



DEWETRON

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# OXYGEN Tape Sensor and Resolver Plugin v1.2

TECHNICAL REFERENCE MANUAL

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# 1 PREFACE

OXYGENs Tape Sensor and Resolver Plugin allows speed and angle determination for Tape Sensors (black and white striped band with optical sensor) and for Resolvers with and without envelope detection.

- This manual is only referring to the Tape Sensor and Resolver Plugin. For general software operation instructions, please refer to the latest version of the OXYGEN technical reference manual available on the CCC-portal (<https://ccc.dewetron.com/>).

## Installation

If the system has been configured by the DEWETRON factory, the Tape Sensor and Resolver Plugin plugin is already configured.

If the Tape Sensor and Resolver Plugin plugin was delivered separately from the measurement system (or in combination with a TRIONet), the Tape Sensor and Resolver Plugin plugin needs to be added manually to the OXYGEN program directory after the installation is finished.

To do so, copy the file *Tape Sensor and Resolver Plugin* to the following directory *C:\Users\Public\Documents\Dewetron\Oxygen\plugins*.

You can also reach this directory by right clicking on the Oxygen desktop icon, selecting *Properties* and clicking on *Open file location*.

Please note that the Tape Sensor and Resolver Plugin is **compatible with OXYGEN R6.x and newer**.

## 2 TAPE SENSOR CONFIGURATION

This section explains how to use and configure the Tape Sensor Plugin.

Required is a black and white tape with an optical sensor connected to a CNT input is required. The gap on the tape **needs to be larger** than the typical line width of the tape for the gap detection to work properly. This gap can be white or black:

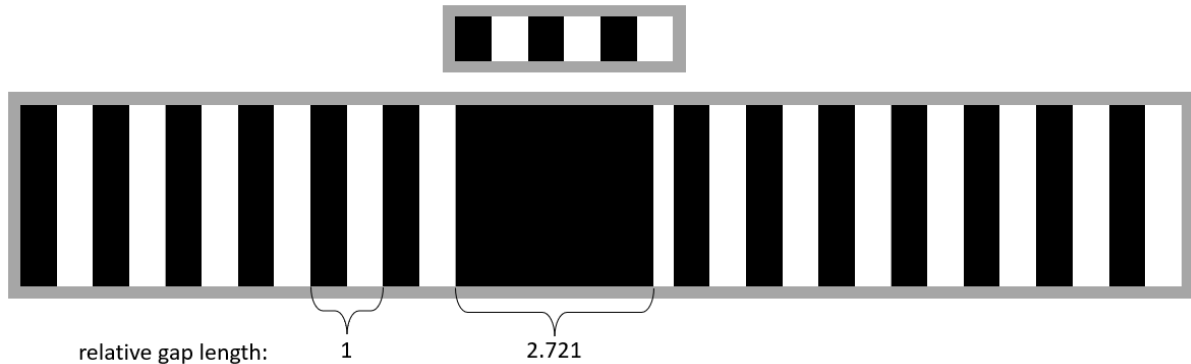


Figure 2-1: Setting up the relative gap length

The plugin has an input field called relative gap length. This is set to 2 by default. The relative gap length does not need to be measured or known exactly. But a minimum relative gap length needs to be specified in the plugin. For the tape in the figure above specifying a relative gap length of 2 is sufficient. If the relative gap length would be set to 3, then the gap would not be detected.



Figure 2-2: Changing the sample rate of the counter channel

It is advised to select a high sample rate for the CNT channel, 1 MHz is recommended. Figure 2-2 shows the sample rate input field in the channel list. The sample rate can be changed after clicking on this field.

Note that the counter channels CNT, Frequency, Angle and Speed do not need to be recorded. Only the CNT channel is needed as a calculation base for the Tape Sensor calculation. The Angle and Speed channels under CNT 8/1 as seen in Figure 2-2 are **not** the Tape Sensor output channels and can be deactivated.

The Tape Sensor Plugin works online and offline. Offline calculation requires a recorded CNT channel. Note, that CNT channels are not recorded by default.

Adding the Tape Sensor Plugin in OXYGEN is done in the following way:

- Start OXYGEN and Open the Channel List (see yellow box in Figure 2-3)
- Select **one** Event counter channel denoted as CNT X/X for which the speed and angle should be calculated by marking the respective check box on the left-hand side (see red box in Figure 2-3)
- Click on the + button on the bottom left (see blue box in Figure 2-3)
- Click on Tape Sensor in the Advanced Math group (see purple box in Figure 2-3)
- Click on the Add button (see green box in Figure 2-3)

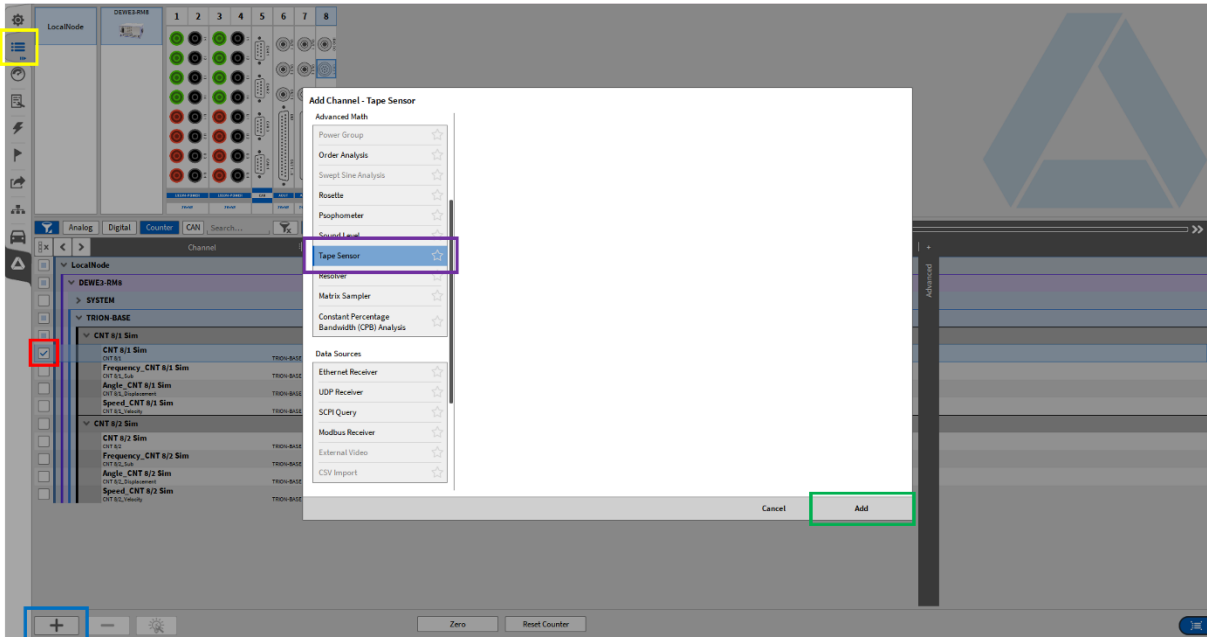


Figure 2-3: Adding a Tape Sensor in OXYGEN

Following output channels are available for the Tape Sensor:

- *Angle, in degrees [0°, 360°]*
- *Speed, in rpm*
- *Pulses per rotation, as float [e.g. 148.685]*
- *Rel gap width, as float [e.g. 2.721]*
  - *The angle channel is reset at the end of every gap.*

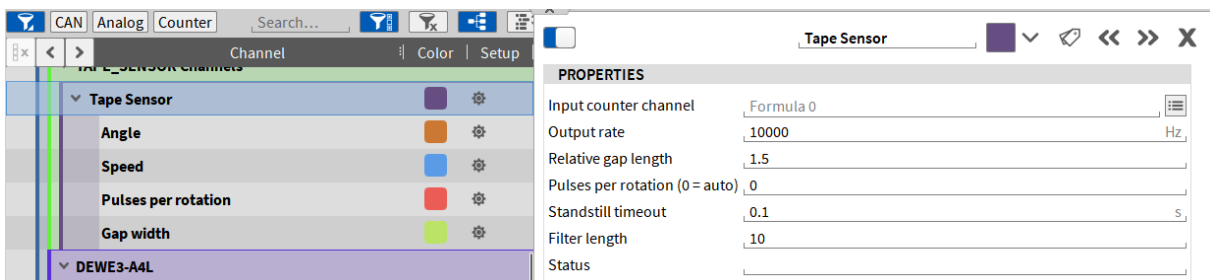


Figure 2-4: Tape Sensor settings

The Tape Sensor Plugin has following properties:

- *Input counter channel*
- *Output rate, default: 1000 Hz*
- *Relative gap length, default: 2*
- *Pulses per rotation (0 = auto), default: 0*
- *Standstill-Timeout, default 0.1 s*
- *Filter length, centered moving average filter of angle increments*
- *Status*

The *Input counter channel* should be the event counter, e.g. CNT 8/1. This channel can be selected before or after adding the Tape Sensor.

The Output rate can be set in Hz.

The Pulses per rotation are the virtual number of pulses if the gap would include pulses. This is per default 0, so the pulses per rotation are calculated every rotation. In the automatic mode the pulses per rotation are calculated every rotation and the calculated value is output in the Pulses per rotation channel. This value can be fixed by inputting a user-defined value, like 148.685. This user-defined value can be calculated by using an average of the Pulses per rotation channel over a long period of time at constant speed. This eliminates any inconsistencies of the per revolution calculated value.

The Standstill-Timeout is the time needed after no pulse is detected and standstill is assumed. This will hold the angle and set the speed to 0.

In the automatic mode (Pulses per rotation set to 0) two passing gaps are needed until the speed and angle are updated. Until the information of all pulses between two gaps is given to the counter no speed values can be known, hence the Tape Sensor output channels are NaN (not a number). This is not needed after specifying a user-defined Pulses per rotation value.

The Status field is only an output of error or warnings. This includes messages like Input channel is not supported or Input channel is not usable.

It is possible to use an analog channel as the *Input counter channel*, as the plugin recognizes events if this input channel increases by 0.5 since the last sample. This is intended for CNT channels, counting the TTL signal edges and outputting integer values, but also works for analog channels. If a noisy analog channel is used as the tape sensor input, use a formula channel with the edge() function, found in the formula channel. The edge() function is recommended, since oscillations around 0.5 due to noise will result in wrongly detected events and incorrect calculated speed.

## 3 RESOLVER CONFIGURATION

This section explains how to use and configure the Resolver Plugin.

It is advised to use a high sample rate for the resolver input channels. Factor 20 – 100 above the excitation frequency is sufficient. 1 MHz is recommended for excitation frequency of 100kHz. The resolver plugin can be configured in **two different modes**. Mode 1 with excitation and mode 2 without excitation.

Mode 1 requires 3 analog signals:

- Sin
- Cos
- Excitation

Sine and cosine must be modulated by the excitation. Envelope detection will happen in software.

Mode 2 requires 2 analog signals:

- Sin envelope
- Cos envelope

Sine and cosine must be envelopes and not be amplitude modulated by an excitation signal. Envelope detection must be done by the resolver electronics. No excitation signal is needed and should not be given to the resolver plugin.

Adding the Resolver Plugin in OXYGEN:

- Start OXYGEN and Open the Channel List (see yellow box in Figure 3-1)
- Select 3 signals **sin, cos, excitation** analog signals (see red box in Figure 3-1) **or** select 2 signals sin envelope, cos envelope
- Click on the + button on the bottom left (see blue box in Figure 3-1)
- Click on Resolver in the Advanced Math group (see purple box in Figure 3-1)
- Click on the Add button (see green box in Figure 3-1)

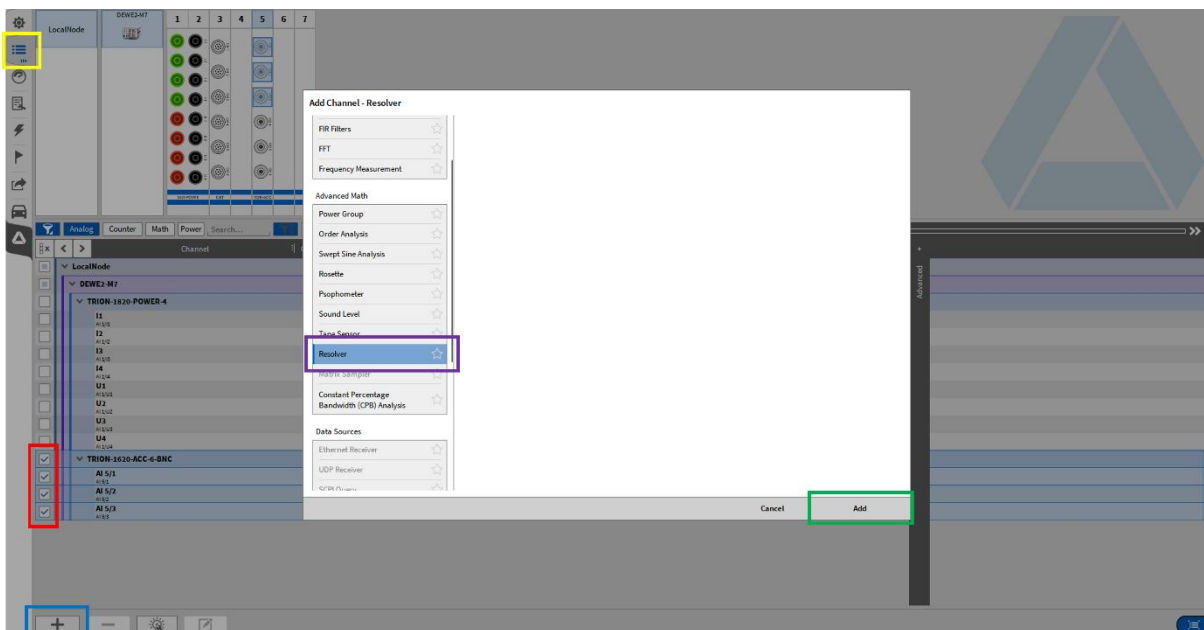


Figure 3-1: Adding a Resolver in OXYGEN

Following output channels are available for the Resolver:

- *Angle, in degrees [0°, 360°]*
- *Speed, in rpm*

The angle channel is 0° at the zero crossing of the sine wave envelope.

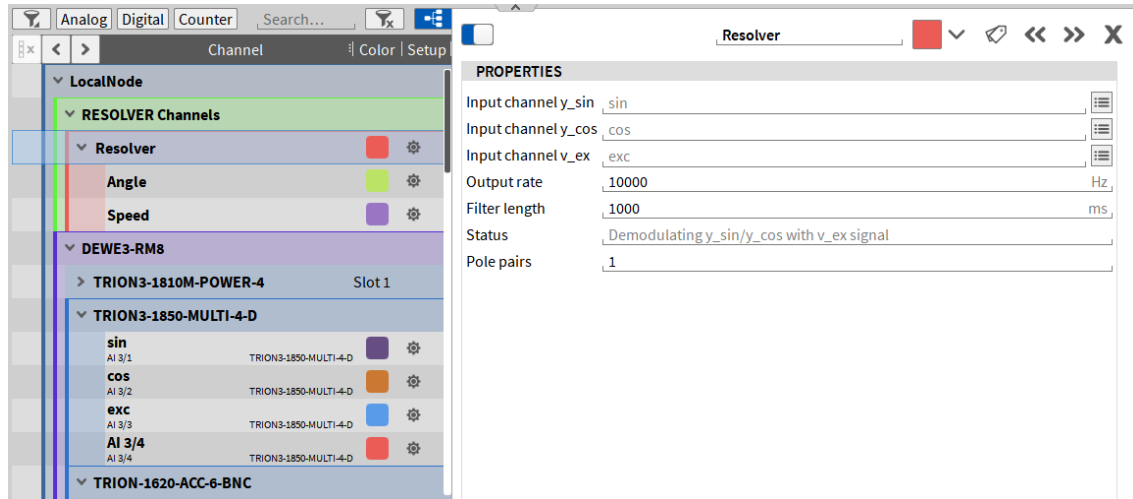


Figure 3-2: Resolver Plugin properties

The Resolver Plugin has following properties:

- *Input channel y\_sin*
- *Input channel y\_cos*
- *Input channel y\_ex*
- *Output rate, default 10000Hz*
- *Filter length, default 1000ms*
- *Status*
- *Pole pairs (Pole pair number of resolver)*

The Filter length parameter will set a smoothing moving average filter on the Speed channel only with a window length of 0 .. 1000ms (default is set to 1000ms).

The Status field will give information about which mode the resolver plugin is in.

Status Demodulating y\_sin/y\_cos with v\_ex signal is mode 1. This mode requires excitation and modulated sine and cosine signals.

Status Using demodulated y\_sin/y\_cos signals is mode 2. This mode requires sine and cosine envelope signals and no excitation. To get into mode 2 leave the Input channel y\_ex empty.

Following signals are expected for mode 1 (①) and mode 2 (②).

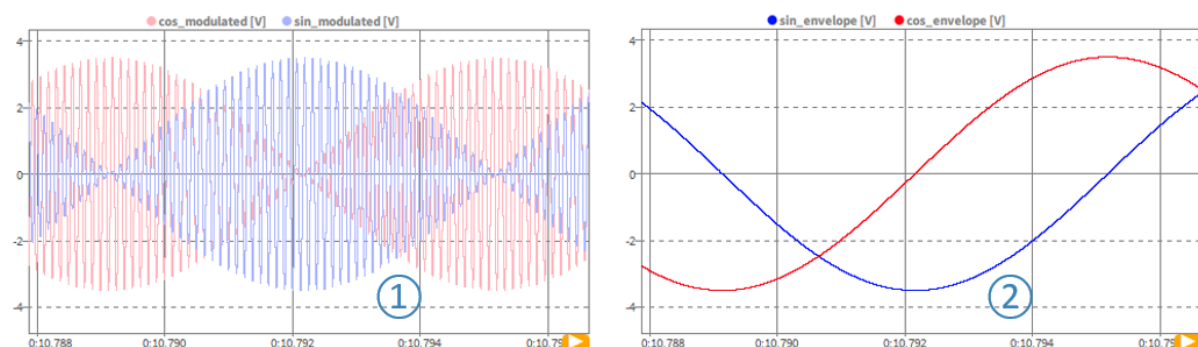


Figure 3-3: Comparison of the Resolver modes

# 4 EXAMPLES

## Tape Sensor:

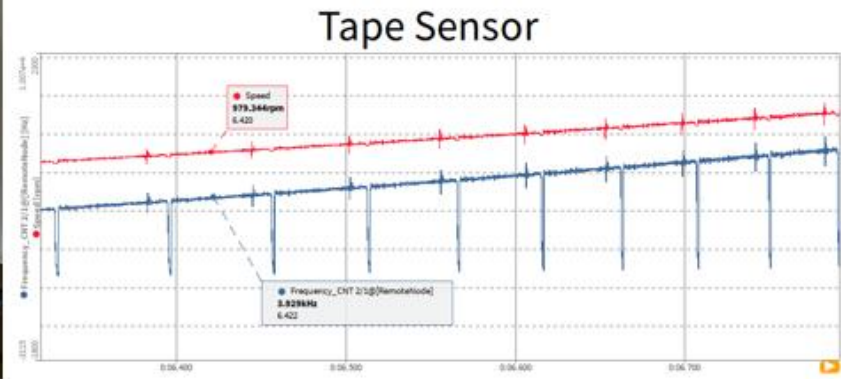
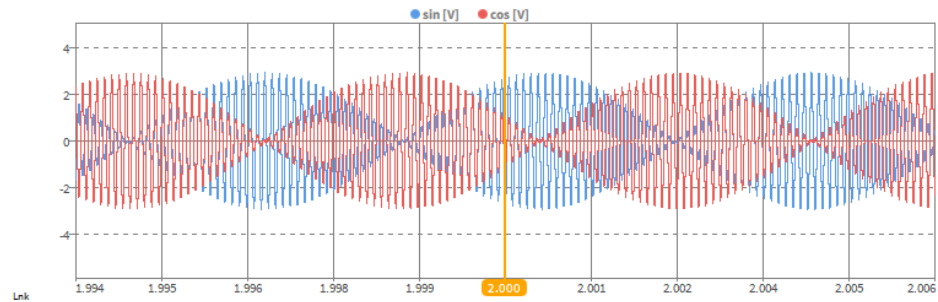


Figure 4-1: Tape Sensor example in OXYGEN

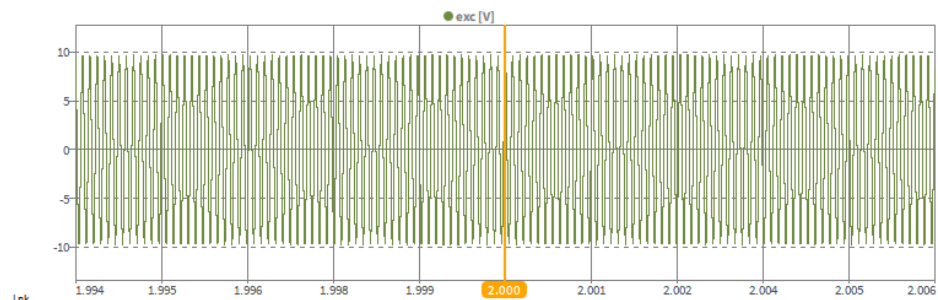
In the figure above, the blue signal is the frequency channel of the counter group with negative spikes at the gap. The red signal is the speed channel of the Tape Sensor Plugin which detects and corrects the gap to calculate the speed of the machine.

## Resolver:

Resolver  
Sin Cos  
signals



Resolver  
Exc  
signal



Plugin  
output

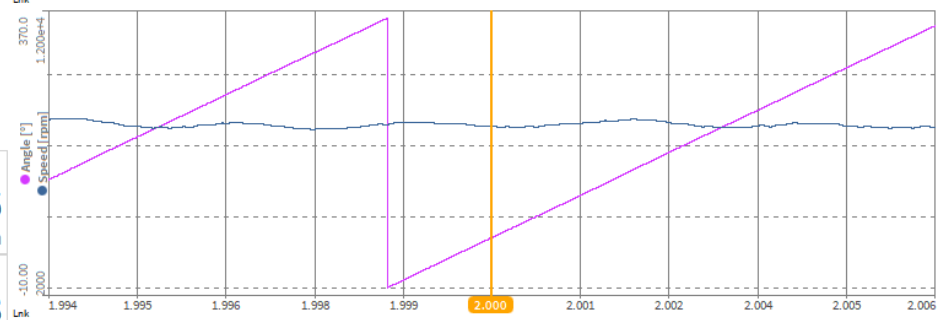
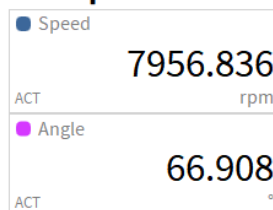


Figure 4-2: Resolver example in OXYGEN

The resolver example shows the modulated analog signals and the plugin output in OXYGEN.

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