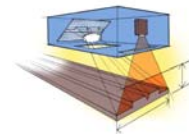




# *Feature Tracker SL Profile Sensor Technology For Automatic Guiding*

**ByteWise Measurement Systems USA**  
**1150 Brookstone Centre Parkway**  
**Columbus, Georgia 31904**

**Dennis Reynolds**  
**330.633.2253 Akron Office**  
**706.593.3091 Mobile**  
**[dreynolds@bytwise.com](mailto:dreynolds@bytwise.com)**



**November 12, 2004**

**Feature Tracker SL  
Profile Sensor Technology  
For Automatic Guiding  
November 12, 2004**

---

**Introduction**

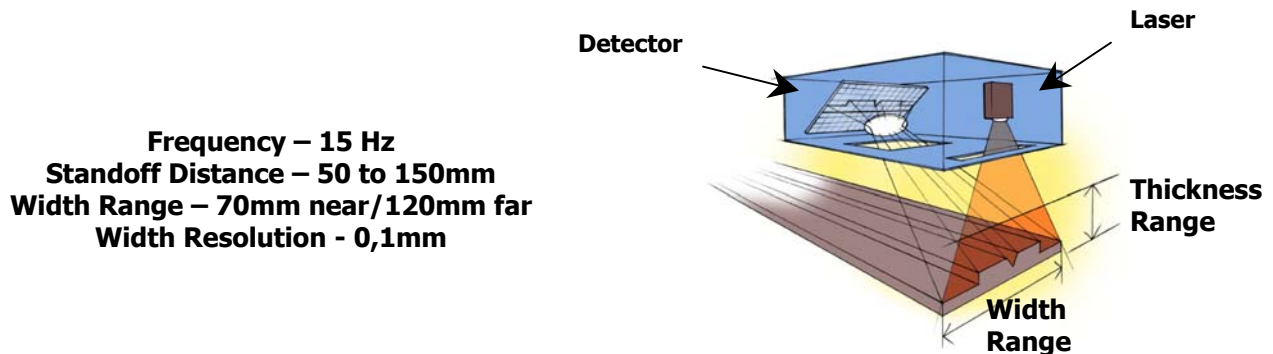
The Bytewise Feature Tracker (FT) is a modular system that can be easily configured to automatically sense the center die groove or bump and output an analog signal to a guiding system. FT can also find the center of treads without grooves or bumps by finding the center point of symmetry along the tread's top profile. The system continuously monitors the profile in real time, providing key profile measurements to the guiding control system. FT Systems utilize Bytewise Profile Sensors to digitize the tread profile.

Two Profile Sensors can be combined to find the outside edges of the tread (or other component) and interpolate the center position for guiding. This configuration is known as the Dual Feature Tracker (DFTSL) system.

FT Systems can also be configured to measure width of extruded or calendered components.

**Profile Sensors**

Profile sensors are manufactured by Bytewise. The Profile Sensor utilizes a laser light source to project a laser light line across the surface of the profile. The laser light line reflects from the surface, through a lens, and onto a high-resolution 2-dimensional digital detector. These detectors and light sources are assembled into complete sensor assemblies.



**Bytewise Profile Sensor SL5100**



**Feature Tracker SL  
Profile Sensor Technology  
For Automatic Guiding  
November 12, 2004**

---

Laser triangulation provides for true geometrical measurement of the area of interest. This is far different from traditional front-lit machine vision technology:

- The Profile Sensor works from a data set of 1,024 two dimensional (xy) geometrical coordinates (numbers) whereas machine vision works from a data set of one-dimensional gray-scale images.
- The Profile Sensor is calibrated in two dimensions via a method traceable to NIST Standards.
- The Profile Sensor is not influenced by variations in surface color, texture, and ambient lighting; and does not require back lighting or a special conveyor material. It is a self-contained sensor.

### **FT Software**

FT software is comprised of several elements:

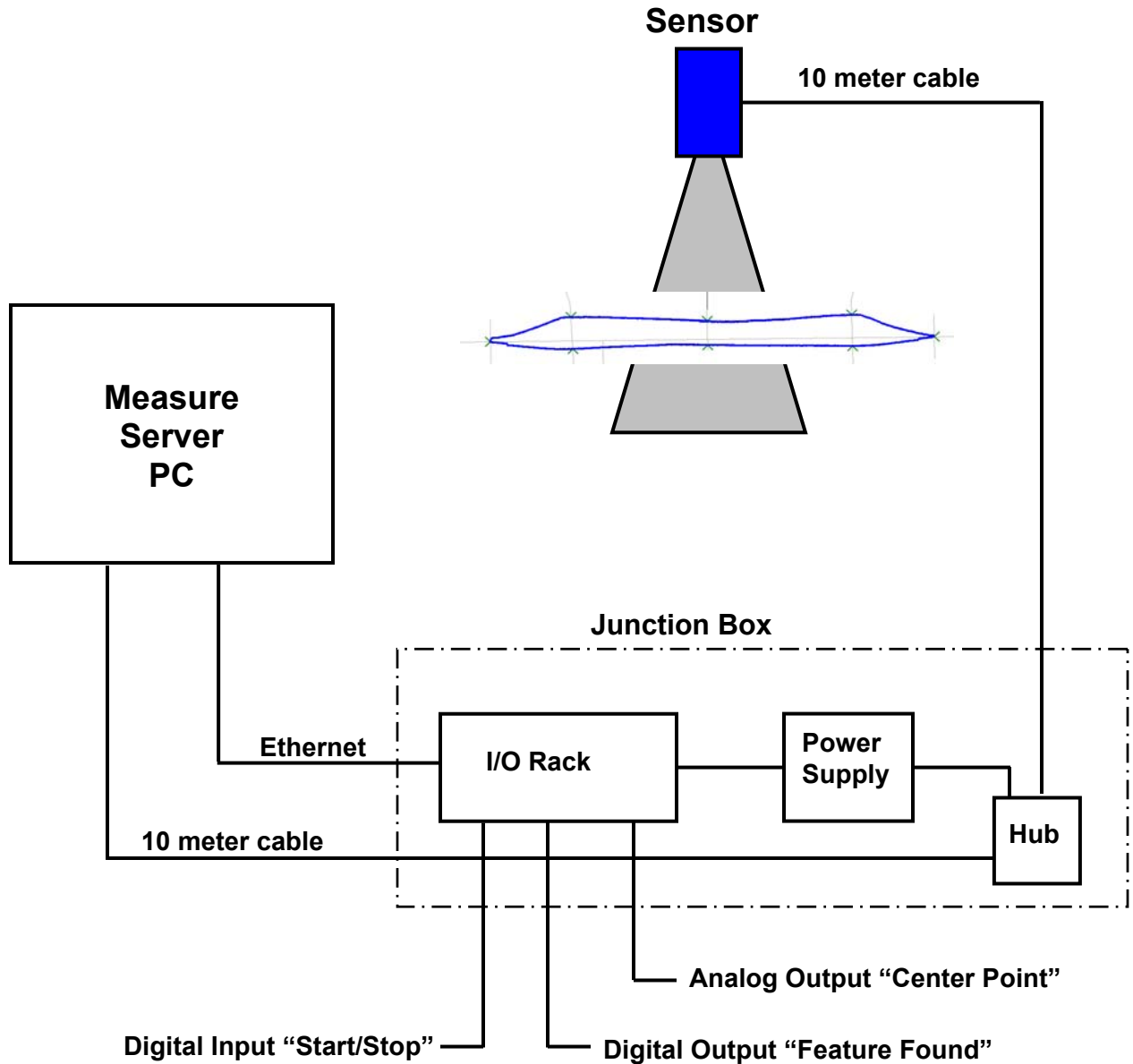
- Visualization – this displays the visual image of the profile comprised of the 1,024 measurement points.
- Feature Finder Caliper – this caliper finds the center point via any of the following methods, which are selected by the user:
  - First – finds the first feature (bump or groove) the caliper reaches that meets the design criteria.
  - Biggest – this searches the profile for the biggest feature that meets the design criteria – bump or groove.
  - Closest to Size – this permits to user to define the expected bump or groove size while the Feature Finder searches for the feature closest to that size.
  - Symmetry – this compares the left and right-side profile shape to find a center point that exhibits maximum symmetry.
  - Center Point between two outside edges – Dual Feature Tracker (two-sensors) permit recognition of the outside edges and interpolation of the center point location.

Compound reference points can be defined, i.e., the distance between two measure points, such as tread shoulders. The Feature Finder Caliper looks for features within user-defined design criteria – a filter window set by height and width.

- Output Definition – the output channel can be configured to continuously output the real-time center point location, to output the average of a user-defined number of measures, or to output based on a user-defined measurement interval.
- Trend Graph – the center point location over time can be visualized in a graph.
- Data Log File – all measures can be stored to a data log file that can be exported to external applications such as EXCEL or Mini-Tab.
- Width Calipers - In addition to Center Point Measurement, FT software provides calipers for measuring general purpose width for components such as body plies and belts.

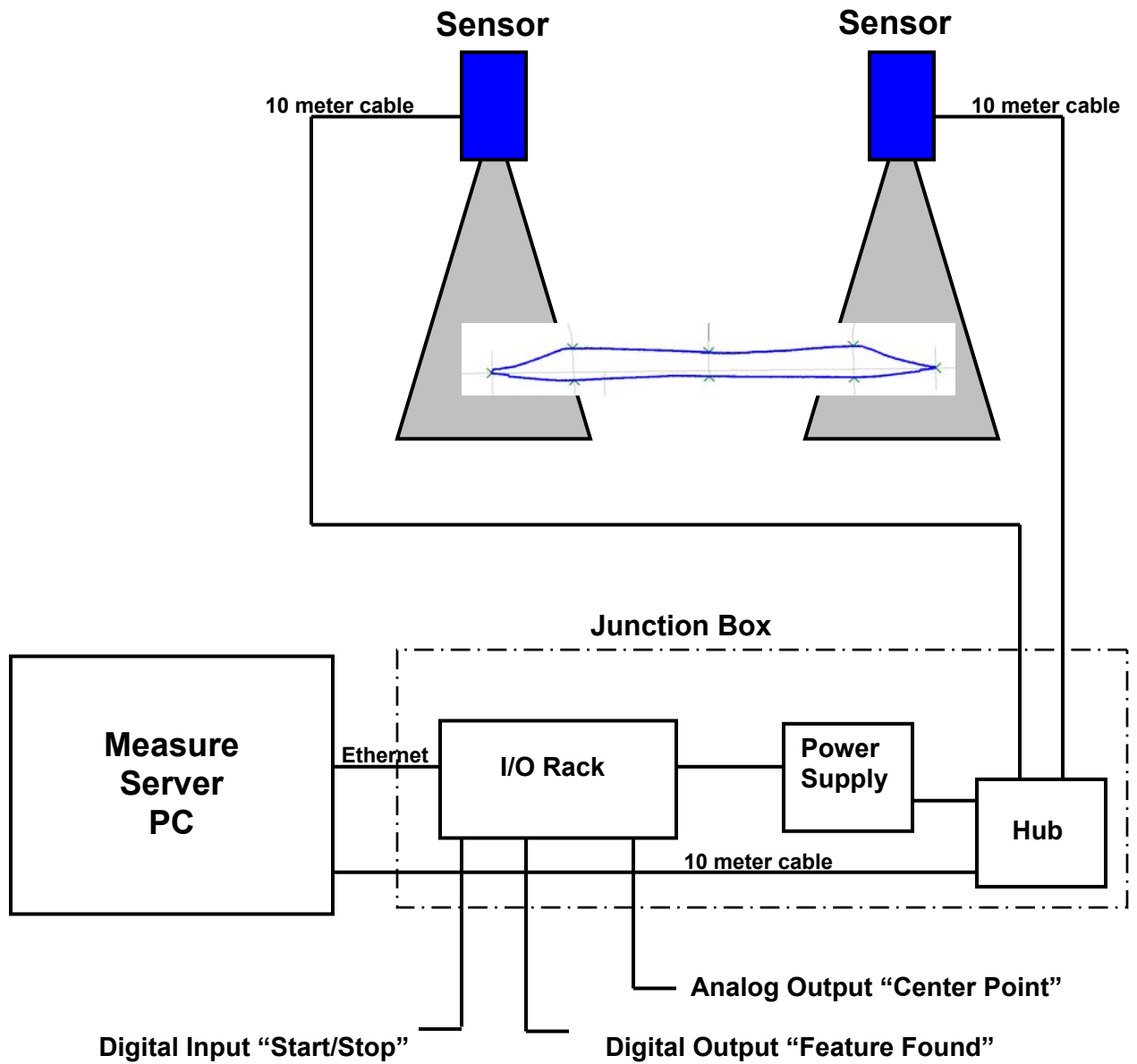
**Feature Tracker SL**  
**Profile Sensor Technology**  
**For Automatic Guiding**  
**November 12, 2004**

---



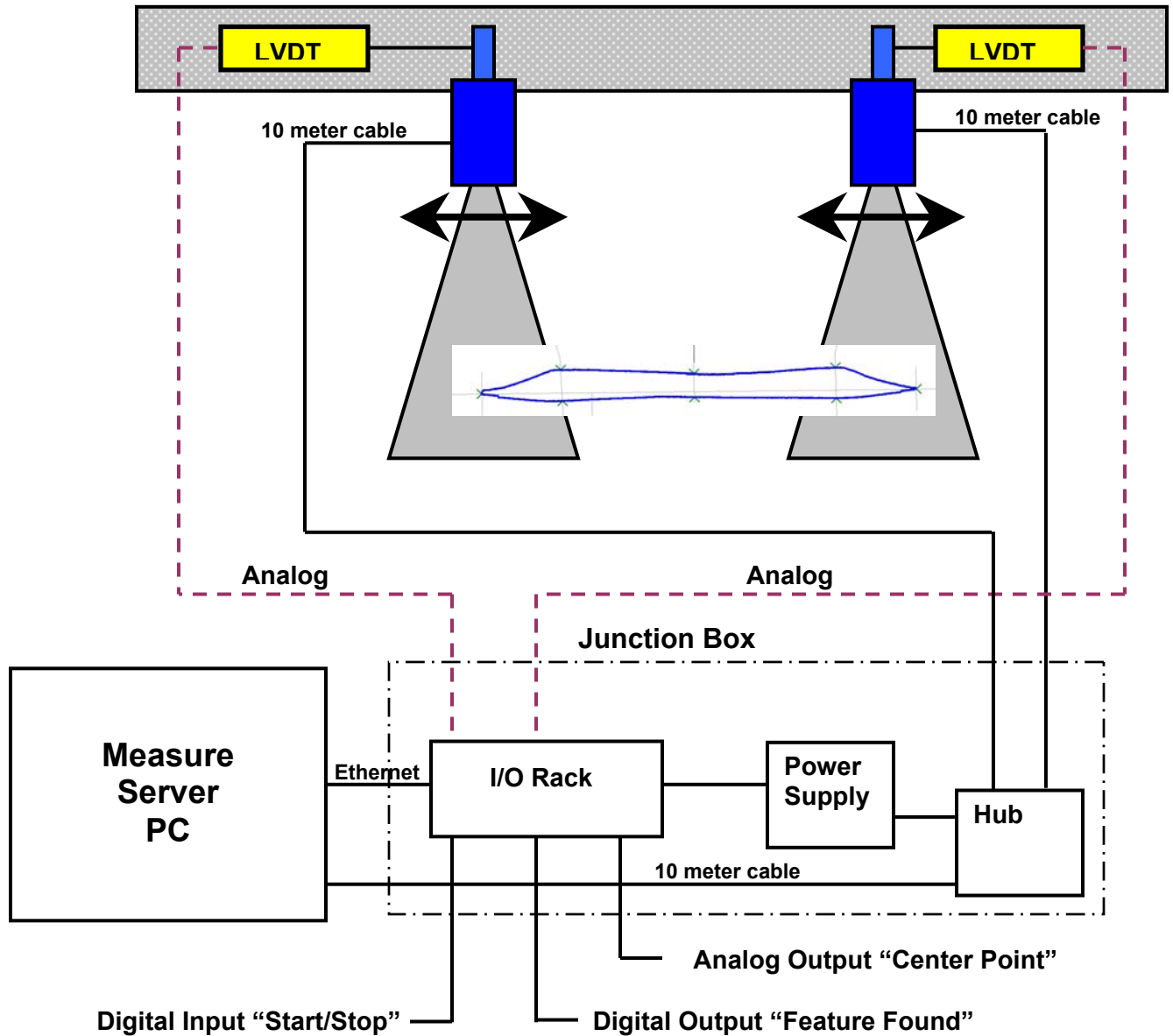
**Feature Tracker Configuration for Tread Guiding**

**Feature Tracker SL**  
**Profile Sensor Technology**  
**For Automatic Guiding**  
**November 12, 2004**



**Dual Feature Tracker Configuration for Guiding**

*Feature Tracker SL  
Profile Sensor Technology  
For Automatic Guiding  
November 12, 2004*



**Dual Feature Tracker Configuration Manual or Automatic Width Adjustment for Guiding or Width Measurement**



***Feature Tracker SL  
Profile Sensor Technology  
For Automatic Guiding  
November 12, 2004***

---

***Measure Server PC***

The sensors are wired to the Measure Server PC. This is a desktop PC dedicated to the real-time measurement process. The User should provide a cabinet to protect the PC from the environment. The User should also provide a CRT or LCD Display to view the measurement results and configure the system.

***I/O Rack***

The I/O rack is configured by ByteWise according to the overall system requirements. The following I/O are available:

- Analog Output "Center Point Location" – This output may be specified as +/- 10 VDC, 0 – 10 VDC, or 4-20 mA.
- Digital Output "Feature Found" - This is ON as long as the FT is finding valid center points, and goes OFF if the center point feature cannot be found. If the center point feature is not found, the system will maintain the Analog Output for the last valid measurement.
- Analog Inputs LVDT – This supports input of the sensor position for systems that provide manual or automatic re-positioning of sensors for edge guiding or width measurement.

***Junction Box***

A small junction box is provided to house the I/O rack, Sensor hub, power supply(ies), and wiring terminations.

***Center Point Reference***

All Center Point measurements are referenced to the measurement system centerline, which shall be aligned to the tire building drum centerline by the user.

***Limits of Measurement***

Measurement of steep angles is limited by the laser reflection back to the sensors. The maximum measurable angle is 60 degrees at the outer edges of the field of view. The maximum measurable angle is 75 degrees at the center of the field of view.

***Calibration and Registration***

Sensors are factory calibrated. Dual sensor systems require a Registration Fixture to register the sensors into a common coordinate system.