



KA Sensors Ltd

# Engineering Document

RWT - Rear Wheel Torque Transducer



## **Outline:**

The RWT rear wheel torque transducer developed by KA Sensors provides a cost effective and accurate rear wheel power and torque measurement tool for race teams and OEM R&D teams.

The design is a self-contained sensor unit; it is direct replacement for the rear wheel sprocket carrier on most standard motorcycle wheels. The RWT is capable of providing reliable and valuable data for set up and

development of motorcycles.

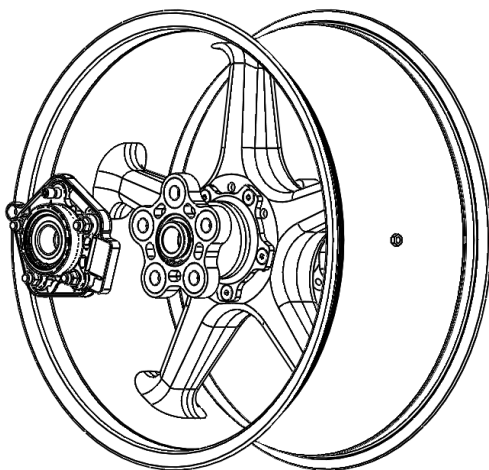
### **Sensor features**

- Self-Contained, Compact Design
- Measures Drive Torque and Engine Braking Torque
- Robust Aluminium Housing Will Accept Rigours Of Paddock Use
- Lightweight Design Minimises Increase In Unsprung Mass
- Counterbalance Weight Ensures Unit Is Fully Balanced Ready For Use
- Wireless Signal Output To Chassis Mounted Receiver Box
- Long Life Between Charging – 10 Hours
- Robust Battery Charging Port
- Fully Sealed And Waterproof Electronics
- High Frequency Logging Rates – Up To 1000Hz
- Analogue Output Works With Majority Of Data Loggers

### **Benefits**

- Rear Wheel Torque And Power Measurement In Real Time
- Use For Engine Development – Assess Where Power Is Used Allowing Engine Development Strategies To Be Focused
- Use For Gear Ratio Selection – Assess If Ratios Are Providing Optimum Power At Rear Wheel
- Use For Rider Knowledge – Assess How Rider Applies Power
- Adaptable To Most Race Wheels – Marchesini / OZ / Dymag / BST
- Easy To Fit - Direct Replacement For Standard Wheel Sprocket
- Will Accept Standard Sprockets

### **Installation**



The RWT is incorporated into the rear wheel sprocket carrier. The existing sprocket carrier is replaced with the transducer which is engineered to install exactly into each type of wheel. The

transducer uses a wireless signal to transmit the measured data to the receiver which is mounted on the chassis.

## **Typical Applications:**

### **Engine Torque and Power Measurements**

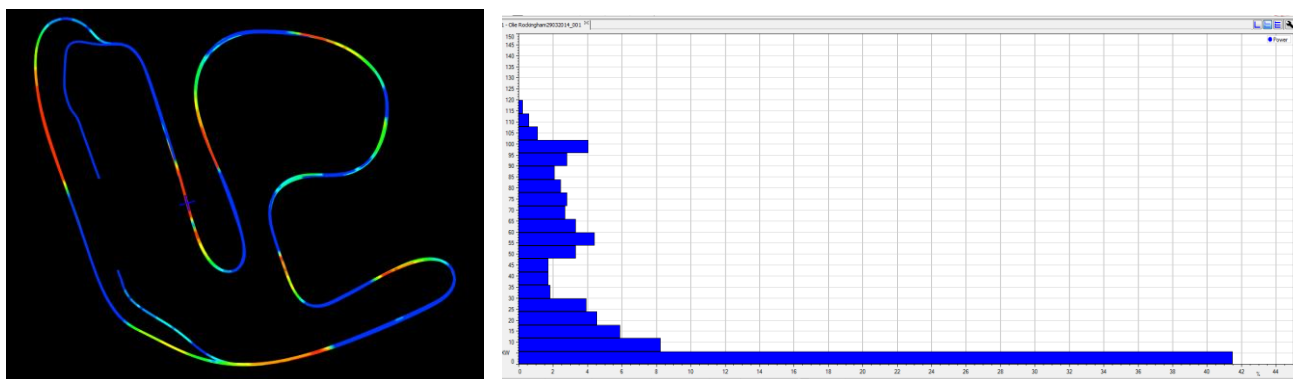
The KA Sensors RWT measures the torque transmitted to the rear wheel simultaneously with wheel speed, air box pressure, ambient air temperature, ambient air pressure and lean angle at the moment of measurement on the road or track. It is therefore, an accurate representation of engine power output for the track conditions as the motorcycle was tested.

Rolling road and engine dyno power measurements are corrected by using a factor specified by the SAE. This factor ensures that whatever power is measured is not influenced by atmospheric conditions, thus allowing results from different tests to be compared. However, during a race or test session the ambient pressure and temperature may be such that the output power of the engine is higher or lower than corrected SAE measurements from the rolling road.

By using the RWT the race engineers can establish if the engine performance is higher or lower than the expected power output taken from the rolling road or dyno. Real power data can be taken and used by the engineers to adjust engine or chassis live during pre-race set-up.

The RWT data provided can be used to provide histogram data and rainbow charts that show the power usage during a lap of the track. This data can provide information such as:

- How engine performance can be improved, based upon power and torque usage
- Changes to gearing to optimise acceleration rates
- Provide the rider with information on when and where power and torque is applied, allowing a better understanding of riding techniques.
- Optimising quick-shift gear changing to minimise the reduction in torque during a gear change
- Optimise slipper clutch and correlate back torque settings
- Confirm rider feedback against objective data



The RWT provides real time data for race or development set-up. It can also be used by scrutineers to accurately measure and confirm engine power, therefore allowing a balance of power between different teams or manufacturers.

## Driveline Losses and Rotating Inertia

Driveline losses can be measured and quantified by using two torque transducers, the RWT on the rear wheel and a gearbox sprocket mounted transducer



Some MotoGP teams use the sprocket transducer similar to above.

By comparing the two measurements it is possible to gather data on the efficiency of the final drive. There will be time delays between the two measurements which is a function of the rotating inertia and compliances within the final drive assembly. The data can also be factored into the traction control strategy.

## Tyre Coefficient of Friction

Tyre coefficient of friction is very difficult to obtain, tyre manufacturers do not supply this data readily and yet it is a critical parameter in the simulation of motorcycle performance.

The tyre coefficients of friction values vary depending on the track conditions and the track surface. The ability to measure the tyre coefficient of friction will be of great value to the race teams looking to generate simulation models representative of the real track conditions experienced by the rider. Set-up changes can be made faster and more cost effectively by taking advantage of the tyre data obtained.

By using torque, tyre load and radius it is possible to calculate the friction coefficients during real live testing. Some of the data that can be determined by knowing the tyre coefficient of friction include:

- How track conditions effect the tyre coefficient of friction
- To assess a new tyre, and quickly make set-up changes
- Understand tyre life in detail, by observing how tyre coefficient changes during use. This data can be used to inform the rider on race strategy, and could help increase tyre life.

The KA Sensors RWT rear wheel torque transducer provides engineering teams with data that could not have been previously obtained cost effectively.

### **RWT General Specifications:**

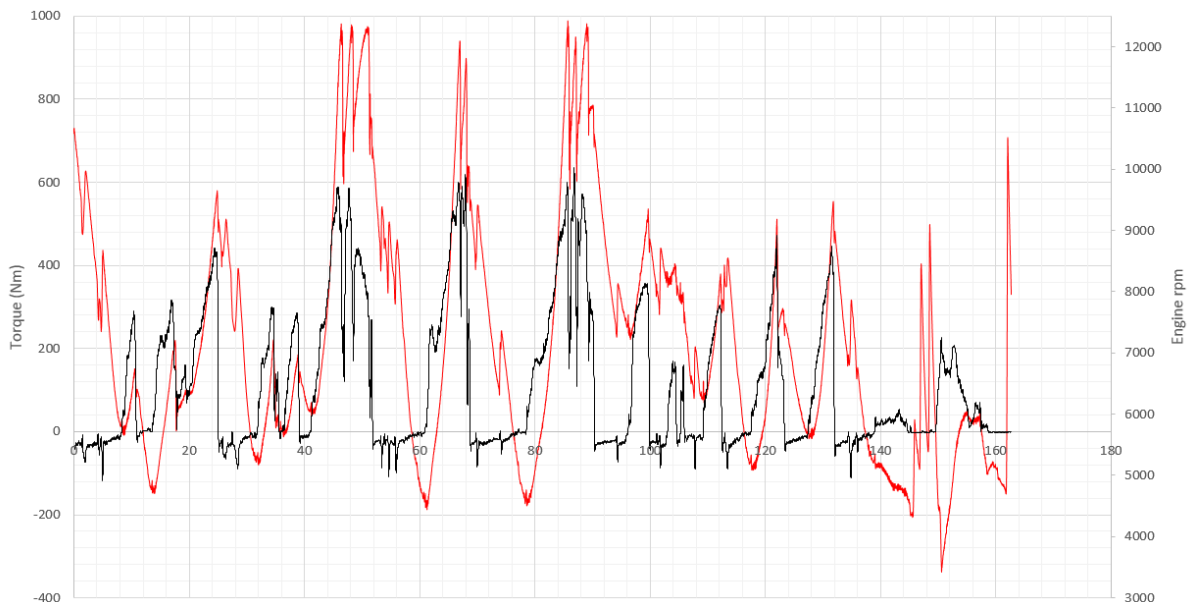
- Housing Material: 7075-T6 Aluminium
- Drive Pin Material: 17-4PH Stainless Steel, or Ti6AL4V Titanium, Depending On Spec
- Water Resistance: Fully Potted And Waterproof Electronics
- Torque Range: +/-100 to 1000Nm (Higher Torque Upon Request)
- Supply Voltage: 8 – 16V
- Output Voltage: 0.5 to 4.5V (2.5V offset)
- Accuracy: +/- 2% Typical
- Output Frequency: 1000Hz
- Operating Hours: 10 Hours Before Recharge
- Operating Temperature: 0 to +70°C

### **Typical Data:**

Below shows data indicative of the torque values obtainable

Black = Torque

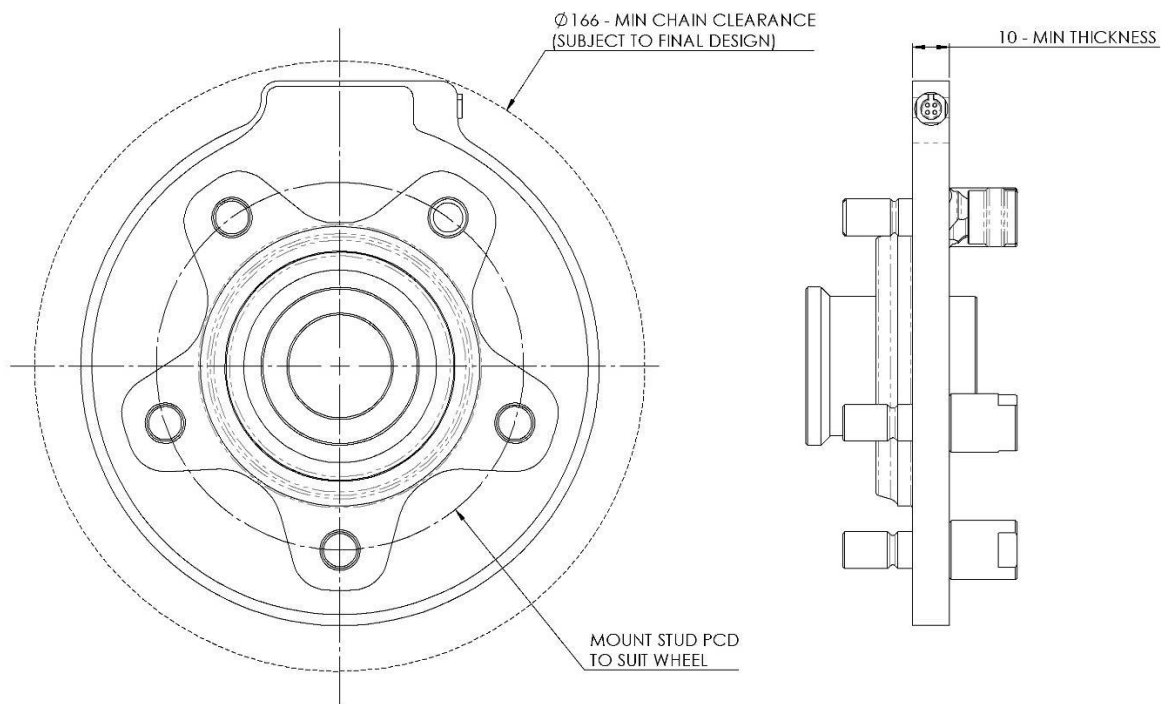
Red = Engine Speed



### **Typical Dimensions:**

The sprocket carrier dimension will vary depending upon the type of wheel being used; however the drawings below show typical sizes.

#### Sprocket carrier



#### Receiver

