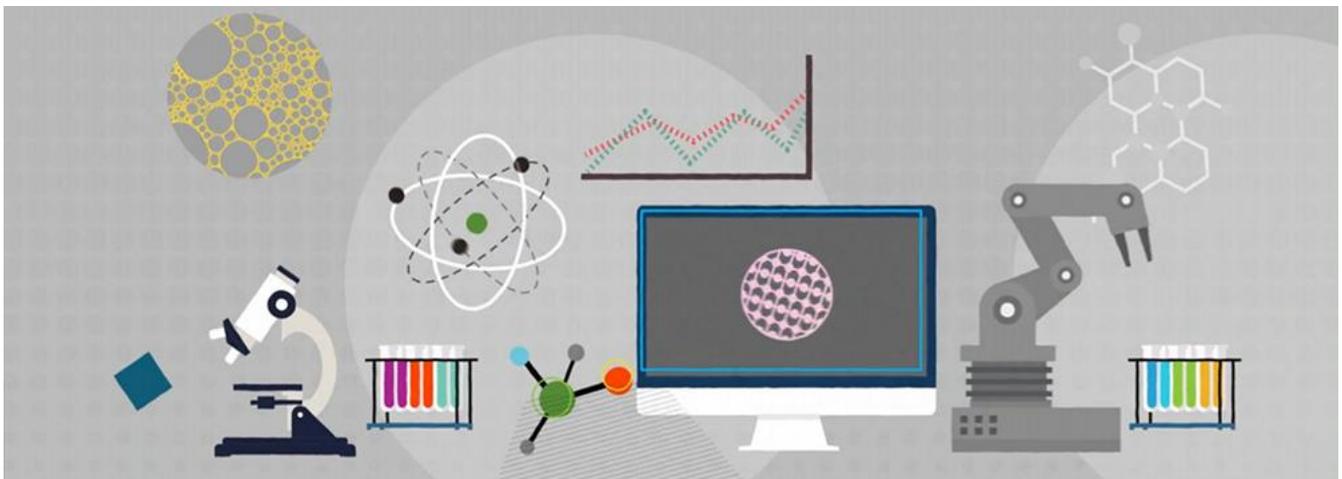


MATERIALS INNOVATION FACTORY

HENRY
ROYCE
INSTITUTE

AUTOMATED FORMULATION SYSTEMS



AUTOMATED FORMULATION ROBOT (GEOFF)

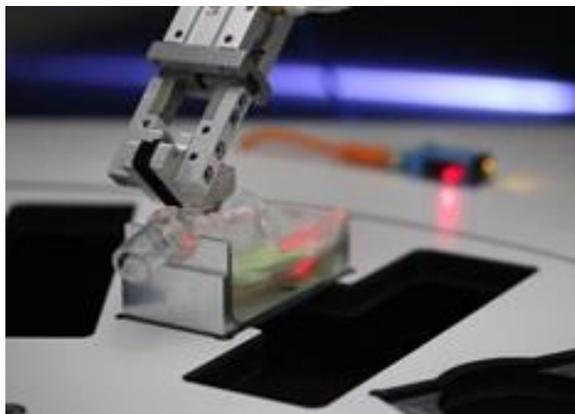
SAMPLE TYPE

GEOFF can handle ingredients with a wide viscosity range and has the capability to dispense slurries that require heating and stirring. Powders can be added to formulations. It can measure pH and viscosity values and adjust completely autonomously.



WHAT IS IT?

GEOFF is an automated formulation platform that can make up to 24 800g formulations in 24 hours. It consists of 4 mixing stations and a robotic arm which picks up kettles containing raw materials and gravimetrically dispenses them into formulation pots. Each station is capable of bulk and homogenous mixing and excellent process control. Each formulation can be heated individually up to 80 °C.



WHY USE GEOFF?

- Integrated with our scientific data management system: FLEX
- Excellent repeatability and accuracy
- Frees up valuable time for human controllers
- Scale up formulations
- Automated Dispensing



SPECIFICATION / ATTACHMENTS

GEOFF can hold;

- 10 liquids @ 2 kg
- 10 liquids @ 200 g
- 6 hot/stirred liquids @ 2 kg
- 10 powders @ 150 g

All materials are gravimetrically dispensed

Dispensing parameters are tailored to the raw material properties

Heating and cooling can be controlled upon addition of ingredients

QUESTIONS? - CONTACT US.



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Supplier website:
www.labmanautomation.com

FORMAX

The Chemspeed formulation platform specializes in the dispense of highly viscous materials and powders with a balance resolution of 100 – 10 µg. The automation equipment provides continuous real time monitoring and control of all formulation parameters such as temperature.



WHAT IS IT?

A highly adaptable robotic formulation platform designed for a wide range of applications:

- Emulsion formulation, application, testing
- Paint formulation, application, testing
- Personal care products formulation, application, testing
- Home care products
- OLED, OPV, fuel cell ink formulation, application, testing
- Battery paste and electrolyte formulation, application, testing
- Engine oil and grease formulation and testing
- Catalyst paste making and extrusion

TECHNICAL HIGHLIGHTS

- Formulation Scale: 8mL (vials) and 80 g with mixing
- 24 independent mixing modules equipped with stirrer and scrapers
- Throughput: Typically 5 runs of 24 per fortnight
- 4-Needle Head for volumetric liquid handling and sampling
- Independent formulation and mixing parameters can be set for each sample
- Gravimetric dispensing liquids & powder
- Controlled Heating/Cooling, addition whilst mixing
- Raw materials:
 - Liquids @ 16 g
 - 5 hot/stirred liquids @ 16 g
 - 15 powders @ 15 g



OPERATIONAL MODES

The operator loads the robot with materials for formulation or dosing 8 mL vials with samples for further analysis (such as use on the HTR).

QUESTIONS? - CONTACT US.



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HIGH THROUGHPUT RHEOMETER

THE BENEFITS: HIGH THROUGHPUT RHEOLOGY:

Rheological characterisation of materials is time consuming and requires experience to set up the equipment and interpret the results. The validity of any results is thus very dependent on the protocol used and how the user has interacted with the materials and instrument. Utilising a robot, whilst not appreciably faster than a human operator, can realise benefits in more repeatable and robust data output.

TECHNICAL HIGHLIGHTS

- Integrated with our scientific data management system: FLEX
- 24-hour operation
- Reliable rheological measurement with a standard MCR rheometer
- Cone-plate and parallel plate geometries available
- Fully automated sample loading and trimming
- Bar code reader for sample identification
- Fully automated cleaning with customized procedures
- Full range of rheological measuring parameters in rotation and oscillation
- Temperature control with Peltier heated and electrically heated systems

Software

- Method development with rheometer software
- Automated analysis, printout and export of measuring data
- Methods and data interchangeable between lab and automation equipment
- Individual set of measuring and analysis parameters for any number of samples

WHAT IS IT?

The Anton Parr HTR 502 plate rheometer is the first fully automated rheometer available. Rheological measurements are carried out by MCR rheometers in the high quality the instruments are known for, while a robot handles all additional tasks pertaining to the measurement: sample loading, sample trimming and the cleaning of the upper and lower measuring system while the next measurement is already in progress. The complete automation of the entire measuring procedure, from sample loading right through to data evaluation, for the very first time allows fully realized high-throughput rheometry.



SPECIFICATION / ATTACHMENTS

- Vial based sample input for aspiratable liquids
- Pre-loadable plates for paste workflows
- Smooth or cross hatched geometries

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PHIL CUP/BOB RHEOMETER

THE BENEFITS

Rheological, particle size, pH, conductivity, colourimetry and RI characterisation of materials is time consuming and requires experience to set up the equipment and interpret the results. The validity of any results is thus very dependent on the protocol used and how the user has interacted with the materials and instrument. Utilising a robot, giving benefits in more repeatable and robust data output.



TECHNICAL HIGHLIGHTS

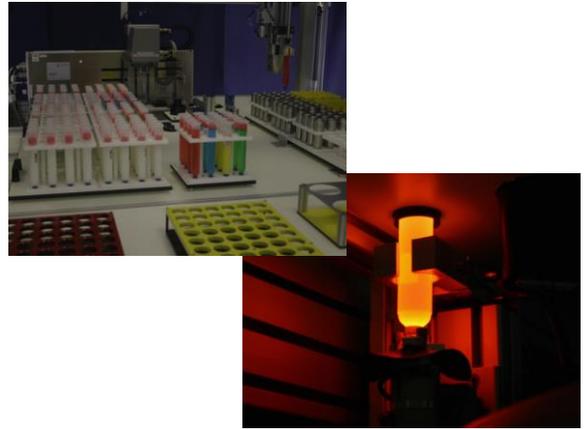
- 24-hour operation
- Rheology Shear, stress & oscillation (Anton Paar)
- pH & Conductivity (Metrohm)
- Colorimetry (Ocean optics)
- Refractive Index (backscattering samples)
- Particle size (Malvern)

Software

- Integrated with our scientific data management system: FLEX
- Method development with rheometer software
- Methods and data interchangeable between lab and automation equipment

WHAT IS IT?

The “Phil” Characterisation platform designed by Labman Automation Ltd is a bespoke robotic platform designed to perform multiple measurements on liquid samples in terms of rheology, pH and particle sizing (depending on materials).



OPERATIONAL MODES

1. Load the robot with sample cups that are pre-filled with sample, the robot then loads and unloads them into the rheometer and performs the analysis.
2. Load the robot with empty samples cups and pre-filled disposable syringes. The robot picks the syringe barrel, decaps it, dispenses the sample into a rheometer cup, recaps the syringe barrel and then loads/ unloads the rheometer as in mode 1.

QUESTIONS? - CONTACT US.



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FORMULATION ENGINE

Main Platform

WHAT IS IT?

The main platform provides services (power, gasses, fluids and communications) to processing modules

Two robot arms each on a linear track provide consumables and raw materials to processing modules.

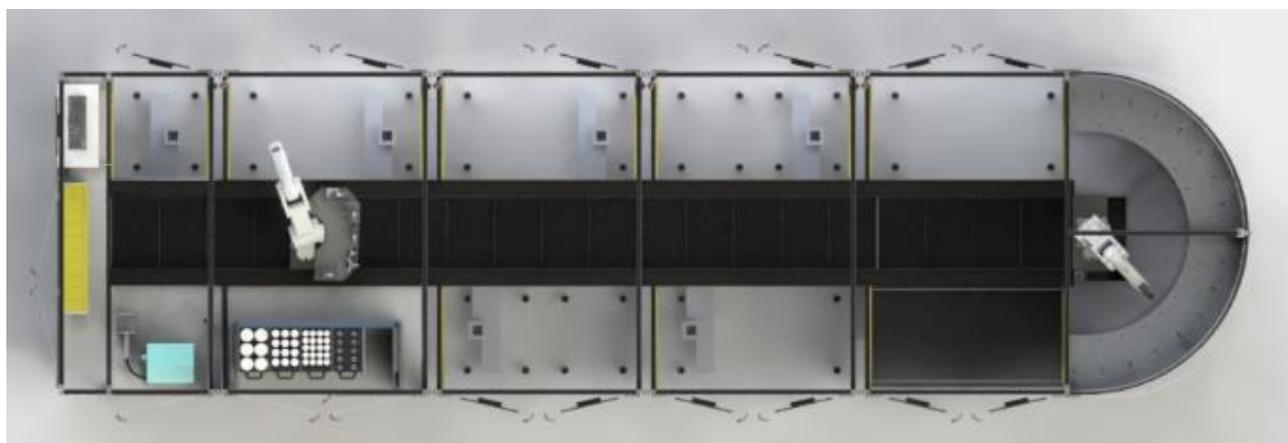
Modules can be interchanged when required by the workflow

PROCESSING MODULES

The modular design of the formulation engine future proofs the robot for more opportunities in the future.

Current processing modules are;

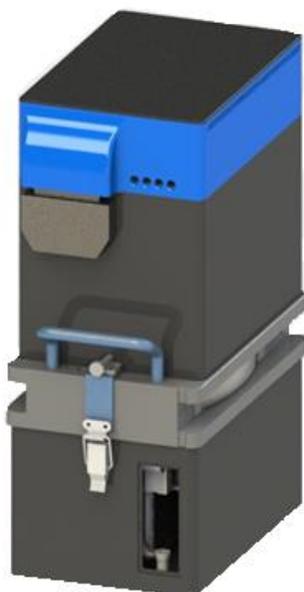
- Triple Overhead Mixer
- XYZ Processing Module
- Dispensing Module
- Photocatalysis Module



MOBILE DISPENSING UNITS (MDUs)

MDUs provide raw materials to the processing modules in the Formulation Engine. They are capable of dispensing;

- Powders
- Low/high viscosity liquids
- Slurries
- Molten liquids



CONSUMABLE STORE

One end of the Formulation Engine will contain pre barcoded consumables ranging from 2-1000ml in plates or racks ready to be supplied to the processing modules. An inkjet printer will be located on deck for any secondary labelling requirements.

QUESTIONS? - CONTACT US.



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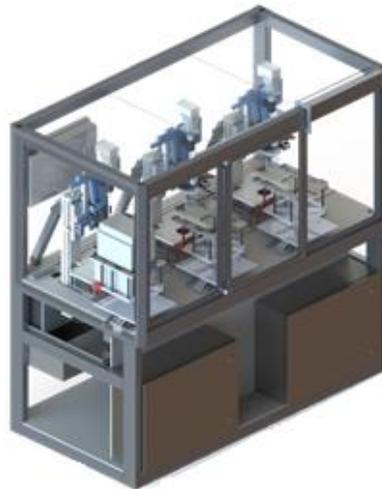
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FORMULATION ENGINE

Triple Overhead Mixer

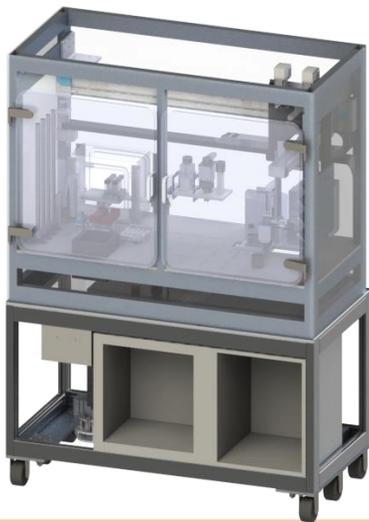
WHAT IS IT?

The triple overhead mixer module has three identical stations that are capable of mixing on 50ml or 200ml scale. Gravimetric additions can be made whilst mixing, homogenising and controlling temperature. pH can also be measured and adjusted.



Triple
Overhead
Mixer

XYZ
Dispensing
Module



XYZ

WHAT IS IT?

The XYZ module is a gantry robot for moving consumable and performing syringe needle transfers. It also houses a Mettler Toledo Quantos for highly accurate powder dispenses. Syringe pump dispensers allow gas caps of Nitrogen or Argon. It can cap, crimp, shake and ultrasonicate vials.

Dispensing Module



Dispensing
module

WHAT IS IT?

The dispensing module dispenses into various consumable fed from the main platform. It dispenses powders into boats in a dehumidified atmosphere. It also contains four fixed syringe needles for low viscosity additions.

QUESTIONS? - CONTACT US.



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FORMULATION ENGINE: THE PHOTOCATALYSIS MODULE

WORKFLOW

New Catalysts prepared by the xyz module are transferred in Crimp cap vials.

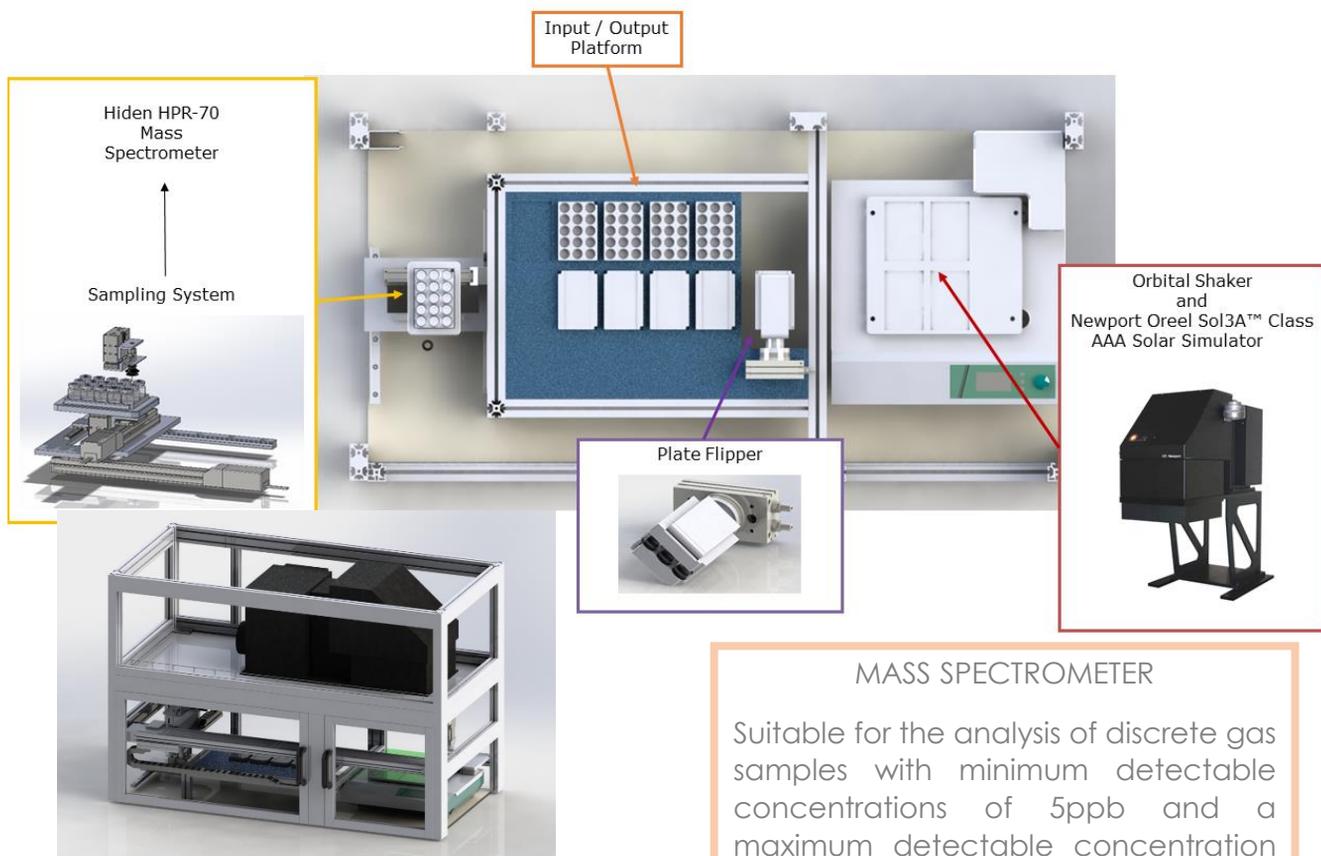
The plates are flipped to enable illumination via the base of the vial.

The solar simulator illuminates the samples to catalyse the chemical reactions (max 60 x 10 mL vials).

The samples are analysed using a Hiden HPR-70 mass spectrometer.

WHAT IS IT?

This module completes the photocatalysis workflow for materials discovery and research. Following the XYZ processing module, new catalysts are exposed to light from a solar simulator to promote water splitting and carbon capture. The headspace of each sample is analysed using a mass spectrometer to detect if the reactions were successful.



SOLAR SIMULATOR

The solar simulator is positioned on the top of the module, illuminating part of the processing deck below.

Using a single lamp design to meet all three Class A performance criteria (Spectral performance, Uniformity of Irradiance and Temporal Stability) with a 30 x 30 cm output beam.

MASS SPECTROMETER

Suitable for the analysis of discrete gas samples with minimum detectable concentrations of 5ppb and a maximum detectable concentration of 100%.

QUESTIONS? - CONTACT US.



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www.hidenanalytical.com

www.newport.com