Flat-Trac® Tire Test Systems

- Proven Flat-Trac® Roadway Technology
- Unmatched Multi-Axial Measurement
- State-of-the-art Control and Analysis Software
- Engineered to Deliver Repeatable Results
- Unparalleled MTS Global Support
MTS Flat-Trac® Tire Test Systems
The world standard for tire performance measurement

Virtually every major tire manufacturer and vehicle maker in the world depends on MTS Flat-Trac Tire Test Systems to deliver its most critical tire performance data. Whether you need precision, repeatability, or power, MTS Flat-Trac Tire Test Systems will help you meet your engineering objectives – with confidence.

**Complete range of testing capabilities for passenger car, commercial truck, and motorsports applications.**

Today, there are over 40 Flat-Trac Tire Test Systems installed around the globe testing a complete range of passenger car, light truck, SUV and motorsport tires. This customer base of tire manufacturers, vehicle manufacturers, and racing teams depend on MTS testing systems as the best choice possible when it comes to effectively matching machine performance to precision tire testing needs.

All of our Flat-Trac Tire Test Systems measure a broad range of tire behavior by controlling the speed, load, inflation pressure, and true tire motion relative to the road. Which system is best for your application depends on your testing needs. If you need to make sensitive steady state measurements to evaluate on-center handling properties, we have the steady-state system you need. If you need to understand tire response behavior, then we can match one of our dynamic systems to your exact size and power requirements. If you need a system you can depend on, MTS has the right solution.

**All the data you need to create a competitive edge – quickly and precisely.**

The system’s wide range of available control parameters provide the flexibility you need to characterize your tires in the controlled environment of your laboratory. Simple, but powerful, software lets you quickly configure industry standard, as well as your own unique, custom tire tests designed to help you understand the forces and moments produced by your tires under a wide variety of conditions.

Data acquisition and control setups include access to all important test parameters such as roadway speed, tire spindle speed, normal force, lateral force, wheel torque, loaded radius, slip angle, inclination angle, and tire inflation pressure. Now it’s easier than ever to get the advanced data you need to precisely optimize your tire performance – and outmaneuver your competition.

From Akron to Stuttgart, from Shanghai to Seoul – we deliver the support you need, whenever and wherever you need it.

MTS fields the largest service, support, and consulting staff of any automotive testing solution provider. This global team of highly experienced test engineers and professionals provides a comprehensive range of services including preventative maintenance, system lifecycle management, and process optimization. You can be sure that we will be there to meet your training and support needs – whenever and wherever you need us to maximize your testing productivity.

The Flat-Trac LTR delivers the high force capability needed for characterizing light truck, SUV and motorsport racing tires.
The Flat-Trac CT with powerful spindle drive is optimized for dynamic force and moment tests that produce large lateral or longitudinal forces.

Flat-Trac Test and Measurement Capabilities:
- Steady State Force and Moment
- Dynamic Force and Moment
- Residual Aligning Moment and Lateral Force
- Radial Deflection
- Effective Rolling Radius
- Slip Angle Sweep
- Slip Angle Sinusoidal
- Tire Traction
- Simulation
Get the Precise Performance Data You Need to Build the Next Generation of Tires - Today

The latest Flat-Trac systems are the third generation of MTS Flat-Trac Tire Test technology and a continuation of more than 30 years of automotive testing experience. Flat-Trac Tire Test Systems are currently being used to collect data for computerized tire modeling, quality auditing, competitive benchmarking, program qualification, and many other applications. MTS Flat-Trac Tire Testing Systems are available in four standard configurations that can be customized to meet special customer requirements.

Flat-Trac Classic System
This system is an excellent choice if you want genuine Flat-Trac quality and engineering in a pre-configured package. The system is configured to offer the free-rolling force and moment testing capability of the original MTS Flat-Trac Tire Test Systems. It has an electric roadway drive motor and the same multi-piece load cell package used by the Flat-Trac SS. Although it is designed to meet requests for standard free-rolling steady state force and moment tire tests, it is capable of performing slip angle sweep tests at modest rates. You can even use it for running simple roadway simulations.

Flat-Trac SS (Steady State) System
The Flat-Trac SS is designed for free-rolling steady state testing but is capable of delivering higher velocities than the Classic. It is ideal for tests that require high sensitivity and higher speeds, like low speed uniformity tests or effective rolling radius tests. It is used to acquire high-quality data for vehicle handling models and tire qualification on passenger car and many light truck tires. Moderate rate dynamic tests, such as sweep type force and moment tests are supported as well.
**Flat-Trac CT (Cornering and Traction) System**

The Flat-Trac CT Tire Test System is equipped with a powerful 2800 Nm spindle drive, which gives it the ability to perform tests that require driving or braking force in addition to free-rolling steady state tests. Its compact multi-axial load cell spindle assembly and detachable 2800 Nm spindle drive make the CT the most versatile Flat-Trac System available. The CT’s added power and spindle drive make it ideal for conducting tire tests that produce large lateral or longitudinal forces. The system is capable of testing passenger car tires at speeds of up to 250 km/h.

**Flat-Trac LTR Tire Testing System**

The Flat-Trac LTR offers the high force capability needed for characterizing light truck, SUV, and racing tires. This system is ideal for conducting tire tests that produce extremely large lateral or longitudinal forces. Originally configured with a powerful, 5000 Nm spindle drive for performing traction tests it can be fitted with a 10000 Nm spindle drive for those who need more torque. The LTR System lets you dynamically change tire attitudes and loads on a continuous flat road surface while simultaneously measuring tire-generated forces and moments. The system is capable of testing at speeds of up to 320 km/h for racing tires.
Our ongoing commitment to sensor technology, complex controls, and precision engineering enables us to match unique MTS technology to unique customer needs. For over 30 years, this commitment to advancing technology and attention to detail has made the Flat-Trac Tire Test System the gold standard for measuring tire handling properties.

1. A-Frame Tire Carriage
The robust A-frame tire carriage mounted on a stiff structure ensures extremely low deflections while applying steady state or dynamic loads to the test tire. The efficient geometry provides a base to deliver a wide range of slip angle and inclination angle movement about the tire centerline for precise tire motion simulation.

2. Radial Actuator
The tire spindle assembly is supported and positioned by a radial actuator mounted in the apex of the A-frame. The radial actuator’s piston rod guides the radial motion and allows the spindle to be steered for precise slip angle control using hydrostatic bearings. The bearings provide a stiff reaction base for large overturning moments while producing low friction to allow dynamic steer and radial motions.

3. Sensors, Spindle, and Strong Arm
Tire loads are measured with MTS engineered sensors that use strain gages to ensure the best steady state measurement and dynamic measurement capability. The SS uses a multi-component sensor system where each sensor is optimized to sense one component of force or moment with minimal crosstalk. The CT system uses a one-piece sensor system to minimize moving mass and provide high measurement bandwidth for dynamic testing. Its multi-axial design is multi-functional. By also serving as the spindle housing, it is integrated as close as possible to the tire to improve measurement accuracy. The cast strong arm provides a rigid connection between the radial actuator and the tire spindle and load cell assemblies.

4. Stainless Steel Roadway System
A revolving, continuous stainless steel belt with an abrasive surface coating provides a flat, simulated road surface. Active belt control enables the system to react the high lateral forces developed by the tire during force and moment testing. The roadway is designed to operate at high speed while minimizing slip angle error due to belt deflection and tracking control motion. Limit sensors monitor belt tension and belt position to make sure the system stays within acceptable limits during operation.
5. Hydrodynamic Water Bearing System
The flat belt test surface is tensioned around two drums. The tire load is supported by a hydrodynamic water bearing placed between the drums. In addition to supporting the tire vertical load, the bearing provides a large testing surface that is stiff and flat. Water flow, which is delivered by a temperature-controlled supply, removes the heat and provides the lubricant to minimize friction between the belt and bearing.

6. Drive Systems
Flat-Trac Classic and SS Systems designed for free-rolling testing use a DC motor to control roadway speed. Flat-Trac CT and LTR Systems use a regenerative hydraulic drive system with a secondary hydrostatic drive system to control the roadway speed and wheel torque or slip ratio. Regenerative capability optimizes the use of system power, which lowers your operating costs.

7. Tire Inflation Pressure System
Tire inflation pressure is servo controlled using an inflation pressure assembly mounted on the rear of the A-frame. Inflation pressure can be continuously controlled during a test, or can be inflated to the correct test pressure and capped, so the contained air pressure can be measured during the test.

8. Automated Control System
Provides the flexibility and productivity to be able to define and deploy both industry standard and unique automated tire tests with ease. Using a stand-alone Test Definition and Analysis PC, the operator can create Tire Test Definition (TTD) files or analyze test data without interrupting tests that are in process. Using the real-time control workstation the operator can make adjustments for controlling, tuning, configuring and calibrating the system, as well as selecting and controlling the execution of predefined automated tests.
Automated Digital Controls for Fast, Flexible Tire Testing

The Flat-Trac Digital Control System combines an intuitive graphical user interface with a complete range of built-in standardized tests, standard analysis templates and simple operating procedures to keep your operators running tests—not learning new software.

**Real-Time Control combines precision and productivity.**

The heart of the automated system is the Real-Time Control Interface. It is the primary human/machine interface to perform calibrations and execute and monitor tests in real-time. The operator selects tests, views and manages sensor signals, digital inputs, outputs, and limit detection status on the display monitor.

The actual real-time control of the tests is performed on dedicated processors for best performance. Advanced PID control loops are used to precisely control the machine. A variety of control modes are available, including: position, force, deflection, and delta-mean offset. For intuitive operation, the test is controlled in SAE coordinates rather than machine coordinates, but for data acquisition, the user may select from a number of different coordinate system groups including SAE, JASO and ISO. The controller automatically maintains control of the machine, detects abnormal conditions, acquires data, and displays the test status to the operator.

**Separate Test Definition and Analysis Workstation Frees the Real-Time Control System for Testing.**

A separate test definition and analysis PC lets the test engineer create tire test definition files and analyze test data offline, which keeps the real-time control interface workstation free to run the actual tests. Once the test definition software creates tests, they are automatically transferred to the real-time control workstation where they are put into the list of tests available to be run.

Tests are defined by specifying test procedures, tire descriptions, tire conditioning procedures, and data acquisition configurations. Test procedures can be defined to use inflation pressure and load information contained in the tire description so that a single procedure can be used for many different tires.

**Flexible Data Acquisition Parameters Optimize File Size and Acquisition Modes.**

The control system lets you select from a number of data acquisition modes including time sampled, time averaged, timed revolution, spindle-clocked over revolutions, and revolution averaged (time sampled or spindle clocked). The user may also adjust sample rate, channels to acquire, and digital filters. Channels can be selected from different coordinate system groups including SAE, JASO and ISO. Machine coordinate channels and command channels can also be selected.

Digital filters are specified in the data acquisition configuration for the IIR filter in the data acquisition process. The digital IIR filter set includes fifth order filters: Butterworth, Elliptic, Chebychev I or Chebychev II.

**Built-In Analysis and Reporting Software Put Your Test Results on the Fast Track.**

MTS provides a number of standard software tools that enable you and your team to efficiently and effectively work with the acquired data. Test data files can be imported into MTS Data Workshop, a Microsoft Excel based application, resident on the Test Definition and Analysis PC. Data Workshop is used to generate standard test reports and plots. These standard reports include: residual pull test analysis, force and moment test analysis, frequency response analysis, steady state analysis, cornering power analysis, and rolling resistance analysis. Data files also can be converted to a user-specified text file format and used in most third-party data analysis and reporting packages. Analysis can be run automatically as tests are completed.

Standard tire test analysis templates enable efficient and effective data handling and reporting.
Partial list of the standard tests currently available:

- Residual Pull
- Steady State Force and Moment
- Camber Thrust
- Cornering Power
- Slip Angle Sweep
- Drive Retard Torque
- Drive Retard Slip Ratio
- Slip Angle Frequency Test for sinusoidal slip angle testing
- Dynamic Residual Pull Test using sinusoidal slip angle motion
- Deflection Frequency Test for sinusoidal loaded radius testing
- End Level Tests for TIME, and others tests
- Rolling Resistance and Rolling Loss Tests consistent with SAE J1269.
- Coast Down Rolling Resistance Test Type consistent with SAE J2452 stepwise coast down methodology
Decades of Flat-Trac Tire Testing Experience

As the recognized leader in tire force and moment measurements, MTS has been designing, building, and integrating force transducers into tire test systems for over 30 years. Today, over 40 Flat-Trac Tire Testing Systems are in operation around the globe.

MTS introduced the first Flat-Trac Tire Testing System using its patented stainless steel, continuous belt technology for steady-state force and moment testing. Most of these systems are still in operation and many have been upgraded. The first systems featured speeds of up to 130 km/h and control in five degrees-of-freedom.

The Flat-Trac II introduced sweep testing and sinusoidal control of testing parameters plus a spindle drive capable of delivering 2000 Nm of wheel torque control. Other enhancements included increased speed slip angle and inclination angle capability. Digital control was introduced in the Flat-Trac II system along with a larger suite of test definition and analysis capability.

Flat-Trac III introduced a whole new generation of testing performance with its new digital control system, which greatly expanded the system’s testing, analysis and reporting capabilities.
MTS: Where Experience Drives Value

► Driving innovation by developing technologies that enable engineers to meet their most critical objectives – today and in the future.

► Driving high performance by leveraging decades of experience to deliver flexible, reliable, and accurate test systems that generate high quality data.

► Driving productivity by making continuous product improvements that shorten test cycles and speed time-to-market.

► Driving worldwide service by providing responsive service and support through local professionals and a global commitment to the testing industry.

Flat-Trac LTR expands operating range for trucks and motorsports.

Flat-Trac III family evolves Classic, SS, and CT.
MTS offers a wide range of accessories and custom solutions based on MTS patented Flat-Trac technology, which are designed to enhance the functionality of your full-vehicle testing systems.

**Flat-Trac Roadway for Dynamic Road Handling Testing**

Combine four flat belt roadways with the ability to travel up to 250 km/h, steer and provide vertical excitation, with a robot driver, an active restraint system, and a host of transducers, and you have a system that is able to accurately measure values that once were considered immeasurable. Perform a J-turn at 60 km/h and examine the dynamic forces at the center-of-gravity and at each of the tire patches; drive in a perfect circle and gradually increase the speed until the vehicle breaks away. This system is the ultimate measurement tool.

**Flat-Trac Roadway for Dynamic Road Handling Testing on Large Vehicles**

A Flat-Trac roadway system designed to test the performance and durability of large trucks and trailers. The simulator enables more exhaustive and reliable tests with the benefits offered by a laboratory environment than any other current technology. Current designs are capable of handling vehicles weighing up to 36 tons.

**Flat-Trac 5-Belt For Aerodynamic Testing**

The Flat-Trac 5-Belt Roadway uses four roadways like the Flat-Trac Roadway, but adds a fifth roadway that extends the length of the vehicle at the center of the test system to simulate the aerodynamic conditions experienced on the highway.
Flat-Trac Rolling Road for Aerodynamic Motorsport Testing

Introduced for motorsports applications and now being applied in passenger car applications, the Flat-Trac Rolling Road is designed to accurately simulate aerodynamic conditions underneath automotive models in wind tunnels, as well as for model positioning and precision force measurement. The wide rotating steel belt reaches the same velocity as the air stream, which can be up to 300 km/h. Load cells positioned underneath the moving belt measure wheel lift and down force during tests.

Flat-Trac Dynamic Roadway for Ride and Comfort Analysis Testing

Designed around a traditional four-poster testing setup, the Flat-Trac Dynamic Roadway adds the flat roadway surfaces and two-axis vibration that is necessary for comfort analysis. Other testing applications include fuel economy, rolling resistance, power train performance and suspension tuning.
Kinematic and Compliance Deflection Measurement Systems

The MTS K&C System measures the kinematic and compliance deflections of a vehicle's suspension to provide the information suspension designers need to achieve their handling objectives - faster. The K&C System applies precisely controlled displacements and forces to a vehicle's tires through four independent loading platforms while holding the body fixed. The resulting wheel displacements are measured with a six-axis wheel motion sensor and the forces produced at each wheel are measured with a six-axis load cell.

MTS K&C Systems are available to measure both static and dynamic kinematic and compliance deflection properties. A flexible control system and advance software tools let you program the sequencing of events, data report formats, and the user interface, all in a high-level language.

Capabilities include:
- Transient maneuver decomposition
- Frequency response
- Dynamic deflection
- Static deflection
- Inertia properties
**Tire Rolling Resistance Measurement System**

The MTS Tire Rolling Resistance Measurement System is designed to meet all requirements of SAE Rolling Resistance Standard J1269, as well as other industry standard ISO and SAE rolling resistance tests. The system's advanced control system is easy to use, more productive and more flexible than any competing system on the market today. This precision assembly is capable of measuring the tire's drag force with a unique biaxial force transducer that is accurate to within 0.5N.

**Capabilities include:**
- Accurate replication of road load profiles including radial force, lateral force, driving/braking torque, inclination, and velocity.
- Ability to control the test machine in lateral force control using the slip angle motion.
- Radial loads can be varied to simulate road inputs and weight transfer during maneuvers.
- Inclination angle can be varied relative to the roadwheel.
- Wheel braking and driving torque can be varied to simulate engine and brake inputs.

**Other capabilities include:**
- Precision tire displacement geometries supported by a stiff, robust test frame to assure accuracy and repeatability.
- Suitable for use with a wide range of passenger car and truck tires.
- Digital electronic test controller with intuitive operator interface for easy, flexible set-up and testing using pre-defined automated or manual test procedures.
Just-In-Time Support Around the Clock and Around the Globe

With reduced development cycles and innovative design requirements, you need to maximize the efficiency and effectiveness of your tire testing efforts. MTS has the expertise and the resources to understand your challenges and complement your skills wherever you need them. We are capable of providing daily or weekly consulting to meet your immediate needs, or we can provide engineering studies, comprehensive training, and development programs to address longer-term concerns.

We can tie your global operations together with one technology and one support organization.

We can help you tie your global operations together by helping you transfer your testing knowledge to new plants and R&D labs throughout the world. MTS is the one tire testing equipment company that has the breadth and depth to meet all of your global needs.

MTS has service and support offices on 6 continents and in over 50 countries for fast delivery of service and parts.

Our equipment service offerings are designed to maximize uptime and keep your lab running productively. MTS field service engineers are strategically located to give you the fast response time you need.

Services include:
- Calibration and verification services to ensure reliable test results.
- Preventive maintenance to minimize downtime.
- Scheduled and emergency repair services to bring your testing systems back up and running in the event of a failure.
- A worldwide parts distribution network that can supply the parts you need when you need them.

MTS fields the largest service support and consulting staff of any automotive testing solution provider.

We have the field support and consulting staff to meet your needs no matter where your facilities are. We can help you with troubleshooting, upgrading software, installing replacement parts, or just helping get the job done. Whatever you need, our experienced support engineers will help you keep your lab running smoothly.

Complete engineering support, knowledge transfer, and customer training whenever and wherever you need us.

All MTS training courses are designed to help you maximize the productivity and lifetime of your test system investment. The courses provide an opportunity for hands-on learning to ensure that you are familiar with every aspect of your test system. Our training courses cover systems and software operation and maintenance, testing principles, methodologies, and applications.

MTS provides in-depth, focused training on the operation and maintenance of your testing equipment at your site or at a convenient MTS location.
MTS offers complete calibration services required for the consistent, verifiable results your testing procedures demand.

The MTS Service Agreements save you time and money.

Software and electronics technologies continue to change rapidly in our industry. This can create many challenges when trying to keep systems current and compatible with evolving PC technology, while meeting increasing workload demand. MTS offers service agreements that make it easy and cost-effective to maintain and enhance your systems with the assurance that experience MTS technical support is waiting to help.

Our Service Agreements include:

- Periodic software updates
- Easier budgeting with fixed costs
- Preferential technical assistance at no additional cost
- Locked in support costs
- Multiple system support discounts

For More Information

Contact your MTS field sales engineer for more information. You can also write, call, FAX, or e-mail, MTS at the addresses on the back page.
### Basic Specifications and Comparison Chart

<table>
<thead>
<tr>
<th></th>
<th>Classic</th>
<th>SS</th>
<th>CT</th>
<th>CT_{wc}</th>
<th>LTR 320-5000</th>
<th>LTR 320-10000</th>
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<td><strong>Tire Size Capabilities</strong></td>
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<td>Wheel Torque or Traction Tests</td>
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<td>Rolling Resistance Testing</td>
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<td><strong>Performance Capabilities</strong></td>
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<td>Speed (km/h)</td>
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<td>Slip Angle (deg)</td>
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<td>Sweep Rate – SA &amp; RL (deg/sec &amp; mm/s)</td>
<td>&lt;10 &amp; &lt;25</td>
<td>15 &amp; 75</td>
<td>50 &amp; 300</td>
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<td>Sinusoidal Control Frequency Range (Hz)</td>
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<td>&gt;200</td>
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<td>Inertial Compensation</td>
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1 MTS Flat-Trac Tire Test Systems for force and moment testing do not meet ISO or SAE accuracy requirements for rolling resistance (RR). MTS recommends a dedicated MTS RR machine to meet ISO and SAE RR recommended practice.

2 Uniformity analysis software is not included. MTS recommends a dedicated uniformity measurement system for customers that want maximum uniformity measurement performance.
<table>
<thead>
<tr>
<th>Data Acquisition Capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Acquisition Modes</td>
</tr>
<tr>
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</tr>
<tr>
<td>Spindle Clock Data Acquisition</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drive System Capabilities</th>
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<tbody>
<tr>
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<tr>
<td>Spindle Drive</td>
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</table>

<table>
<thead>
<tr>
<th>Engineering and Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customizable with Options</td>
</tr>
<tr>
<td>Project Review Meeting</td>
</tr>
<tr>
<td>Performance Verification Report</td>
</tr>
<tr>
<td>Acceptance Test Plan</td>
</tr>
<tr>
<td>Pre-shipment Customer Visit</td>
</tr>
</tbody>
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<tr>
<th>Training</th>
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3 The CT load cell configuration has better durability for horizontal force overloads than the CT$_{wc}$ configuration. Consult MTS for further details.

4 Operation and routine maintenance training occurs on-site during installation.

5 Preshipment training includes all operation training. Installation training is a refresher on operation training plus routine maintenance training.