Green Tire Uniformity Measurement System using CrossCheckHD Sensors

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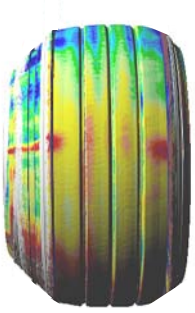

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Introduction

The Green Tire Uniformity System is a sensor and software package used to scan green tires at any stage of production to measure the key geometry features that affect cured tire uniformity and balance performance. The system is available in two configurations - portable and fixed. The portable tripod-mounted version can be moved from drum-to-drum, and from machine-to-machine. This provides a way to thoroughly study the carcass, belt/tread package, and final shaped green tire for radial and lateral runout, and splice quality. The fix-mounted version provides a means to perform 100% inspection at any drum for any parameter. This is useful for understanding the population characteristics of green tire runouts and to alarm when limits are exceeded.

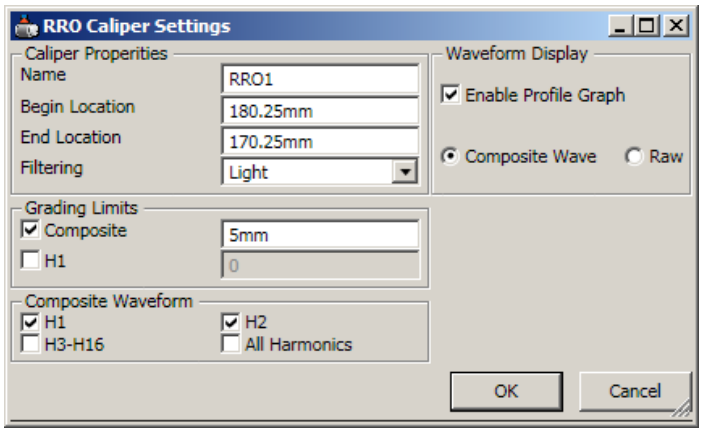
CrossCheckHD Sensor Technology

CrossCheckHD™ is a family of high speed laser line sensors. These are referred to by many other names in the industry – laser stripe sensors, sheet-of-light laser sensors, and laser profile sensors. HD designates the high data-density version that utilizes a high speed CMOS detector. These sensors project a line of laser light across a surface, which is reflected back to the sensor through a lens and onto a CMOS detector where each profile is digitized and converted to XY coordinates. The high scanning frequency is possible because the image recorded on the CMOS image sensor is processed directly on-chip, and the 750,000 pixel image is reduced to a 1500 point profile, in sub-pixel co-ordinates, directly on board the chip. The sensor is factory calibrated to convert the sub-pixel co-ordinates which stream from the sensor to real word, NIST traceable measurements expressed in microns. This conversion takes place in the PC-based driver that communicates to the sensor via a Gigabit Ethernet connection. The coordinates are output as streaming data points over Ethernet in a TCP/IP text-based protocol. A software driver command set permits the sensor to be set up and operated from external software applications.

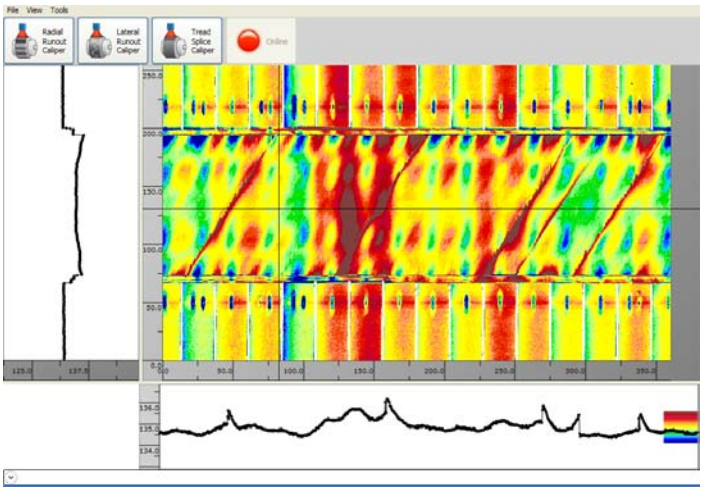
GTU Software

The GTU Software is a suite of viewing and analysis tools developed to address the special types of analyses needed in measuring green tires on the TBM. Key items include:

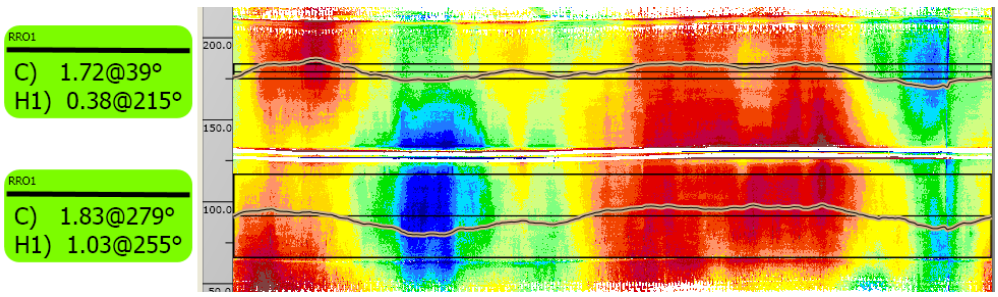
- Start scan from keyboard
- Start scan from relay contact
- Scan with encoder count
- Scan number of profiles
- Scan from encoder start/stop
- View runout color map
- View 3D image
- View circumferential waveform
- View lateral waveform
- View harmonics
- Filter data
- Rotate data
- Crop data
- Radial runout caliper
- Lateral runout Caliper
- Tread splice caliper
- Set pass/fail limits
- Export caliper waveform as .csv
- Export surface data point cloud as .csv



Example of the RRO Caliper Settings Window



Example of Belt Scan with Lateral and Circumferential Waveforms



Example of a Scan with Right and Left RRO Caliper Waveforms

GTU Portable Diagnostic Configuration

A typical GTU portable diagnostic system includes:

- Sensor
- Sensor interface module
- Cable - sensor to sensor interface module
- Cable - PC to sensor
- Notebook PC
- PC card
- Tripod
- Portable case

In the portable configuration the measurement cycles are started from the PC keyboard. There is no cycle control interface to the PLC.

GTU Fix-Mounted Configuration

A typical GTU fixed-mounted system includes:

- Sensor
- Sensor interface module
- Cable - sensor to sensor interface module
- Cable - PC to sensor
- Desktop PC
- Monitor
- Trigger input interface

In the fixed configuration the measurement cycles are started from the PLC. The cycle ends upon one full rotation of the encoder.

Sensor interface Module

Pictured at right, this includes:

- Power on switch
- Key switch
- Power-on indicator light
- Safety circuit interlock
- Encoder port
- Sensor port
- 110/220V power cord
- Cable length between the module and the sensor is 10 meters maximum, 25 meters with and extender.

Trigger Input Interface Module

Pictured at right, this includes:

- Power on switch
- Power on indicator light
- Ethernet port
- Trigger port
- Wiring terminals for PLC interface

Dual Sensor Configurations

For wide system configurations such as carcass-drum scanning, two sensors are pre-mounted on a cross-bar. This configuration can be implemented as a tripod-mounted portable system or a fixed-mounted system. The sensor interface modules are also pre-mounted to the cross-bar, and wired to the sensors. A single wiring termination is provided for power supply to the sensor interface module, Ethernet connection to the sensors, and encoder wiring to the sensor interface module. The Ethernet cable is limited to 100 meters between the sensor and the PC. The buyer must provide encoder wiring and power wiring to the cross-bar.

Dual sensor configurations are available only with the 700-900mm standoff sensors.

Other Information

Refer to the Specification Sheet for each sensor size for information about size, range, field-of-view, frequency, resolution, accuracy, and laser safety classifications.