a frequent basis			🟢

FAQ

Your question isn't included?

Axel Kindgen, Head of IT & Digitalization,
SCHMIDTSCHACK | ARVOS GmbH

will be happy to receive your email
and answer any questions:

Zero.One@arvos-group.com

What is Zero.One? #1

Zero.One is a system for the sensor-based analysis of the components of a process heat exchanger. The specially developed sensors for the system give real-time readings of the exchanger's operating parameters. On the basis of this data, algorithms provide recommendations for the optimal utilization of the heat exchanger. With this functionality, Zero.One increases the efficiency of the plant system as a whole.

Where does the name "Zero.One" come from? #2

Zero.One makes reference to the fundamental concept of a binary system, and thus is an emblem for digitalization. Zero.One also denotes the next evolutionary stage of the heat exchanger – where its physical functionality is coupled with sensor technology, artificial intelligence and diagnostic capabilities.

What does Zero.One measure? #3

Zero.One measures the physical parameters of temperatures, pressures, mass flows and material thicknesses.

How are measurements made? #4

Specially developed, proprietary sensors measure various parameters in critical areas. These data are processed with so-called edge devices, transmitted to the cloud and analyzed.

What are the benefits of Zero.One? #5

Zero.One increases the heat exchanger utilization. Critical parameters are the extension of the delta between maintenance intervals, shortening of downtime for maintenance service as well as monitoring of performance losses through fouling and corrosion.

What effect will Zero.One have on my maintenance management? #6

Zero.One supports operational planning of maintenance service and helps to reduce service times to the necessary minimum.

Can Zero.One be retrofitted for existing products? #7

In principle, yes, if no other status monitoring system is installed. If such a system is already in place, then it is necessary to analyze whether it can be combined with Zero.One.

Who puts Zero.One into operation? #8

Commissioning is performed by SCHMIDTSCHACK in close cooperation with the plant operator or the plant designer. In all cases, however, SCHMIDTSCHACK provides the expert team for the Zero.One hardware and software solution.

I am interested in Zero.One. How long does it take until I can start making use of Zero.One and what do I need to do to make this possible? #9

The basis of a Zero.One project is an initial workshop. Following this, establishing settings in the system takes six months. After a further 12 months, enough data has been gathered to adjust the algorithms more precisely. The system will then run optimally for your production.

Is the security of collected data guaranteed? #10

The data are stored in a European cloud and thus are subject to strict European data protection regulations. Only SCHMIDTSCHACK has access to the collected data and no other third party. SCHMIDTSCHACK has set up an information security management system in accordance with ISO 27001.

Is there user training for handling Zero.One? #11

Yes. In the course of project implementation, users receive training. In addition, Zero.One initiates a new level of quality in knowledge management. Digital contents are documented and archived around the clock for the preparation of work instructions, training materials and operative documentation that are globally available at all times.

Is it allowed to operate Zero.One in explosion-protected areas? #12

Yes. The electrical components are secured in special boxes and fulfill the requirements for plant operation in explosion-endangered areas in accordance with ATEX Operating Guidelines and other international standards.

Are there industry-wide standard interfaces? #14

There are various standards that are compatible with each other. These interfaces include: RS232, Ethernet, RS485, as well as APIs for connecting to the cloud. Communication standards include: OPC-UA, MQTT, Modbus-TCP and SNMP.

How does Zero.One support our own digital transformation and the achievement of Industry 4.0 standards? #13

Zero.One provides the impetus for digital transformation in an established industry and improves existing processes in this industry rather than making them superfluous. Zero.One also sets the impulse for an unprecedented level of knowledge management that optimizes production processes.

SCHMIDTSCHESCHACK | ARVOS GmbH
Ellenbacher Strasse 10
34123 Kassel, Germany

SCHMIDTSCHESCHACK | ARVOS GmbH
Parsevalstrasse 10
40468 Düsseldorf, Germany

SCHMIDTSCHESCHACK | ARVOS LLC
6500 Brooktree Road, Suite 300
Wexford, PA 15090-1395, USA

SCHMIDTSCHESCHACK | ARVOS LLC
Houston Office
5444 Westheimer Road, Suite 1000
Houston, TX 77056, USA

SCHMIDTSCHESCHACK | ARVOS K.K.
2-3-4 Minatojima-nakamatchi, Chuo-ku
Kobe, 650-0046, Japan

SCHMIDTSCHESCHACK | ARVOS ASIA PACIFIC Pte Ltd
Branch office
25 International Business Park
#02-12A German Centre
609916 Singapore

Zero.One@arvos-group.com