

# 1 Technical Specification IM10T-30

## 1-1 System

|                             |   |
|-----------------------------|---|
| Drop height                 | Range 50mm to 3000mm<br>Resolution 1mm<br>Accuracy $\pm 2$ mm   |
| Drop mass                   | Range 8kg to 30kg<br>Increments 1.0kg<br>Accuracy $\pm 0.5\%$<br>Wide range of standard and custom interchangeable strikers   |
| Mass arrest                 | By pair of self compensating shock absorbers  |
| Mass arrest<br>SIPS option  | Secondary specimen impacts prevented by second impact prevention system<br>Rebounding impact mass detected by laser photo-switch and arrested using pneumatically activated buffers   |
| Velocity range              | 1.0m/s to 7.67m/s   |
| Velocity range<br>HV option | 1.0m/s to 20m/s   |
| High Velocity option        | Impact carriage accelerated using elastomer cord<br>Impact velocity predicted by measuring tension in cord and integrating with respect to winch displacement to calculate stored energy<br>Velocity repeatability better than 2% |
| Energy range                | 2.5J to 882 J   |
| Energy range<br>HV option   | 2.5J to 2000 J  |
| Base                        | Free standing on isolation mounts<br>T-slotted M12, with datum location<br>Width 1420mm, Depth 760mm, Thickness 100mm   |
| Tower assembly              | Manufactured from 3mm walled box section steel<br>Enclosed by panels with electro-mechanical interlocked front access door  |
| Specimen area               | Versatile specimen support chamber with internal dimensions<br>Width 1200mm, Depth 700mm, Height 5500mm   |
| Access                      | Impact resistance polycarbonate doors front and rear with electro-mechanical interlocks   |
| Drop parameter control      | Height or velocity or energy, controlled by software  |
| Gross Weight                | 3000kg approximately  |
| Overall dimensions          | Width 1420mm, Depth 760mm, Height 5500mm  |
| Control systems             | Servo controller (winch)<br>Imatek C3008 (machine interface)<br>ImpAcqt V3 control software (on PC for impact test sequencing)  |



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| Winch                       | <p>AC brushless servo motor fitted with brake, driving simplex chain via precision gearbox.</p> <p>Resolver attached to motor provides position feedback.</p> <p>Dual circuit mechanical limit switches to detect</p> <ul style="list-style-type: none"><li>(a) top of travel (fixed position)</li><li>(b) winch chain gone slack (any position)</li></ul> <p>Secondary over-run limit switches provide back-up.</p>   |
| Release                     | <p>Release of mass by rotation of hook on bottom of catcher.</p> <p>Activation of both release cylinder and interlock cylinder required for release.</p> <p>Anti-recoil brakes minimise mechanical shock for high velocity testing</p>   |
| Safety                      | <p>Safety is compliant with the European CE machinery safety directive (89/392/EEC &amp; 91/368/EEC - machinery safety EN60204-1:1992).</p> <p>Access to specimen area protected by solenoid-locked doors when the catcher or impact mass are in an unsafe position.</p> <p>Winch drive and release mechanism electrically isolated when access doors are open.</p> <p>Emergency stop function electrically isolates winch drive and release.</p> <p>All safety systems dual circuit and fail-safe.</p> <p>No unsafe release of the impact mass possible under any of the following conditions:</p> <ul style="list-style-type: none"><li>(a) failure of mains power supply</li><li>(b) failure of compressed air supply</li><li>(c) failure of control software</li></ul> |
| Instrumentation – Force     | <p>Impact force measured by Kistler force link, mounted immediately behind striker</p> <p>Dynamic rated capacity: <math>\pm 60\text{kN}</math>.</p> <p>Linearity: <math>&lt;0.5\%</math> of rated output.</p> <p>Hysteresis: <math>&lt;0.5\%</math> of rated output.</p> <p>Operating temperature range: <math>-20^{\circ}\text{C}</math> to <math>+120^{\circ}\text{C}</math>.</p> <p>Safe overload: <math>\pm 150\%</math>.</p>  |
| Signal conditioning – Force | <p>By matched charge amplifier</p> <p>Bandwidth: DC – 50KHz, <math>-3\text{dB}</math></p> <p>Range: <math>\pm 100</math> to <math>999,000\text{pC}</math></p> <p>Output voltage: <math>\pm 10\text{V}</math></p> <p>Linearity: <math>&lt;\pm 0.1\%</math></p> <p>Accuracy: <math>\pm 0.5\%</math></p> <p>Auto-zero function: automatic zero of force signal output applied as part of test cycle</p>   |
| Data acquisition – Force    | <p>Sample rate: 3,000,000 samples per second.</p> <p>Resolution: 16 bits</p> <p>Data points captured per impact: 50,000</p>  |



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|                              | Calibrated accuracy: $\pm 0.1\%$<br>Timebase accuracy: $\pm 0.01\%$<br>Triggering: from force signal, laser/photodiode detector or external trigger  |
| Data acquisition – Auxiliary | Three additional channels with the same specification, simultaneously sampled  |
| Instrumentation – Velocity   | Impact velocity measured immediately prior to impact<br>Method: time of flight of target through laser/photo-diode detector<br>Timing resolution: 25ns<br>Target dimensions accuracy $< 0.1\%$<br>Overall accuracy: $\pm 0.1\%$                    |
| Performance                  | Overall accuracy of force measurement: $\pm 0.75\%$<br>Overall accuracy of absorbed energy: $\pm 1.5\%$  |
| Supplies                     | Electricity: 230VAC $\pm 10\%$ , 16Amp, 50/60Hz $\pm 1\%$ , 1-phase, Neutral and Protective Earth.<br>Air: 0.7Mpa to 0.8Mpa clean non-lubricated air   |
| Emissions                    | Noise: site dependent<br>Vibration: site dependent<br>Dust: none<br>Radiation: none  |
| Operating environment        | Temperature: $+5\text{C}$ to $+30\text{C}$<br>Humidity: 0% to 90% non-condensing<br>Electrical immunity: to EN 50 082<br>All main electrical control systems rated at, or housed in enclosures, with protection category IP65 (to EN 60 529/10.91) |

## 1-2 Software specification

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|----------------|--|
| Platform       | PC running Microsoft Windows XP Pro / Vista<br>Minimum specification of 2GB RAM, 120GB hard drive, DVD drive, 21" flat panel display   |
| Environment    | Compatible with MS Office 2003/XP (supports export in native Excel format files, and Windows MetaFiles for graphics)   |
| Purpose        | Control of impact testing sequence and analysis of impact data   |
| Access control | Three, password protected levels:<br>(a) limited access, to perform pre-defined impact tests<br>(b) supervisor access, to control the type of test performed and the required documentation information etc<br>(c) engineering access, for sensitive configuration and calibration functions<br><br>Access is controlled by passwords. The user ID forms part of the test information that has to be entered |
| Language       | UK English, with easy to use human/machine interface   |

### Data security

All calibration and configuration information is held as data files on the hard drive of the control PC

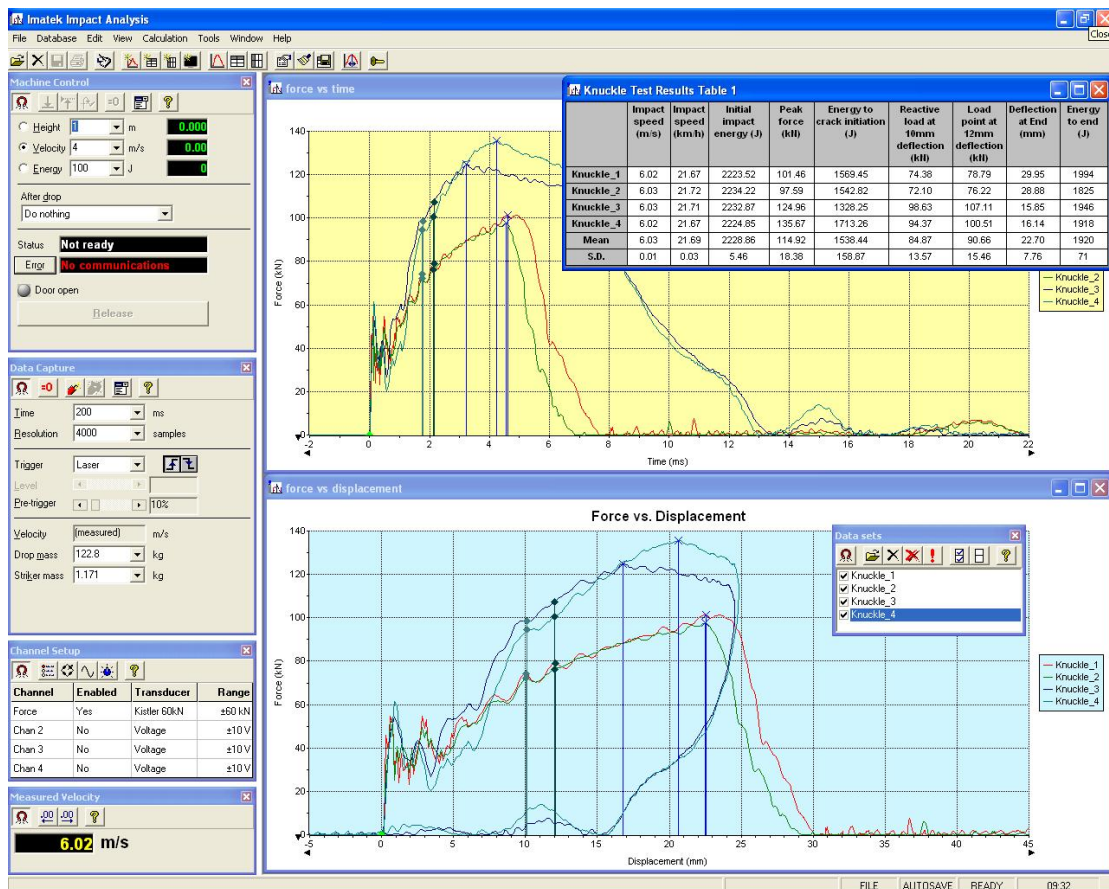
Password protection of the configuration mechanism provides protection from accidental or malicious modification

Standard operating system features provide integrity checking (CRC checksum)

### Test information

As standard, the Impactqt software allows for configuration of what information is stored with each test

## 1-3 Graphical user interface



The GUI provides both control of the impact test (drop parameters and data acquisition parameters) and analysis of the resulting data.

### Control

Impact parameter (height, velocity or energy)  
Data acquisition parameters (sample rate, sweep length)  
Impact sequence

### Indication

Machine status  
Current impact mass position (height, velocity, energy)

### Data capture

Force vs time  
Initial impact velocity



|                   |  |
|-------------------|--|
| Calculations      | Acceleration<br>Velocity<br>Displacement<br>Energy<br>User-defined curves<br>User-defined numerical results  |
| Units             | Fully configurable units for any requirements<br>Default units: SI, cgs and US   |
| Markers           | Configurable system of markers to identify specific points on curve, including: <ul style="list-style-type: none"><li>▪ start of impact</li><li>▪ yield load</li><li>▪ maximum load</li><li>▪ initiation of crack propagation</li><li>▪ end of crack propagation/test</li></ul>  |
| Data presentation | Graphs of any standard calculated or measured quantity against any other, including user-defined curves.<br>Appearance of graphs very flexible<br>Tables of numerical results and documentation information<br>Hard copy of graphs and tables<br>User-definable report layout  |
| Other features    | Test results database<br>Automatic save of test results<br>Three configurable levels of user access<br>User-configurable documentation fields<br>Frequency analysis of captured data (FFT) and very flexible filtering (Butterworth, Bessel and FFT filter types)<br>Configuration back-up restore mechanism for securing apparatus configuration and calibration information<br>Configurable screen layout<br>Export of test data to Microsoft Excel, Windows Metafile and "comma separated value" (.CSV) file. |

## 1.4 Standard options

|                     |   |
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| Standard Anvil      | Variable height anvil stack   |
| 5Kg Variable Mass   | Range 2kg to 5kg<br>Increments 0.5kg<br>Accuracy $\pm 0.5\%$                            |
| 100Kg Variable Mass | Range 50kg to 100kg<br>Increments 5.0kg<br>Accuracy $\pm 0.5\%$                         |
| Force transducer    | Options with dynamic rated capacity from $\pm 10\text{kN}$ up to $\pm 120\text{kN}$     |
| Plaque Test set     | Includes striker, anvil and clamping system<br>Complies with EN ISO6603-2 or ASTM D3763 |
| Film test kit       | Complies with EN ISO 7763 or ASTM D1709   |
| Flexible Film Test  |   |



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|---|--|
| CAI fixture                                 | Compression After Impact testing to requirements of ASTM7136 & ASTM 7137<br>Striker and support fixture as defined by ASTM D7136                                 |
| Charpy                                      | Charpy testing of standard polymer and mettalic specimens.<br>Complies with geometries of EN ISO179, ASTM E23.   |
| Izod  | Izod testing of standard polymer and mettalic specimens.<br>Complies with geometries of EN ISO180, ASTM E23.   |
| Energy absorption<br>Cushioning performance | Energy absorption testing for aluminium honeycombs, and polymeric foams to EN ISO4651 and ASTM D4168   |
| Cylinder Crush Test                         | Analysis of flow stress properties of metallic specimens. Strain rates up to 1500 <sup>s-1</sup>   |
| High Rate Tensile                           | Polymer and metallic specimens. Strain rates up to 1500 <sup>s-1</sup>   |
| Dynamic Displacement                        | Specimen deformation measured directly during impact.  |
| Temperature<br>Conditioning                 | Standalone temperature chamber for pre-conditioning of specimens.<br>Range -70°C to 200°C.<br>Internal dimensions Width 400mm, Depth 400mm, Height 400mm         |
| Additional DAQ Channels                     | Additional DAQ channels, up to 16 in total, with synchronous sampling at 5ms/s   |
| Integrated High Speed<br>Video              | Visual recording of impact event. Full control using systems software. Captured images linked to graph markers.<br>Measurements can be taken direct from images. |