COURSE OVERVIEW IE0576
CEMS Analyzers Maintenance from ABB

Course Title
CEMS Analyzers Maintenance from ABB

Course Date/Venue
Session 1: June 30-July 04, 2025/Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
Session 2: October 26-30, 2025/Tamra Meeting Room, Al Bandar Rotana Creek, Dubai, UAE

Course Reference
IE0576

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

Course Description

This practical and highly-interactive course includes real-life case studies and exercises where participants will be engaged in a series of interactive small groups and class workshops.

This course is designed to provide participants with a detailed and up-to-date overview of CEMS Analyzers Maintenance. It covers the purpose and objectives of CEMS, regulatory standards, emission parameters and extractive versus in-situ systems; the ABB CEMS system architecture, types of ABB analyzers and regulatory compliance and QA/QC requirements; the functional blocks and signal paths, sensor modules and measurement principles; the user interface and menu navigation, communication protocols and data access; working with flammable/toxic gases and electrical safety practices; and the analyzer cabinet ventilation and purging and lockout/tagout procedures.

Further, the course will also discuss the NDIR measurement technology, zirconia oxygen measurement, paramagnetic oxygen measurement and FID and CLD technology (hydrocarbon and NOx); configuring CEMS system using ABB Panel 800 HMI, fieldbus/protocol settings (MODBUS, PROFIBUS), alarm and status configurations and datalogger and historian configuration; the sample conditioning system (SCS), routine maintenance tasks, preventive maintenance scheduling and calibration procedures; and troubleshooting common issues covering signal loss and noisy readings, sensor contamination and blockages, flow and pressure anomalies and internal diagnostics and log review.

During this interactive course, participants will learn the maintenance tools and accessories comprising of special ABB calibration tools, gas regulators, fittings, and tubing, diagnostic software tools and portable gas detectors and meters; the analyzer module replacement procedures, advanced diagnostic features and integrating with DCS/SCADA; the data logging and archiving, signal conditioning and analog output testing and redundancy and fail-safe operation; reading and interpreting ABB manuals and using wiring and layout diagrams; and applying maintenance SOP documentation and troubleshooting flowcharts.

Course Objectives

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

- Apply and gain an in-depth knowledge on CEMS (continuous emissions monitoring system) analyzers maintenance
- Discuss the purpose and objectives of CEMS, regulatory standards, emission parameters and extractive versus in-situ systems
- Identify ABB CEMS system architecture, types of ABB analyzers and regulatory compliance and QA/QC requirements
- Recognize functional blocks and signal paths, sensor modules and measurement principles, user interface and menu navigation and communication protocols and data access
- Work with flammable/toxic gases and apply electrical safety practices, analyzer cabinet ventilation and purging and lockout/tagout procedures
- Carryout NDIR measurement technology, zirconia oxygen measurement, paramagnetic oxygen measurement and FID and CLD technology (hydrocarbon and NOx)
- Configure CEMS system using ABB Panel 800 HMI and apply fieldbus/protocol settings (MODBUS, PROFIBUS), alarm and status configurations and datalogger and historian configuration
- Apply sample conditioning system (SCS), routine maintenance tasks, preventive maintenance scheduling and calibration procedures
- Troubleshoot common issues covering signal loss and noisy readings, sensor contamination and blockages, flow and pressure anomalies and internal diagnostics and log review
- Identify maintenance tools and accessories comprising of special ABB calibration tools, gas regulators, fittings, and tubing, diagnostic software tools and portable gas detectors and meters
- Employ analyzer module replacement procedures, identify advanced diagnostic features and integrate with DCS/SCADA
- Illustrate data logging and archiving, signal conditioning and analog output testing and redundancy and fail-safe operation
- Read and interpret ABB manuals, use wiring and layout diagrams, apply maintenance SOP documentation and troubleshoot flowcharts

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 CEMS analyzers maintenance for maintenance engineers/technicians, CEMS operators, environmental engineers, service technicians, quality assurance and regulatory compliance officers, system integrators, plant/facility managers and other technical staff.

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.

Course Fee

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.

Accommodation

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

Certificate Accreditations

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**. 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:

Dr. Ahmed El-Sayed, PhD, MSc, BSc, is a **Senior Electrical & Instrumentation Engineer** with **35 years** of extensive experience within the **Oil**, **Gas**, **Power**, **Petroleum**, **Petrochemical** and **Utilities** industries. His experience widely covers in the areas of **Flow Measurement** Devices, **Water Network** Pipe Materials & Fittings, **Mapping & Inventory** of Pipes & Fittings in the Water Supply System, **Water Distribution System** Operator, **Sewer System and Sewage Flows**, **Ultrasonic Inspection**, and **Advanced Visual Techniques** of Predictive Maintenance, Water Meter Reading (**MMR**), **Network Management & Supervision**, **Leakage Prevention & Control**, Waste Water Treatment, **Water Utility Regulation and Economics**, **Health & Safety Rules & Regulations**, **Safety Management**, **Accident Investigation**, Advanced Distributed Control System (**DCS**), **DCS** Operation & Configuration, **DCS** Troubleshooting, **DCS Yokogawa** ProSafe-RS Safety Instrumented System, **DCS Yokogawa** Centum VP, **DCS Emerson** DeltaV, **DCS GE Mark VI**, Programable Logic Controller (**PLC**), Supervisory Control & Data Acquisition (**SCADA**) Systems, **Process Control**, **Control Systems & Data Communications**, **Instrumentation**, **Automation**, **Valve Tuning**, Safety Instrumented Systems (**SIS**), Safety Integrity Level (**SIL**), Emergency Shutdown (**ESD**), **Telemetry** Systems, **Boiler Control & Instrumentation**, Advanced Process Control (**APC**) Technology, Practical **Fiber-Optics** Technology, **Compressor** Control & Protection, **GE Gas Turbines**, **Alarm** Management Systems, **Engine** Management System, **Fieldbus** Systems, **NEC** (National Electrical Code), **NESC** (National Electrical Safety Code), **Electrical Safety**, **Electrical Hazards** Assessment, **Electrical Equipment**, Electrical Transient Analysis Program (**ETAP**), Power **Quality**, Power **Network**, Power **Distribution**, **Distribution Systems**, **Power Systems Control**, **Power Systems Security**, Power **Electronics**, **Power System** Harmonics, **Power System** Planning, Control & Stability, **Power Flow** Analysis, **Smart Grid & Renewable** Integration, **Power System Protection & Relaying**, Economic Dispatch & Grid Stability Constraints in Power Plants, Electrical Demand Side Management (DSM), Electrical **Substations**, **Substation Automation** Systems & Application (IEC 61850), **Distribution Network** System Design, **Distribution Network Load**, Electrical **Distribution** Systems, **Load Forecasting** & System Upgrade (Distribution), **Overhead Power Line** Maintenance & Patrolling, High Voltage **Switching** Operations, Industrial **UPS Systems & Battery** Power Supplies, Electric **Motors & Variable Speed Drives**, **Generator** Maintenance & Troubleshooting, **Generator** Excitation Systems & AVR, **Transformer** Maintenance & Testing, Lock-Out & Tag-Out (**LOTO**), Confined Workspaces and **Earthing & Grounding**, He is currently the **Systems Control Manager** of **Siemens** where he is in-charge of Security & Control of Power **Transmission Distribution** & **High Voltage** Systems and he further takes part in the Load Records Evaluation & Transmission Services Pricing.

During his career life, Dr. Ahmed has been actively involved in different Power System Activities including Roles in Power System Planning, Analysis, Engineering, **HV Substation** Design, Electrical Service Pricing, Evaluations & Tariffs, Project Management, Teaching and Consulting. His vast industrial experience was honed greatly when he joined many International and National Companies such as **Siemens**, **Electricity Authority**, Egyptian Electricity Holding, Egyptian Refining Company (ERC), **GASCO**, Tahrir Petrochemicals Project, and **ACETO** industries as the **Instrumentation & Electrical Service Project Manager**, **Energy Management Engineer**, **Department Head**, **Assistant Professor**, **Project Coordinator**, **Project Assistant and Managing Board Member** where he focused more on dealing with Technology Transfer, System Integration Process and Improving Localization. He was further greatly involved in manufacturing some of **Power System** and **Control & Instrumentation Components** such as Series of Digital Protection **Relays**, MV **VFD**, **PLC** and **SCADA** System with intelligent features.

Dr. Ahmed has **PhD**, **Master**'**s** & **Bachelor**'**s** degree in **Electrical Engineering** from the **University of Wisconsin Madison**, **USA** and **Ain Shams University**, respectively. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/ Assessor/Trainer** by the **Institute of Leadership and Management** (**ILM**), an active member of IEEE and ISA as well as numerous technical and scientific papers published internationally in the areas of Power Quality, Superconductive Magnetic Energy Storage, SMES role in Power Systems, Power System **Blackout** Analysis, and Intelligent Load Shedding Techniques for preventing Power System Blackouts, HV **Substation Automation** and Power System Stability.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course 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 CEMS*** *Purpose & Objectives of CEMS • Regulatory Standards (EPA, EEA, Local) • Emission Parameters (Nox, SO2, CO, CO2, O2, Etc.) Overview of Extractive versus in-Situ Systems*
0930 – 0945	*Break*
0945 – 1030	***ABB CEMS System Architecture*** *Architecture Major System Components (Analyzers, Probes, Sample Conditioning) • Sample Handling System Overview • Integration with DCS/PLC/SCADA • Redundancy & Modular Design Concepts*
1030 – 1130	***Types of ABB Analyzers*** *Gas Analyzers (FID, NDIR, CLD, Zro2, Paramagnetic) • Particulate & Opacity Monitors • Dust & Flow Measurement Instruments • Analyzer Selection Criteria*
1130 – 1230	***Regulatory Compliance & QA/QC Requirements*** *Calibration, Zero/Span Checks • Data Validation & Reporting • Daily, Quarterly, & Annual QA Checks • Compliance Certification & Audit Process*
1230 – 1245	*Break*
1245 – 1330	***ABB AO2000 Series Overview*** *Functional Blocks & Signal Paths • Sensor Modules & Measurement Principles • User Interface & Menu Navigation • Communication Protocols & Data Access*
1330 – 1420	***Safety Considerations & Work Permits*** *Working with Flammable/Toxic Gases • Electrical Safety Practices • Analyzer Cabinet Ventilation & Purging • Lockout/Tagout Procedures*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*End of Day One*

Day 2

0730 – 0830	***NDIR Measurement Technology*** *Infrared Absorption Principle • Light Source & Detector Mechanisms • Cross-Sensitivity & Compensation • Calibration & Linearity*
0830– 0930	***Zirconia Oxygen Measurement*** *Electrochemical Oxygen Sensing • Reference & Measuring Electrodes • Temperature Compensation • Calibration & Lifetime Factors*
0930 – 0945	*Break*
0945 – 1100	***Paramagnetic Oxygen Measurement*** *Magnetic Susceptibility Concept • Sensor Construction & Operation • Flow & Pressure Impact • Maintenance & Troubleshooting*

1100 – 1230	***FID & CLD Technology (Hydrocarbon & NOx)*** *Flame Ionization Detector (FID) Components • Carrier Gas & Flame Control • Chemiluminescence Principle in CLD • Interference & Calibration Gases*
1230 – 1245	*Break*
1245 – 1330	***ABB CEMS System Configuration & Setup*** *Configuration Using ABB Panel 800 HMI • Fieldbus/Protocol Settings (MODBUS, PROFIBUS) • Alarm & Status Configurations • Datalogger & Historian Configuration*
1330 - 1420	***Sample Conditioning System (SCS)*** *Sample Probes & Filters • Sample Transport Lines (Heated/Unheated) • Chillers, Pumps, & Moisture Traps • Condensate Management & Drain System*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*End of Day Two*

Day 3

0730 – 0830	***Routine Maintenance Tasks*** *Daily Visual Inspections & Leak Checks • Weekly Probe Cleaning & Filter Changes • Quarterly Maintenance Checklist • Long-Term Service Planning*
0830– 0930	***Preventive Maintenance Scheduling*** *Maintenance Frequency Planning • Spare Parts & Consumables Inventory • Service Logs & Documentation • Analyzer Runtime Hour-Based Scheduling*
0930 – 0945	*Break*
0945 – 1100	***Calibration Procedures*** *Zero & Span Gas Calibration Process • Calibration Frequency & Intervals • Manual versus Auto-Calibration • Calibration Drift & Documentation*
1100 – 1230	***Troubleshooting Common Issues*** *Signal Loss & Noisy Readings • Sensor Contamination & Blockages • Flow & Pressure Anomalies • Internal Diagnostics & Log Review*
1230 – 1245	*Break*
1245 – 1330	***Maintenance Tools & Accessories*** *Special ABB Calibration Tools • Gas Regulators, Fittings, & Tubing• Diagnostic Software Tools • Portable Gas Detectors & Meters*
1330 - 1420	***Analyzer Module Replacement Procedures*** *Sensor Module Replacement • Internal Electronics Module Change • Safe Disassembly & Reassembly • Firmware & Configuration Retention*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*End of Day Three*

Day 4

0730 – 0830	***Advanced Diagnostic Features*** *Analyzer Self-Test Functions • Error Codes & Alarm History • Signal Trending & Performance Metrics • Predictive Diagnostics*
0830– 0930	***Integration with DCS/SCADA*** *Communication Protocol Mapping • Signal Scaling & Mapping• Alarm Interface Configuration • Time Synchronization & Data Stamping*
0930 – 0945	*Break*

0945 – 1100	***ABB Control Builder or Maintenance Software*** *Remote Access & Configuration • Backup & Restore of Analyzer Settings • Real-Time Monitoring Via Software • Firmware Updates & Upgrades*
1100 – 1230	***Data Logging & Archiving*** *Internal Logger Configuration • CSV/Log Export Setup • Compliance Data Retention • Secure Data Storage*
1230 – 1245	*Break*
1245 – 1330	***Signal Conditioning & Analog Output Testing*** *4-20 Ma Loop Testing • Analog Scaling Verification • Digital I/O Verification • Relay/Alarm Output Testing*
1330 - 1420	***Redundancy & Fail-Safe Operation*** *Redundant Analyzer Setup • Automatic Switchover Configuration • Fail-Safe Gas Routing • Alarm Prioritization Strategy*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*End of Day Four*

Day 5

0730 – 0930	***Hands-On Analyzer Maintenance*** *Zero & Span Calibration with Actual Gases • Cleaning Sample Lines & Probes • Module Replacement (Dummy Unit) • Fault Simulation & Resolution*
0930 – 0945	*Break*
0945 – 1130	***Real-World Case Studies*** *Case 1: O2 Reading Drift Due to Probe Contamination • Case 2: Moisture Ingress in Sample Lines • Case 3: NDIR Zero Drift & Troubleshooting • Case 4: Communication Loss with DCS*
1130 – 1230	***ABB Documentation & Manuals*** *Reading & Interpreting ABB Manuals • Using Wiring & Layout Diagrams • Maintenance SOP Documentation • Troubleshooting Flowcharts*
1230 – 1245	*Break*
1245 – 1345	***Workshop: System Walkthrough*** *Full System Inspection Checklist • Hands-On Configuration Review • Cross-Check Analyzer to HMI Readings • Simulated Calibration & Error Handling*
1345 – 1400	***Course Conclusion***
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*End of Course*

Practical Sessions

This practical and highly-interactive course includes real-life case studies and exercises:-

Course Coordinator

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