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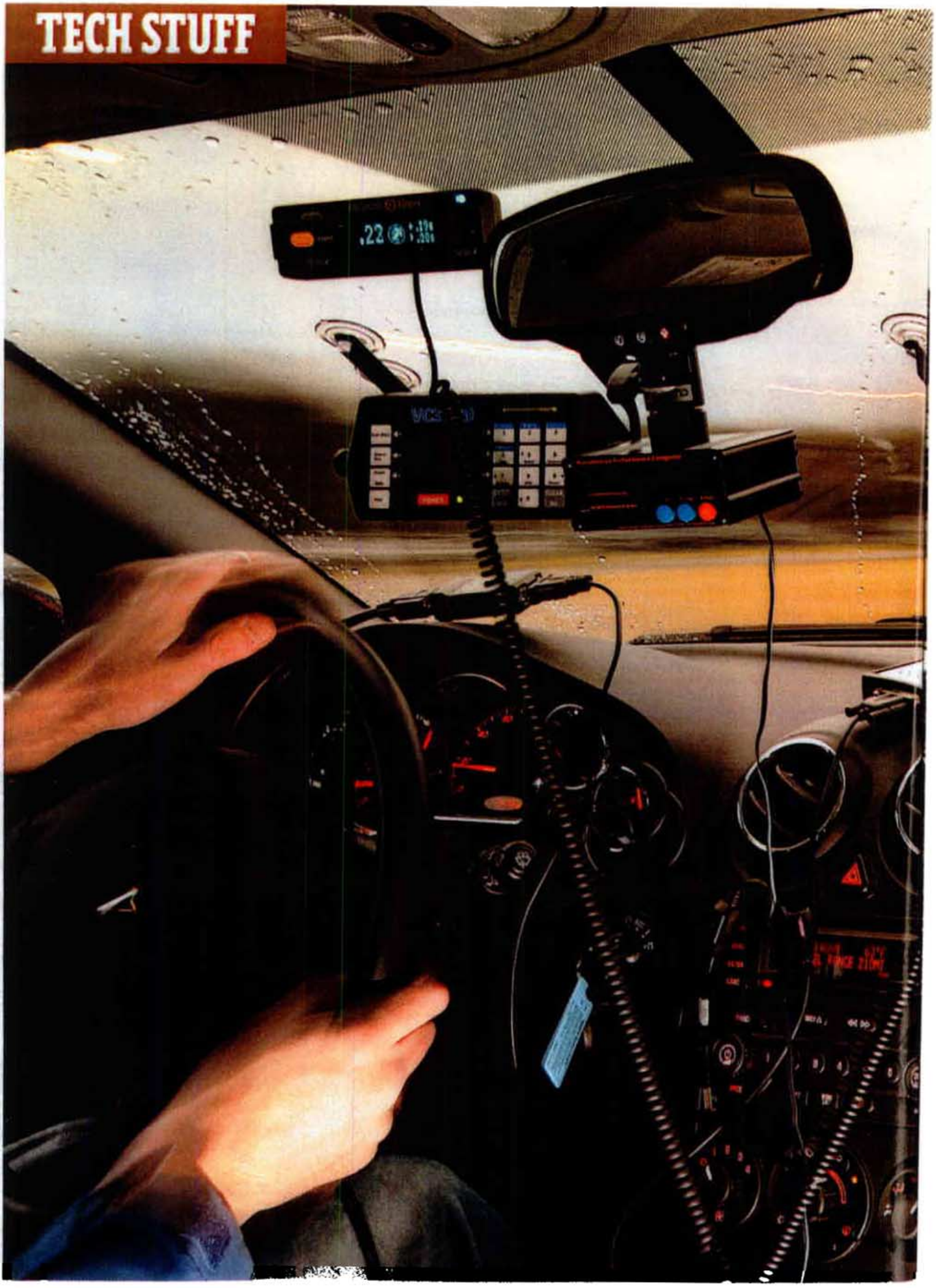
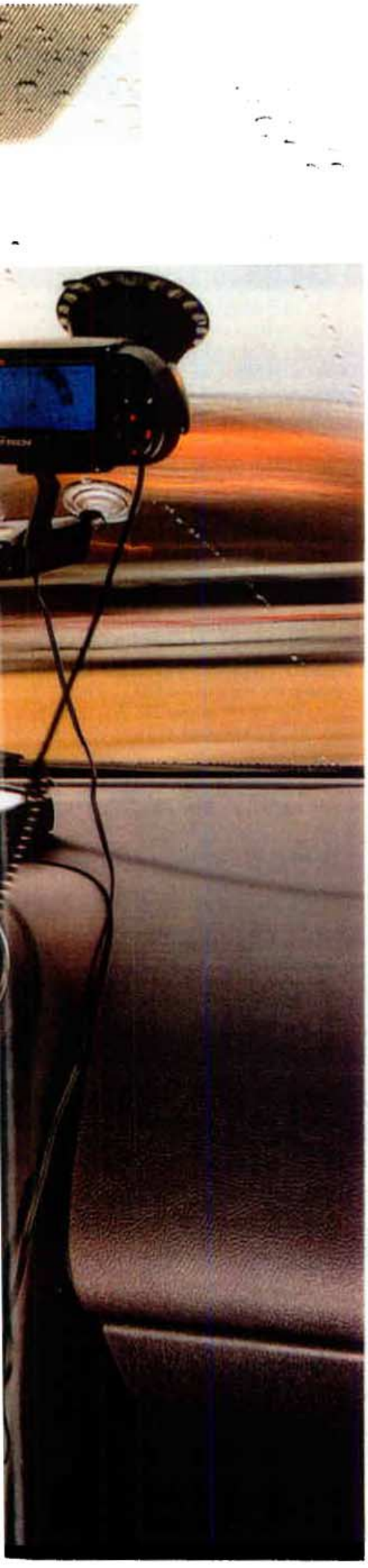




Do Inexpensive Performance Meters Work?

The makers of these compact devices suggest they're as accurate as more expensive test gear. To find out, we put seven of them through our wringer.

BY DAVE VANDERWERP AND LARRY WEBSTER

PHOTOGRAPHY BY AARON KILEY AND MORGAN J. SEGAL

"What'll it do?"

That's the big question heard over and over during the course of *C/D*'s instrumented testing of some 130 cars a year. Although testing is the most entertaining part of our jobs, we do take it seriously enough to have forked over more than $30,000 a few years back for three state-of-the-art VBOX testing systems made by Racelogic that provide the performance numbers essential to our road tests.

But perhaps there's no need to spend so much. In the past decade, a number of companies have sprung up that sell relatively inexpensive devices they claim can accurately measure a car's performance.

So we got our mitts on seven of these performance meters. Because they can get pricey, we imposed a $1000 cap; our seven ranged from $90 to $960. Most of these meters simply attach with suction cups to the inside of the windshield, like radar detectors. Our mission was to find out if they work, and it was not easy. In fact, we wound up making more than 100 quarter-mile passes at a drag strip 1000 miles away in Gainesville, Florida. (For you cynics, we had a nonstaffer buy the units to ensure we got representative examples.)

Six of the seven units we bought use internal accelerometers and an electronic timer to measure performance. An accelerometer is a device about the size of a wristwatch battery that produces an electrical signal that changes under acceleration. Simply put, if you can monitor acceleration in relation to time, you can calculate speed and distance traveled.

Accelerometers have one big drawback, however. The unavoidable pitch and roll motions of a vehicle being driven hard can upset the readings since they alter the plane in which the accelerometer operates. Under hard acceleration, for example, a car's tail squats and its nose lifts, so the accelerometer on the windshield is pointing slightly upward rather than horizontally down the road in the direction of the car's motion.

You can ignore this effect if you simply want to find out whether a modification has made your car faster or slower. However, if you want to determine whether one car performs better than another, you'd better budget some time to calibrate the meter for each vehicle.

Our sophisticated VBOX system doesn't use accelerometers, precisely to avoid this problem. Instead, the VBOX relies on the global-positioning system (GPS) to measure a vehicle's motion. To work, the VBOX must be in communication with at least four of 24 GPS satellites orbiting the earth. As a vehicle travels down the test venue, there's a minuscule shift in the arrival time of the radio signals that travel between the satellites and the VBOX's antenna. By measuring this shift, the VBOX calculates speed, acceleration, and distance. Racelogic, the company that makes the VBOX, asserts that its devices are accurate to within 0.06 mph.

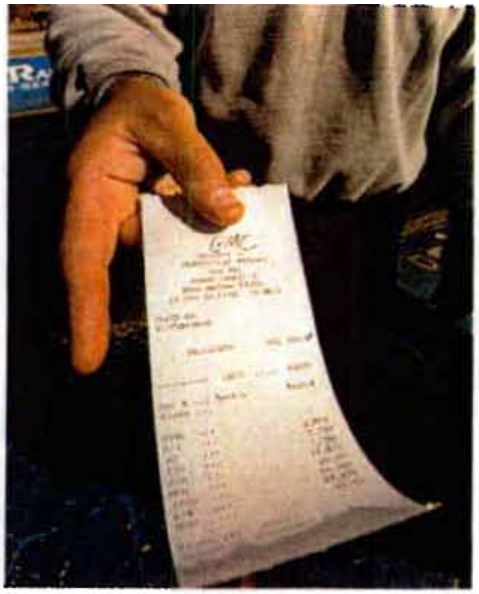
Another way to measure performance involves tapping into a car's onboard computer. One of the seven performance meters, the Nology PDA-Dyno, relied on

this method. Using wheel speeds from the computer, the PDA-Dyno calculates speed and distance. The problem is that the wheel-speed sensors on new cars are calibrated precisely to the diameter of the car's original tires. Change your tire size or run too little or too much air pressure, and you'll get inaccurate readings.

Some of the units we tested have multiple accelerometers capable of taking measurements in a lateral as well as longitudinal direction and can therefore also measure cornering grip. But there, too, the accelerometer's reading is inaccurate when the car leans in a turn.

No two meters are exactly alike, although all the manufacturers claim each meter can accomplish a variety of tasks with excellent accuracy. Naturally, there is a dizzying array of features, not all of which are convenient. For example, after you mount the $90 Tazzo on your windshield and line up at the start of the drag strip, you have to decide what you'd like to measure—either a 0-to-60-mph time or a quarter-mile. But not both. The Tazzo will record only one task at a time. In contrast, the Passport G-Timer GT2, at $180, will provide a range of acceleration numbers from a single run.

We figured if one of these meters could accurately measure a quarter-mile run, then it could likely provide correct numbers for all the shorter distances—0 to 50, to 60, and so on. So the quarter-mile run became our test parameter. For the purposes of this evaluation, we could have simply used the VBOX as the yardstick by which to compare each meter's results, but we decided to go all the way and measure against the undisputed king of timing systems—the foolproof lights used at drag strips.



With the strips in Michigan closed for the winter, we dragged all our expensive test gear and the seven meters to Gainesville Raceway in Florida for two days of comparison testing. And because we wanted to see how body motions would affect the accuracy of the meters, we tested them on two vehicles, a Pontiac G6 and a GMC Envoy XUV.

We tested each meter, mounted according to its instructions, in eight runs against the drag strip's timing lights. We positioned each car precisely at the starting line [see "The Importance of 'Rollout,'" below].

For the first four runs, we used the out-of-the-box settings (shown as "uncalibrated" in the graphs). Most of the meters can be calibrated to compensate for time gained (or lost) due to the vehicle's pitch. However, to do so you'll need drag-strip results to provide an accurate measure of the vehicle's actual performance.

After the first four runs, we tinkered with available settings and then ran and averaged four more passes, shown as "calibrated" in the following graphs. If the meter was capable of recording braking or lateral g, we simply used the meter in conjunction with our regular testing procedure and compared the results.

As noted earlier, we made more than 100 passes down that quarter-mile and tabulated stacks of data (we also ran tests of our VBOX against the drag-strip timing system). We did our best to boil down the data to the easily digestible graphs shown here. If you want to see the results for

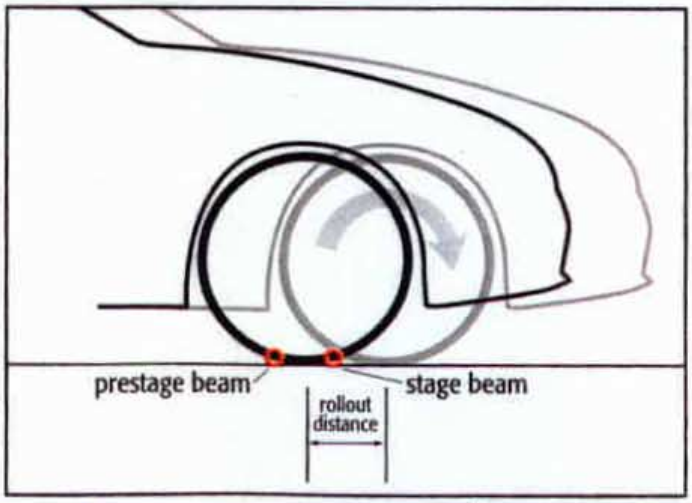
The Importance of 'Rollout'

Should the owner of one of these meters want to compare its performance against the authoritative equipment used at drag strips, he or she will need to deal with "rollout," which is the distance a vehicle can move before triggering the timing lights.

A little drag-strip primer: As a car creeps toward the two light beams of the starting area, its front tire will eventually block the first beam and trigger a "prestage" warning. This informs the driver that the official starting line, where the "stage beam" shines across the track, is only seven inches ahead. When the front tire triggers that second beam, the vehicle is properly staged for a run. However, the vehicle's position can still vary by well over a foot while its front tires are blocking the stage beam. This is critical, because the drag-strip clock does not start until the second light, or stage beam, is uncovered. It is this distance that is the critical rollout.

The length of the rollout depends on the diameter of the tire and where the driver chooses to position the car at the start. Although the rollout distance is typically only a foot or so of a quarter-mile, it can affect the elapsed time by as much as 0.3 second, and to the serious gearhead, that's an eternity. Therefore, we needed to make sure every run in our test started at precisely the same point because of that 0.3-second issue.

The meters presented some problems in this area. They didn't all deal with rollout in the same way. Most had adjustable distance rollout. One used speed rollout that triggered the meter's clock when the car reached a speed threshold, and one had a nonadjustable 12-inch rollout. Another had no rollout at all. To keep things even, we positioned the cars on the track with a 12-inch rollout for all the tests because that distance matched up with most of the meters. Also, a car accelerates to 3 mph in about 12 inches, so that distance worked well for the meter with speed rollout. *–LW*



every run, we've posted a spreadsheet at www.CARandDRIVER.com. Number geeks, have fun.

We found the meters were off by a few tenths of a second in the worst case to a mere couple hundredths in the best case. Here, in price order, lowest to highest, is what we learned about each meter.

Gold Coast Systems Tazzo VPC, $90

Highs: Attractive price, highly accurate once it's calibrated.

Lows: Small screen, can only do one test at a time.

The Verdict: Better than we thought the cheapest meter here would be, but there are even better deals out there.

We nicknamed the Tazzo "performance-meter lite" because it will take just five measurements: time to 60 feet, to 60 mph, to an eighth of a mile, and to a quarter-mile; and 60-to-0 braking distance. And it calculates road horsepower once you've entered in the vehicle's weight—as can all the other meters here. The maker claims the meter can measure cornering grip as well, but you have to mount the Tazzo sideways to do it, and then it's borderline dangerous to try to read the display. So to us, that doesn't count.

As mentioned earlier, you can't view all the acceleration parameters after a run, so when you line up, you have to make a choice: Do you want to see the 0-to-60 time, or would you rather get quarter-mile data?

To calibrate this unit, you do four drag-strip runs and record the times from the Tazzo and the track's timing system. Then you use the formulas in the owner's manual and enter the factors into the meter. The Tazzo has a nonadjustable 12-inch rollout, so to get the best results, you'll have to perform your runs with a 12-inch rollout. With proper calibration, the Tazzo was one of the most accurate meters in the test. Without calibration, its quarter-mile numbers were about 0.2 second different from the drag lights when the Tazzo was installed in the Pontiac G6, but in the squat-happy Envoy, the gap grew to almost a full second.

The Tazzo also performed well in the 60-to-0 braking test. There isn't a lot to complain about here except for the small screen.

Passport G-Timer GT2, $180

Highs: Easy to use, clearly legible screen, a plethora of interesting displays.

Lows: Optional PC software is a little simplistic.

The Verdict: Lots to offer for the price.

The Passport G-Timer comes in two versions, the $100 GT1 and the $180 GT2. We tested the GT2 and decided it is worth double the price of the $90 Tazzo. It displays all the segment data from one drag-strip run (0 to 50, 60, 70, etc.), it has a 10-run memory and a long list of possible screen displays, it measures cornering grip,

		Gold Coast Systems Tazzo VPC	Passport G-Timer GT2	Hamilton Performance Electronics PocketDYNO	Tesla Electronics G-tech/ Pro RR	Nology PDA-Dyno	Vericom VC3000	Race Technology AX22
	price	$90	$180	$250	$300	$370	$898	$960
operation	accelerometer based	✓	✓	✓	✓		✓	✓
	GPS based							✓
	three-axis accelerometer				✓			
	rechargeable battery						✓	
	requires handheld computer			✓		✓		
	accepts external inputs						✓	✓
	internal memory		✓		✓		✓	
acceleration	starting-light simulation				✓			
	rollout type	distance	distance	speed	distance	none	distance	distance
	adjustable rollout		✓	✓	✓		✓	✓
	pitch correction	✓	✓		✓		✓	✓
	road-horsepower measurement	✓	✓	✓	✓	✓	✓	✓
	estimates quarter-mile			✓				
	shift lights				✓			
skidpad	g-meter on screen	✓	✓	✓	✓		✓	✓
	measures lateral g		✓	✓	✓		✓	✓
	skidpad simulation		✓					
	roll correction		✓				✓	✓
braking	60–0 braking	✓	✓		✓		✓	✓
	adjustable braking parameters				✓		✓	✓
data	multiple results from each run		✓		✓	✓	✓	✓
	stores runs		✓	✓	✓	✓	✓	✓
	analysis software		$25		✓	✓	$350	✓
other options	road-course recording				✓		requires PC software	✓
	OBD II interface					✓	$350	
	measures rpm				✓	✓	$560	✓

and its layout is simple and the controls are intuitive.

The Passport has an adjustable distance rollout. To ensure accuracy, there is a pitch factor to calibrate the meter. The owner's manual provides suggestions for different types of cars, and we used the correction factor of 2.5 when the Passport was installed in the Pontiac G6. After performing the four initial runs, we experimented to find a number that made the meter line up closer with the drag-strip results, which turned out to be 3.4.

When calibrated, the Passport was a smidge less accurate than the Tazzo, but we're splitting hairs here because the difference in accuracy works out to a measly one-tenth of one percent.

The Passport has a handy skidpad function that averages the lateral g over an adjustable time period from 3 to 16 seconds. There's a calibration factor for this feature as well, and we were able to get the Passport to within 0.01 g of what our usual testing procedure produces.

The Passport's braking numbers were five to eight feet longer than what our

VBOX recorded. It's likely, however, that fiddling with the calibration factor would have reduced the discrepancy, but we're guessing that owners of these personal meters probably won't spend an excessive amount of time trying to get perfect results.

As for that less expensive GT1 model, it records the same straight-line numbers as the GT2, but it only saves one run and you can't download data to a PC. We'd opt for the GT2. Purchase the optional $25 serial cable and software, and you can then download acceleration runs to your PC.

Hamilton Performance Electronics
PocketDYNO, $250

Highs: Small, easy to use, can estimate quarter-mile results from 0-to-60 times.

Lows: No pitch or roll adjustments, requires a handheld computer, not very accurate or precise.

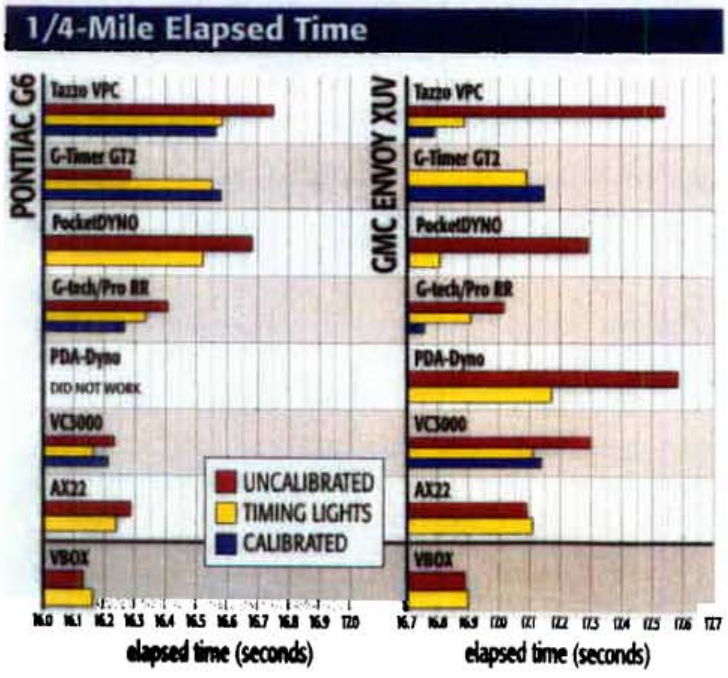
The Verdict: Some innovative thinking, but a lack of accuracy sinks it to the bottom of this group.

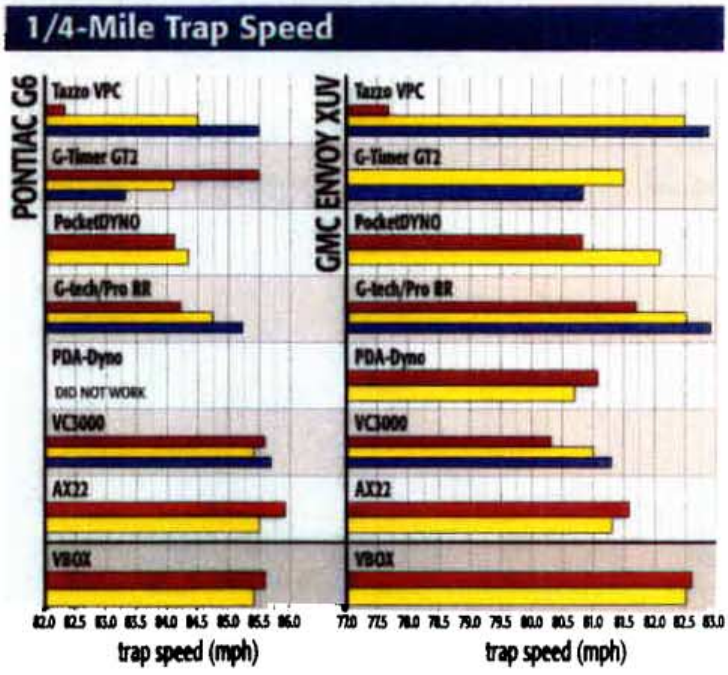
The PocketDYNO is a small box (about the size of a three-by-five card) that we mounted to each vehicle's center console with Velcro. It feeds data to a handheld computer (a Palm, a Pocket PC, or a laptop). Its unobtrusive size is appealing, and it's one of only two units in this test that won't take up any windshield real estate.

Properly mounting the PocketDYNO is critical, because it has no adjustment for pitch or roll. Therefore, the closer it is to level and square to the car, the more accurate it will be.

With only three test options, operating the PocketDYNO is easy. You can choose a speed run, a distance run, or a g measurement. During a speed run, the PocketDYNO measures the 0-to-60 time and then estimates a quarter-mile time and speed based on the 0-to-60-mph data. The distance run measures quarter-mile times, and the g measurement can store up to 20 seconds of data and display peak g in four directions.

The PocketDYNO's calculations turned out to be slower than the authoritative drag-strip times in both vehicles, off by 0.16 second in the G6 and 0.48 second





in the Envoy. Some runs got within 0.1 second of the drag-strip time, but others were as far off as 0.65 second, making the PocketDYNO the least reliable timer. Its only adjustment for rollout is start speed, but even with changes, this meter's accuracy did not improve.

We suspect the PocketDYNO was less accurate inside the Envoy because that vehicle's high center of gravity aggravated the PocketDYNO's inability to adjust for pitch.

However, the estimated quarter-mile function is a good idea—a driver is less likely to attract cops when doing 0-to-60 runs on public roads—and was more accurate than the PocketDYNO's actual quarter-mile measurements during our tests. The estimated quarter-mile times were 0.06 second off in the G6 and 0.19 off in the Envoy.

Because the PocketDYNO can't be adjusted for roll, its results on the skidpad were not accurate. In the G6 it was 0.05 g off, and in the tippy Envoy it missed the mark by 0.12 g.

The PocketDYNO is the only meter of the bunch that estimates quarter-miles, but its lack of accuracy stands out in this group, and for $250, it isn't a bargain.

Tesla Electronics G-tech/Pro RR, $300

Highs: Good accuracy without calibration, fantastically useful PC software, lots of unique features that you learn to appreciate.

Lows: Sunlight can make the screen difficult to read.

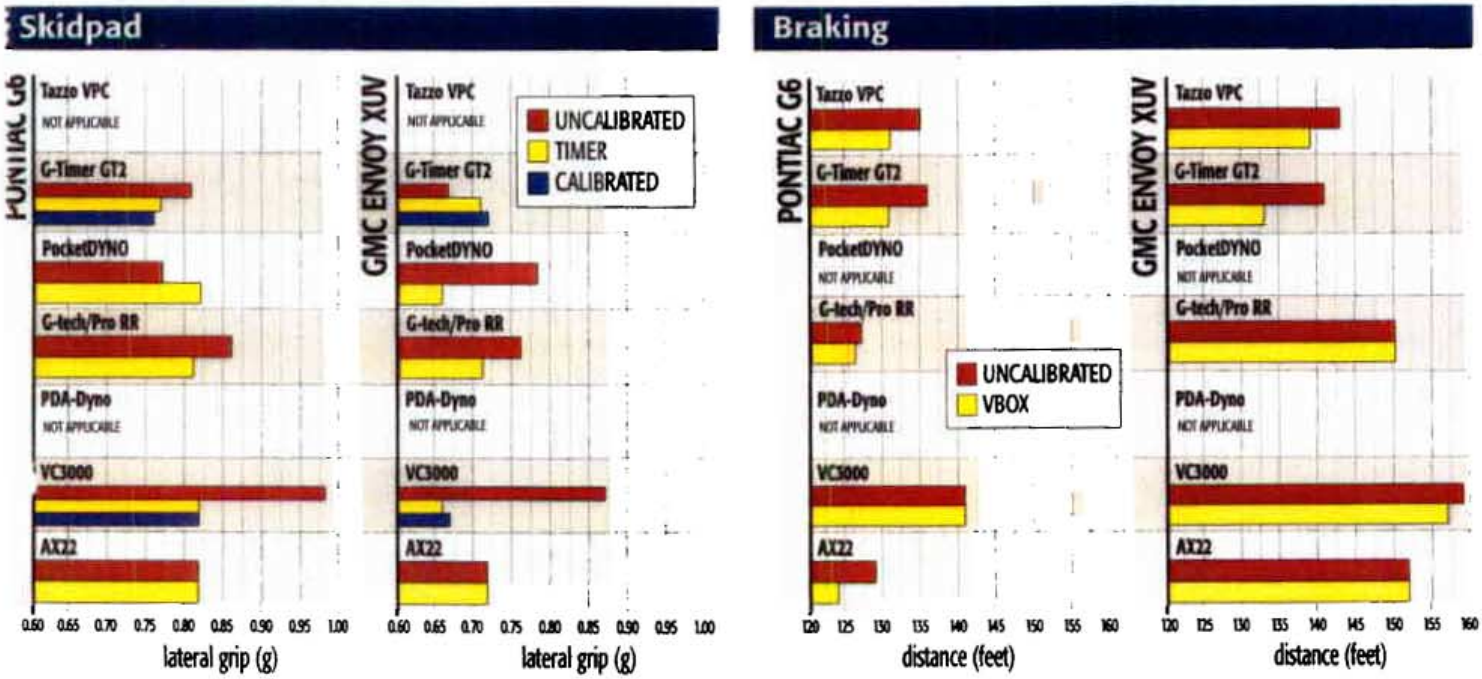
The Verdict: It does a lot for $300.

We really grew to like the G-tech/Pro RR. For starters, it's the only one of the accelerometer-based units that measures acceleration in the vertical plane. Theoretically, that means the G-tech can detect how dramatically the car pitches during an acceleration run and automatically correct for it. We found that only the $960 Race Technology AX22 was measurably closer to the drag lights without calibration. Also, when it was installed in the Envoy, the G-tech recorded the same 60-to-0 stopping distances as the VBOX.

There is a calibration procedure that supposedly makes the G-tech's quarter-mile speed readings more closely match those of the drag lights. We performed the prescribed calibration, but interestingly, we found the procedure increased accuracy only when the G-tech was installed in the Envoy.

That quibble aside, the G-tech has two unique features. It has shift lights that flash at a designated rpm to signal when it's time to shift gears. Plus, there's a simulated drag-strip starting system that tests your reaction time. You can also store configuration data for numerous vehicles so you can switch from car to car without having to reprogram the tachometer or shift lights.

Like some of the other meters, the G-tech measures cornering grip but provides



no calibration function for this feature. During our testing, we found that the lateral-g number the G-tech displayed was about 0.05 g higher than what the car was pulling according to our timing device.

It was the computer software that really set the G-tech apart, however. The G-tech has internal memory to record data that can be downloaded onto a computer. With the software installed on your computer, you can review and compare drag-strip runs. Since the unit also logs rpm, you can see which shift points improved acceleration.

Plus, you can record g-loading as you negotiate a racetrack, download the data, and compare your performance from lap to lap. The information provided isn't detailed enough to dramatically help a pro driver, but it could definitely aid a beginner. It highlights where the driver is pushing the car and where he or she isn't.

The software is intuitive and easy to use and automatically creates new directories and files based on the date and time the data were recorded.

There is a less expensive version of the G-tech, called the SS, that sells for $200 and does not have the racetrack features of the RR, nor does it come with the software that lets you view and compare runs on a PC. Both G-techs, however, have excellent windshield mounts, simple buttons to navigate the various options, and the handy tachometer and shift lights.

The first G-tech debuted in 1995 and has undergone four redesigns since then. The extensive development shows, and you should definitely check out the Web site [see "Manufacturers," page 153], which has pages of technical articles and a forum in which you can discuss your results.

If you can stretch your budget to $300, you won't be disappointed.

Nology PDA-Dyno, $370

Highs: Compact size, consistent (but inaccurate) quarter-mile times, ability to monitor vehicle sensors and clear trouble codes.

Lows: Inaccurate results, no acceleration adjustments, no braking or lateral-g measurements, has to communicate with ever-changing vehicle electronics, requires a handheld computer.

The Verdict: If you're more into fiddling with electronics than measuring a car's performance, this is for you.

The Nology unit is the oddball of the group. The others all have accelerometers, this does not. It gets its power and deciphers all its information from the OBD II (on-board diagnostics, second generation) connector, which is usually located underneath the driver's-side dash panel. The OBD II prerequisite means the PDA-Dyno won't work on any model-year vehicle before 1996. But because of its connection into the vehicle's electronics, the PDA-Dyno can display outputs from various sensors: such things as engine speed, fuel economy, oxygen-sensor status, and any trouble codes stored in the car's computer.

Those additional features are certainly an advantage for the PDA-Dyno, but communicating with a vehicle's electronics can often be tricky business, and at $370 (not including the required handheld computer), it doesn't come cheap. Since we're skeptics, we made sure the PDA-Dyno worked on all the vehicles in our Michigan test fleet, but when we got to Florida, it wouldn't communicate with the Pontiac G6. This is exactly the downside with this type of system—you're always wondering if it's going to work, and wondering when the automakers will change their standards, requiring you to buy a new device.

For our tests with the Envoy, which

consisted of quarter-mile runs, the PDA-Dyno showed its lack of adjustability. This unit has no compensation for rollout and instead measures a 0-to-quarter-mile time. Because of this, we found the PDA-Dyno's times to be about 0.4 second slower when compared with the drag strip's numbers. Roughly 0.3 second of that difference can be attributed to rollout, which means the PDA-Dyno is still 0.1 second slow and therefore not up to snuff with the top units here. The trap speeds were consistently inflated by about 0.4 mph, because the PDA-Dyno's trap-speed measurement is slightly different from the drag strip's. However, run to run, the PDA-Dyno is precise in time and speed, which makes it useful for before-and-after comparisons.

Vericom VC3000, $898

Highs: Accurate results, easy to mount precisely with built-in bubble levels, most comprehensive brake tester of the group, internal battery requires no power outlet.

Lows: Pricey, oversized, must dial in pitch-and-roll compensation to obtain accurate results.

The Verdict: Professional-level acceleration and brake testing without using wheel speeds or GPS info.

Two more worth noting: The $745 MaxQData MQ175 (left) uses GPS inputs and accelerometers, taps into a vehicle's OBD II system, and logs data on a handheld computer. It looks impressive, but since it requires more than a few minutes of setup time, we felt it wouldn't fit in with this group (425-562-3423; www.maxqdata.com). The Racepak G2X (right) is a GPS-based data logger that's so new it wasn't available for our test. The G2X will cost $899, and in addition to measuring speed, acceleration, and position, it has a dash display that shows lap-time data (949-709-5555; www.racepak.com). We'll test both of these systems in the coming months and let you know what we think.

The VC3000 is at least twice the size of any other meter in this test. But with the added bulk come more features. It's the only device with a rechargeable battery, so you don't need the vehicle's power outlet. It also has a bubble system similar to the one on a carpenter's level that makes proper mounting on the windshield easy. Menus on the VC3000 are well laid out, cutting down on the study time before measuring acceleration, braking, or grip. All runs can be stored to the VC3000's onboard memory for later review or scrolled through after a run is completed.

With default settings, the VC3000 always registered slightly slower than the timing lights, whereas the trap speeds were high in the Pontiac but low in the Envoy. Timing was reasonably accurate in the G6—slow by 0.07 second—but less so in the Envoy, where it was off by nearly 0.2 second. Again, this is due to the Envoy's greater pitch during acceleration. After dialing in the VC3000 using the pitch factors, it was off by 0.05 second in the G6 and 0.03 in the Envoy, making it second best in this test. Trap speeds were high by 0.3 mph in both vehicles after pitch adjustments.

Similarly, on the skidpad the VC3000 was off by more than 0.10 g initially but was within 0.01 g after dialing in the roll-compensation factor.

Correcting for Weather

One of the best uses for these performance meters is to track the effectiveness of modifications done on a car. First you test the car in stock condition and record the results. Then you install a new exhaust system, or whatever, and test it again.

But there's a problem: A car will run faster on a cool day than it will on a hot day because cooler air is denser and contains more oxygen, allowing the engine to burn more fuel. Similarly, high barometric pressure produces more power than low pressure, and dry air has more oxygen than moist air. So how do you know if a quicker run was due to the new exhaust or more favorable weather?

Because we conduct much of our testing in Michigan, with its extremes of bitter cold and withering heat, we are always dealing with this problem. To eliminate the effects of weather we use a mathematical calculation to adjust our test results to dry air at sea level (barometric pressure of 14.7 psi) and a temperature of 60 degrees Fahrenheit. If it's cold out, the weather correction typically slows down our raw results, and conversely, when it's hot, the performance results improve.

In summary, we always measure the prevailing wet- and dry-bulb temperatures and absolute barometric pressure at each of our test sessions. We use these data to calculate the amount of dry air present and refer to a series of charts to adjust our raw performance numbers to compensate for these conditions.

To read the gory details of all these procedures, please visit www.CARandDRIVER.com.

–LW

Brake measurements with the VC3000 were second best in this group. The braking runs from 60 mph were within an impressive two feet of the VBOX's numbers—only the G-tech was closer. The start speed is adjustable, and unlike any of the others here, the VC3000 calculates at what speed you started braking and corrects the stopping distance accordingly, just as we do with our brake testing.

A couple nicks on the VC3000's report card are its $898 price and the lack of any explanation about the calibration procedure in the owner's manual. We figured it out, but since it is imperative to the meter's accuracy, it should be explained.

Race Technology AX22, $960

Highs: Pinpoint accuracy from car to car with no fiddling, slickest windshield mount of the bunch, uses common CompactFlash memory cards to store data.

Lows: Most expensive, minimal information displayed on screen, three-button interface is not intuitive, difficult to glean performance data from computer software.

The Verdict: The most accurate device—no adjustments required.

At $960, the AX22 is the most expensive device in this test. However, it is the only one to use GPS to assist in its calculations, making it more like the VBOX system than any of the others. The AX22 uses both accelerometers and GPS info to cipher acceleration times and braking distances. With the AX22's GPS input, the driver can determine the best line around a race course using the supplied software, lap times, and lap-to-lap comparisons of measured variables such as speed or g.

Mounting the AX22 is made easy by a large suction cup and a locking device that ensures the unit is mounted securely the first time—no saliva required.

Accurately measuring quarter-mile times is the AX22's strong suit. From the get-go, it was just 0.04 second slow on the Pontiac and 0.02 second slow on the GMC. We fiddled with the pitch factor, but that didn't affect the results in the least. However, trap speeds were always high—by 0.3 mph in the G6 and 0.4 mph in the Envoy.

The AX22 maintained its accuracy while circling the skidpad, where its results were absolutely spot-on in both vehicles. However, we got mixed results when measuring stops from 60 mph. The AX22 was five feet off in the Pontiac—the second worst in the test—but perfectly true in the Envoy. We can't explain this odd variation in results, and there is no specific braking calibration.

Although the AX22 provides highly accurate data, it was the most difficult meter to operate in our test. It requires some study time to use the AX22's three buttons to navigate the menus with any success. On top of that, if you scroll through the results at the end of an acceleration test, you can't scroll again. The only way to access the numbers a second time is to download them to a computer—easy enough, since the AX22 is the only device to use a CompactFlash memory card—but even then the pertinent quarter-mile times aren't easily extracted. And braking results can't be seen at all until the information is downloaded.

So the AX22 is the most accurate but also the least user-friendly and the priciest. However, if testing requires switching vehicles with no time for calibration, the AX22 won't let you down.

You might be wondering how *C/D*'s much-heralded VBOX stood up to the timing lights. We tested it with the drag lights, and it was more accurate than the best meter in this test, the AX22. Both of these systems are so close to the drag lights, however, that it's barely worth mentioning that a difference exists. We're talking about discrepancies that are less than half a percent.

However, for our testing we need real-time display of acceleration data, in-depth-analysis software, and external inputs for a brake trigger, just three of many features the VBOX has that the AX22 does not.

Judging by this current crop of performance meters, however, we find that the VBOX's advantages are being challenged. We won't be benching it anytime soon, but we did find that people with much less than $11,800 (the current price of a VBOX) can buy a meter that provides some amazingly good results. As a measuring device for a single car, most of the meters are quite good, but if you want to determine definitively whether one car outperforms another, you'd better budget some time for calibration. The VBOX requires no calibration.

Before you take out your car to try to equal our times, remember that our results are adjusted for weather conditions [see "Correcting for Weather," page 152]. We also average the best runs in two directions to cancel out the effects of wind, and we use a 3-mph rollout. And of course there is car-to-car variability.

Finally, find a safe spot for testing—one that lets you concentrate on the task at hand rather than traffic. ■

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