

# Tire Footprint Pressur

Tire Footprint Pressure Mapping System

The TireScan<sup>™</sup> system is a unique tool used to capture static or dynamic tire footprint patterns using a tactile pressure sensor. The system's tailored graphing and image analysis software enables quantitative and qualitative evaluation of tire behavior.

#### TireScan System Configurations

- CrossDrive Systems
- VersaTek<sup>®</sup> Systems
  - Passenger, Bus & Small Truck
- VersaTek<sup>®</sup> Systems
  - Aircraft, Agricultural, Truck & Bus

#### **Key Features (Benefits)**

- Dynamic recording and playback
- Graphing and data analysis capabilities
- Durable & reusable sensors
- Thin & incompressible dimensional stability is key for repeatable measurements
- Suitable for lab and field testing
- Fast testing procedure. No ink, paper or scanning
- Evaluate tire footprint conditions to optimize performance

General Sens	or Specifications
Sensor Technology	Resistive
Accuracy	± 5%
Pressure Range	0-2,068 kPa (0-300 psi)
Thickness	0.2 mm (0.008 in.) Not compressible



- Tire footprint pressure pattern evaluation
- Tread design
- Manufacturing quality assurance
- Vehicle suspension analysis

#### **Tire Types:**

- Passenger
- Bus
- Truck
- Agricultural
- Aircraft
- Racing
- ATV
- Motorcycle

## System Hardware Options

**CrossDrive System:** Base plate with fully integrated electronics that connect to sensor with a large sensing area and high resolution. Supports a wide range of tire measurements with a single configuration.

**VersaTek System:** Modular hub and ruggedized handles that can connect with a variety of sensors. Handles can be mounted to base plates for improved electrical and mechanical grounding.





System Models					
Tire Types to be Measured	CrossDrive System	VersaTek System			
		TVR8404			
Passenger, Bus & Small Truck	TCR8540	TVR8406			
		TVR8408			
		TVR7202			
Agricultural, OTR, Aircraft, Truck & Bus	TCR8540	TVR7202Q			
		TVR8001			

#### MAP FOOTPRINT IN STATIC OR DYNAMIC APPLICATIONS



Static Load



Dynamic Rolling (Portable for track testing) δ

#### **Key Software Features**

TireScan provides the tools for more comprehensive and higher quality analysis than ordinary pressure sensing technologies. The software displays the pressure distribution data in multiple formats, for superior analysis.

- Real-time display of pressure distribution data in 2D & 3D
- Record and play-back pressure "movies"
- Plot pressure, area, and force data over time and distance
- Displays surface area & void ratio of tire footprint
- Export data to ASCII or AVI files
- View and compare multiple tests simultaneously
- Save recording as an FSX "movie" file



Displaying the peak forces as a tire rolls across a sensor



2D pressure distribution image of a tire footprint showing Perimeter Area, Contact Area, and Cross Sectional Pressure Profile of the tire. It also shows the Length and Width of the tire footprint.

	A 1.3064	5 mm2			
NOISE_THRESHOLD 3					
SECONDS_P	ER_FRAM	AE 0.02			
MICRO SECO	DNDO				
EXTENDED (	OMPRE	SSION 3			
TIME 7/2/20	10 11:26:	21.33AM			
SATURATION	PRESS	URE 1674.64	кРа		
CALIBRATIO	N_POINT	13.11376	(KNewtons)	362876 (RJ	w Sum) 96
CALIBRATIO	N_MODE	1 Point			
CAL_FPI_17	00				
CAL FPC 17	100				
CAL FPS 1-	1				
CAL_RSI_13	62876				
CAL_RSC_13	62876				
CAL_SM_19	661				
CAL_CMO_1	0				
CALIBRATIO	N_INFO	C:\Users\ca	ladro\Deskt	op\8408_p	assenger e
SENSITIVITY	Low-3				
361431114111					
MAP_INDEX	0				
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TireScan data exported to ASCII displayed in a spreadsheet.



When a box is drawn around an image, the software will automatically find the perimeter of the tire. The area of the total foot print is compared to the area making contact with the sensor to calculate the void ratio.

## **CrossDrive Multipurpose Tire System**

Tekscan's newest ruggedized TireScan system is capable of measuring large tire footprints at a high resolution. The CrossDrive TireScan system includes integrated data acquisition electronics and sensor designed to withstand harsh testing environments.



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## **Sensor Specifications**

System Model	8540
Sensing Area	508 mm x 508 mm (20.0 in. x 20.0 in.)
System Area	704.9 mm x 807.1 mm (27.75 in. x 31.78 in.)
# of Sensing Elements	250,000
Spatial Resolution	1.0 mm x 1.0 mm (0.040 in. x 0.040 in.)
Standard Pressure Range	300 psi
Scanning Rate (Hz)	25
Visual Output	

#### **Data Acquisition Electronics**

In order to obtain the pressure data, our scanning electronics scan the thousands of sensing points within each sensor. The data is instantly relayed to the software on your PC via a USB cable.



Aluminum housing was designed to provide smooth surface for tire to roll over electronics. The leading and trailing plates can be attached for use during rolling tests or removed for static measurements using a load machine.

#### **Shear Force Cover**



Protects sensor from shear forces during certain measurements such as; acceleration, deceleration, toe, and camber.

Data Acquisition Electronics Specifications				
Housing Material	Aluminum (Viton seal)			
Connection Type	Ruggedized USB 2.0			
Weight	72 lbs.			
Power Source	Input: 100-240V 5A 50-60 Hz, 1.2A Output: 12V, 5A			
Cable Length	3m (10 ft) standard (Up to 5m (16.4 ft) available)			
Ambient Temperature	-40° to 60°C (-40° to 140°F)			
Ambient Humidity	5% to 90% RH			

#### VersaTek System: Passenger, Bus & Small Truck

The Ruggedized TireScan system includes metal scanning electronics enclosures designed to withstand harsh testing environments, a sensor-mounting platform, and leading and trailing drive plates that provide a smooth ride across the sensor.



TVR8404TVR8406TVR8408(4)(53.5 mm)(53.5 mm)(53.5 mm)(53.5 mm)(50.3 in)(52.5 mm)(50.5 mm)(50.6 mm)(50.6 mm)(20.1 mm)(50.6 mm)(50.6 mm)(50.6 mm)(50.6 mm)(20.1 mm)(50.6 mm)(50.6 mm)(50.6 mm)(50.6 mm)

#### **Sensor Specifications**

Custom Norma			
System Name	TVR8404	1788406	1788408
Sonsing Area	268.2 mm x 317.0 mm	268.2 mm x 317.0 mm	402.3 mm x 433.2 mm
Sensing Ared	(10.56 in. x 12.48 in.)	(10.56 in. x 12.48 in.)	(15.84 in. x 17.06 in.)
# of Sensing Elements	36,608	82,368	133,408
Spatial Pacalutian (X V)	1.5 mm x 1.5 mm	1.0 mm x 1.0 mm	1.1 mm x 1.1 mm
Spatial Resolution (X, I)	(0.060 in. x 0.060 in.)	(0.040 in. x 0.040 in.)	(0.045 in. x 0.045 in.)
Standard Pressure Range	300 psi	300 psi	300 psi
Scanning Rate (Hz)	106	71	29
# of Handles	4	6	8
System Weight	35.58 lbs.	39.55 lbs.	43.52 lbs.
Visual Output			

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#### **Data Acquisition Electronics**

In order to obtain the pressure data, our scanning electronics scan the thousands of sensing points within each sensor. The data is instantly relayed to the software on your PC via a USB cable.



The VersaTek Hub collects data from the VersaTek Handles and sends it over to the PC via USB.



The VersaTek Ruggedized Handle (VR2) connects to the Tekscan sensor tab to scan the sensor as pressure is applied. Housing provides tension to hold sensor flat to the mounting plate and keeps the sensor properly aligned.

Data Acquisition Electronics Specifications			
	Handles: Anodized Aluminum (Viton Seal)		
Housing Material	Hub: Polyurethane [PUR] (Grey)		
	Base, Lead and Trail Plate: Aluminum		
Connection Type	USB 2.0		
Power Source	Input: 100-240V 5A 50-60Hz, 1.2A Output: 12V, 5A		
Cabla Langth	Hub to PC: 4.57m (15 ft) standard (Up to 30.48m (100 ft) available)		
Cable Length	Handle to Hub: 3m (10 ft) standard (Up to 5m (16.4 ft) available)		
Ambient Temperature	-40° to 60°C (-40° to 140°F)		
Ambient Humidity	5% to 90% RH		

## VersaTek System: Aircraft, Agricultural, Truck & Bus

The Ruggedized TireScan system includes metal scanning electronics enclosures designed to withstand harsh testing environments.



**TVR7202** 

**TVR7202Q** 



590.3mm (23.24 in)

1517.4 mm (59.74 in.)





Can be mounted to a 1320.8 x 1905.0 mm (52 x 75 in) base plate.

\* Enclosure bar sits below scanning electronic edge. Serves as a grounding path for electronics and can be connected to base surface for secure mounting of electronics.

308.6 mm (12.15 in.) 301.0 mm

11.85 in.)

## **Sensor Specifications**

System Name	TVR7202	TVR7202Q	TVR8001	
Consider Anos	704.1 mm x 625.9 mm	1415 mm x 1259 mm	292.6 mm x 268.2 mm	
Sensing Area	(27.72 in. x 24.6 in.)	(55.72 in. x 49.56 in.)	(11.52 in. x 10.56 in.)	
# of Sensing Elements	8,712	34,848	8,448	
Spotial Baselution (X V)	7.1 mm x 7.1 mm	7.1 mm x 7.1 mm	3.0 mm x 3.0 mm	
Spatial Resolution (A, F)	(0.28 in. x 0.28 in.)	(0.28 in. x 0.28 in.)	(0.120 in. x 0.120 in.)	
Standard Pressure Range	300 & 600 psi	300 & 600 psi	300 psi	
Scanning Rate (Hz)	191	191	173	
# of Handles	4	8	2	
System Weight	6.91 lbs.	20.32 lbs.	6.66 lbs.	
Visual Output				

#### **Data Acquisition Electronics**

In order to obtain the pressure data, our scanning electronics scan the thousands of sensing points within each sensor. The data is instantly relayed to the software on your PC via a USB cable.



The VersaTek Hub collects data from the VersaTek Handles and sends it over to the PC via USB.



The VersaTek Ruggedized Handle (VR2) connects to the Tekscan sensor tab to scan the sensor as pressure is applied. Housing provides tension to hold sensor flat to the mounting plate and keeps the sensor properly aligned.

Data Acquisition Electronics Specifications			
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Housing Material	Hub: Polyurethane [PUR] (Grey)		
Connection Type	USB 2.0		
Power Source	Input: 100-240V 5A 50-60Hz, 1.2A Output: 12V, 5A		
Cable Length	Hub to PC: 4.57m (15 ft) standard (Up to 30.48m (100 ft) available)		
Ambient Temperature	-40° to 60°C (-40° to 140°F)		
Ambient Humidity	5% to 90% RH		

#### **Sensor Equilibration**

All TireScan systems include a sensor equilibration device. The equilibration process normalizes all the sensing elements on the sheet, improving the accuracy and extending the lifespan of the sensor.

All TireScan equilibration devices require Pneumatic (compressed air) and can apply a maximum uniform pressure of 100 psi (689 kPa) to a sensor. An equilibrator is included in a system purchase (model dependant on system).



Data Acquisition Electronics Specifications					
System Name	PB100K	PB100H	PB100T	PB100T-1	PB100N
TCR8540	Х				
TVR8404					
TVR8406					
TVR8408					
TVR8001		Х			
TVR7202					Х
TVR7202Q					Х
TV8404		Х		*	
TV8406		Х		*	
TV8408				Х	
TV8001		Х		*	
TV7202		Х		*	
TV7202Q					Х
* Sensors compatible with PB100H Equilibrator will fit into PB100T-1 Equilibrator					

#### Why Equilibration?

Over time and through repeated loading, individual pressure sensing elements will start to vary in sensitivity. The equilibrator applies a uniform pressure across the face of the sensor, allowing the software to easily see and quantify these variations.



Sensor in Equilibrator before software equilibration is performed



Sensor in Equilibrator after software equilibration is performed

#### **Related Products & Options**

#### **Tire Bead**

In addition to measuring tire footprint pressure patterns, TireScan also allows the option of measuring tire bead pressure profiles. Please refer to the Sensor Catalog to view tire bead sensors.



Above: 2D output and plot of the tire bead contact pressure profile.

The pressure profile is plotted from outside the tire, past the flange and bead, to inside the tire. The tire bead sensor shows the pressure on the bead at different points in the rotation, allowing for verification of good seal design on both sides of the tire. Tire bead sensor is compatible with slip ring for use while tire is spinning.

#### **Analog Input**

External data can be recorded and analyzed by TireScan software via USB-6008, an analog to digital input module (priced separately). Data from an analog sensor can now be evaluated against tactile sensor data in TireScan.

- Load cell connected to analog input channels can be used for real-time calibration of TireScan sensor
- Plot external sensor data against sensor pressure, area, and force data
- Export and import external analog data into TireScan



Optional USB-6008 Analog/Digital to USB converter



Analog input and Tekscan data



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