

## ***Preliminary Experiment - Measuring RPM***



### **EXPERIMENT OVERVIEW**

This experiment demonstrates the proper technique for measuring WindPitch blade revolutions per minute (RPM) using the General Technologies model TA105 infrared laser tachometer.

Students will become familiar with operating the tachometer along with the WindPitch wind turbine and floor fan in order to learn how to correctly measure RPM for subsequent WindPitch wind turbine experiments.

### **EXPERIMENT OBJECTIVES**

- Students will use the Scientific Process to perform the experiment.
- Students will understand how to setup and use the laser tachometer to measure RPM.
- Students will understand how to correctly orient the tachometer in front of the WindPitch in order to measure RPM.

### **SAFETY**

**Caution must be exercised when using the wind turbine and table fan. Spinning blades can pose a hazard and can cause injury if not careful. DO NOT PLACE YOUR FINGERS, HANDS, ARMS, FACE OR ANY OTHER PART OF YOUR BODY IN THE SPINNING WIND TURBINE OR FAN BLADES!**

**[Wear safety glasses for all experiments](#)**



## General Technologies TA105 Features

The TA105 Laser Tachometer and counter can be used to measure the number of rotations per minute (RPM) or total number of rotations or events on any spinning shaft, pulley, wheel, drive belt, fan, or other rotating objects in general - safely, accurately and easily.

Wide measuring range: 2.5 to 99,999 RPM, 2" to 20" reading distance, Min/max and last reading memory recall, <0.5 sec. response time, count function and auto power off.

- Bright and powerful laser optical system allows for easy targeting of rotating shafts, wheels, pulleys, etc., even in bright daylight.
- Measurements can be obtained from safe and comfortable distances between 2 to 20 inches
- The large 5 digits display allows measurements without the need to switch scales or multiply reading ranges
- Comes complete with batteries, reflective tape and soft carrying pouch

## Easy To Operate

- Aim the laser beam at reflective tape placed on rotating shafts, pulleys, wheels or objects, depress the switch and read instant RPM displayed on the LCD
- High intensity laser beam not affected by shop or ambient light
- RPM range from 2.5 to 99,999
- 5 Digit Large LCD display
- Auto Ranging
- 0.5 Second sampling time
- Memory recall: Max, Min, Last value
- TOT: Total revolution count
- Resolution: 0.1RPM<1000 RPM, 1.0 RPM>1000 RPM

## General Specifications

**Display:** 5 digits 0.7" (16mm) LCD, Max. of 99999 display, with measuring unit indicator and Laser On Target indicator

**Resolution:**  $\pm(0.05\%+1 \text{ Digit})$

**Operating Temperature:** 32°F to 122°F (0°C to 50°C)

**Response time:** 0.5 sec. (over 120 RPM)

**Range Selection:** Auto Ranging

**Memory:** Max. Value, Min. Value and Last Value stored automatically in memory

**Distance to target:** 2" to 20" (50 mm to 500 mm)

**Laser Pointer:** Laser Diode, < 1mW output wavelength 630-670 nm, Class II

**Power Source:** 4 x 1.5 V type AA/UM3 or equivalent

**Battery life:** Approx. 5 hours.(w/alkaline batteries)

**Dimensions:** 6.3"x 2.8"x 1.5" (160 x 72x 37 mm)

**Weight:** 6.96 oz. (200 g) with battery.

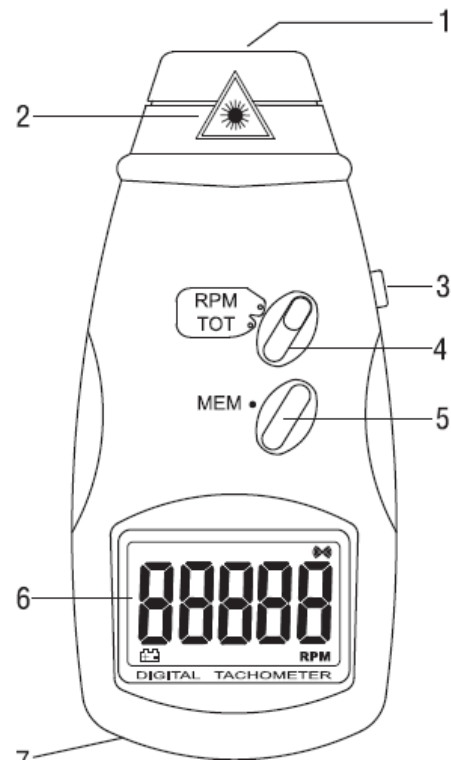
## Measurement Specifications

Accuracies are  $\pm(\% \text{ of reading} + \text{number of least significant digits})$  at 23°C  $\pm 5^\circ\text{C}$  ambient temperature, with less than 75% RH.

Function	Range	Acuracy	Resolution
RPM	2.5 to 999.9 RPM	$\pm(0.05\%+1 \text{ Digit})$	0.1 RPM
	1000 to 99,999 RPM		1 RPM
TOT (total revolutions)	1 to 99,999 RPM	$\pm(0.05\%+1 \text{ Digit})$	1 RPM

## Instrument Description

- 1) Laser output
- 2) Laser warning symbol
- 3) Measurement button
- 4) Function switch
- 5) Memory button
- 6) Digital display
- 7) Battery compartment cover



## General RPM Measurement Techniques

Cut a 1/2" length of the reflective tape and peel off the back to expose the adhesive.

Attach it to the rotating part or shaft to measure, observing the following recommendations:

- The non-reflective area must always be smaller than the reflective piece of tape.
- If the object or shaft to measure is reflective, it must first be covered with a black tape or painted black before attaching the reflective tape.

Apply a reflective mark or a piece of reflective tape to the rotating object under measurement. Before applying the tape verify that the surface is clean and smooth.



Slide the RPM-TOT function switch to the "RPM" position

Press the measurement button and aim the light beam to the reflective mark or tape on the rotating object.

Verify that the "On Target Indicator" appears on the display, indicating that the instrument is detecting the rotation of the object and the reflective mark on it.

Proceed to read the RPM on the digital display.

## Display Hold

The instrument will automatically hold the last reading immediately after the “On Target Indicator” on the display turns off, and hold it while the “Measurement button” is pressed.

## MEM function

In every measuring cycle (pressing the measuring button, obtaining a reading, and then releasing the button), the instrument will automatically store in its internal memory the Maximum, Minimum and Last value. To retrieve the values in memory follow the procedure described below:

- With the instrument off press and hold down the “MEM” button to display the Maximum value stored in memory. Display screens will alternate between “UP” (maximum) and the stored maximum reading. Note the value and release the “MEM” button.
- Pressing and holding again the “MEM” button will display the Minimum value stored in memory. Display screens will alternate between “dn” (minimum) and the stored minimum reading. Note the value and release the “MEM” button.
- Pressing and holding again the “MEM” button will display the last reading value stored in memory. Display screens will alternate between “LA” (Last reading) and the stored last reading value. Note the value and release the “MEM” button.

This memory retrieval cycle will keep repeating in the order detailed above.

**Note: The values stored in memory will be retained until a new measurement cycle is performed. Removing the batteries or low batteries will cause all values stored in memory to be erased.**

## TOT (Total revolutions)

- Apply a reflective mark or a piece of reflective tape to the rotating object under measurement.
- Slide the function switch to the “TOT” position
- Press the measurement button and aim the light beam to the reflective mark or tape on the rotating object.
- Verify that the “On Target Indicator” appears on the display, indicating that the instrument is detecting the rotation of the object and the reflective mark on it.
- Proceed to read the total revolutions on the digital display.

## EQUIPMENT

- General Technologies TA105 handheld tachometer
- Large 16" to 20" floor fan with 3 way speed control
- WindPitch wind turbine

## EXPERIMENT SETUP

Setup the floor fan with the WindPitch in front of it per the photo below.

## DOING THE EXPERIMENT

1. Set the table or floor fan as close as possible to the wind turbine blades. **MAKE SURE THAT THE WIND TURBINE BASE IS SECURE AND CAN'T MOVE. USE A BOOK OR OTHER OBJECT TO HOLD IT IN PLACE BEFORE TURNING THE FAN ON.**
2. Cut a 1/2" square section of reflective tape and apply it to the side of the WindPitch blade hub just behind the blades.
3. Set the fan to the highest speed setting.
4. On the tachometer set the RPM / TOT button to RPM.
5. Aim the tachometer at the reflective tape and push the square Measurement Button on the side. A red dot will appear on the rotating hub and RPM reading should appear on the display.
6. Test the validity of the RPM reading by changing the fan speed (faster and slower) to see the RPM readings change.

