

Screen >> Optimize >> Scale-up: Better >> Safer - Faster

Company & Product Overview



BETTER CHEMISTRY - FASTER

HEL's motto is **better chemistry - faster**; our products are designed to enable research chemists to achieve their goals faster, more accurately and more efficiently.

Operating internationally, HEL is a company that specializes in research and pre-pilot scale chemical reactors and systems. We provide both automated and manual tools for process R&D to clients in the pharmaceutical, fine chemical and petrochemical industries, as well as in academia.

Originally established in 1987 purely as a consultancy, the company has grown to include a complete team of chemists and chemical engineers, working from our fully equipped testing facility in the UK. Innovation and new product development are ingrained in HEL's culture, and our specialist software development team with now over 20 years' of automation and control experience, is continually improving the most powerful and chemist friendly software available. Qualified employees, modern production procedures and technologies as well as quality control are the basis for our outstanding products and services.



Our Customers

Our customers include the top twenty pharmaceutical giants, major fine chemical and petro-chemical companies, universities, research institutes, government laboratories and many more. We build long term relationships with our customers, fostering an on-going exchange and collaborative learning environment.

HEL CLIENTS AND USERS INCLUDE

Top Pharmaceutical Companies

Abbott
Amgen
AstraZeneca
BMS
Boehringer Ingelheim
CIPLA
Dr Reddy's Laboratories
Eli Lilly
GlaxoSmithKline
Janssen
Johnson & Johnson
KRKA
Merck
Novartis
NPIL
Pfizer
Roche
Samchully
Sanofi Aventis
Takeda

Top Chemical Companies

Air Products
AKZO Nobel
Albermarle
Arkema
Bayer
BP
Chevron
CIBA
Degussa
Dow
DSM
DuPont
Eastman Chemical
Exxon
Fujifilm
Johnson Matthey
Jubilant
Shell
Sigma Aldrich
Syngenta

Top Universities and Research Institutes

BAM
Cambridge University
HEMRL
Industrial Technology Research Institute
Imperial College
Leeds University
Massachusetts Institute of Technology
Max Planck Institut
McMaster University
TNO
Trinity University, Dublin
University College London
University of California
University of Massachusetts
University of Mumbai
University of Warsaw
Texas A&M University
TU Delft
Tianjin University
Tsinghua University

HEL'S PRODUCTS & SYSTEMS

Products According to Research Stage

While our traditional customer base is in **synthetic chemistry**, our products are suited to **med-chem** groups, **bio processes** and emerging technologies (such as **alternative fuels**, for example), as well as university research. HEL's product range broadly fits the following key stages of **process development**, and both **high and low pressure** designs are available for each phase:

- Screening...** manual or with relatively simple controls
- Optimization...** using automated tools to perfect the process prior to scale-up with confidence, due to excellent data logging and control
- Scale up...** bench and kilo laboratory reactors for safe scale up

Products According to Specialization

HYDROGENATION & CATALYSIS TOOLS and reactions at elevated pressure form a significant portion of applications covered by HEL products. This is based on our strong chemical engineering background.

CRYSTALLIZATION AND PARTICLE CHARACTERIZATION are especially important in the pharmaceutical and related industries, with several products in our portfolio.

PARALLEL PROCESS DEVELOPMENT platforms, which can be adapted for different applications, form the backbone of many solutions in totally unrelated industries.

SAFE SCALE-UP TOOLS have been our core strength since inception more than 20 years ago, and HEL still offers the widest range of products covering each step in the process development life cycle.

BENCH & KILO SCALE REACTOR SYSTEMS based on our flexible and expandable AutoLAB system, backed-up by over 20 years in reactor design.



Standard and Customized Solutions

Our modular chemistry platforms, designed by chemists and chemical engineers and supported by in-house mechanical, software and electronics engineering capabilities, allow us to offer cost effective systems with maximum flexibility.

Service and Maintenance

During the first year of ownership, your purchase from HEL is covered by a standard comprehensive warranty. To increase the lifespan and productivity of your HEL equipment and minimize down time, we have designed a range of maintenance agreements to match your requirements.

HEL has a dedicated support team that provide a fast and effective response to both on-site and remote diagnostics and repair.

PARALLEL PROCESS DEVELOPMENT

COMPACT, CHANGEABLE, ECONOMIC REACTION BLOCK

Independent temperature monitoring and control

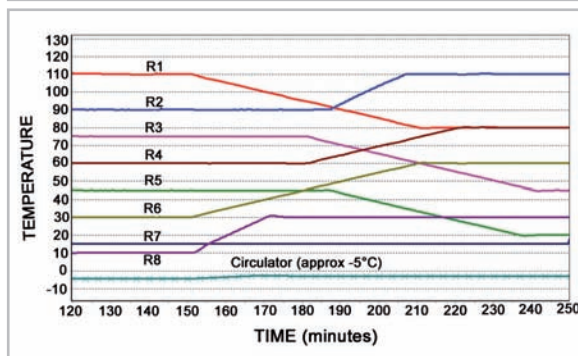
- | Temperature range of -60°C to +225°C
- | Over 100°C range between zones
- | Independent stirring, controlled & measured



PolyBLOCK 4
working volumes
of up to 500ml

Since 2007, **PolyBLOCK** users include:

- | AstraZeneca | Bayer | BI | BP | Cephalon | GSK
- | Johnson & Johnson | Novartis | Pfizer | Sanofi



PB8 Independent temperature ramps – 30ml vessels

Small Footprint
35cm x 20cm x 20cm

Full control, real time data

Easy to use control software with choice of interfaces

- | Choice of touch screen or conventional PC interface
- | Real time editing of ramp rates, run times and set points
- | Data is easily exported to Excel or similar packages for analysis
- | Option of full recipe design with multi-user interface



Agitation

Suspended mechanical stirring
for high liquid levels and suspensions
(standard feature)



Overhead stirring for
high viscosity liquids



**Use any combination
of reaction vessels
on one platform**

Increase the efficiency of your process screening
and optimization with HEL's multi-zone products

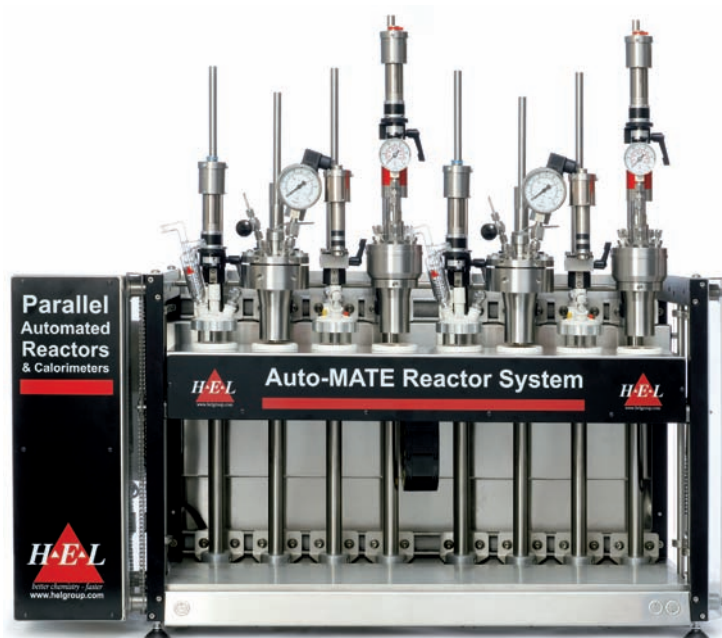
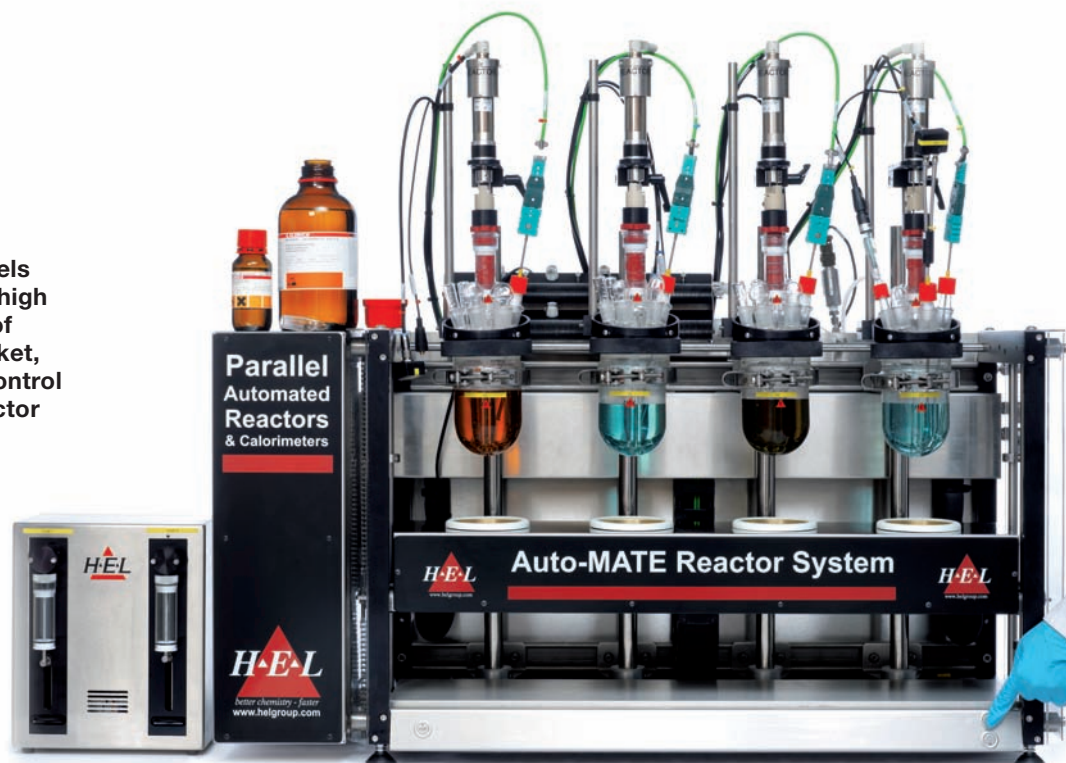
CUSTOMIZED MULTI-REACTOR SYSTEM

HIGHLY FUNCTIONAL AND VERSATILE PLATFORM

AutoMATE II is the new generation of HEL's high functionality parallel reaction platforms. It provides flexibility, efficient use of space, a wide choice of features and controls and most importantly – scalable data.

- | Temperature range of -80°C to +250/500°C
- | Over 100°C difference between reactors
- | Vials, flasks and custom reactors up to 500ml, interchangeable
- | Almost limitless expansion of features: calorimetry, distillation, multiple feeds, hydrogenation and other pressure reactions, crystallization studies

AM4 with 350ml glass vessels interchangeable with other high and low pressure reactors of different sizes. Movable jacket, independent temperature control and monitoring of each reactor



Mix & match 8 different reactors & vials, low & high pressure

AM8 with movable jacket allowing over 100°C range at any time



Easy switching of vessels at any time

BENCH & KILO SCALE REACTOR SYSTEMS

FLEXIBLE AND EXPANDABLE BENCH AND PILOT SCALE REACTOR SYSTEMS

- | Manual to fully automated systems available
- | Quickly generate reliable and reproducible data
- | Modular hardware and software with many upgrade options
- | A choice of easily interchangeable vessels from 200ml to 20 liter

AutoLAB with bench-top stand, configured with automatic dosing



100bar, 20 liter reactor on floor standing trolley

Floor standing 10 liter **AutoLAB** with distillation, feeds and sampling unit



Applications include

- | Organic process synthesis
- | Automated solubility and MSZW generation
- | Hydrogenation and other high pressure processes
- | Continuous and batch processes
- | PAT implementation

SAFE SCALE-UP TOOLS

Three main product classes - all used in well equipped laboratories of large corporations, using common software platform to produce similar data files, making it simple for users to move between the different systems.

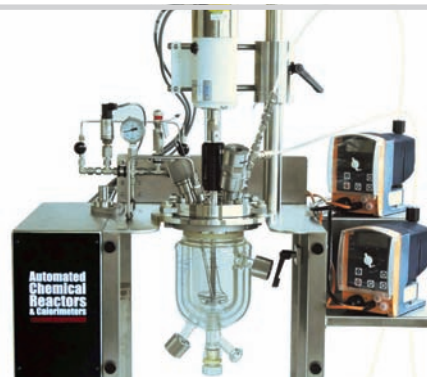
- | Screening device for thermal reaction hazards
- | Reaction calorimeter to generate scale up data and adiabatic calorimeters for detailed safety evaluation and relief system sizing
- | Complementary instruments for different stages of process development

REACTION CALORIMETRY

Studies the desired reaction and confirms the safety and operability of the process when it is scaled up. Reactions are run exactly as they will be on the large scale and conditions are accurately reproduced.

- | Heat release data calculated on-line
- | No calibration or off-line calculations
- | Ideal for research chemists and specialists alike

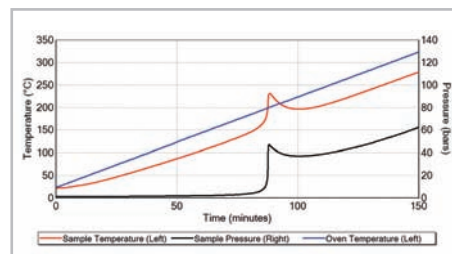
Similar with glass pressure reactor



THERMAL SCREENING

- | Determines conditions of temperature, pressure and concentration to handle chemicals safely
- | Uses 1-5g of sample and provides thermal stability information - including pressure
- | Ideal for non-specialists
- | Thermo kinetic information available for specialist users

TS^U thermal screening unit



Thermal stability tests using ~2g of sample, gives clear pressure and temperature data, requiring virtually no user experience for result interpretation

ADIABATIC CALORIMETRY

- | Phi-TEC I: modern, compact, safe design
- | Accurate 'onset' data, thermo kinetics and derived parameters
- | Sample agitation as standard
- | Special 'battery testing' version

Adiabatic Reaction Calorimeter **Phi-TEC I** based on original Dow 'ARC' concept



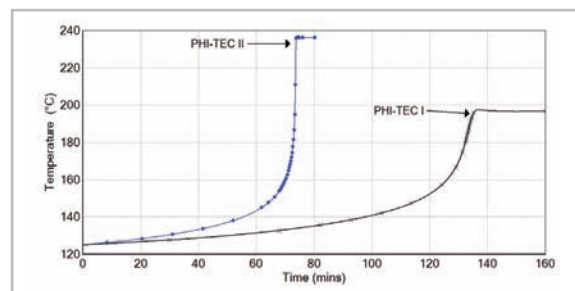
Range of test cells for PHI-TEC and TS^U

Phi-TEC II – a versatile high and low phi-factor calorimeter, which can run TS^U and Phi-TEC I type tests as well as a range of additional ones with low phi-factor cells.

- | Allows 'what if' failure scenarios to be evaluated experimentally
- | Data can be applied directly to size vents for runaway reactions
- | Wide range of test cells for variety of process safety applications



Phi-TEC II for low 'phi-factor' testing



Runaway data from PHI-TEC calorimeter

HYDROGENATION & CATALYSIS TOOLS

STIRRED PARALLEL REACTORS FOR RAPID SCREENING OF HIGH PRESSURE REACTIONS

A dedicated parallel reaction system for the rapid development of high pressure reactions and heterogeneous catalysis systems. **The High Pressure ChemSCAN (HPCS)** is an eight-reactor platform rated to 100bar and 200°C - each reactor independently controlled and monitored with full software control.

The system's key features include:

- Independent temperature control in each vessel
- Individual pressure control, allowing tests at different pressure
- On-line gas consumption calculation and display, in each reactor



16ml reactor, available in 316SS or Hastelloy

FIXED BED, CONTINUOUS FLOW REACTOR

For continuous flow screening and optimization of hydrogenation and other high pressure reactions. Gas and liquid are dosed into a reactor (in the form of a pipe) where the temperature is controlled. Product leaving the vessels can be sampled and analyzed as operating conditions are varied.

FlowCAT
for continuous
flow screening

Applications

- Screen new chemistries, rapidly
- Optimize yield, identify new catalysts
- Use for small-scale production, quickly and safely



Gas & Liquid
Feeds

Tube
Reactor

Sample

Product

Pressure
Control

- Control of feeds, temperature, pressure and sampling
- Real-time process data



HIGH THROUGHPUT TOOLS

CATALYST SCREENING

Complete units for hydrogenation and other high pressure reactions. CAT systems have been designed to provide a cost effective, simple and easy to use tool for high pressure reaction screening. They can be used directly on stirring hot plates or oil baths.

Manual Systems

- Head fitted with coolant connection
- "Cold fingers" condense vapors and minimize cross contamination



- Uses 18 x 2ml HPLC vials (with or without Septa) but without refluxing features



Automated System

Fully automated design based around 96-well Zinsser block



ROBOTICS CONTROLLED SYNTHESIS

- Built around the flexible PolyBLOCK reaction block, allowing a range of reactors using the same platform
- Capable of HPLC integration with live data displays
- Allows recipe changes anytime, live
- Makes possible parallel evaluations such as drug stressing, solubility studies, catalyst/route selection and other custom applications



LP ChemSCAN
using PolyBLOCK PB8.
2 PolyBLOCKs can be served by one robot

CRYSTALLIZATION & PARTICLE CHARACTERIZATION

PARALLEL SOLUBILITY AND MSZW DETERMINATION

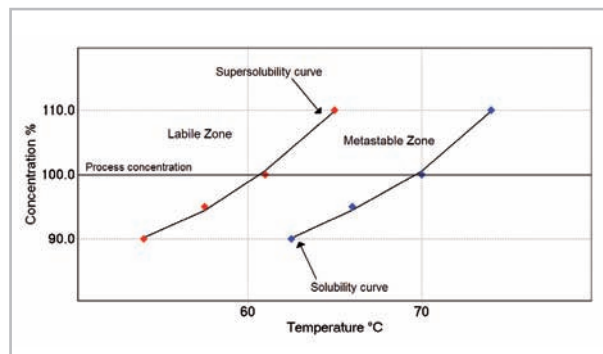
Automated determination of solubility (or MSZW) in 4 to 8 stirred samples, over a range of concentrations. Working volume 1ml to 350ml.

The system will automatically:

- | Heat/cool each sample independently
- | Detect dissolution/crystallization



CrystalSCAN
using PolyBLOCK PB8



Raw temperature and turbidity data is displayed graphically as the experiment proceeds. Key data is then automatically extracted to produce a complete MSZW plot, live

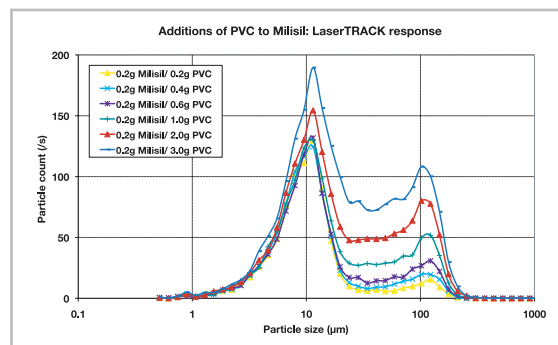
Automatically generate MSZW and solubility curve in up to 8 reactors

PROCESS OPTIMIZATION BY ON-LINE PARTICLE SIZING

- | Accurate prediction of size and distribution
- | Fully integrated into process data
- | Fast and easy extraction of key data
- | Applications include crystallization, polymerization, formulation, bio-reactors



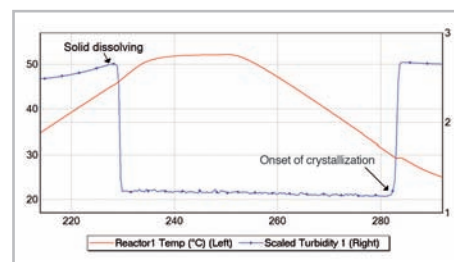
LaserTrack™ probes to suit vessel sizes



AUTOMATED SOLUBILITY MONITOR

- | Log temperature, turbidity, and pH
- | Easy and reliable metastable zone width determination
- | Probes for any size vessel
- | Data is automatically displayed, easy to interpret
- | Clear determination of dissolution and crystallization points

CrystalEyes measures solubility easily and reliably



Turbidity response as solution is heated and cooled

ADD-ONS FOR NEW & EXISTING REACTORS

PORTABLE TOOLS FOR USE ON EXISTING AND NEW REACTORS

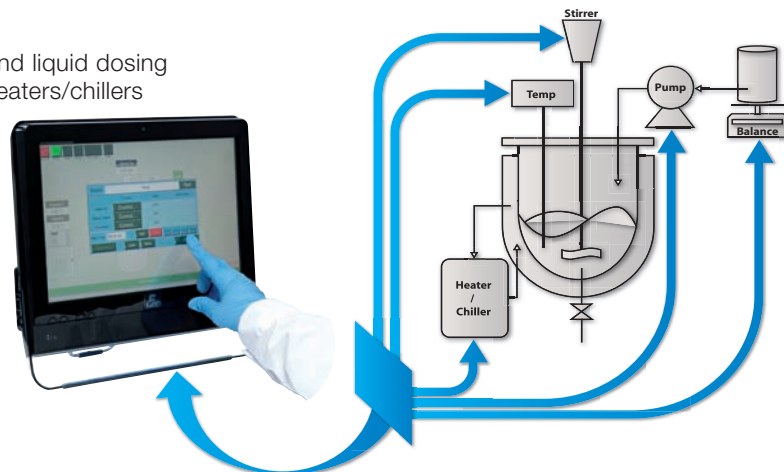
| Touch screen operation | Graphical data display | Data download to PC for archiving | Simple setup, easy to use |
Typical Configurations described below:

CONTROL AND DATA LOGGING SOLUTIONS FOR ANY REACTOR

- | Simple touch screen operation, intuitive user interface
- | Powerful control and logging of temperature, stirring, and liquid dosing
- | Suitable for use with existing or new pumps, stirrers, heaters/chillers on any Jacketed Laboratory Reactor

MicronOTE includes

- | Touchscreen PC (Compact 7", Standard 15.6" screen sizes) and software
- | All cables and connectors
- | Control and log modules available for:
 - Temperature
 - Dosing
 - Stirring
 - pH

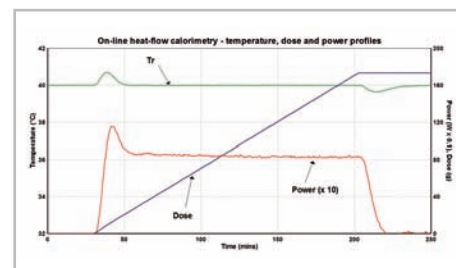


SIMPLIFIED REAL-TIME CALORIMETRY

Add to any:

- | High or low pressure reactor
- | Designed for development chemists, NO calibration, or knowledge of calorimetry theory required

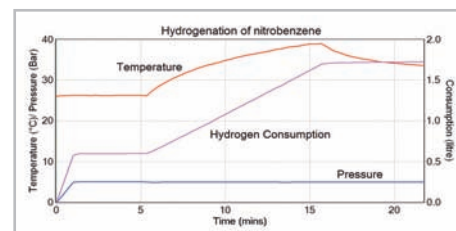
Enhanced software plus 'heat flow meter'



GAS FEED / PRESSURE CONTROLLER

- | Control pressure
- | Record pressure, temperature and uptake
- | Live gas uptake monitoring based on gas law
- | Use with any size/style pressurized reactor
- | Complete system, ready to run

PressControl data for a hydrogenation reactor



AUTOMATED SAMPLING UNIT

- | Portable unit takes samples on any reactor when you want
- | 6 or more samples, at user defined intervals
- | Liquid and slurry samples possible
- | No cross contamination
- | Dilution/quench included
- | Integrated touch pad controller

ASU is a compact sampler for atmospheric pressure applications





HEL'S KEY STRENGTHS ARE:

Knowledgeable staff - highly qualified and experienced chemical engineers and chemists

Quality - underpinned by ISO9001 certification for 20 years

Service - choice of service contracts backed by established culture of unmatched client support

Range of products - both off-the-shelf and custom designs, manual and fully automated controls, low and high pressure/temperature applications, single and parallel/multi-vessel products

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