

USING A FORCE SENSOR TO MEASURE EFFORT

MATERIALS:

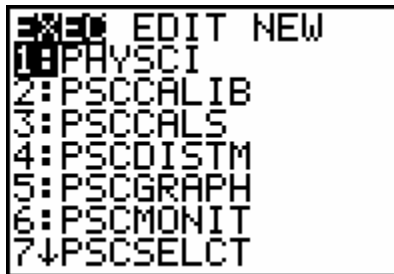
LabPro / CBL / CBL2 Data collector

TI Graphing Calculator

PROCEDURE:

Note: TI graphing calculators are made to turn themselves off when not in use to save batteries. If the calculator turns itself off during any part of the set up, simply press the \wedge button.

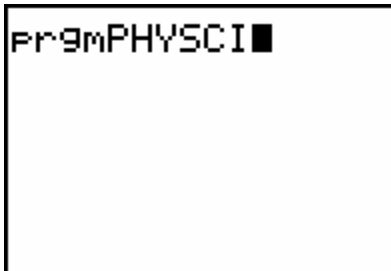
1. Connect the calculator to the data collector with the link cable.
2. Connect the force sensor to the data collector by plugging the sensor into CH 1 (Channel 1). You must use a DIN-BTA adaptor.
3. Turn the calculator ON and the data collector \wedge .
4. Press 8 on the calculator. Your calculator screen should look like this:



```

3:50 EDIT NEW
1:PHYSCI
2:PSCCALIB
3:PSCCAL
4:PSCDISTM
5:PSCGRAPH
6:PSCMONIT
7↓PSCSELCT
  
```

5. Select the PHYSCI program by pressing 1 or b
6. Now your calculator screen looks like this:



```

PrgrmPHYSCI
  
```

7. Press **b** again to get this screen:

```

VERNIER SOFTWARE
PHYSICAL SCIENCE
WITH THE CBL
FOR THE TI-73
6/18/98   ENTER
  
```

8. Press **b** again to get this screen:

```

***ADMIN MENU***
1:SET UP PROBES
2:COLLECT DATA
3:VIEW GRAPH
4:VIEW DATA
5:SELECT REGION
6:MATCH
7:QUIT
  
```

9. Select 1: SET UP PROBES by pressing 1 or **b**. Your screen will now look like this:

```

ENTER NUMBER OF
PROBES:█
  
```

- 10.If you get this screen:

```

***LINK ERROR***
PRESS HALT ON
THE CBL. MAKE
SURE THE LINK
CONNECTORS ARE
FIRMLY PUSHED
IN.
ENTER
  
```

Check to make sure your cables are firmly plugged in and try again.

11. You are going to use 1 force sensor (or probe), so enter “1”:

```
ENTER NUMBER OF
PROBES: 1
```

and press b .

12. Now your screen looks like this:

```
SELECT PROBE
1: TEMPERATURE
2: CONDUCTIVITY
3: FORCE
4: LIGHT
5: MAGNETIC FIELD
6: PH
7: MORE PROBES
```

13. You need to tell the equipment that you are using the force sensor, so press “3”. You will get this screen:

```
USE LOWEST
AVAILABLE
CHANNELS.

ENTER CHANNEL
NUMBER:
```

14. The calculator is asking which channel or port we have plugged the sensor in. We are using CHANNEL 1, so press 1:

```
USE LOWEST
AVAILABLE
CHANNELS.

ENTER CHANNEL
NUMBER: 1
```

and press b . Your calculator screen now looks like this:

```

**CALIBRATION**
1:USE STORED
2:PERFORM NEW
3:MANUAL ENTRY
  
```

15. We have to decide which calibration we will use. We usually use the ones that come with the equipment, so select 1:USE STORED and you will come to this screen:

```

FORCE PROBE
1:STUDENT FORCE
2:DUAL-RANGE
  
```

16. The equipment is asking us to tell it which type of sensor we are using. We are using a student force sensor, so select 1: STUDENT FORCE and move on to this screen:

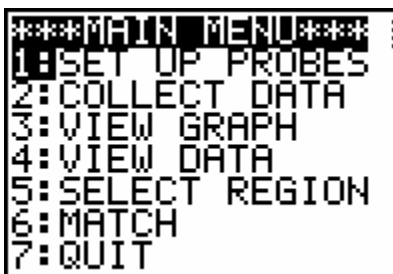
```

***MAIN MENU***
1:SET UP PROBES
2:COLLECT DATA
3:VIEW GRAPH
4:VIEW DATA
5:SELECT REGION
6:MATCH
7:QUIT
  
```

17. Now that we have set up the probes, our next job is to tell the equipment how to collect our data. Select 2: COLLECT DATA and you will be here:



18. We want the force sensor to act like a spring scale. To do this we will select 1: MONITOR INPUT. The equipment is ready to measure effort.
19. Gently pull on sensor. You will see the effort in Newtons on the calculator screen.
20. Hang different loads from the sensor and observe the effort it takes to lift them. Try one, two, three, or more weights. Observe.
21. Hang a four-weight load from the lever. How much effort does it take to lift it? Explore placing the load and effort at different places on the lever system.
22. To quit the program press \ . You will be back at this screen:



23. Press 1: SET UP PROBES to start over or press - , then ^ to turn the calculator off. Turn the data collector off as well.