RPC® Pro Software

The intelligent solution for laboratory simulation and analysis

POWERFUL, INDUSTRY-LEADING **MTS RPC PRO SOFTWARE** PROVIDES THE ULTIMATE IN DATA VALIDATION, ANALYSIS, SIMULATION AND TEST MONITORING. THIS STATE-OF-THE-ART, PATENTED SIMULATION SOFTWARE PRODUCES ACCURATE AND REPEATABLE TEST RESULTS TO HELP BRING YOUR VEHICLES TO MARKET FASTER.

Optimize Laboratory Simulation and Analysis with Powerful, Easy-to-Use RPC Pro Software

RPC Pro software is the ultimate tool set for laboratory simulation of your product's field performance. This integrated suite of applications is designed for complex, high channel-count systems and provides simulation control, analysis, and information management. It is specifically designed for evaluation of vehicle durability, performance, powertrain, noise, vibration and harshness, and ergonomics.

RPC Pro uses Remote Parameter Control™ techniques to quickly and accurately duplicate the service environment of your specimen by recording parameters—strains, accelerations and displacements—on the proving ground and reproducing that environment on an MTS test fixture. Supported systems include four posters, multiaxial simulation tables (MAST™) and spindle-coupled road simulator configurations.

More Information for Your Effort

Tests cost money and take time, so it is critical to extract as much information as possible from every test. Using advanced editing and analysis techniques, RPC Pro software optimizes your simulations to maximize laboratory productivity and helps you transform data into useful, functional information through advanced analysis, editing and reporting. That means less time in development and faster time to market.

The process begins with the collection of information about the "real-world" operating environment through field-recorded data. During test modeling and simulation, information obtained through dynamic monitoring of the specimen provides valuable, sometimes critical, information about the character of its performance. RPC laboratory testing lets engineers duplicate the environment to which components are subjected and observe the failures that occur.

RPC Pro Software – Unmatched Anywhere in the World

RPC Pro software is the world's leading software package for data validation, analysis, laboratory simulation and test monitoring. It complements existing test system installations, providing:

- Advanced methods
- Intelligent simulation tools
- Customizable, process-driven user interfaces
- Customization and automation capabilities to meet specific needs
- Unsurpassed control techniques and analysis functionality
- Powerful diagnostics

Designed by Simulation Engineers

RPC Pro software is the MTS flagship product for road simulation and ground vehicle testing, designed with input from simulation and development engineers throughout the vehicle industry. With over 35 years of industry experience and more than 1,000 RPC systems installed worldwide, MTS is uniquely positioned to address the real needs of the global simulation community.

Benefits of Open Architecture

RPC Pro software lets users customize every aspect of the application, from definition of simulator attributes and specification of drive signals to pre- and post-processing analysis. The software's extensible design provides standard features and configurability for easy automation of user processes, and its open architecture supports access to multiple computation engines such as Matlab.

Built-In Project Data Management

The software lets you automatically manage user data, log files and project information on a project-by-project basis, and provides consistent operation and ease of use in a structured project format.

Seamless Controller Integration

RPC Pro software integrates seamlessly with the MTS suite of controller products for quick configuration and easy use. Third-party controllers can be employed using a file-based communication protocol.

Process Automation Reduces Test Time

RPC Pro software automates the entire simulation process, simplifying use, ensuring consistent operation and allowing easy customization for specific test systems.

RPC Pro Software Helps You "Work Smarter"

With its robust, intelligent diagnostics, RPC Pro software simplifies every step of the process with:

- Push-button, process-focused applications
- Transparent data management
- Online signal display
- Predefined tests stored in customizable templates to test setup time, ensure consistency and reduce operator error

Solve Problems Quickly

The system's Interactive Simulation Desktop tools and processes help save time and money by identifying and addressing problems early in the simulation process. These tools include:

- Signal processing calculators
- Control band estimation
- Matrix Editor with automatic inverse views
- Channel transformation for easy input of user algorithms

Accelerating Product Development

RPC Pro software, in conjunction with other MTS products, provides a comprehensive set of common application tools for concurrent product evaluation engineering. These tool sets support enterprise-wide activities, including better integration of remote development sites and easy sharing of simulation information across the enterprise to support collaborative engineering.

Flexible Licensing Adds Versatility

The MTS Network License Manager lets you configure the software to meet your requirements. You only purchase the packages and options you need.

ACQUIRE SOFTWARE FOR ROAD LOAD DATA ACQUISITION

Acquisition and verification of field data are critical steps in the product design and evaluation process. Problems due to bad data can include:

» Over- or under-design based on erroneous fatigue life calculations

» Incorrect failure mode and failure location replication on physical tests

» Inaccurate reproduction of time-to-failure

» Erroneous results from virtual models

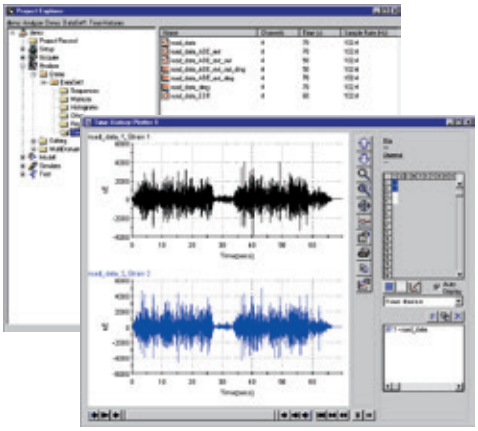
A small investment in improved data validation can help avoid late-stage design changes and costly warranty issues. The Acquire package provides quick visual data validation, advanced signal processing and data manipulation tools including automated defect detection features.

» The Acquire package is built around intelligent data validation tools that reduce vast amounts of data to a concise defect list, allowing you to interactively inspect the data and accept or reject data based on the validation results.

» The type and location of each defect are reported. Problem viewers highlight anomalies and let you effortlessly evaluate problem channels and consider whatever action is appropriate.

» Powerful signal analysis tools, customizable processes and batch processing functionality are available for cases requiring additional processing.

» This optional module lets users quantify the levels of modulation present in data acquired from rotating apparatus.



Project Manager

The Project Manager application is a required module. It is the foundation of the product, providing control of default settings and functioning as a launch pad for other RPC Pro applications. It includes RPC Pro Data Manager for efficient management of test lab information.

Acquire

The Acquire package provides an application for transferring data into RPC Pro projects and several methods for validating data including:

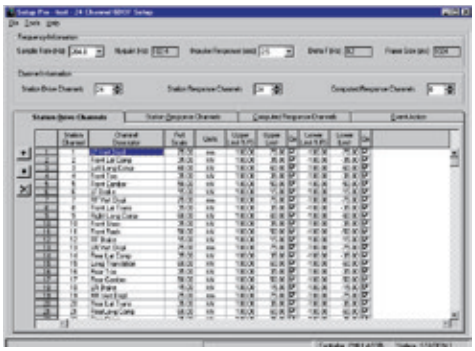
» Online checking for data spikes

» Data saturation

» Data limits

» Interactive comparisons with reference files

» Interactive analysis and diagnostic tools



Setup

The Setup application is used to specify test configurations, allowing the user to interactively define drive, response and online computed channels. It is required when using a simulator to play out drive files or acquire response data. Templates within the setup application help:

» Standardize custom systems

» Minimize setup time

The interactive channel feature:

» Creates associations with properties like transducer type, serial number and orientation

» Adds user-defined fields

» Supports automatic generation of channel descriptors, adding valuable configuration information

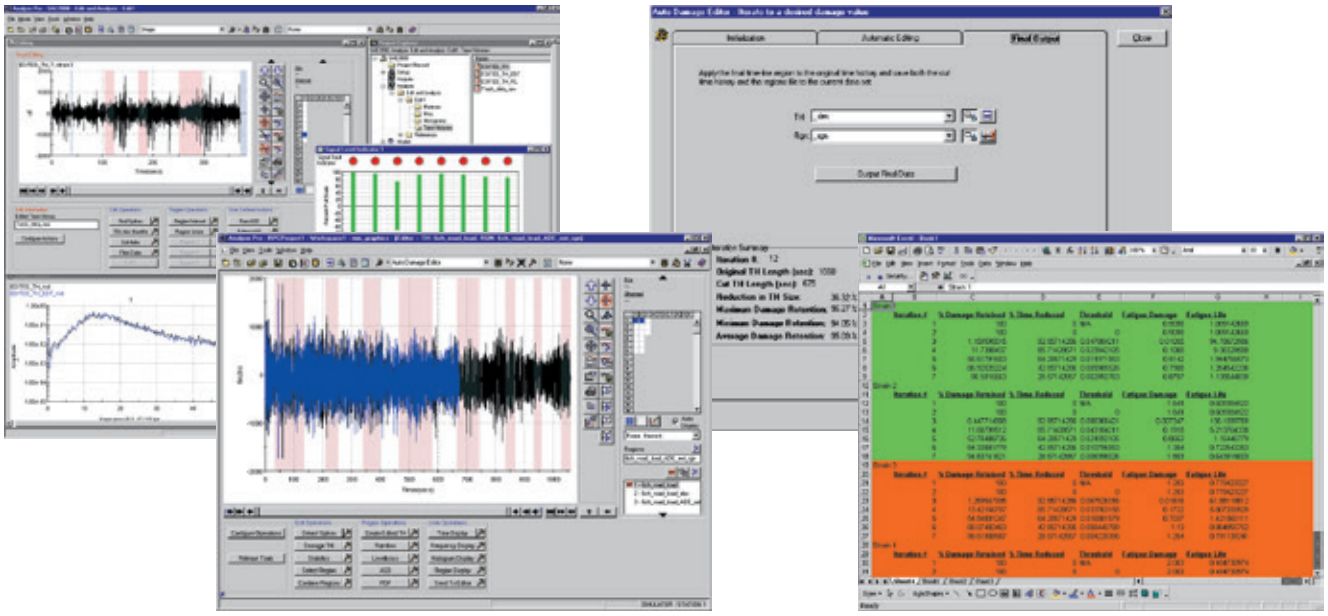
Analyze

The Analyze application supports interactive, fatigue-based data editing and analysis across multiple domains including:

» Time history (point-by-point comparison)
» Spectral (frequency)
» Trend (statistical)
» Fatigue (histograms)

The application includes a variety of tools, such as stress/strain life prediction, rainflow cycle counting and probability density analysis, and includes interactive analysis and diagnosis capabilities similar to those of the Acquire application.

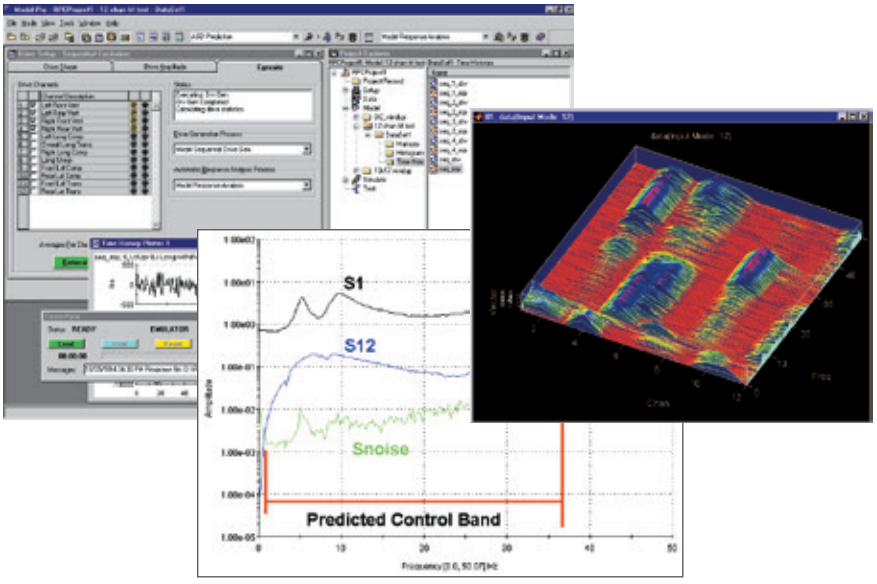
The Analyze application's Auto Damage Editor tool (ADE) is a fatigue-sensitive editor that allows you to accurately and automatically reduce the length of data files required for simulation. By specifying a desired damage retention percentage and defining parameters from which to calculate damage, the ADE tool will iterate to an optimum solution, balancing damage retention with time reduction. A color report visually summarizes the status of the tool's progress. This type of interactive wizard-driven tool is representative of a whole suite of value-added process tools within RPC Pro software.



Model

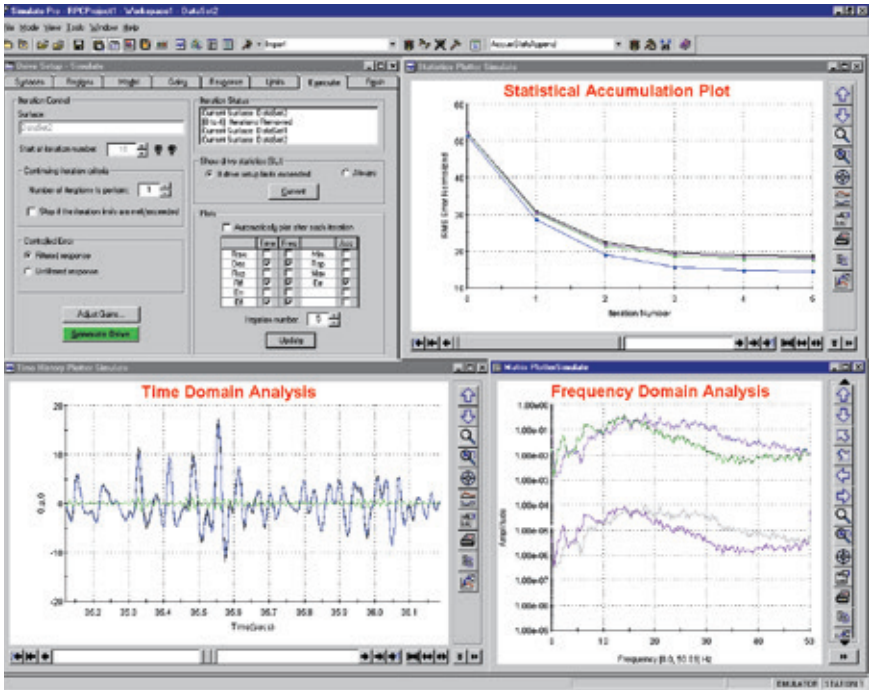
The Model application provides tools to generate simultaneous and sequential random drive files, calculate system models and generate inverse models. A variety of interactive diagnostic checks are incorporated into Model including:

» Control band estimator
» Auto spectral density (ASD) prediction
» Coherence
» Engineering rank inverse
» Singular value decomposition



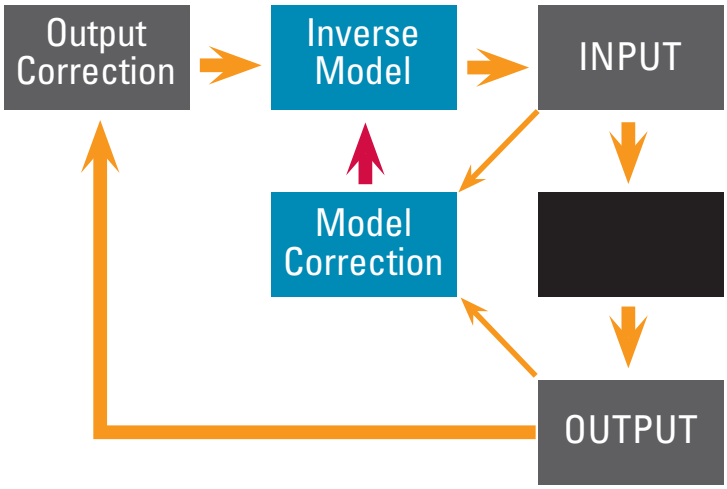
Simulate

The Simulate application provides an interactive environment for performing iterations. Iteration convergence criteria may be directly evaluated in all domains—time, spectral, trend and fatigue—while user-definable processes support further analysis of data. Customizable processes and templates let you define automatic iterations, use multiple models and execute the iteration process with convergence targets and divergence limits.



ADAPTIVE ITERATION MODELING (TURBO RPC)

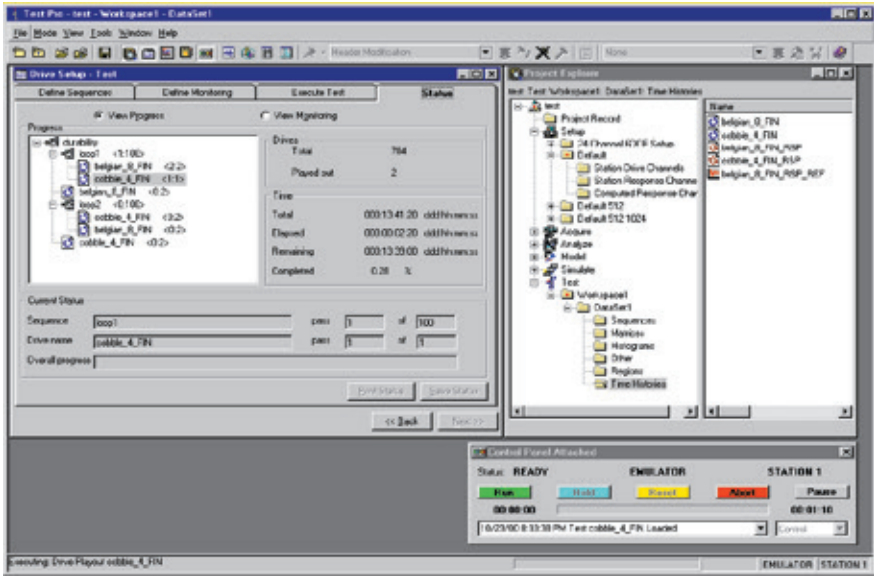
Simulate includes the adaptive inverse modeling control technique called Turbo RPC. This adapts the system model, represented by the inverse frequency response function (FRF), to changes—non-linearities and shifting resonance problems, for example—in the characteristics of the specimen during iterations. In already stable systems the Turbo RPC technique allows for fewer iterations to meet convergence criteria. However, the control technique also provides you with a tool for the challenges other control software is incapable of solving.



The latest advance to this control technique is Time Varying Turbo, which creates a separate correction matrix for small sections of data to maximize corrections where required. This is just one more example of the commitment at MTS to continual software improvement.

Test

The Test application provides a powerful way of creating and modifying durability test schedules, defining event action sequences and monitoring test status. The application also facilitates execution of user-definable processes at various times during test playout and automated archiving of test response data. The test application can be tailored to your needs by choosing the test bundle configuration most suitable to your requirements. The test application has a base test configuration which includes creation and modification of test sequences and test playout. All monitoring options are facilitated as plug-in functionality. The monitoring options supported by Test include the following:



» **TIME HISTORY MONITORING** provides a point-by-point comparison of response time histories. A reference is collected and stored during the first pass of the durability sequence. For each subsequent pass, response data is compared against the reference and user-specified limits. Each data point of the response is compared against the corresponding reference data. This provides a very precise monitoring technique able to detect very small differences from one pass to the next. If you choose the appropriate transducer locations and limit settings, this monitor will detect the smallest changes that occur during the progress of your test.

» **TREND MONITORING** tracks the change in statistics (maximum, minimum, RMS, mean, standard deviation and range) calculated from each pass of the durability test. Limits may be set as percentages of the statistic calculated after an initial pass through the drive sequence. Trend monitoring provides a method of detecting slow and gradual change over the duration of the test. Visualization of trend statistics as the test progresses provides a way to observe the rate of specimen degradation.

» **FATIGUE MONITORING** tracks the cumulative damage and the change in damage per pass of a durability test. Damage calculations are derived from rainflow histograms computed for both the current pass of each drive file and a cumulative histogram representing the cyclic content of the elapsed test time. Limits for change in damage on a pass-by-pass basis and maximum cumulative damage are supported.

» **SPECTRAL MONITORING** tracks the change in frequency content calculated from each pass of a durability test. A reference is collected and stored during the first pass of the test. For each subsequent pass, response spectral data is compared against the reference and user specified limits.

The Base Test application includes one monitoring option. When you purchase Test you can choose the monitoring function most suitable to your laboratory's needs. Additional monitoring features can be added at any time. If all monitoring features are desirable, the Full Test bundle is the most cost-effective solution. It includes the features of Base Test and all of the monitoring options.

RPC Pro Data Manager is built into the RPC Pro application, providing easy information access and effective data management. The software's robust database engine delivers the functionality you need to successfully leverage the valuable information your laboratory produces without the cost and complexity of ordinary data management solutions.

RPC Pro Data Manager:

» Supports all data regardless of format

» Utilizes a central data server for project archival

» Provides flexible keyword management with user-definable keywords

» Includes RPC Product Driver for auto-recognition of RPC Pro projects and data

» Features flexible search and retrieval capabilities

» Employs a robust security model for user-based security

» Facilitates network-based information sharing

Tight Integration, Streamlined Access

Optimizing test information management can significantly improve your development processes. RPC Pro Data Manager lets you leverage test information by making data directly available from the RPC Pro tool menu. A single interface lets you identify, retrieve and load relevant data into the current program, saving time and allowing easy sharing of information.

Ease-of-Use

RPC Pro Data Manager is easy to use, eliminating the complexities of interacting directly with a database system.

Supports All Data Formats

The software works with any data that is accessible from Windows® Explorer via a network. A typical project archive can include test data, photographs, test logs, video clips, system configuration details, process information and analysis results. Additional information could include test specimen details, operator information and miscellaneous notes. When additional information is generated, it can be easily associated with the archive.

Flexible, Secure Archival and Search

Entries for each item are archived in a central data server, while associated keyword/value pairs are kept in the RPC Pro database. This ensures quick and efficient interface with the RPC Pro database, and allows the flexibility of storing large archived data sets on a separate computer in a different location. RPC Pro Data Manager can require specific keywords in all archives, can define a default value for keywords, and can define a limited set of valid values for keywords. This helps enforce consistency in data archival and guarantees that data can be easily and comprehensively searched in the future.

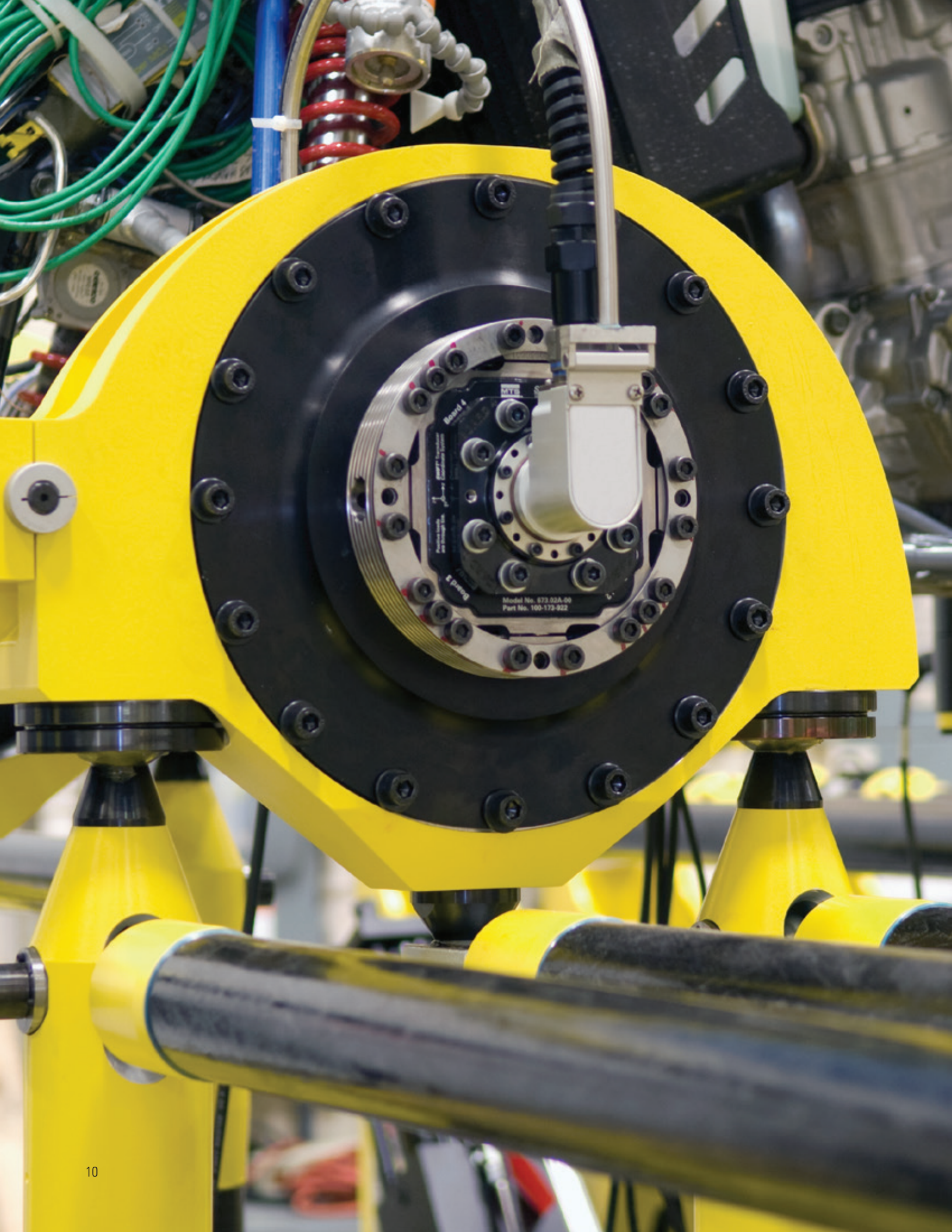
The software also offers flexible search and retrieval capability, letting you search for specific archives, and data within them, using simple or complex user-defined queries. These are written within RPC Pro software and can be saved and made available to all users.

User-Based Security

The software's robust security model protects the RPC Pro database and manages access granted to users. The RPC Pro administrator can define each user's level of access, ranging from simply viewing information to creating archives to performing administrative tasks.

Cost-Effective Data Management

RPC Pro Data Manager optimizes test information management and promotes increased sharing of critical information. Its robust data engine, broad functionality and ability to support all data formats let you streamline RPC test information management, enhance lab efficiency and accelerate your development processes.


Model No. 673.02A-00
Part No. 100-173-922

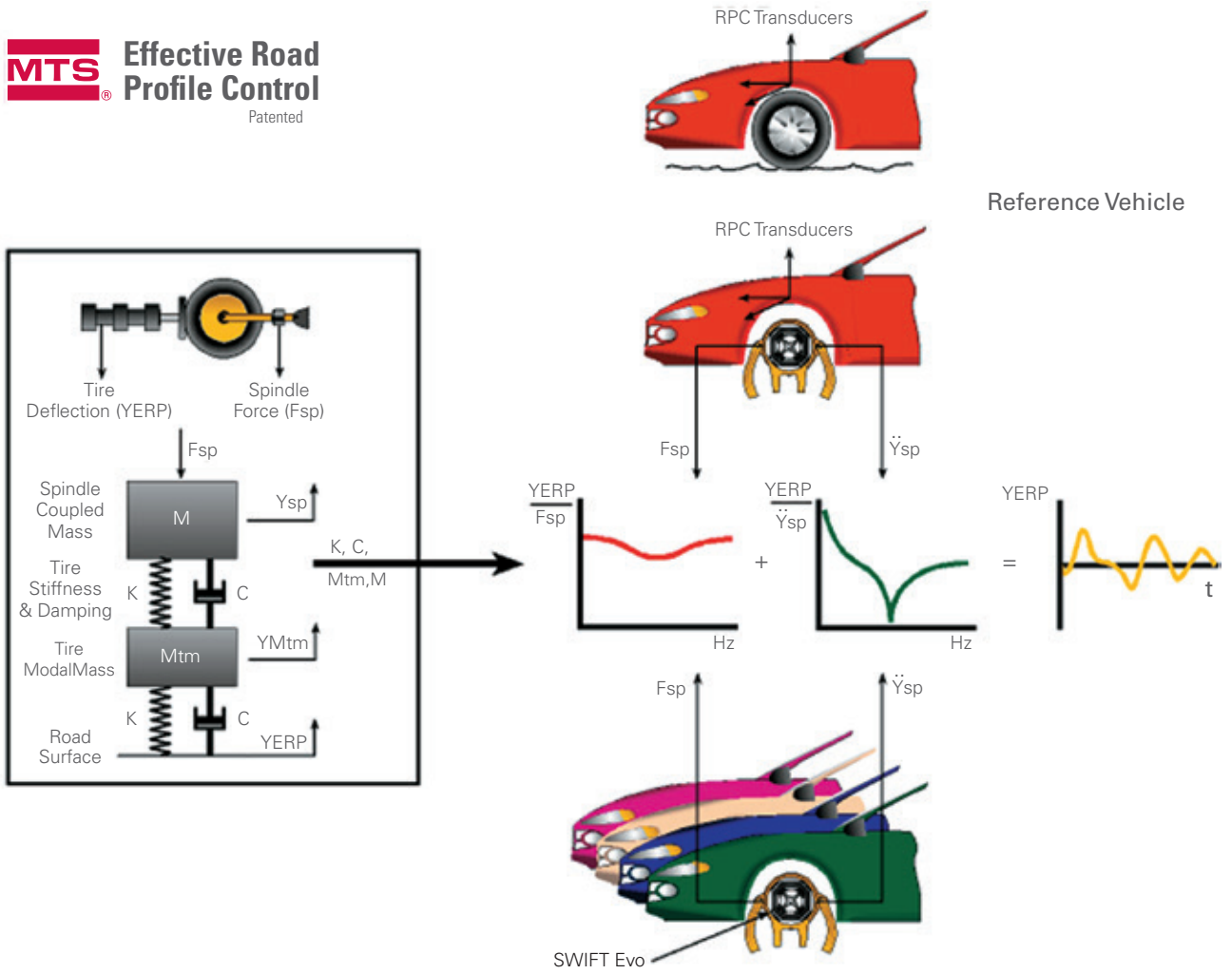
Effective Road Profile Control™ (ERPC™) Software

This powerful, patented software option is suitable for spindle-coupled free body simulation tests. It is a control technique that allows road profile estimation. By letting you estimate road profiles, it helps cut the duration of your development program and the number of prototype vehicles built. ERPC software lets you test different loading or vehicle configurations without having to acquire new data on the proving ground, because it derives equivalent input history from the first measurement of response. The ERPC option allows for tire model drive generation and control, tire model computation and analysis, and integration of ERPC capabilities into the iteration loop.

ERPC software has many advantages for simulation testing. Since effective road profiles are independent of most common vehicle modifications, they can be used repeatedly to develop road simulation tests. By equipping a road simulator with MTS SWIFT Evo® (Spinning Wheel Integrated Force Transducer) systems, effective road profiles can be calculated and used directly as RPC Pro test parameters. ERPC software is equally valuable for modeling and analysis. Just as road profiles make laboratory simulation more accurate by adding the tire degree of freedom to the test, they also provide a better generic parameter from which to drive dynamic computer-aided engineering models. The ERPC tire model can be coupled to existing analytical body and chassis models, allowing effective road profiles to be used as the road input to the entire virtual vehicle.

Ride Comfort Analysis

Ride Comfort Analysis is typically performed to quantify the relative level of discomfort associated with vehicle motion. This analysis is based on the NASA 2299 and ISO 2631 standards and can be applied to full vehicle or component level assessment. Both the NASA and ISO standards are directly available via the wizard interface. However, you can also define and use custom weighing functions. Output is presented automatically in an easily understood summary report, in which all details are simultaneously captured in a database of ride comfort results, allowing you to compare current analysis with historic results.



RPC Pro Licensing Structure Enhances Flexibility

License Information

All RPC Pro packages include a highly flexible, network-based license manager. The number of licenses for each bundle and/or options will depend on your anticipated usage. This provides the ability to configure a system that specifically meets your needs. RPC Pro software is offered with both purchased and leased licenses for flexible management of capital resources.

Floating Licenses

Each workstation will have all of the purchased software resident. When a user launches RPC Pro software, the license manager checks with the server (a single designated workstation) to see if there is a Project Manager license available. Then, when the user launches an application, the license manager checks again with the server to see if there is an available license for that application. If available licenses are found, the software launches and the license server updates the available count appropriately. If not, the user is alerted.

For example, if you have purchased three copies of the Analyze bundle, up to three users may operate the application anywhere on the network at any time as long as three Project Manager licenses are available. If a fourth user attempts to run RPC Pro software, the license server will notify the user to wait until someone is finished. Another example is if you have purchased the Analyze, Simulate and Test bundles and you require simultaneous access by three users — one doing analysis-only work and two others running simulators to do iterations and run a durability test — three licenses of Project Manager are necessary.

Redundant License Server

If your primary license server is taken off-line for maintenance, it doesn't take your RPC Pro software with it. You can use a second computer as a redundant server that will take over and keep you up and running.

Easy to Increase License Count

You may upgrade your license count at any time. If your usage level increases, new licenses require only a telephone call or a visit to the MTS Web site.

RPC Users' Groups

Users' groups serve the industry as a forum for discussion of technical issues related to Remote Parameter Control simulation testing. These groups meet regularly in Asia, North America and Europe.

As an RPC Pro licensee, you will automatically be invited to participate in RPC Users' Group events. You will be able to network with other RPC users, some with decades of experience in the technology. You will be able to learn from their experience and hear the latest product reports from MTS. MTS is the only company in the industry with a dynamic, networked user community, all helping one another further RPC simulation technology.

MTS is committed to maintaining your RPC Pro software at peak performance. Our unique Software Support Plan (SSP) program will provide you with software at the latest technology level. The software is regularly enhanced based on feedback from the hundreds of engineers involved with RPC products on a daily basis.

Our SSP contracts provide a direct, priority technical support line. Our engineers help address challenges, and user input helps guide the future direction of the product. You will be provided with one year of coverage when you purchase your new RPC Pro licenses. As long as you keep your SSP contract current, you can renew it annually for a nominal fee. If you let the contract lapse, MTS has a "catch-up" program so you can renew coverage. MTS will provide you with software updates for the duration of the contract.

SSP Features

» MTS will provide regular software updates as they become available, for the duration of the contract.

» You may contact our technical support staff via the MTS Web site, telephone (toll-free in the USA), e-mail or fax.

» MTS will ship updated documentation and media, formatted for your system, with installation procedures and release notes.

SSP Benefits

CONFIDENCE

Because your MTS software is upgraded to the latest technology, you will be able to meet the changing needs of your testing community.

PRIORITY SERVICE

As a contract customer you have direct access to an experienced product support team.

COST CONTROL

You will not face the cost of retaining, training and managing a staff of software engineers to develop and maintain the software for systems covered by the contract.

IMPROVED UPTIME AND EASE OF USE

Periodic updates to RPC software have consistently improved system uptime and ease of use.

TEST PRODUCTIVITY

Your MTS software will operate at peak performance on the latest computer equipment.

What is an Update?

An update is a fully tested set of applications that include value-added improvements over your existing software. These improvements may include:

» Enhancements over existing functionality, typically in response to requests made by SSP subscribers at RPC Users' Group meetings or directly to MTS representatives.

» Changes allowing the product to run on new hardware, operating systems and platforms. Software licenses may be exchanged for equivalent RPC Pro software on a different operating system if and when it becomes available.

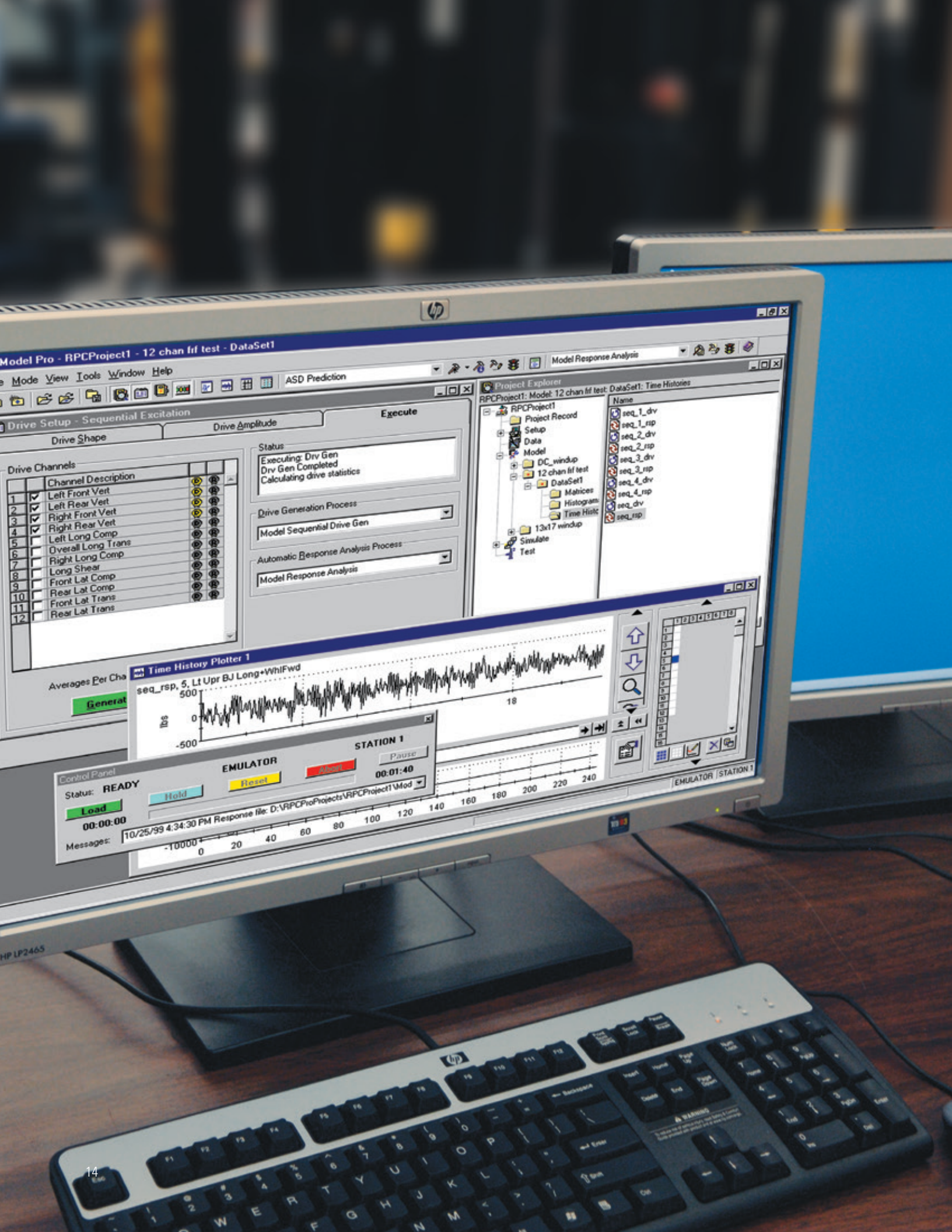
» Incremental improvements to the robustness of the product resulting from testing and software fixes, generally made before problems affect our users.

For More Information

For more information on how RPC Pro software can improve your productivity and shorten your product development cycles:

» Contact your local MTS field sales engineer or

» E-mail MTS directly at info@mts.com


Model Pro - RPCProject1 - 12 chan frf test - DataSet1
Mode View Tools Window Help
ASD Prediction
Model Response Analysis
Drive Setup - Sequential Excitation
Drive Shape
Drive Amplitude
Execute
Drive Channels
Channel Description
Left Front Vert
Left Rear Vert
Right Front Vert
Right Rear Vert
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Status
Executing: Drv Gen
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Drive Generation Process
Model Sequential Drive Gen
Automatic Response Analysis Process
Model Response Analysis
Project Explorer
RPCProject1: Model: 12 chan frf test: DataSet1: Time Histories
RPCProject1
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Setup
Data
Model
DC_windup
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DataSet1
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Histograms
Time Histc
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STATION 1
Load
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Reset
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EMULATOR
STATION 1
HP LP2465

Software Functionality Matrix

RPC Pro software consists of the following core components:

» Project Manager
» Setup
» Acquire
» Analyze
» Model
» Simulate
» Test
  – Time history monitoring
  – Trend monitoring
  – Fatigue monitoring
  – Spectral monitoring

(Base Test includes one monitoring option.)

Optional components are:

» ERPC software
» Ride Comfort software

The following table is provided as a guide for selection of the appropriate functionality based on your needs.

Task	Required Modules	Feature Summary
Data acquisition and validation***	Project Manager Acquire	Online data validation, data conversion (eg. Somat, RPC III), spectral analysis, Histogram count generation
Stand-alone plotting	Project Manager	Time history, matrix and histogram plotters
Data analysis	Project Manager Analysis	Customizable interactive editor, statistical editing, spectral analysis, fatigue analysis, auto damage editor Region-based operations, trigger definition
Simulation drive file development	Project Manager Setup Model Simulate	FRF generation and calculation, system-level diagnostics, iterations, Turbo RPC
Testing and monitoring	Project Manager Setup Test**	Definition of test sequence, test playout and monitoring
ERPC software		
Tire characterization	Project Manager Setup Model ERPC*	Develop tire-specific ERPC filters
Simulation	Include ERPC software option in drive file development bundle	Utilize ERPC in the RPC "control loop"
Ride comfort analysis		
Analysis only	Project Manager Acquire *Ride Comfort	This is the minimum bundle to perform ride comfort analysis.
Profile generation and simulation	Include ride comfort option in drive file development bundle	Excitation profile generation and playout, simulation of field data for comparative analysis

* Denotes optional packages

** Test can be configured as base test with selective monitoring options or as full test including all monitoring options

*** Usually provided in conjunction with a Somat data acquisition unit

Regional Business Centers

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