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# RS Console

A New Window on Test Control



INSTRON® STRUCTURAL TESTING SYSTEMS

# A New Window on Test Control

RS Console provides the computer-based front panel for the Labtronic® 8800 Controller. RS Console combines over thirty years of experience writing applications software for testing applications, with the results of customer surveys and feedback on what users need. As the new generation of test software, RS Console sets the standard for test control interfaces for the 21st century.

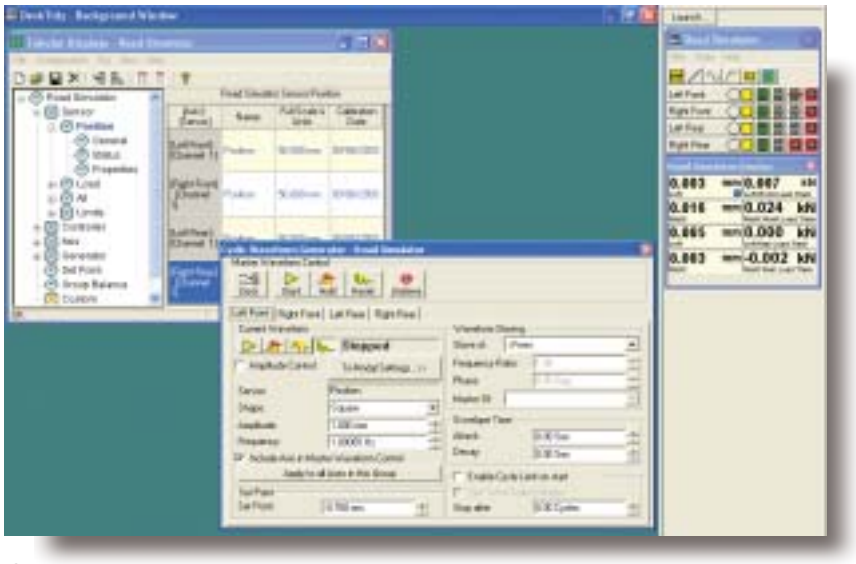
## Easy-to-Use, Natural Interface Design

By using a computer as the front panel for its Labtronic 8800 Controller, IST has reduced the burden of test set-up and control for the operator while increasing the reliability of the test system and the results it produces.

Access to all standard and advanced controller features is made through the intuitive Windows® user interface.

## Standard Interface

Thanks to a single versatile controller design for all IST test equipment, the user interface provided by RS Console for test operation is the same for all test systems whether they are simple single-axis rigs, or complex multi-axis cross-coupled systems. There is no need to train operators and service personnel to support multiple types of controllers depending on the test application.



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**Desk Tidy**

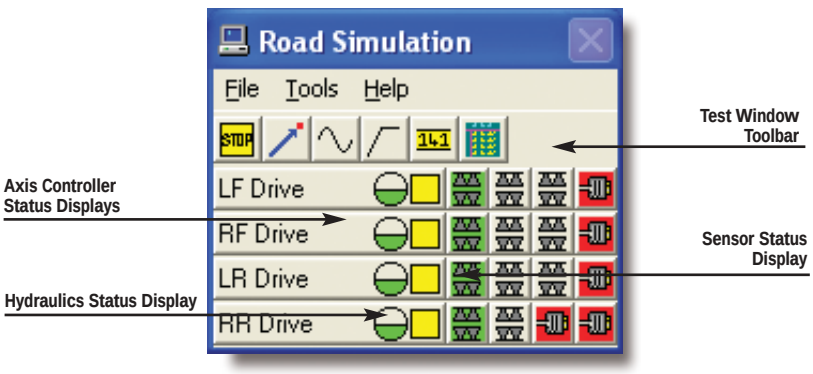
## Test Toolbar

RS Console allows multiple tests to be run from one computer. To do this, test toolbars are used in conjunction with summary views of RS Console compatible applications.
A test toolbar is opened at the side of the screen into which summary views that display only information required during the running of a test are loaded. Details can be displayed at the simple click on the mouse button, and settings changed by the user, if required. The remainder of the screen can be used as if it were the full screen, running either testing application programs in their full view or any other standard Windows application.

The Desk Tidy function allows you to display on your PC desktop the windows associated with a specific test group, while keeping most of the other windows hidden. This gives you more space on the screen for other application windows e.g. monitors such as TrendMon.

## The Front Panel

Running under the Windows operating system, the new RS Console controller front panel provides the buttons and icons that allow direct access to the controller functions. Visual feedback of the controller and status are provided at a glance, including hydraulic power status, command input, control mode, limits status, and sensor calibration status. Clicking the right mouse button on an icon or button provides access to the associated properties of the control channel or axis in a manner familiar to Windows users. Selected parameters of a particular test group can be shown within a single display table.

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**RS Console - test window: quick channel information**

## Simple Controller Configuration and Tuning

All configuration and tuning is performed through a computer interface. No electrical jumper or switch changes, cable swapping, or potentiometers adjustments are required.

## Test Configuration Save and Restore

For every test configuration, all test conditions and transducer calibrations can be saved for later use and restored by a simple mouse click.

## No External Diagnostic Equipment Required

With RS Console, all configuration and tuning tools required are emulated in the software, so the use of a digital voltmeter or oscilloscope is no longer necessary.

## Sensor Conditioning

The Labtronic® 8800 controller accepts a variety of different transducers and sensors. Sensor conditioning, adjustment of feed voltage and sensitivity are all achieved by software. This applies not only to the sensors supplying the actuator position and load signals, but also to additional sensors connected by means of Sub-D connectors.

RS Console recognizes the type of transducer on the basis of the wiring in the connector. This means that no adjustments have to be performed on the Labtronic itself. Available options are AC high signal level, DC high (external excitation), AC low, DC low (external), DC high (internal) and DC low (internal).

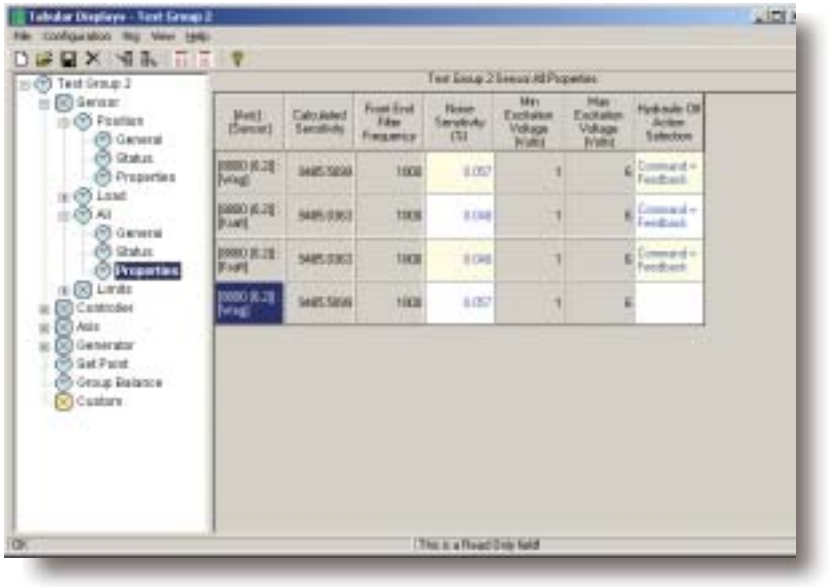
## Encoder Sensor Conditioner Module Support

Support is now provided for encoder based transducers supplying position and velocity control and feedback signals in digital form.

## Customized User Management

The User Manager is used to set up the different user rights of the testing system and provides different users with varying degrees of access to the different parts of the software.

This security module is highly flexible and the default setting can easily be adapted to fit into existing processes.



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**Tabular Display - controller properties**



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**User management**

# The Interface

## Test Configuration

Wheather you are dealing with a single-channel or a multi-channel test setup, test configuration in RS Console is done using the Configuration Manager Display. This shows the control channels available and allows the user to assign them to test groups. Just drag and drop the channel into the group that it is to be part of for assignment. Test rig and channel names can be chosen at random and changed at any time. After test configuration, all the configuration details can be written to a file so that they can be restored at a later date.

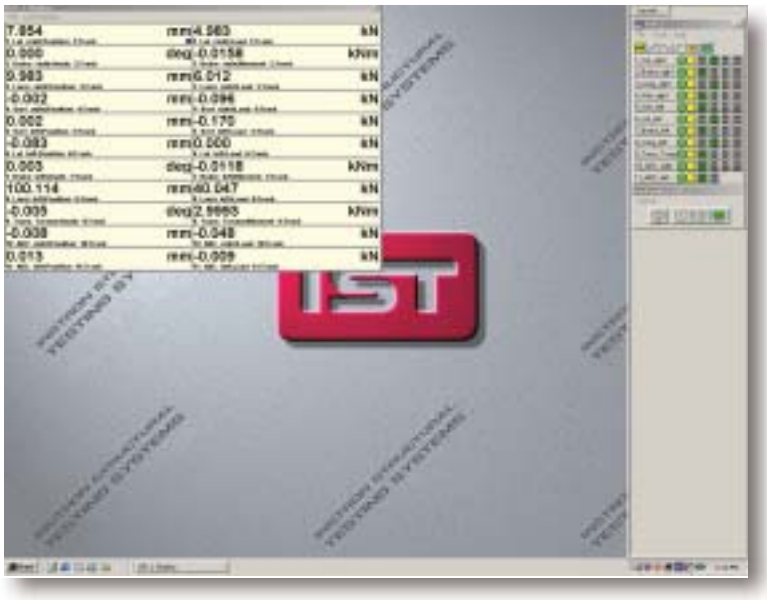
Main features of the Configuration Manager:

### Hot Configuration

Hot Configuration means that the Configuration Manager will run simultaneously with RS Console. Unused channels can be reconfigured while other test groups are still running.

### Firmware Implementation of Event and Limit Grouping

The Configuration Manager calculates the appropriate event and limit group number, informs any online devices and stores it in the registry. This number is then applied to the tower whenever a device gets online or Console is started. This means that group events do not affect devices in another test group although they are in the same physical tower.



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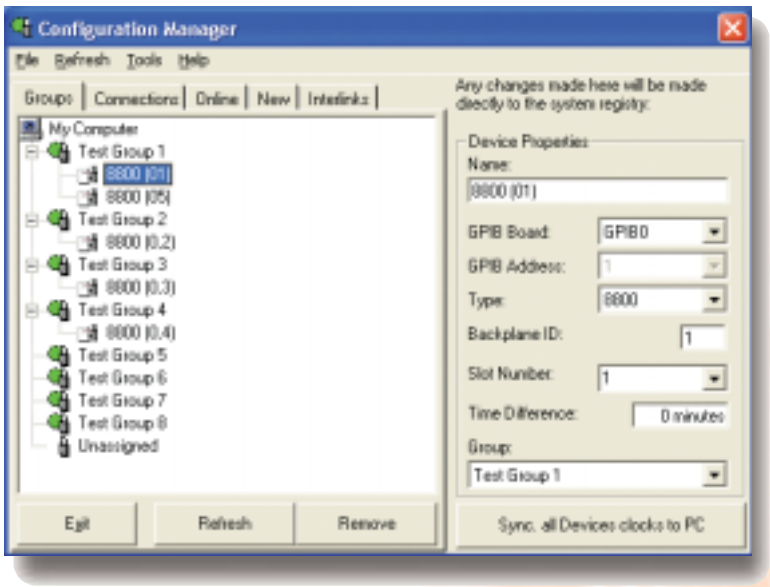
**Test control**

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**Configuration Manager**

## Calibration

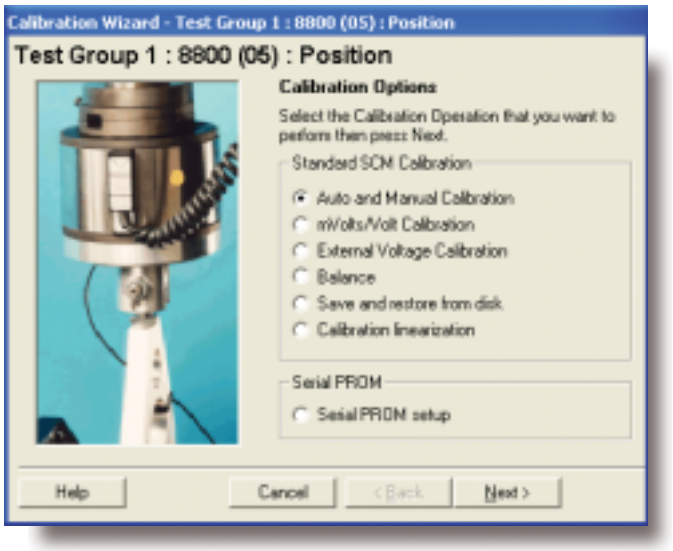
Any test is only as accurate as the calibration of the measurement transducers. ISO 9000 defines accuracy requirements and specifies requirements regarding the traceability of the calibration. RS Console fulfils these requirements, providing a highly accurate, repeatable and easy-to-use calibration method.

### Calibration Wizard

The Calibration Wizard guides the user through the calibration procedure step-by-step. At the completion of the calibration of the input data channel, all configuration details can be written to file so that the exact calibration data can be archived. Furthermore, the IST Calibration Wizard provides a standard, repeatable process which can be used as a standard procedure or work instruction in your laboratory quality documentation.

### Linearization

All data for transducer linearization is written into a look up table and can be stored either in a storage chip permanently connected to the sensor or in a file on your PC.

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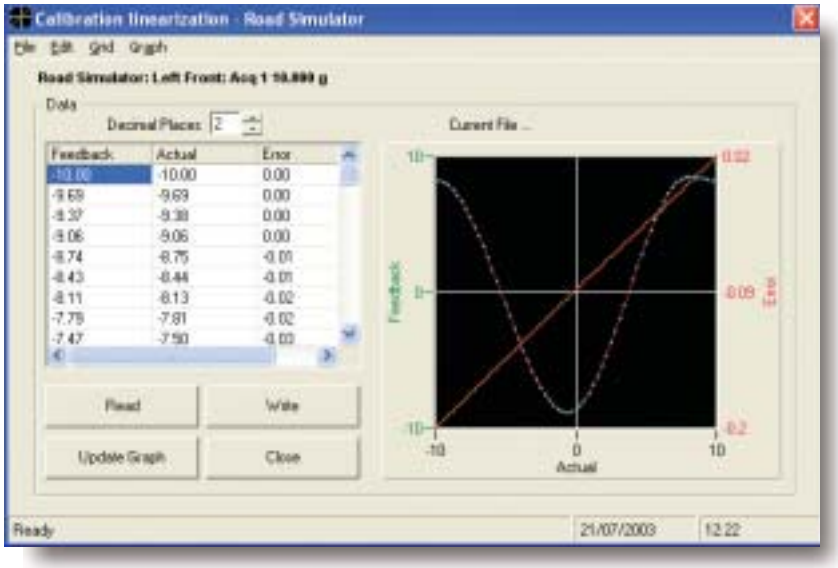
**Calibration Wizard: various calibration methods**

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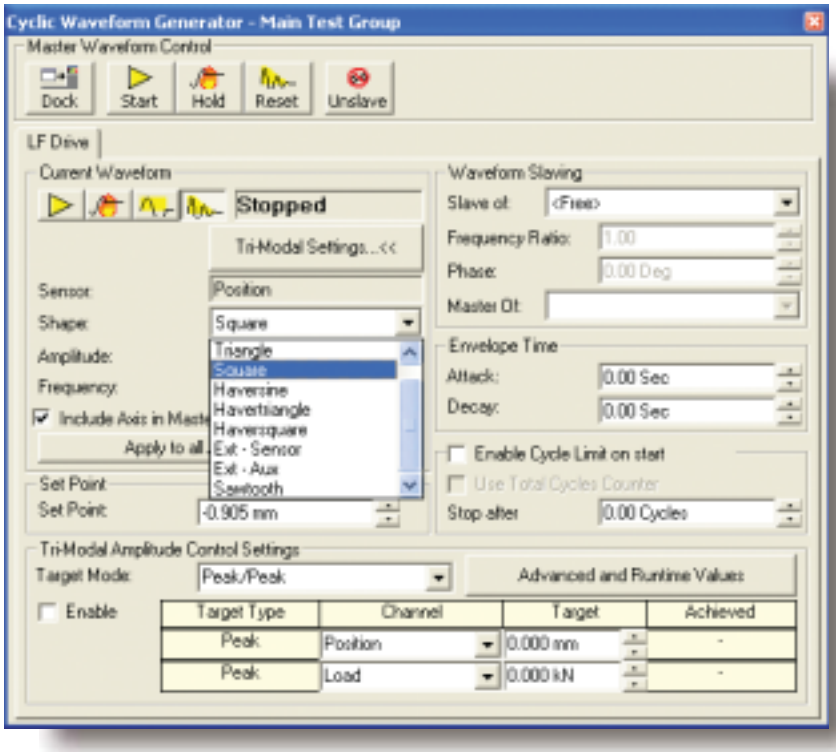
**Calibration Linearization**

# Test System Control

RS Console provides the user with a set of tools to control the test and to generate command signals for a number of purposes.

## Group Set Point

The Set Point control is used to move the actuator, or group of actuators, in a test to a new position. Frequently this is used to bring the actuators from their rest position to an operating position prior to running the test. The servo loop control mode can also be changed at this time, as can the speed to ramp between positions or loads.

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**Cyclic Waveform Generator**

## Waveform Generation

### Cyclic Waveform Generator

The Cyclic Waveform Generator is a versatile tool used to generate cyclic command waveforms for one or more axes in a group. Several options are available:

- Waveform shape, sine, square, triangle, waversine, havertriangle, haversquare, sawtooth as well as inputs from external analog sources
- Waveform amplitude
- Waveform frequency
- Independent or slaved axes with adjustable phase difference and frequency ratios
- Cycle counter
- Start and stop signal envelope duration

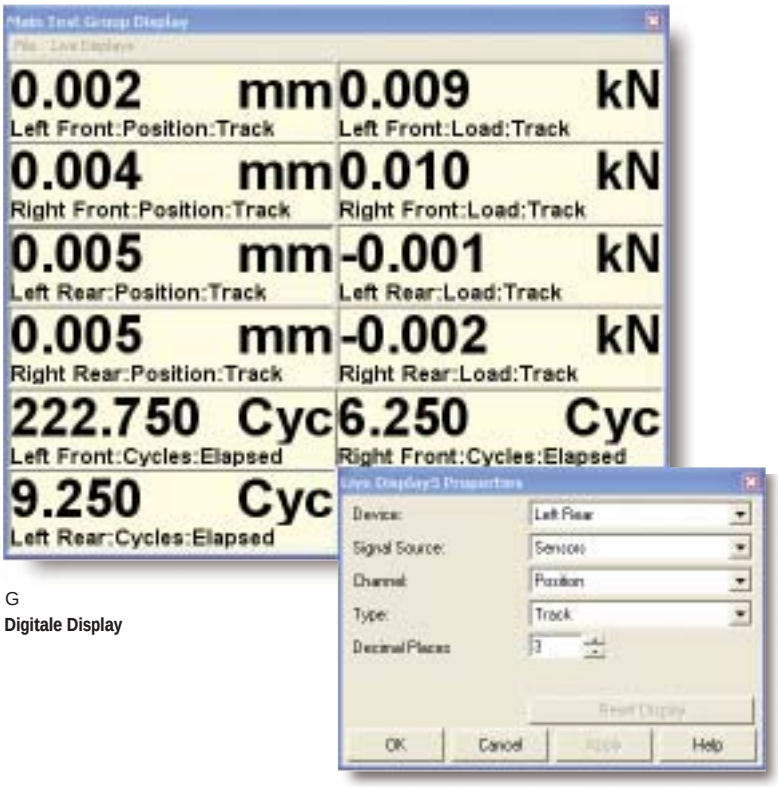
### Trimodal Amplitude Control

Trimodal control enables cyclic command signals to be specified in a variety of different ways:

- Upper and lower peak
- Mean value and amplitude
- Mean value and lower (or upper) peak

Each of these targets can be set for any measurement variable available in a given controller board.

This type of peak value control enables you, e.g. to set a desired load as target for one direction of movement, combined with a given displacement as target for the other direction of movement (optional feature).

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**Digitale Display**

## Digital Displays

RS Console is capable of displaying all parameters associated with a test using the Digital Display module. It can be used to view sensor information, instantaneous readouts as well as max, min, amplitude, and ultimate values. It can display all parameters of the control loop, such as command signal, error, and PID terms. Waveform Generation information, elapsed cycles, total cycles, or feedback cycle count and fatal count can also be displayed.

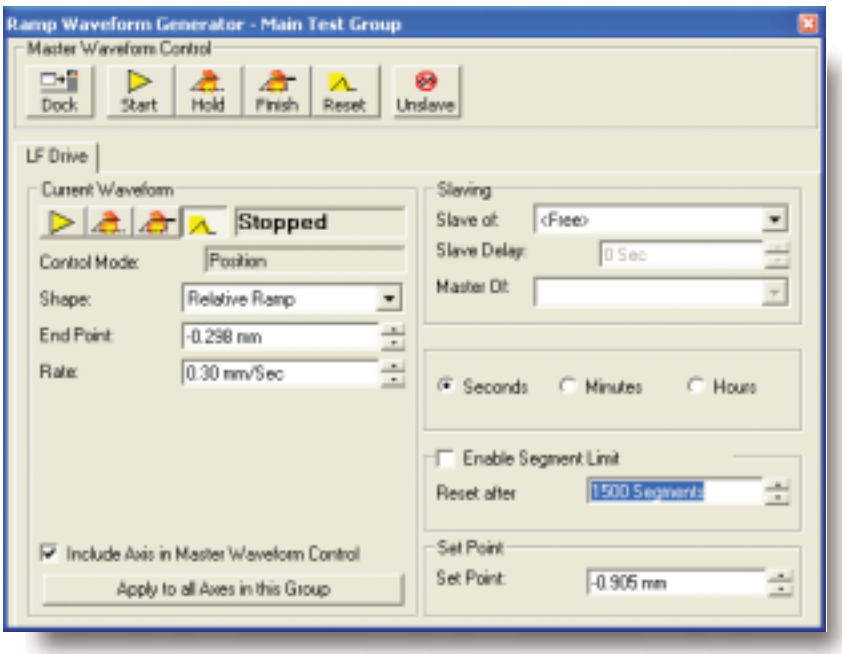
The Digital Display module is highly flexible allowing data to be displayed either in a large screen view or in a summary view in the test toolbar. The large screen view can be re-sized to show any number of individual displays. Thus a large number of channels can be viewed with a small display, or a few channels can be viewed with a display that takes up the full screen and can be seen from a distance. The individual displays can be positioned anywhere on the screen. This allows the user to save and restore a previously defined display configuration.

### Ramp Waveform Generator

The Ramp Waveform Generator is used to generate constant rate ramp command signals to one or more control channels. The control axes ramps can be run independently or 'slaved' together. The ramp types available are:

- Relative ramp
- Dual ramp
- Trapezoid
- Absolute ramp
- Hold

Each of the ramp rates can be set anywhere between milliseconds and hours. With the use of the ramp and cyclic waveform capabilities in RS Console, many simple cyclic tests can be run without the need for additional application software.

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**Ramp Waveform Generator**

# Tools to Facilitate Loop Tuning

## Servo Loop Tuning

An important part of the test set-up is the tuning of the servo control loops for optimum dynamic response. With the RS Console software, this can be carried out either manually or automatically.

Depending on requirements, one to three different controller concepts can be used

### Manual Tuning

With manual loop tuning the user is presented with an oscilloscope, signal generator, and controller loop tuning parameters all in one window. Adjustment for inertia feedback and actuator resonance compensation signals is also available. To tune the servo control feedback loop, all the user has to do is:

- Set the desired command perturbation waveform on the signal generator
- Press the start button and observe the command and feedback traces on the oscilloscope
- Adjust the controller PIDL gain settings until the desired response is obtained
- Stop the command perturbation by pressing the stop button and then moving onto the next channel

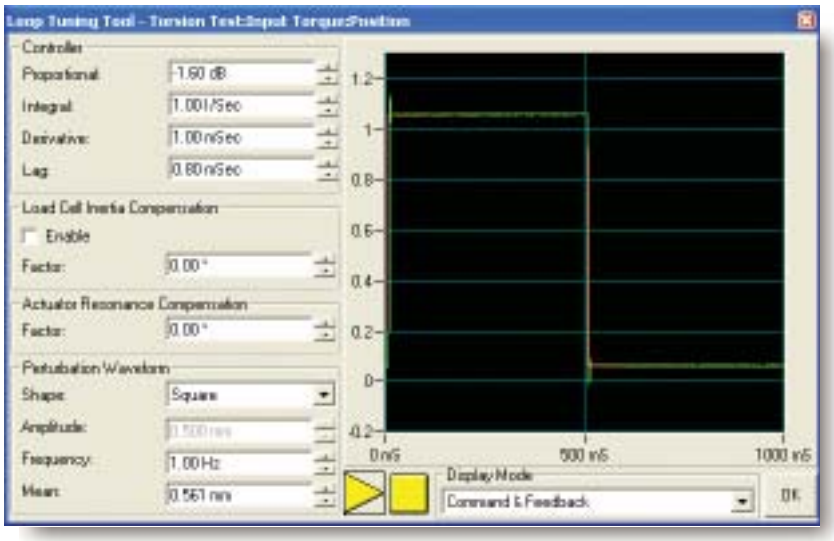
In addition to the assessment of the effect of the control parameters on the conventional x/ t display, frequency domain diagrams are also provided.

### Serial PID Controller

In addition to the usual PID parameters, the serial controller as the standard controller includes an additional L term, which reduces the closed-loop gain at higher frequencies, which is useful when there is a mechanical resonance (it can move the critical -180º phase point away from a resonant peak).

### Automatic Tuning

With automatic loop tuning, all the user has to do is to set the desired disturbance amplitude and the frequency of excitation, and the RS Console software does the rest. The correct proportional, derivative and lag terms are chosen to give a servo loop response with the desired damping characteristic.

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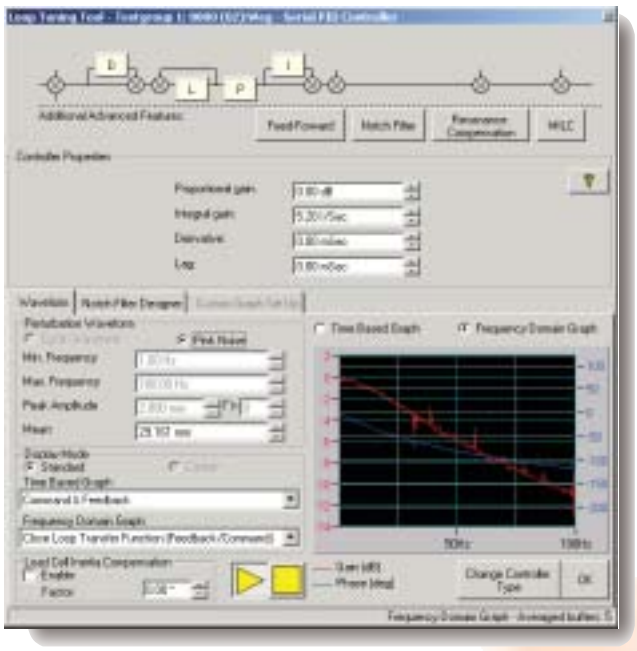
**Loop Tuning Tool**



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**Advanced Loop Tuning Tool**

## Advanced Loop Tuning

This option provides experienced users with a choice of alternative controller structures and further tools for loop tuning. All displays required for this purpose are integrated into RS Console, so that no additional equipment is required for signal analysis.

### Parallel PID Controller

A parallel PID control-loop has the advantage that proportional gain is independent of the integral and derivative. Differential and integral term are parallel, offering greater flexibilty in optimization. However for most applications, serial and parallel implementations give similar performance.

### Cascade Control

The cascade controller consists of two nested parallel PID controllers. The inner loop feedback signal is usually position and the outer loop feedback load, but neither is restricted to these. Cascade control is particularly applicable for difficult load control loops for structural test rigs, typically those with compliant test pieces or those exhibiting some degree of backlash. Cascade control helps controller tuning for such applications by closing the loop on position (inner-loop) before closing the loop on load (outer-loop).

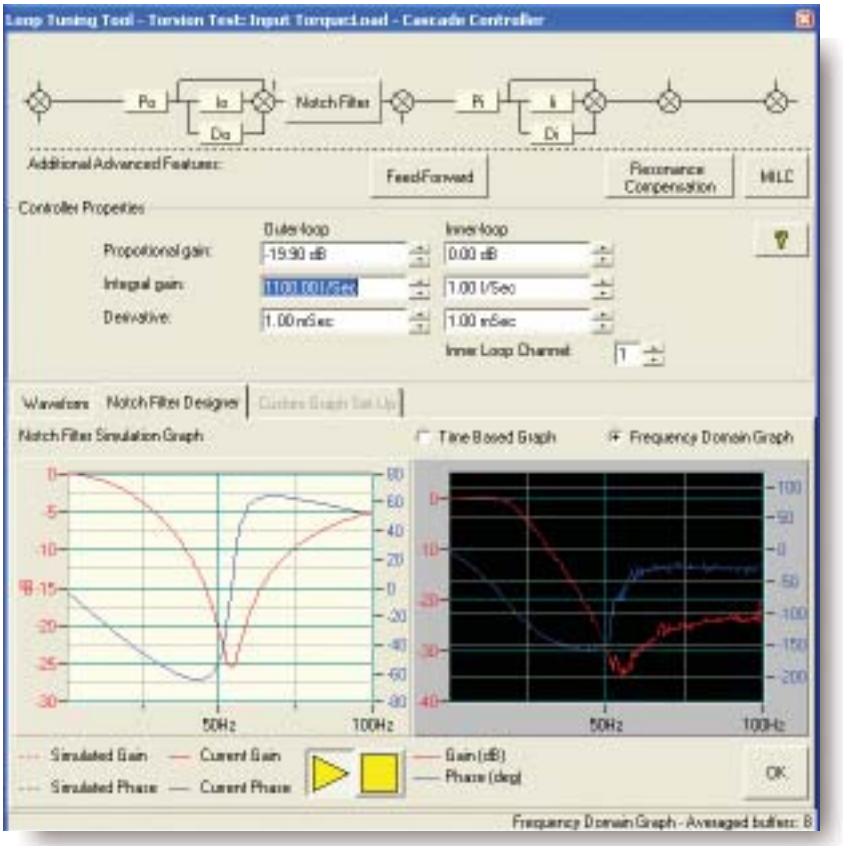
### Notch Filter

A Notch Filter is available at the output of a serial or parallel controller or at the output of the outer loop of a cascade controller. The characteristics of the filter are determined by means of user-defined parameters.

As an example, the Notch Filter can be set to increase or decrease the gain at a critical frequency and it can be used to adjust the gain above some transient area. The effect of the parameters is shown in the graphic below.

### Feed Forward

In the feed forward path, the high frequency component of the command signal is applied directly to the valve drive to amplify amplitudes in the higher frequency range without endangering loop stability.

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**Advanced Loop Tuning Tool**

# Access to Digital Controller Features

## Transducer Limits

With RS Console, limit values can be set for every transducer input connected to the Labtronic® 8800 Controller. When a limit is armed and tripped, a selected action takes place. These actions, possibly different for each axis, include:

- Actuator off
- System stop
- Hold
- Reset
- Unload
- System reset
- System unload

It should be noted that the transducer inputs that are monitored with the limit function need not be the control feedback signals for the servo loop. Any measured signal from the test can be limit monitored. In addition, the comprehensive set of limit actions on the Labtronic 8800 Controller is much wider than those available with traditional analog controller systems.

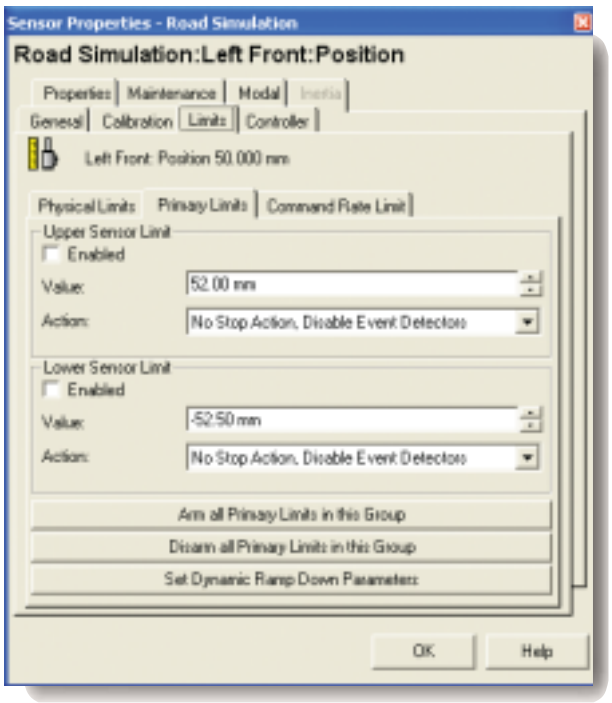
## Load Protect

RS Console allows access to the load protect feature of the Labtronic 8800 Controller. Load protect operates in position control situations where a specimen load feedback signal is available. With load protect enabled, the load in the specimen is constrained within specified load limits, and thus protected, independent of the position command.

## Adaptive Control

Another simple window allows the setting-up of the Labtronic 8800 Controller adaptive control function. In single axis tests in load control, with adaptive control enabled, the Labtronic 8800 Controller monitors the stiffness of the specimen through the position and load feedback sensors. It continually updates the loop PIDL parameters for optimum servo loop stability and response.

In traditional analog systems the setting up of these kinds of system depended on the manual adjustment of potentiometers and was subject to error and drift. With RS Console, the transformations are done by precise mathematical equations. Set-up of the transducer and actuator combinations and entering of the modal coefficients are simple, accurate and straightforward operations. When modal control is activated from Console, adaptive control is locked out.

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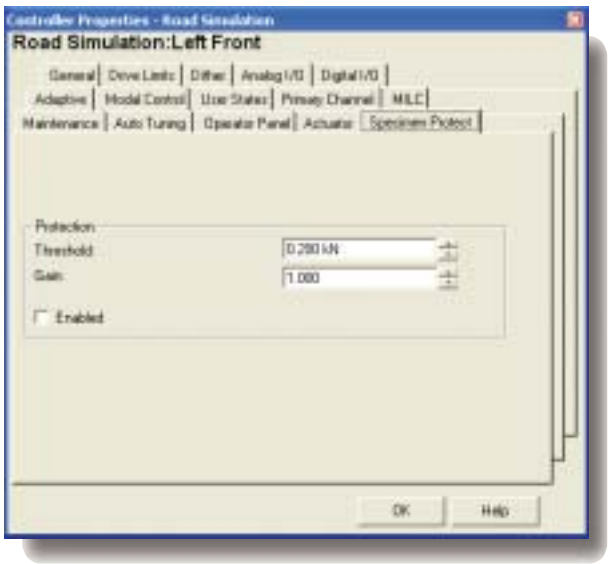
**Sensor limits**

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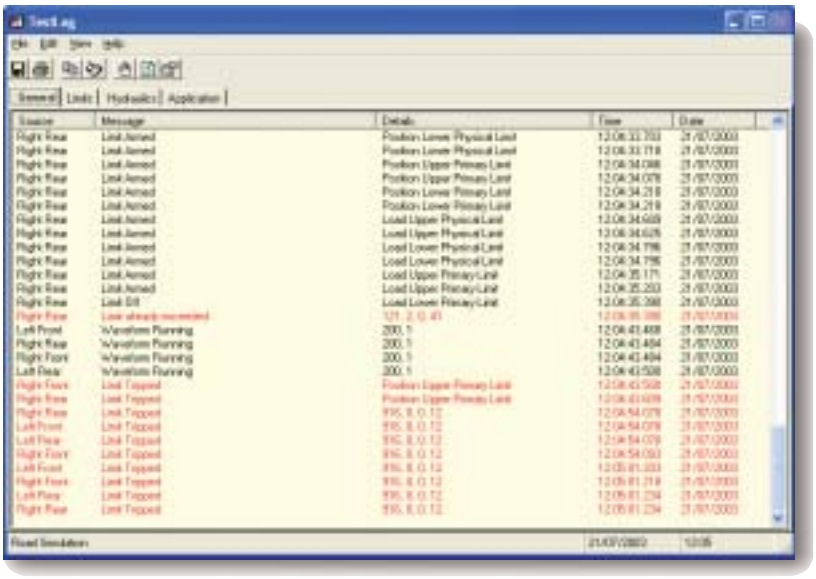
**Specimen protect**



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**Test Log**

## Test Log

An important part of any test is ensuring that the test procedure was carried out correctly and that no errors were inadvertently introduced. Historically, the best way of carrying out this process was to write up a test log where every step in the development and running of the test was recorded. RS Console makes the recording of test log information significantly easier. Integral to RS Console is a test log capability where all significant control, hydraulic, and status messages are logged along with a time stamp.
There is also the capability for users to enter their own time stamped comments into the log. While not entirely eliminating the need for other documentation of the test, these test logs can form an important part of the final test documentation.

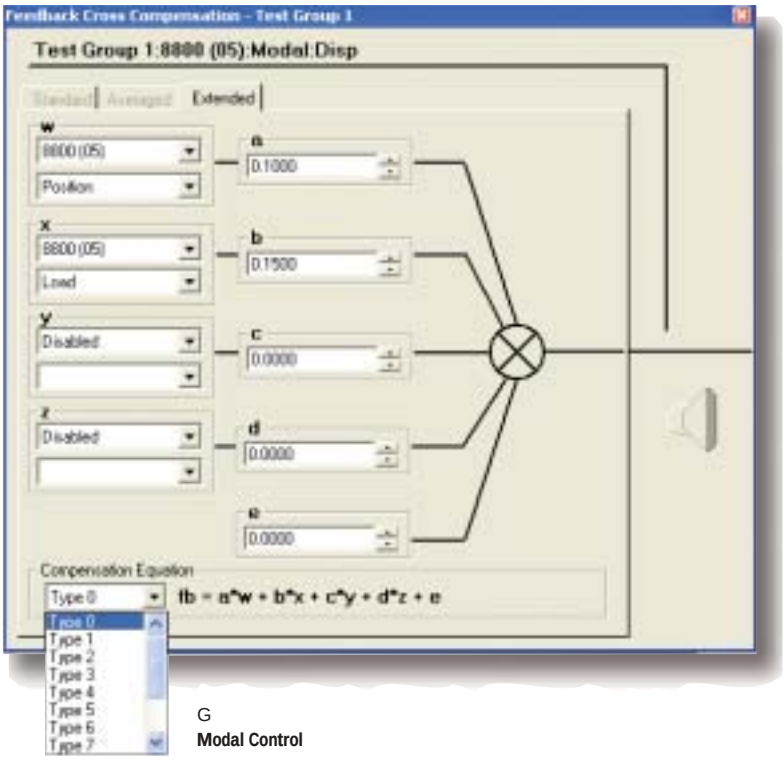
Messages can be displayed on a per group basis for multi-test stations. Test logs can also form part of an ISO 9000 test quality monitoring program and be written into your company's test procedures.

## Modal Control

Labtronic® 8800 Controllers are capable of being operated in a modal control mode where sets of feedback transducers signals and actuator servo valves commands are combined to make virtual transducers and actuators. This capability extends the range of test systems the Labtronic 8800 Controller can control to include those requiring cross-axis compensation schemes and inertial reaction simulations of full vehicles. This is important where control of both horizontal load and displacement is required.

### Cross Compensation

A range of cross compensation options including feedback cross compensation, servovalve cross compensation and geometric cross compensation is available. Modal control is enabled through the combination of both feedback cross compensation and servo valve cross compensation.

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**Modal Control**




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