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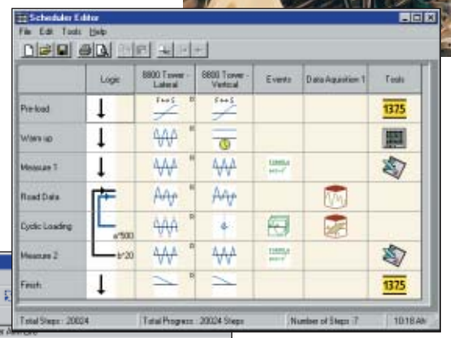
Labtronic™ 8800 Controller

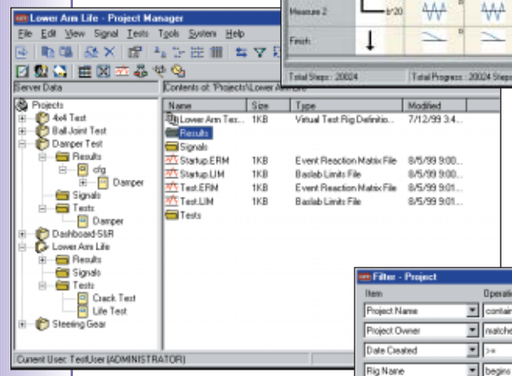
Structural test control system

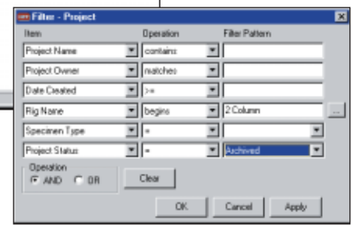
INSTRON STRUCTURAL
TESTING SYSTEMS

Unbeatable power and flexibility for simulation and component testing

The Labtronic 8800 Controller is a state-of-the-art digital controller for simulation and component tests from IST. It is fully integrated with unique PC-based Windows® applications software forming the worlds most advanced test control system.







The Labtronic family of controllers includes the Labtronic 8800 and the Labtronic 8400 controllers. The Labtronic 8800 is a multi channel controller, available as a compact tower providing up to 6 channels of control or as a 19 inch rack mounted unit providing control for up to 24 actuators. The Labtronic 8400 controller is a single axis controller. Between them the family provides solutions for a wide range of applications ranging from simple component tests to complex multi axis simulations.

The Labtronic 8800 Controller is highly flexible – you can alter your testing configuration rapidly with a minimum of lost testing time. When actuators are built into new test rigs, the configuration software will enable them to be quickly and easily assigned to the correct test group. The system has the capability to automatically recognise which hydraulic controls should be associated with which actuators. It can be used with the comprehensive RS LabSite software suite. The advanced features, which include high order control, automatic control loop optimization and automatic transducer recognition, provide a level of flexibility, power and data integrity unmatched in simulation and component testing technology.

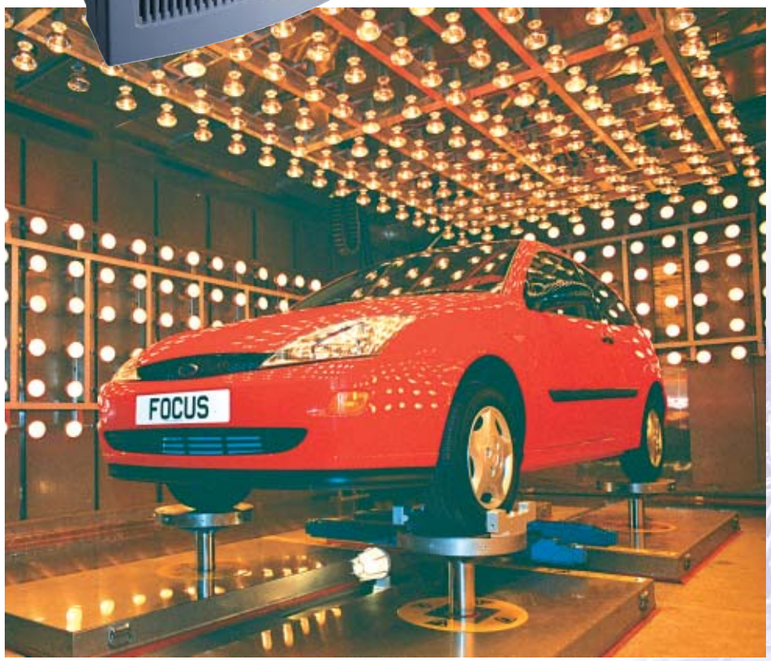
Endless options in a digital environment

Whether running a simple single axis test or complex multi axis simulation, both the tower and rack-mounted forms of the Labtronic 8800 controller use the same controller boards, command set and software user interface. Labtronic 8800's user interface, RS Console, runs under Windows® with the RS LabSite suite of application programs running alongside, all of which have the same look and feel. As a result, Labtronic 8800 is simple both to configure and reconfigure, throughout a test laboratory for single and multi axis tests and multi station tests. Furthermore, the standard firmware, hardware and user interface mean less operator training and easier servicing.

Configuring tests

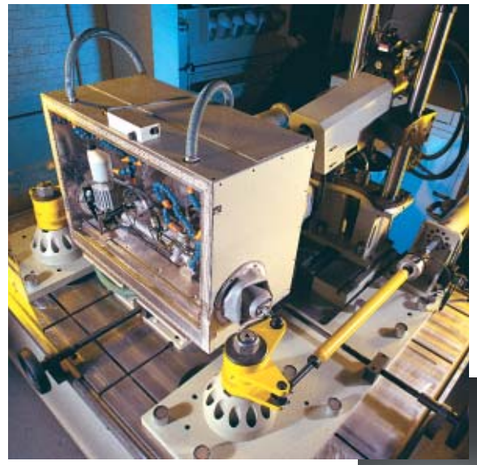
Labtronic 8800 provides an independent set of hydraulic controls for up to four separate tests. To configure a test, simply plug the appropriate cables into the connector panel. The hydraulic controls automatically sense the presence of the connections and illuminate to indicate that they are active, providing instant visibility of which manifolds or substations you have under your control. Controls are also provided for the remote operation of a hydraulic power pack.

You can join tower versions of Labtronic 8800 together using Sync-Link to provide additional channels of control. It is also possible to link controllers with Labtronic 8400 single axis controllers. The controllers can use either hardware front panels or the RS Console software, or a combination of the two.



Labtronic 8800 is easy to retrofit

You can use Labtronic 8800 to control your existing Instron and Schenck rigs. It can also be retrofitted to control servohydraulic testing systems from other manufacturers. Labtronic 8800 can replace older analog controllers even for complex, full vehicle test systems, providing all of the benefits of a digital controller. When used in place of Schenck controllers, it can be used in conjunction with existing LabSite software and Proco hardware.



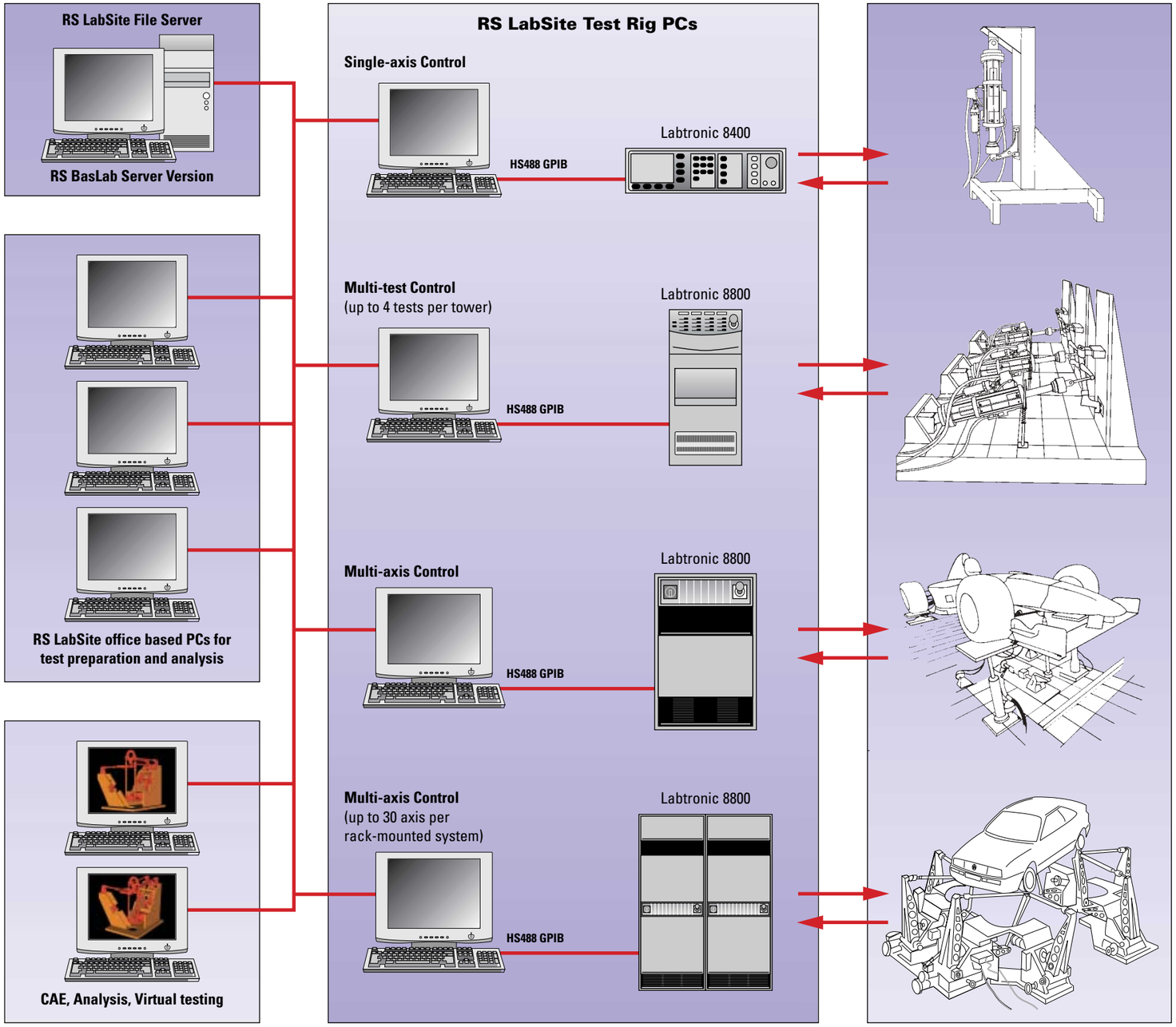
Digital repeatability

Being fully digital, Labtronic 8800 provides test control which is absolutely repeatable. In addition to digital closed loop control and downloading of test data, all of the set-up parameters associated with a test such as limit values and actions and loop shaping terms, can be stored on the test control computer. This means that every aspect of a test, including data and parameters, can be archived and recalled later so that an exact reproduction of the test can be performed at any time in the future.

Digital Laboratory integration – the path to concurrent testing

Digital test control provides you with complete mobility of your test data. Labtronic 8800's industry standard HS488® GPIB interface allows communication with computers using standard plug-in cards, creating an environment in which you can perform computer control, data acquisition and graphical display all set at the same time. By adding a local area network to the PC, data can be transferred easily to other computers. The ability to move test data freely from site to site enables you to set up a laboratory in which all of your data processing is integrated. The development of the Digitally Integrated Testing Laboratory through the server version of RS LabSite brings about dramatic improvements in efficiency and effectiveness. For example, within an establishment, test data can be shared with Computer-Aided Engineering (CAE) departments and other functions such as design and development.

Test data ranging from simple, single axis applications to complex multi-station tests can be shared via an ethernet LAN with remote computers such as office based LabSite systems, computers used fo virtual testing and other CAE systems.



Making the best use of today's technology

Labtronic 8800's design makes the best possible use of hardware, firmware and software. For example, all safety-critical functions such as hydraulic control and emergency shut-down are carried out entirely in hardware. Critical real time functions such as limits, events, PID loop, cross-compensation, data logging, amplitude control, adaptive control, filtering and cycle counting are carried out in firmware, where fast response time can be relied upon – limit actions in Labtronic 8800 firmware are applied in under one millisecond. The user interface, report writing, test definition, data display, results manipulation and on-line help functions are all controlled in software, where the benefits of the most recent developments in Windows® technology can be exploited to the full.

High performance control characteristics

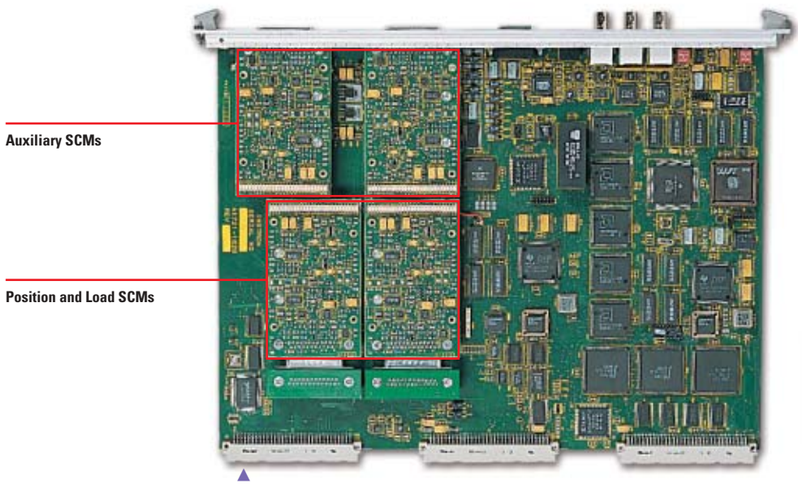
Labtronic 8800 is a fully digital closed loop controller. The main controller board, the Integrated Axis Controller (IAC) board incorporates dual DSP processors, one for loop closure and the other for signal conditioning.

Communication between the controller and a host computer for test control is carried out by means of the new HS488® high speed industry-standard GPIB interface. HS488® has been developed to increase the maximum data transfer rate of ANSI/IEEE Standard 488.1-1987 up to 8 Mbytes per second. Labtronic 8800 has the capability to handle virtually any laboratory simulation or component test.

Digital technology allows factors which degrade control performance, such as noise and drift, to be eliminated. Furthermore, digital filters are provided and these exhibit identical characteristics across all channels, a factor which is particularly important for multi-axis tests and applications where phase is critical, such as elastomeric testing.

State-of-the-art measurement technology

Each IAC incorporates up to four sensor conditioning modules (SCMs). These use state of the Digital Signal Processing (DSP) technology together with Instron's patented oversampling technique to extract data with an effective typical resolution of 19 bits at a bandwidth of 1kHz. Up to 24 bit resolution is available for displays. This means that there is no longer any necessity for signal ranging. Typically two SCMs are used to measure actuator position and load, the other two being available for auxiliary channels. The signals are used for digital loop closure and are also available as data acquisition channels directly to a host computer, providing a highly cost effective route for data acquisition. Either AC or DC transducer excitation is provided and the SCM can work with a wide range of either ratiometric devices or DC output devices.



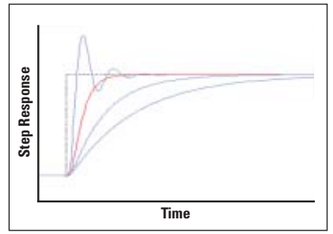
IAC Board

All frequently used channel connections are made at the front of the controller for speed and convenience.

In addition to the standard SCM, a special version is available for measurement from incremental or absolute digital encoders, providing measurement of position or velocity or both. All types of SCM are available in two forms, data acquisition and control or data acquisition only. These data acquisition SCMs are fitted to special versions of the IAC to provide a unit for up to four channels of data acquisition only. In all cases, digital filtering is available on all channels and data acquisition is simultaneous (to avoid data skew, multiplexing is not used) and all channels can be logged in true synchronisation with the actuator drive data.

Comprehensive control loop capabilities

Standard and high order control loop strategies are available. The standard Labtronic 8800 has a four-term controller which handles not only Proportional, Integral and Derivative (PID) terms, but also a Lag term. This additional term gives you the ability to optimize the control loop for a wider range of systems, particularly in the presence of resonances. The control loop is also provided with an actuator resonance compensation input.



Step responses in automatic loop shaping

Automatic loop shaping automatically sensors the control loop of the test system at a click of the mouse. It handles this in firmware, is fast, easy to use and eliminates the possible human errors or variations which can occur with manual loop shaping.

Automatic transducer recognition and calibration

With Labtronic 8800, all IST sensors can be automatically calibrated. All that you have to do is press a button. In addition, a wide range of other devices can be accommodated by the system, including strain gauges, accelerometers, LVDTs, pressure accelerometers, transducers, DC output conditioners and encoders.

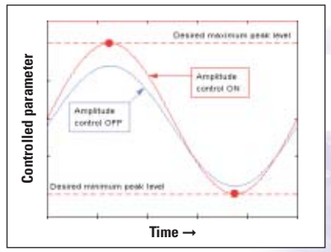
Sensors of other manufacture can be fitted with a connector to provide automatic recognition and calibration capability, or they can be calibrated manually. In addition the connector can be programmed to contain corrective sensor specific data to allow sensor calibration to be linearised.

Transducer calibration

Making the best use of today's technology

Amplitude correction techniques

The Labtronic 8800 has sophisticated on-board waveform generation capabilities. These include cyclic waveform and complex ramp waveform generation. When running with cyclic waveforms, the controller has a built-in capability to automatically modify the command signal in order to maintain the required amplitude for a particular test as the compliance of the test component changes, or to compensate for the dynamics of the control loop. Operating on the control parameter, this is a standard feature of the software.



Amplitude control maintains peaks at requested levels

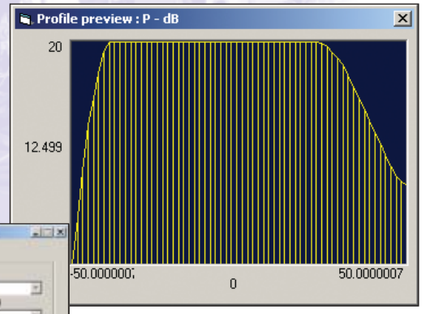
Also available through the applications software is an option for tri-modal amplitude control, whereby the waveform to be maintained can be specified either in terms of a mean level and an amplitude or in terms of a maximum and a minimum peak. In either case any control mode can be selected and the parameters used to define the waveform may be a mixture of units.

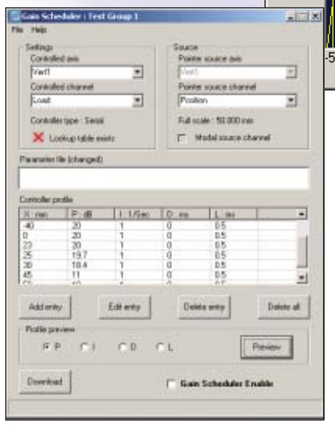
Motion isolated load control

This optional advanced feature allows actuators which are acting typically in load control to achieve high levels of control accuracy when connected to a test piece which is subject to an external motion. This is achieved by feeding forward in the control loop, information which describes the external motion in terms of acceleration and velocity.

Load protect

The Labtronic 8800 load protect feature is particularly useful for connecting the rig actuators to the test component. The actuators are moved in position control while an outer loop ensures that the actuator cannot produce a force that exceeds a pre-set level.





Gain scheduling for testing non-linear components

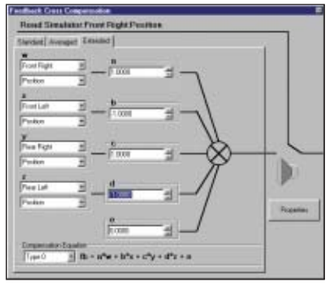
Gain scheduling

The Labtronic 8800 gain scheduling option allows the control terms for an actuator control loop to be modified in real time whilst a test is running in accordance with the measured signal from a given sensor. This is particularly useful when testing specimens which exhibit non-linear characteristics, where different gain values are appropriate for different regions of the actuator stroke.

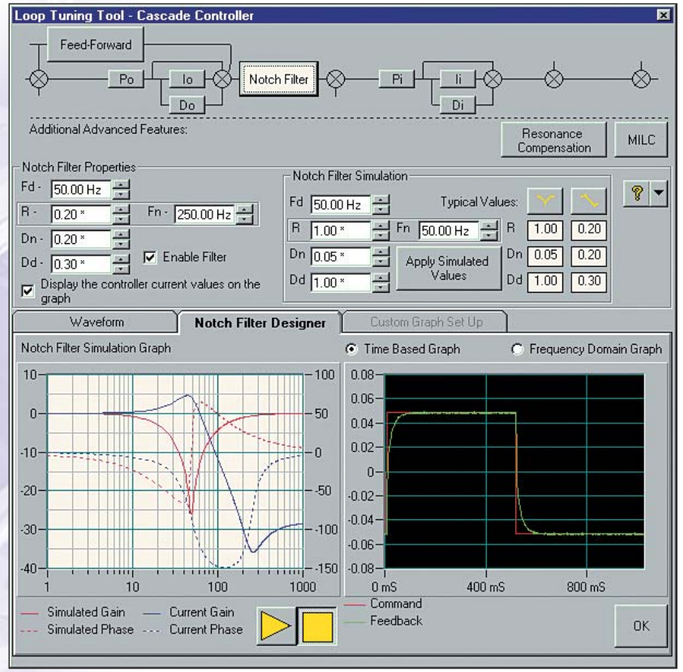
Modal control

Labtronic 8800's modal control option allows the direct control of user defined motions such as for example X, Y ,Z, pitch roll and yaw in the case of a multi axis shake table. Feedback cross-compensation allows virtual transducers to be defined from a combination of up to four real transducers. Servovalve cross compensation allows the drive for a servovalve to be compensated by the output from up to four other control channels. Both these features can be activated independently, but when they are used in combination, full modal control is achieved. As well as allowing the user direct control of deterministic command signals, modal control allows each of the virtual control loops to be independently tuned, providing increased control bandwidth.

In addition, servovalve cross compensation can be used to provide geometric compensation on a test rig by enabling the servovalve drive on one axis to be modified in sympathy with sensor information from other axes in accordance with a pre-defined compensation equation.



Feedback cross compensation for modal control



High Order Control

High order control

In addition to a conventional control loop, the Labtronic 8800 has an option to provide cascade control and a notch filter. These have the capability to achieve a much higher level of control particularly in cases where backlash or resonances are present. The inner controlled variable is (normally position), provides a robust control loop. The outer controller (normally load) contains a parallel PIDF control loop and a notch filter to compensate for system resonances. Using these techniques the control bandwidth is significantly increased and the control loop is more stable and less sensitive to changes in the dynamic behaviour of the test piece.

Optional modules

Optional modules are also available for signal conditioning and loop closure for three stage servovalves. These are available for all types of Labtronic controllers. Also available is a differential pressure compensation module to reduce the effect of oil column resonance. This is particularly effective when large masses are present.

Reliability

The reliability of the Labtronic 8800 Controller has been optimized by significantly reducing the number of cables and pin-type connectors, elements which can contribute to increased failure rates. The use of surface-mount technology rather than push-in sockets also increases overall system reliability.

Technical Specifications

General

Number of control loops per tower	1 to 6 Integrated Axis Controllers (IAC)
Number of hydraulic controls per tower	4 plus ring main hydraulic power supply
Number of IACs per tower	6
Number of signal conditioners per IAC	1 to 4
Number of control channels per IAC	1 to 4
Package style	Free standing tower or rack mount

Integrated Axis Controller (IAC)

Program storage	1 MB Flash memory. Firmware can be updated from a PC via the GPIB.
Self test	Automatic on power up
Diagnostics	Interactive diagnostics via diagnostic port

Closed Loop Control

Type	PID + Lag + external compensation input
Loop options	Serial, Parallel, Cascade
Control loop update rate	Up to 5 kHz user selectable
Auto loop shaping	Position, Load and Strain
Adaptive loop shaping	Continually updated PID terms
Adaptive loop shaping update rate	1 kHz
Servovalve dither	Variable 0 to 10 % drive 200 Hz to 500 Hz
Servovalve null	Auto-adjust
Servovalve limits	Independent settings for low/high pressure Variable ±100% of full scale
Compensation input	± 10 V differential (e.g. for Delta P etc.)

External Inputs and Outputs

Digital logic inputs	4 off, programmable
Digital logic outputs	4 off, programmable
Analog outputs	4 off ±10V scalable, selctable demand, feedback(s) error etc.
Analog inputs	1 off +10 V scalable

Signal Conditioning

Compatible transducer types	Resistive, AC and DC e.g. load cells, LVDTs, Pre-conditioned devices
Transducer recognition/calibration	Automatic and manual
Excitation frequency	5 kHz
Excitation voltage AC/DC	1 to 15.45 V RMS AC 1 to 23.35 V DC
Input sensitivity (ratiometric devices)	0.05 mV/V to 4.7 V/V
Input sensitivity (DC output devices)	± 10 V
Balance range	±100 % of full scale
Overange	±100 % of full scale
Data rate	5 kHz
Resolution	19 bits (1 kHz bandwidth)
Accuracy (reference Cal)	0.25% of reading or ±0.005% of full scale whichever is greater
Accuracy (mV/V Cal)	0.5% of reading or ±0.01% of full scale whichever is greater
Transducer linearization	Look up table, 65 interpolated points

Demand Generation

Set point	±105 % of full scale
Internal waveforms	Sine, Triangle, Square, Haversine, Havertriangle, Haversquare, Ramp, Trapezoidal
Internal waveform amplitude resolution	32 bit
Internal waveform frequency resolution	64 bit
Internal waveform maximum frequency	1 kHz
Waveform frequency accuracy	0.01 % of setting
Swept waveform generation	Frequency, amplitude, phase
Random segment generation	End points or end points with time via GPIB
Sample data playback	Via GPIB
Sample data playback rates	Fully selectable. Up to 5,000 samples per second per IAC
Sample data buffer size	48 kb per IAC
Sample data filters	6 pole digital Butterworth, Chebyshev, Bessel or user defined with a fully selectable corner frequency

Data Logging

Sampling rate	Fully selectable up to 5 kHz
Maximum data logging rate	8 channels at 5 kHz per IAC
Buffer size	160 kB per IAC
Filters	6 pole digital Butterworth, Chebyshev, Bessel or user defined with a fully selectable corner frequency

Limit Detectors

Types	Min (2 available per conditioner) Max (2 available per conditioner))
Update rate	1 kHz
Action	Programmable

Event Detectors

Types	Current, amplitude, mean, underpeak, break, count, digital, error, group GPIB trigger
Update rate	1 kHz
Action	User selctable

Peak Detectors

Types	Min, Max, Amplitude, Mean,
Update rate (all sensors)	5 kHz
Update rate (DC sensors)	5 kHz or 40 kHz user selectable

Computer Interface

Type	GPIB (IEEE HS488)
GPIB bandwidth	8 Mbyte per second
Buffer size	24 kByte to multiple buffers

Hydraulic Controls

Main ON/OFF	Can be used to control a hydraulic ring main power supply or local hydraulic power supply
OFF/PILOT/LOW/HIGH (1 to 4)	Can be used to control sub-station, shut-off manifold or hydraulic power supply
Actuator grouping	Hydraulic controls may be linked in groups to provide simultaneous switching of actuators in a multi axis test
Emergency stop	Front panel emergency stop. Remote Emergency stop line connector. Emergency stop connector available at each actuator. Configurable to meet EN 954-1 category 2 or 3.

Supply and Environmental

Supply voltage	90 - 132 V & 180 - 264 V (No adjustment required)
Supply frequency	45 to 65 Hz (No adjustment required)
Power consumption	800 VA maximum
Operating temperature range	10 to 38 °C (50 to 100 °F)
Storage temperature range	-40 to 66 °C (-40 to 151 °F)
Operating humidity range	10 to 90 % non-condensing
Storage humidity range	0 to 95% non-condensing, non-frosting

Standards

EMC – emissions	EN50081-1 (1992)
EMC – immunity	EN50082-1 (1992)
Safety	IEC204-1 (1992) / EN60204-1 (1993)

Dimensions

Tower

Height	650mm (25.6 in)
Width	280mm (11.0 in)
Depth	570mm (22.4 in)
Weight (fully populated)	32 kg (71 lbs)

Single unclad Rack mountable unit

Height	629mm (24.8 in)
Depth	433mm (17.0 in)
Width (to suit standard 19 in rack mounted equipment)	223.0 (8.8 in)
Weight (fully populated)	32kg (71 lbs)

Instron Structural Testing Systems Corporation
28700 Cabot Drive, Suite 100
Novi, MI 48377, USA

Tel: +1 248 553 4630
Toll free: +1 800 651 0924
Fax: +1 248 553 6869

Instron Structural Testing Systems GmbH
Landwehrstrasse 65
D-64293 Darmstadt
Germany

Tel: +49 6151 3917-0
Fax: +49 6151 3917-500

Instron Structural Testing Systems Limited
Coronation Road, High Wycombe
Buckinghamshire, HP12 3SY
United Kingdom

Tel: +44 1494 456789
Fax: +44 1494 456777

www.instron.com/ist

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