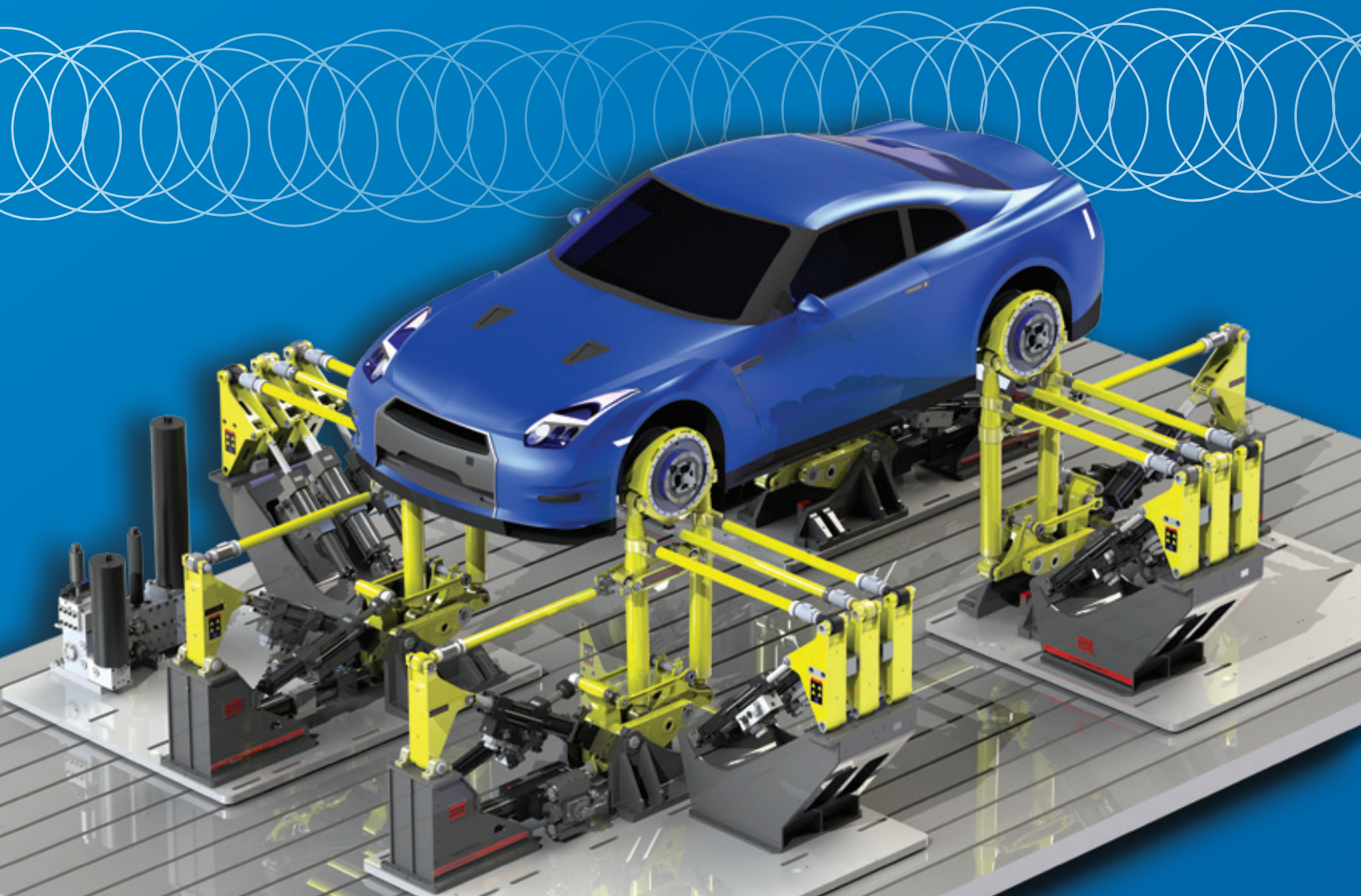
MTS SWIFT® Evo

Spinning Wheel Integrated Force Transducer

SINCE THE INTRODUCTION OF THE **SWIFT**, THIS SYSTEM HAS BEEN EMPLOYED IN DEVELOPMENT PROGRAMS OF MANY OF THE WORLD'S VEHICLE MAKERS, AS WELL AS THEIR SUPPLIERS. OVER 800 LEGACY SWIFT UNITS ARE IN USE ON THE MOST DEMANDING PROVING GROUNDS. WITH A STRONG MTS GLOBAL TEAM OF EXPERTS WE CAN SIMPLIFY YOUR TESTING WITH SERVICE FOR THESE LEGACY UNITS, CALIBRATION OF NEW AND LEGACY PRODUCTS, MAKING SWIFT EVO THE BEST CHOICE FOR BOTH ROAD AND ROAD SIMULATOR APPLICATIONS.



Evolving Technology

SWIFT Evo technology provides superior, high quality measurements using an innovative 1-piece design that results in a high sensitivity wheel force transducer with excellent linear behavior and high overload capacity. The SWIFT Evo series has evolved with improved specifications, additional electronic data information, and a new Graphical User Interface.

The SWIFT Evo is tested to SAE J267 and J328 requirements*, assuring a long expected life period when properly maintained. The one-piece construction and MTS' patented flexure isolation reduce cross coupling and increases sensitivity for resolution of very small forces and moments.

Save Time & Money

Streamline your tests and save time on the proving ground or in the lab on a simulation rig. The ease of installation and inherent reliability of the rugged structure of the SWIFT Evo transducer, coupled with a new Graphical User Interface and Transducer Electronic Data Sheet (TEDS), which contains the critical calibration data, allows data to be delivered to your design team or test lab in hours, rather than days. Financial investment in SWIFT Evo technology can be recouped in as little as three vehicle data acquisition programs.

APPLICATIONS:

- Road load data acquisition
- Laboratory simulation such as spindle coupled road simulation and other systems
- Tire tread wear and characterization testing
- Dynamic suspension characteristics measurements
- Supporting vehicle analysis needs such as computer model verification and NVH study

The one-piece design of the SWIFT Evo transducer is machined of high-strength aluminum, titanium or stainless steel with eight fully active bridges. All SWIFT Evo transducers use this efficient and robust design and construction approach. Advantages include:

» Stiff outer ring and flexure beam isolation – Results in a design that is insensitive to stiffness variation in mating with rims and road simulator fixtures. **Overall, an easier transducer design to use and work with.**

» One piece design, no bolted joints – Avoids micro slippage which can occur in bolted joints which is the largest contributor to hysteresis. Also enables efficient heat transfer across the structure minimizing temperature differentials in gaged areas. **A transducer that has excellent hysteresis performance and minimizes thermal impact.**

» Patented flexure isolation structure – Decouples the six components of measurement to reduce cross-coupling between measured axes, increases the sensitivity and reduces thermal response. **A transducer that has excellent accuracy.**

» Efficient mechanical design – Requires minimal gages in the structure improving reliability and robustness. **A transducer that has been proven to be robust and one that customers can rely on for many years to come.**

» Digital output available in CAN2.0A / CAN2.0B format.

Aluminum versions are engineered for road load data acquisition applications. A titanium or steel version may be preferred in applications where higher loads are necessary, or where challenging high cycle durability requirements are anticipated. Performance specifications for all models and versions are located in the back of this brochure.

Since the SWIFT Evo transducer is adaptable to many wheel sizes and vehicle spindle configurations, one set of transducers can be used on a wide range of vehicles. Each version of the SWIFT Evo transducer provides high load capacity, as well as outstanding durability and accuracy. The universal application and flexibility of the SWIFT Evo transducer saves you time in your testing setup and changeover, in addition to having a range of sizes to meet all your testing needs.

SWIFT Evo Tire Assembly

Ease of Installation

The SWIFT Evo transducer design was engineered for easy installation. It can be installed, connected, and ready for operation in just a few hours, saving time and effort versus traditional methods. MTS will custom design these components to meet your exact installation requirements while keeping differential weight at a minimum.

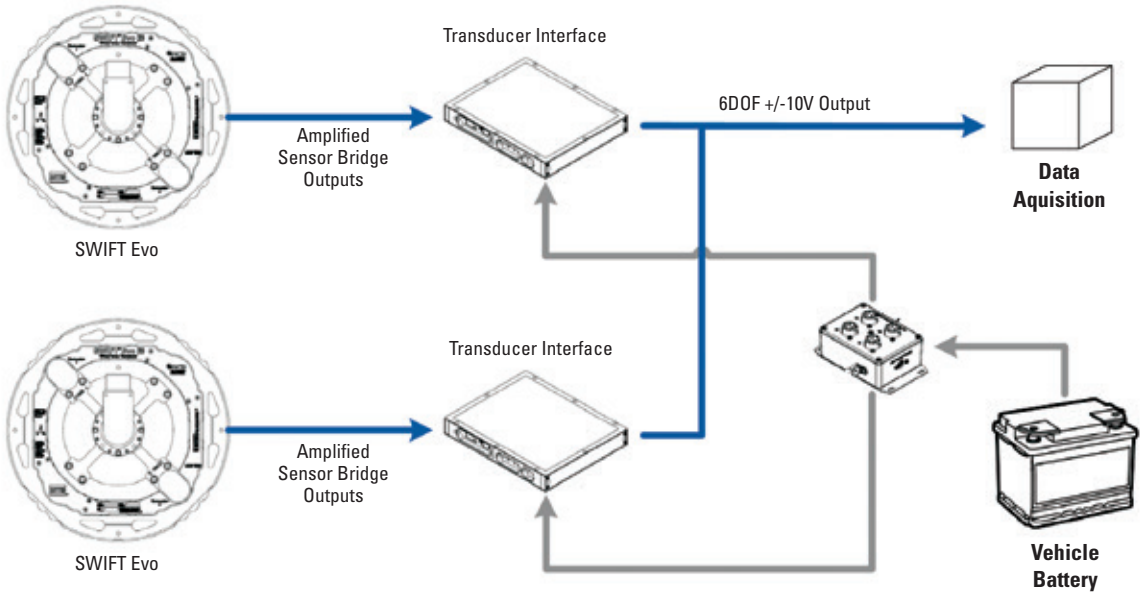




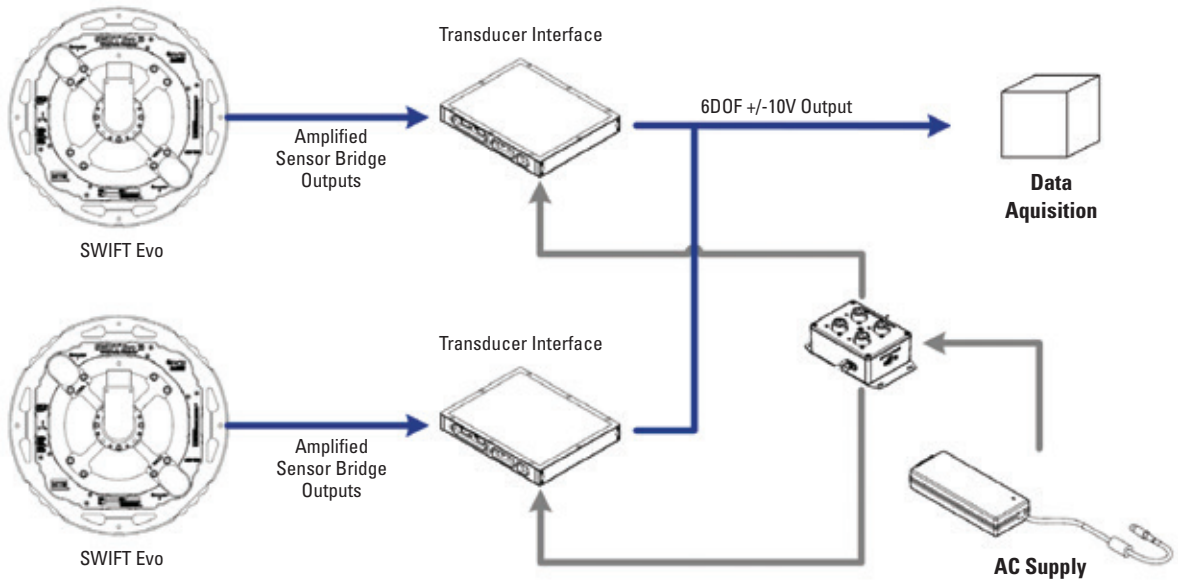


When using a SWIFT Evo sensor on a moving vehicle, the strain gage bridges within the transducer measure components of forces and moments, while an angular position transducer measures the relative position of the sensing bridges relative to the vehicle body. Analog electronics onboard the transducer condition the strain gage bridges to an amplitude level that permits low noise signal transmission.

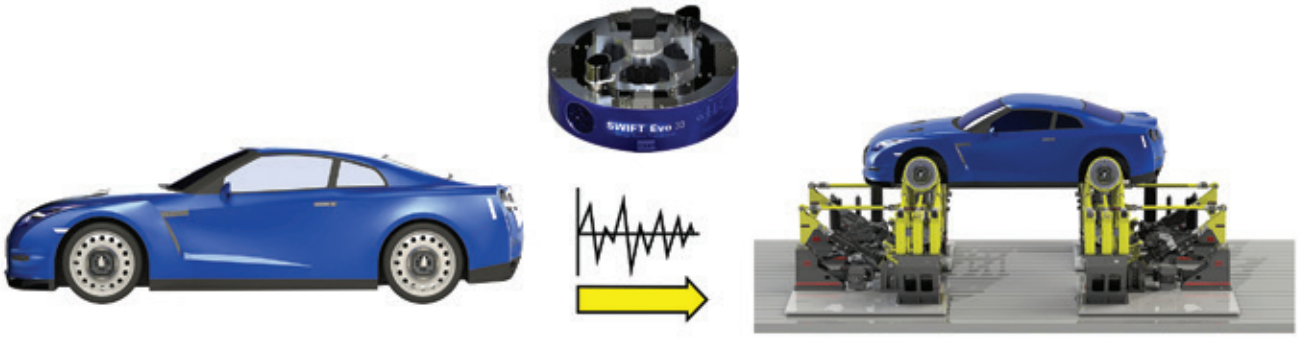
This approach maximizes the signal-to-noise ratio of the data while the SWIFT Evo design provides you with high quality data, signal integrity, and superior synchronicity. The output from the Evo TI (Transducer Interface) is an analog high-level signal suitable for input to a multi-channel data acquisition system. The Evo TI (Transducer Interface) performs geometric strain bridge summation, cross-talk compensation and coordinate transformation to give outputs in the six loading axes in stationary vehicle coordinates.

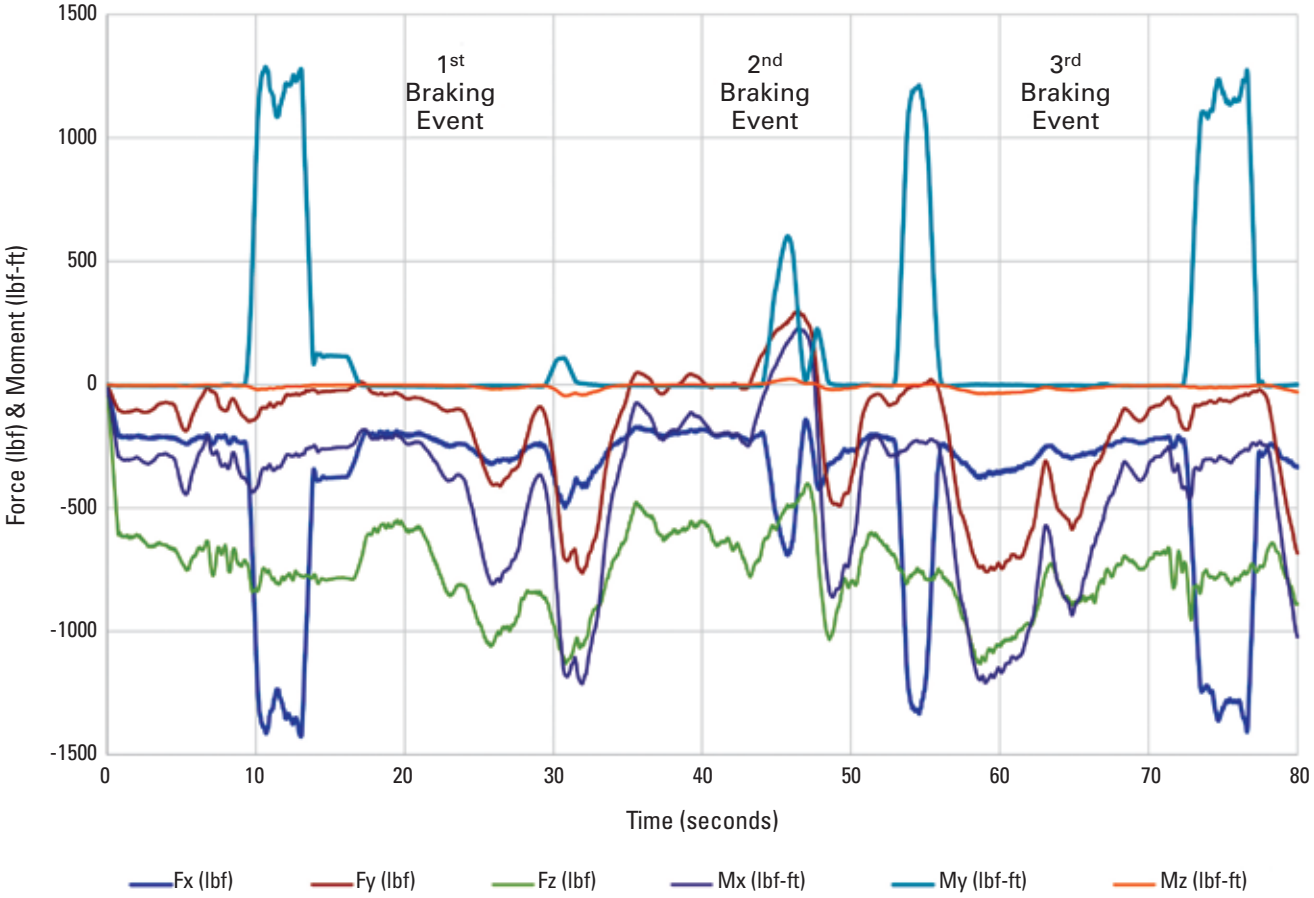


Road Load Data Acquisition Configuration



Durability Rig Data Acquisition Configuration





Shown above is actual spindle load data taken with a SWIFT Evo sensor from heavy braking events.

The SWIFT Evo transducer measurement system employs the Evo TI to transform the measured wheel data to true spindle loads in real time. This maintains the accuracy of the measured loads while avoiding phase distortion and high noise levels. Enhanced performance is especially apparent at lower amplitudes and higher frequencies, allowing the accurate measurement of the loads critical for NVH or tirecharacterization studies.

THE MEASURED PARAMETERS ARE:

- Longitudinal force (Fx)
- Lateral force (Fy)
- Vertical force (Fz)
- Overturning moment (Mx)
- Driving/braking moment (My)
- Steering moment (Mz)
- Wheel rotational position

One Transducer Multiple Wheel Sizes

The SWIFT Evo transducer design simply and inexpensively adapts to a wide variety of wheel rim and hub configurations while maintaining an overall mass comparable to the standard wheel. With four sizes available, you can employ the SWIFT Evo transducer on a wide range of vehicles. Four standard sizes of SWIFT Evo transducers are available, covering a broad range of testing requirements.

Four standard sizes of SWIFT Evo transducers are available, covering a broad range of testing requirements:

- SWIFT Evo 10 for motorcycles, ATVs, and small vehicles
- SWIFT Evo 20 for small cars and high performance cars
- SWIFT Evo 30 for medium and large passenger cars and minivans
- SWIFT Evo 40 transducer for light trucks and sport-utility vehicles (SUVs)

The SWIFT Evo 10/20/30/40 transducers are available in aluminum and titanium versions. The SWIFT Evo 45 transducer is available in titanium only. Performance specifications are available in the back of this brochure. Additionally, MTS can design and manufacture custom rim and hub adapters to meet the installation requirements. Please contact MTS for more information on these applications.

SWIFT Evo 10

SWIFT Evo 20

SWIFT Evo 30

SWIFT Evo 40

Determining the Correct Model

To determine the correct SWIFT Evo transducer for your application, take the axle weight for the axle the SWIFT Evo is to be mounted on, and divide by two for the half axle weight. Select a SWIFT Evo for which the SAE rating table (below) meets or exceeds the half axle weight of the application. This will give the approximate load on the rim. All sensors have passed the SAE J267 or J328 specifications for rim design*. See the chart below and consult with MTS to determine the exact SWIFT Evo model needed for your applications.

Model	Material	Transducer Weight	
SWIFT Evo 10	Al	1.2 kg (1.7 lbs)	250 kg (550 lbs)
SWIFT Evo 10	Ti	1.9 kg (3.2 lbs)	420 kg (920 lbs)
SWIFT Evo 20	Al	3.1 kg (6.8 lbs)	438 kg (965 lbs)
SWIFT Evo 20	Ti	4.8 kg (10.6 lbs)	717 kg (1,580 lbs)
SWIFT Evo 30	Al	4.3 kg (9.4 lbs)	662 kg (1,460 lbs)
SWIFT Evo 30	Ti	6.3 kg (13.9 lbs)	1,089 kg (2,400 lbs)
SWIFT Evo 40	Al	8.5 kg (18.8 lbs)	1,225 kg (2,700 lbs)
SWIFT Evo40	Ti	12.4 kg (27.3 lbs)	2,313 kg (5,100 lbs)

0 1500 3000 4500 6000 7500 9000

** See specifications for complete information in English and Metric units.*

Half Axle Durability Rating (kg)*

Training

Technicians are available to assist with your setup of SWIFT Evo transducers. In addition, we can offer a SWIFT Evo training program that is designed to improve technician efficiency and maximize system performance. Expertly led training courses provide hands-on learning to make sure your technicians are thoroughly familiar with the SWIFT Evo system and know how to operate it properly.

Consulting

MTS offers a complete set of professional engineering services including test consulting. MTS experts will listen to your test objectives, analyze your situation, and create an action plan to specific system requirements. We can provide test designs, data collection, and results analysis, as well as help you develop long-range lab plans that support your testing goals.

Warranty

MTS builds some of the most rugged and reliable testing equipment on the market. MTS warrants its equipment to be free from defects in material and workmanship under normal use, given proper installation and maintenance, for 24 months from the date of shipment. Defective equipment may be repaired or replaced at our option. Visit www.mts.com to see full details of our limited warranty.

SWIFT Evo units are subject to a highly refined, automated process that calibrates the entire transducer assembly, cycling through each channel while simultaneously exciting all other channels.

Calibration

Test labs must calibrate their testing equipment to help ensure data accuracy. SWIFT Evo transducers are calibrated at the MTS Metrology and Calibration Laboratory. This lab provides top-quality, quick turn-around calibration services for hundreds of SWIFT transducers per year and is accredited by the American Association for Laboratory Accreditation (A2LA Certificate Number 1044.1) to perform calibration in electrical, mechanical, dimensional, time/frequency, temperature/humidity, and vibration. **The basis for this accreditation is the international standard for calibration laboratories, ISO/IEC 17025 "General Requirements for the Competence of Calibration and Testing Laboratories" and ANSI/NCSL Z540-1.** Contact us to schedule a calibration of your SWIFT or SWIFT Evo transducer.

Repair

Making sure that equipment is ready for use when needed and test projects are completed on-time without unexpected breakdowns are important aspects of test lab management. But unexpected breakdowns occur. Whether it is a minor repair, or your transducer has serious damage, we can meet your service needs to get the unit repaired and back to your test laboratory quickly.

Technical Support

Support and assistance in answering technical questions that you may encounter with your SWIFT Evo system is available by calling 1-952-937-4000 or 1-800-328-2255.

SWIFT Evo Highlights

- One piece design with high natural frequency
- Improved accuracy with crosstalk, hysteresis, and nonlinearity
- Insensitive to variations in stiffness among wheel rims and road simulator fixtures
- Proven durability with over 800 units sold
- IP67 rated
- World-wide support & service
- 2 year warranty
- New Graphical User Interface
- TEDS addition
- MTS Metrology and Calibration Lab is an ISO/IEC 17025:2017 Accredited Laboratory (by A2LA, an accreditation body), for all SWIFT Evo disciplines
- Digital output available in CAN2.0A / CAN2.0B format

"The swift evo continues the long tradition of the legendary swift product line with engineering enhancements made to make the product even more accurate, easier to use and with the same durability major auto manufacturers worldwide have come to expect from mts"

- Rick Meyer,
  Chief Engineer,
  Custom Transducers

SWIFT Evo 10 Motorcycle/ATV Specifications

Measured Value		Units	Aluminum SWIFT Evo 10A	Titanium SWIFT Evo 10T
Maximum Calibrated Load Ratings:				
Fx		kN (lb)	12 (2,643)	20 (4,400)
Fy		kN (lb)	7 (1,540)	12 (2,640)
Fz		kN (lb)	12 (2,643)	20 (4,400)
Mx		kN-m (lb-ft)	1.6 (1,180)	3 (2,235)
My		kN-m (lb-ft)	2.2 (1,612)	3.5 (2,565)
Mz		kN-m (lb-ft)	1.6 (1,180)	3 (2,235)
Noise Level Peak to Peak (0-500 Hz)		N	4	6
Maximum Usable RPM		RPM	2400*	2400*
Maximum Operating Temperature (measured at the spindle hub)		°C (°F)	125 (257)	125 (257)
Shock Resistance; Each Axis		G	60	60
SWIFT Evo Environmental Protection Rating		IP67		
Input Voltage Required		VDC	10-28	
Input Power Required per Transducer		W	6	
Output Voltage Full Scale Calibrated Load		VDC	±10	
SAE Bending Moment Seen on Cell		kN-m (lb-ft)	1.45 (1,072)	4.76 (3507)
			Specification % (Typical Performance %**)	
Nonlinearity	Force	%FS	0.4 (0.2)	0.4 (0.2)
	Moment	%FS	0.7 (0.2)	0.7 (0.2)
Hysteresis	Force	%FS	0.2 (0.2)	0.2 (0.2)
	Moment	%FS	0.5 (0.2)	0.5 (0.2)
Crosstalk	Fy → Fx,Fz	%FS	0.6 (0.2)	0.6 (0.2)
	Fx ←→ Fz	%FS	0.6 (0.2)	0.6 (0.2)
	Fx,Fz → Fy	%FS	0.5 (0.2)	0.5 (0.2)
Assembly Information:				
Transducer		kg (lb)	1.2 (2.7)	1.9 (4.2)
Minimum Rim Size		mm (in)	177.8 (7)	177.8 (7)
Typical Lug Nut Bolt Circle Accommodated		mm	All	
Output Connector Type			BNC	
Auto Shunt Calibration			On Vehicle or Test Rig	

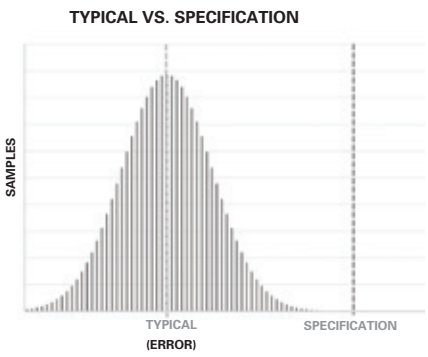
*3000 rpm for tests lasting less than 30 minutes and 200 mph cooling air.

** "Typical Performance" listed is better than or equal to the median historical performance level.

Notes:

- Based on loads at the center of the transducer.
- Each SWIFT Evo transducer will be calibrated on an MTS calibration machine. MTS provides complete documentation of calibration values by serial number for each SWIFT Evo unit. Unique calibration values are stored electronically and transferred to the transducer interface box (Evo TI box) shipped with each SWIFT Evo system.
- Periodic recalibration services can be provided by MTS.
- MTS can manufacture rims designed in accordance with SAE J328 criteria.
- Proper rim design is essential for optimum performance.

Specifications are subject to change without notice.



SWIFT Evo 20 Small Car Specifications

Measured Value		Units	Aluminum SWIFT Evo 20A	Titanium SWIFT Evo 20T
Maximum Calibrated Load Ratings:				
Fx		kN (lb)	21 (4,721)	30 (6,744)
Fy		kN (lb)	16 (3,597)	25 (5,620)
Fz		kN (lb)	21 (4,721)	30 (6,744)
Mx		kN-m (lb-ft)	4 (2,950)	6 (4,425)
My		kN-m (lb-ft)	5 (3,687)	8.5 (6,269)
Mz		kN-m (lb-ft)	4 (2,950)	6 (4,425)
Noise Level Peak to Peak (0-500 Hz)		N	4	6
Maximum Usable RPM		RPM	2400*	2400*
Maximum Operating Temperature (measured at the spindle hub)		°C (°F)	125 (257)	125 (257)
Shock Resistance; Each Axis		G	60	60
SWIFT Evo Environmental Protection Rating		IP67		
Input Voltage Required		VDC	10-28	
Input Power Required per Transducer		W	6	
Output Voltage Full Scale Calibrated Load		VDC	±10	
SAE J328 Half Axle Rating		kg (lb)	438 (965)	717 (1,580)
SAE Bending Moment Seen on Cell		kN-m (lb-ft)	3.1 (2,305)	4.5 (3,292)
			Specification % (Typical Performance %**)	
Nonlinearity	Force	%FS	0.3 (0.15)	0.3 (0.15)
	Moment	%FS	0.5 (0.2)	0.5 (0.2)
Hysteresis	Force	%FS	0.2 (0.1)	0.2 (0.1)
	Moment	%FS	0.3 (0.2)	0.3 (0.2)
Crosstalk	Fy → Fx,Fz	%FS	0.4 (0.25)	0.4 (0.25)
	Fx ←→ Fz	%FS	0.5 (0.25)	0.5 (0.25)
	Fx,Fz → Fy	%FS	0.5 (0.3)	0.5 (0.3)
Assembly Information:				
Transducer		kg (lb)	3.1 (6.8)	4.8 (10.6)
Minimum Rim Size		mm (in)	304.8 (12)	304.8 (12)
Typical Lug Nut Bolt Circle Accommodated		mm	Up to 120	
Output Connector Type			BNC	
Auto Shunt Calibration			On Vehicle or Test Rig	
Modal Properties: Frequency				
With Tire & Rim	Mx, My	Hz	325	
	Fy	Hz	610	
Without Tire & Rim	Mx, My	Hz	980	
	Fy	Hz	1,575	

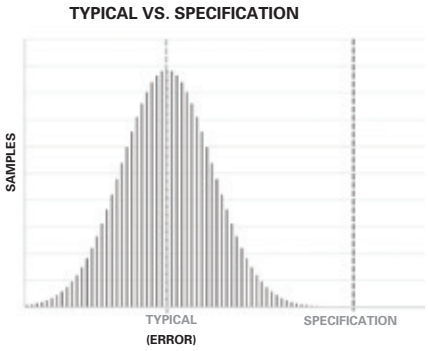
*3000 rpm for tests lasting less than 30 minutes and 200 mph cooling air.

** "Typical Performance" listed is better than or equal to the median historical performance level.

Notes:

- Based on loads at the center of the transducer.
- Each SWIFT Evo transducer will be calibrated on an MTS calibration machine. MTS provides complete documentation of calibration values by serial number for each SWIFT Evo unit. Unique calibration values are stored -electronically and transferred to the transducer interface box (Evo TI box) shipped with each SWIFT Evo system.
- Periodic recalibration services can be provided by MTS.
- MTS can manufacture rims designed in accordance with SAE J328 criteria.
- Proper rim design is essential for optimum performance.

Specifications are subject to change without notice.



SWIFT Evo 30 Passenger Car Specifications

Measured Value		Units	Aluminum SWIFT Evo 30A	Titanium SWIFT Evo 30T
Maximum Calibrated Load Ratings:				
Fx		kN (lb)	28 (6,295)	50 (11,240)
Fy		kN (lb)	23 (5,171)	40 (8,992)
Fz		kN (lb)	28 (6,295)	50 (11,240)
Mx		kN-m (lb-ft)	5 (3,688)	9 (6,638)
My		kN-m (lb-ft)	7.5 (5,532)	13 (9,588)
Mz		kN-m (lb-ft)	5 (3,688)	9 (6,638)
Noise Level Peak to Peak (0-500 Hz)		N	3	5
Maximum Usable RPM		RPM	2400*	2400*
Maximum Operating Temperature (measured at the spindle hub)		°C (°F)	125 (257)	125 (257)
Shock Resistance; Each Axis		G	60	60
SWIFT Evo Environmental Protection Rating		IP67		
Input Voltage Required		VDC	10-28	
Input Power Required per Transducer		W	6	
Output Voltage Full Scale Calibrated Load		VDC	±10	
SAE J328 Half Axle Rating		kg (lb)	662 (1,460)	1,089 (2,400)
SAE Bending Moment Seen on Cell		kN-m (lb-ft)	4.8 (3,544)	8.0 (5,893)
			Specification % (Typical Performance %**)	
Nonlinearity	Force	%FS	0.2 (0.15)	0.2 (0.15)
	Moment	%FS	0.3 (0.2)	0.3 (0.2)
Hysteresis	Force	%FS	0.2 (0.1)	0.2 (0.1)
	Moment	%FS	0.3 (0.2)	0.3 (0.2)
Crosstalk	Fy → Fx,Fz	%FS	0.25 (0.2)	0.25 (0.2)
	Fx ←→ Fz	%FS	0.3 (0.2)	0.3 (0.2)
	Fx,Fz → Fy	%FS	0.4 (0.2)	0.4 (0.2)
Assembly Information:				
Transducer		kg (lb)	4.3 (9.4)	6.3 (13.9)
Minimum Rim Size		mm (in)	330.2 (13)	330.2 (13)
Typical Lug Nut Bolt Circle Accommodated		mm	Up to 120	
Output Connector Type			BNC	
Auto Shunt Calibration			On Vehicle or Test Rig	
Modal Properties: Frequency				
With Tire & Rim	Mx, My	Hz	385	425
	Fy	Hz	675	765
Without Tire & Rim	Mx, My	Hz	845	810
	Fy	Hz	1,255	1,445

*3000 rpm for tests lasting less than 30 minutes and 200 mph cooling air.

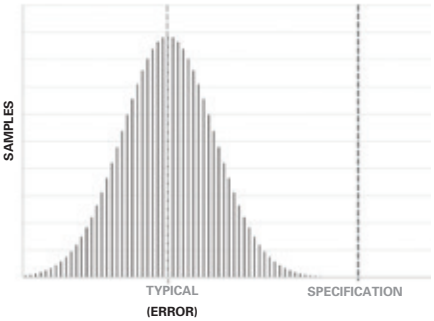
** "Typical Performance" listed is better than or equal to the median historical performance level.

Notes:

- Based on loads at the center of the transducer.
- Each SWIFT Evo transducer will be calibrated on an MTS calibration machine. MTS provides complete documentation of calibration values by serial number for each SWIFT Evo unit. Unique calibration values are stored -electronically and transferred to the transducer interface box (Evo TI box) shipped with each SWIFT Evo system.
- Periodic recalibration services can be provided by MTS.
- MTS can manufacture rims designed in accordance with SAE J328 criteria. Proper rim design is essential for optimum performance.

Specifications are subject to change without notice.

TYPICAL VS. SPECIFICATION



SWIFT Evo 40 Light truck Specifications

Measured Value		Units	Aluminum SWIFT Evo 40A	Titanium SWIFT Evo 40T
Maximum Calibrated Load Ratings:				
Fx		kN (lb)	40 (8,992)	60 (13,489)
Fy		kN (lb)	30 (6,744)	45 (10,116)
Fz		kN (lb)	40 (8,992)	60 (13,489)
Mx		kN-m (lb-ft)	9 (6,638)	15 (11,063)
My		kN-m (lb-ft)	13 (9,588)	20 (14,751)
Mz		kN-m (lb-ft)	9 (6,638)	15 (11,063)
Noise Level Peak to Peak (0-500 Hz)		N	4	6
Maximum Usable RPM		RPM	2400*	2400*
Maximum Operating Temperature (measured at the spindle hub)		°C (°F)	125 (257)	125 (257)
Shock Resistance; Each Axis		G	60	60
SWIFT Evo Environmental Protection Rating		IP67		
Input Voltage Required		VDC	10-28	
Input Power Required per Transducer		W	6	
Output Voltage Full Scale Calibrated Load		VDC	±10	
SAE J328 Half Axle Rating		kg (lb)	1,225 (2,700)	2,313 (5,100)
SAE Bending Moment Seen on Cell		kN-m (lb-ft)	9.5 (6,977)	15.5 (11,466)
			Specification % (Typical Performance %**)	
Nonlinearity	Force	%FS	0.3 (0.15)	0.3 (0.15)
	Moment	%FS	0.5 (0.2)	0.5 (0.2)
Hysteresis	Force	%FS	0.2 (0.1)	0.2 (0.1)
	Moment	%FS	0.3 (0.2)	0.5 (0.2)
Crosstalk	Fy → Fx,Fz	%FS	0.2 (0.2)	0.2 (0.2)
	Fx ←→ Fz	%FS	0.3 (0.2)	0.3 (0.2)
	Fx,Fz → Fy	%FS	0.25 (0.2)	0.25 (0.2)
Assembly Information:				
Transducer		kg (lb)	8.5 (18.8)	12.4 (27.3)
Minimum Rim Size		mm (in)	381 (15)	381 (15)
Typical Lug Nut Bolt Circle Accommodated		mm	Up to 170	
Output Connector Type			BNC	
Auto Shunt Calibration			On Vehicle or Test Rig	
Modal Properties: Frequency				
With Tire & Rim	Mx, My	Hz	470	480
	Fy	Hz	740	770
Without Tire & Rim	Mx, My	Hz	810	775
	Fy	Hz	1,490	1,570

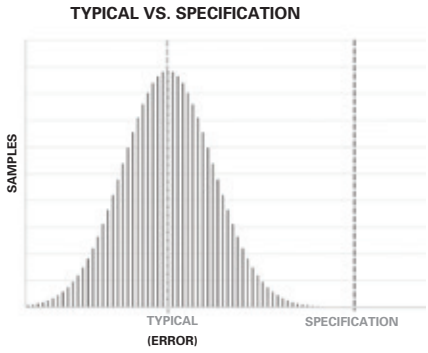
*3000 rpm for tests lasting less than 30 minutes and 200 mph cooling air.

** "Typical Performance" listed is better than or equal to the median historical performance level.

Notes:

- Based on loads at the center of the transducer.
- Each SWIFT Evo transducer will be calibrated on an MTS calibration machine. MTS provides complete documentation of calibration values by serial number for each SWIFT Evo unit. Unique calibration values are stored electronically and transferred to the transducer interface box (Evo TI box) shipped with each SWIFT Evo system.
- Periodic recalibration services can be provided by MTS.
- MTS can manufacture rims designed in accordance with SAE J328 criteria.
- Proper rim design is essential for optimum performance.

Specifications are subject to change without notice.



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100-641-165a SWIFT Evo • Printed in U.S.A. • 08/23