

Pinewood Derby Timer (PDT)
and
PD Test/Tune/Track (PDT3) Utility

User Documentation

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http://www.miscjunk.org/mj/pg_pdt.html

Pinewood Derby Timer

The Pinewood Derby Timer (PDT) is an Arduino based track timer. The robust and flexible design allows the PDT to be easily constructed and modified to meet your specific needs.

Features of the PDT include:

- Easily expandable from 1 to 6 lanes
- Supports (optional) solenoid start gate circuit
- Supports (optional) lane place/time digital displays
- Works standalone or can be interfaced to software running on a PC
- Supports lane masking, start gate status check, force end of race

Interfacing the PDT to software running a PC allows races to be managed and allows you to record and archive car run times as you test/tune your Pinewood Derby car(s). Currently compatible with the following software:

- Free PD Test/Tune/Track (PDT3) software utility (see below)
- The popular [Grand Prix Race Manager](http://www.miscjunk.org/mj/pg_pdt.html) software

Timer Configuration

The top of the PDT timer code (Arduino sketch) contains a few options that need to be configured before use:

```
/*-----*
 - TIMER CONFIGURATION -
*-----*/
#define NUM_LANES      1                // number of lanes

// #define LED_DISPLAY  1                // Enable lane place/time displays
#define SHOW_PLACE     1                // Show place mode
#define PLACE_DELAY    3                // Delay (secs) when displaying time/place
#define MIN_BRIGHT     0                // minimum display brightness (0-15)
#define MAX_BRIGHT    15                // maximum display brightness (0-15)
#define GATE_RESET     0                // Enable closing start gate to reset timer
/*-----*
 - END -
*-----*/
```

Each of the options are explained below.

Changing Number of Lanes

The default version of the PDT is configured for 1 track lane. If you have a multiple lane track you will need to update the timer code (Arduino sketch). The NUM_LANES variable should be changed to match the number of lanes on your track:

```
#define NUM_LANES      1                // number of lanes
```

Optional Lane Place/Time Displays

The default setup of the PDT is configured to not have any display – the results are only sent to an attached PC. If you choose to utilize the optional lane place/time display a few changes need to be made to the timer code (Arduino sketch) and the Arduino IDE environment.

Display Library Configuration

The first change is to the Arduino IDE environment – you need to download and install the following libraries. The download and instructions for installation can be found at the following links:

<https://github.com/adafruit/Adafruit-LED-Backpack-Library>

<https://github.com/adafruit/Adafruit-GFX-Library>

The second change is to the PDT code (Arduino sketch), the following line needs to be uncommented (remove the two slashes at the beginning of the line) so that it appears like this:

```
#define LED_DISPLAY 1 // Enable lane place/time displays
```

Display Behavior

By default, when utilizing the display functionality, as cars finish the race their finishing place is displayed. When all cars have finished the displays will then alternate between the finish order and elapsed time. To change the time delay between the two change the following parameter to desired number of seconds:

```
#define PLACE_DELAY 3 // Delay (secs) when displaying time/place
```

If it is desired to only show elapsed time – with no finish order – the following line should be changed from the default,

```
#define SHOW_PLACE 1 // Show place mode
```

to

```
#define SHOW_PLACE 0 // Show place mode
```

Display Brightness

The following two parameters limit the range of the dimmer knob which controls the brightness of the lane displays. Limiting the maximum brightness can control the total power draw of the lane displays.

```
#define MIN_BRIGHT 0 // minimum display brightness (0-15)  
#define MAX_BRIGHT 15 // maximum display brightness (0-15)
```

Gate Reset

The following parameter (when set to 1) enables the gate reset functionality, the default is disabled (set to 0). When enabled the timer – when in the FINISHED state – can be reset by

closing the start gate. Caution should be taken if manually recording results – resetting the timer clears the displays.

```
#define GATE_RESET    0                // Enable closing start gate to reset timer
```

Optional Start Gate Solenoid Circuit

If you build the optional start gate solenoid circuit no changes need to be made to the PDT code – just connect the solenoid circuit to the correct pin as specified on the schematic.

Upload PDT Sketch to Arduino

Once the timer configuration is completed the PDT timer code (Arduino sketch) needs to be uploaded to your Arduino. If you're not familiar with the Arduino please refer to the following reference:

[Getting Started with Arduino](#)

Operation

The timer can be operated manually as described below or via a software application as discussed later in the document.

Manual Operation

Manual operation of the PDT is simple, the current status of the timer is indicated by the color of the status LED.

READY (Blue LED)

The timer is ready for a race to start. If displays are used they will each show dashes '----' indicating the PDT is ready.

Hitting the reset button the PDT (with the start gate closed) puts the timer into the 'READY' state.

Starting the race by opening the start gate (either via software or manually) causes the timer to leave the 'READY' state and enter the 'RACING' state.

RACING (Green LED)

The race has started and the timer is watching each lane for cars to finish. If displays are used they will each go blank indicating the race is in progress.

If displays are used, as cars finish the displays will show either their current place (1st, 2nd, etc.) or their elapsed time (in seconds) depending on how the timer was configured.

Once all cars have finished the timer will leave the 'RACING' state and enter the 'FINISHED' state.

Hitting the reset button while in the 'RACING' state will cause the current race to end and will put the timer in the 'FINISHED' state.

FINISHED (Red LED)

The race is over. If displays are used they are either alternating between place and time or simply showing the time (based on the timer configuration).

Hitting the reset button (with the start gate closed) will cause the timer to leave the 'FINISHED' state and enter the 'READY' state. If the start gate is open when the reset button is hit the timer will remain in the 'FINISHED' state. If the Gate Reset option is enabled the timer will be reset automatically when the start gate is closed.

Using the GrandPrix Race Manager

The PDT can be interfaced with the popular GrandPrix Race Manager software. To configure GPRM for use with the PDT within GPRM select the "Options" menu, then select "Setup Options" and finally select "Hardware Options...".

On the resulting "Hardware Setup" window on the "Timing tab", select "Other Serial Timer" in the "Timing System" group then hit the "Custom Setup" button. On the resulting "Custom Serial Timers Options" window enter the following configuration and then hit the "Save" button.

COM Port Settings

Baud:	9600
Data Bits:	8
Parity:	None
Stop Bits:	1

Start Gate Status

Check Command:	G
Open Response:	O
Timer Start Message:	B

Timer Reset

Reset Command:	R
Ready Response:	K
Response Delay:	0.25 secs

Lane Masking

Mask Command:	M
Remove all Masks:	U

Other Software Commands

Force Data Send:	F
Trigger Solenoid:	S

Miscellaneous

Read Delay:	0.25 secs
Precision:	0.0001 secs
Max Time:	9.9999 secs
Lane Labels:	Numbers

Refer to the GPRM help for general usage of the application.

Using the PD Test/Tune/Track (PDT3) Utility

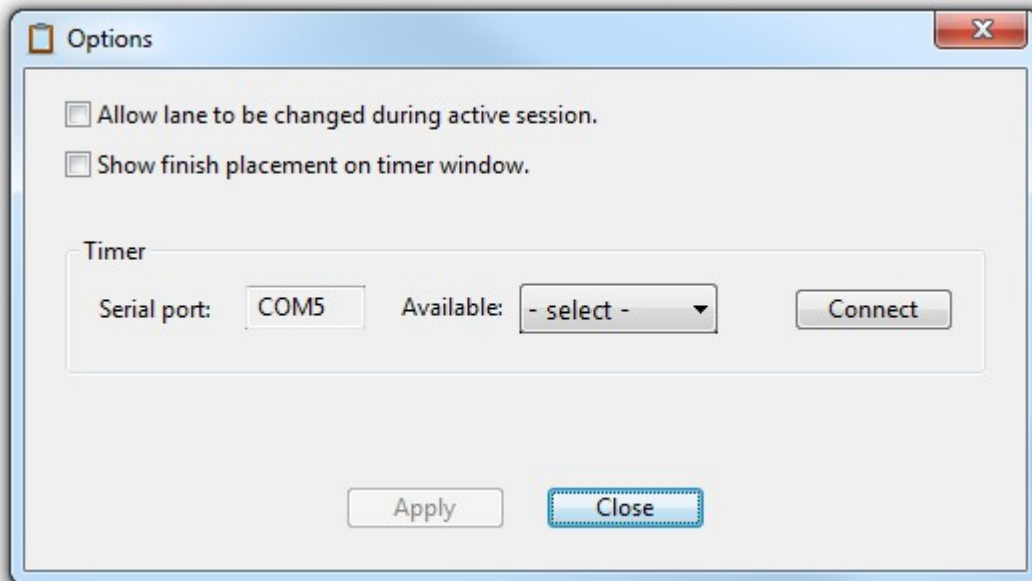
The PDT3 utility is a free software program that fully interfaces with the PDT and allows you to record, analyze and archive car run times during the testing/tuning process of building a Pinewood Derby car.

Configuration

After installation a shortcut for PDT3 will be placed on your desktop similar to the one shown here. If needed the PDT3 utility can be uninstalled via the Control Panel → Programs and Features window.



The first step to perform after installation is to setup the connection between the PDT and the PDT3 utility. Selecting “Options...” from the “Edit” menu will display the following dialog:



In the “Timer” group select the COM port for the PDT from the list of available ports and hit the “Connect” button. If successful you will see the COM port displayed in the status bar of the main PDT3 screen.

IMPORTANT: The timer needs to be in the 'READY' or 'FINISHED' state when starting PDT3 or manually connecting. If the timer is in the 'RACING' state PDT3 will not be able to connect.

Note: The number of lanes does not need to be configured, the software obtains that information from the timer.

The last step to perform before first use is to create a new database file by selecting “New” from the “File” menu. Typically each car would have it's own database file. The current database file is listed in the status bar of the main screen.

Current Session Tab

The main screen of the PDT3 utility, the Current Session tab, is shown below. This screen displays and records what is considered the current working session. As runs are performed the run times are added to the run list at the right. The overall average and standard deviation are automatically calculated as runs are added. In addition the delta time difference between each run time and the overall average is calculated for each run.

The Lane selection list specifies which time is captured on a multi-lane track. Whether this value can be changed after the first run is performed is controlled by a flag in the "Option..." dialog.

The screenshot shows the 'PD Test/Tune/Track' application window. The 'Current' tab is active, displaying a 'Lane' dropdown set to '1', a 'Date' field showing '2011-05-28 01:05:27', and a 'Notes' text area containing '2nd attempt at correcting steering. Turned DF (left) axle 1/4 turn CCW to 9 o'clock (from original position)'. A 'New Session' button is located below the notes. To the right, a table lists five runs with their respective times and delta values. Below the table, the 'Average' is 2.716 and the 'Std Dev' is 0.009. At the bottom left, a 'Timer' section includes 'READY', 'Reset', 'Start', and 'Force End' buttons. The status bar at the bottom shows the file path 'D:\DEV=\DerbyTimer\red.db' and the version 'Timer: [COM5] [ver 1.10]'.

Run #	Time	Delta
1	2.712	-0.004
2	2.706	-0.010
3	2.719	+0.003
4	2.712	-0.004
5	2.733	+0.017

The "Notes" field is a free-form field available for a description of the session.

Erroneous run times can be deleted by selecting the run time in question and hitting the delete button to the lower right (✖). The entire list of run times can be copied to the clipboard (in csv format) by hitting the copy button to the upper right (📋).

The date/time displayed above the run time list reflects when the session was created.

The “New Session” button will archive the current session data and start a new one.

Track / Timer Control

The Track/Timer control (shown below) on the “Current Session” tab is used to control the PDT. It will only be active if there is a successful connection to the PDT.



The “Reset” button sends a reset message to the PDT. The status field indicates the current status of the track/timer. Description of timer/track status:

- Not Ready - the track/timer is not ready (need to reset)
- Gate Open - the start gate is open (cannot reset until closed)
- Ready - the timer/track is ready (to start)
- Racing - the race is in progress
- Finished - the race is completed

The “Start” button will send a start message to the PDT. If the PDT is equipped with the optional start gate solenoid circuit this message will open the start gate. If the PDT does not have that option simply initiate the run by manually opening the track's start gate – the software will automatically determine that the run has been started.

The “Force End” button will send a force end message to the PDT which will immediately send all lane times to the PDT3 software. This feature is typically used when for some reason (a derailment, for example) the car does not finish the run.

Lane Times Window

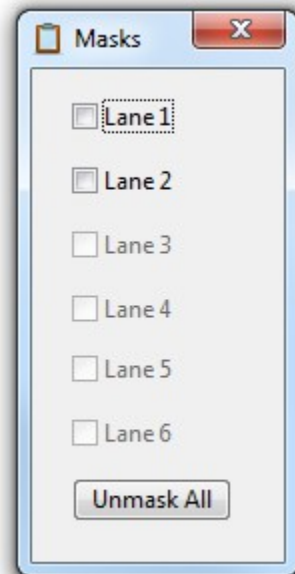
The “Lane Times” window, shown here, can be opened by selecting “Lane Times” from the “View” menu. This window display the run times for each lane at the completion of the run.



Lane Masks Window

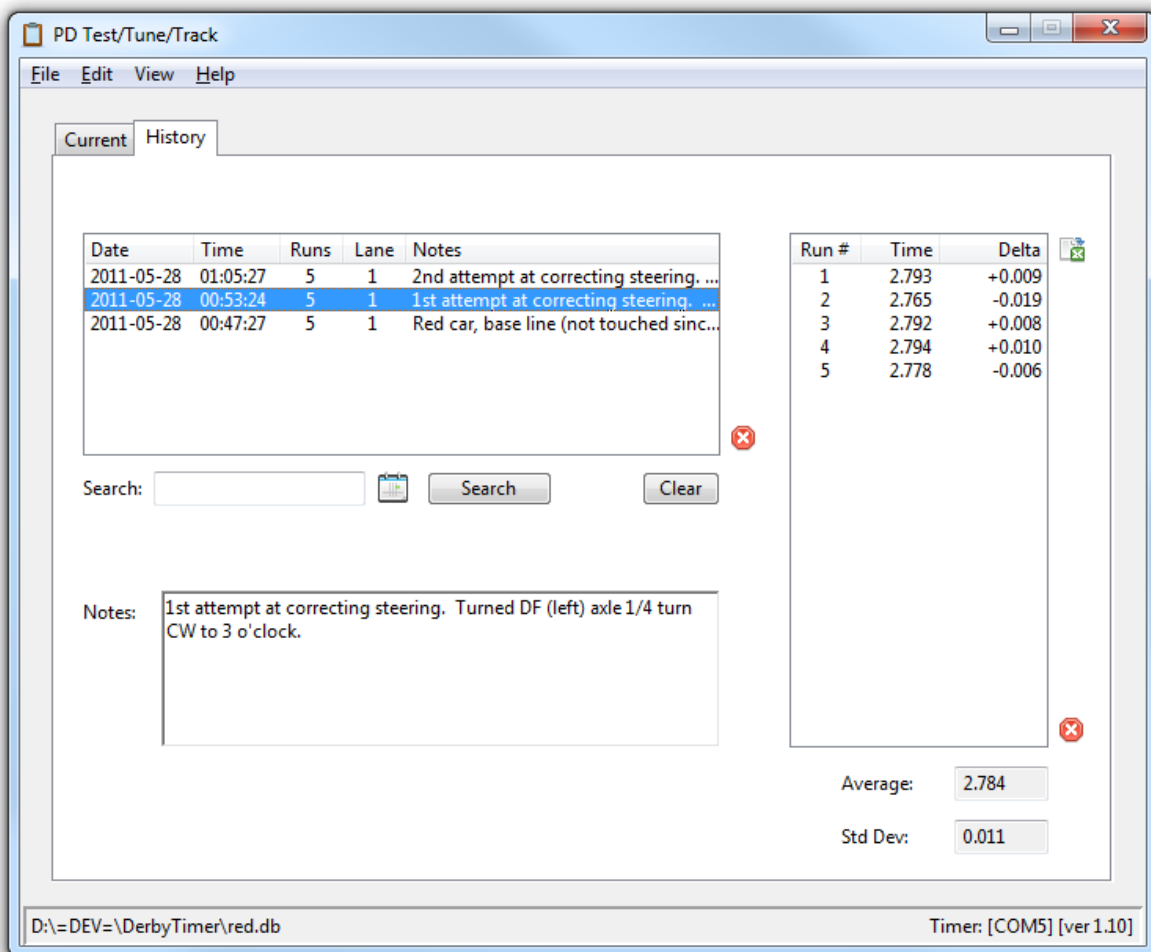
The “Lane Masks” window, shown here, can be opened by selecting “Lane Masks” from the “View” menu. On a multi-lane track this window allows you to mask unused lane(s). The “Unmask All” button resets (clears) all lane masks.

Masking a lane tells the PDT to not wait for a car to finish on an unused lane (since there is no car on that lane or lanes).



History tab

The “History” tab, shown below, allows you to search for, browse and display all historical



sessions. Data cannot be altered but sessions or runs can be deleted.