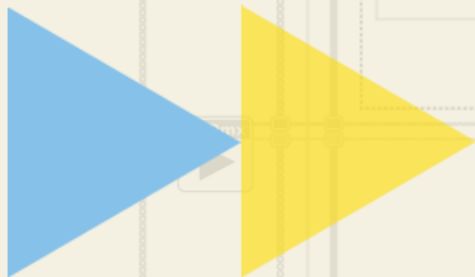
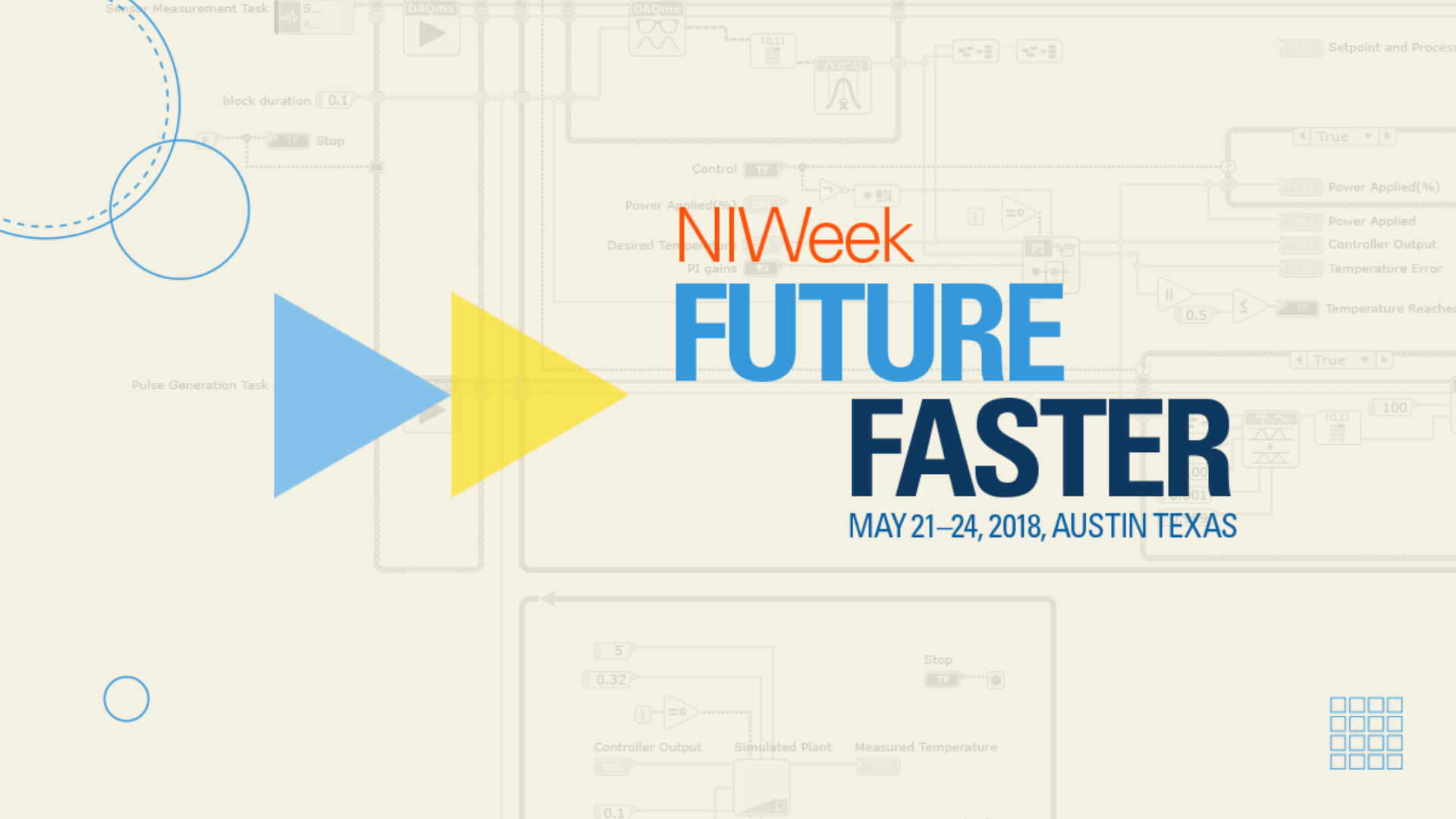


NIWeek

FUTURE

FASTER

MAY 21-24, 2018, AUSTIN TEXAS





LabVIEW Based Displays

Online Visualization of Telemetry Data during a Rocket Flight
using OPC UA and LabVIEW

Airbus Defence and Space
Enrico Noack

A.M.S. Software GmbH
Johannes-Max Bergel

Companies Introduction

- A.M.S. Software GmbH
 - Alliance Partner of NI for 20+ years
 - Software and Hardware Systems
 - LabVIEW Engineers (CLA, CLD)
- Airbus Defence and Space
 - Program Line: Space Systems
 - Sounding Rocket Program

The Sounding Rocket Program – TEXUS/MAXUS

- Civil research under μg conditions
- Is operational since 1977
- Scientists are responsible for the experiments
- Airbus is responsible for the system
- In total 64 launches have been performed

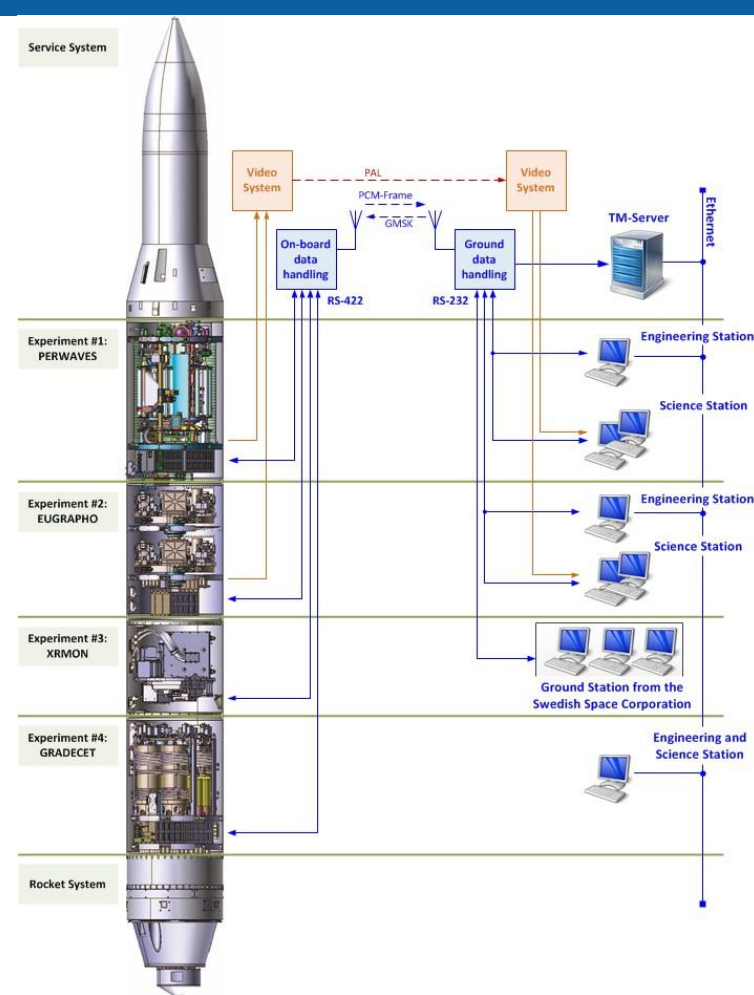


The Sounding Rocket Program – TEXUS/MAXUS

	TEXUS	MAXUS
Total Length	13 m	17 m
Payload Length	5,3 m	6,6 m
Total Mass	2,65 t	12,3 t
Payload Mass	400 kg	800 kg
Apogeum (max Altitude)	250 km	700 km
ug Time	~ 360 sec	~ 720 sec

Typical Launcher Configuration

- Four scientific experiments per launcher
 - Experiment H/W and S/W
 - Science stations
- The back-bone
 - On-board data handling
 - Data transmission
 - Ground data handling
 - Engineering stations

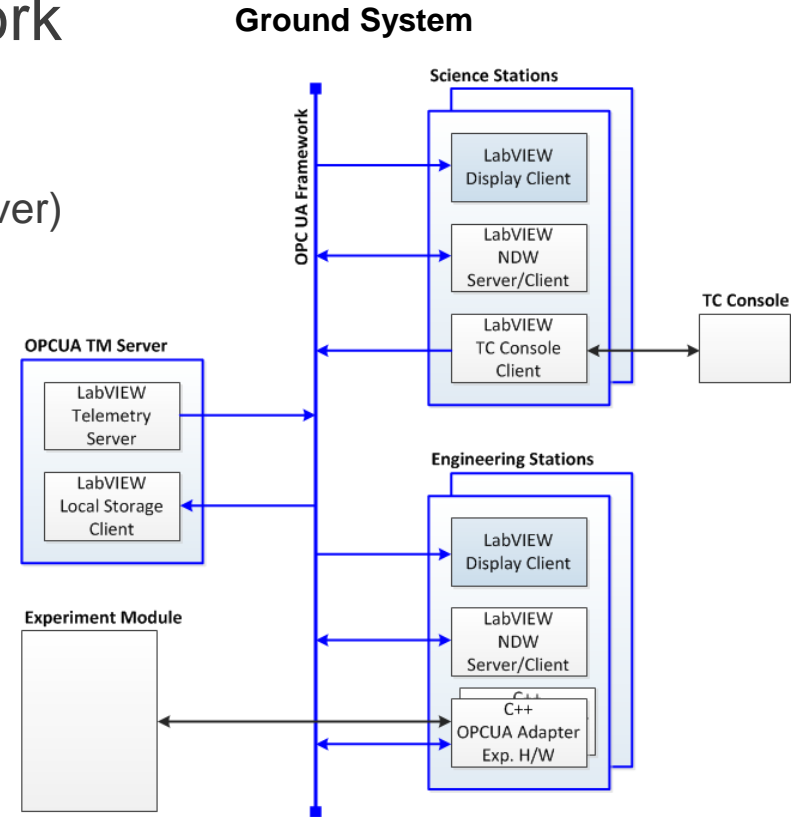


Challenge

- Modern payload center for the scientists (Mission Control)
- Customized Displays without Programming

OPC UA – Decentralised Framework

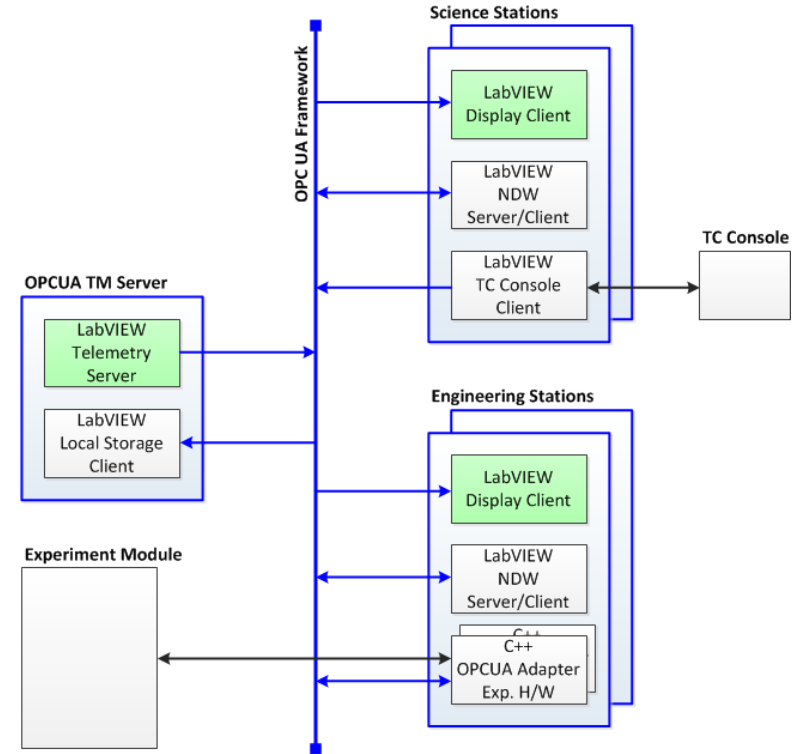
- OPC UA supports the modular approach
 - Data can be provided by different sources (server)
 - Data can be directly access by different consumers (clients)
 - Single modules can be exchanged
 - No central entity that needs to be updated/maintained



Roadmap

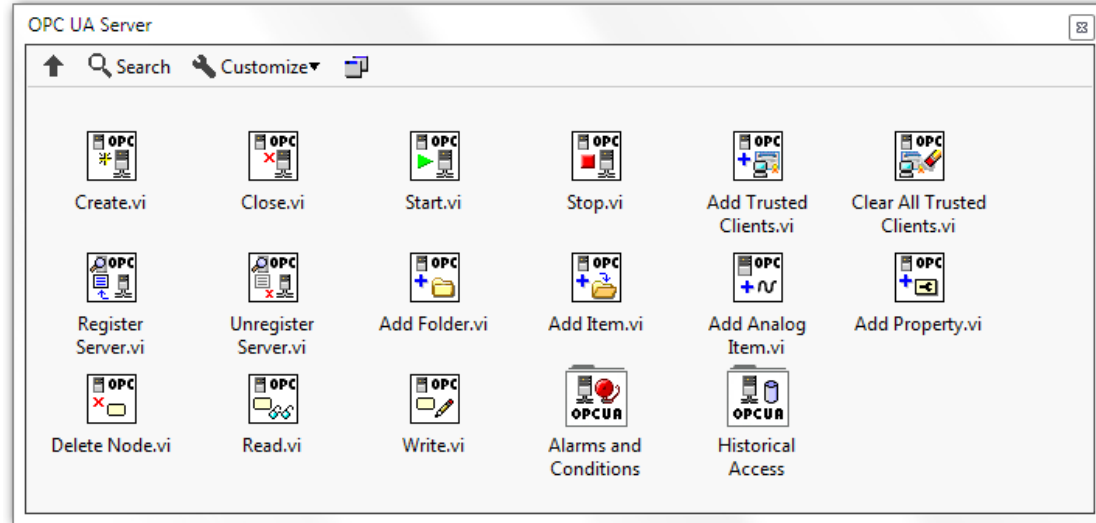
- Step 1
 - Implementation of LabVIEW Based Displays
 - One server for multiple display clients
 - Used for the MX9 Flight in April 2017
- Step 2
 - Roll-out of the Prototype in 2017
 - Multiple servers for multiple clients
 - Used for the TX54/55 flight in May 2018
 - Parallel operation to the existing system

Ground System



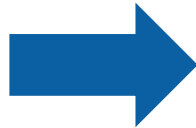
What is OPC UA?

- Open Platform Communication – Unified Architecture
- High level data transport on TCP/IP Networks
- New OPC UA Stack in LabVIEW 2017
- Replacement of OPC



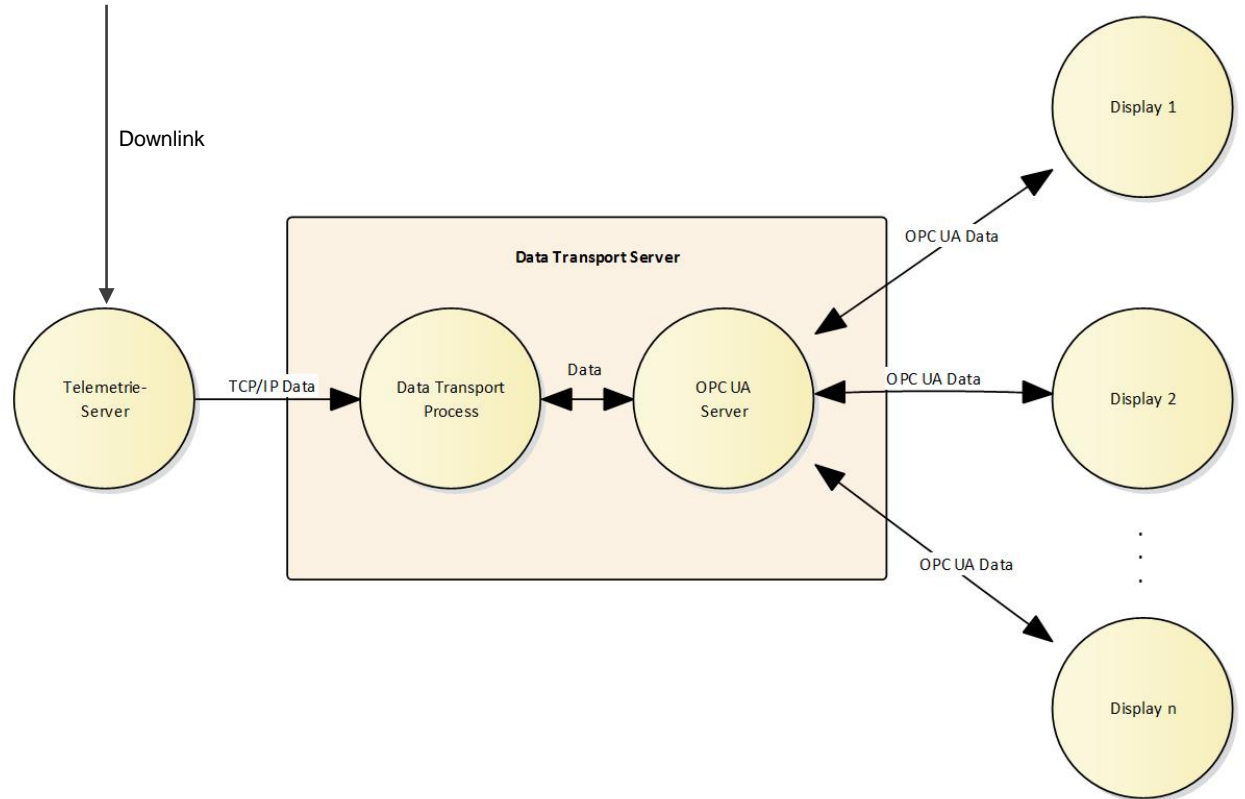
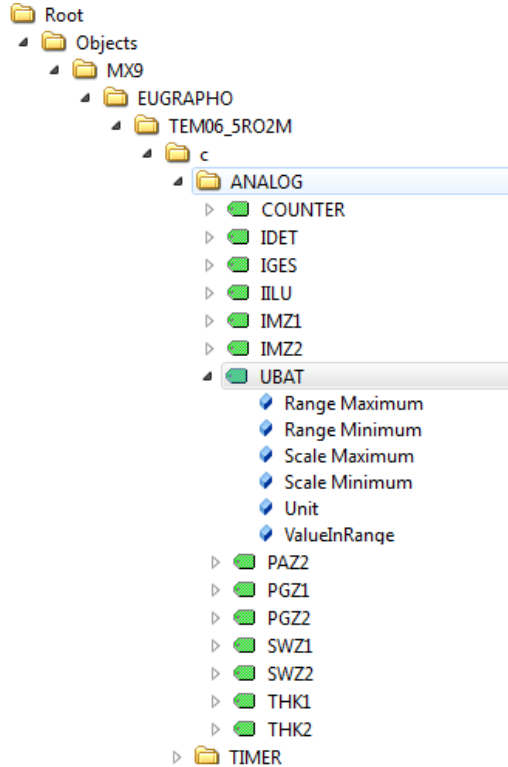
Why do we use OPC UA?

- Standardized and Modern, in focus of Industry 4.0!
- Structured data (Variables in a named tree)
- Open and transparent, platform independent
- TCP/IP packets optimized for high bandwidth



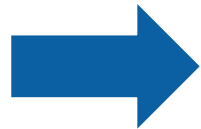
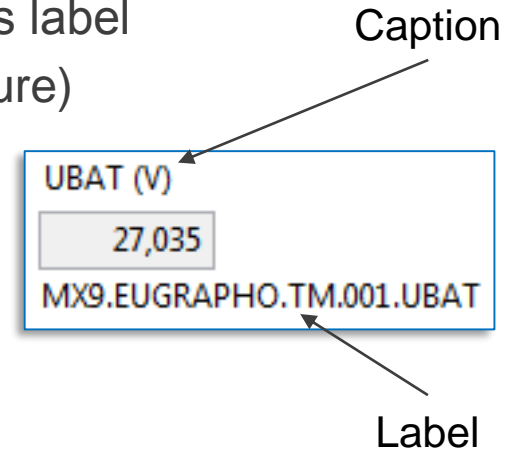
Let's use OPC UA!

OPC UA Data Transport Server (OPC UA Adapter)



How does the OPC UA to Display coupling work?

- Connect to OPC UA servers using LabVIEW 2017 API
- Generic background multi server processes
- Subscribe items (controls) for monitoring
- Bind a control to a OPC UA variable by using the control's label
- Get OPC UA data change events (LabVIEW event structure)
- Visualize data on user interface
- No LabVIEW coding needed, as required

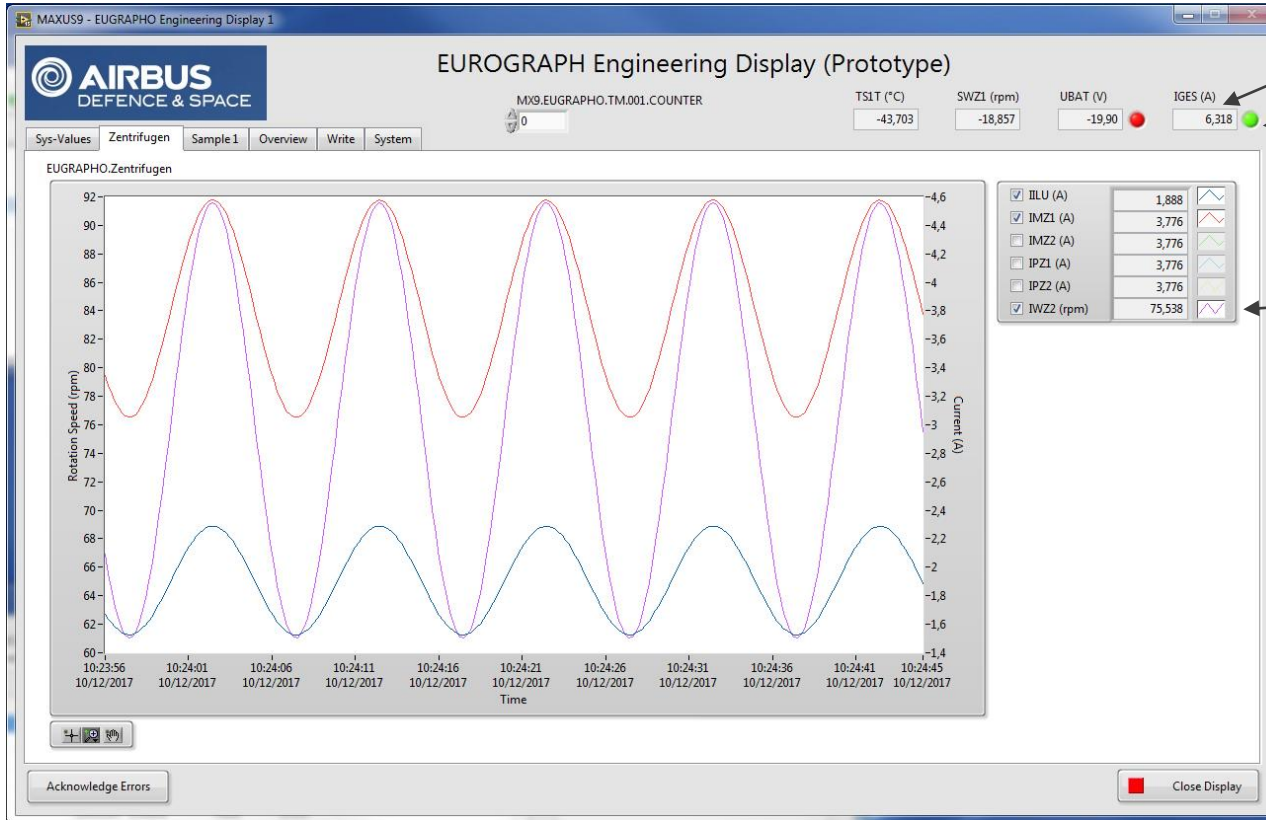


Let's use LabVIEW without wires!

Demo



LabVIEW Front Panel



Value

In Range?

Automated Legend

Description and Tip

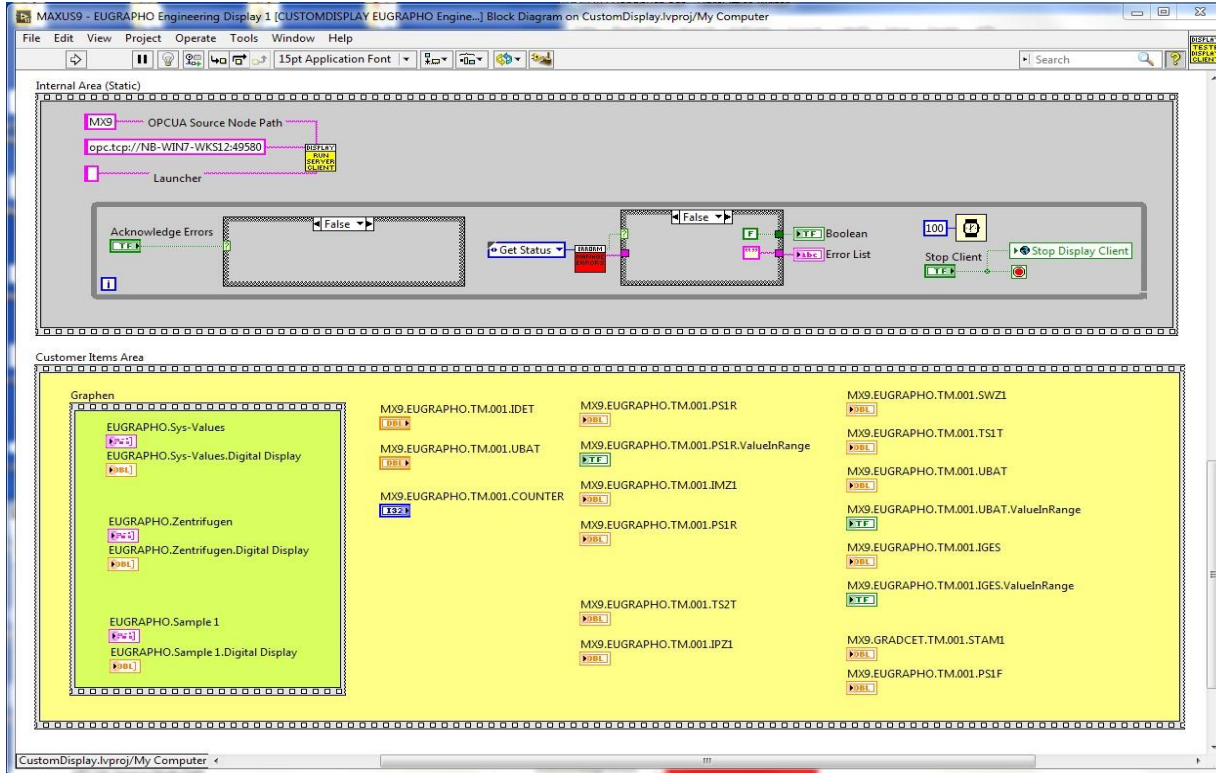
"EUGRAPHO.Zentrifugen" Description

EUGRAPHO.TEM06_5RO2M.c.ANALOG.ILU
EUGRAPHO.TEM06_5RO2M.c.ANALOG.IMZ1
EUGRAPHO.TEM06_5RO2M.c.ANALOG.IMZ2
EUGRAPHO.TEM06_5RO2M.c.ANALOG.IPZ1
EUGRAPHO.TEM06_5RO2M.c.ANALOG.IPZ2
EUGRAPHO.TEM06_5RO2M.c.ANALOG.IWZ2
duration (s) = 1800

"EUGRAPHO.Zentrifugen" Tip

OK Cancel Help

LabVIEW Block Diagram



Supporting Tools – Item Browser

Display Client - Item Browser

Filter items by Path: EUGRAPHO.TM.001

server endpoint URL: opc.tcp://NB-WIN7-WKS12:49580

Launcher: MX9 Remove Launcher

Version: 1.0.0.10

Item Path	Item Name	Value	Type	Access	Quality	Description
MX9.EUGRAPHO.TM.001.COUNTER	COUNTER	26206	Int32	Read	Good	Packet-Counter (fortlaufend)
MX9.EUGRAPHO.TM.001.COUNTER.Unit	Unit		String	Read	Good	
MX9.EUGRAPHO.TM.001.COUNTER.Scale Minimum	Scale Minimum	0,000	Double	Read	Good	
MX9.EUGRAPHO.TM.001.COUNTER.Scale Maximum	Scale Maximum	0,000	Double	Read	Good	
MX9.EUGRAPHO.TM.001.COUNTER.Range Minimum	Range Minimum	0,000	Double	Read	Good	
MX9.EUGRAPHO.TM.001.COUNTER.Range Maximum	Range Maximum	1000,000	Double	Read	Good	
MX9.EUGRAPHO.TM.001.COUNTER.ValueInRange	ValueInRange	F	Boolean	Read	Good	Bad_Waiting
MX9.EUGRAPHO.TM.001.UBAT	UBAT	-9,927	Double	Read	Good	Batterie-Spannung
MX9.EUGRAPHO.TM.001.UBAT.Unit	Unit	V	String	Read	Good	
MX9.EUGRAPHO.TM.001.UBAT.Scale Minimum	Scale Minimum	0,000	Double	Read	Good	
MX9.EUGRAPHO.TM.001.UBAT.Scale Maximum	Scale Maximum	32,000	Double	Read	Good	
MX9.EUGRAPHO.TM.001.UBAT.Range Minimum	Range Minimum	0,000	Double	Read	Good	
MX9.EUGRAPHO.TM.001.UBAT.Range Maximum	Range Maximum	30,000	Double	Read	Good	
MX9.EUGRAPHO.TM.001.UBAT.ValueInRange	ValueInRange	F	Boolean	Read	Good	
MX9.EUGRAPHO.TM.001.IGES	IGES	-27,830	Double	Read	Good	Gesamtstrom
MX9.EUGRAPHO.TM.001.IGES.Unit	Unit	A	String	Read	Good	
MX9.EUGRAPHO.TM.001.IGES.Scale Minimum	Scale Minimum	0,000	Double	Read	Good	
MX9.EUGRAPHO.TM.001.IGES.Scale Maximum	Scale Maximum	30,000	Double	Read	Good	
MX9.EUGRAPHO.TM.001.IGES.Range Minimum	Range Minimum	0,000	Double	Read	Good	
MX9.EUGRAPHO.TM.001.IGES.Range Maximum	Range Maximum	20,000	Double	Read	Good	
MX9.EUGRAPHO.TM.001.IGES.ValueInRange	ValueInRange	F	Boolean	Read	Good	
MX9.EUGRAPHO.TM.001.IDET	IDET	-4,412	Double	Read	Good	Detektor-Strom
MX9.EUGRAPHO.TM.001.IDET.Unit	Unit	A	String	Read	Good	
MX9.EUGRAPHO.TM.001.IDET.Scale Minimum	Scale Minimum	0,000	Double	Read	Good	
MX9.EUGRAPHO.TM.001.IDET.Scale Maximum	Scale Maximum	5,000	Double	Read	Good	
MX9.EUGRAPHO.TM.001.IDET.Range Minimum	Range Minimum	1,000	Double	Read	Good	
MX9.EUGRAPHO.TM.001.IDET.Range Maximum	Range Maximum	3,000	Double	Read	Good	
MX9.EUGRAPHO.TM.001.IDET.ValueInRange	ValueInRange	F	Boolean	Read	Good	
MX9.EUGRAPHO.TM.001.IROT	IROT	-1,033	Double	Read	Good	ROT-Strom

Buttons: Save and Close, Cancel, Copy Selected Item Name, Make a Graph from Selected Items, Acknowledge Errors

Description and Tip

"EUGRAPHO.Zentrifugen" Description

EUGRAPHO.TEM06_5RO2M.c.ANALOG.IILU
EUGRAPHO.TEM06_5RO2M.c.ANALOG.IMZ1
EUGRAPHO.TEM06_5RO2M.c.ANALOG.IMZ2
EUGRAPHO.TEM06_5RO2M.c.ANALOG.IPZ1
EUGRAPHO.TEM06_5RO2M.c.ANALOG.IPZ2
EUGRAPHO.TEM06_5RO2M.c.ANALOG.IWZ2
duration (s) = 1800

"EUGRAPHO.Zentrifugen" Tip

Buttons: OK, Cancel, Help

Next Steps

- Continue usage of OPC UA Decentralized Network for coming launches
 - Switch off the old system (now parallel)
 - Continue progress on developing of OPC UA servers, clients and data binding (tools)
- OPC UA also for science data (Kohn Experiment)
 - Use cRIO based OPC UA Server for easy laboratory operation or parabolic flights
 - CompactRIO with NI-DAQmx (cRIO 9046)
 - CompactRIO in Space (2019)