COURSE OVERVIEW IE1116
Smart Gas Metering Skids & Advanced Measurement Technologies

Course Title
Smart Gas Metering Skids & Advanced Measurement Technologies

Course Date/Venue
Session 1: June 15-19, 2025/Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE
Session 2: November 23-27, 2025/Meeting Plus 9, City Centre Rotana, Doha, Qatar

Course Reference
IE1116

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

This course is designed to provide participants with a detailed and up-to-date overview of Smart Gas Metering Skids & Advanced Measurement Technologies. It covers the importance of accurate gas measurement, gas flow properties, types of gases in the industry and applications in custody transfer and process control; the basic principles of fluid flow, components of gas metering skids and types of gas meters; the gas flow measurement standards, smart metering concepts, ultrasonic flow meters, coriolis flow meters and turbine and rotary meters; and the pressure and temperature compensation, gas chromatography in skid systems, flow computers and data acquisition.

Further, the course will also discuss the skid fabrication and layout design, control panel and SCADA integration; the power supply and electrical design, power supply and electrical design; the smart communication technologies and calibration and validation procedures; the routine operation of gas metering skids and common troubleshooting scenarios; and the predictive and preventive maintenance, diagnostic tools and remote monitoring and safety in gas metering operations.

During this interactive course, participants will learn the legal requirements for custody transfer, approval of measuring systems, role of third-party verification and penalties for metering inaccuracies; the gross calorific value (GCV) determination, correction factors and calculation methods and invoice generation and audit trails; the ISO 17025 calibration lab requirements, MID compliance and API/AGA reporting requirements; the concept of digital twins for metering skids and AI for anomaly detection, predictive maintenance through ML models and future integration with blockchain for billing; the planning and specification phase and vendor selection; and the technical bid evaluation, installation and commissioning management and risk mitigation and project handover.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain an in-depth knowledge on smart gas metering skids and advanced measurement technologies
- Discuss the importance of accurate gas measurement, gas flow properties, types of gases in the industry and applications in custody transfer and process control
- Recognize the basic principles of fluid flow, components of gas metering skids and types of gas meters
- Review gas flow measurement standards, smart metering concepts, ultrasonic flow meters, coriolis flow meters and turbine and rotary meters
- Recognize pressure and temperature compensation, gas chromatography in skid systems, flow computers and data acquisition
- Illustrate skid fabrication and layout design, control panel and SCADA integration, as well as power supply and electrical design, power supply and electrical design
- Discuss smart communication technologies and apply calibration and validation procedures, routine operation of gas metering skids and common troubleshooting scenarios
- Employ predictive and preventive maintenance, diagnostic tools and remote monitoring and safety in gas metering operations
- Explain the legal requirements for custody transfer, approval of measuring systems, role of third-party verification and penalties for metering inaccuracies
- Apply gross calorific value (GCV) determination, correction factors and calculation methods and invoice generation and audit trails
- Identify ISO 17025 calibration lab requirements, MID compliance and API/AGA reporting requirements
- Discuss the concept of digital twins for metering skids and apply AI for anomaly detection, predictive maintenance through ML models and future integration with blockchain for billing
- Describe planning and specification phase and apply vendor selection and technical bid evaluation, installation and commissioning management and risk mitigation and project handover

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of smart gas metering skids and advanced measurement technologies for instrumentation & control engineers, measurement engineers & technicians, process engineers, operations & maintenance personnel, gas transmission & distribution engineers, SCADA & automation engineers, project & engineering managers, regulatory compliance & QA/QC professionals, procurement specialists (technical), consultants & EPC contractors

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Haward's Certificates are accredited by the following international accreditation organizations:

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. John Vorster, MSc, BTech, is a **Senior Instrumentation & Control Engineer** with over **25 years** of industrial experience within the **Oil**, **Gas**, **Process**, **Refinery**, **Power** and **Nuclear** industries. His wide expertise includes **Field Indication Instruments**, **P&ID** & Technical Specification, **Test Equipment Calibration**, **Field Bus** & **Field Communications**, Testing, Calibration & Maintenance of **Flow**, **Level**, **Pressure & Temperature**; **Flow Measurement & Custody Measurement**, **Flow Computer**, **Turbine Flowmeters**, **Ultrasonic Flowmeter**, **Positive Displacement Flowmeter**, **Coriolis Flowmeter**, **Flow Rate Corrections**, **Pressure Flow Transmitters**, **Pressure Methods**, **Flow Nozzles**, **Orifice Plates**, **Venturi Tubes**, **Pitot Tubes**, **Process Control** Design & Plant Modelling, **Instrumentation**, **Automation**, **Process Control** Instrumentation, **Analyzer** Measurement Systems, **Pressure** Management, Selection & Sizing of all Instrumentation, **SIL** Criteria, Calibration & Configuration of Installed Instrumentation, **PLC & DCS**, **Bearing Replacement** and **Control Valves**. Further, he is also well-versed in HAZOP, LOPA Studies, Radiation Protection, Hazardous Substances, Hazardous Area Classification, Nuclear Devices Maintenance, Loop Drawings, Loop Calculations, Engineering Drawings, Shutdown Maintenance & Planning, Asset Management, Six Sigma, Energy Management & Measurements, Project Management, Strategic Resource Planning, Budget Preparation, ISO 9001, ISO 14000 and ISO 18000 standards. He is currently the **Instrumentation Analyzer & Engineer** of **Sasolburg** wherein he is in-charge of the design and monitoring of the analyzer measurement systems.

During his career life, Mr. Vorster has gained his practical and field experience through his various significant positions and dedication as the **Project Manager**, **Senior Trainer/Instructor**, **Senior Instrumentation Engineer**, **Instrumentation Engineer**, **Green Belt Project Leader**, **Instrumentation Technologist**, **Senior Instrumentation/Electrical Artisan**, **Instrumentation Artisan** and **Apprentice Instrumentation** for numerous international companies including **Sasolburg**, **DOW Chemical Company**, **Safripol** and **Iscor**.

Mr. Vorster has a **Master's** degree in **Engineering Development & Management**, as well as a **Bachelor's of Technology** degree and a **National Diploma** in **Electrical Engineering**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**), an **Appointed Radiation Protection Officer** and a **Qualified Instrument Mechanician**. Moreover, he is an active member of Project Management Institution (**PMI**) and South African Institute of Measure and Control (**SAIMC**) and has delivered numerous courses, workshops, conferences and seminars internationally.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Fee

Dubai	**US$ 5,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Doha	**US$ 6,000** per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the workshop for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to Natural Gas Metering*** *Importance of Accurate Gas Measurement • Overview of Gas Flow Properties • Types of Gases in the Industry • Applications in Custody Transfer and Process Control*
0930 – 0945	*Break*
0945 – 1030	***Basic Principles of Fluid Flow*** *Flow Regimes: Laminar vs. Turbulent • Reynolds Number and Its Significance • Pressure, Temperature, and Density Relations • Compressibility Factors in Gases*
1030 – 1130	***Components of Gas Metering Skids*** *Piping and Valves • Pressure Regulators and Filters • Flow Conditioners and Strainer Elements • Isolation and Bypass Systems*
1130 – 1215	***Types of Gas Meters*** *Orifice Plate Meters • Ultrasonic Flow Meters • Turbine Meters • Coriolis and Thermal Mass Flow Meters*
1215 – 1230	*Break*

1230 – 1330	***Gas Flow Measurement Standards*** *AGA (American Gas Association) Standards • ISO 5167 and ISO 6976 • API MPMS Standards • OIML and Other Metrological Guidelines*
1330 – 1420	***Basics of Smart Metering Concepts*** *Definition of Smart Metering • Key Differences from Conventional Metering • Digital Integration and Remote Monitoring • Benefits in Terms of OPEX and Data Availability*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***Ultrasonic Flow Meters*** *Principle of Operation (Transit Time, Doppler) • Inline vs. Clamp-On Meters • Accuracy and Calibration Requirements • Diagnostic Capabilities and Self-Checks*
0830 – 0930	***Coriolis Flow Meters*** *Mass Flow Measurement Principle • Installation Requirements • Density and Temperature Measurement • Performance in Multiphase Flow*
0930 – 0945	*Break*
0945 – 1100	***Turbine & Rotary Meters*** *Design and Operational Principles • Advantages and Limitations • Bearings and Rotor Behavior • Maintenance and Lifecycle Cost*
1100 – 1215	***Pressure & Temperature Compensation*** *Real Gas Behavior • Integration with RTD and Pressure Transmitters • Smart Transmitters (HART, Foundation Fieldbus) • Compensation Algorithms and Implementation*
1215 – 1230	*Break*
1230 – 1330	***Gas Chromatography in Skid Systems*** *Role of GC in Quality Measurement • Composition Analysis for Energy Content • Integration with Flow Computers • Calibration and Sample Conditioning*
1330 – 1420	***Flow Computers & Data Acquisition*** *Key Functions of Flow Computers • Connectivity with Sensors and Meters • Real-Time Logging and Trending • Protocols: Modbus, Profibus, OPC*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3

0730 – 0830	***Skid Fabrication & Layout Design*** *Skid Piping Layout and Footprint Optimization • Materials Selection (Piping, Instruments) • Skid Frame and Structural Considerations • Accessibility and Maintainability*
0830 – 0930	***Control Panel & SCADA Integration*** *PLC/DCS Integration • Remote Terminal Units (RTU) • Human-Machine Interface (HMI) • Alarm and Shutdown Systems*
0930 – 0945	*Break*

0945 – 1100	***Power Supply & Electrical Design*** *Power Requirements for Instruments • Hazardous Area Classifications (ATEX, IECEx) • Cabling and Junction Box Layouts • UPS and Battery Backup Systems*
1100 – 1215	***Smart Communication Technologies*** *IoT and IIoT for Gas Metering • Wireless Communication (NB-IoT, LoRaWAN) • Edge Computing in Smart Skids • Cybersecurity Considerations*
1215 – 1230	*Break*
1230 – 1330	***Calibration & Validation Procedures*** *Factory Acceptance Tests (FAT) • Site Acceptance Tests (SAT) • Meter Proving Techniques • Verification Frequency and Traceability*
1330 – 1420	***Case Study: Integrated Smart Metering Skid*** *Process Flow and Block Diagram Review • Discussion of Selected Instruments • Challenges and Optimization • Q&A and Lessons Learned*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4

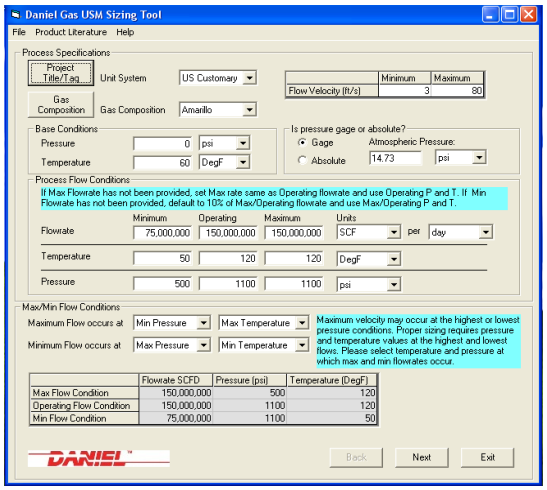
0730 – 0830	***Routine Operation of Gas Metering Skids*** *Startup and Shutdown Procedures • Reading and Interpreting Flow Data • Checking for Abnormal Conditions • Operational Best Practices*
0830 – 0930	***Common Troubleshooting Scenarios*** *Zero Drift and Signal Loss • Pressure Drops and Gas Surges • Communication Failures • False Readings or Alarms*
0930 – 0945	*Break*
0945 – 1100	***Predictive & Preventive Maintenance*** *Scheduled Inspection Routines • Cleaning of Filters and Sensors • Trending Meter Performance Data • Preventing Calibration Drift*
1100 – 1215	***Diagnostic Tools & Remote Monitoring*** *Use of Diagnostic Dashboards • Embedded Diagnostics in Smart Meters • Remote Analytics via Cloud Platforms • Predictive Alerts and Asset Health Index*
1215 – 1230	*Break*
1230 – 1330	***Safety in Gas Metering Operations*** *Handling Pressurized Systems • Gas Leak Detection Systems • Fire/Explosion Protection Strategies • Emergency Response Protocols*
1330 – 1420	***Hands-On Exercise or Simulation*** *Walkthrough of a Smart Metering SCADA • Live Data Interpretation • Alarm Condition Diagnosis • Parameter Configuration Exercise*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

Day 5

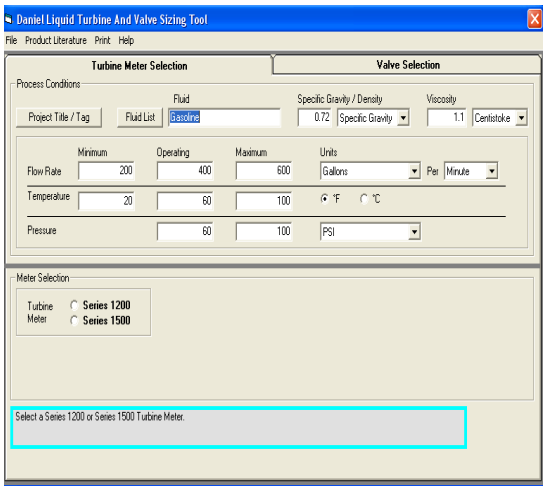
0730 – 0830	***Custody Transfer & Legal Metrology*** *Legal Requirements for Custody Transfer • Approval of Measuring Systems • Role of Third-Party Verification • Penalties for Metering Inaccuracies*
0830 – 0930	***Energy Billing & Gas Quality Calculations*** *Energy vs. Volume Billing • Gross Calorific Value (GCV) Determination • Correction Factors and Calculation Methods • Invoice Generation and Audit Trails*
0930 – 0945	*Break*
0945 – 1100	***Regulatory Standards & Certification*** *ISO 17025 Calibration Lab Requirements • MID Compliance (EU Measuring Instruments Directive) • API/AGA Reporting Requirements • Certifying Authorities and Periodic Audits*
1100 – 1215	***Digital Twin & AI in Metering*** *Concept of Digital Twins for Metering Skids • Use of AI for Anomaly Detection • Predictive Maintenance through ML Models • Future Integration with Blockchain for Billing*
1215 – 1230	*Break*
1230 – 1345	***Project Planning & Execution of Metering Systems*** *Planning & Specification Phase • Vendor Selection and Technical Bid Evaluation • Installation & Commissioning Management • Risk Mitigation and Project Handover*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about t Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulators (Hands-on Practical Sessions)

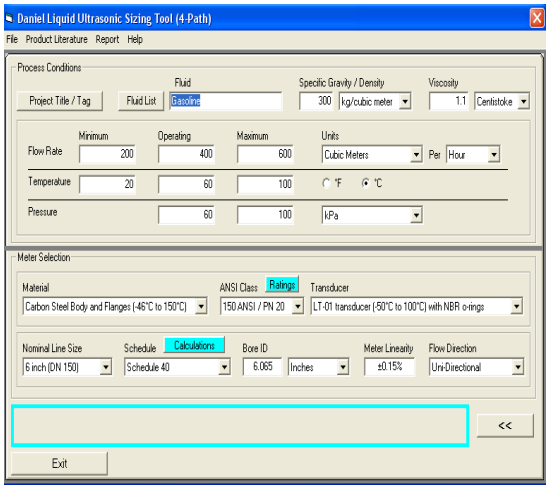
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art "Gas Ultrasonic Meter Sizing Tool", "Liquid Turbine Meter and Control Valve Sizing Tool", "Liquid Ultrasonic Meter Sizing Tool" and "Orifice Flow Calculator" simulators.



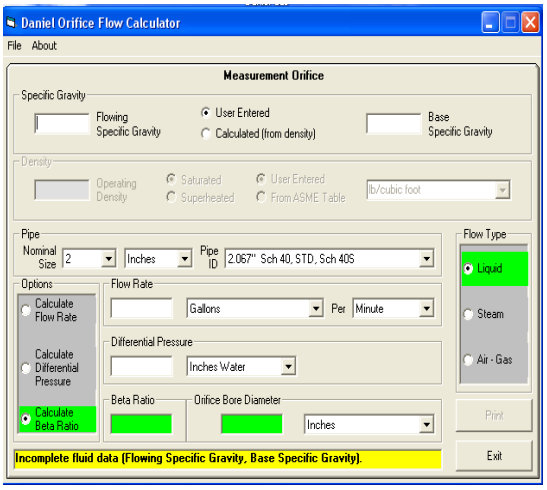
Gas Ultrasonic Meter (USM) Sizing Tool Simulator



Liquid Turbine Meter and Control Valve Sizing Tool Simulator



Liquid Ultrasonic Meter Sizing Tool Simulator



Orifice Flow Calculator Simulator

Course Coordinator

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org