

Inspired by **temperature**



High precision  
**Temperature control solutions**

for the Pharmaceutical industry and Biotechnology

**huber**

# Temperature control solutions for the Pharmaceutical industry



Huber offers a wide range of temperature control systems and associated accessories.

The perfect unit for any application can be found within the range and help is always at hand to guide users to the right product for their application.

This assistance is in the form of engineering expertise, well qualified and experienced partners and our wide range of Case Studies freely available on our web site.

Our portfolio can be broadly split into three ranges: Uni-stats (hydraulically sealed thermostats), Open Bath Thermostats and chillers.

## Typical applications

- Reactors
- Laboratory instruments
- Sample preparation
- Process cooling
- Quality control
- Material testing
- Process development
- Scale-up
- Miniplants
- Pilot plants
- Kilolabs
- and much more

# and Biotechnology



## Process thermostats

Unistats are designed to control temperature in a wide variety of applications across all industries. They are used extensively in many departments and applications in the Pharmaceutical industry from small scale research to large scale production over a temperature range of -125 °C to 425 °C.

Their ability to rapidly change the temperature of the circulating heat transfer fluid (HTF) and the advanced self-tuning PID controller provides the application with extremely tight and responsive temperature control. This can be seen in the Case Study collection on the Huber website.



## Baths and Circulators

Our product line with classical constructed open baths and circulators are split into two ranges.

The KISS range are simple units designed for small bench top applications. They have a simple controller and are easy to use.

The CC range has the more extensive Pilot ONE controller. Used in smaller application and especially when the rapid response of the Unistats is (perhaps) not required. Providing temperature control from -90 °C to 300 °C, they are an effective and useful laboratory work horse.



## Chillers

Unichillers are specifically designed to remove heat but are also capable of temperature control within  $\pm 0,1$  K if fitted with an optional heater. The chiller range is split into two groups.

The OLÉ range is for more simple applications such as cooling condensers on low-volume rotary evaporators or low volume bioreactors. The controller is simple and easy to use.

The T range are floor standing chillers designed for larger applications, e.g. cooling the condenser on a high volume rotary evaporators or used as a "central chilled water supply" for the whole laboratory. They are also very often used to control the temperature of large bioreactors.

# High precision temperature control in Research, Development



## Research & Development

Huber units provide stable and predictable temperature control. This performance removes an unpredictable variant from the research.



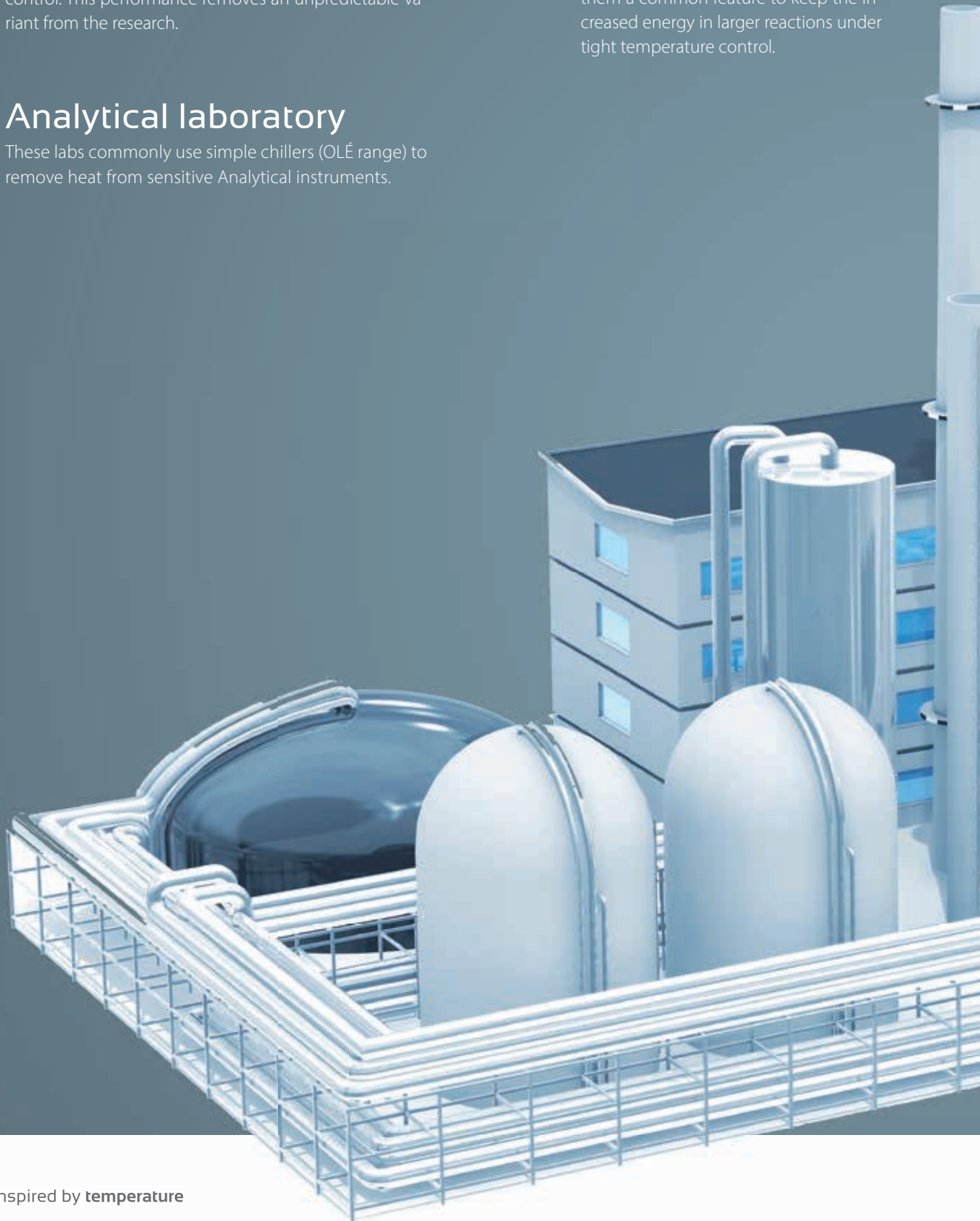
## Scale up

The rapid response of Unistats make them a common feature to keep the increased energy in larger reactions under tight temperature control.



## Analytical laboratory

These labs commonly use simple chillers (OLÉ range) to remove heat from sensitive Analytical instruments.



# and Production



## Manufacturing

Can be "low" or "high" volume batches.



## Formulation

Typically, bench-top open bath systems and chillers are used in various applications.



## Bioproduction

Unichillers fitted with heaters provide economic and reliable temperature control on Bio Reactors from Bench scale 1-litre fermenters to 3,000-litre Production scale Bio Reactors.



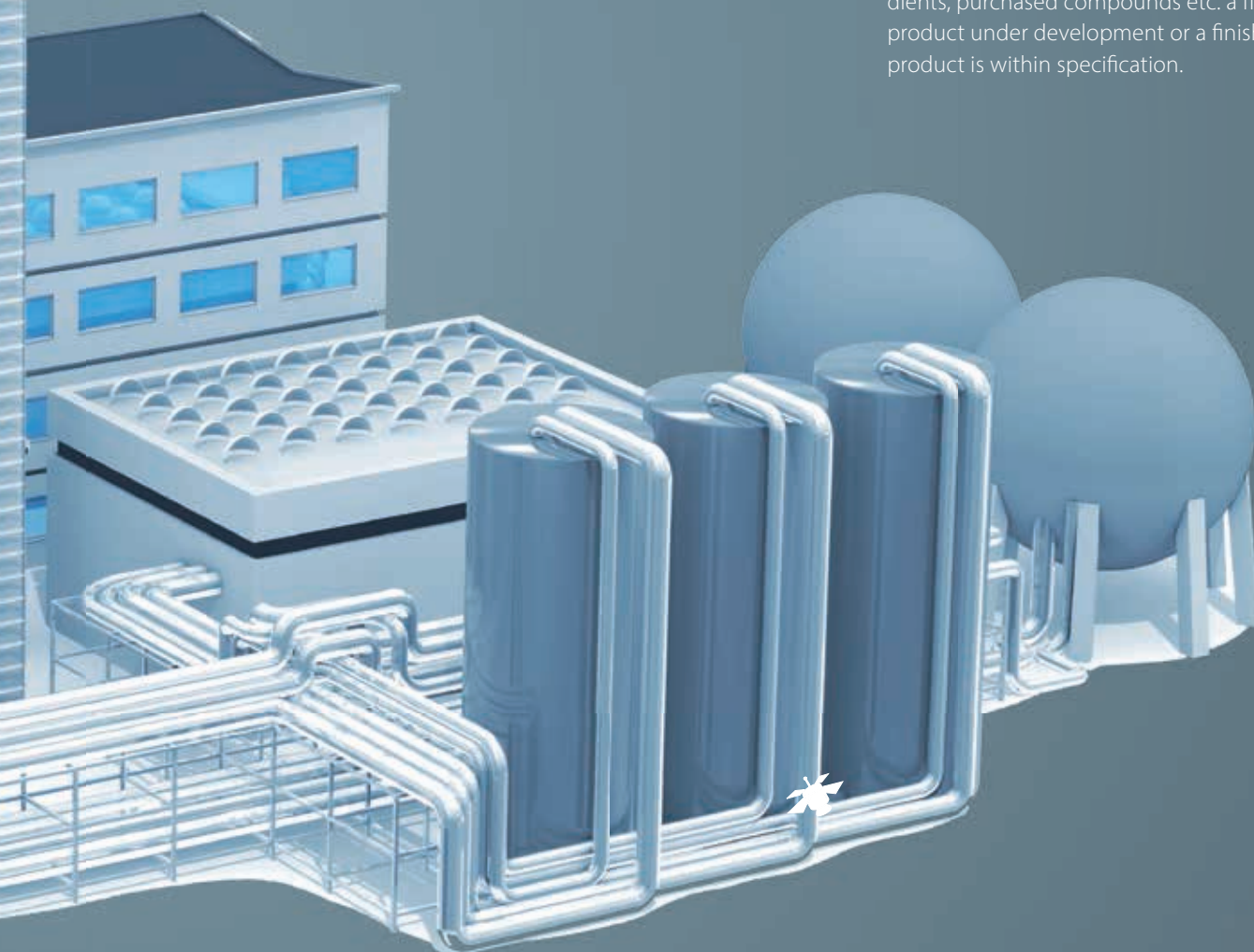
## Continuous flow

Unistats and open bath units are used to reliably and accurately control the temperature of the reaction zones within the reactor.



## Quality control

Procedure intended to ensure that raw ingredients, purchased compounds etc. a finished product under development or a finished product is within specification.



# Application examples



## Glass reactors

Jacketed glass reactors are a common tool. The ability to control the temperature of the reaction mass depends on the speed at which the jacket's temperature can be changed to transfer thermal energy through the glass wall. The speed of transfer depends on the thermal qualities and design of the reactor and the Delta-T between the jacket and reaction mass.

Glass reactors are inherently sensitive to pressure (typically the maximum permissible jacket pressure is 0.5 bar) and thermal shock (caused by the difference in temperature

between the jacket and the reaction mass). Unistats have Variable Pressure Control (VPC) and a Delta-T limit to protect against both.

In addition, the unique "Process Safety Over Temperature" that can be activated within the standard "Over Temperature" function will ensure that the pump and cooling system continue to operate in the event that a (e.g) thermal runaway is powerful enough to activate the "Over Temperature" protection.



## Glass lined reactors

The metal component of the reactor will have a different expansion coefficient to the glass lining. To protect against stripping the glass by heating or cooling too quickly, the ramp rate can be set and controlled to either change the temperature of the jacket at a rate that does not endanger the glass lining or to be programmed in steps so that a "dwell" time allows the glass and metal to settle at the same temperature before the next change in temperature.



## Stainless steel reactors

These reactors are robust and are typically not subject to damage from either jacket pressure or rapid thermal changes.



## Continuous flow reactors

Flow reactors are becoming more common in research and production. Huber units from the simple CC-304B up to large Unistats are used on this application. Some of these reactors have a high flow resistance.

Unistats provide sufficient pressure to ensure maximum heat transfer flow for the best possible temperature control in the reaction zones within the Flow reactor.



## Pressure reactors

Unistats are capable of extremely rapid temperature changes to control (for example) the high energy reactions often carried out in Pressure Reactors (glass/metal).

The T range of Unistats are often used for high temperature reactions of this kind. Being hydraulically sealed there are no vapours from the heat transfer fluid.

To further protect the heat transfer fluid, a simple "Expansion Tank Sealing Kit" facilitates a low flow of Nitrogen vapour to hold the fluid in the expansion tank under an inert vapour blanket.

# Application examples



## Bioreactors

Often, bioreactors can only use water or water/glycol as an HTF. After a process, the bioreactors need to be cleaned and sterilised "Cleaned In Place" (CIP) and "Sterilised in Place" (SIP). These routines are carried out at temperatures up to 120 °C using steam (The Huber Unichiller T-H temperature range can be extended to +120 °C).

Before this can take place, the bioreactor's jacket must be drained of the water/glycol. Using a series of valves the reactor jacket can be drained into a holding tank and on completion of SIP. The system can be refilled by starting the chiller's pump. The holding tank/expansion tank can be fabricated by Huber separately. Pipework, valves etc. must be carried out locally.

## Process schematic







## Controlled Rate Freeze & Thaw

Some preparations need to be frozen at a predefined rate and then thawed at a predefined rate. The built-in "Program" feature in the Pilot ONE allows the creation of multiple programs that can be either stored in the Pilot ONE memory or onto a Thumb drive via the USB interface. The creation of a program is highly flexible yet extremely simple to realise thanks to the simple graphic display which clearly shows each step in the program as it is created and when it is completed.

The frozen blocks of medical preparation can be thawed out in a special bath. These baths are temperature controlled using a programmed Unichiller-eo.

The "eo" – external open version of Unichiller range enables direct contact of the heat exchange medium (Water-Glycol mixture) with the baths for efficient heat transfer.

Unistat technology can be also applied for the freeze and thaw applications.



## Glove Box

The temperature control of diverse applications inside the glove box can be provided with Unistats, chillers and immersion coolers from the TC range .



## Rotary evaporators

Huber chillers have a low internal volume which means that the generated cooling power is more concentrated on the application. Instead of wasting cooling power on a massive reservoir, more applications can be attached.

# Application examples



## Rheometers, Viscometers

To provide accurate and constant temperature control of a sample while under test, the Ministat or a unit from the "K" series are used.

Compact, flexible and providing thermal stability to 0.02 K, these units can be ideal for controlling viscometer samples.



## Analytical lab equipment

Diverse analytical laboratory equipment such as X-ray diffractometers, mass spectrometer, etc. produce heat which has to be removed effectively. Huber chillers as source of external cooling with its compact design and small foot print will save precious space in labs.



## Milling machines

The mills grind up samples into the nano range. The grinding action generates heat which needs to be removed. This installation is with Unichiller 045T.

# Applications and units

Application	Unistats	Chiller	Open Baths	Immersion Cooler	Heat transfer station
Calibration	✓		✓		
Calorimeters	✓		✓	✓	
Climate chamber	✓				
Cooling of sealing of drying oven		✓			
Cold plates	✓	✓			
Decentralization of centralized cooling system		✓			
Defined thawing of a medicinal preparation		✓			
Distillation devices, short path distillation	✓	✓	✓		
Fermenter		✓			✓
Filter, tangential flow filter, filter dryer		✓			
Freeze dryers, spray dryers		✓			
Freeze thawer		✓			
Fume hood	✓	✓	✓		
Gas supply, LN generator		✓			
Glove box	✓	✓		✓	
Liquid extraction columns	✓	✓	✓		
Milling machine		✓			
Mixing vessel		✓			✓
Particle sizer		✓			
Reactor, biology		✓	✓		✓
Reactor, cascade	✓		✓		
Reactor, glass	✓	✓	✓		
Reactor, continuous flow	✓	✓	✓		
Reactor, stainless steel / pressure	✓	✓	✓		
Reactor, pallet		✓			
Reactor, single use		✓			✓
Reactor, microreactor			✓		
Rheometer, viscometer, hazemeter		✓	✓		
Sample preparation, test tubes, flasks				✓	
Shaking plate			✓		
Single-use bioprocess bags		✓			
Solvent can		✓			
Thermogravimetry		✓			
Thermal analysis	✓		✓	✓	
Thin film evaporation	✓	✓	✓		
Thermal control solutions	✓				
Titration vessel			✓		
Ultrasonic bath		✓			
Vacuum pump		✓			
X-ray diffractometer, mass spectrometer		✓			

# Controller features

at a glance

Bath Circulators are available either with the controllers KISS®/OLÉ or Pilot ONE®

KISS®/OLÉ controller:

- ➔ **Simple operation**  
Simple 3-key operation with menu navigation in plain text.
- ➔ **OLED display**  
Large, bright OLED display with display of setpoint and actual value, Tmin, Tmax.
- ➔ **Basic functions**  
Equipped with functions for most routine applications in the laboratory.
- ➔ **USB, RS232**  
As standard with RS232, USB and Pt100-sensor connection (option).

Pilot ONE® controller:

- ➔ **Ease of operation**  
Intuitive operation in 13 languages via touch screen and full process control.
- ➔ **5,7" touch colour display**  
Large, colour TFT touch screen with graphics function and favourites menu.
- ➔ **Extended professional functions**  
Functional features can be extended for demanding applications by means of E-grade.
- ➔ **Interfaces**  
As standard with RS232, USB and Ethernet as well as Pt100 control probe connection.
- ➔ **Integrated programme encoder**  
Programme encoder with 100 steps as well as linear and non-linear ramp function.
- ➔ **Record process data**  
Recording of process data on a connected USB medium.



➔ KISS controller (Circulators)



➔ OLÉ controller (Circulating chillers)



➔ Pilot ONE controller

Function/Features	OLÉ	KISS	Pilot ONE			
			E-grade "Basic" in scope of delivery	E-grade "Exclusive" Cat.No. 9495	E-grade "Professional" Cat.No. 9496	
Thermoregulation	Controller parameter tuning	predefined		predefined <sup>1</sup>	TAC	TAC
	Calibration for control sensor (Internal, Process)	1-point		2-point	5-point	5-point
	Monitoring (Level protection, Over temperature protection <sup>2</sup> )	✓	✓	✓	✓	✓
	Adjustable limit alarms			✓	✓	✓
	VPC (Variable Pressure Control) <sup>3</sup>	✓	✓	✓	✓	✓
	Venting program	✓	✓	✓	✓	✓
	Compressor automatic control	✓	✓	✓	✓	✓
	Set point limit	✓	✓	✓	✓	✓
	Programmer				3 programmes / max. 15 steps	10 programmes / max. 100 steps
	Ramp function				linear	linear, non-linear
	Temperature control mode (Internal, Process)				✓	✓
	Maximum heating / cooling power adjustable				✓	✓
Display and operation	Temperature display	OLED		5,7" TFT touch screen, colour		
	Display mode	numeric		graphic, numeric		
	Display resolution	0,1 °C		0,1 °C	0,1 °C / 0,01 °C	0,1 °C / 0,01 °C
	Graphic display of temperature curves			Window, full screen, scalable		
	Calendar, Date, Time			✓	✓	✓
	Languages menu navigation	DE, EN		DE, EN, FR, IT, ES, PT, CZ, PL, RU, CN, JP, KO, TR		
	Temperature format	°C / °F		°C / °F / K	°C / °F / K	°C / °F / K
	Display mode (screen) switch by swiping			✓	✓	✓
	Favourites menu			✓	✓	✓
	User menus (Administrator level)					✓
	2. set point					✓
Connections	Digital interface RS232	✓	✓	✓	✓	✓
	USB interface	✓	✓	✓	✓	✓
	Ethernet RJ45 interface			✓	✓	✓
	Pt100 control probe connection (external control)				✓	✓
	Pt100 sensor connection (only display)	✓ <sup>4</sup>	✓ <sup>4</sup>	✓		
	External control signal / ECS STANDBY <sup>5</sup>	✓ <sup>4</sup>		✓	✓	✓
	Programmable volt-free contact / ALARM <sup>5</sup>	✓ <sup>4</sup>		✓	✓	✓
	AIF (analog interface) 0/4-20 mA or 0-10 V <sup>6</sup>			✓	✓	✓
Digital interface RS485 <sup>6</sup>			✓	✓	✓	
Various	Alarm signal optical / acoustic	✓	✓	✓	✓	✓
	AutoStart (Mains failure automatic)	✓	✓	✓	✓	✓
	Plug & Play-Technologie			✓	✓	✓
	Technical glossary			✓	✓	✓
	Remote control / Data visualisation via Spy Software	✓	✓	✓	✓	✓
	E-grade Evaluation versions available (30 days)			✓	✓	✓
	Service data recorder (flight recorder)			✓	✓	✓
	Saving/loading of temperature control programs				✓	✓
	Process data logging direct to USB stick				✓	✓
Calendar start					✓	

<sup>1</sup> 30-day evaluation version TAC function available

<sup>2</sup> For units with integrated over-temperature protection

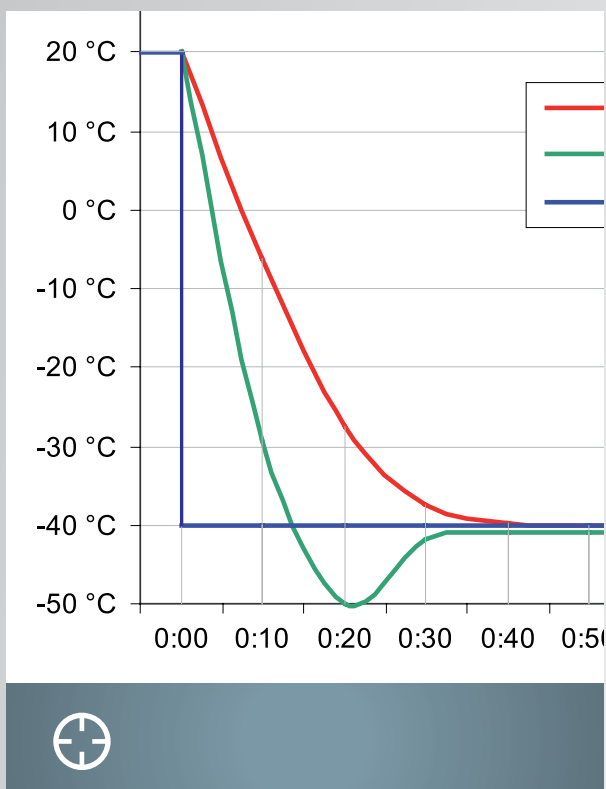
<sup>3</sup> For models with variable-speed pump or an external bypass

<sup>4</sup> Optional, only available factory fitted (additional charge)

<sup>5</sup> Standard on Unistats, otherwise via optional Com.G@te or POKO/ECS interface

<sup>6</sup> Via optional Com.G@te

# Advantages and features for efficient temperature control



## True Adaptive Control

Compared to most automatic PID controllers, True Adaptive Control (TAC) even goes one step further. TAC analyses the control loop over the entire temperature range and creates a multidimensional model of the application.

The temperature controller's PID parameters are continually updated to give the best control parameters. This enables the controller to always achieve the shortest "time to temperature" with minimal over/undershoot. If required, the PID controller parameters can also be adjusted manually.

## Pressure Control VPC

Variable Pressure Control (VPC) reliably protects glass reactors against damage caused by excessive pressure. The risk of rupture of expensive glass apparatus is avoided. Changes in viscosity of the heat transfer fluid (HTF) during heating and cooling are automatically compensated for by VPC.

Some Unistats have a speed-controlled pump with soft start that regulate the pressure via an integrated pressure sensor. Unistats with a constant speed pump motor can control the pressure with an optional VPC-Bypass.



## Programming

The integrated programmer with linear ramp function allows the implementation of individual temperature set-points or more complex temperature requirements with up to 100 programme steps. Either temperature-stable or time-stable, optional with additional actions such as the control of a floating contact, analogue output, control mode etc.



## Record data

Process data can be saved directly on a USB stick. The storage is carried out at a time interval of 5 seconds as a universally usable CSV file, which can easily be evaluated with e.g. Microsoft Excel® and processed further. Also new is the storage and loading of temperature control programmes to a USB stick.



## Interfaces

Units with Pilot ONE controller can be easily integrated into automated systems and Distributed Control Systems (DCS) for remote operation and/or monitoring. The Pilot ONE comes as standard with USB (host & device), LAN and RS232. The optional ComG@te provide additional analogue interfaces (configurable as 4–20mA or 0–10V), RS485 and a further RS232. Pilot ONE units have ModBus installed and are also ready to be integrated into Profibus based systems.



## OPC-UA compatible

The optional OPC UA feature can be activated via a E-grade package. The -UA (OPC Unified Architecture) communication protocol describes data semantically and thus enables data exchange between automation systems without having to programme a driver for this purpose. Using the E-grade OPC-UA, Huber temperature control units with Pilot ONE can communicate via the modern OPC-UA protocol.

# Advantages and features for efficient temperature control



## Process optimisation

The E-grade “Explore” turns a Unistat into a development tool for process and chemical engineering. This E-grade is an advanced development of the previous Unistat abilities and uses the equipment features of the Unistats to represent important process and performance data on the device display/output via interfaces.

E-grade “Explore” provides temperature, HTF pressure and (with an optional Flow Sensor) HTF flow rates. When a Flow Sensor is used, Flow Rates can also be controlled. This measurement and control of various parameters and the display of process data makes this E-grade ideally suited for the development and optimisation of processes, the determination of heat balances and abort criteria, use tests of raw materials and for the advance data collection for scale-up trials.



## High safety

Unistats have many features for handling temperature control applications remotely and safely during continuous operation. Over-temperature, setpoint and alarm limits can be adjusted according to the conditions of the application. The temperature and pressure sensors can be calibrated and the microprocessor controller monitors the operating status.

VPC (Variable Pressure Control) monitors the maximum pressure in the fluid loop. Passive components ensure an extraordinarily high level of reliability.





## Outside installation

As a cost effective solution for ATEX zone or just to save space in the facility, Unistats and chillers can be constructed with an IP54 rating and installed outside.

On request the units can be built with air-cooled condensers large enough for the refrigeration system to generate 100 % cooling power in ambient temperatures of up to +40 °C. For colder climates, adaptations to allow operation in much cooler sub-zero ambient temperatures are available.



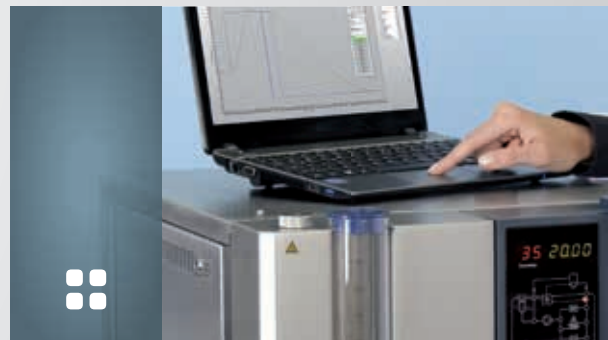
## Explosion protection (ATEX)

If Unistats are to be operated in connection with explosion-proof systems, there are two options: using the ATEX-compliant remote control, the Unistat is set up outside the explosion zone. Alternatively, the Unistat can be installed inside a pressurised, enclosed Ex px cabinet (available from us as part of a complete solution) and set-up within the explosion zone.



## Scale-up for professionals

Unistats can thermally control small quantities just as well as production quantities. Models with cooling capacities of 0,7 to 130 kW permit flexible scale-up in research, kilo-laboratory, mini-plant, pilot plant and in production. Unistats rise to the challenge of scale-up because their performance is uniformly good from smallest to largest units and the user interface is common to all units.



## E-grade<sup>®</sup> Explore

The optional E-grade "Explore" turns your Unistat into a development tool for process and chemical engineering. With the E-grade, viewing and/or recording further information on temperature, heating/cooling capacity and pump capacity in the system is possible. Typical applications are process development and scale-up trials.

# Advantages and features for efficient temperature control

**Unistat® 610w**  
Controlling simulated exothermic reactions at -40 °C in a Radleys 10-litre reactor

**Requirement**  
This case study looks at the response of a Unistat 610w working to control exothermic reactions in a 10-litre glass reactor at -40°C.

**Method**  
M30x1.5 hoses are used to connect the setup and the working fluid is DW Therm. The exothermic reactions are conducted with a heating power of 50 W and 100 W.

**Setup details**

Temperature range:	-60 °C...+200 °C
Cooling power:	7.0 kW @ 200...0 °C 6.4 kW @ -20 °C 3.3 kW @ -40 °C 0.8 kW @ -60 °C
Heating power:	6.0 kW
Heats:	2x1.5 m M30x1.5 (#6386)
Thermal fluid:	DW Therm (#6479)
Reactor:	10-litre jacketed glass reactor
Reactor content:	7.5 litre M99.055.03 (#6259)
Stirrer speed:	200 rpm
Control:	process

**Results Performance**

The 50 W heat results in approximately 1 K of temperature rise. With a cooling power of 3.3 kW the unit takes 9 minutes to bring the process temperature back to its setpoint. Meanwhile the process temperature rises up to approximately 2 K with the 100 W of heat addition. The internal temperature cools to approximately -57.5 °C in order to pull the process temperature back to -40 °C. When the heater is switched off, the temperature of the process falls and the thermostat starts heating the jacket in order to return the process temperature to the setpoint.

Inspired by temperature

More than 200 case studies on our website!

## Case studies

Example cases show real results and offer support when making your buying decision. Our case studies demonstrate the thermodynamic properties of Huber units on the basis of practical examples and are therefore best suited for making a fair comparison with the competition.

Our database contains more than 200 case studies with applications from various manufacturers. The test set up and all the measurements taken are described in detail and the results are recorded in the form of a temperature recording.



## Low operating costs

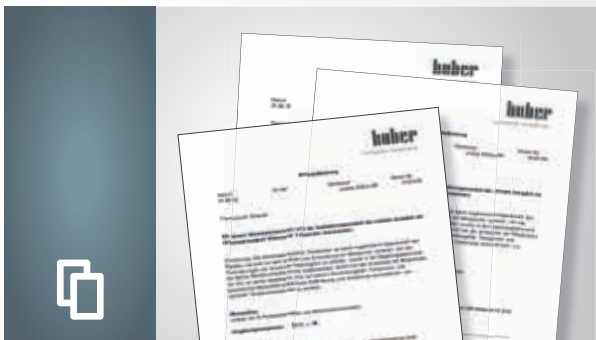
The focus is always on the temperature control task when working with Unistats. Excellent heat transfer, reproducible results and very high temperature change speeds result in a significantly improved return on investment. The longevity of the heat transfer fluid and the low consumption values for cooling water and energy also ensure low operating costs.



## 3-2-2 warranty

Our free of charge 3-2-2 warranty extension offers many extra benefits. All you have to do is to fill in the free online registration form on our website.

The guarantee for all Huber products is 12 months from the day of delivery. When registering the machine giving the end customer address and the serial number, Huber will give an extended guarantee as listed below.



## Certificates / Calibration

If required, you can obtain a factory calibration certificate. Test protocol and other certification for your Huber unit is available on request.



## User Training

In our user training courses we communicate technical information about temperature control units and their practical application. You receive valuable information which enable optimum machine use. The training content is matched to the requirements and prior knowledge of the participants.

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designed for you

Please visit our website or contact our sales team  
for further information and correct selection  
of accessories, temperature transfer fluids, etc.

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