Intelligent Engine Analyzer

Training

Pressure Transducers

by Bernie Thompson - ATS

Fig. 1

It was black with a two inch brim; the inside had a red satin liner. By all accounts it looked like a normal top hat that anyone could be wearing. The man placed the top hat on the table where, in an instant, he had reached into the hat and out came a white rabbit! How did the rabbit appear, was it magic or mechanics? Once there is an understanding of what has happened it is no longer magic; but only physics.

For over one hundred years mechanics have been diagnosing the internal combustion engine. Over the years many tools have been developed to help with this process and with the advent of the modern automobile have come modern high tech diagnostics. Now, let us pull a rabbit out of the hat and examine the magic behind one of these high tech diagnostic tools; the modern pressure transducer.

A pressure transducer is a device that takes a physical quantity and changes it into an electrical signal. The pressure transducer can measure physical quantities such as; oil pressure, fuel pressure, engine compression, exhaust pressure, intake pressure, crankcase pressure, and radiator pressures to just name a few. By viewing this electrical signal on an oscilloscope, a large amount of information can quickly be conveyed to the technician. These devices will change the way that the modern technician will diagnose the internal combustion engine.

Now let us examine a Dodge Caravan with a 3 liter V-6 engine with overhead camshafts. This vehicle was brought in exhibiting a rough idle condition. The complaint was verified and the PCM codes were pulled. There were no pending or mature DTCs recorded and all of the monitors had run. A pressure transducer was placed into the exhaust tailpipe (Figure 1). This pressure transducer is a special type of transducer called a differential pressure transducer which can read the exhaust pulses from the tailpipe. For years technicians have used their hand or a dollar bill to feel or see these exhaust pulses in order to determine whether the exhaust pulses were even. This can help with the diagnosis of the engine. If the differential pressure transducer is connected to an oscilloscope, these exhaust fluctuations can be viewed as a waveform, which will help the modern technician in diagnosing the engine.

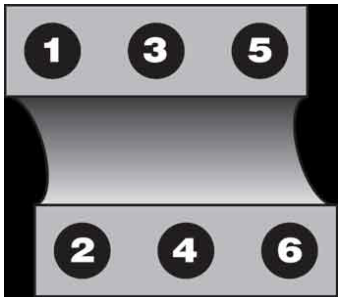

Fig. 2

This waveform, however, cannot be understood without a trigger to locate the exhaust pulsations. If the ignition is used as the trigger, the exhaust pulsations can be related to each individual cylinder. To accomplish this, the firing order must first be known (Figure 2). There will also be a timing issue when applying the trigger to the exhaust waveform. In a four cycle engine, the ignition spark occurs at the end of the compression stroke. During the compression stroke and power stroke both the intake and exhaust valves are closed. At the point the spark ionized the spark plug electrodes; the air/fuel mixture is ignited. In turn, the burning air/fuel mixture creates an expanding force that drives the piston away from the cylinder head. As the piston