WOODWARD MICRONET CONTROL SYSTEM TRAINING COURSE
Week 4, 08 – 12 October 2018, Elst – The Netherlands

This training course has been developed in order to fill in customers’ need to get the highest level of training needed for operating and maintaining the LM2500+/DLE - LM6000DLE gas turbines and deals with all I&C aspects when working with these complex installations.

For whom?
I&C Technicians and Supervisors, Operators and Operation Managers.
In general for those who need an in-depth understanding of the Woodward Micronet Control System.

The training course is meant for employees of end users of gas turbines (companies with one or more operating LM-type gas turbines or companies that are going to operate LM-type gas turbines).

Entry level
Thorough understanding of the gas turbine equipment and its operation. Familiarity with control system basics. The training participants should be familiar with analog and digital control techniques.

VBR Turbine Partners advises that participants have followed the mechanical LM2500/PGT25 and LM6000 training course, or have gained similar knowledge.

Course manual
Each trainee will receive a training manual in full color, covering the relevant subjects of the training course. The text in the course manual, supplied by VBR Turbine Partners, will be in English and they will cover all subjects handled in the course.

Language
The training will be conducted in English. The manuals are in the English language as well.

Trainer
A qualified English speaking senior instructor with over 15 years’ experience will present the course.

Training location
The training course will be held at the VBR Turbine Partners premises in Elst, The Netherlands.

Training duration
Monday/Tuesday/Wednesday/Thursday
09:00 – 16:00
Friday
09:00 – 14:00
12:00 – 13:00

Pricing / payment conditions
For the Familiarization Woodward Micronet & Engine Control training course, in Elst, The Netherlands, the cost will be:
€ 2.500,- per person. (excl. VAT, lodging and travel expenses)
Payment in advance after receipt of our invoice.

Registration
If you wish to participate in the course please use the registration form at least three (3) weeks prior to the start of class. You can also request a registration by e-mail (refer to the e-mail address below. VBR Turbine Partners requests to send a PO (purchase order) with or immediately after the registration. Receipt of the registration form will be formally confirmed by mail. An invoice will be included if prepayment is required.

Cancellation
If you have received a registry confirmation but are forced to cancel, you can cancel the registration up to two (2) weeks before the course commencement date. The paid amount will then be refunded. After this date, or in the event of a no-show, no amount will be refunded.

VBR Turbine Partners reserves the right to cancel or defer the course. Cancellation or deferral of the training course will be notified by VBR Turbine Partners two (2) weeks prior to the course date. VBR Turbine Partners is not responsible for any expenses incurred due to non-refundable airline tickets or hotel accommodations.

Hotel accommodation
As an attachment to the registry confirmation, you will receive a list of hotels in the vicinity of Elst, and a map showing the route to the training location.

For registration you can use the link below:
Then scroll to the bottom of the page.

**General information about the Woodward Micronet control system training course**

Reference number: 35601443

**Course objective:**
- Understand the basic construction of the GE LM gas turbines and their auxiliary systems.

**Course content:**

**Day 1**
- Make acquaintance and presentation of the program
- An introduction to LM gas turbines
  - Gas Turbine Basics
  - Introduction to the LM Gas Turbines
- An introduction to the Major Components of the LM2500/PGT25 and LM6000
  - Low Pressure Compressor (LPC)
  - High Pressure Compressor (HPC)
  - Variable Geometry Control System compressor (IGV, VSV, VBV)
  - Combustion System (SAC - DLE)
  - High Pressure Turbine (HPT)
  - Low Pressure Turbine (LPT)
  - 6 Stage GE Power Turbine (PT)
  - Bearings, Sumps and Frames
  - An introduction to the Auxiliary Equipment and Systems
    - Device summary
    - Flow and Instrumentation Diagrams (F&ID’s / P&ID’s)
    - Hydraulic starting system

**Day 2**

**Controls hardware & software**

Instrumentation & Control
- On- and off engine instrumentation
  - Pressure / speed / temperature - LVD’s – RTD – CHPOT – vibration – air inlet filter dp sensor, PS3 and its specialties, Overspeed devices,
- Control elements and related components
  - Main fuel System components, such as gas fuel metering valve and liquid fuel metering valves, fuel shut-off valves
  - Actuators variable geometry
- I&C measuring methods
  - Single Ended versus differential measurement and why is this important for sensitive signal loops and control systems
- Calibration of special instrumentation
- EMC Principles and the Pitfalls
- Introduction to Woodward hardware
  - Digital controls philosophy vs analog
  - Purpose built hardware platform evolution
  - Woodward hardware platforms – Netcon5000 – MicroNet
- Customers relevant rack, I/O modules, cables, FTM’s and power supply
- Customers relevant fuel valve and other accessories
- Familiarization GAP
  - Dedicated control software evolution
  - Woodward GAP software description
  - GAP architecture and navigation
  - System Logic Flow
  - Special GAP blocks
  - Fault accommodation
  - Technical Interface
  - Safety connect to the CPU

**Day 3**

**Generic Control and Monitoring**

Introduction to LM Gas Turbine Control and Monitoring
- Control fundamentals, parameters, closed and open loops
- Basic of sequencing and fuel control
- Basics of compressor control and load sharing
- Basics of performance and monitoring
  - Generic Control and Monitoring
    - I/O requirements
    - Package sequencing requirements
    - Fuel control requirements
    - Package sequencing requirements
    - Fuel valve maintenance
  - Control and Monitoring implementation in GAP
  - Review of package P&ID and identification of instrumentation
  - GAP implementation in GAP
  - Package sequencing in GAP
  - Load control in GAP
  - HMI screens, trends, alarms & shutdowns
  - Performance / condition monitoring
  - Practical Exercises with GAP

**Day 4 and 5**

**Troubleshooting and real-life cases**
- Real life examples and Exercises
  - Pre-start checks
  - Start-up and shutdown sequencing
  - Loading, load sharing, load steps and rejections
  - Under-speed and over-speed events
  - Stall and flameouts
  - Compressor washing
- Exercise with GAP software, Compile and load application, loading tuneables
  - Package P&ID’s
  - I/O options and benefits
  - Fuel control and load issues
  - Evaluation of the training course
  - Course evaluation and issue of certificates

**Further information**

If more information concerning the training course is required, or if you need information about other training possibilities, please do not hesitate to contact the VBR Turbine Partners training department.

e-mail: training@vbr-turbinepartners.com

For more information or a request for registration please contact training@vbr-turbinepartners.com.