PA-DIM®

ACHEMA2024
World Forum and
Leading Show for the Process Industries

Process Automation – Device Information Model (PA-DIM)

Version V01 // June 2024

Technical Status – Demonstrators – Solutions at Achema 2024

PA-DIM @ Achema
Frankfurt am Main, Germany
June 10 – 14, 2024

WELCOME

ABB PA-DIM®

Frank Fengler, ABB

WELCOME

PA-DIM is a groundbreaking specification that revolutionizes interoperability with standardized device parameters. Whether you're a manufacturer, a system integrator, or an end user, PA-DIM empowers you to unlock the full potential of your field devices.

PA-DIM aims to replicate field devices across hosts, cloud platforms, and analytic applications using a common information model. By doing so, it maximizes the value of data from diverse field devices—regardless of their types, brands, or communication protocols.

To achieve this ambitious goal, collaboration is key. All organizations serving the process industry—both hosts and devices—must come together. They need to agree on critical parameters and create a standardized framework that's machine-readable and universally understood. PA-DIM aligns with existing standards, such as OPC UA device specifications and FDI (Field Device Integration), to ensure seamless interoperability.

PA-DIM didn't emerge overnight; it's the result of years of concerted effort by industry leaders. FieldComm Group, OPC Foundation and NAMUR started the collaboration – today it's co-owned in addition by ISA100, ODVA, PNO, VDMA and ZVEI.

NAMUR leverages their expertise to serve as the host organization for NOA (NAMUR Open Architecture) and PA-DIM is the current implementation for the NOA Information Model. Existing standards, like the common data dictionary (IEC 61987 CDD), are reused to maintain consistency. PA-DIM aligns its data model specification with OPC UA data structures. OPC UA serves as the primary IIoT (Industrial Internet of Things) protocol, ensuring widespread adoption. Additionally, we're developing model support for vendors to include closed, proprietary data and creating mapping tools for other common protocols.

Join the PA-DIM Revolution! PA-DIM isn't just an acronym; it's a game-changer. As we move forward, let's embrace this standardized approach to process automation devices. Together, we'll enhance efficiency, reduce integration headaches, and pave the way for a more connected industrial landscape.

Welcome to PA-DIM—where data speaks a universal language!

Regards,

Frank Fengler
Head of Cyber Security & Connectivity for
Measurement & Analytics, ABB
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CONTENTS

OVERVIEW

Overview of the PA-DIM (Process Automation Device Information Model)

PA-DIM is a collaborative effort between FDT Group, FieldComm Group, ISA100, NAMUR, ODVA, OPC Foundation, PROFIBUS & PROFINET International, VDMA and ZVEI

This specification is co-owned by the associations:

It serves as a common language for describing device data, regardless of the protocol, type of device, or manufacturer. Here are the key points about PA-DIM:

1. PURPOSE AND SCOPE:

- PA-DIM defines the OPC UA Information Model to represent and access Process Automation Devices.
- It provides a structured hierarchy for standardized data access for devices, ensuring consistency across different devices and protocols.
- The scope of the joint working group is to enhance the OPC UA for Devices (DI) companion specification1.

2. SEMANTIC IDENTIFICATION:

- One of the primary benefits of PA-DIM is its ability to map protocol-specific parameters to globally standardized terms.
- PA-DIM is a **manufacturer-independent Information Model** that defines a structured hierarchy for data access.
- Devices (assets) have a set of signals (functions), such as process variables, which are based on the **OPC UA for Devices (DI).**
- PA-DIM reuses interfaces like **IVendor and ITag Nameplate,** as well as **IDeviceHealth** from the DI model.
- Additionally, PA-DIM introduces the **IAdministration** and **ISignalSet** interfaces, making it reusable by other Information Models.
- All parameters are defined in **IEC 61987 CDD** with a **Semantic ID (IRDI),** ensuring easy reuse across different software tools and protocols.

3. SIGNAL VARIABLES AND TYPES:

- The **SignalVariableType** is an extension of **OPC UA Part 8: Data Access** and describes both analog and discrete variables, including their simulation.
- This variable can be used at any object, even from other Information Models.
- The **PA-DIM SignalType Object** builds upon the SignalVariableType and adds specific methods like **ZeroPointAdjustment** or **AutoAdjustPositioner.**

4. SIMPLIFIED DATA ACCESS:

- PA-DIM provides a **manufacturer-independent, sorted,** and **structured hierarchy** for accessing device data.
- Prioritized mapping ensures consistency across different devices and protocols.

AVAILABILITY

Information / Download

The PA-DIM specification is co-owned by multiple associations. All of them agreed on the same content but published the specification under their own IPR with different names.

THE CONTENTS OF THESE SPECIFICATIONS IS IDENTICAL:

- FDT 23-0001: 2023-10-27 (1.01.0)
- FCG TS10098: 2023-10-27 (1.01.0)
- ODVA PUB00351: 2023-10-27 (1.01.0)
- OPC 30081: 2023-10-27 (1.01.0)
- PNO PI 50.002: 2023-10-27 (1.01.0)

DOWNLOAD THE SPECIFICATION HERE:

www.fdtgroup.org/pa-dim
www.fieldcommgroup.org/pa-dim
www.odva.org/pa-dim
www.opcfoundation.org/pa-dim
www.profibus.com/pa-dim

PA-DIM™ 1.0 – Started with Process Instrumentation

OVERVIEW:

- **PA-DIM™ 1.0** focuses on process instrumentation devices, including pressure (P), differential pressure (DP), temperature (T), flow (F), level (L), and valve postioner.
- The primary goal is to standardize a basic set of device information for various purposes.

KEY FEATURES:

- **Identification:** PA-DIM™ provides consistent methods for identifying devices across different protocols.
- **Diagnosis:** It includes diagnostic information for preventive maintenance.
- **Process Variables:** Standardized access to process variables.
- **Core Parameters:** Basic parameters relevant to process instrumentation.
- **NAMUR Open Architecture Requirements:** PA-DIM aligns with NAMUR recommendations for open architecture.

TIMELINE:

- Started in 2017: The collaborative effort began.
- Release in 2020: The first version of PA-DIM was officially released.

PARAMETER STANDARDIZATION:

- PA-DIM defines approximately 50 standardized parameters relevant to process instrumentation devices.

MILESTONES

PA-DIM™ 1.1 – Added Process Analyzers

HIGH-LEVEL GOALS:

- **Process Analyzers:** Focuses on collecting standardized “vital” data for preventive maintenance.
- **Secure Data Transmission:** Ensures secure data transmission using a standardized communication system.

USE CASES AND REQUIREMENTS:

- **NAMUR/ZVEI AK Process Analyser:**
  - **Phase 1 (green bullets in Figure 1):** Covers TOC (Total Organic Carbon), CGA (Common Gas Analyzer), and pH measurements (Part of PA-DIM 1.1).
  - **Next Phase (blue bullets in Figure 1):** Expands to include PGC (Process Gas Chromatographs), gas detectors, and spectrometers.
- GeneralDeviceConditionSet including service performance parameters e.g., ResidualLife, OperationDuration, PowerOnDuration, OperationCycleCounter

PARAMETER STANDARDIZATION:

- PA-DIM™ 1.1 introduces approximately **80 additional parameters** specifically for process analyzers.

TIMELINE:

- **Started in 2020:** Development of PA-DIM™ 1.1.
- **Release in 2023:** The updated version became available.

CHARACTERISATION OF PROCESS ANALYSER

The area of process analysers is divided into a range of sub-areas.
The names of the sub-areas are shown in Figure 1.
All definitions of parameter are within https://cdd.iec.ch

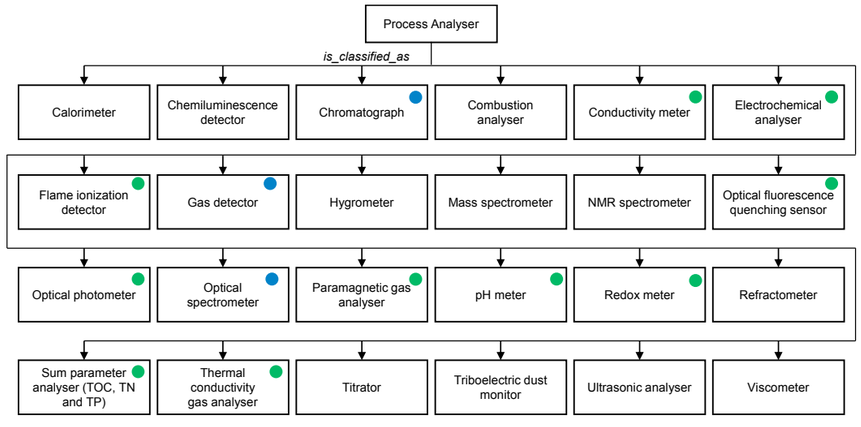


Figure 1 – Characterization of process analyser IEC 61987-41 ED1; green bullets phase 1, blue bullets next phase

FUTURE

PA-DIM™ – Future versions

Criteria for achieving NOA (Network Oriented Architecture) conformance using the PA-DIM (Process Automation Device Information Model) standards and interfaces, along with other relevant specifications for OPC UA (Open Platform Communications Unified Architecture):

1. USE EXISTING PARAMETERS/TYPES FROM PA-DIM:

- Leverage the existing parameter types defined in the PA-DIM model.
- These standardized parameters ensure consistency and interoperability across different devices and protocols.

2. PROVIDE NEW PARAMETERS WITH DEFINITIONS IN IEC CDD (IRDI):

- Introduce new parameters specific to your use case or device type.
- Define these parameters in the IEC CDD (International Electrotechnical Commission Common Data Dictionary) using unique IRDIs (International Registration Data Identifiers).

3. PA-DIM INTERFACES:

- Utilize the following PA-DIM interfaces:
  - **VendorNameplate Interface:** Provides consistent vendor-related information.
  - **TagNameplate Interface:** Focuses on tag-related details for identification.
  - **DeviceHealth Interface:** Includes diagnostic information for device health monitoring.
  - **AdministrationType Interface:** Handles administrative aspects of the device.
  - **SignalSet Interface:** Defines the set of signals (process variables) associated with the device.

4. GRANULAR CONFORMANCE UNITS & FACETS:

- Ensure that your implementation adheres to granular conformance units and facets as specified on profiles.opcfoundation.org.
- These conformance units and facets define the specific features and capabilities supported by your device.

5. GENERAL COMPANION SPEC TOPICS:

- Fulfill important topics outlined in the general Companion Specification.
- These topics may cover security, communication protocols, and interoperability guidelines.

6. UA COMPANION SPECIFICATIONS TEMPLATE:

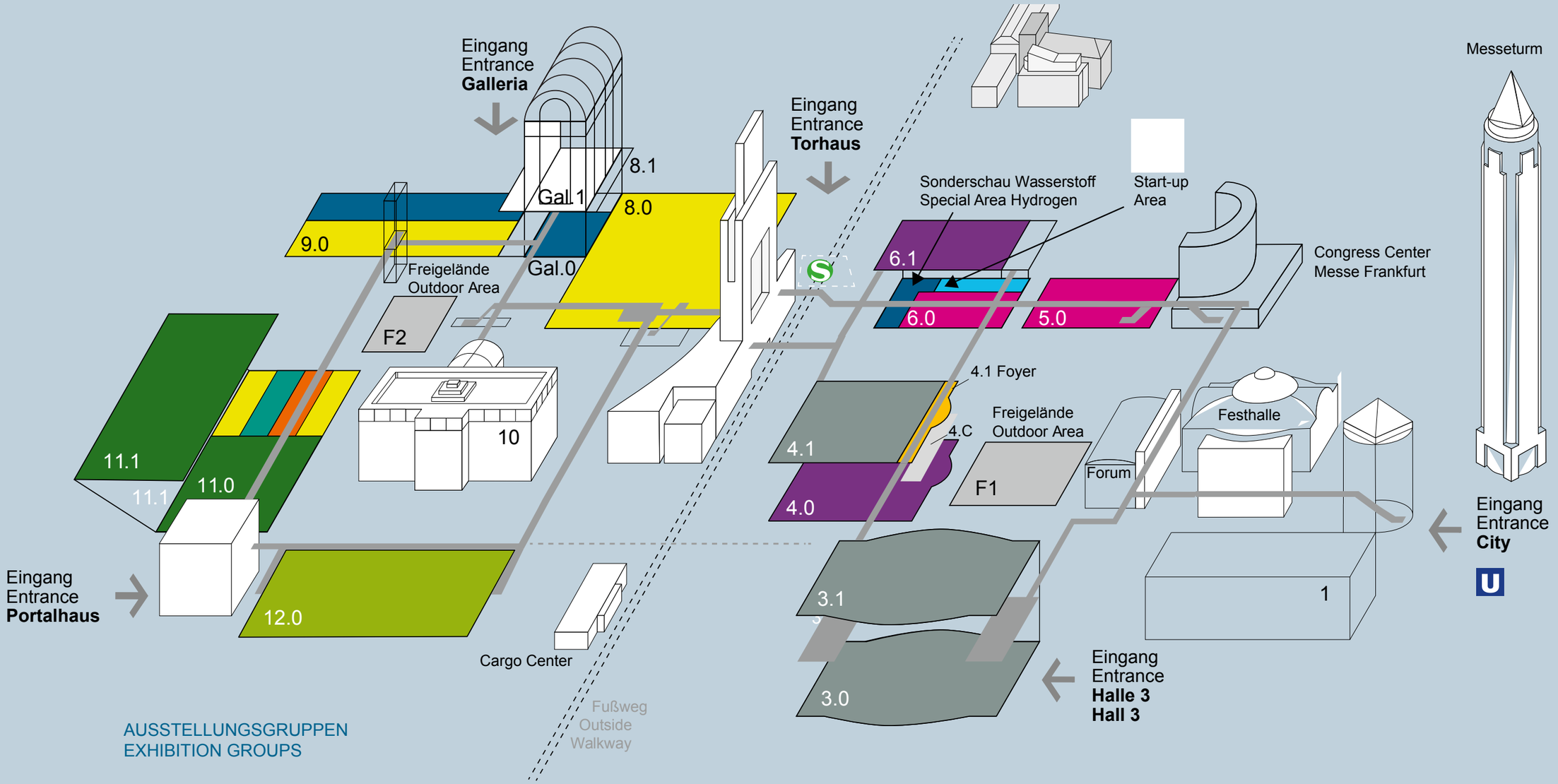
- Use the latest version of the UA Companion Specifications Template.
- Follow template’s guidelines for structuring and documenting your device information model.

7. FULFILL UA MODELLING BEST PRACTICES:

- Adhere to OPC UA modelling best practices.
- Ensure consistency, clarity, and semantic correctness in your model.

By following these criteria, you can achieve NOA conformance while leveraging the power of PA-DIM and other relevant standards.

ACHEMA 2024 MAP EXHIBITS GUIDE FOR PA-DIM DEMONSTRATORS



FieldComm Group™ — Connecting the World of Process Automation
HALL 11.0, C14

ODVA™
HALL 11.0, A3

OPC FOUNDATION
HALL 11.0, C3

PI PROFIBUS · PROFINET
HALL 11.0, C4

FieldComm Group™
Connecting the World of Process Automation

Visit FieldComm Group at ACHEMA in Hall 11.0, Stand C14

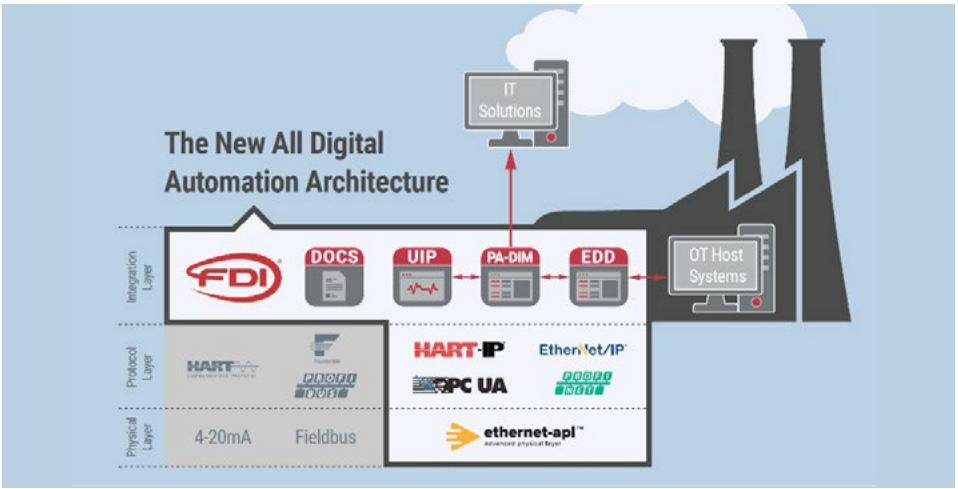
FieldComm Group is a co-owner of the PA-DIM specification and host of the PA-DIM working group as well as an owner of the Field Device Integration (FDI) specification and technology. Each of these technologies uniquely provide value and aid automation facilities in their quest for digitalization. PA-DIM provides an automation protocol neutral and semantically standardized way to represent device information to OPC UA enabled clients from simple dashboards to full featured engineering systems. When coupled with FDI technology and developer tools users can be assured of information integrity between IT -centric systems, and plant floor OT systems including DCS hosts and asset managers. As shown, PA-DIM, FDI, Ethernet-APL and an IP enabled automation protocol form the foundation of the new all-digital automation architecture.

FieldComm Group's working group model assures that suppliers, end users, and standards organization can all equally contribute requirements to furthering the development of PA-DIM technology specifications. Contact FieldComm Group to learn more about PA-DIM.

For further information, representatives from FCG are available for inquiries.

CONTACT:
Paul Sereiko
psereiko@fieldcommgroup.org

FCG – User Association of Automation Technology in Process Industries



TED. MASTERS,
President and CEO
FieldComm Group

"PA-DIM is a key technology across all of industrial automation to unlock the power of data. By creating a broad scale common data model independent of supplier or transport method, the PA-DIM information model will be the future of the digitalization of the automation industry and a key enabler of creating value from the data these devices can provide. We are excited to see the adoption of all major standard organizations and users supporting this technology for both the installed base as well as future generation products!"

Visit ODVA at ACHEMA in Hall 11.0, Stand A3 to learn about PA-DIM® in Process Automation

ODVA is collaborating with major standards development and end user organizations serving the process automation industry regarding the Process Automation Device Information Model (PA-DIM) specification. ODVA is pleased to support PA-DIM to enable greater information standardization within process automation, which will allow for more seamless data analysis and prognostics. End users of EtherNet/IP networks will be able to leverage PA-DIM to move data from the field to the cloud and to realize improved data standardization across networks.

PA-DIM is a specification that allows for protocol agnostic communication of common process automation instrument parameters, including semantic IDs as defined by IEC 61987, using OPC UA information modeling techniques. Eliminating automation protocol dependencies simplifies the integration of IT and OT systems. Including semantic device information enables unambiguous machine-to-machine (M2M) communication. Fieldbus-specific implementations are converted into the address space of the PA-DIM Information Model.

Products using PA-DIM can easily support the NAMUR Open Architecture (NOA) use cases including automated as built, unique identification, device dimensioning, multivariable possibility check, read multivariable process values, device life cycle backup, health monitoring, and diagnosis. Visit the ODVA booth at ACHEMA in Hall 11.0, Stand A3 to see a device from ODVA Member Endress+Hauser that supports EtherNet/IP and includes a Field Device Integration (FDI) Package with PA-DIM. To learn more, visit www.odva.org/pa-dim.

For further information, representatives from ODVA are available for inquiries.

Visit ODVA online at
odva.org

DR. AL BEYDOUN,
ODVA President and Executive Director

“ODVA is pleased to support the PA-DIM profile to enable greater information standardization within process automation, which will allow for more seamless data analysis and prognostics. End users of EtherNet/IP networks will be able to leverage PA-DIM to move data from the field to the cloud and to realize improved data standardization across networks.”

PA-DIM & OPC UA & Ethernet-APL at the Achema 2024 @ OPCF booth Hall 11.0 C3

The OPC Foundation strongly believes that the combination of enabling technologies, merged as a solution “PA-DIM via OPC UA over APL”, will be a key technology for coming decades.

- PA-DIM is key to replicating a field device within hosts, cloud, and analytic applications in a common information model, inclusive of user (NAMUR) core parameters to maximize the value of data from field devices of all types, brands and protocols. PA-DIM is an important information model – one of over 150+ domain-specific OPC UA models.
- The key to APL technology is its ability to extend capabilities and simplify applications for end users by scaling an Ethernet-based IT infrastructure from edge to sensor: APL is a perfect enabler for extending OPC UA to the field level.
- OPC UA: Compared to other established fieldbus solutions only OPC UA technology scales from the sensor to the cloud and back, transporting standardized information models via secure communications across plant networks in a way that streamlines the deployment and operation of industrial automation implementations.

INDUSTRY DEMONSTRATORS AT OPC FOUNDATION BOOTH: HALL 11.0 C3

During Achema, the OPC Foundation is showing three major industry realizations at the OPC booth:

1. A **SAMSON** Field device publishing OPC UA PubSub (UDP) over Ethernet-APL
2. The **PEPPERL-FUCHS** Ethernet-APL Power Switch
3. A **BECKHOFF** embedded PLC, acting for brownfield scenarios, collecting **HART** data via Ethernet APL from the south port and exposing this information via an OPC UA server supporting the **NOA** model, including PA-DIM

In addition, the OPC Foundation shows demonstrations about:

- **Digital Product Passport, Product Carbon Footprint, and the Battery Passport,** each powered by OPC UA
- **AAS powered by OPC UA**
- Cloud Interoperability: Pushing standardized data to **Alibaba-Cloud, AWS, Huawei, Microsoft and SAP**
- Field Interoperability: Standardized, horizontal data exchange for Controller-to-Controller scenarios (OPC UA FX).

For further information, representatives from OPC Foundation are available for inquiries.

CONTACT:
OPC Foundation
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www.opcfoundation.org/process

STEFAN HOPPE,
OPC Foundation
President and Executive Director
stefan.hoppe@opcfoundation.org

“Digitization needs a secure transfer of globally-accepted information models across industries, technologies, and applications. No single organization can achieve this alone! OPCF, as a co-owner from the beginning, welcomes the extended ownership of PA-DIM to ensure this necessary global acceptance. OPC UA over MQTT is the only accepted field-to-multi-cloud solution – the combination of this with PA-DIM plus 150+ additional information models is unique.”

Visit PNO at ACHEMA in Hall 11.0, Stand C4

PA-DIM, an important standard for bridging the gap between OT technologies and the IT world, is also an important part of PI's full stack solution "PROFINET over APL": PROFINET over APL (based on ethernet-APL) plus FDI and PA-DIM. PROFIBUS & PROFINET International (PI) presents a joint PA-DIM demo with the Field Comm Group (FCG) at our booth C4 in Hall 11, where the two organizations also present a Field Device Integration (FDI) demo, complementing PI's new use case based "PROFINET for PA" demo wall.

Three demonstration scenarios highlight selected benefits of PA-DIM, such as protocol-independent KPI dashboards, uniform information between IT and OT systems, and integration with plant engineering tools.

The protocol independent KPI dashboard demonstration shows two PROFINET over APL devices and one HART 4-20mA device connected to a controller that includes an embedded OPC UA server. An integrator has mapped key information from the three devices to the server in the protocol-neutral PA-DIM format. A web-based application accesses the OPC UA server and presents protocol-neutral device information through a series of dashboards. In this demonstration, the dashboards have been designed to implement one of the NAMUR Open Architecture use cases called Device Dimensioning. A short video explains this use case.

Interested in learning more about PA-DIM as an important part of PI's PROFINET over APL solution? Please contact representatives from the PI organization at our booth, visit our website at www.profibus.com/pa-dim, or read the new version of our PA white paper "PROFINET – The Solution Platform for Process Automation".

For further information, representatives from PNO are available for inquiries.

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info@profinet.com
https://www.profinet.com/

"PI has further expanded its solution portfolio for process automation. For the digitalization of the field level, our PROFINET over APL full-stack solution not only includes our proven profiles such as PA Profile 4, but is also supplemented by FDI and PA-DIM."

DIETMAR BOHN,
Executive Director PNO at PI

PA-DIM is the current implementation for the NOA Information Model

NAMUR welcomes the increasing adoption and utilization of PA-DIM (Process Automation Device Information Model) in the process industry. PA-DIM offers significant value for automation technology and contributes substantially to enhancing efficiency and flexibility in the process industry.
By utilizing PA-DIM, users of automation technology can expect a uniform and standardized description of device functions and characteristics, leading to improved interoperability and seamless integration of devices into automation systems. This enables faster commissioning, simplified maintenance, and greater flexibility in selecting and integrating devices from various manufacturers.

NAMUR is confident that the enhanced use of PA-DIM will help reduce complexity in automation, improve the transparency of device information, and lower overall operating costs for users. Furthermore, PA-DIM will form the foundation for future developments in the realm of digital twins and predictive maintenance in the process industry.
NAMUR calls upon all stakeholders in the process industry to recognize the benefits of PA-DIM and actively leverage its advantages to enhance the efficiency, flexibility, and future-proofing of their automation systems.

For further information, representatives from NAMUR are available for inquiries.

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Ms Christine Oro Saavedra

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Cross Industry harmonized standards are certically important

Products from the mechanical and plant engineering are used in several industries of discrete manufacturing like automotive as well as process industry like chemicals, pharma or food and beverage. For this reason, it is important for the VDMA to influence and support the PA-DIM Initiative with the mayor goal to develop interface standards based on OPC UA that are harmonized cross industry wise.

This will allow i.e. component manufacturers to use the same interface standards for every customer, reducing the effort of interface development, easier integration of products in existing production and providing seamless access to standardized information.

“With our experience of the last 10 years and more than 100 released OPC UA Companion Specifications it is critically important to ensure harmonization between these standards including the ´OPC UA for Machinery´ and the PA-DIM.”

ANDREAS FAATH,
Managing Director
VDMA Machine Information Interoperability

PA-DIM is great basis for our digitalization efforts

“Automation and Process Automation are the Key enablers to face the Major Challenges of the Future: Sustainable, efficient, and interoperable production. By creating and introducing smart digitalization concepts, for example NOA (NAMUR Open Architecture), together with the end users of NAMUR, ZVEI and its member companies help process and discrete industries to master these challenges. We are happy and feel privileged to be a co-owner of PA-DIM, which is a great basis for our digitalization efforts.”

FELIX SEIBL,
Managing Director,
Measurement and Process Automation Section,
Automation Department ZVEI

PA-DIM®

The PA-DIM specification is co-owned by the associations:

ABOUT PA-DIM AND THE PA-DIM OWNERS ALLIANCE

The Process Automation Device Information Model Standard (PA-DIM) is a specification that defines protocol agnostic communication of common process automation parameters, including semantic IDs as defined by IEC 61987, using OPC UA information modeling techniques. Eliminating protocol dependencies simplifies the integration of IT and OT systems, while enabling a semantic device information approach for unambiguous machine-to-machine (M2M) communication. Seamless communication is achieved through data-mapping of fieldbus-specific instrument parameters using the address space defined in PA-DIM specification.

PA-DIM Owners Alliance encompass standards development and end user organizations that share a common interest in collaboratively developing specifications and technology to accelerate the digital transformation of the process automation industry. Each participating organization is a co-owner of the PA-DIM specification, which is managed by the PA-DIM Working Group that is hosted by the FieldComm Group. Current PA-DIM Owners are FDT Group, FieldComm Group, ISA 100 WCI, NAMUR, ODVA, OPC Foundation, PROFIBUS and PROFINET International, VDMA, and ZVEI.

FIND MORE INFORMATION HERE:

www.fdtgroup.org/pa-dim
www.fieldcommgroup.org/pa-dim
www.odva.org/pa-dim
www.opcfoundation.org/pa-dim
www.profibus.com/pa-dim