Closed-Loop Controller

Item	Item-No.
ATeC 16 RT	00031376-63
ATeC 32 RT	00031377-63
ATeC 64 RT	00031378-63
ATeC 128 RT	00031379-63
ATeC 256 RT	00031380-63

ATeC
Adaptive Temperature Controller

For identification, parameter determination and intelligent control of thermal processes

Stable thermal process conditions provide the basis for complex production systems. The Adaptive Temperature Controller (ATeC) supports rapid implementation of this task with the highest control quality. In parallel with other control sequences, a single ATeC module operates up to 256 temperature control loops simultaneously on the M1 real-time system.

Determining parameters automatically

The ATeC is designed for heating systems as well as for combined heating and cooling systems. Using integrated identification routines, the system is able to determine the characteristics of different process lines automatically. The calculated control parameters enable reference-variable response to be optimized and disturbances to be suppressed for each individual task without the need for in-depth control know-how. Time-consuming experiments are no longer needed. This reduces costs considerably, especially for processes with very long time constants or when fully automatic adjustment is required during operation after a tool was changed.

Energy-optimized control

Multiple channels can be combined into a group and controlled in a coordinated manner. Pulses generated to control actuators by means of PWM or PFM are distributed automatically within a period. Thus, almost constant power consumption is achieved. Through start-up optimization, control of each loop is initiated in a way that allows all zones to reach their set point temperature almost simultaneously. This makes it possible to save valuable energy without additional effort or expenses. If necessary, power and energy management limits the total power released. In this way, control of actuators is adapted to the existing power supply connection without the need for further adjustments.
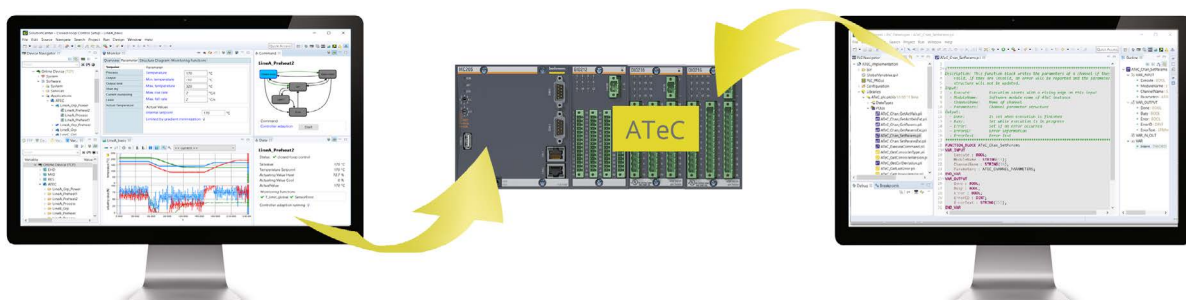
Handling coupled systems

When multiple heating and cooling systems have a mutual effect on one another, isolated consideration of individual controlled systems is no longer sufficient. By adaption in it's operating point, the controller is tuned exactly to these conditions. Moreover, known disturbance variables can be taken into account for feedforward control. In doing so, optimal results are reachable even under production conditions.
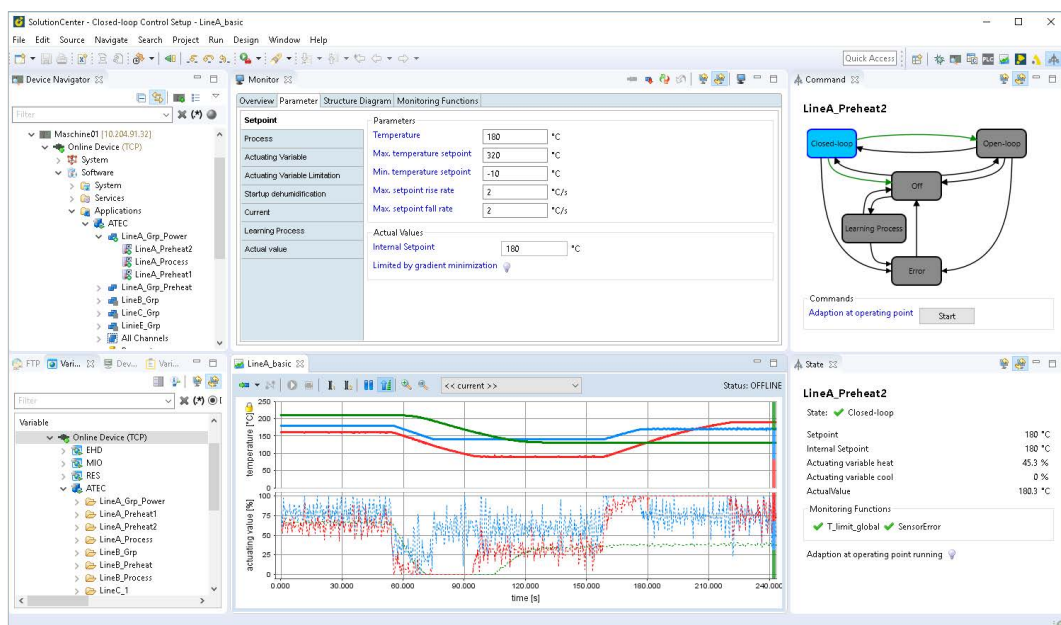
Monitoring included

If a control loop does not behave as intended, the ATeC is able to diagnose this beforehand. Monitoring of temperature limits, control deviation or a temperature tolerance band are included as standard functions. Through verifying the heating current, a pending or possibly already started heater failure is detectable.

In case of an error, the desired reaction can be selected on the basis of process requirements. If material would harden in a feed screw, heating is maintained at a constant power level. If, on the other hand, exceeding a maximum temperature limit is expected, heating is shut off.

Fully integrated into the engineering tool

Maximum convenience during start-up and operating mode is assured by full integration of the Adaptive Temperature Controller (ATeC) into the Bachmann SolutionCenter. In order to configure and parametrize an ATeC software module, a custom interface was introduced.

Alternatively, the Adaptive Temperature Controller (ATeC) can be integrated into an application. That's enabled by libraries, available in C/C++ as well as IEC 61131-3. All temperatures and manipulated variables can be observed in Recorder Scope3 beside other application variables. This allows a quick capture and graphically display of temperature control behavior at any time, even during real-time operation.

ATeC – Adaptive Temperature Controller

General Product Features

Channel configuration	Heating and cooling closed-loop control within one channel
Number of possible channels	256
Grouping through group functions	Available
Sampling times	20 ms to 100 s
Temperature units	°C, K, °F

Excerpt of Available Functions

Identification of temperature control systems	Automatic parameter identification for different types of controlled systems
Automatic determination of control parameters	Calculation based on identified control path model. Desired controller type is selectable.
Consideration of coupled systems	Take interaction into account during system identification as well as in operation, above all during heat-up phase
Power and energy management	Dynamic or continuous power limitation for a partial area or the entire system on the basis of local electrical power supply connection
Optimization of start-up time	Start time of the individual controls selected such that all temperature control systems reach their set point value simultaneously.
Heating current monitoring	Plausibility check of the measured currents based on the manipulated variable outputs for identification of heating elements that have failed partially or totally. Initial measurement of electric current automatically.
Dehumidification during heat up	Heating elements are held at a selectable start-up temperature for a specified length of time. In this way, any humidity present can escape slowly without damaging the heating elements.
Multiple monitoring functions	Temperature limits, tolerance band, updating of measured values, sensor fault, etc.

Signal Interfaces

Digital signals	All Bachmann module in category DI All Bachmann module in category DO
Analog signals	AIO20x/SI, AIO208, AIO216, GIO212, AI208/SI All Bachmann modules in category AO
Temperature measurement	GIO212, AIO20x/SI, AIO208, AIO216, TCO2xx-C: Temperature sensor and thermocouple as listed in the respective data sheet
Power measurement	GM260, GMP232/x, GSP274
Fieldbus modules	All corresponding Bachmann modules

Actuator Control

Analog actuation	0 to 100 %, scalable at desired output
Digital actuation	• Pulse width modulation (PWM) • Pulse frequency modulation (PFM) • Continuous actuation via 2 outputs (open, close)

Software Interfaces

API user interface	IEC 61131-3 as well as C/C++ libraries for parameter assignment, operation and diagnosis triggered in other application
Process communication	Provision of all values via the SVI (Standard Variable Interface)

ATeC – Adaptive Temperature Controller	
ATeC Configuration, Parameter Assignment and Operation	
SolutionCenter	Full integration
Applications	Libraries: IEC 61131-3, C/C++
External processes	Operation enabling via DI channels
Installation	
Delivery form	Supplied as part of the M-Base
Licensing	Number of configurable channels depends on license
License protection	Hardware-dependent license file
System Requirements	
Real-time system	• Bachmann M1 processor modules of the series MH, MC, MX, MPC • M-Base V3.95 and higher • Cpp library V4.1 • RAM: 8 MB of free memory for first channel, approx. 220 kB for each additional channel
Engineering computer	For computer requirements, see SolutionCenter product data sheet
Engineering software	SolutionCenter V2.30 or higher (M-Base V4.30)

Order Codes ATeC		
Item	**Item No.**	**Description**
ATeC 16 RT	00031376-63	Runtime license for ATeC software multi-channel temperature controller. Enables configuration, parametrization and operation of up to 16 controlled systems. License bounded to target device.
ATeC 32 RT	00031377-63	Runtime license for ATeC software multi-channel temperature controller. Enables configuration, parametrization and operation of up to 32 controlled systems. License bounded to target device.
ATeC 64 RT	00031378-63	Runtime license for ATeC software multi-channel temperature controller. Enables configuration, parametrization and operation of up to 64 controlled systems. License bounded to target device.
ATeC 128 RT	00031379-63	Runtime license for ATeC software multi-channel temperature controller. Enables configuration, parametrization and operation of up to 128 controlled systems. License bounded to target device.
ATeC 256 RT	00031380-63	Runtime license for ATeC software multi-channel temperature controller. Enables configuration, parametrization and operation of up to 256 controlled systems. License bounded to target device.