

BELTRONICS™

**Vehicle
PERFORMANCE COMPUTER**

Vector **SERIES** with Vacuum Fluorescent Display

OWNER'S MANUAL



WARNING

The manufacturer is not responsible for any accidents, property damage, or injuries that occur while using the Performance Computer.

Like your car's speedometer, this device is no more than a measuring instrument, a tool that can be used to measure vehicle performance. Obey all traffic laws on the street. Drive responsibly, and use common sense.

ROLLOVER WARNING

This device measures G-Forces, but it does not change the laws of physics. Under certain circumstances, almost any vehicle can roll over, causing serious injury or death. Taller vehicles such as SUVs, trucks, and vans are more likely to roll than conventional cars, so even more care needs to be taken with those vehicles.

No electronic device can take the place of the driver's judgment.

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One-button operation

TIMED RUN OPERATION

Stop car, press **TIMED RUN** button, then start anytime.

G-METER OPERATION

Press and release **G-METER** button to display G-Forces. Press again to choose alternate G-Meter displays.

To enter Setup Mode, hold this button



REVIEW TIMED RESULTS

Press **UP** or **DOWN** buttons to review data from last ten timed runs.

G-METER CALIBRATION

Install unit on windshield, park on level ground, then press and release **CALIBRATE** button.

To adjust display brightness, hold this button

Quick Start Guide

Please read the entire manual to learn details of the many capabilities of your new Performance Computer. This page provides only a basic overview of the installation, features, and capabilities.

INSTALLATION

1) Plug into lighter socket

Plug the cord into the Performance Computer, and into your car's lighter socket. The Performance Computer is always "On," there is no on-off switch.

(If your car's lighter socket is always powered, unplug the Performance Computer when not in use to avoid discharging your car's battery.)

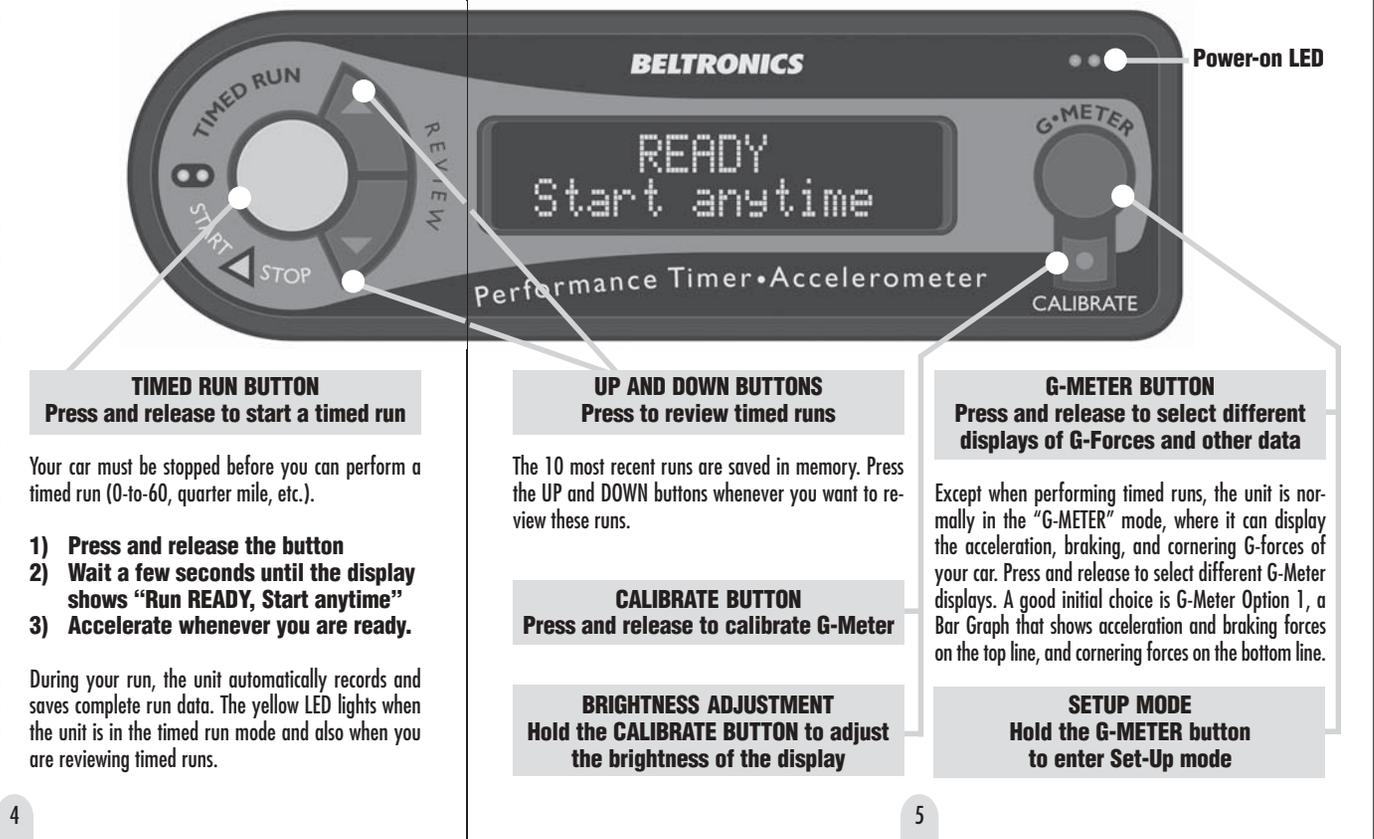
2) Attach to windshield in center of car

Mount the Performance Computer centered between the driver and passenger with the suction cup mount. Make sure the unit is mounted squarely in the car. Do not mount the unit so it is angled toward the driver.

Pivot the unit on the bracket until it is approximately level (it is not necessary to be perfectly level).

3) Park on a level surface, then press and release the CALIBRATE button

Each time you remount the unit, you must calibrate the G-Meter. (The calibration is stored in memory even if the unit is unplugged, so you don't need to calibrate again unless you reposition or reinstall the unit.)



Installation

Mounting Location

Mount the unit on the windshield, centered between driver and passenger. The unit must be straight across the car. Do not angle the unit toward the driver!

Angle adjustment

Pivot the unit on its windshield bracket until it is approximately level. It is important that the unit stays in position during use. If the unit pivots too easily, tighten the large Phillips-head fastener slightly.

Calibration

- **G-Meter:** Park on a level surface, then press the CALIBRATE button to calibrate the G-Meter function.

- **Timed Run:** You do not have to press the calibration button before a timed run. The Performance Computer automatically performs a separate internal calibration before each timed run.

Remote Control Cord

A convenient way to control your Performance Computer.



- Press and release the button to operate the G-Meter function. Press again to change to different display.

- Press and hold the button to start a Timed Run.

Unit must be mounted squarely in car

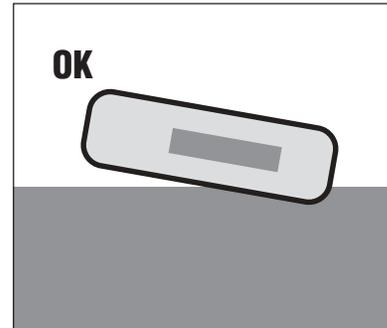
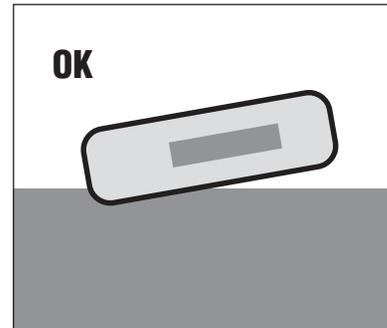
Mount the unit on the windshield, centered between driver and passenger. The unit must be straight across the car. Do not angle the unit toward the driver!



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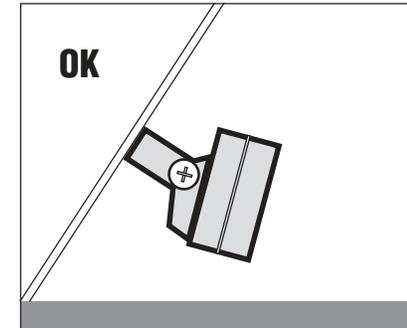
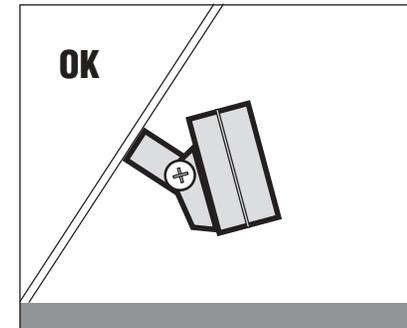
Unit does not have to be exactly level

The unit does not have to be perfectly level side to side, special circuitry automatically compensates for mounting angles up to 30 degrees from level.



Tilt does not have to be exactly level.

The front of the unit does not have to be perfectly level, special circuitry automatically compensates for mounting angles up to 30 degrees from level.



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How it works

The Performance Computer measures the performance of your car by sensing acceleration forces.

An internal precise digital 2-axis accelerometer tracks your car's acceleration, braking, and cornering forces approximately 200 times each second. A built-in computer continuously analyzes this data and calculates corrected G-Forces for the G-Meter operation, and speed and distance data for the Timed Run operation.

Your Performance Computer was developed and tested extensively, both at drag strips and using our VBOX professional vehicle testing equipment, the ultra-precise data acquisition system used by auto makers BMW, Honda, and AMG Mercedes; race teams Ford Racing, Roush Industries, Chip Ganassi Racing, and Renault F1; tire manufacturers Michelin, Bridgestone, Goodyear, and Kumho; and car testers at Car and Driver and Automobile Magazines.

The result is the most accurate accelerometer-based performance computer available. And it's the first unit with true one-button operation: Press a single button for calibration, a single button for G-meter operation, a single button to start a timed run, and a single button to review your previous runs.

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Specifications

Accelerometer

2-axis, $\pm 2G$ range, high-resolution digital outputs.

Processor

Advanced RISC-based 8-bit microcontroller with 128KB Flash Program Memory, 4KB SRAM, 4KB EEPROM, integral 8-channel 10-bit A/D converter. Throughput up to 14.75 MIPS at 14.75 MHz. Additional external 1MB flash memory for data storage.

Temperature Compensation

Factory-calibrated. Internal digital temperature sensor provides real-time continuous temperature compensation.

Power Regulation

Ultra-stable high-efficiency digital power supply with secondary 5 volt regulator for accelerometer power.

Display

Vacuum Fluorescent Graphics display, 1792 pixel.

Housing

Polycarbonate/ABS alloy. Aluminum mounting bracket.

Dimensions

5.5"W x 1.7"H x 1.4"D., Weight 5 oz.

Power Requirement

12 volt DC Negative ground, 250 mA typical.

G-Meter Operation

The basics of G-Forces

When you're not performing a Timed Run, the Performance Computer is in the G-Meter Mode, where it can display the acceleration, braking, and cornering forces of your car.

These forces are measured in "G's," and they are the best way to measure your car's performance. You've felt these forces—when a powerful car "pushes you back in the seat," when a panic stop presses you forward against the seat belt, and when a sharp corner presses you against the door panel.

What the G-Meter shows

The G-Meter displays the G-Forces exerted by your car, in the plane of the road. On a perfectly level surface, the G-Meter will read zero when your car is not moving, or when it is traveling "steady-state" (not accelerating, braking, or turning).

However, on hills or sloped surfaces, the G-Meter will show a small G-Force, even when your car is not moving. This shows the force your tires are exerting to keep your car from sliding down the slope.

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TO SELECT G-METER

Press and release the G-METER button to choose the G-Meter mode.

Press and release the button again to select different G-Meter display options.

To Calibrate the G-Meter, park on a level surface, then press and release the CALIBRATE button.

WARNING!

This device measures G-Forces, but remember, it does not change the laws of physics. Under certain circumstances, almost any vehicle can roll over, causing serious injury or death. Taller vehicles such as SUVs, trucks and vans are more likely to roll than conventional cars, so even more care needs to be taken with those vehicles. No electronic device can take the place of the driver's judgment.

G-METER OPTION 1: BAR GRAPHS

Press and release the G-METER button as necessary to select "G-METER OPTION 1."

This display shows straightforward bar graphs of G-Forces. The top line shows acceleration and braking forces; the bottom line shows cornering forces.

The default scale for the Bar Graphs is .80 G full scale. You can adjust this using the Setup mode.

Typical Cornering G-Forces

Below we list typical maximum cornering forces for different types of cars. Of course, auto testers use smooth, level pavement under optimum conditions to achieve these figures.

Standard sedan .70 G to .80 G

Sports sedan .80 G to .90 G
For example, BMW M3, Acura RSX, etc.

High performance .90G to 1.00G
For example, Corvette, Viper, Porsche 911

Modified car 1.00 G or more



The car is accelerating at .45 G.



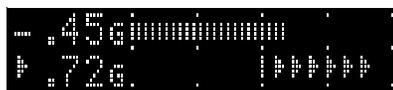
The car is braking at .22 G.



The car is cornering to the right at .72 G.



The car is cornering to the left at .43 G.



The car is accelerating at .45 G, and cornering to the right at .72G.

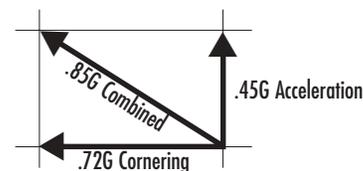
G-METER OPTION 2: FRICTION CIRCLE

Press and release the G-METER button as necessary to select "G-METER OPTION 2."

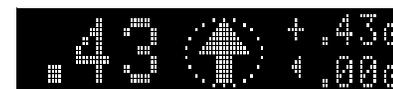
The small numbers on this display show the braking and acceleration force on the top line, and the cornering force on the bottom line.

The large number shows the combined G-Forces, and the arrow shows the approximate direction of those forces.

The combined G-Force is not the simple addition of the two forces; instead it is the "vector sum" of those forces, as shown in the example below.



When the combined G-Force is under .15G, the arrow is displayed as an outline pointing straight ahead.



The car is accelerating at .43 G.



The car is braking at .32 G.



The car is cornering to the left at 1.03 G.



The car is accelerating at .45 G, and cornering to the left at .72G. The combined G-Force is .85G.

G-METER OPTION 3: PEAK HOLD

Press and release the G-METER button as necessary to select "G-METER OPTION 3."

This display shows the peaks in acceleration, braking, left cornering, and right cornering G-Forces, and "holds" those numbers on the screen for 4 seconds.

You can adjust the hold time using the Setup mode.



Showing a recent acceleration peak of .38G.



Showing a recent braking peak of .48G.



Showing a recent left cornering peak of .57G.



Showing a recent right cornering peak of .83G.



Showing recent peaks in all four directions.

G-METER OPTION 4: FORWARD + 0 to 60

Press and release the G-METER button as necessary to select "G-METER OPTION 4."

The top line shows acceleration and braking forces, the same as G-METER Option 1: Bar Graphs.

The second line shows your "Top 10" best 0 to 60mph times to date. (Of course, you must perform timed runs before times will appear in this display). The display continuously scrolls through your best 0 to 60 times.



Showing acceleration of .22G, and a #1 top 0 to 60 run to date of 5.46 seconds.



Showing acceleration of .45G, and a second-best top 0 to 60 run to date of 5.60 seconds.



Showing braking of .23G, and a third-best 0 to 60 run to date of 5.93 seconds.

G-METER OPTION 5: BEST 0 TO 60 RUNS

Press and release the G-METER button as necessary to select "G-METER OPTION 5."

This display does not show G-Forces, it only displays your 10 best 0 to 60 times to date. The display continuously scrolls through your best 0 to 60 runs.



Showing a #1 best 0 to 60 run of 5.64 seconds.

G-METER OPTION 6: BEST 1/4 MILE RUNS

Press and release the G-METER button as necessary to select "G-METER OPTION 6."

This display does not show G-Forces, it only displays your 10 best 1/4 Mile times to date. The display continuously scrolls through your best 1/4 Mile runs.



Showing a #1 best 1/4 mile run of 13.26 seconds at 106.3 mph.

G-METER OPTION 7: RACEMONITOR .10

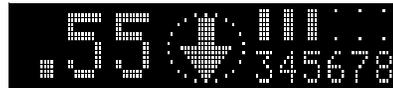
Press and release the G-METER button as necessary to select "G-METER OPTION 7."

This display shows only the combined vector forces (see the explanation in G-METER option 2: Friction Circle).

In addition to a large numerical readout of the combined G-Force and an arrow showing the approximate direction of the forces, the RaceMonitor display also has a 6-segment bar graph meter so you can see your G-Force at a glance.



The car is accelerating and turning left with a combined G-Force of .25G.



The car is braking at .55 G.
Since the default Meter Maximum is .80G, the six segments indicate .30, .40, .50, .60, .70, .80G



In this example, the Meter maximum has been changed to 1.30G in the Setup mode.
In this case, the segments indicate .80, .90, 1.00, 1.10, 1.20, 1.30G
The car is cornering left at 1.25G.

Each segment of the bar graph represents .10G. The standard Bar Graph maximum is .80G, however you can change the maximum in the Setup mode.

G-METER OPTION 8: RACEMONITOR .05

Press and release the G-METER button as necessary to select "G-METER OPTION 8."

This display is the same as the RaceMonitor .10, except each bar graph segment represents .05G.

In addition to a large numerical readout of the combined G-Force and an arrow showing the approximate direction of the forces, the RaceMonitor display also has a 6-segment bar graph meter so you can see your G-Force at a glance.



The car is accelerating and turning left with a combined G-Force of .25G.



The car is braking at .65 G.
Since the default Meter Maximum is .80G, the six segments indicate .55, .60, .65, .70, .75, .80G



In this example, the Meter maximum has been changed to 1.10G in the Setup mode.
In this case, the segments indicate .85, .90, .95, 1.00, 1.05, 1.10G
The car is cornering left at 1.05G.

Each segment of the bar graph represents .05G. The standard Bar Graph maximum is .80G, however you can change the maximum in the Setup mode.

Timed Runs

Your Performance Computer's intuitive "one-button" operation makes timing your car's performance easy.

You start the process by pressing the TIMED RUN button. The unit performs an internal calibration, then the timer starts automatically when you accelerate, and stops automatically at the end of your run.

It is not necessary to accelerate to a very high speed or for a full 1/4 mile to perform a timed run. The Performance Computer records data for short runs also (you must accelerate to at least 30mph).

Detailed run results for your 10 most recent runs are automatically kept in memory. Review the results anytime with the UP and DOWN buttons.

Tip for accurate timed runs

The road does not have to be perfectly level, but it should be flat. In other words, testing on a slight incline is acceptable, provided the slope is relatively consistent for the entire length of the run.

Of course, your car will accelerate slower on an incline. Temperature and wind will also affect your results.

1: HOW TO START A TIMED RUN

- 1 **Car must be stopped.**
- 2 **Press and release the TIMED RUN button.**
- 3 **Wait a few seconds until you see:**

- 4 **Start whenever you are ready.**

NOTE: You do not have to press the CALIBRATE button before a timed run. The Performance Computer performs an internal calibration each time you start a timed run. (The calibration of the G-Meter function is not changed during a timed run, so the G-Meter will operate the same before and after a timed run.)

2: TIMER STOPS AUTOMATICALLY

The Performance Computer automatically records all run data, and will continue taking data until any of the following occurs:

- 1 **You stop accelerating.**
—or—
- 2 **You travel 1/4 mile.**
—or—
- 3 **Time exceeds 30 seconds.**
—or—
- 4 **You press the Timed Run button again.**

3: REVIEWING RESULTS

After the run ends, the unit will display two alternating screens:



This screen explains that you can see more information by pressing the UP and DOWN buttons. (See the following pages of this manual for details.)



This screen shows one data point for your timed run, depending on the details of your run:

- 1 **If your top speed was under 60 mph:**
It will show the highest "even-10mph" speed you reach. For example, if your top speed was 46mph, it will display your 0 to 40 time.
- 2 **If your top speed was over 60 mph, but you decelerated before 1/4 mile:**
It will show your 0 to 60 time.
- 3 **If you complete the 1/4 mile:**
It will show your 1/4 mile time and speed.

4: REVIEWING DETAILED RUN RESULTS

The Performance Computer automatically records all run data during a timed run. To review the data after the run, press the UP and DOWN buttons.

The data for your 10 most recent runs is automatically kept in memory. You can review the data immediately after your run, or anytime later. The memory is maintained even when the unit is powered off.

As you press the DOWN button, you'll see the data for your most recent run first. Keep scrolling down for data from previous runs.

The Performance Computer automatically numbers the runs, and displays the run number during timing. The system assigns numbers in sequence, and after you complete 99 runs, the counter restarts at Run #1.

After reviewing the data, press the G-METER button to return to G-Meter mode, or press the TIMED RUN button to start another timed run.

AN EXAMPLE OF RUN DATA

Here is an example of the data you can view after each timed run.

Each time you press the DOWN button, you will see another screen of data.

This run was for a complete 1/4 mile, shorter runs will have less data to review.



1 Press the DOWN button to see more run info.



2 1/4 mile time and trap speed.



3 1000 foot time, 1/8 mile time and trap speed.



4 330 foot and 60 foot times.



5 Maximum speed and horsepower data.
(324HP average, with 366HP peak at 49mph)



6 Time-to-speed data.



7 Time-to-speed data.



8 Time-to-speed data.



9 Time-to-speed data.



10 Time-to-speed data.



11 Press the DOWN button to see the previous run.

NAVIGATING THROUGH THE DATA

The DOWN button always steps down from one item to the next. The UP button steps up one item at a time to the beginning of that run, then jumps to the beginning (not the end) of the above run.

After you have 10 runs in memory, please spend a few minutes scrolling up and down through the data to familiarize yourself with this system.

Measuring Horsepower

For the performance computer to accurately measure your car's horsepower, you must enter information about your vehicle's weight, drivetrain loss, and aerodynamic qualities.

Note: This setup is optional, and is NOT necessary for accurate Timed Runs or G-Meter function.

In a timed run, the rated horsepower of your car's engine is consumed in four primary ways:

- 1) The power to actually accelerate the weight of the car.
- 2) The power consumed by frictional losses in the car's drivetrain.
- 3) The power used to overcome the rolling resistance of the tires.
- 4) The power used to overcome aerodynamic drag.

With the Performance Timer's Setup Mode, you can enter details about your car that will enable it to calculate the power used by each of these four items. The Performance Computer will then combine these factors to calculate the approximate total horsepower being produced by your engine.

To accurately measure engine horsepower, the following six setup items must be correct:

Vehicle Weight • HP Min Speed • HP Max Speed
HP Drivetrain Loss • Rolling Resistance • Drag CDA

To enter Setup, hold the G-METER button. Then follow the on-screen instructions, which are:

- To go to the next item, press the START button.
- To change the setting of an item, press the UP or DOWN button.
- To exit the Setup Mode, press the G-METER button.

VEHICLE WEIGHT

You must enter the weight of your vehicle using the Setup Mode. This information is usually available in your vehicle owner's manual or brochure.

Several different terms are used by manufacturers. "Curb Weight" is the weight of the vehicle without passengers and cargo. "Payload" is the maximum allowable weight of passengers and cargo. "GVWR" is the sum of the Curb Weight and the Payload, so it is the maximum allowable weight of the vehicle including passengers and cargo.

You should use the Curb Weight if available, but add the weight of the driver, passengers and cargo, plus any additional equipment added to the vehicle.

HORSEPOWER SPEED MIN AND MAX

You must select the speed range for horsepower calculations. The Performance Computer will calculate the average horsepower over this range, as well as the peak horsepower within the range.

It is usually most helpful to choose a speed range and stay with that speed range. This makes it easier to see improvements as you modify your car, etc.

The Setup Item "HP Min Speed" sets the speed that the unit starts measuring horsepower.

The Setup Item "HP Max Speed" sets the speed that the unit stops measuring horsepower.

The default speed range is 30 to 60 mph.

DRIVETRAIN LOSS

A surprisingly large portion of your engine's horsepower is consumed by frictional losses in the car's transmission and driveline. Use the following table as a guide.

2 wheel drive with manual transmission	.15
2 wheel drive with automatic transmission	.20
4 wheel drive with manual transmission	.20
4 wheel drive with automatic transmission	.25

Note: If you prefer to measure wheel horsepower, change this setting to zero.

ROLLING RESISTANCE

This is a characteristic of the vehicle's tires. For most passenger vehicles, the default of .013 is the proper choice.

AERODYNAMIC DRAG $C_D A$

This setting is very important for accurate horsepower calculation, especially at higher speeds. In fact, the power needed to push your car through the air increases with the cube of the car's speed.

For example, if the aerodynamic resistance of your car consumes 10 HP at 30 mph, if you increase your speed by a factor of 2 (to 60 mph), the horsepower consumed increases by a factor of 2^3 , or 8 times, to 80 HP.

The CDA factor is actually the product of two items.

" C_D " means "drag coefficient," and it is a direct indication of how "slippery" the shape is — how easily it goes through the air. C_D is the measure of the qualities of the shape itself, not the size.

In other words, the C_D of a small model of a Porsche 911 is exactly the same as the C_D of a full-size 911.

"A" is the frontal area of the car, in square feet.

The product of these two terms, " C_D " times "A," is " $C_D A$," and that's the number you need to enter in the Performance Computer's Setup Mode.

How to determine the CDA of your car:

There are three possible ways to determine the CDA of your car:

- Find specifications for your car's CDA
- Estimate your car's CDA
- Calculate your car's CDA using a coastdown test

Details on each method follow.

1 Manufacturer's specifications or other research

Very rarely do manufacturers list the aerodynamic qualities of their cars, unless those qualities of the car are exceptional.

However, sometimes you get lucky. One of our test vehicles was an Audi S4. Searching on Google, we quickly found specifications for the faster European RS4, which is virtually identical in size and shape to the S4.

Note: If you find specifications for foreign cars they usually list frontal area in M², or square meters. Multiply those figures by 10.76 to convert to square feet.

Try searching for the terms "drag coefficient" or "frontal area" and the make of your car.

Also, we will be compiling a list of different vehicles and their CDA values and we will post that information on our website, so be sure to check that as well.

2 Estimate your vehicle's CDA

Use the following examples to estimate the CDA for your vehicle.

Honda Insight .25 CD x 20.4 sq. ft. = 5.1 CDA

Corvette C5 .29 CD x 21.3 sq. ft. = 6.2 CDA

Porsche 911 .32 CD x 19.4 sq. ft. = 6.2 CDA

Audi S4 .31 CD x 21.9 sq. ft. = 6.8 CDA

Honda Civic .34 CD x 21.0 sq. ft. = 7.1 CDA

Minivan or SUV .40 CD x 30.0 sq. ft. = 12.0 CDA

Pickup or van .45 CD x 35.0 sq. ft. = 15.8 CDA

Modern passenger car CD's are usually .30 to .35.

Van, SUV and truck CD's are usually .35 to .45.

3 Calculate your vehicle's CDA

You can determine the correct CDA number by using a "coastdown" test.

- On a flat road, on a day with no wind, accelerate to slightly above 60 mph.
- Put your car in neutral (whether your car has an automatic or manual transmission, it is important to put the car in neutral).
- Measure the time it takes your car to decelerate from exactly 60 mph to exactly 50 mph.
- Perform this test at least three times in each direction, to make sure your results are relatively consistent.
- Average your times, then use the table to the right to determine the CDA factor.
- Multiply your car's weight times the CDA factor from the table to determine your car's CDA.

EXAMPLE: Find the CDA of a 4000 pound car that takes 17 seconds on average to coast from 60 to 50 mph.

Look at the table. For 17 seconds, the factor is .001824. Multiply that times 4000 pounds to get the car's CDA.

$$4000 \times .001824 = 7.296$$

7.296 is the car's approximate CDA.

The average time it takes your car to coast from 60 mph to 50 mph (in seconds)

Multiply your car's weight by this number to calculate your CDA.

10.0	.004305
10.5	.004018
11.0	.003757
11.5	.003519
12.0	.003301
12.5	.003100
13.0	.002915
13.5	.002743
14.0	.002584
14.5	.002435
15.0	.002297
15.5	.002167
16.0	.002046
16.5	.001932
17.0	.001824
17.5	.001723
18.0	.001627
18.5	.001537
19.0	.001451
19.5	.001370
20.0	.001293

Setup Mode

The Setup mode lets you enter your car's weight and make other selections to optimize horsepower measurement, and also customize the operation of other features.

G-Meter and Timed Run accuracy

For most cars, it is not necessary to change any Setup items for accurate G-Meter and Timed Run functions.

Horsepower Accuracy

For accurate horsepower calculations, you will need to adjust the following Setup items: Car Weight, HP Min Speed, HP Max Speed, HP Drivetrain loss, Rolling Resistance, and Aerodynamic Drag CDA.

See more information in the "Measuring Horsepower" section.

HOW TO ENTER THE SETUP MODE

- 1 **Hold the G-METER button.**
- 2 **After 5 seconds, you will see these two alternating instructions:**



This screen explains that you should press the START button if you want to go to the next item in the Setup Mode.



This screen explains that you should press the G-METER button if you want to exit the Setup Mode.

OVERVIEW OF SETUP MODE ITEMS

1 **Car Weight**

You must enter your car's weight for accurate horsepower calculations. Default is 2000 pounds.

2 **Pitch characteristics of car**

The way your car tilts back during acceleration. Default is 2.0 degrees per G, typical for sporty cars.

3 **Roll characteristics of car**

The specific way your car leans during cornering. Default is 3.0 degrees per G, typical for most cars.

4 **Clear Saved Runs**

The internal memory saves full details on the 10 most recent timed runs. This lets you erase those runs.

5 **Clear Best Runs**

The unit remembers the "Top 10" 0 to 60 and Quarter Mile times from all the runs you have ever timed. This lets you erase those figures.

6,7 **HP Min Speed and HP Max Speed**

The Performance Computer calculates your car's horsepower between 2 speeds. Defaults are 30 and 60mph.

8 **HP Drivetrain Loss**

Default is .15 (15 percent)

9 **Rolling Resistance**

Default is .013

10 **Aerodynamic Drag CDA**

Default is 7.00

11 **Meter Maximum**

This sets full scale for the Bar Graphs used in the G-Meter displays. Default is .80G.

12 **Peak Hold**

This sets the time that peak values are held on the "Peak Hold" G-Meter display. Default is 4 Seconds.

13 **Sound**

This turns the beep tones on and off. Default is On.

14 **Show Run Data**

This lets you choose what information to display after a timed run. Default is to display All Run information.

15 **End Timed Run**

You can choose to end timed runs automatically, or time each run for 30 seconds. Default is Automatic.

16 **Brake Test**

You can choose to include "60mph to zero" brake testing in timed runs. Default is Brake Test Off.

17,18 **Speed Rollout, 1/4 Mile Rollout**

You can select the criteria to start timed runs, both for speed measurements (0 to 60, etc.) and for distance measurements (1/4 mile, etc.), to match timing methods used by drag strips and professional testers. Each setting is adjustable from zero to 25 inches.

19 **Trigger**

G-Force criteria to start timed runs. Default is .10 G.

20 **Clear User Calibration**

This can be used to confirm the accuracy of your Performance Computer.

21 **DataLogger**

You can enable a special mode that allows saving a single 5 minute log of acceleration in memory.

22 **Factory Default**

Lets you restore all settings to factory default.

DETAILS ON SETUP MODE ITEMS

To enter the Setup Mode, hold the G-METER button. Then follow the on-screen instructions, which are:

- To go to the next item, press the START button.
- To change the setting of an item, press the UP or DOWN button.
- To exit the Setup Mode, press the G-METER button.

1 CAR WEIGHT

You must enter your car's weight for accurate horsepower calculations. Default is 2000 pounds.

2 PITCH CHARACTERISTICS OF CAR

Most users won't need to adjust this setting.

This describes the specific way your car tilts back during acceleration. Default is 2.0 degrees per G. Cars with very stiff or very soft suspensions may need to change this setting for more accurate timed runs.

For cars with very soft suspension, change to 2.5

For cars with very stiff suspension, change to 1.5

For very stiffly-sprung race cars, change to 1.0

(Settings we used: Porsche Turbo Cup race car: 1.3, Z06 Corvette: 1.5, Audi S4: 2.0, and Volvo sedan: 2.5)

3 ROLL CHARACTERISTICS OF CAR

Most users won't need to adjust this setting.

This describes the specific way your car leans during cornering. Default is 3.0 degrees per G, typical for most performance cars. Cars with very stiff or very soft sus-

pensions can change this setting for more accurate cornering G-Force measurements.

For cars with very soft suspension, change to 6.0.

For cars with soft suspension, change to 4.5.

Default is 3.0

For cars with very stiff suspension, change to 2.5

For race cars, change to 1.5

4 CLEAR SAVED RUNS

Most users won't need to use this command.

The Performance Computer's internal memory saves full details on the 10 most recent timed runs. The details on these runs are always viewable by pressing the UP and DOWN buttons (and can also be downloaded to your PC or Palm with the optional software and cable). As you make additional runs, the oldest run is always automatically deleted from memory (to make room for the new run). However, if for some reason you want to erase the ten runs stored in memory, this menu item lets you do that.

5 CLEAR BEST RUNS

Most users won't need to use this command.

The Performance Computer remembers the "Top 10" 0 to 60 and 1/4 Mile times from all the runs you have ever timed. (This memory is separate from the 10-run memory that keeps full details on your ten most recent runs.) The "Top 10" memory only saves the actual 0 to 60 times, and 1/4 mile times and speeds. This menu item lets you erase those figures.

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6,7 HP MIN SPEED AND HP MAX SPEED

These two Setup items let you choose what range of speed should be used to calculate your car's horsepower. The default settings are 30mph for the HP minimum speed, and 60 mph for the HP maximum speed.

8 HP DRIVETRAIN LOSS

This is a correction factor you can set to adjust horsepower calculations for drivetrain losses. Default is .15 (15% drivetrain loss). See the "Measuring Horsepower" section for more details.

9 HP ROLLING RESISTANCE

This is a correction factor you can set to adjust horsepower calculations for rolling resistance. See the "Measuring Horsepower" section for more details.

10 HP AERODYNAMIC CDA

This is a correction factor you can set to adjust horsepower calculations for the aerodynamic drag of your car. See the "Measuring Horsepower" section for more details.

11 METER MAXIMUM

Most users won't need to adjust this setting.

This sets full scale for the Bar Graphs used in the G-Meter displays. The default is .80G.

Race cars and very high-performance street cars can corner at 1.00G or more, so drivers of those cars may want to adjust the meter maximum.

12 PEAK HOLD

Most users won't need to adjust this setting.

This sets the time that peak values are held on the "Peak Hold" G-Meter display. Default is 4 Seconds.

13 SOUND

Most users won't need to adjust this setting.

This turns the beep tones on and off. Default is On.

14 SHOW RUN DATA

Most users won't need to adjust this setting.

This lets you choose what information to display after a timed run. The default is to display All Run information. You can also choose to display only some of the run data, as shown below.

Choose "1/4 mile" data to show only:

1/4 mile time and trap speed

1000 foot time

1/8 mile (660 foot) time and trap speed

330 foot time

60 foot time

Choose "Speeds" data to show only:

Maximum speed

Peak and average horsepower

Time-to-speed data

(0 to 10, 0 to 20, 0 to 30, etc.)

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DETAILS ON SETUP MODE ITEMS (cont'd)

15 END TIMED RUN

Most users won't need to adjust this setting. You can choose to end timed runs automatically, or time each run for 30 seconds. Default is Automatic.

END RUN AUTO

When set for Automatic, the Performance Computer will automatically end timed runs when any of the following occur:

- or —
- You stop accelerating.
- or —
- You travel 1/4 mile.
- or —
- Time exceeds 30 seconds.

END RUN 30 SEC

If you are performing very high speed testing, such as 0 to 120 times, your runs may continue beyond 1/4 mile. If so, change the setting to "30 sec." Then the Performance Computer will take run data for a full 30 seconds each run. (To end a run any time before 30 seconds, just press the TIMED RUN button.)

16 BRAKE TEST

You must change this setting if you want your Performance Computer to perform brake tests.

You can choose to include "60mph to zero" brake testing in timed runs. Default is Brake Test Off.

To perform 60 to 0 brake tests, change this setting to "Brake Test Auto."

TO PERFORM A BRAKE TEST

(After you have changed this setting to BrakeTest Auto)

- The car must be stopped.
- Press the TIMED RUN button.
- Wait until the display says "RUN READY"
- Accelerate somewhat quickly to at least 63 mph (but no faster than 80 mph).
- Immediately perform your brake test. Brake hard until your car comes to a complete stop.
- After the car stops, use the UP and DOWN buttons to review your run data. (The brake test results will be included as additional items added to the standard acceleration run data.)

17 SPEED ROLLOUT 18 1/4 MILE ROLLOUT

Most users won't need to adjust these settings.

You can select the criteria to start timed runs, both for speed measurements (0 to 60, etc.) and for distance measurements (1/4 mile, etc.), to match timing methods used by drag strips and professional testers. Both rollout settings are adjustable from 0 to 25 inches.

As you may be aware, in drag racing the timer doesn't start the instant the car begins to move. An optical sensor shines across each lane, and before the race can begin, each driver must "stage" his car by moving it forward until the front tire blocks the beam. When the beam is blocked, the "Staging" light is illuminated on the starting tree to show that the driver is in position.

The ET timer doesn't start until the front tire rolls forward out of the beam. The driver has a small amount of flexibility in where he positions his car before the start. The distance the car can move before triggering the timer is called "rollout."

You can set your performance timer to work the same way. If you choose no rollout, the timer starts the instant the car begins to accelerate. Or you can adjust the rollout distances to mimic the timers at drag strips, typically 8 to 16 inches for street vehicles.

Your Performance Computer has two separate Setup items for rollout:

"Speed Rollout" affects only the results for 0 to 10, 0 to 20, 0 to 30, etc.

"1/4m Rollout" affects only the 60 foot, 330 foot, 1/8 mile, 100 foot, and 1/4 mile times.

BUT DOES ROLLOUT REALLY MATTER?

YES! It doesn't seem like a few inches could significantly affect your results, but in fact, this small distance makes a big change in your car's times.

Even a very fast car is moving very slowly right after it starts a run, so depending on which rollout option you choose, you can affect your timed runs by 1/4 second or more. For example, if your car accelerates at .50G when you start your run, it will take .35 seconds to travel 12 inches.

In this case, setting the rollout to 12 inches would result in times that are .35 seconds faster, since the timer won't start counting until after the car travels 12 inches.

Some car magazine testers and auto manufacturers use rollout in their instrumented acceleration testing (including 0 to 60 times) to closer match drag strip starts. Their reported times are therefore always noticeably quicker than times reported by other testers that do not use rollout (and instead time cars from the instant they begin to move).

The defaults for both the Speed Rollout and the 1/4 Mile Rollout are 12 inches.

DETAILS ON SETUP MODE ITEMS (cont'd)

19 TRIGGER

Most users won't need to adjust this setting.

This sets the G-Force criteria to start timed runs. The default is .10 G, meaning that the timer starts counting when it detects acceleration of .10G. Lower settings may cause false triggering due to vibration of the car. If your car has significant vibration from the engine, you may need to increase the trigger criteria to eliminate false triggering of the timer.

20 CLEAR USER CALIBRATION

Most users won't need to use this command.

This can be used to confirm the unit's accuracy.

- 1 In the Setup Mode:
 - Change the Pitch to 0.0
 - Change the Roll to 0.0
 - Clear the User Calibration
- 2 Go to G-Meter mode, Friction Circle display
- 3 DO NOT PRESS THE CALIBRATE BUTTON
- 4 Hold the Performance Computer level with the display facing up. The unit should read very close to 1.00G
- 5 Hold the Performance Computer with its right side down and left side facing up. The unit should read very close to 1.00G.
- 6 Then for normal operation, use the Setup Mode to reset Pitch to 2.0 and Roll to 3.0

21 DATALOGGER

Most users won't need to adjust this setting.

You can enable a special mode that allows saving a single 5 minute log of acceleration in memory, for download to your computer or Palm (you'll need the optional software and cable). Here's how it works.

- 1 Change this Setup item to "DataLogger On"
 - 2 You can still perform conventional timed runs (by pressing and releasing the TIMED RUN button).
 - 3 To perform a 5 minute Datalogger run, press and hold the TIMED RUN button on the Performance Computer.
 - 4 Do not release the button until the display says "Release button."
 - 5 Perform your run. The Datalogger will take data for 5 minutes, or until you end the run by pressing the TIMED RUN button again.
 - 6 Download your data to your computer or Palm.
- NOTE: When you press the button to begin a Datalogger run, the 10 standard timed runs in memory are deleted (to make room for the 5 minute run).

22 FACTORY DEFAULT

Most users won't need to use this command.

This lets you restore all of the Setup items to their original factory default settings. It also clears all runs in the "10 Most recent run" memory, and the "Top 10 best times" memory.

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Optional accessories

These accessories are included with some models, but are also available separately.

DOWNLOAD SOFTWARE AND CABLE

You can download detailed data of your runs to your laptop, PC, or Palm for analysis and graphing. See complete information provided with the software.

PERMANENT MOUNTING BRACKET

Some race sanctioning organizations may require that your Performance Computer is permanently attached to your car. This bracket replaces the windshield mount.

USE CARE WHEN INSTALLING THIS BRACKET!

(See our website if you'd like more details)

- 1 To remove the windshield bracket, carefully unscrew the large Phillips-head fastener and remove.
- 2 Carefully remove the long bolt. Take care not to lose the neoprene O-rings mounted on both sides in between the bracket and the housing.
- 3 Insert the bolt through the square hole on the new bracket, and carefully guide the bolt into the hole on the right side of the Performance Computer.

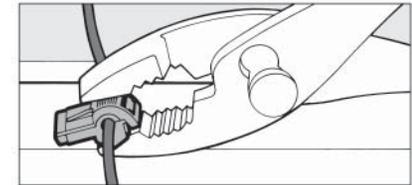
BE PATIENT WHILE GUIDING THIS BOLT INTO PLACE. IT IS POSSIBLE TO DAMAGE THE CIRCUITRY IF YOU FORCE THE BOLT INTO POSITION.

- 4 Carefully line up the bracket, making sure the O-rings are in position. Bend the bracket slightly if necessary. Then carefully insert the Phillips-head fastener, and tighten. Do not overtighten.

DIRECT-WIRE REMOTE CONTROL CORD

IMPORTANT: This must be installed by someone experienced with automotive electrical systems. If in doubt, see your car dealer or a car stereo installer.

The black ground wire is fitted with a lug that must be attached to an electrical ground. The red-striped wire for +12 volts is fitted with an insulated 1/4" male spade lug connector. We have also supplied a special blue connector that allows you to tap into an existing wire in your vehicle. This connector can only be used with wire gauges 14 through 18.



Most users tap into a "switched" circuit of the vehicle (one which is on when the car is on, and off when the car is off). To install the blue connector, position it around the wire you wish to tap into, then squeeze it with pliers until the halves snap together. Then plug the insulated connector from the power cord into this connector.

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Troubleshooting

See additional troubleshooting tips, FAQ's, and other information on our website, or email us at:

belsupport@beltronics.com

G-METER ACCURACY

When driving on sloped or crowned roads, it is normal for the G-Meter to read slight g-forces, even when the car is not accelerating or is stationary.

The G-Meter measures G-Forces in the plane of the road. After you calibrate it on level ground, it will read zero G's on level ground. But on a hill, slope, or a crowned road, it will show a small G-Force reading. This reading shows the force your tires are exerting to stop your car from sliding down the hill.

TIMED RUN ACCURACY

For most cars, the Performance Computer will provide very accurate timed runs without changing any of the Setup mode items. However, to fine-tune your results to match times from a drag strip, you may need to adjust the Rollout and Pitch settings in the Setup mode.

- **Important:** Do not adjust any settings based on the results of only one or two runs. Make at least three or four runs, and compare official track times to the times from your Performance Computer. Also, it is very important to stage your car exactly the same for each

run at the drag strip, since changes in your position of only a few inches will significantly affect the drag strip times due to rollout.

- The two Setup mode items that affect Timed Run accuracy are "Rollout distance" and "Pitch Characteristics" (the way your car tilts back under acceleration).

Significantly modified cars may require additional experimentation to determine the proper settings, but the following is a straightforward process to optimize the settings for most streetable vehicles.

1 Fine-tune "Rollout" in Setup Mode

Adjusting the Rollout setting will change all of your times equally (60', 330', 1/8 mile, 1000', and 1/4 mile).

Ideally you should adjust the Rollout setting so on average the Performance Computer's 60 foot times are very close to the drag strip's 60 foot times.

Every situation and vehicle is different, but here are some ballpark adjustments:

- Increasing the Rollout setting by 3" in the Setup mode will reduce the Performance Computer's times by approximately .04 seconds.
- Decreasing the Rollout setting by 3" in the Setup mode will increase the Performance Computer's times by approximately .04 seconds.

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2 Fine-tune "Pitch" in the Setup Mode

After you've adjusted the Rollout setting so the 60 foot times are as close as possible on average, you can adjust the Pitch setting to correct for your vehicle's exact suspension characteristics. Changing this setting will not significantly affect 60 foot times, but will affect 1/8 and 1/4 mile times.

If the Performance Timer shows times that are faster (shorter times) than the official drag strip time, you should increase the Pitch setting.

If the Performance Timer shows times that are slower (longer times) than the official drag strip time, you should reduce the Pitch setting.

Every situation and vehicle is different, but here are some ballpark adjustments:

- Increasing the Pitch setting from 2.0 to 2.2 will increase your 1/4 mile time by approx .03 sec.
- Decreasing the Pitch setting from 2.0 to 1.8 will decrease your 1/4 mile time by approx .03 sec.

Here are some pitch settings that provided very accurate results with some cars used in our testing:

Porsche 944 Turbo Cup race car	1.3
Z06 Corvette	1.5
Audi S4	2.0
Volvo and Ford sedans	2.5

Be sure to write down your settings when you personalize menu items for your vehicle, in case you need to reenter those settings in the future.

RELOADING FACTORY DEFAULTS

In the unlikely event your Performance Computer ever shows gibberish on its display or does not respond normally when you press the buttons, follow these steps to automatically restore the factory software.

NOTE: This procedure also returns all of the Setup Mode items to their factory default settings. You will have to reenter information about your vehicle's weight, etc.

TO RESTORE THE FACTORY SOFTWARE TO DEFAULT:

- With the Performance Computer unplugged, press and hold these three buttons: UP, DOWN, G-METER.
- Plug the unit in while you continue to hold down the three buttons.
- The display will read "Loading factory defaults."
- Release the buttons.
- Using the Setup Mode, adjust items to your personalized settings (vehicle weight, etc.).

DEMO MODE

There is a "demo mode" that can be used to show the basic capabilities of the Performance Computer. Hold the UP button and the G-METER button for five seconds to activate the demo mode. To exit this mode you must power down the unit and then turn it back on.

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Warranty

One Year Limited Warranty

The manufacturer warrants your Performance Computer against all defects in materials and workmanship for a period of one (1) year from the date of the original purchase, subject to the following terms and conditions: The sole responsibility of the manufacturer under this Warranty is limited to either repair or, at the option of the manufacturer, replacement of the Performance Computer. There are no expressed or implied warranties, including those of fitness for a particular purpose or merchantability, which extend beyond the face hereof. Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.

The manufacturer is not liable for any incidental or consequential damages arising from the use, misuse, or mounting of the Performance Computer. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This Warranty gives you specific rights. You may have other legal rights, which vary, from state to state. This Warranty does not apply if the serial number on the housing of the unit has been removed, or if your unit has been subjected to physical abuse, improper installation, or modification.

Service

Service Procedure

If your Performance Computer ever needs service, please follow these simple steps:

- 1 Review the appropriate section of this manual. It may have a solution to your problem.
- 2 If possible, check out our website for answers to common questions, or email us at:

belsupport@beltronics.com

- 3 To arrange service, call us toll-free:
U.S. 1-800-341-2288
Canada 1-800-268-3994

We may be able to solve your problem over the phone. If the problem requires that you send your Performance Computer to the factory for repair, we will provide you with a Service Order Number, which must be included on the outside of your shipping box.

Enclose the following information with your unit:

- Your Service Order Number
- Your name and return address
- Your daytime telephone number
- A description of the problem.

Out Of Warranty Repairs

For out of warranty repairs, include prepayment in the amount you were quoted by the Customer Service Representative. If the unit has been damaged, abused, or modified, the repair cost will be calculated on a parts and labor basis. If it exceeds the basic repair charge, you will be contacted with a quotation. If the additional payment is not received within 30 days (or if you notify us that you choose not to have your unit repaired at the price quoted), your unit will be returned, without repair. Payment can be made by check, money order, or credit card. Mail the unit and Power Cord To:

BELTRONICS
Customer Service Department
Service Order Number _____
5442 West Chester Road
West Chester, Ohio 45069

For your own protection, we recommend that you ship your Performance Timer postpaid and insured. Insist on a proof of delivery, and keep the receipt until the return of your unit.

www.beltronics.com

BELTRONICS™

5442 West Chester Road, West Chester, Ohio 45069, USA
CUSTOMER SERVICE: 800-341-2288 (USA) • 800-268-3994 (CAN)



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