

Using the DataGate Program

The DataGate data-collection program for TI Graphing Calculators is used to collect, examine, analyze, and graph Photogate data in *Physics with Calculators* experiments. DataGate is a single program, not a group.

Use the link cable to connect the LabPro or CBL 2 to the TI Graphing Calculator. Firmly press in the cable ends. Turn on the calculator. Follow these steps to start the DataGate program on your calculator:

TI-73, TI-82, TI-83, or TI-83 Plus Calculators

Press **PRGM** and then press the calculator key for the *number* that precedes DATAGATE (usually **1**). Press **ENTER** and wait for the main screen to load.

TI-86 Calculators

Press **PRGM** and then press **F1** to select <NAMES>, and press the menu key that represents *Datagate*. (<DATAG> is usually **F1**). Press **ENTER**, and wait for the main screen to load.

TI-89, TI-92, or TI-92 Plus Calculators

Press **2nd** [VAR-LINK]. Use the cursor pad to scroll down to “*Datagate*”, then press **ENTER**. Press **)** to complete the open parenthesis that follows “*Datagate*” on the entry line and press **ENTER**. Wait for the main screen to load.

Main Screen

The main screen of *Datagate* is shown at the right. The top half of the screen shows the current sensor setup and data collection mode. The portion below the double bar displays the menu options. The current status of the photogate is shown (an “X” indicates the gate is blocked, an “O” indicates the gate is unblocked). This status display is useful to verify that the sensor is functioning properly.

```
DIG1:PHOTOGATE --X--  
  
MODE:MOTION  
-----  
1:SETUP      4:ANALYZE  
2:START      5:QUIT  
3:GRAPH
```

SETUP

Choose SETUP from the main screen to change the data collection mode. From here you can select one of four Photogate data collection modes.

```
PHOTOGATE SETUP  
-----  
1:MOTION  
2:GATE  
3:PENDULUM  
4:PULSE  
5:RETURN TO MAIN SCREEN
```

Motion

Motion timing is used with picket fences, smart pulleys, or other custom devices with uniformly spaced bars or spokes. Using the number of bars or spokes and the corresponding distance between them, DataGate calculates distance, velocity and acceleration values and graphs them.

```
SELECT DEVICE  
-----  
1:VERNIER PICKET FENCE  
2:SMART PULLEY  
3:CUSTOM
```

Picket Fence

After selecting the Vernier picket fence from the Select Device screen, you will be presented a screen with the settings you have chosen. Here you choose to keep the settings and return to the main screen, or go back and change them.

```
SETTINGS  
MODE:MOTION  
DEVICE:VERNIER PICKET  
-----  
1:OK  
2:CHANGE SETTINGS
```

Smart Pulley

After selecting SMART PULLEY, you will be asked how many spokes your pulley has,

```
HOW MANY SPOKES?  
1:10 SPOKES  
2:3 SPOKES
```

then the pulley diameter,

```
PULLEY DIAMETER?  
1:INSIDE  
2:OUTSIDE
```

and the estimated number of revolutions the pulley will make.

```
ESTIMATE NUMBER  
OF REVOLUTIONS  
?■
```

Custom

When customizing the experiment, you will be asked to define it in distance and number of leading edges.

```
ENTER LEADING  
EDGE DISTANCE  
IN METERS:  
2  
ENTER NUMBER OF  
LEADING EDGES:  
4  
■
```

You will be presented a screen with the settings you have chosen. Here you choose to keep the settings and return to the main screen, or go back and change them. Select start to begin data collection. Data collection ends automatically in motion mode.

```
SETTINGS
MODE: MOTION
DEVICE: CUSTOM
LEADING EDGE DIST(M): .2
NUMBER OF EDGES: 4
-----
1: OK
2: CHANGE SETTINGS
```

Gate

Gate mode can be used with one or two Photogates (two gates requires a LabPro interface). Gate mode reports the length of time a gate is blocked.

```
HOW MANY PHOTOGATES?
-----
1: ONE PHOTOGATE
2: TWO PHOTOGATES
```

During setup for gate mode DataGate prompts you for a flag width, or the width of the object passing through the Photogate.

```
ENTER WIDTH OF
FLAG IN METERS:
█
```

You will be presented a screen with the settings you have chosen. Here you choose to keep the settings and return to the main screen, or go back and change them.

```
SETTINGS
MODE: GATE - TWO GATES
FLAG WIDTH(M): 2
-----
1: OK
2: CHANGE SETTINGS
```

After setting the gate mode, select START to begin data collection. The length of time the gate is blocked and the number of times it has been blocked is displayed. Press **STO▶** to end data collection.

Pendulum

Pendulum mode is used with one Photogate only. After setting pendulum mode, select START to begin data collection. The first time a pendulum bob passes through the gate is ignored. The next three passes are used to determine a period. Each successive set of three passes is used to measure a new period. Press **STO▶** to end data collection and to display an average period.

Pulse

Pulse mode is used to measure the time between successive blocks of either the same gate (one gate mode) or two gates. Two gate mode requires a LabPro interface.

```
HOW MANY PHOTOGATES?
-----
1: ONE PHOTOGATE
2: TWO PHOTOGATES
```

In two gate mode the distance between gates can be entered to calculate a velocity based on the time interval.

```
ENTER DISTANCE
BETWEEN GATES
IN METERS:
█
```

You will be presented a screen with the settings you have chosen. Here you can choose to keep the settings and return to the main screen, or go back and change them.

```
SETTINGS
MODE: PULSE - TWO GATES
DIST. BETWEEN GATES(M): .2
-----
1: OK
2: CHANGE SETTINGS
```

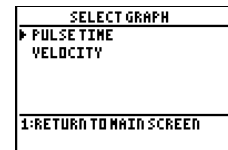
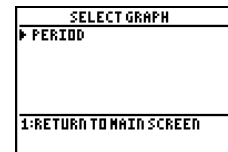
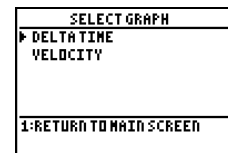
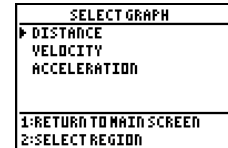
START

Select START to begin data collection. In gate, pulse and pendulum modes press **STO▶** to end data collection. Data collection ends automatically in motion mode.

GRAPH

The GRAPH screen automatically appears when you are finished collecting data or when GRAPH is chosen from the main screen. To view a graph, use the **▲** and **▼** keys on the calculator and press **ENTER**.

- The screen to the right appears after taking motion data
- This screen appears after taking data in gate mode
- This graph option screen appears after taking pendulum data
- And this is the screen you see after collecting pulse time (You can only get velocity when using two photogates.)

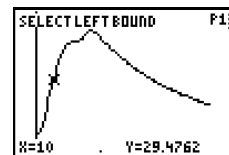


If you want to view another graph, press **ENTER**. The graph screen appears again so you can choose another channel.

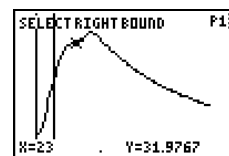
SELECT REGION

This option is used to remove unwanted data from lists, *i.e.* data outside the region of interest. This option may be necessary for data analysis. Data outside the selected region are permanently deleted.

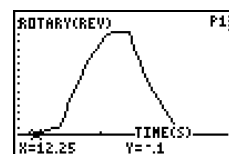
- Select the left bound, as viewed on the bottom, using the **◀** and **▶** keys. When the values you want for the left bound is displayed, press **ENTER**.



- Repeat for the right bound and press **ENTER**



- The new graph will automatically be displayed.



ANALYZE

The ANALYZE option on the main screen produces this list of options. You can perform a curve fit, determine statistics over a region of data, and determine the integral over a region of data.

| ANALYZE MENU |
|-------------------------|
| 1:RETURN TO MAIN SCREEN |
| 2:CURVE FIT |
| 3:STATISTICS |
| 4:INTEGRAL |

CURVE FIT

Choosing CURVE FIT from the ANALYZE OPTIONS menu produces a list of curve fit options.

After a curve fit is performed, the fitted curve is drawn as a continuous line, and the data points are shown with box point protectors.

| SELECT CURVE FIT |
|-----------------------------|
| 1:QUAD (DIST VS TIME) |
| 2:LINEAR (VELOCITY VS TIME) |
| 3:RETURN TO ANALYZE OPT. |

STATISTICS

This option finds the mean, min, max, standard deviation, and number of data points of a selected region. After selecting this option, choose a graph from the displayed list. Use the arrow keys to move the cursor and select the left bound of the region and press **ENTER**. A vertical line will be drawn on the graph. Now move the cursor to select the right bound and press **ENTER**. After the calculator has finished determining the statistics, a message will be displayed instructing you to press **ENTER** to continue. The numerical results will be displayed. Calculating statistics will not delete data.

| SELECT GRAPH |
|--------------------------|
| 1:DISTANCE VS TIME |
| 2:VELOCITY VS TIME |
| 3:ACCELERATION VS TIME |
| 4:RETURN TO ANALYZE OPT. |

INTEGRAL

The integral function is used to integrate a section of the graph. After selecting this option, choose a graph from the list. Use the arrow keys to move the cursor and select the left bound of the region and press **ENTER**. A vertical line will be drawn on the graph. Use the cursor to select the right bound and press **ENTER**. The numerical results will be presented.

| SELECT GRAPH |
|--------------------------|
| 1:DISTANCE VS TIME |
| 2:VELOCITY VS TIME |
| 3:ACCELERATION VS TIME |
| 4:RETURN TO ANALYZE OPT. |

QUIT

Select Quit to leave DataMate and return to the home screen of the calculator. On the TI-89, TI-92 and TI-92 Plus calculators you must press F5 or HOME to return to the home screen. To see the last graph select zoomstat as appropriate for the calculator model.