

DEXPI Introduction

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Motivation & Problem statement



Data Exchange in Plant Life Cycle





One of more important documents in a process plant...



P\$ID Information





Zeichen	Gegenítand	Stück- zahl	Material	Bemerkungen
A B C D E F G H J K L M N O P	Schubflange Verfchlußflück Bolzen Lagerfchalenhälfte Zwifchenlagen Kreuzkopfbolzen Scheibe Mutter Keil Scheibe Kopffchrauben Sicherungsfchraube Mutter	$ \begin{array}{c} 1 \\ 1 \\ 2 \\ 2 \\ 2 \\ 1 \\ 1 \\ 1 \\ 1 \\ 4 \\ 2 \\ 2 \end{array} $	Siemens-Martin-Stahl Schmiedeeifen Bronze Meffing Stahl Schmiedeeifen Stahl Schmiedeeifen Stahl Schmiedeeifen	Im Gabelende Keilnut. Mit ³ / ₄ "-Gewinde und je zwei Multerr O und N nebft Sicherung M. Neues Modell, ausgießen mit Lagermetall Mit ³ / ₄ "-Gewinde und Keilnut. ³ / ₄ "-Gewinde, ⁵ / ₁₆ "-Gewinde. S.a.
			Lis	ts

Cinclude and Coluberry Weichman Me



Structures

P\$ID information transferred as...





NO standard for P\$ID exchange







DEXPI use cases

DEXPI workflows

These (data exchange) workflows are supported through the DEXPI standard

- PID data exchange between CAE systems / Data handover of semantic PID's:
 - From EPC to 0/0
 - From EPC to equipment supplier
 - From O/O to contractor
 - From O/O to equipment supplier
 - Inside a company between different departments

Exchange Data, not documents





Handover between PID tools





Handover between PID tools





DEXPI workflows



These (data exchange) workflows are supported through the DEXPI standard



Handover between PID tools







DEXPI group

DEXPI – A Successful Team

International Multi Sides Team



Software Vendors

- > Autodesk
- > Aucotec
- > Aveva
- Bilfinger
- > Hexagon
- \geq PTC
- \geq Semantum
- Siemens
- > X-Visual
- ➢ eVision

- **ISO TC 184 SC4**
- > CII / FIATECH
- DECHEMA / NAMUR / DKE / VDMA > OPC Foundation > SSG

DEXPI Data Exchange in the Process Industry

Research Organizations

- \geq AixCAPE e.V.
- VTT of Finland
- **TU Berlin**
- **RWTH Aachen University**
- Tecgraf/PUC Rio

DEXPI Hackathons

Two times a year



DEXPI Mission

What we do



We work to create an **open**, neutral and reliable **data exchange standard** for the **process industry** to establish a future-proof **digitalized collaboration**.



... and we started with the P&ID



DEXPI Collaboration

DEXPI's Influence and cooperation DEXPI Data Exchange in the Process Industry FOUNDATION **Fiatech** Construction NAMUF Industry Innovation that builds the world Institute[®] DEXPI Data Exchange in the Process Industry POSC Caesar Association VDE DIN PROCESSNET **CFiHOS** EINE INITIATIVE VON DECHEMA UND VDI-GVC International Electrotechnical Commission



DEXPI Deliverables & Resources





1. DEXPI Specification for Exchange of PIDs (Version 1.2)

2. Extension for the Proteus Scheme (resulting in Version 4.0.1)

3. Tools & Test cases

4. CAE Interfaces of the leading PID software

www.DEXPI.org



News, Contacts, DEXPI Specification, Publications, Events



DEXPI Data Exchange in the Process Industry

The objective of the DEXPI initiative is to develop and promote a general data exchange standard for the process industry, covering all phases of the lifecycle of a (petro-)chemical plant, ranging from specification of

Upcoming Events

August 22, 2019
 DEXPI Org. meeting

DEXPI Information Model published DEXPI DexPI Data Exchange in the Process Industry

http://dexpi-information-model.aixcape.org/

DEXPI Verificator



Online (previously) and Offline versions available



Line 21: Error: Invalid XML document: Element 'PlantInformation', attribute 'SchemaVersion': The value '3.6.0' does not match the fixed value constraint '4.0.1'.

Test Cases



Free available on https://github.com/DEXPI/TestCases

		DEXPI / TestCases	O Unwatch ▼ 7 ★ Star 1 % Fork 4			
Data Exchange in th	Code I Issues I I Pull re-	♦ Code ① Issues ①				
Repositories	Branch: master TestCases / tests /	Branch: master TestCases / tests / E02 Tank with Nozzles / Upload files File				
Pinned repositories	rttskr committed on GitHub Add files v	^w rttskr committed on GitHub Rename E02V01-AUD.EX02.xml.xml to E02V01-AUD.EX02.xml Latest com Latest com				
TestCases	C01 Pump, Tank, and Control loop	 E02V01-AUD.EX01.png	some files moved to test folder	12 days ago		
A place to track all test cases.	C02 DEXPI Example Complete E+P	E02V01-AUD.EX01.xml	some files moved to test folder	12 days ago		
● HTML 🚖 1 🦞 4	C03 DEXPI Example Tank Displ Pump	E02V01-AUD.EX02.xml	Rename E02V01-AUD.EX02.xml.xml to E02V01-AUD.EX02.x	cml 12 days ago		
Search repositories	C04 DEXPI Example Pump Plate Heat	E02V01-AVV.EX01-VTT.IM01.PNG	some files moved to test folder	12 days ago		
	E01 Tank T100	E02V01-AVV.EX01-XVT.IM01.png	some files moved to test folder	12 days ago		
	E02 Tank with Nozzles	E02V01-AVV.EX01.xml	some files moved to test folder	12 days ago		
DEXPIdev	E03 Pump With Nozzles	E02V01-AVV.EX02-VER.IM01.html	some files moved to test folder	12 days ago		
Development of the DEXPI group: Specific	E04 HeatExchanger With Nozzles	E02V01-AVV.EX02.png	some files moved to test folder	12 days ago		
Updated 11 days ago	E05 Pump With Nozzles And HeatExc	E02V01-AVV.EX02.xml	some files moved to test folder	12 days ago		
	🖿 E06 Pump, HeatExchanger, Nozzles C	E02V01-ING.EX01-XVT.IM01.png	some files moved to test folder	12 days ago		
TestCases	E07 PressureVessel with ColumnSecti	E02V01-ING.EX01.PDF	some files moved to test folder	12 days ago		
A place to track all test cases.	E08 ProcessColumn with ColumnSect	E02V01-ING.EX01.png	some files moved to test folder	12 days ago		
🛑 HTML 🌟 1 🦞 4 Updated 12 days ago	I01 Measurement	E02V01-ING.EX01.xml	some files moved to test folder	12 days ago		
	I02 Control	some files moved to test folder	12 day	's ago		
	103 Measurement and Control	Move files to correct location	12 day	's ago		

DEXPI interfaces of CAE systems



CAE Vendor		Product	DEXPI Interface
Autodesk	🙏 AUTODESK.	AutoCAD P&ID 2020	Import & Export
Aveva		Aveva PID	Import & Export
Hexagon	HEXAGON	SmartPlant PID	Export
Siemens	SIEMENS	Comos PID	Import & Export
VTT	V TT	Apros	Import
X-Visual	XVISUAL	PID	Import



Quality Control

External Test Body Founded



- Independent Test Organization plants & bytes
- Founded for that reason
- Funded by Owners / Operators
- SW vendors provide
 - Software + DEXPI Interface
 - Training
- Timeline agreed with DEXPI group





DEXPI Testing Data

Example testing data provided by Evonik, BASF and Equinor

Testing and development timeline



How we proceed in 2019 and beyond





CFIHOS - DEXPI – RDL2 Alignment











Common goal

- Software for the Process Industry shall support both concepts
- Software has two interfaces: one for CFIHOS and one for DEXPI
- The software has only one internal software configuration, perhaps some small mapping for the two interfaces
- The software supports all users with a user-friendly interface and a correct terminology

Of course: concerning to its scope software may support only one approach



Alignment - done



Based on CFIHOS V 1.4 (2019-10) and DEXPI V 1.2 (2016) & V 1.3 (2020-02)

- Design principles
 - Class and subclass concept
 - > UoM concept
 - Property type concept
 - Relation between classes and properties
- Plant breakdown structure
- Lifecycle approach



Alignment – TO-DOs



Design principles

- Component concept
- Inheritance concept
- Apparatus / machine taxonomy
- Piping component taxonomy
- Instrumentation taxonomies for field devices
- Property mapping
- Common RDL concept: CFIHOS and DEXPI



CHIFOS - DEXPI alignment concept



DEXPI Data Exchange in the Process Industry







Merge of classes example compressor



Compressor			COMPRESSOR	http://data.posccaesar.org/rdl/RDS14286497	1.2	FD	compressor	CFIHOS-30000524	mechanical equipment class
	CentrifugalCompressor		CENTRIFUGAL COMPRESSOR	http://data.posccaesar.org/rdl/RDS417194	1.2	AS	centrifugal compressor	CFIHOS-30000520	compressor
		Impeller (0*)	IMPELLER	http://data.posccaesar.org/rdl/RDS414539	1.2	AS			
	AxialCompressor		AXIAL COMPRESSOR	http://data.posccaesar.org/rdl/RDS417239	1.2	AS	axial compressor	CFIHOS-30000516	compressor
		Impeller (0*)	IMPELLER	http://data.posccaesar.org/rdl/RDS414539	1.2	AS			
	ReciprocatingCompressor		RECIPROCATING COMPRESSOR	http://data.posccaesar.org/rdl/RDS417284	1.2	AS	reciprocating compressor	CFIHOS-30000551	compressor
		Displacer (0*)	Displacer	http://sandbox.dexpi.org/rdl/Displacer	1.2	AS			
	RotaryCompressor		ROTARY COMPRESSOR	http://data.posccaesar.org/rdl/RDS435374	1.2	AS	rotary compressor	CFIHOS-30000552	compressor
		Displacer (0*)	Displacer	http://sandbox.dexpi.org/rdl/Displacer	1.2	AS			
	AirEjector		AIR EJECTOR	http://data.posccaesar.org/rdl/RDS5770157	1.2	AS			
		Impeller (0*)	IMPELLER	http://data.posccaesar.org/rdl/RDS414539	1.2	AS			
	SpecialCompressor		SpecialCompressor	http://sandbox.dexpi.org/rdl/SpecialCompre	e 1.2	AS			
		Impeller (0*)	IMPELLER	http://data.posccaesar.org/rdl/RDS414539	1.2	AS			
		Displacer (0*)	Displacer	http://sandbox.dexpi.org/rdl/Displacer	1.2	AS			

DEXPI_CFIHOS_Class_Compare_V1.xls



Merge of classesexample manual valves



	AS	1.2	SHUT OFF VALVE	http://sandbox.dexpi.org/rdl/ShutOfValve	manual valve	CFIHOS-30000649	valve
AngleBallValve	AS	1.2	ANGLE BALL VALVE	http://sandbox.dexpi.org/rdl/AngleBallValve			
AngleGlobeValve	AS	1.2	ANGLE GLOBE VALVE	http://data.posccaesar.org/rdl/RDS882944			
AnglePlugValve	AS	1.2	ANGLE PLUG VALVE	http://sandbox.dexpi.org/rdl/AnglePlugValve			
AngleValve	AS	1.2	ANGLE VALVE	http://data.posccaesar.org/rdl/RDS5789384			
BallValve	AS	1.2	BALL VALVE	http://data.posccaesar.org/rdl/RDS416654	ball valve	CFIHOS-30000807	manual valve
ButterflyValve	AS	1.2	BUTTERFLY VALVE	http://data.posccaesar.org/rdl/RDS416609	butterfly valve	CFIHOS-30000810	manual valve
GateValve	AS	1.2	GATE VALVE	http://data.posccaesar.org/rdl/RDS416519	gate valve	CFIHOS-30000838	manual valve
GlobeValve	AS	1.2	GLOBE VALVE	http://data.posccaesar.org/rdl/RDS416204	globe valve	CFIHOS-30000840	manual valve
NeedleValve	AS	1.2	NEEDLE VALVE	http://data.posccaesar.org/rdl/RDS421064	needle valve	CFIHOS-30000852	manual valve
PlugValve	AS	1.2	PLUG VALVE	http://data.posccaesar.org/rdl/RDS421109	plug valve	CFIHOS-30000860	manual valve
StraightwayValve	AS	1.2	STRAIGHTWAY VALVE	http://data.posccaesar.org/rdl/RDS9390905			
					block and bleed valve	CFIHOS-30000808	manual valve
					choke valve	CFIHOS-30000812	manual valve
					diaphragm valve	CFIHOS-30000818	manual valve
					double block and bleed valve	CFIHOS-30000822	manual valve
					eccentric rotating disc valve	CFIHOS-30000825	manual valve
					multiport valve	CFIHOS-30000850	manual valve
					slide valve	CFIHOS-30000866	manual valve
	AngleBallValve AngleGlobeValve AnglePlugValve BallValve ButterflyValve GateValve GlobeValve NeedleValve PlugValve StraightwayValve	ASAngleBallValveASAngleGlobeValveASAnglePlugValveASAngleValveASBallValveASBallValveASGateValveASGobeValveASPlugValveASStraightwayValveASAngleValveASASASASASASASASASASASStraightwayValveAS<	As1.2AngleBallValveAS1.2AngleGlobeValveAS1.2AnglePlugValveAS1.2AngleValveAS1.2BallValveAS1.2BallValveAS1.2GateValveAS1.2GobeValveAS1.2PlugValveAS1.2StraightwayValveAS1.2AngleValveAS1.2StraightwayValveAS1.2AS1.2ASAS1.2StraightwayValveAS1.2AS1.2ASAS1.2AS1.3AS1.3AS1.4AS1.4AS1.4AS1.4AS1.4AS1.4AS1.4AS	AS1.2SHUT OFF VALVEAngleBallValveAS1.2ANGLE BALL VALVEAngleGlobeValveAS1.2ANGLE GLOBE VALVEAnglePlugValveAS1.2ANGLE VALVEAngleValveAS1.2ANGLE VALVEBallValveAS1.2BALL VALVEBallValveAS1.2BALL VALVEBatterflyValveAS1.2BUTTERFLY VALVEGateValveAS1.2GLOBE VALVEIdobeValveAS1.2GLOBE VALVEPlugValveAS1.2NEEDLE VALVEStraightwayValveAS1.2STRAIGHTWAY VALVEIdobeValveAS1.2Independent of the 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DEXPI_CFIHOS_Class_Compare_V1.xls

Alignment CFIHOS - DEXPI DEXPI Det Exchange in the Process Industry

Major work areas

- Immediately
 - Complete the common CFIHOS DEXPI model
 - Tag classes (80% ready)
 - Property mapping
 - find right place in documentation structure of CFIHOS
 - Implementation work for software vendors

later

Common RDL concept











Thank you!





BACKUP SLIDES



Comparison – Plant breakdown structure



Enterprise -> Site --> Industrial Complex ---> Process Plant ----> Plant Section ----> Plant Item

and Area, Train, System

Similar concepts (site, plant), but no complete match (e.g. industrial complex, plant section)



Comparison – Apparatus / machine model

Some Tag classes of

mechanical equipment class like

compressor
conveyor
damper
driver
fired heat transfer equipment class
heat exchanger
lifting device
louvre
marine
mechanical seal
other mechanical equipment





Specialization of

Different taxonomies, different properties



Comparison – Piping model

Some Tag
classes
of piping and
pipeline
equipment like

buckle initiator christmas tree diverter flame arrestor flange funnel guide post ignitor e injection point line blind manifold nozzle

pig launcher	
pig loop	
pig receiver	
pig transmitter	
pig trap	
pipe	
pipe bend	
pipe flange spade	
pipe support	
pipe tee	
pipeline	
piping spool	
riser	
seal	
spacer	
spark arrestor	
spectacle blind	
spool piece	
spring support	
thermowell	

Piping Network System

Piping Network Segment

Piping Components (ISO 10628:2012)

21	Valves
22	Check valves
23	Valves and fittings with safety function
24	Fittings

Different taxonomies, different properties



Comparison – Instrumentation model

blow down valve analysing instrument butterfly control valve control switch Some Tag choke control valve controller deluge valve classes detecting element diaphragm control valve of down hole safety valve detector eccentric rotating disc control valve flow meter instrument emergency shut down valve flow totalizer gate control valve equipment gauge globe control valve general instrument and motor operated valve indicating instrument needle control valve Control level instrument plug control valve slide control valve orifice plate valves solenoid valve signal converter temperature instrument transmitter



Different taxonomies, different properties

DEXPI Data Exchange in the Process Industry

Contact Information



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