



Calo2310

A new, universal range of Reaction Calorimeters for Safety Investigations and Scale-Up

On-Line Evaluation			
Power		Heat	
HF	-0,1 W	33,1 kJ	
HB	-1,1 W	27,9 kJ	
Ref	0,0 W		
Cal	0,0 W	34,1 KJ	
mass	635,0 g	cp	2,42 J/g+K
A (t)	0,0440	A (t-1)	0,0440 m ²
U (t)	153,05	U (t-1)	122,75 W/m ²
cp(t)	2,91	cp(t-1)	1,92 J/g+K
Integration ON		Calibration ON	
Reset Values			



Calo 2310 eco

With on-line display of A, U, cp in the Blue Window

Isothermal heat flow Calorimeter, best choice at entry level for safety investigations and Scale-up applications.

Calo 2310 base

With on-line display of output and heat of heat-flow, displays A, U, and cp in the Blue Window

Universally suitable, non-isothermal heat flow Calorimeter with automated „Zero Watt“ Base-line function for experienced user, capable of performing complex assignments.

Calo 2310 pro

With on-line display of output and heat of heat-flow and heat-balance as well as A, U and cp in the Blue Window

Combined heat flow and heat balance Calorimeter with automated „Zero Watt“ Baseline in non-isothermal mode. The professional Calorimeter for the complete range of reaction mechanisms.

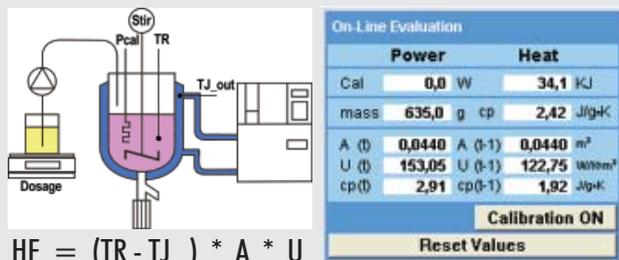
Calo2310 eco

The classical entry level Heat-flow instrument at economical cost



- The entry level heat-flow calorimeter within the isothermal standard range (iso HFC)
- cp Determinations are automatically performed during calibration
- Blue Window display of A, U and cp
- Simple operation combined with offline evaluation using „KaloGraph“
- Optional heat-balance within the reflux condenser

Measuring principles & Blue Window



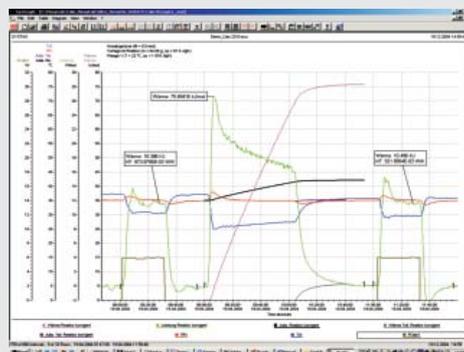
$$HF = \frac{(TR - TJ_{out})}{(T - T_{out})} * A * U$$

(W) (°C) (°C) (m²) (W/m²·K)

Data Summary Calo2310 eco

Reactor	Glass, cylindrical, 1l capacity, double jacket, with bottom discharge valve
Operating Range	-20°C to +180°C
Thermostat	Unistat Tango from -40°C to +200°C
Stirrer Speed	40 to 2000 rpm
Dosing Mode	1 x gravimetrically, using membrane pump
Temp.-Resolution	0.007 K (all signals)
Accuracy	4% (isothermal, 5° to 50°C)
OPTIONS	Heat-balance reflux (accuracy 10%), second dosing facility, pH, pH control, pressure/vacuum, distillation, pressure reactor version

Evaluation Calo2310 eco



Shows the SysGraph evaluation software with *KaloGraph* package for manual baseline, calibration, output and heat, with adiabatic increase.

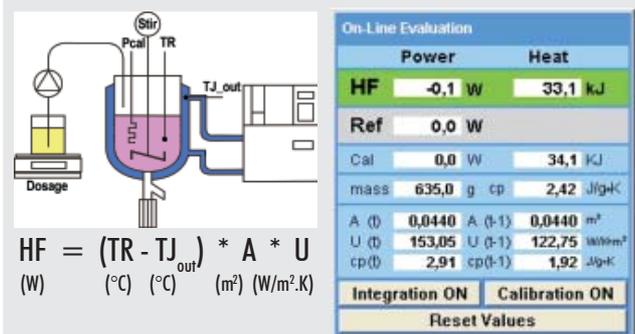
Calo2310 base

The high performance Heat-flow Reaction Calorimeter



- High performance calorimeter, non-isothermal advanced type (n-iso HFC)
- Automated „Zero Watt“ baseline function, instrument supported evaluation
- Measurement can be performed without simultaneous calibration
- Automatic cp determination during calibration
- On-line display of output, heat, A, U and cp
- Optional heat-balance within reflux condenser

Measuring principles & Blue Window



$$HF = \frac{(TR - TJ_{out})}{(T - T_{out})} * A * U$$

(W) (°C) (°C) (m²) (W/m²·K)

Data Summary Calo2310 base

Reactor	Glass, cylindrical, 1l capacity, double jacket, with bottom discharge valve, sealed, with safety valve
Operating Range	-20°C to +180°C
Thermostat	Unistat Tango from -40°C to +200°C
Stirrer Speed	40 to 2000 rpm
Dosing Mode	1 x gravimetrically, using membrane pump
Pressure/Vacuum	0 to 1.6 bar _{abs} including control
Temp.-Resolution	0.007 K, HF signal 0.001 K
Accuracy	3% (isothermal, 5° to 50°C)
OPTIONS	Heat balance reflux (accuracy 7%) second dosing facility, pH, pH control, distillation with balance, pressure reactor version

HFC Heat Flow Calorimetry
HBC Heat Balance Calorimetry

**Innovative SYSTAG Reaction Calorimeters
for Safety and Scale-up**

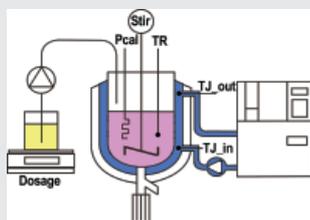
Calo2310 pro

Professional Universal Reaction Calorimeter



- Top class, combined heat-flow and heat-balance calorimeter for non-isothermal applications (n-iso HFC and HBC)
- Using simultaneously two complimentary measuring methods for critical comparisons
- Automated „Zero Watt“ baseline, based on instrument supported evaluation
- Measurement capability even without simultaneous calibration
- cp Determination automatically during calibration
- Blue Window with online display of A, U, cp as well as output and heat, for heat-flow (HF) and heat-balance (HB) each
- Optional heat balance within reflux condenser and combined total balance
- HBC is independent of filling level, viscosity, vortex and heat transit

Measuring principles & Blue Window



$$HB = (T_{J_{in}} - T_{J_{out}}) \cdot cp \cdot r \cdot F$$

(W) (°C) (°C) (J/g.K) (g/ml) (ml/s)

$$HF = (TR - T_{J_{out}}) \cdot A \cdot U$$

(W) (°C) (°C) (m²) (W/m².K)

On-Line Evaluation	
Power	Heat
HF -0,1 W	33,1 kJ
HB -1,1 W	27,9 kJ
Ref 0,0 W	
Cal 0,0 W	34,1 kJ
mass 635,0 g	cp 2,42 J/g.K
A (D) 0,0440	A (I-1) 0,0440 m²
U (D) 153,05	U (I-1) 122,75 W/m².K
cp (D) 2,91	cp (I-1) 1,92 J/g.K
Integration ON	Calibration ON
Reset Values	

Data Summary 2310 pro

Reactor	Glass, conical shape, 1l capacity, triple wall, with bottom discharge, tight, with safety valve
Operating Range	-50°C to +180°C
Thermostat	Unistat 380w from -80°C to +200°C
Stirrer Speed	40 to 2000 rpm
Dosing Mode	1 x gravimetrically, using membrane pump
Pressure/Vacuum	0 to 1.6 bar _{abs} including control
Temp.-Resolution	0.007 K, HF and HB signals 0.001 K
Accuracy	HF: 2%, HB: 4% (isothermal, 5° to 50°C)
OPTIONS	Heat balance, reflux (accuracy 5%), second dosing facility, pH, pH control, distillation with balance, pressure reactor.

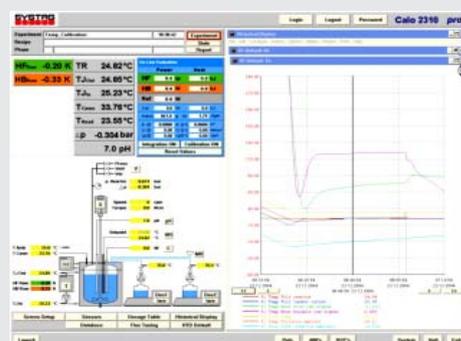
Overview

Depiction of a Calo2310 pro, trolley mounted, with reflux and distillation facilities. Other types of configurations are available.

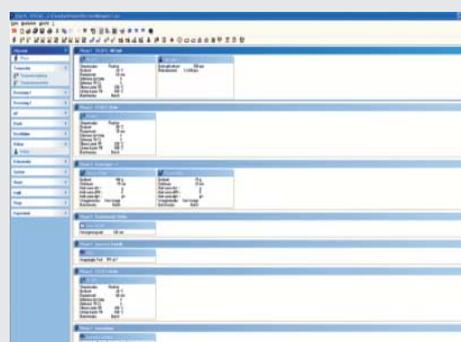


Calo2310 eco or Calo2310 base can be directly assembled into a desk mounted hood (only upper frame structure).

The new FlexySys Surface provides comprehensive operating facilities, whilst reaction progress can be monitored at a glance.

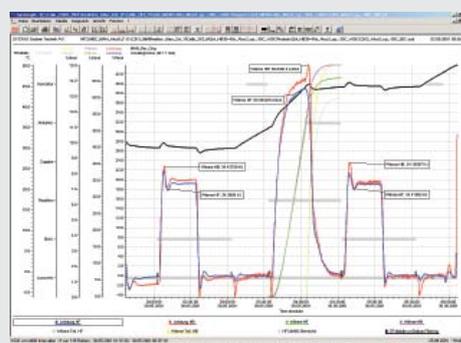


The new Recipe Editor OperX is a drag-and-drop Windows Editor incorporating all advantages of the current Base Operations.

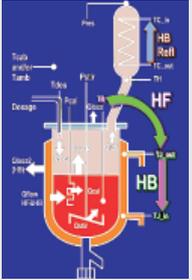
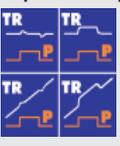
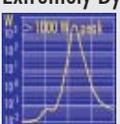
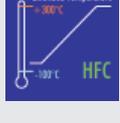


Evaluation Calo2310 base & pro

SysGraph evaluation software combined with Calo2000 package for automated „Zero Watt“ baseline function, output and heat of HF, HB and reflux as well as adiabatic increase TR.



Comparison Table of all Instruments

Calorimetry Specifications		Calo2310 Family			Instrument Selection List			
		eco	base	pro		eco	base	pro
Calorimetric-Methods  <ul style="list-style-type: none"> HB Reflux Balance HF Reactor Heat-flow HB Reactor Heat-balance 		●	●	●		●	●	●
Applications  <ul style="list-style-type: none"> Syntheses Polymerisations Crystallisations 		●	●	●		●	●	●
Experiment types  <ul style="list-style-type: none"> Reactor control isothermal Jacket control isoperibolic Reactor control ramping Jacket control ramping Adiabatic control 		●	●	●		●	●	●
cp Determinations  <p>The cp value is automatically determined during calibration</p>		●	●	●		●	●	●
On-line Display  <ul style="list-style-type: none"> A, U, m, cp-calc, cp-measured Pcal, Qcal P-HF, Q-HF, optional P-Refl P-HB, Q-HB 		●	●	●		●	●	●
Extremely Dynamic  <p>Short duration peak output is displayed with excellent accuracy</p>		●	●	●		●	●	●
Excellent Kinetic-Dynamic  <p>Due to model, extremely short response time effects real time monitoring of reaction</p>		●	●	●		●	●	●
Dosing Error Compensation  <ul style="list-style-type: none"> Correction dosing heat Correction surface enlargement 		●	●	●		●	●	●
Stirrer Correction  <ul style="list-style-type: none"> Vortex correction Stirrer output correction 		●	●	●		●	●	●
Closed System  <p>Closed system prevents evaporation losses, required for pressure measurement and control option</p>		○	●	●		○	●	●
Lid Heating Facility  <p>Prevents condensation on lid</p>		○	○	●		○	○	●
CFR 21 part 11  <p>Conforms with CFR 21 part 11 protocol</p>		●	●	●		●	●	●
Access Control  <p>Various security levels with individual names and passwords</p>		○	○	○		○	○	○
Acceptance Certification  <p>Installation and Operation certification Factory and site acceptance tests</p>		○	○	○		○	○	○
Expanded Temperature Range  <p>Expanded temperature range from -80°C to 250°C using a variety of heat transfer media</p>		○	○	○		○	○	○
Reactor Types <ul style="list-style-type: none"> Double jacket, glass, 1l, cylindrical Triple jacket, glass, 1l, cylindrical Triple jacket, glass 1l, conical Other shapes or volumes, glass Steel pressure reactors 60 bar, 1l, cylindrical Other designs, materials, pressure 		●	●	●		●	●	●
Thermostats & Temp. Ranges <ul style="list-style-type: none"> Unistat TANGO, -20°C to +180°C Unistat 380w, -50°C to +180°C Reactor lid thermostat CC 302-3 Thermostat 390wHT -80°C to +240°C Lid thermostat 360wHT -60°C to +240°C 		●	●	●		●	●	●
Stirrer <ul style="list-style-type: none"> 2 Ranges 40 to 400 and 200 to 2000 rpm Basket stirrer, glass Anchor stirrer, glass Other designs (propeller etc) 		●	●	●		●	●	●
Dosing Equipment <ul style="list-style-type: none"> Dosing #1, 1 l/h, membrane pump, balance Dosing #2, 1 l/h, membrane pump, balance PTFE Peristaltic pump, 0.6 l/h Volume dosing by injection pump Pre-pressurised valve dosing 		●	●	●		●	●	●
pH/pX Measuring & Control <ul style="list-style-type: none"> pH/pX measuring only pH/pX control (requires Dosing #2) 		○	○	○		○	○	○
Reflux, Reflux Splitter, Distillation <ul style="list-style-type: none"> Reflux condenser, w/o HB reflux measurement Reflux condenser, with HB measurement Reflux splitter with distillation cooler & balance 		●	●	●		●	●	●
Pressure Measurement & Control <ul style="list-style-type: none"> Pressure measurement (1.6 bar) Pressure control: Pressure, venting, vacuum Other ranges for 10 or 100 bar 		○	●	●		○	●	●
Optional Measuring Instruments <ul style="list-style-type: none"> Turbidity measurement Integration of mid- FTIR instruments Integration of Lasentec instrument 		○	○	○		○	○	○
Further Upgrade Options <ul style="list-style-type: none"> Calo 2310 eco to Calo 2310 base to 			○	○			○	○