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Z Corp 310 3D Printer

Technical Specification

Build Speed: 2 - 4 layers per minute
Build Size: 203 x 254 x 203 mm (8 x 10 x 8 inches)
Material Options: High performance composite, direct casting, investment casting
Layer Thickness: User selectable at time of printing; .076 - .254 mm (.003 - .010 inches)
Resolution: 300 x 450 dpi
System Software: Z Corporation’s proprietary software accepts solid models in STL, VRML and PLY file formats as input. Zprint software features 3D viewing, text labelling, and scaling functionality. The software runs on Microsoft Windows* NT, 2000 Professional and XP Professional.
Equipment Dimensions: 74 x 86 x 109 cm (29 x 34 x 43 inches)
Equipment Weight: 113 kg (250 lbs.)
Power Requirements: 115V, 4.3A or 230V, 2.4A
Number of Printheads: 1
## Z Corp 450 3D Colour Printer

**Technical Specification**

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<td><strong>Build Speed:</strong></td>
<td>2 - 4 layers per minute</td>
</tr>
<tr>
<td><strong>Build Size:</strong></td>
<td>203 x 254 x 203 mm (8 x 10 x 8 inches)</td>
</tr>
<tr>
<td><strong>Material Options:</strong></td>
<td>High-performance composite</td>
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<tr>
<td><strong>Layer Thickness:</strong></td>
<td>User selectable at time of printing; .089 - .102 mm (.0035 -.004 inches)</td>
</tr>
<tr>
<td><strong>Resolution:</strong></td>
<td>300 x 450 dpi</td>
</tr>
<tr>
<td><strong>Number of Print Heads:</strong></td>
<td>Two (one tricolour, one clear)</td>
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<tr>
<td><strong>System Software:</strong></td>
<td>Z Corporation's proprietary software accepts solid models in STL, VRML, and PLY file formats as input. ZPrint software features 3D viewing, text labelling, and scaling functionality.</td>
</tr>
<tr>
<td><strong>Equipment Dimensions:</strong></td>
<td>122 x 79 x 140 cm (48 x 31 x 55 inches)</td>
</tr>
<tr>
<td><strong>Equipment Weight:</strong></td>
<td>193 kg (425 lbs)</td>
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<tr>
<td><strong>Power Requirements:</strong></td>
<td>100V, 14.4A or 115V, 14.0A or 230V, 6.2A</td>
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<td><strong>Network Connectivity:</strong></td>
<td>TCP/IP 100/10 base T</td>
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<td><strong>Workstation Compatibility:</strong></td>
<td>Windows® 2000 Professional and Windows XP® Professional</td>
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BFB 3D Touch Printer

3D Touch Triple

**Supports thermoplastic materials:**
- Acrylonitrile Butadiene Styrene (ABS)
- Polylactic Acid (PLA)
- Soluble Polylactic support (PLA)

**Technical Specification**

- **Build size:** 185 x 275 x 210mm (xyz)
- **z-axis resolution:** 0.125mm
- **Deposition rate:** 15mm³ / s
- **Large print area:** 275x275x210mm

**Print speed extruded volume:** 15mm³ (9/16th”³) per second print and polymer dependant
Technical Specification

Automatic Operation
Catalyst software automatically imports STL files, orients the part, slices the file, generates support structures (if necessary), and creates a precise deposition path to build your ABS model. Multiple models can be packed within the build envelope to maximize efficiency. Catalyst provides queue management capabilities, build time, material status and system status information. Dimension 3D Printers run unattended and provide system and build status information via e-mail, pager, or the Internet.

Network Connectivity
- TCP/IP 100/10 base T

Workstation Compatibility
- Windows NT/Windows 2000/Windows XP
- Build Size:
  - Maximum size 203 x 203 x 305 mm

Materials
- ABS plastic in standard white, blue, yellow, black, red or green colours. Custom colours available.

Support Structures and Removal
Catalyst software automatically creates any needed support structures to complete the part. Two support removal processes are available. With Dimension, a Break Away Support System allows for easy support removal — simply break away the supports. Dimension SST offers a soluble support removal process for hands-free model completion.

Material Cartridges
- One autoload cartridge with 922 cu. cm. (56.3 cu. in.) ABS material.
- One autoload cartridge with 922 cu. cm. (56.3 cu. in.) support material.

Layer Thickness
- .245 mm (.010 in.) or .33 mm (.013 in.) of precisely deposited ABS and support material.

Size and Power Requirements
- Size: 686 x 914 x 1041 mm Weight: 136 kg (300 lbs.)
- Power Requirements: 110-120 VAC, 60 Hz, minimum
Stratasys 400mc FDM

Technical Specification

System Highlights: Widest variety of material options and custom configurations. Larger build envelope and multiple material bays for longer, unattended operation. Best surface finish and feature detail. Capable of multi-coloured parts in a single build.

Build Size: Maximum size 356 x 254 x 254 mm

Materials
- ABS-M30 in standard white, blue, yellow, black, red or green colours.
- ABS-M30i
- ABSi
- ABS-ESD7
- PC-ABS
- PC
- PC-ISO
- ULTEM 9085
- PPSF/PPSU
- Soluble Support - ABS-M30, ABS-M30i, ABSi, ABS-ESD7, PC-ABS
- Break Away Support - PC, PC-ISO, ULTEM 9085, PPSF/PPSU

Accuracy
- +/- .127 mm or +/- .0015 mm per mm, whichever is greater.

Layer Thickness
- 0.330 mm
- 0.254 mm
- 0.178 mm
Arcam AB S12T - Electron Beam Melting

**Capability**
- Additive Manufacturing of functional metallic components
- High energy electron beam (3.5kW) for high conversion rates
- High quality microstructure
- High density components

**Technical Specification**
- **Build size:** 200 x 200 x 180mm
- **Layer thickness:** 0.05 - 0.2mm
- **Build rate:** up to 60cm³/hr
- **Accuracy:** ±0.4mm

**Materials (most metals and alloys):**
- Titanium and Ti alloys
- Stainless steel
- Inconels
- Refractory metals
Hybrid Printing System

ALM - XYPrint100Z Hybrid Printing System

2D and 3D printing and pumped deposition of inks and viscous fluids.

Capability

- Hybrid printing system, capable of depositing low viscosity dyes and inks through twin 512dpi inkjet heads including conductive nanosilver, and high viscosity materials including ceramic pastes and liquid polymers through a microdeposition pump. This can be achieved on a range of substrates in 2D and 3D.

- Volumetric deposition control down to 1 picolitre (pump) and 14 picolitre (inkjet heads).

- Curing of materials by either Phoseon UV lamp or Near Infrared (NIR) 3000K lamp.

- Max build envelope of 210mm x 260mm x 140mm.
Hybrid Plasma Transferred Arc/CNC Additive Layer Manufacturing system

PTA integrated with CNC for hybrid material deposition and removal.

### Capability
- Weld deposition currents up to 200A
- Local and global Argon shielding for deposition of reactive metals (e.g. Titanium)

#### 2 powder feeders:
- Independent flow control rate
- 15 - 20g/min (material dependent)
- Variable feed position (front and rear of melt, in variety of patterns (1 - 6 powder streams)
- Deposition speeds up to 450mm/s
- Typical weld currents 25 - 150A

#### 1 wire feed gun:
- High deposition rates (10+kg/hr)
- Less oxidation risk (cleaner feed-stock)
- No powder handing safety requirements

### Advantages of the technology

#### Flexibility:
- ALM, repair and augmentation of parts
- Variable material feed enabling tailored response (mechanical, electrical etc)
- In-process machining of parts enabling internal accuracy and enhanced fatigue resistance
- Low purchase, running and maintenance cost
- PTA is standard welding technology, highly reliable, easily integrated into CNC
- Anode is non-consumable, electricity and gases are only consumables

#### Capability:
- High quality deposition at high material rates
- Low dilution of deposit with substrate (minimal waste)
The **Vehicle Energy Facility** (VEF) is a state-of-the-art hybrid powertrain research facility providing first class capabilities and flexibility for the testing and characterisation of hybrid powertrains, components and control systems. The VEF can test from component level to the complete system including powertrain, electric drives and energy storage.

**Typical Usage:**

- Hybrid vehicle architecture testing
- Powertrain component testing and characterisation
- Control strategy development and refinement
- Fuel economy and emissions testing
- Electric motor testing and characterisation
- Electrical energy storage testing and characterisation
- Real world performance testing of bio-fuels
- Optimised energy management for HEVs
- Determination of the effects of driver behaviour on hybrid and conventional vehicles over a wide range of drive cycles
- Determination of local emissions in conjunction with CO2 emissions for different control strategies
- Plug-in HEV leading to Vehicle-to-Grid (V2G) research

**Equipment includes:**

**Froude Hofmann**
Large dynamometer – 570 kW, up to 5,000 rpm, 3,200 Nm maximum torque
Small dynamometer – 320 kW, up to 10,000 rpm with fully synchronised operation with large dynamometer

**Bitrode**
FTF Battery simulator and battery pack cycler – 500A, 900V, up to 250kW maximum

**dSPACE**
Hardware-in-loop (HIL): allowing simulation of vehicle components/systems in conjunction with real components

**Horiba**
Emissions measurement capability for NOx, CO, CO2, Total Hydrocarbon (THC), O2 and diesel particulates

**Key Features:**

- Unique synchronised dual dynamometer architecture
- Supports EV, HEV and conventional IC engine powertrain testing
- Full legislative and real-world/user-defined drive cycle capability
- Multiple engine fuelling options: gasoline, diesel, ethanol, and special bio-fuels
- Full gaseous and particulate exhaust emissions measurement
- High power vehicle battery simulation and battery cycling
- Simulation platforms for early lifecycle development and testing of virtual components and/or control strategies
- Robot driver
Weiss Gallenkamp Votsch VC3 4060 x 2 Environmental Chamber

**Capability**

- Highly efficient 32 bit control and monitoring system SIM PAC* with integrated measurement data recording
- CONTROLPAD* with actual value display of temperature and humidity, start/stop, on/off of the lighting, fault indication – combined with 8” or 12” touchpanel
- 8” colour touchpanel with menu-guided surface
- USB and Ethernet interface
- Remote control and remote monitoring via intranet or internet
- Autoadaptive control system with continuous self-optimisation
- Safety device for test specimens with independent temperature
- Measurement tmin/tmax
- Outstanding spatial temperature distribution through aerodynamic air flow
- Reliable test values even with high environmental temperatures

**Technical Specification**

- Operating range: -40°C to +180°C
- Humidity controlled: 10% to 90%
- EUCAR hazard levels 6
- Lithium ion battery testing capable

This equipment was part funded by the European Regional Development Fund and may, therefore, have restrictions on its usage.
Weiss Gallenkamp WK3 340/40 Environmental Test Facility

**Capability**

The environmental test facility allows the conditioning or ageing of materials with both temperature and humidity.

The large chamber volume enables large components to be tested. Temperature and humidity cycles are fully programmable using the user-friendly touch-screen and Windows-based software. The unit is automatically supplied with de-mineralised water so that long-term tests can run automatically.

**Technical Specification**

- Test space (mm): 750 h x 580 w x 765 d
- Maximum temp (°C): 180
- Minimum temp (°C): -42
- Maximum temp rate - heating (°C min-1): 3.2
- Maximum temp rate - cooling (°C min-1): 4.0
- Temperature range for humidity tests (°C): +10 to +95
- Humidity range (%): 10 to 98

This equipment was part funded by the European Regional Development Fund and may, therefore, have restrictions on its usage.
Weiss Gallenkamp Votsch VT3050 High Temperature Battery Storage Chamber

**Capability**
- Reliable temperature tests ranging from -30 °C to +100 °C for a large variety of applications:
- Ageing of equipment
- Constant temperature tests
- Changing temperature tests on raw materials and finished products
- Testing of total assemblies in the electrical and electronic industries
- Functional tests applying various ambient temperatures

**Technical Specification**
- Test space volume: 500 ltrs
- Temperature range: -30/+100°C
- Temperature fluctuation: ±0.5K
- Deviation in space: ±1.5K
- Temperature gradient: 3K
- Temperature rate of change:
  - Heating: 2.0K/min
  - Cooling: 1.4K/min
- Heat compensation max.: 650W
- Calibrated values: +23°C/+80°C
- Test space dimensions:
  - Width: 710mm
  - Depth: 590mm
  - Height: 1250mm
- External:
  - Width: 940mm

This equipment was part funded by the European Regional Development Fund and may, therefore, have restrictions on its usage.
Technical Specification

5m x 3m thermal room: -
-40°C to +80°C, +/- 1°C, 0.5°C/min

250kW Froude Hofmann dynamometer: -
- 251kW (absorbing) / 267kW (motoring)
- 850Nm
- 10,000 rpm

250kW Bitrode FTF Pack cycler (see separate entry): -
- 900V, 500A, 250 kW

Multiple independent DUT cooling circuits: -
- 4 individual chiller/heater units
- Temperature range 5 - 90°C
- 5, 10, 15, 20 kW
dSPACE High Performance Real-time Simulation Platform

dSPACE Simulator Mid-Size with Quad-core CPU, high speed FPGA simulation block

dSPACE Simulator Mid-Size is a hardware-in-the-loop (HIL) simulator for testing automotive ECUs systematically and automatically. The simulation model runs on the processor board. dSPACE Simulator Mid-Size generates and measures I/O signals via the DS2211 HIL I/O Board, which also performs the signal conditioning. Additional I/O and signal conditioning have also been added on this equipment.

**Typical fields of application include:**

- Motor, power electronics, vehicle dynamics and body electronics HIL
- Open-loop or closed-loop environment
- Realistic unit tests
- Function integration tests, release test, and ECU diagnostics tests
- Automated testing
- Real-time simulation
eDRIVEsim is designed to conduct controller testing and HIL simulation of various electric and power electronic systems including:

- PMSM, BLDC, and IM motor drives
- Automotive: Hybrid power trains, power steering, and auxiliary power systems
- Transportation: Trains traction and auxiliary systems, ship propulsion systems
- Rectifiers and battery chargers
- Wind energy and power electronic distributed generation and distribution systems
- Industrial drives and multi-level converters
Espec Cell/Module Thermal Chambers

ESPEC PL-3KPH Environmental Chamber x 3

**Capability**
- Energy-efficient refrigeration with exclusive electronic expansion valve system
- Specialized humidity generation and control
- Unique thermal break construction for extreme testing
- USB port for uploading and downloading test programs and operation data logs
- Remote monitoring, programming, and data collection via Ethernet/LAN-based Web Controller
- Safety device for test specimens with independent temperature

**Technical Specification**
- -40°C to +150°C
- Relative humidity 20 - 98%
- EUCAR hazard levels 6
- Lithium ion battery testing capable
Bitrode MCV 16-100-5 EV/HEV Battery Cell Test System

**Technical Specification**
- Constant Current Amp Range (±0.1%) 0.00 – 100.00
- Charge Voltage (±0.1%) 0.000 – 5.000
- Discharge Voltage (±0.1%) 0.000 – 5.000
- Constant Wattage 500.0W
- Circuits per Cabinet 16

**Features**
- Drive simulations with standard Electric Vehicle tests: FUDS, SFUDS, GSFUDS, DST and ECE-15L
- Drive Cycle Conversion utility automates test program development from acquired battery usage data
- Constant Current, Power or Voltage Control
- Bipolar capacity for discharging to below zero volts
- Parallel circuit operation for greater flexibility in test specification
- Assignable Data Channels
- Test control and data management with Bitrode’s VisualCN Lab Client software suite
**Bitrode FTV4-200-60 EV/HEV Module Test System**

**Technical Specification**
- Constant Current Amp Range (A) per circuit: 0.00 – 200.00
- Constant Current Amp Range (A) per cabinet: 0.00 – 800.00
- Charge/Discharge Voltage (V): 0.000 – 60.00
- Constant Wattage per circuit (kW): 12.000
- Constant Wattage per cabinet (kW): 48.000
- Maximum Channels: 4

**Features**
- Drive simulations with standard Electric Vehicle tests: FUDS, SFUDS, GSFUDS, DST and ECE-15L
- Drive Cycle Conversion utility automates test program development from acquired battery usage data
- Test control and data management with Bitrode’s VisualLCN Lab Client software suite
- Constant Current, Power or Voltage Control
- Bipolar capacity for discharging to below zero volts
- Parallel circuit operation for greater flexibility in test specification
- Assignable Data Channels
- Discharge power recycled to AC line for cooler, more energy-efficient operation
- No performance loss under voltage control
- Remote Binary Protocol via Ethernet connection available for 3rd party software control
- Program execution is independent from the PC with VisualLCN software
**Bitrode FTF-500-900 EV/HEV Battery Pack Test System**

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**Technical Specification**
- Constant Current Amp Range (A) 0.00 – 500.00
- Charge/Discharge Voltage (V) 0.00 – 900.00
- Output Power(kW) 250.00

**Features**
- Drive simulations with standard Electric Vehicle tests: FUDS, SFUDS, GSFUDS, DST and ECE-15L
- Drive Cycle Conversion utility automates test program development from acquired battery usage data
- Test control and data management with Bitrode’s VisuaLCN Lab Client software suite
- Discharge power recycled to AC line for cooler, more energy efficient operation
- Includes built-in isolation transformer, AC input filter, and DC output filter ensuring stable communication to BMS or ECU
- All units built to CE specifications
- No performance loss under voltage control
- Remote Binary Protocol via Ethernet connection available for 3rd party software control
- Software based complete calibration takes <20 minutes
- Safety features include circuit shutdown when the cabinet door is open. Program execution is independent from the PC with VisuaLCN software
Brüel & Kjær Medium Force Shaker

**Uses**
- Automotive parts and systems - qualification testing
- Electronic assembly, computer equipment testing
- Avionics and military hardware testing
- Satellite component testing
- Product and package testing
- General stress screening
- Package testing
- Shock testing applications

**Features**
- 76.2mm displacement in both vertical and horizontal modes for 3-axis testing
- HBT and LPT Combos with table sizes of 600 x 600mm, 750 x 750mm, 900 x 900mm, and 1220 x 1220mm
- Unique 640mm armature minimizes requirements for head expanders when testing bulky or packaged goods
- Wide frequency range from as low as 5Hz with Lin-E-Air™ isolation
- Payloads up to 600kg
- Can be used with AGREE/CERT Standard thermal chambers
Battery Aggressive Test Chambers

Cells for the crushing, penetrating, short-circuiting, over-charging, etc of battery cells

**Technical Specification**

2 x test chambers
- Crush, metered penetration, short-circuit, over-charge etc.
- Hydraulic crush test-rig
- Pack level testing
- CCTV
- Full environmental protection
- Temperature pre-conditioning
- Remote air-conditioning with fabricated enclosures
- -40 to +150°C in test enclosure to ±2°C
Flir High Resolution Thermal Cameras

FLIR T425 high resolution thermal cameras x 2

**Capability**
- Integrated 3.1M pixel digital camera
- USB outputs as well as a removable SD card
- Create visual and infrared non radiometric MPEG-4 video files
- Create an infrared overlay on visual image
- Text comments can be made from a pre-defined list or using the touch screen
- Measurement spots, area with auto hot/cold spot indication, isotherms, ΔT calculation

**Technical Specification**
- IR resolution 320 x 240 pixels 50Hz
- Measurement range: -20 °C to +1200°C measurement range
- Accuracy: ±2°C or ±2% of reading
Flir Ultra-high Resolution Thermal Camera

FLIR X6550SC ultra-high resolution thermal cameras

**Capability**
- USB outputs as well as a removable SD card
- Create visual and infrared non radiometric MPEG-4 video files
- Measurement spots, area with auto hot/cold spot indication, isotherms, ΔT calculation
- High accuracy of +/- 1°C or +/- 1% produces sensitive thermal images. Measures temperatures up to +3,000°C
- Removable Touchscreen LCD

**Technical Specification**
- IR resolution 640 x 512 pixels 125Hz
- Standard measurement range: +5 °C to +300°C
- Accuracy: ±1°C or ±1% of reading
Solartron Electrical Impedance Spectroscopy Frequency Analyser

Solartron ModuLab-MTS Test System

**Capability**
- Electrical impedance spectroscopy (EIS) analysis
- Used for battery and fuel cell research, dielectric analysis, electrochemistry, corrosion studies, sensor development and materials analysis

**Technical Specification**
- Frequency range: 10 µHz to 1 MHz
- Accuracy (ratio): ±0.1%, ±0.1°C
- Maximum current: ±300 mA
- Maximum Voltage: ±100 V
Hioki Battery Tester

Hioki BT3563 Battery Tester

**Capability**

- High-precision cell voltage measurements (accurate to 0.01% of reading)
- Ranges from 3 mΩ to 3000 Ω support coin-size to large-cell batteries
- Measurement circuitry employs enhanced current regulation
- Battery module testing
- Fast 10 ms response and 8 ms sampling time for high-speed measurements
- Large (low-resistance) cell testing
- High-speed mass production testing of coin batteries
- Fuel cell stack measurements
- Battery research and development measurement applications
Thermal Hazard Isothermal Calorimeter

**Technical Specification**

- 300 x 300 x 20 mm cavity for prismatic/pouch cells
- -20 to +60°C at ±0.01°C
- Heat capacity measurement
- Connections to battery cell cyclers
Voltech Multi-channel Power Analyser

Technical Specification
- 6 Wattmeter channels
- 0.02% basic accuracy
- Bandwidth 10MHz
- Sampling 5 - 40MHz
- Voltages up to 2000Vpk
- Currents up to 30Apk (to 1000A rms to 1kHz)
Subjective Evaluation Room

**Capability**

The Evaluation Room at WMG was built by IAC (Industrial Acoustics Company Ltd.)

Subjective evaluations are carried out to capture emotional responses to new products and environments for the purpose of enhancing sound quality and physical environment experiences.

**Technical Specification**

The main items of equipment in the room include:

- air-conditioning
- user programmable, high-frequency, dimmable fluorescent lights
- custom designed jury table & 6 fully-adjustable chairs
- experimenter’s table and chair
- ultra-quiet LCD projector & screen
- ducting for cables
- high quality D/A converter
- 8 very high quality, comfortable, electrostatic, open headphones and amplifiers
- loudspeakers and stands
- 8 juror button boxes and hub system
- mains extension leads, telephone
GTec Multi-Channel Biosignal Amplifier

GTec g.Hlamp 64 channel biosignal amplifier for invasive and non-invasive measurements of bio-electrical activity, i.e. in the brain (electroencephalogram; electrocorticography), heart (electrocardiogram), muscle (electromyography) etc.

All channels can be analysed in real-time using a high speed processing toolbox for MATLAB/Simulink. g.Hlamp is powered by a medical mains power supply or by a battery pack and the system is connected to the computer via USB.

**Technical Specification**

- **Sensitivity** <60nV (LSB), ±250mV
- **Amplifier type** Real DC coupled
- **64xADC** 24 bit (38.4 kHz internal sampling per channel)
- **Input channels** 64 monopolar/32 bipolar (software selectable)
- **Input impedance** >100MΩn
DMG – DMU 60 MonoBLOCK 5 Axis Milling Machining Centre

The DMU monoBLOCK® machines have a fast and dynamic NC-swivel milling head, functioning as a B-axis with a large swivel range even for negative angles up to 30°, as well as a fast NC rotary table.

**Technical Specification**

- X-/ Y-/ Z-axis 730/630)/560/560 mm
- Speed range up to 12,000 rpm
- Rapid traverse and feed rate X/Y/Z 30 m/min
- NC-rotary table, clamping area Ø 600 mm
- Max. load 500kg
- Control and 3D-software: Heidenhain iTNC 530, Heidenhain MillPlus iT V600, Siemens 840D solutionline
DMG – DMU 65 monoBLOCK 5 Axis Milling Machining Centre

The highly dynamic DMU 65 monoBLOCK® combines all of the stability benefits of the monoBLOCK® construction with the advantages of a fast swivel rotary table, and is the most compact machine in its class with a 7.5 m² footprint. Equipped with an optimal and accessible large working area, flexible expansion stages, 3- to 5-axis machines and roughing and finishing operations.

**Technical Specification**

- Motor spindle with 18,000 rpm
- X-/ Y-/ Z-axis 650 / 650 / 560 mm
- Speed range up to 10,000 rpm
- Rapid traverse X / Y / Z 40 m/min
- Fixed table 1,000 × 650 mm
- Max load 1,000 kg
- Siemens 840D solutionline and Heidenhain Itnc 530 operation control

**Features**

- Modular construction kit for all applications ranging from 3-axis to 5-axis simultaneous machining
- Work pieces up to ø 840 mm and 1,000 kg with 5-axis machining (3-axis: 1,800 kg)
DMG – DMC 1035 V Ecoline 3-axis Machining Centre

The C-Frame design offers best conditions and allows large travels at small space requirement.

Technical Specification

- Motor SK40 Spindle 8,000rpm
- DMG SLIMline® Panel with SIEMENS 840D solutionline with ShopMill
- Traverse path X-axis 1,035 mm
- Traverse path Y-axis 560 mm
- Traverse path Z-axis 510 mm
- Rapid traverse 30 m/min
- Number of tools 20
- Table size with T-slots mm 1,200 x 560
- CO₂ injection at the tool tip for cryogenic machining capability
Zwick ±250kN Fatigue Facility

- Servo-hydraulic fatigue machine
- 250kN, 100mm travel

**Standard Equipment**
- Large ~85mm wide grips
- Small 60mm wide grips (±100kN)
- Temperature chamber, -60°C to +200°C, with 100kN grips

**Non-standard Equipment**
- Large variable 3-point bend fixture (up to ~500mm span)
- Crush test platens

This equipment was part funded by the European Regional Development Fund and may, therefore, have restrictions on its usage.
2 x Instron ±25kN Fatigue Frames

- 2 x 8872 servo-hydraulic machines
- 25kN, ±50mm travel

**Standard Equipment**

- Hydraulic grips, 25mm wide
- Mechanical grips, 75mm wide with offset capability
- Temperature chamber, -60°C to +600°C
- Video extensometer
Instron 5800R 100kN Test Machine

Technical Specification

• ±100kN screw-driven static test machine, ~500mm travel
• 100kN, 10kN, 1kN, 500N, 10N load cells
• 80mm, 50mm, 10mm gauge length contacting extensometers
• Temperature chamber, -60°C to +250°C
• Flexure, tensile, compression standardised fixtures
• Large 3 point/4 point bend fixtures
Instron - Very High Strain-Rate Testing Machine

Instron VHS 160/100-20 Very High Strain-rate Testing Machine

**Technical Specification**
- Controlled velocity in the range 1 mm.s⁻¹ to 20 m/s
- Strain rate testing from quasi static to 1000/s
- 100 kN frame for testing specimens (max impact force)

**VHS Features**
- Actuator velocity from 10 mm.s⁻¹ to 20 m/s to deliver strain rate range from 0.01 to 1000 s⁻¹
- Four column load frame for controlled high speed tension & compression testing
- Acceleration of complete moving grip before testing starts to minimise inertia effects (non moving mass at start of testing)
- Machine test bed with T-slots for bolt down of fixtures
- Minimum available testing daylight of 500mm x 1500mm x 800mm (D x W x H)
- Minimum actuator working stroke of 175mm with additional controlled acceleration & deceleration at each end
- Minimum dynamic load capability of 100 kN
- Minimum static load capability of 100 kN
- Closed loop control to minimum 1 m/s
- Fully instrumented data acquisition system
  - Low velocity: minimum 4 channels at minimum 5kHz at 19 bit resolution
  - High velocity: minimum 8 channels at minimum 5kHz at 12 bit resolution
- Fatigue testing capability
- Cyclic loading of minimum amplitude 4mm at minimum 10 Hz
- Automatic compensation of inertia effects on load signal
Erichsen 145/60 Test Machine

Erichsen 145/60 Test Machine

Technical Specification

- Drawing Force: Max. 600 kN
- Blank holder force: Max. 600 kN
- Blank force: Max. 700 kN
- Drawing speed: 0 – 750 mm.min

Tests

- Erichsen Deep-drawing test
- Deep-drawing test
- Bore expanding test
- FLC test with drawing punch diameter up to 100 mm
- Bulge test for a bulge diameter up to 100 mm

Special Tests

Square cupping test, determination of the forming limit curves (FLC), LDH test, bulge test, lubricant test, deep-drawing test with hot drawing equipment up to 550°C, high-speed deep-drawing test, Fukui test, Olsen, Swift, reverse drawing, precision blanking test, hardness test, tensile test.

Capability

Forming Limit Curves

Capability to test over a range of materials gauges, with strain measurement conducted using an optical measurement system. In house curve fitting process has been developed. Possible to test using either the Nakajima-type punch (Hemispherical) or Marciniak-type punch (Flat).

Cupping Test

Capabilities to test lubricants over a range of temperatures (up to 550°C on 1.5 mm thick blanks) and applied coating weights.

Provides information on maximum draw depth as well as the effect of blank holder force and punch speed on materials drawability.

Hole-expansion Test (flangeability)

Options available for both conical and flat punch hole-expansion testing. Determination of strains at failure is possible using the flat punch. Several methods are available for introduction of the initial hole, which can be characterised using optical techniques.

Bulge test (needs additional tool)

This test uses hydraulic medium to draw a blank thereby producing the forming process without any friction.
ARAMIS helps to better understand material and component behaviour and is ideally suited to monitor experiments with high temporal and local resolution.

ARAMIS is a non-contact and material independent measuring system providing, for static or dynamically loaded test objects, accurate:

- 3D surface coordinates
- 3D displacements and velocities
- Surface strain values (major and minor strain, thickness reduction)
- Strain rates

ARAMIS can be used for:

- Determination of material properties (R- and N-values, FLC, Young’s Modulus, etc...),
- Component analysis (crash tests, vibration analysis, durability studies, etc...) and verification of Finite Element Analysis (FEA)

The same system setup is used for multiple applications and can be easily integrated in existing testing environments.

CAD Data Integration

ARAMIS provides an import interface for CAD data which are used for 3D coordinate transformations and 3D shape deviation calculations.

The import interface handles following formats:

- Native: Catia v4/v5, UG, ProE
- General: IGES, STL, VDA, STEP

Real-time Data Processing

The ARAMIS software provides real-time results for multiple measurement positions from the test objects surface. These are directly transferred to testing devices, data acquisition units or processing softwares (e.g. LabView, DIAdem, MSExcel, etc.) and are used for:

- Controlling of testing devices
- Long-term tests with smallest storage requirements
- Vibration analysis
- 3D video extensometer

This equipment was part funded by the European Regional Development Fund and may, therefore, have restrictions on its usage.
ATOS IIe

The ATOS IIe provides an extremely bright light source (4500 ANSI-Lumen) which enables measurements in difficult ambient conditions.

Two 1.4 million pixel cameras deliver 3D coordinates even on dark surfaces in rough environments.

The integrated controller reduces the overall number of components and provides a streamlined measuring device.

**System Configurations**

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<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tr>
<td>Measured Points</td>
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<td>Positioning Pointers</td>
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<td>Sensor Dimensions (mm³)</td>
<td>490 x 300 x 170</td>
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<tr>
<td>Sensor Weight (kg)</td>
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</tr>
</tbody>
</table>
GOM ARGUS Optical Forming Analysis

ARGUS is used to optimise sheet metal forming processes when considering the right material choice and tool optimisation, particularly in the automotive industry.

The optical 3D forming analysis system ARGUS supports such optimisation processes with precise results of the forming distribution of components.

The results from the ARGUS system provide full-field information about:
- 3D coordinates of the component's surface
- Form change (major and minor strain)
- Thickness reduction
- Forming Limit Diagram (FLD)

ARGUS can be used for:
- Detection of critical deformation areas
- Solving complex forming problems
- Optimization of forming processes
- Verification of tools
- Verification and optimization of numerical simulations

Verification of FE Simulations
As part of complex process chains, optical measuring systems have become important tools in industrial sheet metal forming processes in the last years. Together with the numerical simulation of forming they have significant potential for quality improvement and optimization of development time for products and production.

- ARGUS strongly supports the verification of FE-simulations.
- The import of FE result datasets allows to perform numerical full-field comparisons to FE simulations for sheet metal parts.

CAD Data Integration
ARGUS provides an import interface for CAD data which are used for 3D coordinate transformations and 3D shape deviation calculations.

The import interface handles following formats:
- Native: Catia v4/v5, UG, ProE
- General: IGES, STL, VDA, STEP
Volatile Organic Compound (VOC) Emissions Testing and Analysis

Our broad range of analytical equipment allows materials and components to be stress tested for micro-structural defects which is essential for product development and quality control.

VIAQ 1m³ Test Chamber – VDA 276 compliant

Markes Microchamber Thermal Extractor (uCTE)

**Micro-chamber Benefits:**
- Can collect air samples from up to 6 material samples simultaneously
- Highly repeatable and controllable
- Can carry out sampling from ambient to 120°C
- Need only small quantities of sample material (~40mm discs)
- Rapid sample turnaround (based on 30mins sampling time)

Markes International –

Thermal Desorber for Gas Chromatography - ULTRATD

Shimadzu - Gas Chromatograph - Mass Spectrometer – GCMS QP2010S
Metallographic Preparation Facilities

The WMG is home to the **Buehler Centre of Excellence** boasting state of the art metallographic preparation facilities.

**Facilities**
Our facilities include but are not limited too:-
- Numerous high precision sectioning facilities
- Cold, hot, conductive mounting facilities
- Grinding, polishing and vibro-polishing equipment

**Description**
Using these facilities diverse materials can be prepared for microscopy. Our in house expertise allows for the preparation of even the most difficult materials for microscopy.

**Capability**
These facilities have been used to prepare a multitude of materials including magnesium, MMCs, CMCs and organic materials.
Carl Zeiss Scanning Electron Microscope

Carl Zeiss Gemini SEM

**Technical Specification**

Large chamber Carl Zeiss Sigma Field Emission Gun – Scanning Electron Microscope (FEG-SEM) with EDAX X-ray Energy Dispersive Spectroscopy (X-EDS) and Electron Backscatter Diffraction (EBSD) analysis facility.

**Description**

The FEG-SEM is able to conduct microscopy up to the nano-scale level on materials. Using this in conjunction with the EDAX facilities allows us to perform detailed chemical and orientation analysis. Together these provide a powerful tool to analyse the structure of a range of materials including metals, metal matrix composites, ceramic, plastics and organic materials.

**Capability**

These facilities can be used to:-

- Determine the composition, quality and contamination of materials
- Investigate materials failures, microstructural & orientation evolution during thermo-mechanical processing and the structure of MMCs.
- Inspect weld joints, bonded surfaces and degree of texture.
QUV se Accelerated Weathering Tester

Functions
In just a few days or weeks, the QUV can reproduce damage that may occur over months or even years outdoors.

Ultraviolet Light
Ultraviolet light causes almost all the photodegradation to materials exposed outdoors. The QUV tester reproduces only the UV portion of the spectrum. The UVA-340 lamp is the best available simulation of short-wave sunlight. It is especially useful for comparing the performance of different types of polymers and stabilizers.

Moisture Simulation
Products outdoors can be exposed to moisture, in the form of dew, for up to 15 hours per day. It provide a rigorous, yet highly realistic, moisture exposure with cycles of hot condensing humidity. A QUV/spray can simulate the effects of rain, such as thermal shock and erosion.

Capabilities and Technical Specification
Programmable Microprocessor; Automatic Fault Recognition and Alarms; Automatic Shut-down Timer.

UV Exposure

Condensation

Irradiance Control

ISO Calibrations

Temperature Ranges:
- Light Cycle Temp. 45°C – 80°C
- Condensation Cycle Temp. 40°C – 60°C

Specimen Capacity: 48 Specimens (75 x 150 mm)

Size: 137 x 53 x 135 cm (54” x 21” x 53” H)

Weight: 136 kg (300 lbs)
Zeiss Optical Microscope

**Technical Specification**
- 5x, 10x, 20x, 50x, 100x magnification
- Bright-field/dark-field illumination
- Automated stage control with integrated software:
  - Automated image stitching
  - Extended focus capability (Z-stack)

**Programmable Image Post-processing**
- Phase boundary recognition
- Measurements

This equipment was part funded by the European Regional Development Fund and may, therefore, have restrictions on its usage.
Photron High-Speed Digital Camera

Photron Fastcam 1024 PCI Monochrome High-speed Camera

Tower PC with 8GB dedicated memory and integrated data acquisition board for recording correlating event data. Nikon F-mount, with 50mm macro lens.

**Technical Specification**
- 1,000 fps at 1,024 x 1,024 pixels
- 3,000 fps at 512 x 512 pixels
- 27,000 fps at 128 x 128 pixels
- 109,500 fps at reduced resolution
- 6.4 seconds at 1,000 fps full resolution
Triton Tritec Dynamic Mechanical Thermal Analyser

**Dynamic Mechanical Thermal Analyser**
- Analyses of polymers, composites and adhesives
- Establishes processing and performance temperature window
- Phase transitions etc.

**Capabilities**
- -190°C to +400°C
- 0.1Hz to 600Hz
- Flexure, compression, shear and tension
- Humidity and water bath
The WMG X-ray machine is a multi-purpose research diffractometer. A range of specimens are possible including powders and solid objects.

**Applications include**

- Phase analysis
- Volume fraction determination
- Crystal structure evaluation
- Residual stress analysis
- Polymer and metallic systems

Line focus and point focus optics are possible. A spinner is available for small samples.
Instron Spring Assisted, Instrumented Drop Tower

A maximum of 10kJ of impact energy is delivered from 2 springs with the impactor then moving in free fall (depending on fixture and specimen heights to about 1m).

The impact mass is 67.4kg and additional weights can be bolted onto the impactor to increase its mass up to a total of 156 kg (without fixtures). The maximum impact energy is between 10.5 and 11.5 kJ.

**Technical Specification**

- **Maximum Velocity**: 12 – 17 m/s
- **Simulated Drop Height**: 7.4 - 14.8 m
- **Machine Dimensions**: 1.5 x 1.5 x 4 m
- **Crush Fixtures for Columns / Cones**
- **High Speed Systems for DAQ and Video**

**Benefits**

- Impact testing of small and large structures under laboratory controlled conditions to evaluate new materials and joining technologies for crash safety related transport applications
- Validation of material, joint and simulation models
- High impact velocities within a compact space due to spring assisted operation
- Low operational costs (experiment set-up, instrumentation, testing and high speed video can be conducted by just one operator, reusable buffers, automated pick-up of impact mass)
- Fully instrumented system with special load cell for high velocity impact, high accuracy of velocity prediction and high repeatability.

This equipment was part funded by the European Regional Development Fund and may, therefore, have restrictions on its usage.
Twin-Column Large-Volume CMM

Features and Benefits of the Technology

Highly accurate product/component inspection – accuracies of up to 40µm and the ability to compare directly to the original CAD data.

Versatile scanning technologies – capable of measuring the smallest fixings up to a whole vehicle, with either high accuracy or portable systems.

Reverse engineering – ability to generate a digital CAD or surface model from the scan data collected through the use of appropriate software.

Horizontal Scanning Arm Specifications

- Nikon Metrology LK H Premium Horizontal Arm CMM
- Granite table and X guideway
- Ceramic Y and Z guideways
- High efficiency air bearings
- Zero hysteresis friction drives
- Renishaw scales (0.5µm)
- Probe system:
  - Digital touch trigger probe
  - Peck or continuous scanning
  - Stylus and/or probe changer
- Volume Range: 4000 x 1200 x 1000mm to 10000 x 1600 x 2500mm
- Volumetric Accuracy: 8.0+L/250
- Repeatability: 4.5µm
- Velocity: 32 m/min
- Acceleration: 4000 m/min²
- Environment: 20°C +/- 2°C

Scanning Head Specifications

- Nikon Metrology XC65D Digital Cross Scanner
- Multi-stripe laser technology observes part from 3 directions
- Point-per-point laser intensity adaptation
- Scan Speed:
  - Cross Scanner mode: 3 x 25,000pts/s
  - Line scanner mode: 1 x 75,000pts/s
    - 75 lines/s
- Width of View: 3x65mm (3x2.56”)
- Depth of View: 3x65mm (3x2.56”)
- Stand Off Distance (approx.): 75mm (2.95”)
- Accuracy: 15 µm (0.0006”)
- Dimensions: 155x86x142mm (6.1x3.4x5.6”)
- Weight (approx.): 440g (0.97lbs)
- CMM Mounting: Renishaw PH10M(Q)
- Motorized indexing: Probe head with Multiwire
- Laser Class: 2M (visible)

This equipment was part funded by the European Regional Development Fund and may, therefore, have restrictions on its usage.
3D Computer Tomography Scanning

Technical Specifications

- Nikon Metrology Large Cabinet XT H 320 LC Industrial X-ray and CT System
- Micro-focus 225kV X-ray or 320kV source
- Precision 5-axis manipulator can hold samples in excess of 50kg with dimensions of 0.6m (H) x 0.3m (D)
- Radiation shielding is better than 1µSv/hour external
- Fail-safe switches/relays ensure safe operation

Benefits of the Technology

- High resolution – up to 5µm to produce micro detailed 3D representation of objects including porosity
- Versatility – output in a wide range of digital formats including dimensional analysis, fly through video files, rapid prototyping and CAD
- Micro CT scanning enables the high resolution capture of the complete 3D volume of an object.
- This technology is used for the non-destructive measurement of objects and the dimensional inspection of its internal features.
- The system projects a number of X-ray images through an object using a source of up to 320KV and reconstructs a 3D model composed of voxels.
- The system is designed to scan objects within a working volume of 250 x 250 x 600mm at a resolution from 5-120µm.
- Output can be processed as a series of DICOM images or in an STL format used for rapid prototyping and reverse engineering applications.

This equipment was part funded by the European Regional Development Fund and may, therefore, have restrictions on its usage.
Holovis 4K Resolution 3D Rear Projection Wall, with real-time head tracking capability

One of the core technologies within the Product Evaluation Technology centre is a 4K resolution 3D visualisation wall developed by HoloVis International. This facility consists of the latest 10 MegaPixel digital projectors which combine to create the highest resolution system in the UK. Utilising Autodesk Showcase software, the level of photorealism produced allows companies to make effective design decisions early in the product development process. The facility also includes active head and hand tracking for real time interactive Virtual Reality.

Technical Specification

PC workstations run the major CAD software packages, including a full suite of Autodesk software, CT scan to FE mesh software (Simpleware) and point cloud/mesh to surface and/or solid model software (Geomagic and Rapidform).
This equipment is capable of measuring force/torque versus displacement characteristics of conventional push switches and rotary controls.
Controlled Lighting Audit Bay for colour harmony and perceived quality evaluations

**Technical Specification**

- 6m x 3m bed-plate on which object for evaluation can be stably located
- Height adjustable lighting rig comprising 25 X-Rite Spectralight III luminaires, giving a controlled, even light coverage over typical vehicles
- Range of controlled light sources including D65 Daylight, TL84 fluorescent, Cool White fluorescent, Horizon (2300K) incandescent and additional UV which can be combined with the other sources available.
- Illuminance values of approximately 2500 lux can be achieved on the roof surface of an average vehicle with the lights at 3m from floor level
- Temperature controlled, secure environment (swipe card access)
Automated Fusion Welding/Brazing

ABB IRB2400 Robot equipped with 2 axis external axis equipped with either:

- CMT/MIG equipment with 270 Amps output with synergic capability for steel brazing/welding, aluminium welding and aluminium to steel joining. Cladding capability.
- Plasma equipment with 300 Amps output for steel welding/brazing and aluminium welding, with integrated wirefeed.
Automated Resistance Spot Welding

Comau Robot equipped with ARO servo-controlled spot welding gun with force capacity up to 8kN and current capacity up to 53kA. Using a Matuschek welding controller this system is capable of adaptive welding of steel and is currently under development to prove the adaptive spot welding of aluminium.
Comau Smartlaser with 4kW Fibre Laser Source

**Concept**
The combination of high power laser, robotic arm and scanning optics enables multiple welds to be placed around a sheet metal assembly in a reduced time.

- Cycle time savings achieved by the reduction of non-productive time between each individual laser weld
- Cycle time savings up to 75% achievable when compared to similar Resistance Spot Welding (RSW) applications
- Typically used for automotive bolt-on assemblies such as side doors, seat backs, chassis members, etc.

**Technical Specification**
- Fully integrated robotic arm and beam scanning optics
- 4kW IPG Ytterbium Fibre laser source delivered via a 200µm fibre
- Focused spot size ~ 0.7mm
- Output wavelength ~ 1040nm
- Beam repositioning times down to 0.1s
- Weld speeds up to 20m/min
- Stand-off distance – 800mm-1200mm
Laser Beam Measurement and Analysis System

Primes Beam Power Measurement and Focus Monitor

Concept
The beam measurement system analyses the laser beam and presents the user with information on:

- Energy distribution through the beam
- Focused spot size
- Rayleigh length
- Divergence
- Beam mode
- Beam stability

The data gathered can then be used for thorough analysis of the laser beam, and its delivery optics.

Suitable for high-power laser sources
- CO₂
- Nd:YAG, Disk, Fibre

This equipment was part funded by the European Regional Development Fund and may, therefore, have restrictions on its usage.
500 Tonne Press/Extrusion Facility

A 500 tonne industrial press capable of either extrusion or forming operations.

The press is an ideal tool for extrusion alloy development as it offers control of ram speed and discard parameters with load cell and displacement information. Exit temperature is instrumented via a laser pyrometer.

In forming mode, the press offers a large tool area and the possibility of high speed operation via an accumulator facility. There is an associated furnace which extends the capability to hot/warm forming or large component heat treatment. Several standard tools are available.

- Two operation modes – extrusion or forming
- Rapid press forming possible via accumulators
  - 100 mm.s⁻¹ over 125 mm
- Associated furnace capability
  - up to 1200 °C
  - internal volume 1000 × 1300 × 500 mm
100 Tonne Industrial Rolling Mill

The WMG rolling mill is capable of forming metal sheets up to 30cm in width.

- Roll diameter: 254 mm
- Roll face: 305 mm
- Roll speed: 0 to 23 m.min-1
- Max Roll bite: 45 mm (normal use), 65 mm (with jack extension)
- Roll separating force
  - 1000 kN @ 8 m.min-1
  - 800 kN @ 23 m.min-1
Dassett Press For Thermoplastic Composites

**Capability**
- 950kN (100t) vertical clamp compression moulding hydraulic press
- Approximate usable platen size: 700mm x 1000mm
- Min/max daylight: 400mm/750mm
- Rapid closing speed for thermoplastic compression moulding
- Fully controllable closing speed/force
- Oil heaters for mould heating
Engel Injection Moulding Machine
e-victory 740/140

**Capability**
Hydraulic injection moulding machine for processing thermoplastic. The injection unit has a high resolution measuring system and is highly energy efficient. The choice of diameter, geometry and material allows a perfect combination for specific processing conditions.

**Technical Specification**
- Clamp unit - elimination of tiebars offers a significant increase in the usable platen area as well as decreasing mould change and part removal time.
- Barrel and Screw Assembly - A variety of choices of diameter, materials and geometry from standard selections allow the assembly of a customised package to suit any application.
- High-precision mould parallelism - the tie-bar-less clamping unit automatically adjusts to mould parallelism
- Supports heavy moulds - the additional guide shoes support the moving mould halve, mould weight can be increased virtually without limit
- Supports large mould dimensions - the clamping units offer greater freedom for the mould
- Energy Efficiency Hydraulic System: with low noise level, closed-loop controlled pre-heating and cooling, filtration with low wear of oil, closed-loop control of all machine motions.
Engel Injection Moulding Machine
e-victory 310/60

Capability
The electrical injection moulding machine for processing thermoplastic. The injection unit has a high resolution measuring system and is highly energy efficient. The choice of diameter, geometry and material allows a perfect combination for specific processing conditions.

Technical Specification
- Clamp unit - elimination of tiebars offers a significant increase in the usable platen area as well as decreasing mould change and part removal time.
- Barrel and Screw Assembly - A variety of choices of diameter, materials and geometry from standard selections allow the assembly of a customised package to suit any application.
- High-precision mould parallelism - the tie-bar-less clamping unit automatically adjusts to mould parallelism.
- Supports heavy moulds - the additional guide shoes support the moving mould halve, mould weight can be increased virtually without limit.
- Supports large mould dimensions - the clamping units offer greater freedom for the mould.
- Energy Efficiency Hydraulic System: with low noise level, closed-loop controlled pre-heating and cooling, filtration with low wear of oil, closed-loop control of all machine motions. Power unit ECODRIVE with excellent energy efficiency by high dynamic servo pump and very little cooling water consumption.
Uses

- Melting, Conveying, Compressing, Compounding
- Simulation of production processes like blown film, wire coating, profile extrusion
- Testing individual and combined influences of additives (stabilisers, lubricant) and functional additives (anti-oxidation, UV-stabilisers, pigments and fillers)
- Investigating the extrudability of newly developed materials
- Manufacturing films, sheets strands and profiles for optical, mechanical and weathering tests
- Measuring rheological behaviour (dynamic viscosity)
- Compounding & blending of polymers, fillers and additives
- Dispersion and exfoliation of nano-fillers in a polymer matrix
- Small scale production

Features

The HAAKE PolyLab QC is a measuring mixer & extruder system. The modular torque rheometer can be connected to an interchangeable mixer, single-screw extruder, or conical twin-screw extruder. Combining proven technology and state-of-the-art hardware and software with an easy-to-use interface.
HAAKE MARS Rotational Rheometer

Technical Specification

- Temperature Range: -150°C to +600°C
- Torque Range: 0.01 µNm (optional 0.003 µNm in oscillation) to 200 µNm
- Speed Range CS: 10-7 rpm to 1500 rpm
- Speed Range CR: 10-8 rpm to 1500 rpm (4500 rpm optional)
- Frequency Range: 10-6 to 100Hz
- Multiwave: 0.01 to 20Hz
- Normal Force: 50 to 50N
- Angular Resolution: 12 nano rad
- Dimensions (L x W x H): 24 x 24 x 35 in. (60 x 60 x 89cm)

Key Features

- Temperature modules with enhanced temperature control accuracy and expanded temperature module range for applications like starch and polymers
- Comprehensive accessory range to meet individual measuring needs like simultaneous measurements of rheology and optical properties, new measuring geometries
- Improved low-torque performance for sensitive samples
- Investment protection with compatibility for predecessor accessories
Xtrutech Twin Screw Extruder

Xtrutech Twin Screw Extruder XTS19

Twin screw compounding extruder for producing pellets or filaments from a range of polymers, fillers and additives.

**Capability**

Twin Screw Compounding Extruder, water bath, air knife and pelletizer unit.

- Twin 19mm screws, co-rotating
- Clamshell barrel for easy stripdown and cleaning
- Full PLC control of 8 temperature zones
- Volumetric feeder with agitator unit, twin Archimedean screws
- Max throughput 10kg/hour
- Min material required 500g
- Max temperature 450°C
- Capable of processing most engineering polymers including PEEK (Polyether-ether-ketone)

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Automation Systems Demonstrator

The Automation Systems Demonstrator (ASD) is a twelve-station automation system. It features a wide range of technology from leading vendors in its engineering, control and monitoring systems.

**Basic specification**
The facility is approximately 16m by 5m and consists of a twelve-station machining and assembly system. It features sub-systems from leading automation suppliers and controls vendors including ABB, Schneider Electric, Rockwell Automation, Atlas Copco and Rexroth Bosch. The system features an Industrial Ethernet based distributed control architecture, RF tag-based part tracking, lightguard entry together with access gate and safety scanner systems.

**Capability**
The system is a research platform and demonstrator for automation systems engineering and lifecycle support including advanced 3D simulation, virtual engineering, virtual commissioning and remote monitoring. It also supports advanced training related to key aspects of automation systems including drive systems, programmable logic controls (PLCs), sensing methods, industrial Ethernet and fieldbus systems, fluid power, fault diagnostics, safety protocols and safeguards, robotics, human machine interfaces, and process data collection and analysis.
Automation Training System

Four Festo didactic mechatronic system with Siemens PLC control and electric and pneumatic actuators, and associated engineering tools.

**Basic specification**
- Four Festo mechatronic systems composed of part feeding, conveying, indexing, drilling, testing and gantry actuators and sensors.
- Each of the four automation training systems is controlled by a Siemens S7-1200 or 300 series PLC with associated programming software for the IEC61131-3 languages, i.e., sequential function charts, ladder logic, function blocks, and structured text.
- Engineering software to support process planning, virtual engineering, and virtual commissioning.

**Capability**
- Group training on PLC hardware and programming, sensing and actuation, structure programming of PLCs, integrated diagnostics, HMI systems.
- R&D and group training related to the 3D simulation, virtual engineering, virtual commissioning and remote monitoring of automation systems.
Excellent transport and Road links
1 hour to London by train
Nearest airport - Birmingham International - 20 minutes
Nearest train station - Coventry

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The information contained in this brochure was correct at the time of going to print. E&OE.