

Chapter 14: Applications

The Applications Menu

The TI-83 Plus comes with **Finance** and **CBL/CBR** applications already listed on the **APPLICATIONS** menu. Except for the **Finance** application, you can add and remove applications as space permits. The **Finance** application is built into the TI-83 Plus code and cannot be deleted.

You can buy additional TI-83 Plus software applications that allow you to customize further your calculator's functionality. The calculator reserves 1.54 M of space within ROM memory specifically for applications.

Your TI-83 Plus includes Flash applications in addition to the ones mentioned above. Press **[APPS]** to see the complete list of applications that came with your calculator.

Documentation for TI Flash applications is on the TI Resource CD. Visit education.ti.com/guides for additional Flash application guidebooks.

Steps for Running the Finance Application

Follow these basic steps when using the **Finance** application.

Select the Finance application.

Press **[APPS]** **[ENTER]**.

```
APPLICATIONS
1: Finance...
2: CBL/CBR
```

Select from list of functions.

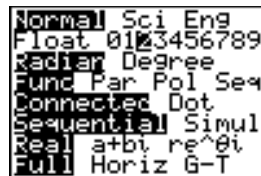
```
0: VARS
1: TVM Solver...
2: tvm_Pmt
3: tvm_I%
4: tvm_PV
5: tvm_N
6: tvm_FV
7: npv()
```

Getting Started: Financing a Car

Getting Started is a fast-paced introduction. Read the chapter for details.

You have found a car you would like to buy. The car costs 9,000. You can afford payments of 250 per month for four years. What annual percentage rate (APR) will make it possible for you to afford the car?

1. Press **MODE** **▼** **►** **►** **►** **ENTER** to set the fixed-decimal mode setting to 2. The TI-83 Plus will display all numbers with two decimal places).



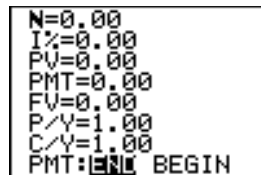
The image shows the TI-83 Plus MODE menu. The options are: Normal, Sci Eng, Float 01, 3456789, Radian, Degree, Func, Par, Pol, Seq, Connected, Dot, Sequential, Simul, Real, a+bi, re^θi, Full, Horiz, G-T. The 'Normal' mode is highlighted.

2. Press **APPS** **ENTER** to select **1:Finance** from the **APPLICATIONS** menu.



The image shows the TI-83 Plus APPS menu. The options are: 1: TVM Solver..., 2: tvm_Pmt, 3: tvm_I%, 4: tvm_PV, 5: tvm_N, 6: tvm_FV, 7: npv(). The '1: TVM Solver...' option is highlighted.

3. Press **ENTER** to select **1:TVM Solver** from the **CALC VARS** menu. The **TVM Solver** is displayed.



The image shows the TI-83 Plus TVM Solver screen. The variables and their values are: N=0.00, I%=0.00, PV=0.00, PMT=0.00, FV=0.00, P/Y=1.00, C/Y=1.00, PMT:BEGIN. The 'PMT:BEGIN' option is highlighted.

Press **48** **ENTER** to store 48 months to **N**. Press **▼** **9000** **ENTER** to store 9,000 to **PV**. Press **(-)** **250** **ENTER** to store -250 to **PMT**. (Negation indicates cash outflow.) Press **0** **ENTER** to store 0 to **FV**.

Press **12** **ENTER** to store 12 payments per year to **P/Y** and 12 compounding periods per year to **C/Y**. Setting **P/Y** to 12 will compute an annual percentage rate (compounded monthly) for **I%**. Press **▼** **ENTER** to select **PMT:END**, which indicates that payments are due at the end of each period.

```
N=48.00
I%=0.00
PV=9000.00
PMT=-250.00
FV=0.00
P/Y=12.00
C/Y=12.00
PMT:END BEGIN
```

4. Press **▲** **▲** **▲** **▲** **▲** **▲** to move the cursor to the **I%** prompt. Press **ALPHA** **SOLVE** to solve for **I%**. What APR should you look for?

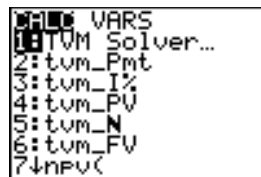
```
N=48.00
I%=14.90
PV=9000.00
PMT=-250.00
FV=0.00
P/Y=12.00
C/Y=12.00
PMT:END BEGIN
```

Getting Started: Computing Compound Interest

At what annual interest rate, compounded monthly, will 1,250 accumulate to 2,000 in 7 years?

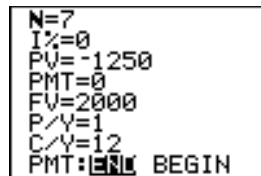
Note: Because there are no payments when you solve compound interest problems, PMT must be set to 0 and P/Y must be set to 1.

1. Press **APPS** **ENTER** to select **1:Finance** from the **APPLICATIONS** menu.



```
0:CALC VARS
1:TVM Solver...
2:tvm_Pmt
3:tvm_I%
4:tvm_PV
5:tvm_N
6:tvm_FV
7:↓nPV<
```

2. Press **ENTER** to select **1:TVM Solver** from the **CALC VARS** menu. The **TVM Solver** is displayed. Press **7** to enter the number of periods in years. Press **▼ ▼ (-) 1250** to enter the present value as a cash outflow (investment). Press **▼ 0** to specify no payments. Press **▼ 2000** to enter the future value as a cash inflow (return). Press **▼ 1** to enter payment periods per year. Press **▼ 12** to set compounding periods per year to **12**.



```
N=7
I%=0
PV=-1250
PMT=0
FV=2000
P/Y=1
C/Y=12
PMT:0 BEGIN
```

3. Press \square \square \square \square \square to place the cursor on the I% prompt.

```
N=7
I%=
PV=-1250
PMT=0
FV=2000
P/Y=1
C/Y=12
PMT: [ ] [ ] BEGIN
```

4. Press \square [ALPHA] [SOLVE] to solve for I%, the annual interest rate.

```
N=7.00
I%=6.73
PV=-1250.00
PMT=0.00
FV=2000.00
P/Y=1.00
C/Y=12.00
PMT: [ ] [ ] BEGIN
```

Using the TVM Solver

Using the TVM Solver

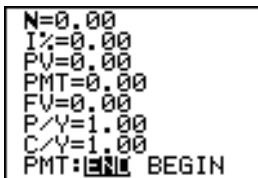
The **TVM Solver** displays the time-value-of-money (**TVM**) variables. Given four variable values, the **TVM Solver** solves for the fifth variable.

The **FINANCE VARS** menu section describes the five **TVM** variables (**N**, **I%**, **PV**, **PMT**, and **FV**) and **P/Y** and **C/Y**.

PMT: END BEGIN in the **TVM Solver** corresponds to the **FINANCE CALC** menu items **Pmt_End** (payment at the end of each period) and **Pmt_Bgn** (payment at the beginning of each period).

To solve for an unknown **TVM** variable, follow these steps.

1. Press **[APPS]** **[ENTER]** **[ENTER]** to display the **TVM Solver**. The screen below shows the default values with the fixed-decimal mode set to two decimal places.



```
N=0.00
I%=0.00
PV=0.00
PMT=0.00
FV=0.00
P/Y=1.00
C/Y=1.00
PMT:[END] BEGIN
```

2. Enter the known values for four **TVM** variables.
Note: Enter cash inflows as positive numbers and cash outflows as negative numbers.
3. Enter a value for **P/Y**, which automatically enters the same value for **C/Y**; if **P/Y** \neq **C/Y**, enter a unique value for **C/Y**.
4. Select **END** or **BEGIN** to specify the payment method.
5. Place the cursor on the **TVM** variable for which you want to solve.
6. Press **[ALPHA]** **[SOLVE]**. The answer is computed, displayed in the **TVM Solver**, and stored to the appropriate **TVM** variable. An indicator square in the left column designates the solution variable.

```
N=360.00
I%=18.00
PV=100000.00
■ PMT=-1507.09
FV=0.00
P/Y=12.00
C/Y=12.00
PMT: [END] BEGIN
```

Using the Financial Functions

Entering Cash Inflows and Cash Outflows

When using the TI-83 Plus financial functions, you must enter cash inflows (cash received) as positive numbers and cash outflows (cash paid) as negative numbers. The TI-83 Plus follows this convention when computing and displaying answers.

FINANCE CALC Menu

To display the **FINANCE CALC** menu, press **[APPS]** **[ENTER]**.

CALC	VARS
1: TVM Solver...	Displays the TVM Solver .
2: tvn_Pmt	Computes the amount of each payment.
3: tvn_I%	Computes the interest rate per year.
4: tvn_PV	Computes the present value.
5: tvn_N	Computes the number of payment periods.
6: tvn_FV	Computes the future value.
7: npv(Computes the net present value.
8: irr(Computes the internal rate of return.
9: bal(Computes the amortization sched. balance.
0: ΣPrn(Computes the amort. sched. princ. sum.
A: ΣInt(Computes the amort. sched. interest sum.

CALC VARS

B: ►Nom(Computes the nominal interest rate.
C: ►Eff(Computes the effective interest rate.
D: dbd(Calculates the days between two dates.
E: Pmt_End	Selects ordinary annuity (end of period).
F: Pmt_Bgn	Selects annuity due (beginning of period).

Use these functions to set up and perform financial calculations on the home screen.

TVM Solver

TVM Solver displays the [TVM Solver](#).

Calculating Time Value of Money (TVM)

Calculating Time Value of Money

Use time-value-of-money (TVM) functions (menu items 2 through 6) to analyze financial instruments such as annuities, loans, mortgages, leases, and savings.

Each TVM function takes zero to six arguments, which must be real numbers. The values that you specify as arguments for these functions are not stored to the [TVM variables](#).

Note: To store a value to a TVM variable, use the [TVM Solver](#) or use $\boxed{\text{STO}}\blacktriangleright$ and any TVM variable on the **FINANCE VARS** menu.

If you enter less than six arguments, the TI-83 Plus substitutes a previously stored TVM variable value for each unspecified argument.

If you enter any arguments with a TVM function, you must place the argument or arguments in parentheses.

tvm_Pmt

tvm_Pmt computes the amount of each payment.

tvm_Pmt[(N,I%,PV,FV,P/Y,C/Y)]

```
N=360
I%=8.5
PV=100000
PMT=0
FV=0
P/Y=12
C/Y=12
PMT:  END  BEGIN
```

```
tvm_Pmt          -768.91
tvm_Pmt(360,9.5) -840.85
```

Note: In the example above, the values are stored to the **TVM** variables in the **TVM Solver**. Then the payment (**tvm_Pmt**) is computed on the home screen using the values in the **TVM Solver**. Next, the interest rate is changed to 9.5 to illustrate the effect on the payment amount.

tvm_I%

tvm_I% computes the annual interest rate.

tvm_I%[(N,PV,PMT,FV,P/Y,C/Y)]

```
tvm_I%(48,10000,
-250,0,12)
          9.24
Ans→I%   9.24
```

tvm_PV

tvm_PV computes the present value.

tvm_PV[(N,I%,PMT,FV,P/Y,C/Y)]

```
360→N: 11→I%: -100
0→PMT: 0→FV: 12→P/
Y
tvm_PV      12.00
            105006.35
```

tvm_N

tvm_N computes the number of payment periods.

tvm_N[(I%,PV,PMT,FV,P/Y,C/Y)]

```
6→I%: 9000→PV: -35
0→PMT: 0→FV: 3→P/Y
tvm_N      3.00
            36.47
```

tvm_FV

tvm_FV computes the future value.

tvm_FV[(*N*,*I*%,*PV*,*PMT*,*P/Y*,*C/Y*)]

6→N:8→I%:-5500→P
V:0→PMT:1→P/Y
1.00
tvm_FV
8727.81

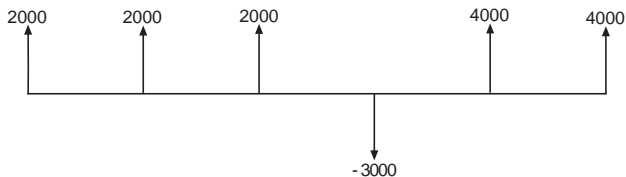
Calculating Cash Flows

Calculating a Cash Flow

Use the cash flow functions (menu items **7** and **8**) to analyze the value of money over equal time periods. You can enter unequal cash flows, which can be cash inflows or outflows. The syntax descriptions for **npv()** and **irr()** use these arguments.

- *interest rate* is the rate by which to discount the cash flows (the cost of money) over one period.
- *CF0* is the initial cash flow at time 0; it must be a real number.
- *CFList* is a list of cash flow amounts after the initial cash flow *CF0*.
- *CFFreq* is a list in which each element specifies the frequency of occurrence for a grouped (consecutive) cash flow amount, which is the corresponding element of *CFList*. The default is 1; if you enter values, they must be positive integers < 10,000.

For example, express this uneven cash flow in lists.



$CF_0 = 2000$

$CFList = \{2000, -3000, 4000\}$

$CFFreq = \{2, 1, 2\}$

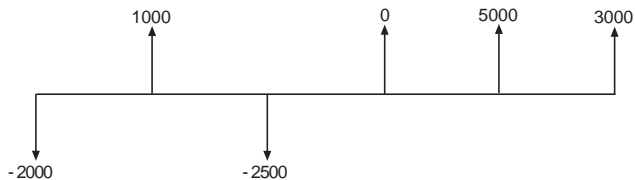
npv(, irr(

npv(net present value) is the sum of the present values for the cash inflows and outflows. A positive result for **npv** indicates a profitable investment.

npv(interest rate, CF_0 , $CFList$ [, $CFFreq$])

irr(internal rate of return) is the interest rate at which the net present value of the cash flows is equal to zero.

irr(CF_0 , $CFList$ [, $CFFreq$])



```
{1000, -2500, 0, 5000, 3000} → L1  
{1000.00 -2500.00 ...
```

```
npv(6, -2000, L1) 2920.65  
irr(-2000, L1) 27.88
```

Calculating Amortization

Calculating an Amortization Schedule

Use the amortization functions (menu items **9**, **0**, and **A**) to calculate balance, sum of principal, and sum of interest for an amortization schedule.

bal(

bal(computes the balance for an amortization schedule using stored values for **I%**, **PV**, and **PMT**. *npmt* is the number of the payment at which you want to calculate a balance. It must be a positive integer < 10,000. *roundvalue* specifies the internal precision the calculator uses to calculate the balance; if you do not specify *roundvalue*, then the TI-83 Plus uses the current **Float/Fix** decimal-mode setting.

bal(npmt[,roundvalue])

```
100000→PV:8.5→I%  
:-768.91→PMT:12→  
P/Y  
12.00
```

```
bal(12) 99244.07
```

$\Sigma\text{Prn}(, \Sigma\text{Int}($

$\Sigma\text{Prn}($ computes the sum of the principal during a specified period for an amortization schedule using stored values for $I\%$, **PV**, and **PMT**. $pmt1$ is the starting payment. $pmt2$ is the ending payment in the range. $pmt1$ and $pmt2$ must be positive integers $< 10,000$. $roundvalue$ specifies the internal precision the calculator uses to calculate the principal; if you do not specify $roundvalue$, the TI-83 Plus uses the current **Float/Fix** decimal-mode setting.

Note: You must enter values for $I\%$, **PV**, **PMT**, and before computing the principal.

$\Sigma\text{Prn}(pmt1,pmt2[,roundvalue])$

$\Sigma\text{Int}($ computes the sum of the interest during a specified period for an amortization schedule using stored values for $I\%$, **PV**, and **PMT**. $pmt1$ is the starting payment. $pmt2$ is the ending payment in the range. $pmt1$ and $pmt2$ must be positive integers $< 10,000$. $roundvalue$ specifies the internal precision the calculator uses to calculate the interest; if you do not specify $roundvalue$, the TI-83 Plus uses the current **Float/Fix** decimal-mode setting.

$\Sigma\text{Int}(pmt1,pmt2[,roundvalue])$

```
360→N:100000→PV:
8.5→I%:-768.91→P
MT:12→P/Y
12.00
```

```
ΣPrn(1,12)
-755.93
ΣInt(1,12)
-8470.99
```

Amortization Example: Calculating an Outstanding Loan Balance

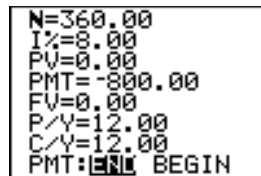
You want to buy a home with a 30-year mortgage at 8 percent APR. Monthly payments are 800. Calculate the outstanding loan balance after each payment and display the results in a graph and in the table.

1. Press **MODE**. Press **▼ ▶ ▶ ▶ ENTER** to set the fixed-decimal mode setting to 2. Press **▼ ▼ ▶ ENTER** to select **Par** graphing mode.



```
Normal Sci Eng
Float 0123456789
Radian Degree
Func Par Pol Seq
Connected Dot
Sequential Simul
Real a+bi re^θi
Full Horiz G-T
```

2. Press **APPS ENTER ENTER** to display the **TVM Solver**.
3. Press **ENTER 360** to enter number of payments. Press **▼ 8** to enter the interest rate. Press **▼ ▼ (-) 800** to enter the payment amount. Press **▼ 0** to enter the future value of the mortgage. Press **▼ 12** to enter the payments per year, which also sets the compounding periods per year to 12. Press **▼ ▼ ENTER** to select **PMT:END**.



```
N=360.00
I%=8.00
PV=0.00
PMT=-800.00
FV=0.00
P/Y=12.00
C/Y=12.00
PMT:END BEGIN
```

4. Press $\uparrow \uparrow \uparrow \uparrow \uparrow$ to place the cursor on the **PV** prompt. Press $\boxed{\text{ALPHA}} \boxed{\text{SOLVE}}$ to solve for the present value.

```

N=360.00
I%=8.00
PV=109026.80
PMT=-800.00
FV=0.00
P/Y=12.00
C/Y=12.00
PMT:  $\square$  BEGIN
  
```

5. Press $\boxed{\text{Y=}}$ to display the parametric **Y=** editor. Turn off all stat plots. Press $\boxed{\text{X,T,}\theta,\eta}$ to define **X1T** as **T**. Press $\boxed{\downarrow} \boxed{\text{APPS}} \boxed{\text{ENTER}} \boxed{9} \boxed{\text{X,T,}\theta,\eta} \boxed{}$ to define **Y1T** as **bal(T)**.

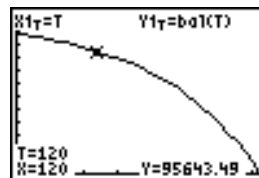
```

Plot1 Plot2 Plot3
X1T  $\square$ 
Y1T bal(T)
  
```

6. Press $\boxed{\text{WINDOW}}$ to display the window variables. Enter the values below.

Tmin=0	Xmin=0	Ymin=0
Tmax=360	Xmax=360	Ymax=125000
Tstep=12	Xscl=50	Yscl=10000

7. Press $\boxed{\text{TRACE}}$ to draw the graph and activate the trace cursor. Press $\boxed{\rightarrow}$ and $\boxed{\leftarrow}$ to explore the graph of the outstanding balance over time. Press a number and then press $\boxed{\text{ENTER}}$ to view the balance at a specific time **T**.



8. Press $\boxed{2\text{nd}} \boxed{\text{TBLSET}}$ and enter the values below.
- TblStart=0**
 Δ Tbl=12

Calculating Interest Conversion

Calculating an Interest Conversion

Use the interest conversion functions (menu items **B** and **C**) to convert interest rates from an annual effective rate to a nominal rate (►**Nom**()) or from a nominal rate to an annual effective rate (►**Eff**()).

►**Nom**(

►**Nom**(computes the nominal interest rate. *effective rate* and *compounding periods* must be real numbers. *compounding periods* must be >0 .

►**Nom**(*effective rate,compounding periods*)

```
►Nom(15.87,4)
      15.00
```

►**Eff**(

►**Eff**(computes the effective interest rate. *nominal rate* and *compounding periods* must be real numbers. *compounding periods* must be >0 .

►**Eff**(*nominal rate,compounding periods*)

```
►Eff(8,12)
      8.30
```

Finding Days between Dates/Defining Payment Method

dbd(

Use the date function **dbd**((menu item **D**) to calculate the number of days between two dates using the actual-day-count method. *date1* and *date2* can be numbers or lists of numbers within the range of the dates on the standard calendar.

Note: Dates must be between the years 1950 through 2049.

dbd(*date1*,*date2*)

You can enter *date1* and *date2* in either of two formats.

- MM.DDYY (United States)
- DDMM.YY (Europe)

The decimal placement differentiates the date formats.

```
dbd(12.3190,12.3  
192)          731.00
```

Defining the Payment Method

Pmt_End and **Pmt_Bgn** (menu items **E** and **F**) specify a transaction as an ordinary annuity or an annuity due. When you execute either command, the **TVM Solver** is updated.

Pmt_End

Pmt_End (payment end) specifies an ordinary annuity, where payments occur at the end of each payment period. Most loans are in this category. **Pmt_End** is the default.

Pmt_End

On the **TVM Solver**'s **PMT:END BEGIN** line, select **END** to set **PMT** to ordinary annuity.

Pmt_Bgn

Pmt_Bgn (payment beginning) specifies an annuity due, where payments occur at the beginning of each payment period. Most leases are in this category.

Pmt_Bgn

On the **TVM Solver**'s **PMT:END BEGIN** line, select **BEGIN** to set **PMT** to annuity due.

Using the TVM Variables

FINANCE VARS Menu

To display the **FINANCE VARS** menu, press **[APPS]** **[ENTER]** **[▶]**. You can use **TVM** variables in **TVM** functions and store values to them on the home screen.

CALC **VARS**

1 : N	Total number of payment periods
2 : I%	Annual interest rate
3 : PV	Present value
4 : PMT	Payment amount
5 : FV	Future value
6 : P/Y	Number of payment periods per year
7 : C/Y	Number of compounding periods/year

N, I%, PV, PMT, FV

N, I%, PV, PMT, and FV are the five **TVM** variables. They represent the elements of common financial transactions, as described in the table above. **I%** is an annual interest rate that is converted to a per-period rate based on the values of **P/Y** and **C/Y**.

P/Y and C/Y

P/Y is the number of payment periods per year in a financial transaction.

C/Y is the number of compounding periods per year in the same transaction.

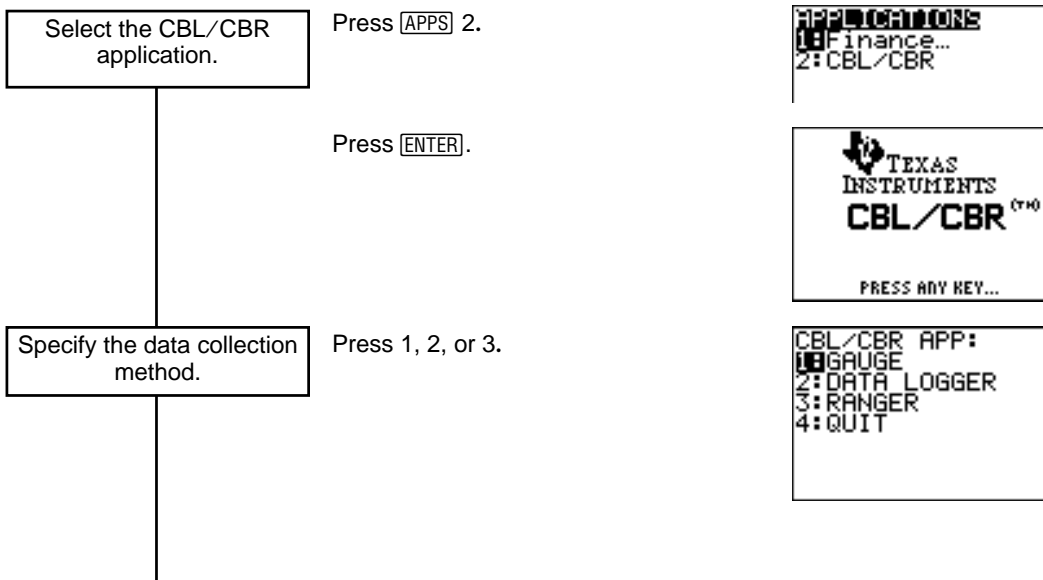
When you store a value to **P/Y**, the value for **C/Y** automatically changes to the same value. To store a unique value to **C/Y**, you must store the value to **C/Y** after you have stored a value to **P/Y**.

The CBL/CBR Application

The CBL/CBR application allows you to collect real world data. The TI-83 Plus comes with the CBL/CBR application already listed on the APPLICATIONS menu (**APPS** 2).

Steps for Running the CBL/CBR Application

Follow these basic steps when using the CBL/CBR application. You may not have to do all of them each time.



Select options, if applicable.

Highlight options or enter value and press **ENTER**.

Collect the data. Follow directions, if applicable.

Select **Go...** or **START NOW**.

Stop the data collection, if necessary. Repeat these steps or exit the APPLICATIONS menu.

Press **ON** and **TRIGGER** or **ON/HALT**.

```
PROBE:Temp Light
Volt Sonic
TYPE: Bar Meter
MIN:0
MAX:6
UNITS: F Ft
DIRECTNS: 07 Off
GO...
```

Selecting the CBL/CBR Application

To use a **CBL/CBR** application, you need a **CBL 2/CBL** or **CBR** (as applicable), a **TI-83 Plus**, and a unit-to-unit link cable.

1. Press **APPS**.



2. Select **2:CBL/CBR** to set up the TI-83 Plus to use either of the applications. An informational screen appears first.



3. Press any key to continue to the next menu.



Data Collection Methods and Options

Specifying the Data Collection Method from the CBL/CBR APP Menu

With a **CBL 2/CBL** or **CBR**, you can collect data in one of three ways: **GAUGE** (bar or meter), **DATA LOGGER** (a Temp-Time, Light-Time, Volt-Time, or Sonic-Time graph), or **RANGER**, which runs the **RANGER** program, the built-in **CBR** data collection program.

The **CBL/CBR APP** menu contains the following data collection methods:

CBL/CBR APP:

- | | |
|----------------|--|
| 1: GAUGE | Displays results as either a bar or meter. |
| 2: DATA LOGGER | Displays results as a Temp-Time, Light-Time, Volt-Time, or Sonic-Time graph. |
| 3: RANGER | Sets up and runs the RANGER program. |
| 4: QUIT | Quits the CBL/CBR application. |
-

Note: **CBL 2/CBL** and **CBR** differ in that **CBL 2/CBL** allows you to collect data using one of several different probes including: Temp (Temperature), Light, Volt (Voltage), or Sonic. **CBR** collects data using only the built-in Sonic probe. You can find more information on **CBL 2/CBL** and **CBR** in their user manuals.

Specifying Options for Each Data Collection Method

After you select a data collection method from the **CBL/CBR APP** menu, a screen showing the options for that method is displayed. The method you choose, as well as the data collection options you choose for that method, determine whether you use the **CBR** or the **CBL 2/CBL**. Refer to the charts in the following sections to find the options for the application you are using.

GAUGE

The **GAUGE** data collection method lets you choose one of four different probes: temp, Light, Volt, or Sonic.

1. Press **[APPS]** **2** **[ENTER]**.
2. Select **1:GAUGE**.
3. Select options.

```
CBL/CBR APP:  
1:GAUGE  
2:DATA LOGGER  
3:RANGER  
4:QUIT
```

```
PROBE: TEMP Light  
Volt Sonic  
TYPE: Bar Meter  
MIN:0  
MAX:100  
UNITS: °C °F  
DIRECTNS: Off Off  
GO...
```

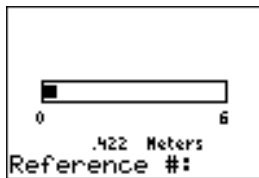
When you select a probe option, all other options change accordingly. Use **▶** and **◀** to move between the probe options. To select a probe, highlight the one you want with the cursor keys, and then press **ENTER**.

GAUGE Options (Defaults)				
Probe:	Temp	Light	Volt	Sonic
Type:	Bar or Meter			
Min:	0	0	-10	0
Max:	100	1	10	6
Units:	°C or °F	mW/cm²	Volt	m or Ft
Directions:	On or Off			

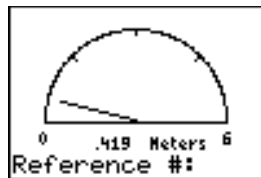
TYPE

The **GAUGE** data collection results are represented according to **TYPE: Bar** or **Meter**. Highlight the one you want with the cursor keys, and then press **ENTER**.

Bar



Meter



MIN and MAX

MIN and **MAX** refer to the minimum and maximum **UNIT** values for the specified probe. Defaults are listed in the Gauge Options table. See the CBL 2/CBL and CBR guidebook for specific **MIN/MAX** ranges. Enter values using the number keys.

UNITS

The results are displayed according to the **UNITS** specified. To specify a unit measurement (**Temp** or **Sonic** probes only), highlight the one you want using the cursor keys, enter a value using the number keys, and then press **ENTER**.

DIRECTNS (Directions)

If **DIRECTNS=On**, the calculator displays step-by-step directions on the screen, which help you set up and run the data collection. To select **On** or **Off**, highlight the one you want with the cursor keys, and then press **ENTER**.

With the **sonic** data collection probe, if **DIRECTNS=On**, the calculator displays a menu screen before starting the application asking you to select **1:CBL** or **2:CBR**. This ensures that you get the appropriate directions. Press **1** to specify **CBL** **2/CBL** or **2** to specify **CBR**.

Data Collection Comments and Results

To label a specific data point, press **ENTER** to pause the data collection. You will see a **Reference#:** prompt. Enter a number using the number keys. The calculator automatically converts the reference numbers and the corresponding results into list elements using the following list names (you cannot rename these lists):

Probe	Comment Labels (X) Stored to:	Data Results (Y) Stored to:
Temp	L TREF	L TEMP
Light	L LREF	L LIGHT
Volt	L VREF	L VOLT
Sonic	L DREF	L DIST

To see all elements in one of these lists, you can insert these lists into the List editor just as you would any other list. Access list names from the **[2nd] [LIST] NAMES** menu.

Note: These lists are only temporary placeholders for comment labels and data results for any particular probe. Therefore, every time you collect data and enter comments for one of the four probes, the two lists pertaining to that probe are overwritten with comment labels and data results from the most recently collected data..

If you want to save comment labels and data results from more than one data collection, copy all list elements that you want to save to a list with a different name.

Also, the **DATA LOGGER** data collection method stores data results to the same list names, overwriting previously-collected data results, even those collected using the **GAUGE** data collection method.

DATA LOGGER

1. Press **APPS** **2** **ENTER**.

```
CBL/CBR APP:
1: GAUGE
2: DATA LOGGER
3: RANGER
4: QUIT
```

2. Select **2:DATA LOGGER**.

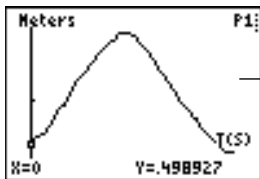
```
PROBE: Temp Light
      Volt Sonic
#SAMPLES: 99
INTRVL(SEC): 1
UNITS: °C °F
PLOT: Real me End
DIRECTNS: On Off
GO...
```

The **DATA LOGGER** data collection method lets you choose one of four different probes: **Temp**, **Light**, **Volt**, or **Sonic**. You can use the **CBL 2/CBL** with all probes; you can use the **CBR** only with the **Sonic** probe.

When you select a probe option, all other options change accordingly. Use **▶** and **◀** to move between the probe options. To select a probe, highlight the one you want with the cursor keys, and then press **ENTER**.

DATA LOGGER Options (Defaults)				
	Temp	Light	Volt	Sonic
#SAMPLES:	99	99	99	99
INTRVL (SEC):	1	1	1	1
UNITS:	°C or °F	mW/cm ²	Volt	Cm or Ft
PLOT:	RealTime or End			
DIRECTNS:	On or Off			
Ymin (WINDOW):	0	0	-10	0
Ymax (WINDOW):	100	1	10	6

The DATA LOGGER data collection results are represented as a Temp-Time, Light-Time, Volt-Time, or Distance-Time graph.



A Distance-Time graph in meters (**Sonic** probe).

#SAMPLES

#SAMPLES refers to how many data samples are collected and then graphed. For example, if **#SAMPLES=99**, data collection stops after the 99th sample is collected. Enter values using the number keys.

INTRVL (SEC)

INTRVL (SEC) specifies the interval in seconds between each data sample that is collected. For example, if you want to collect 99 samples and **INTRVL=1**, it takes 99 seconds to finish data collection. Enter values using the number keys. See the **CBL 2/CBL** or **CBR** guidebook for more information about interval limits.

UNITS

The results are displayed according to the **UNITS** specified. To specify a unit measurement (**Temp** or **Sonic** only), highlight the one you want using the cursor keys, and then press **ENTER**.

PLOT

You can specify whether you want the calculator to collect realtime (**RealTme**) samples, which means that the calculator graphs data points immediately as they are being collected, or you can wait and show the graph only after all data points have been collected (**End**). Highlight the option you want with the cursor keys, and then press **[ENTER]**.

Ymin and Ymax

To specify **Ymin** and **Ymax** values for the final graph, press **[WINDOW]** to view the **PLOT WINDOW** screen. Use **[▲]** and **[▼]** to move between options. Enter **Ymin** and **Ymax** using the number keys. Press **[2nd] [QUIT]** to return to the **DATA LOGGER** options screen.

DIRECTNS (Directions)

If **DIRECTNS=On**, the calculator displays step-by-step directions on the screen, which help you set up and run the data collection. To select **On** or **Off**, highlight the one you want with the cursor keys, and then press **[ENTER]**.

With the **Sonic** data collection probe, if **DIRECTNS=On**, the calculator displays a menu screen before starting the application asking you to select **1:CBL** or **2:CBR**. This ensures that you get the appropriate directions. Press **1** to specify **CBL 2/CBL** or **2** to specify **CBR**.

Data Collection Results

The calculator automatically converts all collected data points into list elements using the following list names (you cannot rename the lists):

Probe	Time Values (X) stored to:	Data Results (Y) Stored to:
Temp	LTEMP	LTEMP
Light	LTLGHT	LLIGHT
Volt	LTVOLT	LVOLT
Sonic	LTDIST	LDIST

To see all elements in one of these lists, you can insert these lists into the List editor just as you would any other list. Access list names from the 2nd [LIST] NAMES menu.

Note: These lists are only temporary placeholders for data results for any particular probe. Therefore, every time you collect data for one of the four probes, the list pertaining to that probe is overwritten with data results from the most recently collected data.

If you want to save data results from more than one data collection, copy all list elements that you want to save to a list with a different name.

Also, the **GAUGE** data collection method stores data results to the same list names, overwriting previously-collected data results, even those collected using the **DATA LOGGER** data collection method.

RANGER

Selecting the **RANGER** data collection method runs the CBR **RANGER** program, a customized program especially for the TI-83 Plus that makes it compatible with the CBR. When the collection process is halted, the **CBR RANGER** is deleted from RAM. To run the CBR **RANGER** program again, press **[APPS]** and select the **CBL/CBR** application.

Note: The Ranger data collection method only uses the Sonic probe.

1. Press **[APPS]** 2 **[ENTER]**.

2. Select 3:RANGER.

3. Press **[ENTER]**.

4. Select options.

```
CBL/CBR APP:
1: GAUGE
2: DATA LOGGER
3: RANGER
4: QUIT
```

```
TEXAS INSTRUMENTS
RANGER (V1.00)
PRESS [ENTER]
```

```
MAIN MENU
1: SETUP/SAMPLE
2: SET DEFAULTS
3: APPLICATIONS
4: PLOT MENU
5: TOOLS
6: QUIT
```

For detailed information about the **RANGER** program as well as option explanations, see the [Getting Started with CBR](#) guidebook.

Starting Data Collection

Collecting the Data

After you specify all of the options for your data collection method, select the **Go** option from the **GAUGE** or **DATA LOGGER** options screen. If you are using the **RANGER** data collection method, select **1:SETUP/SAMPLE** from the **MAIN** menu, and then **START NOW**.

- If **DIRECTNS=Off**, **GAUGE** and **DATA LOGGER** data collection begin immediately.
- If **DIRECTNS=On**, the calculator displays step-by-step directions.

If **PROBE=Sonic**, the calculator first displays a menu screen asking you to select **1:CBL** or **2:CBR**. This ensures that you get the appropriate directions. Press **1** to specify **CBL 2/CBL** or **2** to specify **CBR**.

If you select **START NOW** from the **MAIN** menu of the **RANGER** data collection method, the calculator displays one directions screen. Press **ENTER** to begin data collection.

Stopping Data Collection

To stop the **GAUGE** data collection method, press **CLEAR** on the TI-83 Plus.

The **DATA LOGGER** and **RANGER** data collection methods stop after the specified number of samples have been collected. To stop them before this happens:

1. Press **ON** on the TI-83 Plus.
2. Press **TRIGGER** on the CBR, **START/STOP** on the CBL 2, or **ON/HALT** on the CBL.

To exit from the **GAUGE** or **DATA LOGGER** option menus without beginning data collection, press **2nd** **QUIT**.

To exit from the **RANGER** option menu without beginning data collection, select **MAIN** menu. Select **6:QUIT** to return to the **CBL/CBR APP** menu.

Press **4:QUIT** from the **CBL/CBR APP** menu to return to the TI-83 Plus Home screen.