

1 Technical Specification IM10R-10

1.1 System

Drop height	Range 50mm to 1000mm Resolution 1mm Accuracy ± 2 mm
Standard drop mass	Range 5kg to 30kg Increments 1.0kg Accuracy $\pm 0.5\%$ Wide range of standard and custom interchangeable strikers
Mass arrest	By pair of self compensating shock absorbers
Mass arrest SIPS option	Secondary specimen impacts prevented by second impact prevention system Rebounding impact mass detected by laser photo-switch and arrested using pneumatically activated buffers
Velocity range	1.0m/s to 4.34m/s
Velocity range HV option	1.0m/s to 10m/s
High Velocity option	Impact carriage accelerated using elastomer cord Impact velocity predicted by measuring tension in cord and integrating with respect to winch displacement to calculate stored energy Velocity repeatability better than 2%
Energy range	2.5J to 294 J
Energy range HV option	4.0J to 500 J
Base	Free standing on isolation mounts T-slotted M12, with datum location Width 1060mm, Depth 720mm, Thickness 70mm
Tower assembly	Manufactured from 3mm walled box section steel Enclosed by panels with electro-mechanical interlocked front access door
Specimen area	Versatile specimen support chamber with internal dimensions Width 400mm, Depth 600mm, Height 650mm
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	1000kg approximately
Overall dimensions	Width 1060mm, Depth 720mm, Height 4000mm
Control systems	Servo controller (winch) Imatek C3008 (machine interface) ImpAcqt V3 control software (on PC for impact test sequencing)



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">(a) top of travel (fixed position)(b) winch chain gone slack (any position) <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 & 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">(a) failure of mains power supply(b) failure of compressed air supply(c) failure of control software
Instrumentation – Force	<p>Impact force measured by Kistler force link, mounted immediately behind striker</p> <p>Dynamic rated capacity: $\pm 30\text{kN}$.</p> <p>Linearity: $<0.5\%$ of rated output.</p> <p>Hysteresis: $<0.5\%$ of rated output.</p> <p>Operating temperature range: -20°C to $+120^{\circ}\text{C}$.</p> <p>Safe overload: $\pm 150\%$.</p>
Signal conditioning – Force	<p>By matched charge amplifier</p> <p>Bandwidth: DC – 50KHz, -3dB</p> <p>Range: ± 100 to $999,000\text{pC}$</p> <p>Output voltage: $\pm 10\text{V}$</p> <p>Linearity: $<\pm 0.1\%$</p> <p>Accuracy: $\pm 0.5\%$</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>



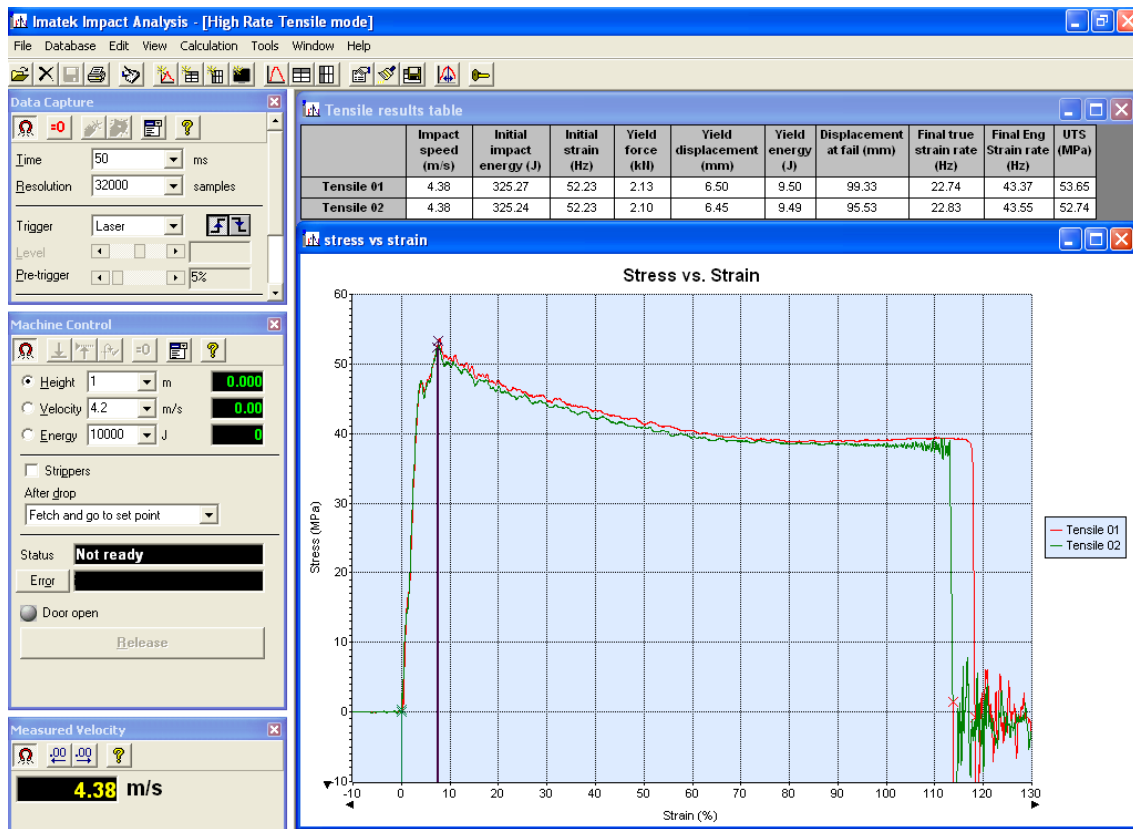
	Calibrated accuracy: $\pm 0.1\%$ Timebase accuracy: $\pm 0.01\%$ Triggering: from force signal, laser/photodiode detector or external trigger
Data acquisition – Auxiliary	Three additional channels with the same specification, simultaneously sampled
Instrumentation – Velocity	Impact velocity measured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

Platform	PC running Microsoft Windows XP Pro / Vista Minimum specification of 1GB RAM, 120GB hard drive, DVD drive, 19" 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: (a) limited access, to perform pre-defined impact tests (b) supervisor access, to control the type of test performed and the required documentation information etc (c) engineering access, for sensitive configuration and calibration functions 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 Impact 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 Velocity Displacement Energy User-defined curves User-defined numerical results
Units	Fully configurable units for any requirements Default units: SI, cgs and US
Markers	Configurable system of markers to identify specific points on curve, including: <ul style="list-style-type: none"> ▪ start of impact ▪ yield load ▪ maximum load ▪ peak compression (non penetration tests) ▪ initiation of crack propagation ▪ end of crack propagation/test
Data presentation	Graphs of any standard calculated or measured quantity against any other, including user-defined curves. Appearance of graphs very flexible Tables of numerical results and documentation information Hard copy of graphs and tables User-definable report layout
Other features	Test results database Automatic save of test results Three configurable levels of user access User-configurable documentation fields Frequency analysis of captured data (FFT) and very flexible filtering (Butterworth, Bessel and FFT filter types) Configuration back-up restore mechanism for securing apparatus configuration and calibration information Configurable screen layout Export of test data to Microsoft Excel, Windows Metafile and "comma separated value" (.CSV) file.

1-4 Standard options

Force transducer	Options with dynamic rated capacity from $\pm 10\text{kN}$ up to $\pm 60\text{kN}$
Standard Anvil	Variable height anvil stack
5Kg Variable Mass	Range 2kg to 5kg Increments 0.5kg Accuracy $\pm 0.5\%$
50Kg Variable Mass	Range 30kg to 50kg Increments 5.0kg Accuracy $\pm 1.0\%$
Plaque Test set	Includes striker, anvil and clamping system Complies with EN ISO6603-2 or ASTM D3763
Film test kit	Complies with EN ISO 7763 or ASTM D1709
Flexible Film Test	



CAI fixture	Compression After Impact testing to requirements of ASTM7136 & ASTM 7137 Striker and support fixture as defined by ASTM D7136
Charpy	Charpy testing of standard polymer and mettalic specimens. Complies with geometries of EN ISO179, ASTM E23.
Izod	Izod testing of standard polymer and mettalic specimens. Complies with geometries of EN ISO180, ASTM E23.
High Rate Tensile	Polymer and metallic specimens. Strain rates up to 1500 ^{s-1}
Dynamic Displacement	Specimen deformation measured directly during impact.
Temperature Conditioning	Standalone temperature chamber for pre-conditioning of specimens. Range -70°C to 200°C. 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 Video	Visual recording of impact event. Full control using systems software. Captured images linked to graph markers. Measurements can be taken direct from images.