



Department for
Science, Innovation
& Technology



TÜV SÜD Real Time Thermodynamics with Physical Property Data Services (PPDS)

The Measurement Focus Group Meeting,
10th of June 2026

**Add value.
Inspire trust.**



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What is PPDS

Comprehensive Thermophysical Data

PPDS provides accurate data for fluids and mixtures using a large validated databank covering ~1500 pure substances.

Versatile Engineering Applications

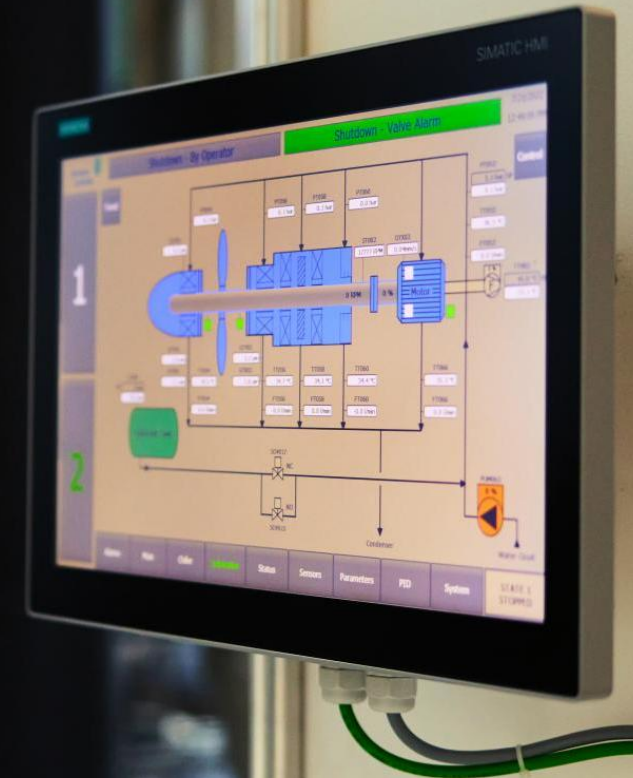
Supports rapid engineering calculations and detailed thermodynamic modeling for various sectors including oil and gas, manufacturing, and food.

Complex Mixtures and Multi-Phase Systems

Capable of handling complex fluid mixtures and multi-phase behavior critical for precise industrial process control.

Integration and Real-Time Operations

Designed for integration in workflows and real-time system operations enhancing performance and safety.



Thermodynamic Calculations Evolution

From Mainframe to Embedded Systems

Origins in Mainframe Computing

PPDS began in the 1970s as a thermodynamic computation tool running on mainframe systems in Glasgow.

Transition Through Platforms

PPDS adapted through desktop workstations and server-based systems, keeping its core scientific engine intact.

Modern Linux-Based Support

Recent expansions enable PPDS to run on Linux x86_64 and ARM architectures, supporting also embedded systems.

Edge Computing Advantages

Deploying PPDS on embedded platforms reduces latency and improves system autonomy via edge computing.



Importance of Thermophysical Properties

Limitations of Lookup Tables vs Real-Time Calculation



Limitations of Lookup Tables

Lookup tables are simple and efficient but rely on fixed assumptions limiting accuracy when conditions change.

Performance Degradation Risks

Deviations in pressure, temperature, or fluid composition cause measurement accuracy to decline and require recalibration.

Real-Time PVT Calculations

Real-time calculations dynamically adjust properties based on actual conditions, ensuring accuracy and adaptability.

Benefits of Real-Time Thermodynamics

Improved reliability, reduced maintenance, and enhanced accuracy are achieved by eliminating static lookup limitations.



Edge Computing in Thermodynamics

System Integration and Flexibility

Flexible Architecture Design

PPDS supports diverse integration scenarios with a client-server model for centralized data management.

Integration Interfaces

Built-in API and Excel interface enable seamless integration with external software and ease of use for engineers.

Dual Operation Modes

Supports offline engineering tasks and real-time process monitoring for flexible workflow adaptation.

Scalable Industrial Application

Designed to scale from small applications to large industrial systems with efficient system operation.



Edge Computing in Thermodynamics

Embedded Real-Time Thermodynamic Engine



Real-Time Thermodynamic Calculations

The hardware module performs accurate PVT calculations in real-time at the point of data acquisition, enhancing measurement response.

Multi-Phase Flash Calculation Support

Supports complex multi-phase flash calculations for petroleum fractions and mixtures, suitable for demanding industrial environments.

Enhanced System Autonomy

Embedded PPDS engine reduces latency and reliance on external servers, enabling autonomous and faster system operation.

Critical Industrial Applications

Ideal for custody transfer and process control scenarios where fast, accurate decisions are essential.



Edge Computing in Thermodynamics

Integration and Security



MODBUS TCP/IP Protocol

Supports MODBUS TCP/IP for communication with PLCs and SCADA systems, ensuring industrial compatibility.

REST API Integration

Provides REST API with JSON communication for advanced monitoring and integration with cloud and analytics tools.

Secure HTTPS Communication

Utilizes HTTPS to encrypt all data exchanges, emphasizing cybersecurity and data integrity in industrial environments.

Versatile System Integration

Combines traditional and modern protocols to bridge legacy systems with contemporary digital infrastructures.



Edge Computing in Thermodynamics

Industrial ARM64 Deployment

Compact Industrial Design

The PPDS hardware module uses a small form-factor industrial SBC for flexible deployment in harsh conditions.

ARM64 Architecture Efficiency

ARM64 architecture provides a balance of computational power and energy efficiency for continuous operation.

Robust Industrial Features

Supports wide-range DC power, Ethernet connectivity, and industrial-grade components for stable performance.

Edge Computing Deployment

Designed for edge computing, it processes data close to the source to reduce delays and improve responsiveness.

GATEWORKS GW7100

Rugged Industrial
Single Board Computer



35 x 100 mm



1x GbE



Mini-PCIe



Industrial I/O

ARM64

64-bit ARM Architecture
NXP i.MX 8M Mini / Cortex-A53



Efficient



Embedded



Linux Ready

HARSH + HOT CONDITIONS

Industrial Temperature Range



-40°C to +85°C



Rugged



Reliable



Up to 85°C



2026-06-10

Edge Computing in Thermodynamics

Industrial ARM64 Deployment

High Performance Computing

The PPDS module delivers fast real-time thermodynamic calculations with minimal latency for accurate measurements.

Wide Temperature Operation

Designed to function reliably across diverse temperature ranges, suitable for harsh industrial environments.

Reduced Network Dependency

Edge deployment eliminates constant server communication, reducing latency and improving system autonomy.

Enhanced System Reliability

Robust edge hardware ensures consistent and reliable performance even in remote or isolated locations.

GATEWORKS GW7100

Rugged Industrial
Single Board Computer



35 x 100 mm



1x GbE



Mini-PCIe



Industrial I/O

ARM64

64-bit ARM Architecture
NXP i.MX 8M Mini / Cortex-A53



Efficient



Embedded



Linux Ready



```
$ uname -a  
Linux gw7100 5.15.71 #1  
aarch64 GNU/Linux  
0101010000101  
0101000101010  
110110101100  
0101010101101
```

HARSH + HOT CONDITIONS

Industrial Temperature Range



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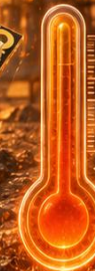
Rugged



Reliable



Up to 85°C



Real-World Deployment

GM Flow Adjusta-Cone® Wet Gas Flow Meter Integration

Real-time Thermodynamic Calculations

The PPDS module embeds real-time thermodynamic calculations directly within the flow meter for enhanced accuracy and performance.

Dynamic Fluid Property Adaptation

Continuous calculation of fluid properties based on pressure, temperature, and composition enables dynamic adaptation to changing conditions.

Successful Field Testing

Initial tests at TÜV SÜD's Advanced Multiphase Facility show positive performance and reliable data from the integrated system.

Enhanced Measurement Solutions

The integration validates PPDS technology as a practical solution enhancing existing measurement devices for broader applications.



Thank you

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