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MARCH 2012

HOW IT WORKS
DATA LOGGERS & IGNITION CONTROLLERS PG.66

HEAVY HAULER
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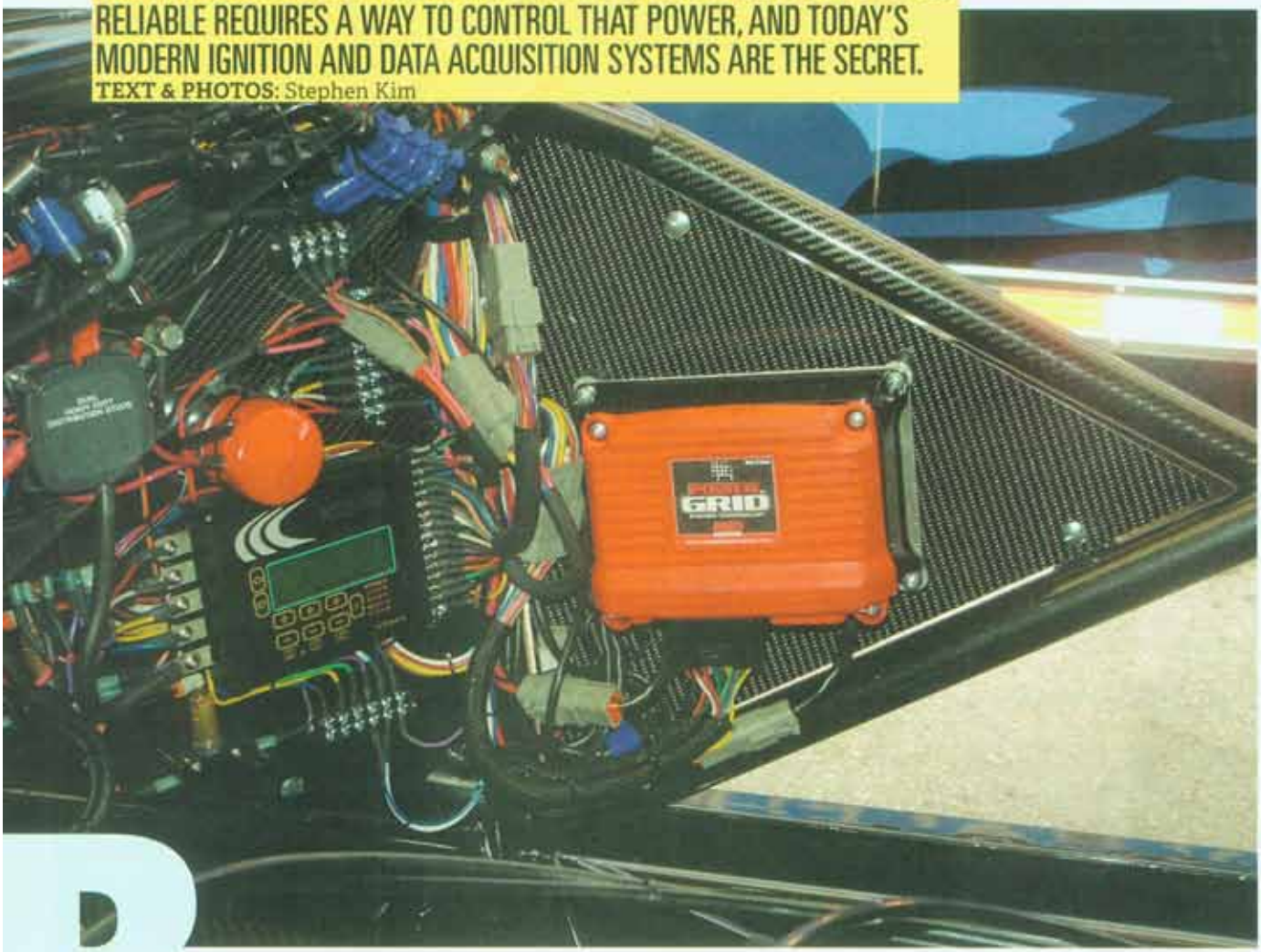
How It Works

MAKING HORSEPOWER IS THE EASY PART. GETTING IT DOWN THE TRACK RELIABLE REQUIRES A WAY TO CONTROL THAT POWER, AND TODAY'S MODERN IGNITION AND DATA ACQUISITION SYSTEMS ARE THE SECRET.

TEXT & PHOTOS: Stephen Kim



Back in the day, electronics referred to transbrakes, delay boxes, and throttle stops. With all due respect to the older crowd, in an era when 3,500-pound door slammers are running 7-second e.t.'s on 275 drag radials, it's time to reevaluate the meaning of the word. Today's small-tire drag racers are setting the scoreboards on fire thanks to a one-two tandem punch of staggering horsepower and incredibly efficient power management, and neither would be possible without the rise of modern electronics. If there's traction to be had on a dragstrip, today's advanced electronics will find it, and there's no better way to go faster than to put the power your engine is already making down to the pavement more efficiently.

To help racers accomplish this, MSD revolutionized the small-tire drag racing scene with the introduction of the Programmable Digital 7 ignition box nearly eight years ago. Instead of relying on driveline sensors to directly measure wheelspin, MSD came up with the ingenious concept of limiting engine acceleration. In essence, it provided a means of controlling traction without utilizing a traditional traction control system. Always looking to up the ante, MSD recently unveiled the next generation of programmable ignition systems with the Power Grid. As good as the Digital 7 may

"The Racepak software is based on years of experience, along with feedback from customers, which has allowed us to develop analysis software that is easy to learn and easy to use." —Tim Anderson

be, the Power Grid promises to be even better, so naturally, we wanted to take a closer look at both systems to see what they have to offer.

That said, making lots of power and putting it down to the ground won't get you very far if you're blowing up every other pass. Enter data acquisition, which enables racers to monitor every aspect of an engine's vitals to not only maximize performance, but enhance reliability as well. Since it's impossible to monitor dozens of engine parameters while driving—such as ignition timing, air/fuel ratio, inlet air temperature, boost pressure, and exhaust gas temperature—data acquisition systems record all that information for you, making it possible to review the vitals on a computer after a run. In addition to engine sensors, data acquisition systems can record a bevy of chassis and driveline parameters as well, such as driveshaft rpm, shock travel, and torque converter slippage. Racepak is the undisputed leader in data acquisition systems, and the company has just unveiled a budget-priced Sportsman system for weekend warriors. To get up to speed on the latest trends in modern electronics, we sought the expertise of Todd Ryden of MSD and Tim Anderson of Racepak. Here's what they had to say.

DIGITAL 7

TODD RYDEN: The MSD Digital 7 ignition box, PN 7531, has become very popular in small-tire drag racing classes due to its effectiveness in maximizing available traction. In order to optimize traction, there are two main programming options in the 7531 box, the slew rate limit and the rpm limit by time. The slew rate limit is a rate of acceleration rpm limiter that is probably talked about more than used. Racers can set the maximum rate an engine will accelerate—say 1,000 rpm per second—and if the motor tries to exceed that rate due to wheelspin, the Digital 7 will cut spark to keep the engine acceleration rate within the set target. The time-based rev limit, commonly called "racing on the dots", allows racers to program a rev limit that adjusts by time. Both features can help in reducing e.t.'s, but when

"Racepak's experience in building data loggers for the extreme world of nitro-methane drag racing vehicles has carried over to all of our data recorders. Any product that can survive the vibration, pressure, and heat generated by those vehicles will function well in any other type of vehicle." —Tim Anderson

programmed improperly, both could slow you down. That's why proper setup is imperative.

POWER MANAGEMENT

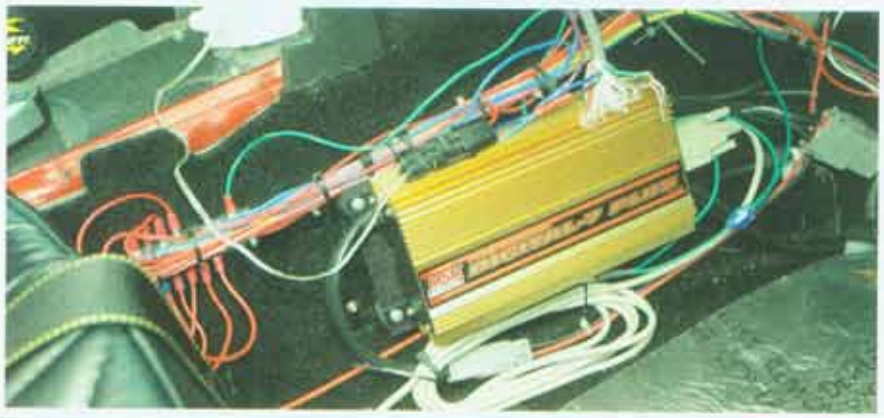
TODD RYDEN: Different combinations respond differently to different power management techniques, and as a result, the MSD 7531 box offers several methods to optimize traction. The rev limit curve, often referred to as "riding the dots", allows racers to limit engine rpm in 100-rpm increments based on time. It's programmed using MSD's easy-to-use tuning software in which rpm is graphed on the vertical axis and time is on the horizontal axis. Let's say you want to leave off the transbrake at 5,500 rpm and shift at 7,000 rpm, but you're spinning the tires coming out of the hole. With the "dots" feature, you can set up the Digital 7 to limit engine rpm to 4,000 rpm

a few tenths of a second into the run, then ramp the rpm back up to 7,000 after two seconds, once the tires have had a chance to hook. For the ultimate in precision, you can set the dots as close as 0.001 seconds apart. To establish a baseline curve, you can record a run using the Digital 7's data logger, copy and paste the rpm off that run into a new map, and fine-tune it from there.

The slew rate control offers a way to maximize traction without relying on a driveshaft rpm sensor to detect wheelspin. Instead, users can set the maximum acceleration rate of an engine in rpm per second. The nice thing about slew rate control is that it provides a rate of acceleration control for each gear, so if you're spinning the tires after shifting into Second gear, you can set it up to limit wheelspin. The slew rate control even has features that account for crank flex and other mechanical variables within the engine. Perhaps the simplest way to enhance traction with the MSD 7531 is with its time-based launch retard. With this feature, you can pull out timing at launch, then progressively ramp it back. For example, if your engine has 36 degrees of total ignition advance, the launch retard feature allows retarding the timing coming out of the hole up to 15 degrees, and ramping it back in from 0 to 2.5 seconds into a run.

POWER GRID

TODD RYDEN: The Power Grid is the next generation in programmable ignitions and offers several updates over the Digital 7. It has a faster, more efficient microprocessor along with an all-new Windows-based software system. The Grid has many features that racers have asked to be improved, including timing by time cylinder timing alterations and other improvements. The Power Grid consists of two pieces: the ignition side (PN 7720)—the brawn—and the Power Grid controller (PN 7730)—the brains of the system. It may seem counterintuitive to separate the two systems, but this arrangement has a few advantages. First, it eliminates the need to offer four different part numbers to have legal systems in all of the different racing classes. Second, it allows racers to install the 7730 Power Grid controller to



an existing ignition system, such as an MSD 8 or Pro Mag, and step up to computer programming capabilities. Being able to connect the Grid controller to an existing MSD ignition box will save racers money simply because they do not need to buy an all-new system to gain access to the increased control that the Power Grid offers. If a racer is building a new car or upgrading the engine to the point where increased spark energy is really needed, they can upgrade to the Power Grid ignition as well as the Power Grid controller. One advantage the Power Grid ignition does have is higher output than standard programmable MSD boxes. However, if a racer is happy with their tried-and-true 7AL-2, but wants to be able to control the timing of each cylinder, adding the Power Grid control module (PN 7730) is the most cost-effective route.

ACCESSORY MODULES

TODD RYDEN: One unique feature of the Power Grid system is that it can be upgraded with several accessory modules on an as-needed basis. The advantage of eliminating the slew rate and dots functions from the Power Grid controller (PN 7730) is that it makes it legal in most race sanctioning bodies. However, we've made separate accessory modules that easily connect through a CAN-bus connection to add the slew rate and dots features back into the system. MSD also offers accessory modules for boost retard and manual launch control.

This way, a racer only has to pay for features they want to add rather than having a bunch of programs and options they don't need or will never use.

EASY CONNECTIVITY

TODD RYDEN: The slick CAN-bus arrangement of the Power Grid system makes it extremely easy to wire up. CAN-bus, or Controller Area Network, is a technology used in most late-model cars and a feature that our sister company, Racepak, has used for years. It allows for a single harness to transfer data to different sensors and controls to ease wiring and connections. In short, you can connect three different modules into our CAN-bus hub, and although they will each provide different accessory controls with features to adjust, they don't need to all be routed separately to the Power Grid module. They all attach through the same connector. This saves a lot of wiring and eliminates the need to duplicate a lot of sensors, saving racers time and money. For example, the MSD ARC Module simply plugs into the CAN hub and if a racer is using a Racepak system, we can use the same driveshaft sensor that the Racepak is recording data with. No duplicate sensors are needed. This is just a glimpse of the many possibilities coming down the road with MSD and Racepak.

NEED FOR DATA ACQUISITION

TIM ANDERSON: Data acquisition used to be the exclusive territory of multimillion-dollar professional race teams, but Racepak has made that same technology available to

the sportsman, grassroots racer. Although data acquisition isn't really necessary for the average street car, it becomes more important as your racing efforts become more serious, and almost mandatory in competitive racing classes. A reference we often use is that the human body works well as a data sensor. What we mean by that is the driver can detect a number of inputs through seat-of-the-pants feel, but as a data recorder the human body does not work so well. There are just too many events happening during the course of a run for anyone to remember and recall all the details. In addition, there is no way to know what is happening inside the engine, or underneath the car, in terms of things like shock travel, driveshaft rpm, air/fuel ratio, and exhaust gas temperature without a data acquisition system. In some respects, the need to acquire data during a race isn't that different from running a dyno. How many dynos are operated with just a tachometer, oil pressure gauge, and water temperature gauge? None. The reason is because in order to make intelligent tuning decisions, data acquisition is critical, both on a dyno and on a race car. As the racing effort becomes more serious, the output of money typically follows. A failure on a $50,000 engine is much more costly than a failure on a $5,000 engine, so the ability to make intelligent decisions becomes more critical.

WHAT CAN YOU RECORD?

TIM ANDERSON: Over 25 years experience in the design and assembly of data acquisition systems has provided the opportunity to develop literally hundreds of different sensors and sensor combinations for the racing competitor. The types of engine sensors used on the data acquisition system in a typical race car would be oil pressure, fuel pressure, nitrous pressure, water pressure, boost, transmission line pressure, manifold vacuum, oil temperature, water temperature, cylinder head temperature, intake air temperature, transmission temperature, EGTs, ignition timing, and air/fuel ratio. Some of the driveline sensors used in the typical race application are driveshaft rpm, clutch rpm, and wheel rpm. These driveline inputs can reveal everything from wheelspin to torque converter slippage, allowing racers to tune their cars accordingly. Likewise, Racepak also offers chassis sensors that measure shock travel, throttle travel, ride height, air pressure, brake pressure, and steering input.

V300 VS. V500

TIM ANDERSON: The V300SD has established itself as a very popular data acquisition system for many NHRA teams as well as high-end amateur racers. It can record up to 67 different channels of information, and saves that data onto a removal SD card for easy viewing. Another unique feature of the V300SD is that it can record more than one run at a time. The Racepak V500 is a slightly older data logger that was developed to offer more analog and rpm recording inputs. This is important in applications that require faster recording, since the sampling rate of analog channels is 1,000 per second. Furthermore, the V500's additional rpm inputs provide the ability to monitor and record both overall and individual cylinder timing with the optional V500 timing package. In total, the V500 can record up to 75 channels of data, and has 4GB of internal memory.

DRAG RACE LOGGER

TIM ANDERSON: For weekend warriors who don't need as many recording channels as the V300SD and V500, Racepak offers the Sportsman drag racing data logger. This unit is ideal for budget-oriented drag racing applications. The Sportsman was designed to offer the same Racepak technology found in the V300SD, but at a price point and sensor input capacity that more closely meets the needs of the sportsman-level racer. The Sportsman still utilizes the exact same sensors as all of Racepak's V-Net–style data loggers, and is recommended for racers looking for 12 or less total external sensor inputs, on a non-magneto–equipped vehicle. That is still plenty of inputs for many drag racing applications. The base Sportsman package monitors engine rpm, driveshaft rpm, battery voltage, acceleration g's, and lateral g's. It includes a driveshaft collar and sensor, and records to a removable SD card.

LOGGERS FOR ROAD RACERS

TIM ANDERSON: The G2X and G2X Pro provide a tremendously flexible data logging option for road racers. They both use the same V-Net–type sensors as utilized by our drag racing recorders. The difference is that they also incorporate GPS data to provide speed, lap times, lap numbers, predictive lap times, and track mapping capabilities all without the need for wheel speed sensors, trackside beacon transmitters, or onboard beacon receivers. Few are aware that Racepak was the first company to develop a commercially available GPS-based data logger for motorsports, dating back to around 2000, with the first systems utilized in NASCAR around 2001. For avid road racers, the G2X and G2X Pro are invaluable tools in not just recording data, but using that data to improve lap times.

V-NET SYSTEM

TIM ANDERSON: For most data systems, the standard method of connecting sensors to the data logger is to route individual power, ground, and signal wires to each individual sensor, either directly from the data logger or from some type of expansion box. From there, sensors are grouped together at a common point, then the wiring bundle is routed back to the data logger. Conversely, Racepak's single-cable system is a much easier and cleaner method of routing data from the sensor to the data logger. Racepak's V-Net system utilizes a single common cable, which is about the diameter of a pencil, that plugs into the data logger and is then routed throughout the vehicle. Inside this cable are five wires: power, ground, shield, CAN high, and CAN low. Sensors are T'd into this V-net cable at any location, with each sensor sharing a common power, ground, and shield. The data from all the sensors are transmitted through two small CAN wires. This arrangement is similar to how a single cable into your home can transmit TV, cable, and telephone, all on the same cable.

INSTRUMENTATION

TIM ANDERSON: Racepak offers a complete line of dashes and gauges that display the information recorded by the sensors in real time. The same V-Net system that makes our data loggers easy to set up makes our gauges easy to use as well. What this means for racers is the ability to connect all the Racepak sensors and instrumentation to the same cable, allowing the instrumentation to share the information from the sensors before passing it onto the data logger. No longer is it necessary to utilize redundant sensors and gauges, but instead, all external devices connected to the data logger share the data. Racepak's gauges and dashes are simple to install, simple to set up, and simple to use. ***CHP***

GET THE HOOKUP

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