**The spoken word applies!**

**German machine tool industry joins forces to tackle Industry 4.0**

**VDW launches Initiative for networked production**

**Statement by Dr. Heinz-Jürgen Prokop, Chairman of the VDW (German Machine Tool Builders’ Association), Frankfurt am Main, Germany, speaking at the EMO Hannover press conference held in Hanover on 18 September 2017**

Ladies and gentlemen,

May I welcome you most cordially to the VDW’s press conference on the first day of the EMO Hannover. After being ceremonially opened by Germany’s President Frank-Walter Steinmeier, the fair got off to a good start this morning. I am confident that the President during his tour of the fair gained meaningful insights into our sector’s internationality and performative capabilities, and experienced many interesting aspects that were new to him. Now we are delighted to note that in all the hustle and bustle of the fair’s first day you are here with us to familiarise yourselves with the machine tool industry’s networking strategy.

The motto of this year’s EMO Hannover is *Connecting systems for intelligent production.* It focuses on digitalisation and networking, currently the most widely discussed issues in the industrial sector. The EMO Hannover is the first fair to showcase extensive networking solutions and their direct implementation in production-technology-related applications. It’s not only software and simulation that are much in demand. Tough practical tests also have to be passed to verify functional efficacy in the production operation. For this to be successful, many preconditions need to be put in place. SAP Director Bernd Leukert’s appearance at today’s opening ceremony has already most impressively pointed out that IT and mechanical engineering have to move more closely together in order to guide Industry 4.0 to success. He stressed that Industry 4.0 requires collaboration, integration and openness. This is also the position of the VDW, and has led to the approach that I should like to present to you today.

We are confident that the EMO Hannover will be helping to kick-start many future networking solutions. Because some of the more than 2,200 exhibitors from 45 different countries are already doing intensive works on this issue. We are not expecting, however, that the entire production world will have been networked for complete coverage in a Big Bang, but that this will be driven forward in a continuous process.

Digitalisation is not something fundamentally new in the field of production technology, certainly since the introduction of NC control. It enables workpieces to be programmed, for example, data to be acquired and read out. This has made innovations possible, like tele-maintenance and process monitoring, which nowadays we could no longer do without. In other respects, too, machine tools have already arrived in the digital or computer age. For quite a time now, it’s been possible to supply models of the machine on the basis of the design data from the CAD system. This enables the production process to be simulated in its entirety beforehand, and thus saves a lot of time and money during actual commissioning. These were already the initial approaches to what we nowadays call a digital twin.

Under the keyword of Industry 4.0, the task now is to network the entire production operation, indeed the entire value added chain. Industry 4.0 and the Internet of things (“Iot”) enable data to be acquired from the production line in real-time, a kind of digital shadow to be created and then meaningfully utilised, enabling new services and business models to be derived for optimising production operations with the aid of systematised analyses. This creates competitive advantages for the customers concerned, who on the basis of data can predictively plan their production operations, for example, organise an ideal schedule for their maintenance work, or implement paperless order processing. Solutions of this kind also create competitive advantages for the machinery manufacturer, if he is able to offer his customers intelligent solutions with added value.

So far, however, there has not been a harmonised, coherently coordinated solution with which the data from different machines can be read out with different control systems from many disparate generations and transferred to production control systems or the cloud in a standardised data format in order to evaluate them and utilise them for optimisation tasks. However, this is what more and more machine tool users from the automotive industry and its component suppliers expect. To use an image coined by a machinery user in the VDW’s Industry 4.0 Working Group: we need an “Industry 4.0 plug connector” enabling us to connect to any desired cloud machines in a standardised form, irrespective of the manufacturer or year of production involved.

Existing production systems are composed of hardware and software, manual workplaces plus innumerable other elements. They have grown organically over many years. There are hundreds of different machines and units, and an even greater number of components. Not least, there are some control systems in use that possess their own interfaces. And at every operator, the interfacing will differ in nuances or in their entirety, depending on the customer, vendor and plant structures involved. If we look at the entire sector in its global context, all the international customers with their systems and processes, the possible combinations are multiplied.

However, if Industry 4.0 is to trigger the anticipated boost to productivity, machines will have to work as smoothly as possible in optimised production processes. This will above all require data from the machines. These can provide information on the condition of a machine, but they can also create transparency as to what orders the machine concerned is currently working on and what orders have already been processed with what manufacturing times. These data are transferred to the process control software, which can be installed on an appropriately selected cloud platform. Connecting up the machines may prove to be a very elaborate process, requiring a description of the interface from the machinery manufacturer involved (which may be not so easy to obtain), and translation of the data tappable there into a standardised data format that is understood by the systems installed. A modification of this kind can be regarded as a minor development project. The solution may subsequently not work reliably, since it may not have been trialled in all situations.

Important aspects that likewise have to be taken into due account are data protection and cyber-security. A standard has to be created here of the kind that the computer industry has created with the USB connector. Here, too, the primary consideration is not the form of the connector, but the standardisation of the protocols that are exchanged through it.

**Standard for machinery interfacing**

This is why the VDW’s Executive Committee decided early this year to launch a joint initiative for the German machine tool industry. The aim is to develop a standard for linking a huge range of disparate machinery control systems to a shared interface (a connector), and create the requisite software. This will enable harmonised data structures to then be transferred directly to existing infrastructural and cloud systems. This produces a certain amount of homogenisation between the numerous production systems that have already mentioned and are currently in use at manufacturers and operators.

For the machinery manufacturers, too, this would be a significant easing of their workload, enabling them to shed tasks that although they urgently need to be completed are nonetheless outside a manufacture’s core remit and entail high costs. The standard being targeted thus frees the individual VDW member from time-consuming work on infrastructural issues. Not least, this creates an open system that offers an urgently needed degree of independence and flexibility. Unfortunately the most recent developments showcased here at the fair also show that in the case of control systems, particularly, the trend toward proprietary eco-systems is still ongoing. We intend to counteract this, and are therefore endeavouring to establish a development partnership with the control system manufacturers in particular, in order to render the VDW’s planned specification usable on the broadest possible scale.

**Initial steps**

Under the aegis of the VDW’S initiative, first of all the following aspects are to be implemented:

1. Joint formulation of an interface specification
2. Implementation of what is called a connector stack, which translates signals from different control system interfaces in accordance with OPC UA (Open Platform Communications Unified Architecture)
3. Implementation of a gateway that on the basis of the OPC UA data structure permits dependable interfacing with different EDP systems and clouds using a standard protocol

Why OPC UA? OPC-UA is a communication standard that is being adopted progressively more often worldwide. It defines requirements like secure access, authentication, bidirectional data traffic, and much more. OPC-UA specifies ***how*** communication is to be handled; the VDW’s initiative is tasked with defining ***what*** is to be communicated, specifically what cross-technology, cross-machine data have to be exchanged.

Here, we do not have to re-invent the wheel in its entirety. Thanks to a foresightful initiative of some members, the VDW had back in 2013 already begun drawing up what is called a Companion Specification, which since July of this year has been published at the standardisation organisation OPC Foundation. This means that directly after the fair we can begin straight away with the first sub-project, the joint expansion of this interface specification. Our **goal** is coherently harmonised networking of the production operation; the **vehicle** for this purpose is OPC-UA, and the **energy** that drives us forward is the jointly specified constant component of the data that we have to exchange for this purpose.

Whereas up to now attention has been focused mainly on the interior view of the machine, namely the interfacing between the control system and the operator interface, the new specification is now to be expanded to cover the exterior view, with the link to the MES (Manufacturing Execution System) and ERP (Enterprise Resource Planning) systems or to the cloud.

Results are already expected in the first quarter of 2018. The goal is to present a basic data record that can then be commented on within the framework of the customary standardisation procedures.

The interface specification describes data formats and semantics independently of the technology involved. No matter from what machine or via what control system the data are read out, they are always imaged in a harmonised data structure. Linkage to the control system interface concerned is provided through a connector. Since the specification of the OPC UA data record is publicly available, a simple configuration of different connectors can be provided for all kinds of control system. Third parties can use the OPC UA specification, thanks to its openness, and it can be adapted to suit older generations of machines and control systems.

This solution ensures a standardised data record from the control system is available for the machine’s user. This also applies for the manufacturer and for third parties, provided they are authorised. Data from different machines can then be uniformly evaluated, for example. Reading out the data does not impair the machine’s performative capabilities. The solution also ensures that it is impossible to execute interventions into the machine’s actual control system if they would be critical in terms of safety. Unfortunately, we are already seeing today that unqualified interventions are being made from outside in order to tap into data, even though this may entail very serious hazards for the operators and the plant concerned.

When the data are available in a harmonised format, the interface to the “rest of the world” still has to be defined. For this purpose, there are already standardised protocols in existence, resembling these we’re familiar with from transfer to an internet browser using HTTPS. Access to these data, however, has to be regulated; it requires authentication and access protection. Data may also have to be compressed and buffered beforehand, since very sizeable amounts of data may be too much for the networks concerned to handle. All these functions are handed by a gateway, which will be specified and implemented in a second phase of the project.

A third phase of the project, finally, involves testing the solutions created at various VDW members, plus final certification by the VDW.

In addition, we shall sounding out what vendors for infrastructure and cloud services are best suited for covering the demand from small and mid-tier machinery manufacturers. While the data interface constitutes the bottom end of networking, there has to be a maximally harmonised technological platform at the top end, for which each machinery manufacturer can in turn develop his own ingenious apps in order to generate an added value for his customers from the data. This task will in future form part of his core business. This means he can deploy his competence to full effect and stand out from his competitors.

By the project’s first milestone at the end of January 2018, the aim is for the requirements to have been specified, the basic specification programmed, and around 30 data records described. We need to be honest at this point. It takes time to form a consensus. The multifaceted needs of our members and their customers are too heterogeneous to be satisfied at a stroke with a fully comprehensive solution. The VDW is chairing the process. Substantively, moreover, it is involving the ISW, the Institute for Control Engineering of Machine Tools and Manufacturing Units at Stuttgart University. It has already established its credentials as a valuable partner, since in the past it had already assisted the VDW in drawing up the first OPC UA specification for machine tools.

**Core team represents firms with different technologies**

The project’s first phase is being handled by a core team from DMG Mori, Emag, Grob, Heller, Liebherr-Verzahntechnik, United Grinding, Trumpf and the VDW. They contribute human resources and/or money to the project. The firms represent a large bandwidth of technologies, but nonetheless represent only a section of the VDW’s overall membership, something we are fully aware of.

This is why through the VDW’S Executive we shall firstly be closely involved with the development work by setting up a steering committee. Secondly, we shall also be conducting regular dialogues with our members, so that they can likewise prepare themselves for the specification. The intention is furthermore to involve the control system manufacturers Beckhoff, Bosch Rexroth, Heidenhain and Siemens as partners right from the start. An initial coordinatory meeting will be held here at the EMO next Friday.

Examples of reciprocal machine interfacing can also be seen here at the EMO. In parallel to the work on our joint project, firms with pilot interfaces have started to run pilot interfaces in order to begun to reciprocally identify strengths and weaknesses of the implementation concerned. The firms involved are Axoom, DMG Mori, Grob, Heller, Hermle and United Grinding.

**Sectoral cooperation is the right way forward**

Ladies and gentlemen, with this cooperative endeavour, the machine tool industry and the VDW are breaking new ground. We are, of course, working together on quite a few issues using the traditional cross-company arrangements: for example, in shared research with public-sector support from the German Ministry of Economic Affairs or at the Energy-Efficiency Round Table with the customers of the automotive industry. In the case of Industry 4.0, however, the manufacturers have in many cases been working in parallel on their own solutions. It is becoming progressively clearer, though, that a lone wolf, even if he’s pre-eminent in his chosen sector, quickly comes up against his limitations. Without a generally valid standard, the solutions of Industry 4.0 will also find it difficult to find market acceptance and thus rapidly increasing dissemination.

We are of the firm conviction that it is unequivocally a good idea to throw overboard any reservations concerning cooperative arrangements, to embrace the principle of sharing knowledge, to benefit from it, and to work together for a joint solution. Many companies have already taken this on board, and are joining forces. New alliances are being announced almost every week.

We must also realise that we aren’t going to be presenting a full-coverage standard immediately. It’s much more important to swiftly arrive at a consensus regarding as broad a specificational approach as possible, and respond with rapid efficacy to continually changing requirements. This approach will, in the estimation of everyone involved, move the entire sector forward, and assure the individual of a secure foundation on which he can progress his business distinctively with all its unique selling points.

Many thanks for your attention!