



# ENGINE & CHP CONTROL

One flexible system for engine, generator and auxiliaries  
based on openECS



## THE WORLD IS ALREADY COMPLEX ENOUGH. IT'S NICE FOR ONCE WHEN SOMETHING IS EASY.

The development of new engine controllers is our daily business. In doing so, we support our clients with practical experience in all the phases of the project for as long as it takes to reach a plant's design goals. Using our experience with over 8,500 customer-specific engine control systems we are confident we will also find the optimum solution for your project. This experience is also reflected in the standard cogeneration application. Aligned to the current requirements, also thought for future challenges.

### HIGH PERFORMANCE PARTNER

We have been a trusted partner to the gas-engine industry for 25 years and also the manufacture of TEM-Evo engine controllers – deployed in thousands of cogeneration plants.

- Technology leader in control systems for large gas engines and cogeneration plants
- Extensive experience gained from projects with a total exceeding 12,500 MW installed electric power
- Smart solutions featuring process and control automation for multiple commodities – for sustainable energy generation and distribution

Our experienced team of engineers and technicians are constantly at your disposal to support your projects:

- Electrical engineering, production of switch cabinets
- Tuition for users and developers
- Qualified Service Hotline
- Fast spare parts shipping

## A CONTROLLER FOR BOTH THE ENGINE AND THE PLANT

The further development of gas engines and new cogeneration plant operating concepts demand a flexible engine controller. One that can keep the engine operating safely at the limit of its mechanical performance while at the same time integrating it seamlessly into the cogeneration plant or into a whole network of plants.

With our construction kit principle with a single concept you can implement control of the engine, the generator and auxiliary systems, up to central SCADA systems. In the final analysis, you decide what we deliver: The AVAT Standard Application or a ready-made solution adapted to your requirements, which our – or your – developers can further refine.

### COMPACT SYSTEM LAYOUT

By the use of compact modules, the space requirement on the mounting plate is reduced by around 50% compared with conventional layouts with the same scope of functions. EPLAN libraries and complete circuit diagrams are available for all the components applied.

### GRID PROTECTION

As well as synchronisation and generator protection functions, grid code functions are already integrated into the system. The Bachmann GSP274 Grid and Generator Measurement Modules feature approved Component Certificates, simplifying the mandatory gen-set certifications. We will also support you during the certification process or in obtaining extensions to existing certificates.

### COMPREHENSIVE SCOPE-OF-SUPPLY

The AVAT Cogeneration Plants Standard Application is delivered with all circuit diagrams, installation instructions, descriptions of functional characteristics and parameters, and lists of limit values.

## ADVANTAGES AND FUNCTIONS AT A GLANCE

### ADVANTAGES

- A control system for both the engine and the plant
- Very fast and robust multi-variable closed-loop controller
- Rapid engine run-up to operating speed
- Wastegate control for improved efficiency
- Compact system layout
- Grid protection
- Powerful built-in diagnostic tools
- Flexibly expandable and adaptable at all times
- Spare parts availability over many years
- Proven technologies from the large engine field

### FUNCTIONS

- Closed-loop control of engine speed, power and air/gas mixture via a single, robust and fast multi-variable controller
- Start/Stop sequences for island and grid-parallel operation
- Wastegate control and ignition management
- High selectivity knock control of individual cylinders
- Misfire detection with automatic power reduction down to engine shutdown
- Monitoring of all sensors and measured values
- CAN connection to the ignition system
- Cogeneration plant control (peripherals)
- Closed-loop control and monitoring of all cooling and heating circuits
- Fan control for dry and hybrid coolers
- Control of flow-side temperature even in part load operation

## THE AVAT COMPLETE CONTROL SYSTEM FOR COGENERATION PLANTS. CONSTANTLY FLEXIBLE, ALWAYS EXPANDABLE.

Based on the open and flexible openECS hardware and software components, you can realise almost any engine and cogeneration plant control system you can envisage. For typical applications we already have tried-and-tested configurations – from circuit drawings to system visualization. An ideal starting point for arriving at your own, constantly expandable solution with a minimum of adaptations.

### AVAT Router MDH814

VPN Router for safe remote access via Internet.

- Internet access via broadband connection or direct via the mobile network (LTE)
- Remote maintenance possible with E<sup>2</sup>SERVICE
- Ready for AVAT VIRTUAL SERVICES



### E<sup>2</sup>CORE-control

Highly dynamic multi-variable controller with direct actuator drive.

- Controls throttle valves and wastegate actuators
- Stepper motor driver for gas mixer control
- Independent controller: rpm / power / mixture
- Connection for lambda probe (optional)



### E<sup>2</sup>KNOCKCON-c20

Reliably detects combustion knock and misfiring from the signals of established piezo knock sensors.

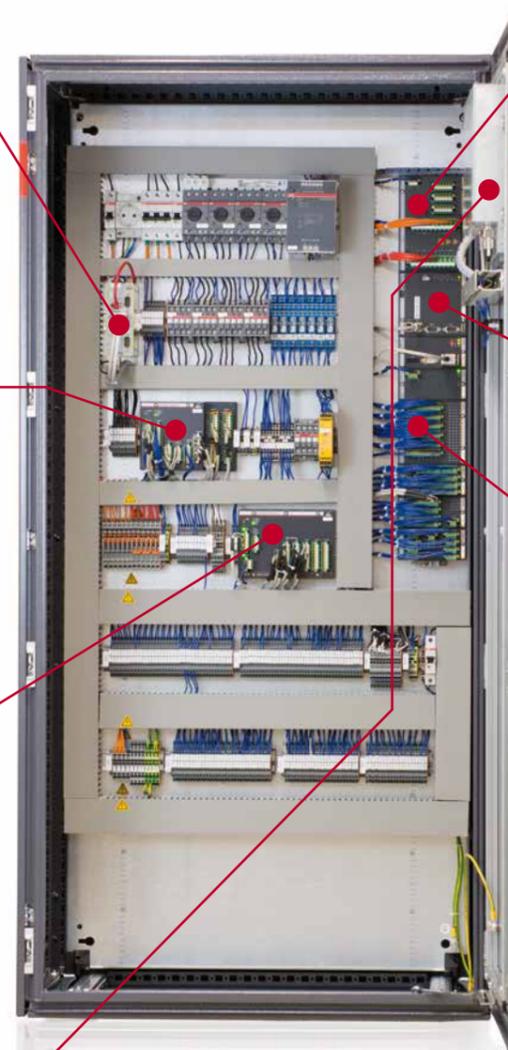
- Knock control of individual cylinders
- Additional misfire detection
- CAN interface to the engine controller



### E<sup>2</sup>PILOT

User terminal with 15" capacitive touchscreen, adapted to the plant operator's needs.

- Rapid overview of engine and peripherals
- Interactive operating log and configurable trending function
- Test functions



### Bachmann GSP274

Grid monitoring, synchronising and generator protection.

- Grid and generator monitoring
- Measurement of U, I, f, P and phase angle
- Integral grid protection functions (active and reactive power, connection criteria)



### Bachmann CPU

Robust industrial controller as the control system's basis. Programmable according to industry-wide PLC Standard IEC 61131-3.

- CPU for engine management and control of peripherals
- All engine components integrated via CAN
- Ethernet interface for visualization and SCADA system



### Bachmann I/O

Flexibly expandable with analogue and digital inputs and outputs.

- Sensors, engine and peripherals
- Control of auxiliary devices (pumps, valves, fans)
- Signals from and to the management system



### E<sup>2</sup>SERVICE (optional)

The software for ambitious service technicians. Task orientated graphical user interface for:

- Commissioning
- Controller adjustment
- Fault finding
- Maintenance

### AVAT VIRTUAL SERVICES (optional)

Central management of the complete engine pool and all service staff.

- Overview of all supervised plants
- E-Mail alerts in case of malfunctions, changes of status and control maintenance events
- List of alarm signals and reset statuses

## AREAS OF APPLICATION

### Engines and actuators

- Premix, lean burn gas engines from MAN, GE Jenbacher, MWM, Caterpillar, Liebherr, etc.
- Natural gas, biogas or special gases
- 250 to 2000 kW output range
- 4 to 20 cylinders
- Exhaust gas turbocharger with option of wastegate actuation
- Central venturi gas mixer with stepper motor control
- High voltage capacitor ignition systems
- Two-stage intercooler

### Plants

- Stationary cogeneration plant applications
- Containerized system or installation in permanent structures
- Engine cooling circuit with emergency cooling via dry cooler
- Intercooler circuit with dry cooler
- Heat extraction via engine coolant and exhaust gas heat exchanger
- Synchronous AC generator, low or medium voltage
- Grid code compliance

## WHAT A CLASSIC PLC NEEDS TO BECOME AN ENGINE CONTROLLER

Why choose between special Engine Control Components and a modular industrial PLC? Exactly this combination gives you a future-proof and highly flexible engine controller.

To control gas engines in cogeneration plants, sensors and actuators are needed that cannot be connected to a classic PLC. This is where the AVAT technology modules come into use. They are fully integrated into the system via the software building blocks.

The modules of the c-Series are an exact mechanical fit to the Bachmann M1-System and are connected via standardized CAN interfaces. Further devices, such as the ignition system, are connected via specific AVAT communication drivers.

As a matter of AVAT policy, all the modules and devices operate according to the principle “smart sensor” and “smart actuator”. They deliver pre-processed information and are controlled and configured by the PLC. All functions access the same data and thus all data are usable in the total system and are displayed on the user interface.



## THE openECS PRINCIPLE

openECS, our flexible engine controller for gas and dual-fuel engines, is a unique system platform which is open for all types of expansion. Functions, modules and subsystems harmonise with a high performance user interface to form a single unit.

### COMPLETE.

With openECS you create a solution that integrates all devices at and around your engine.

### FLEXIBLE.

The modular design makes your Engine Control System future-proof to meet new requirements.

### RELIABLE.

Long-term availability and competent support ensure safe operation in the engine's life cycle.

## THE FAST TRACK TO YOUR ENGINE CONTROL SOLUTION

Start with one of our AVAT Standard Applications. Adapt it to your specific engine and in a short time you have your own, made-to-measure engine control system ready for use.

- START**

**AVAT Standard Applications**  
Our standard applications cover already 80% of your requirements and are available for different engine types.
- ADAPT**

**Make the system fit your engine**  
Simply edit our standard specification. Adapt the system yourself or let our development engineers do it for you.
- RUN**

**Ready for production in short time**  
Business is more than a running engine. We assist in any issue from staff training to documentation and classification.
- OPEN**

**OPEN**  
Open to new requirements. Open to include third-party components. Open to develop your own software.

