



# Eurotherm®



## Optimizing efficiency and regulatory compliance

Vacuum heat treatment control solutions

Meeting the requirements of industrial vacuum heat treatment standards is easier with accurate control of temperature and vacuum pressure.

Choose from a range of control solutions designed to help you achieve:

- Surface/core hardness requirements
- Conforming microstructure
- High quality finish

Optimize cycle times, and record the process to meet heat treatment data regulations.

### Applicable heat treatment standards

AMS2750

CQI-9

AMS2769

[eurotherm.com/heattreat](http://eurotherm.com/heattreat)

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# Vacuum heat treatment control

Vacuum pump sequence and integrated control systems

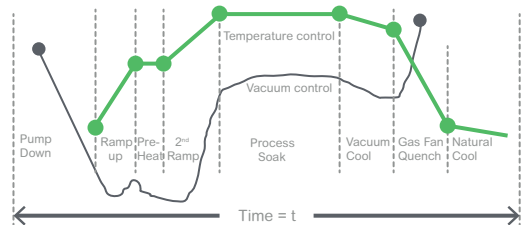


## Eurotherm vacuum cycle overview

### Vacuum control

Provides multi-setpoint control via a setpoint program and sequencing of the vacuum pumping system, with bumpless transfer between low vac and high vac gauges.

### Vacuum HT control



Provides multi-setpoint control via a setpoint program and sequencing of the vacuum pumping system, with temperature cycles.

## Products at a glance

### 2704VC, ideal for vacuum control

Features:

- High vac / low vac control
- Furnace temperature control
- Setpoint programming

Associated products:

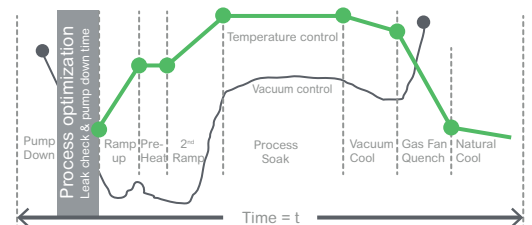
- 6100/6180 data recorder

### E+PLC<sup>400</sup> with E+HMI, ideal for advanced vacuum HT systems

Features:

- High vac / low vac / partial pressure control
- Furnace temperature control
- Load thermocouple inputs
- Quench gas control (gas type/pressure)
- Setpoint programming
- Inbuilt trend and tamper resistant data recording
- IIoT (Industrial Internet of Things) ready
- Easily integrated with 3rd party PLCs (hybrid system)

### Advanced vacuum HT system control

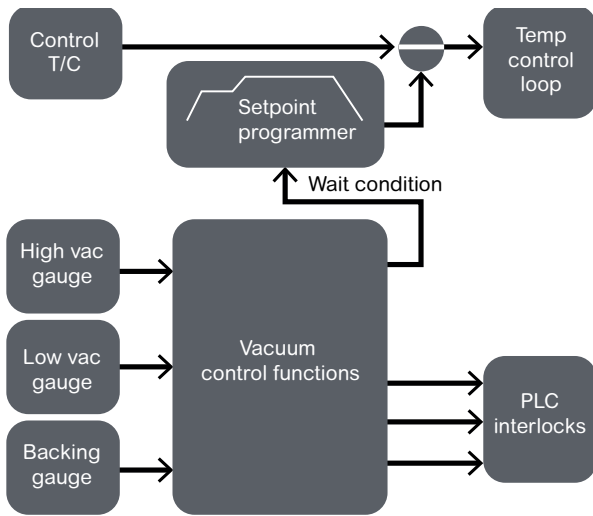


Setpoint control as above, plus leak-rate detection and pumping-time systems to aid the optimization of cycle-times. This IIoT ready system also allows enhancement with predictive maintenance functionality.

Please refer to the back page for a control solutions summary and an overview of our integrated systems and engineering services capability.

# Control system overview

## Features and functions



Control system overview

## Specialized functions for vacuum HT control

### T/C block

The thermocouple linearization function block converts the mV input reading and cold junction temperature into a temperature output. It also provides scaling, low pass filtering, offset and manual-override capabilities.

### Autotune PID control

Provides a channel output to control a process variable (PV), using a precision PID control algorithm designed by Eurotherm. Autotune is included, as well as a 'cutback' feature to control overshoot behavior. A gain scheduling feature is available for adding extra PID tuning sets, to help maintain tight control at different setpoints.

### Thermocouple life\*

Derives the working lifespan of thermocouples in days or number of times used, under different ranges of operating temperature. The block monitors usage times and temperatures, and indicates whether the thermocouple is still valid for use according to the AMS2750 standard.

\* Available in E+PLC only

### Vacuum input

Converts raw electrical measurements into vacuum pressure values. It also supplies a gas calibration factor for non-N<sub>2</sub>-type atmospheres, low pass filtering, offset, and manual override. Provides vacuum gauge linearization for several common vendors, as well as user defined linearization capability.

### Gauge switch

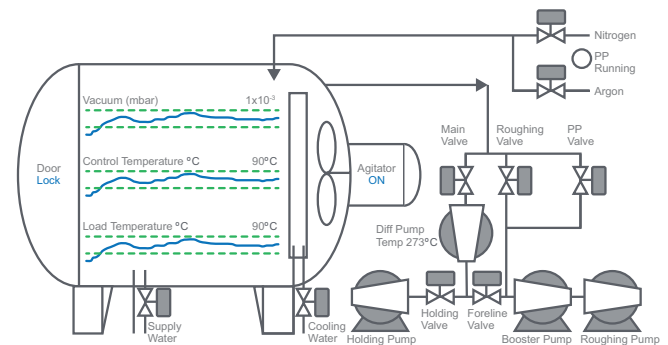
Allows for smooth (bumpless) switching between a "low" vacuum gauge, such as a Pirani gauge, and a "high" ionization type such as an inverted magnetron or Penning gauge.

### Pump-down timer

Optimizes vacuum cycle time by alerting operators to a controller detected event or leak in the vacuum system. It can be configured to signal an alarm if a particular vacuum pressure has not been reached in a given amount of time.

### Leak rate




Implements a leak test strategy for a vacuum chamber, using industry standard leak-rate methodology.



Typical vacuum furnace layout, visualized in E+PLC

# Vacuum sequence and integrated control systems

Example solutions dependent on I/O options

	Discrete control example	System Control	
	Vacuum control	Advanced vacuum heat treatment control	
			
	2704VC	E+PLC <sup>400</sup> 4 module base <sup>1</sup>	E+PLC <sup>400</sup> 16 module base x 2
Typical control inputs (dependent on optional I/O board or module selection)			
Furnace thermocouple	✓	✓	✓
Low vacuum gauge	✓	Dependent on customer specified I/O	✓
High vacuum gauge	✓		✓
Load thermocouple	✓		✓
Program start	✓		✓
Additional thermocouple inputs	Dependent on optional I/O		32
Additional analog inputs		6	
Digital inputs for sequencing		16	96
Typical control outputs (dependent on optional I/O board or module selection)			
Roughing pump	✓	Dependent on customer specified I/O	✓
High vacuum gauge on/off	✓		✓
Diffusion pump	–		✓
Furnace heater	✓		✓
End of cycle/partial pressure alarm	–		✓
Additional analog outputs	–	2	
Digital outputs for sequencing	–	16	64
Typical control function			
Autotuning PID	✓	✓	✓
Extra PID sets	2	6	6
Vacuum algorithms	Basic	Advanced	Advanced
Setpoint programming	Basic	Advanced	Advanced
Data recording	–	✓	✓
Batch management	–	✓	✓

<sup>1</sup> E+PLC<sup>400</sup> with any number of modules from zero upward can be used to create a hybrid advanced vacuum heat treatment control system, in combination with Eurotherm and 3rd party PLCs.

Product I/O options shown are for example only. Contact your local Eurotherm sales representative to discover the most suitable solution for your process.

**Scalable integrated systems and services, from single machine to enterprise solutions, including:**

- Power control (SSR/SCR) and process control
- Data management, alarm management and supervisory systems
- System design, engineering and installation
- Calibration and maintenance services

[eurotherm.com/systems](http://eurotherm.com/systems)

**Eurotherm**  
Faraday Close, Worthing,  
West Sussex, BN13 3PL  
United Kingdom  
Phone: + 44 (0)1903 268500

[www.eurotherm.com](http://www.eurotherm.com)

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