

connecting the world  
of machinery

# the universal machine technology interface

Our promise: Make connectivity between machinery and software easy, secure and seamless – to help customers exploit added value from data.

**Connectivity is key** for all machinery in the 21st century. It means getting data in and out of devices and software systems – preferably via open, standardized interfaces.

**umati is a global community** whose purpose is to introduce a common interface concept based on OPC UA to the market and to foster the acceptance and implementation of these standards. umati started as an alliance of companies from the machine building industries.

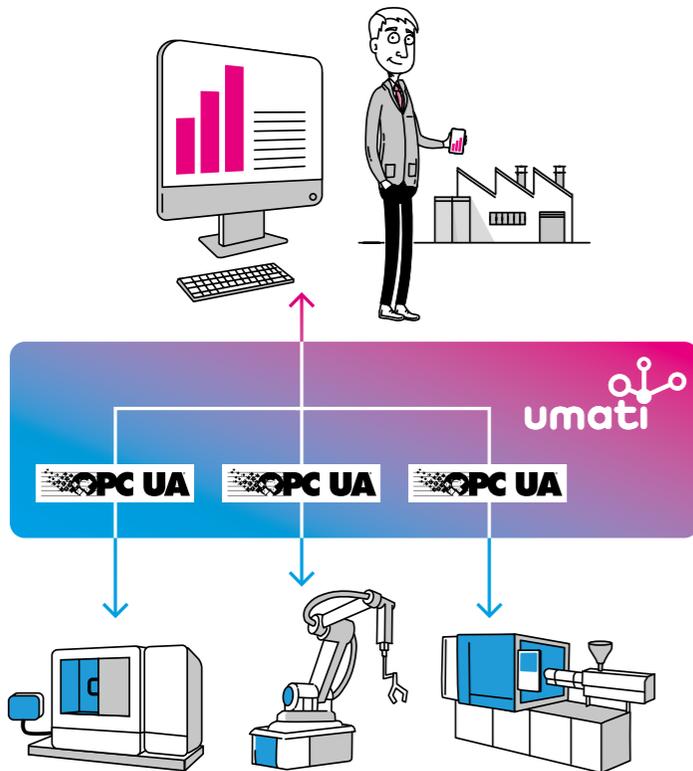
**Our mission** is to provide and demonstrate the common user benefit of true "plug and play" functionality in the field of machinery.

umati relies on **OPC UA as the global interoperability standard**. Standardization work takes place in multiple "Joint Working Groups" with various sectors of the machine building industries and the OPC Foundation. This guarantees that the individual needs of different technologies are taken into consideration and ensures maximum transparency and the support of a strong global community.

**OPC UA and the OPC Foundation:**

- provide a **framework for standardized communication** (**HOW** to communicate)
- **support standardization** of specific needs for various technologies (**WHAT** is to be communicated)
- make the standards **available worldwide with no license fee**.

**How umati works:** several machines with OPC UA servers using Companion Specifications endorsed by umati, implemented according to umati guidelines, are connected to one IT system with an OPC UA client.



# data flow as a user experience

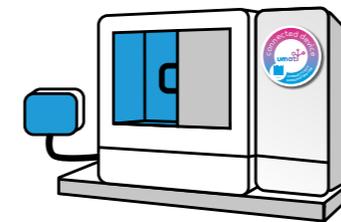
The umati live demonstration proves that connectivity across different machine technologies is a promise come true.

**The umati live demonstration:**

- provides a **"user experience"** for data flow
- has an **open, common set-up** to which participants can connect
- realizes **"criss-cross connectivity"** between machinery and multiple software applications even under trade show conditions

**The umati community benefits from:**

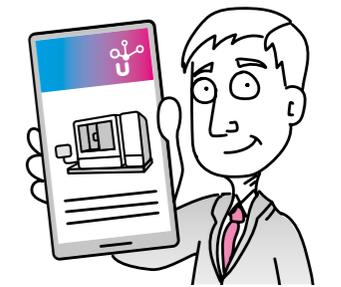
-  a common infrastructure for **secure connection** during a trade show and beyond
-  a vendor-independent **dashboard** to display data for a "machine status monitoring" use case
-  **guidelines** on getting connected – also applicable for testing and plug fests
-  comprehensive **marketing** (including design and templates) for all partners to increase market impact for customers and suppliers



1. Every connected machine features a umati sticker.



2. Scan the QR code or type the shortcut link to access the umati dashboard and see the live data stream from the machine.

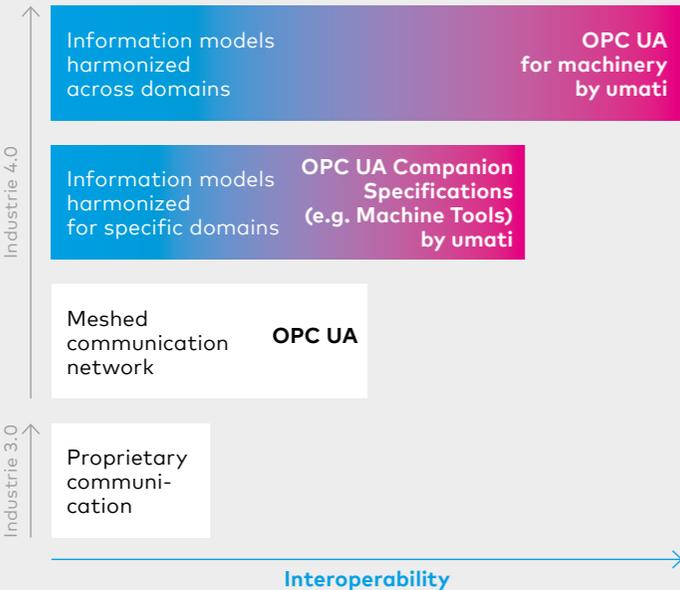


3. Get an overview of all the connected machines at <https://umati.app>

How the umati live demonstration works:

# OPC 40001 UA for Machinery

The **OPC 40001** series is applicable for the entire machine building industry.



The highest level of interoperability is achieved through cross-domain information models. One such information model is the OPC UA Companion Specification OPC UA for Machinery.

It contains various building blocks for machinery that allow use cases across different types of machines and machine components. These building blocks can either be used in other companion specifications or directly in an information model.

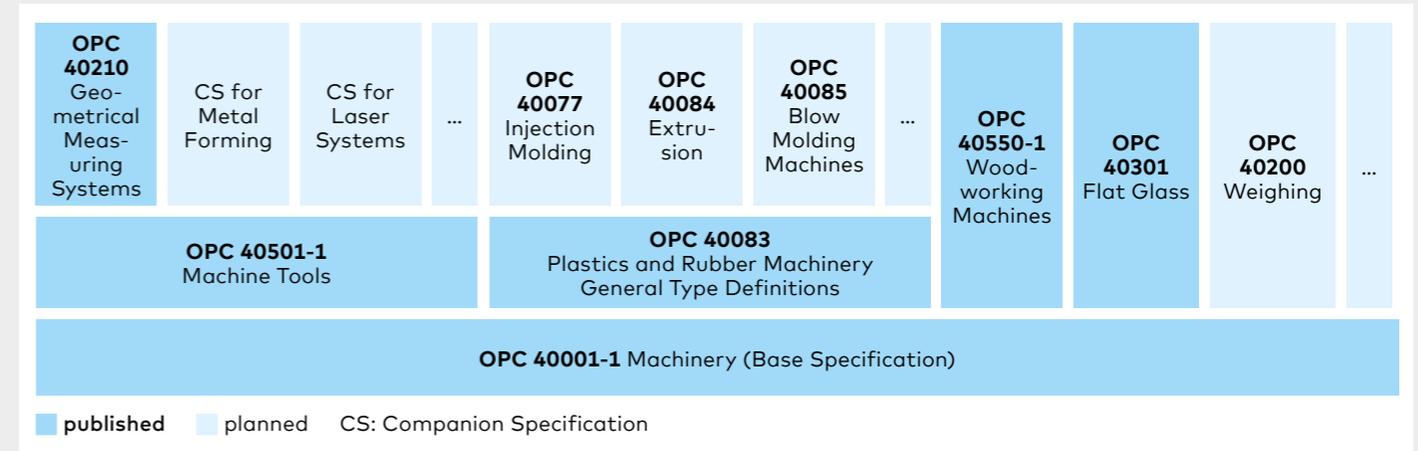
The first version was published in 09/2020 and was one of the first OPC UA companion specifications to be fully endorsed by the umati community. Recently, the version was updated to address additional use cases and will continue to be updated in the future.

The implemented use cases for the identification of machines and components form the basis for the "Plug & Work" target image, as aggregates from a wide range of industries can be identified in the same way and enable machine- and manufacturer-independent recognition between diverse network participants.

### Part 1 covers these use cases:

- Machine Identification and Nameplate**
- Finding all Machines in a Server**
- Component Identification and Nameplate**
- Finding all Components of a Machine**
- Machinery State**
- Currently ongoing: Job Management and Process Values**

### Harmonized Interfaces based on OPC UA for Machinery



The "Machinery State" module paves the way for various use cases like Machine Monitoring and KPI Calculations. Machine availability can easily be determined, resulting in high added value – especially in production where machines from different industries are used.

The first practical implementation is shown in the umati showcase with the umati.app. To see how this is done, visit <https://showcase.umati.org>

OPC 40001-1 / VDMA 40001-1 was developed under the umbrella of VDMA, the Mechanical Engineering Industry Association, in a Joint Working Group with the OPC Foundation. It followed an initiative by a number of technology-specific first-mover standardization groups from different sectors of the machine building industries.



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The specification is available for free at the following repository: [umati.org/ua4m](https://umati.org/ua4m)



# OPC 40010 UA for Robotics

The **OPC 40010** series provides standardized OPC UA information models for industrial robots.

The VDMA OPC Robotics Initiative was established in 2017 to bring together robot manufacturers with the aim of discussing and developing a common, usable, future-proof interface for industrial robots. OPC UA was identified as the obvious choice for the creation of such a standard since it provides feature-rich standardized mechanisms to describe vendor-independent interfaces supported by a strong information model.

As a joint working group, the initiative is organized by VDMA Robotics + Automation and supported by the OPC Foundation. Over the last years, the core working group of this initiative, a group of experts from 14 companies, have developed Part 1 of the VDMA OPC Robotics Companion Specification. Part 1 is the first step in the gradual design-in towards a fully connected Industrial Internet of Things (IIoT). It enables vertical provisioning of information from the lower (Sensor/ Actuator) to the higher (Control, SCADA, MES, Cloud) levels of the automation pyramid.

The **OPC Robotics Information Model** can be used to describe all current and future robotics systems:

- **industrial robots**
- **mobile robots**
- **additional axes**
- **control units**
- **peripheral devices**, which do not have their own OPC UA server

### Part 1 covers these use cases:

- **Structuring of an integrated robot system** into its constituent components
- **Vendor-independent access** to asset information of all integrated robot systems and their components
- **Representation of motion devices** containing one or more axes.
- **Representation of controllers** including their software and task controls.
- **Representation of common safety states** of a motion device system.
- **Common condition monitoring parameters** of the components of an integrated robot system
- **Identification of anomalies** based on the condition monitoring parameters

### Ongoing work to extend Part 1 with:

- addIns for **remote operation** i.e. loading, unloading, starting, stopping programs.
- addIns to **provide the single point of control mechanism**.
- a **dialog mechanism** to handle system notifications that need to be accepted by the operator.

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The specification is available for free here:  
[umati.org/ua4robotics](https://umati.org/ua4robotics)

# OPC 40100 UA for Machine Vision

The **OPC 40100** series provides standardized OPC UA information models for Machine Vision systems

The VDMA OPC Machine Vision Initiative, launched in January 2016, released Part 1 of the OPC Machine Vision Companion Specification in 2019, and Part 2 will be released in 2022. As a joint working group, the initiative is organized by VDMA Robotics + Automation and supported by the OPC Foundation.

The core working group that is developing the specification consists of 17 experts from 10 companies. Due to the enormous variations in machine vision systems all over the world, it is very hard to generalize vision system data. Therefore Part 1 focuses on data management methods without restricting the content of the same. Behavior control and observation of a vision system are the key objectives solved in Part 1. The generic state machine approach introduced in Part 1 of the specification enables monitoring and control of system behavior.

The initiative is currently concluding the development of Part 2 of the specification which aims to define a generic structure and the components of a machine vision system. It describes the relationship between the components and their condition monitoring parameters.

### Part 1 describes the functionality of a machine vision system and covers these use cases:

- **Configuration Management**
- **Recipe Management**
- **Result Management**
- **Safety State Management**
- **Machine vision system state with State Machines**

### Part 2 describes the structure of a machine vision system, its components and the relationships between them and covers these use cases:

- **Identification of the system and its components**
- **Condition Monitoring**
- **Relationship between components**
- **Future proof information model** to allow integration of future detailed companion specifications for the components of a machine vision system

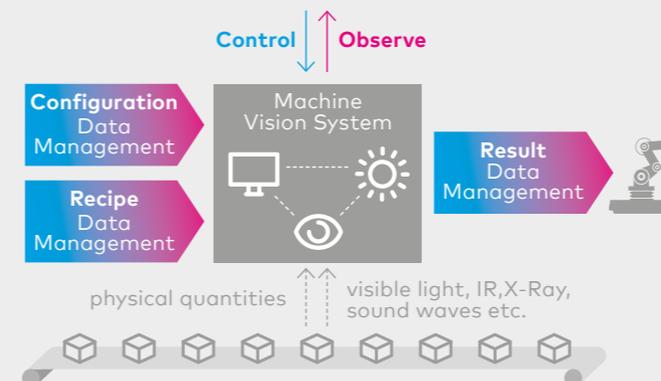
The members of the initiative are:

- |                      |                    |
|----------------------|--------------------|
| • <b>Asentics</b>    | • <b>MVTec</b>     |
| • <b>Basler</b>      | • <b>PeerGroup</b> |
| • <b>Bosch</b>       | • <b>SAC</b>       |
| • <b>EVT</b>         | • <b>Scanware</b>  |
| • <b>Isra Vision</b> | • <b>Stemmer</b>   |
| • <b>Kuka</b>        | • <b>Vitronic</b>  |

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The specification is available for free here:  
[umati.org/ua4mv](https://umati.org/ua4mv)



# OPC 40210 UA for Geometrical Measuring Systems

The **OPC 40210** provides information for data transfer to and from geometrical measuring systems.

For geometrical measuring systems (GMS), such as coordinate measuring systems, form and surface measuring machines as well as multi-point measuring machines, a VDMA working group is defining OPC 40210 UA for Geometrical Measuring Systems in coordination with the OPC Foundation. The aim is to provide information for data transfer to and from geometrical measuring systems via a uniform interface that can be used by digital data processing systems such as MES systems.

For geometrical measurement technology, as the "information supplier" on the quality of production, digitalization has a special significance in the interaction with other production systems. This interaction, which

is also referred to as interoperability of machines and systems, enables companies to participate in new digital structures and is a basic prerequisite for new digital business models. Through interoperable interfaces, machines from different manufacturers can be efficiently integrated into existing and new production landscapes.

The Companion Specification considers the following use cases:

1. **static machine data** (identification of the GMS)
2. **dynamic machine data** (current state/status of the GMS)
3. **job management** (monitoring of measurement routines)
4. **parts data management** (identification of parts and related information)
5. **measurement results** (management of the provision of measurement results)

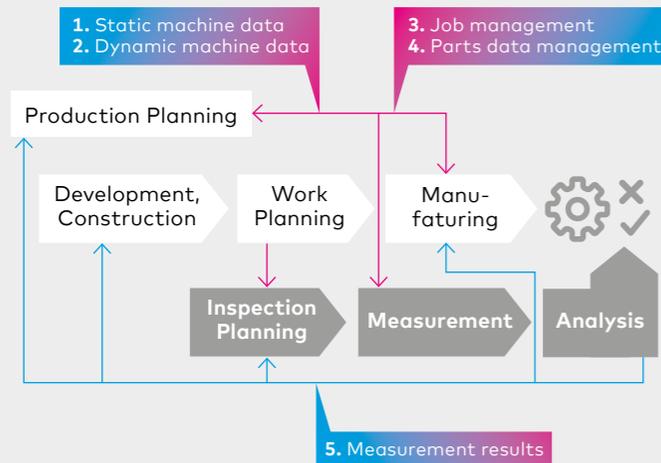
The Companion Specification was jointly developed by:

- Hexagon Manufacturing Intelligence
- Jenoptik
- Mahr
- MARPOSS
- Mitutoyo
- OGP Messtechnik
- Wenzel Metrology
- ZEISS Industrial Quality Solutions

The Companion Specification developed by the industry will be presented at CONTROL 2022 where its practical applicability will be demonstrated on a dashboard. This dashboard (**umati.app**) is provided by the umati community, which promotes the dissemination and use of open interface standards based on OPC UA.

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The specification is available for free here:  
[umati.org/ua4gms](https://umati.org/ua4gms)



# OPC 40451 UA for Industrial Joining Technologies

The **OPC 40451** for Industrial Joining Technologies is an initiative to create common OPC UA interface for joining technologies.

The VDMA Industrial Joining Technologies initiative, launched in May 2019, released Part 1 of the OPC 40451-1 Tightening Companion Specification in 2021, and Part 2 will be released in 2022/2023. As a joint working group, the initiative is organized by VDMA Integrated Assembly Solutions and supported by the OPC Foundation.

The aim of the initiative is to create standard interfaces for joining technologies such as Tightening, Riveting, Gluing, Pressing etc. The first release of the initiative was to cover the specific Tightening use cases along with common elements at the joining level.

The core working group that is developing the specification consists of 15+ experts from 9 companies.

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The specification is available for free here:  
[umati.org/ua4ijt](https://umati.org/ua4ijt)



The following are the **use cases** covered in Release 1, published in October 2021:

## Asset Management

- Overview and identification of the asset

## Result Management

- Standard definition of Result which is common for various joining technologies.
- Tightening Result containing Steps, Traces and Errors.
- Standard interface to access Results using Event, Methods, AddressSpace.

## Basic Events

- Generic event with customized message and Result event with payload.

## Upcoming Releases:

- Create a joining specification to harmonize various joining technologies.
- Cover additional use cases such as
  - Consolidated Result
  - Harmonization of Asset and Result models
  - Comprehensive Event Model
  - Joints
  - Future-proof information model
  - Program, Process, Parts
  - Integration of harmonized location model
  - Future-proof information model through use of flexible modeling approach with required semantics and rules.

The members of the initiative are:

- Atlas Copco
- Cleco
- CSP
- Deprag
- Desoutter
- Rexroth
- SCS Concept Group
- Weber
- Xitaso

# OPC 40501 UA for Machine Tools

The **OPC 40501** series addresses use cases and parameters specifically for machine tools.

The aim is to create a common interface among machine tools of different technologies, manufacturers and model series.

The first part of the OPC UA Companion Specification for Machine Tools aims to provide the basics for such an interface. These allow for monitoring the machine tool and providing an overview of the jobs on it. Most of this information is not specific to a particular technology. The OPC UA for Machine Tools interface facilitates the exchange of information between a machine tool and software systems like MES, SCADA, ERP or data analytics systems.

The Machine Tool Specification was recently updated with Use Cases provided by OPC UA for Machinery, especially the Machine States Use Cases. They serve as the basis for further KPI Monitoring facets to enable calculations based on ISO 22400 KPI definitions.

umati provides resources on how to implement UA4MT uniformly at [umati.org/dev](https://umati.org/dev)

**OPC 40501-1** and **VDMA 40501-1** was initiated by VDW, the German Machine Tool Builders' Association. It was created by a **Joint Working Group** between **VDW** and the **OPC Foundation**, comprising over 90 companies and almost 200 participants from all around the world.

## Part 1 covers these use cases:

	Identify machines of <b>different manufacturers</b>
	Overview of whether <b>production is running</b>
	Overview of <b>parts</b> in a job
	Overview of <b>runtimes</b> for a job
	Overview of <b>machine tool state</b>
	Overview of upcoming <b>manual activities</b>
	Overview of <b>errors and warnings</b>
	Providing information for <b>KPI calculations</b>
	Providing an overview of <b>tool data</b>
	Providing <b>OPC UA for Machinery Use Cases</b>

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The specification is available for free at the following repository: [umati.org/ua4mt](https://umati.org/ua4mt)



# OPC 40701 UA for Surface Technology

The **OPC 40701** is an initiative to create common OPC UA interfaces for surface technology machinery.

The aim of the initiative is to create common OPC UA interfaces for surface technology machinery such as

- **paint application technology**
- **shot blasting technology**
- **plasma surface treatment technology**
- **cleaning and pretreatment technology**

Current activities focus on the interface of material supply systems for coating material. The use-cases considered cover the provision of raw data of

- **all quality-relevant parameters with time stamp to higher-level systems**
- **all process-relevant parameters with time stamp to other components/machines**

The information model aims to provide the basis for detailed monitoring of the material supply system and its components. The model defines parameters for all relevant system components including pumps, tanks, valves, pipelines, filters and measuring devices for monitoring physical quantities such as temperature, pressure, flow, etc.

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On the basis of the information model developed for material supply systems, the OPC UA surface technology community teamed up with umati for demonstration of a complete paint application plant consisting of

- **pretreatment plant**
- **material supply system**
- **dosing system**
- **application system**
- **conveyor**
- **spray booth**
- **dryer**

The paint application plant model has been developed jointly by the **companies**

- **AFOTEK Anlagen für Oberflächentechnik GmbH**
- **b+m surface systems GmbH**
- **Dürr Systems AG**
- **J. Wagner GmbH**
- **Konzeptpark GmbH**
- **WIWA Wilhelm Wagner GmbH & Co. KG**



The umati implementation is a prototype tested in parallel to the development of the information model by the community. The umati demonstrator infrastructure is used to display the current state of work.

# a network of strong partners



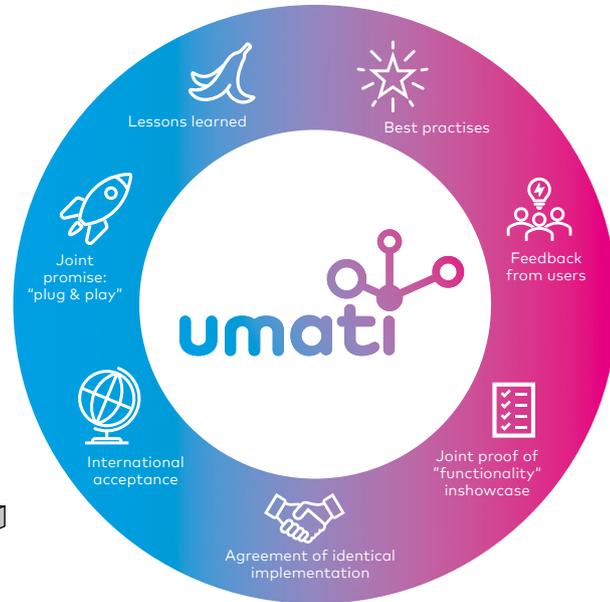
## umati partners:

- advertize the connectivity of their products through the **umati logo**
- have **easier access to their customers**
- benefit from **market stimulation** through strong marketing with high visibility
- demonstrate the **"plug and play"** user experience e.g. by taking part in demonstrations at trade fairs
- are part of a **global community** – for the industry by the industry
- have access to **exclusive** information and tools

The number of umati partners is growing continuously. To see who has already endorsed umati, visit [www.umati.org/partners](http://www.umati.org/partners)

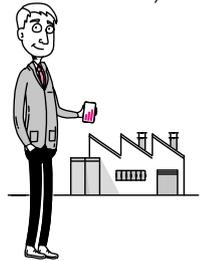
## Machine builders

Associations, working groups



## Users

Various sectors, multiple machinery



umati brings together machine builders, software producers and users in a strong community. They share their experience to benefit from identical implementation of OPC UA standards.

umati is operated by



VDMA – Mechanical Engineering Industry Association  
[www.vdma.org](http://www.vdma.org)



VDW – German Machine Tool Builders' Association  
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