

# Speed Tagging

By Jim Frider • SKF

## General

The purpose of speed tagging is to normalize a group of spectra to rotational orders rather than frequency. When measuring vibration levels, there is often the requirement to compare spectrum plots of different operating speeds. Order normalization allows for such comparisons of synchronous or non-synchronous components of spectrums related to different rotating speeds. This method is particularly useful in the vibration analysis of variable speed machinery and particularly on paper machines where the paper speeds are varied from production run to production run. Another problem associated with these machines is that the paper speed is not constant as the paper is processed from the wet through to the dry sections. Order normalization based on sectioned speed ratios compensates for this variation and allows for the entry of one paper speed to normalize to order format.

## Setting up speed tagging points

To implement speed tagging, one must have PRISM<sup>4</sup> for Windows software, and the CMVA 60 or CMXA 50 SKF Microlog. Speed tagging involves modifying each POINT's setup to include a speed point. Additionally, a speed point is created for the machine. The speed point can be either a process point where the user manually inputs the speed in feet per minute or meters per minute, uses a tachometer point or takes a high resolution spectrum (be sure to place the cursor on the running speed peak and press the **1x RPM** button on the SKF Microlog to store the speed). Next, the user would multi-select the POINTs that will be included in the speed tagged route.



Fig. 1. CMXA 50 SKF Microlog.



Fig. 2. CMVA 60 SKF Microlog.



Use the **Ctrl-click** operation to do this in the plant hierarchy window. Next, click on the **Edit** menu (→ **fig. 3**) and select **Link Speed Reference**.

The cursor will change to a cross. Move this cursor to the POINT you want as the speed point and double-click. The program will then save this POINT as the speed point to each of the selected POINTs in the hierarchy and will ask you to confirm this operation (→ **fig. 4**).

To complete the speed tagging operation, modify the speed ratio for each POINT that has had a speed point assigned to it. This can be accomplished via the **POINT Setup** or the **Modify by Attribute** feature, below the POINT Setup for a POINT that has been assigned a speed point. Note that the speed point has been shaded gray to inform the user that this field cannot be changed in the **POINT Setup** screen (→ **fig. 5**). Use the **Edit** menu's **Clear Speed Reference** command to delete an existing speed point from a POINT or POINTs.

The speed ratio is crucial in the accurate implementation of this feature. The following discussion describes methods for calculating the speed ratio for a number of different scenarios.

## How to calculate the point speed ratio

The paper machine is sectioned in nested rolls of a drive roll and associated auxiliary rolls. Once the speed ratio of the drive roll is calculated, the auxiliary roll ratio is obtained by the ratio of diameter to the drive roll. There are three methods for determining the drive roll speed ratio.

### Case 1

The speed (in CPM or Hz) of the drive roll is unknown, but the diameter is specified. In this case, the circumferential velocity is equal to the paper speed. The speed ratio relationship is:

- $K_{DR} = 3.82 / D_{R(\text{inches})}$  (for English units)
- $K_{DR} = 31,8 / D_{R(\text{centimeters})}$  (for Metric units)

Where:

- $D_R$  = Drive roll diameter

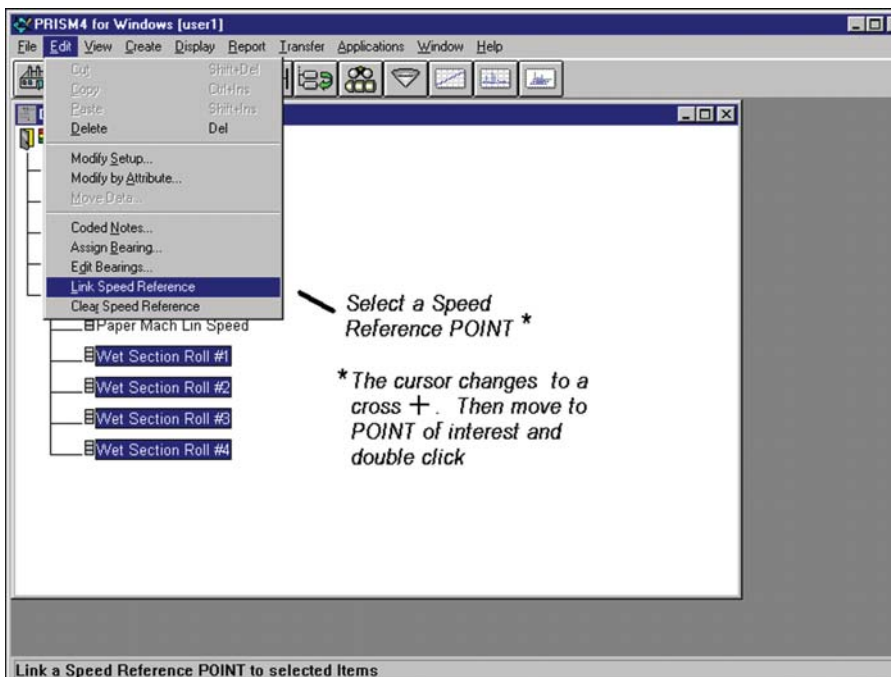


Fig. 3.

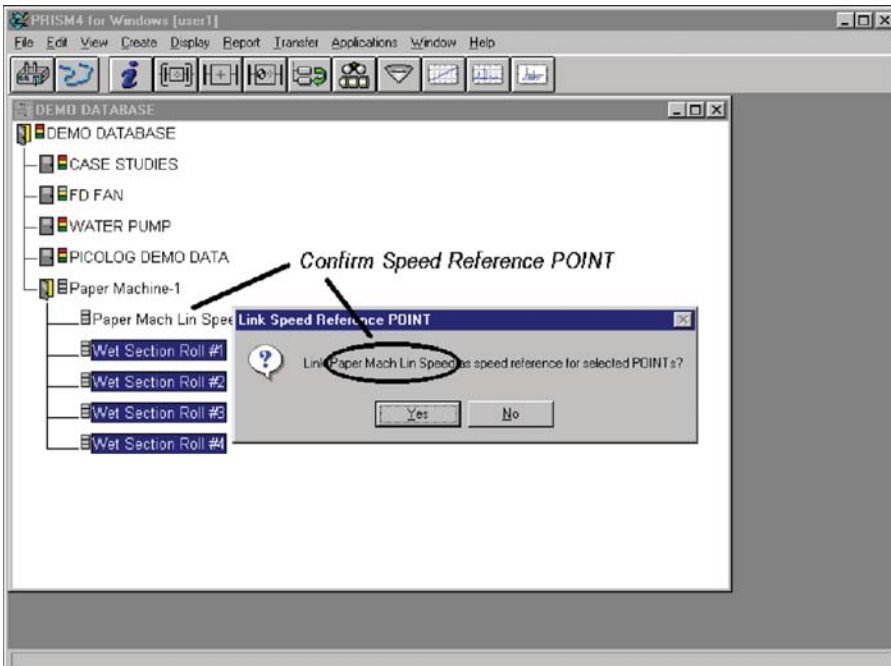


Fig. 4.

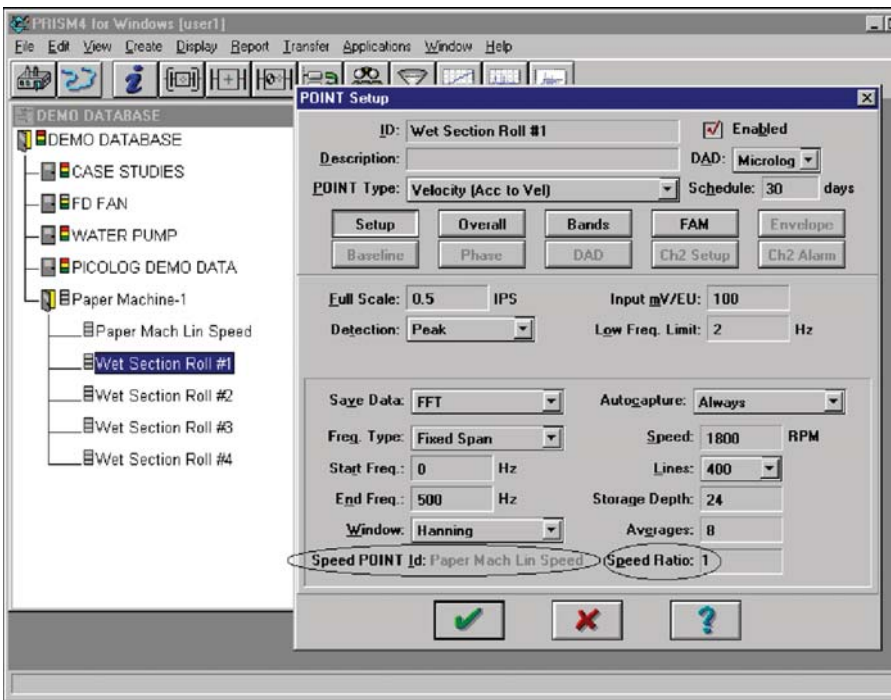


Fig. 5.

## Case 2

The CPM of the drive roll is known:

- $K_{DR} = \text{Drive roll speed (CPM)} / \text{Paper speed}$

Where paper speed can be either in ft./min or m/min.

## Case 3

The speed (in CPM or Hz) of the variable speed motor driving the roll through a gear reduction:

- $K_{DR} = [\text{Motor speed (CPM)} / \text{Paper speed}] \times [\text{Number of pinion teeth} / \text{Number of bull gear teeth}]$

Where paper speed can be either in ft./min or m/min.

Once the drive roll ratio has been computed, it is entered as a fixed constant for all times as related to the specific machine. There are instances where the drive roll diameters are changed. In such cases, the drive roll speed ratios are modified by:

- $K_{DR(NEW)} = K_{DR(OLD)} \times (D_{R(OLD)} / D_{R(NEW)})$

Only the drive roll speed ratio is modified with drive roll diameter change. The auxiliary roll speed ratio remains unchanged.

## Auxiliary roll speed ratio

Once the nested drive roll ratio has been determined, then the auxiliary roll ratio is:

- $K_{DA} = K_{DR} \times (D_R / D_A)$

Where:

- $D_R$  = Drive roll diameter
- $D_A$  = Auxiliary roll diameter

## Generic variable machinery

Speed tagging can be used for machinery other than paper machines. In these cases, the calculations of the speed ratio are usually less complex. Typically, the speed point will be a tachometer reading in RPM or Hz. Most variable speed machinery are either directly coupled (speed ratio = 1) or are coupled via a speed changing device such as a gearbox, belt or hydraulic coupling/transmission. In these cases, the speed ratio is simply the ratio of the output machine speed and the input machine speed.

- $K = \text{Output machine speed (RPM)} / \text{Input machine speed (RPM)}$

Where:

- $K$  = Speed ratio

## Route measurements

Typically, the speed point would be taken first within a Route. Once this speed measurement has been made, the speed tagged points would be taken. The SKF Microlog multiplies the stored speed point value by the speed ratio, stored for each downloaded point. This new speed value is stored with the measurement point. There is no post processing of the speed data in PRISM<sup>4</sup>; it is done entirely in the SKF Microlog. One major benefit of this type of implementation is when the machine changes speed during the route collection process.

If the machine's speed changes during route collection, the speed point can be retaken and all remaining tagged points within the SKF Microlog will use this new speed data. This ensures that the speed data is accurate even if the machine's speed changes during the route.

Later, when analyzing this spectral data, the **Order Normalization** option (spectrum preferences) should be chosen so that the spectra are displayed in orders and not frequency units. This aids in the analysis of spectral data by making the data independent of machine speed variations.

Please contact:

**SKF USA Inc.**

**Condition Monitoring Center – San Diego**

5271 Viewridge Court · San Diego, California 92123 USA

Tel: +1 858-496-3400 · Fax: +1 858 496-3531

**Web: [www.skf.com/cm](http://www.skf.com/cm)**

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