PIPE TRADES PRO™

The Pipe Trades Pro™ Advanced Pipe Trades Math Calculator has been specifically designed for today's pipe trade professionals. No matter what Pipe Trade you work in, you'll find it easy to use, fast, accurate, and reliable. Quickly calculate Offsets, Rolling Offsets, and Cutbacks. Immediately access Pipe Material and Type data, and Pipe Size dimensions. The *Pipe Trades Pro* will help you on the jobsite or in the office.

- *Built-in data and Pipe Sizing for 7 different Piping Materials*

- *Linear and Rolling Offset Solutions for Known and Unknown Fitting Angles*

- *Fitting Take-out and Cut Mark Solutions*

- *Cutback Solutions*

- *Trigonometric Solutions*

- *Circle, Circumference and Area Solutions*

- *Fractional Feet-Inch Input/Output*

- *Simple US/Metric and Flow Conversions and Solutions*

- *Problems Involving All Architectural Fractions — 1/2-1/64ths*

- *And more*

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You may want to practice getting a feel for your calculator keys by reading through the key definitions and learning how to enter basic feet-inch-fractions and metric, how to store values in Memory, etc., before proceeding to the examples.

Order of Operations

Unlike other Calculated Industries calculators, which use the Chaining Method of Operations, this calculator uses the Order of Operation Method.

- Chaining Method ("as entered"): 10 + 4 x 5 = 70
- Order of Operations: 10 + 4 x 5 = 30

The Order of Operations method of computing is based on the following order of precedence:

1) Expressions inside of parentheses

2) Single-variable functions that perform the calculation and display the result immediately (trig functions, square, square root, x^y, percent, reciprocal, angle conversions)

3) Multiplication and division

4) Addition and subtraction

5) Equals (completes all operations)

If you need to calculate using the Chaining Method, you can change this in your calculator Preference Settings.

Using Parentheses

Your calculator has parentheses keys (and) for performing mathematical operations. (In the Order of Operations method, expressions inside of parentheses are performed first.)

The calculator offers up to 21 levels of parenthesis:

1) First parenthesis level opened – press (for one right-sided parenthesis.

2) Second level opened – press (a second time for two right-sided parentheses ((.

3) Third level opened – press (a third time for three right-sided parentheses (((.

4) Fourth level opened – press (a fourth time for four right-sided parentheses ((((.

  Numbers of levels greater than four are shown in the upper left corner of the display.

Basic Function Keys

On/C   *On/Clear Key –* Turns on power. Pressing once clears the last entry and the display. Pressing twice clears all non-permanent values.

Off   *Off –* Turns all power off. Clears all non-permanent memory.

＋－✕ ÷＝   *Arithmetic operation keys*

0 – **9** and **•**   *Keys used for entering numbers.*

Conv   *Convert –* Used with the dimensional keys to convert between units or with other keys to access special functions.

Stor   *Store –* Used for storing values.

Rcl   *Recall –* Used with other keys to recall stored values and settings.

Conv Rcl   *Memory Clear (M-R/C) –* Clears Memory without changing current display.

M+   *Accumulative Memory –* Adds value to Accumulative Memory.

Conv M+   *(M-) –* Subtracts value from Accumulative Memory.

Dimensional Function Keys

Feet	**Feet –** Enters or converts to feet as whole or decimal numbers. Also used with *Inch* and */* keys for entering feet-inch values (e.g., **6** *Feet* **9** *Inch* **1** */* **2**). *Repeated presses during conversions toggle between fractional feet-inch and decimal feet.*
Inch	**Inch –** Enters or converts to inches. Entry can be whole or decimal numbers. Also used with */* for entering fractional inch values (e.g., **9** *Inch* **1** */* **2**). *Repeated presses during conversions toggle between fractional and decimal inches.*
/	**Fraction Bar –** Used to enter fractions. Fractions can be entered as proper (1/2, 1/8, 1/16) or improper (3/2, 9/8). If the denominator (bottom) is not entered, the calculator's fractional accuracy setting is automatically used. Results are always shown in typical building fractional format.
Conv 1	**Gallons per Minute (gpm) –** Enters or converts to gallons per minute.
Conv 2	**Liters per Second (l/s) –** Enters or converts to liters per second.
Conv 4	**Cubic Feet per Minute (cfm) –** Enters or converts to cubic feet per minute.
Conv 5	**Cubic Feet per Second (cfs) –** Enters or converts to cubic feet per second.
Conv 3	**Degrees Celsius (°C) –** Enters or converts to degrees Celsius.
Conv 6	**Degrees Fahrenheit (°F) –** Enters or converts to degrees Fahrenheit.
mm	**Millimeters –** Enters or converts to millimeters.
Conv *mm*	**Meters (m) –** Enters or converts to meters.
Conv 8	**Gallons –** Enters or converts to gallons.
Conv 9	**Liters –** Enters or converts to liters.

Weight/Volume Functions

Stor ➕   *Weight/Volume* **–** Stores a new weight volume as pounds per cubic feet or other format as shown below. Default value is 62.42796 pounds per cubic foot of water (1000 kg/m^3).
- Pounds per cubic foot
- Pounds per cubic inch
- Pounds per gallon
- Kilograms per cubic meter
- Kilograms per liter

Conv 7   *Pounds (lbs)* **–** Enters or converts a weight or volume value to pounds.

Conv /   *Kilograms (kg)* **–** Enters or converts a weight or volume value to kilograms.

Circle Key

Circle   *Circle* **–** Enters diameter and calculates circle area and circumference.

Trigonometric Keys

Sine   Finds the sine of a degree or undimensioned value.

Conv Sine   *Arcsine (sin^{-1})* **–** Gives the angle in degrees for the Sine value.

Cos   Finds the Cosine.

Conv Cos   *Arccosine (cos^{-1})* **–** Gives the angle in degrees for the Cosine value.

Tan   Finds the Tangent.

Conv Tan   *Arctangent (tan^{-1})* **–** Gives the angle in degrees for the Tangent value.

Pipefitting Project Keys

$$\text{Slope} = \frac{\text{Unit Rise}}{\text{Unit Run}}$$
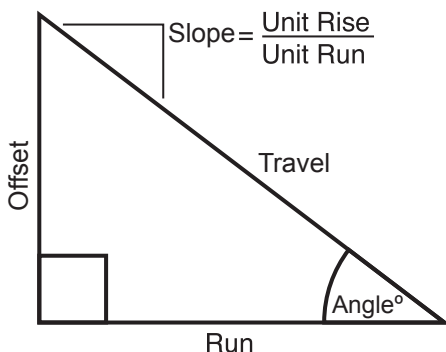
⬚ **Angle/ Slope**   Enters or calculates a linear Slope, Slope Angle, or Percent Grade. The linear slope is the amount of "Offset" over 12 inches of "Run." Values may be entered as:
- a Dimension: **9** **Inch** **Angle/Slope**
- an Angle or Degrees: **4** **5** **Angle/Slope**
- a Percentage (percent grade): **7** **5** **Conv** **←** **Angle/Slope**

Once an angle or slope has been entered, consecutive presses of **Angle/Slope** will convert to the remaining formats listed above.

Conv **Angle/Slope** *Take-Out (T.O./Arc)* **–** Used to enter or solve fitting Take-Outs when calculating pipe cut lengths. Calculates inner, center, and outer arc lengths for marking field cut fittings.

Offset   Calculates or enters the Offset (Rise).

Conv **Offset** *Welder's Gap* **–** Defines the Welder's Gap subtracted from the end to end pipe length calculation. Default value is 1/8", 0 is a valid value.

Run   Enters or calculates the Run.

Travel   Enters or calculates the Travel (Diagonal).

[Pipe Mat'l]	Defines the Pipe Material. (Steel, Stainless Steel, Brass, Aluminum, Cast Iron, PVC or Copper).
[Conv] [Pipe Mat'l]	*Elbow Type* **–** Defines the type of radius (long or short) and whether a factory or field cut 45˚ Butt Weld elbow is being used. Default value is Butt Weld — Long.
[Pipe Size]	Enters the nominal Pipe Size and provides data pertaining to the entered size.
[Conv] [Pipe Size]	*Pipe Type* **–** Defines the Pipe Type based on Pipe Material.
[Conv] [Run]	*Cutback* **–** Calculates pipe Cutback after Bend Angle and Offset are entered.
[Conv] [Travel]	*Rolling Offset (Roll)* **–** Calculates Rolling Offset pipe length.
[Conv] [(]	*Flow* **–** Enter or calculate volumetric Flow Rate through a pipe.
[Conv] [)]	*Velocity* **–** Enter or calculate Velocity and convert between feet per second, feet per minute, and meters per second.
[Conv] [Circle]	*Pressure* **–** Enter Pressure value. Calculate Pressure loss. Convert between units of pressure.
[Conv] [x^2]	*Force* **–** Enter or calculate Force and convert between lbf, newton.
[Conv] [$\sqrt{x}$]	*Area* **–** Enter pipe area for use in Flow, Velocity, Pressure, and Force calculations. Calculate Area given values for Flow/Velocity or Force/Pressure.

Miscellaneous Functions

$($	Open parenthesis key
$)$	Close parenthesis key
x^y	Enters an exponential value other than x^2 or Square Root.
Conv x^y	***Exponential Root Value –*** Enters the exponential root value ($x^{1/y}$).
Conv $+$	***Pi –*** Displays value of π (3.141593).
Conv $\div$	***Reciprocal (1/x) –*** Finds the reciprocal of a number (e.g., 8 Conv $\div$ 0.125).
Conv $-$	***Change Sign (+/–) –*** Toggle displayed value between minus and plus value.
Conv $\times$	***Clear All –*** Returns all stored values to the default settings. (Does not affect Preference settings.)
x^2	Squares the value in the display.
$\sqrt{x}$	***Square Root –*** Calculates the Square Root
Conv 0	***Cost -*** Cost function
Stor 0	Store unit cost
Conv •	***Degrees:Minutes:Seconds –*** Converts between D:M:S and decimal degree formats; repeated presses will toggle between the two formats.
Conv $=$	Paperless tape
Conv Stor	Preference settings
⬅	***Backspace Function –*** Used to delete entries one keystroke at a time (unlike the *On/C* function, which deletes the entire entry).
Conv ⬅	Percent function
Stor 1 - 9	Used to store values in Memory registers 1 through 9.

PREFERENCE SETTINGS

HOW TO SET PREFERENCES

The following sections detail Preference Setting options for the *Pipe Trades Pro* calculator.

Enter the Preference Mode by pressing **Conv** **Stor** (Prefs). Access each category by pressing the **Stor** key until you reach the desired setting. Within each category, press the **+** or **−** keys to toggle between individual selections. Press **On/C** to exit and set your Preference.

Note: *Press* **+** t*o advance and press* **−** *to back up. Pressing the* **Stor** *key continuously in this mode will cycle through all of the Preference Settings.*

You may change these settings at any time by repeating the above, and setting in a new preference.

To reset preferences back to factory default settings, turn your calculator off, hold down the **✕** key and turn the calculator back on.

For example, if you wish to display all your dimensional area answers in square meters, press **Conv** **Stor** **Stor** (Area Std), then the **+** key until **"AREA 0. SQ M"** is displayed. Simply exit this mode by pressing **On/C** and all your future area answers will be displayed in square meters.

KEYSTROKE	DISPLAY
Conv **Stor**	
(Fractional Resolution)	**FRAC 0-1/16 INCH**
+	**FRAC 0-1/32 INCH**
+	**FRAC 0-1/64 INCH**
+	**FRAC 0-1/2 INCH**
+	**FRAC 0-1/4 INCH**
+	**FRAC 0-1/8 INCH**
+ *(repeats options)*	**FRAC 0-1/16 INCH**

(cont'd)

(cont'd)

KEYSTROKE	**DISPLAY**

Second press of **Stor** :
(Area displays)   **AREA Std.**
+   **AREA 0. SQ FEET**
+   **AREA 0. SQ INCH**
+   **AREA 0. SQ M**
+ *(repeats options)*   **AREA Std.**

Third press of **Stor** :
(Volume displays)   **VOL Std.**
+   **VOL 0. CU FEET**
+   **VOL 0. CU M**
+ (repeats options)   **VOL Std.**

Fourth press of **Stor** :
(Meter Linear displays)   **METR 0.000 M**
+ *(floating point)*   **METR FLOAt M**
+ *(repeats options)*   **METR 0.000 M**

Fifth press of **Stor** :
(Decimal Degree displays)   **DEG 0.00º**
+ *(floating point)*   **DEG FLOAt**
+ *(repeats options)*   **DEG 0.00º**

Sixth press of **Stor** :
(Fractional mode)   **FRAC Std.**
+   **FRAC COnSt.**
+ (repeats options)   **FRAC Std.**

Seventh press of **Stor** :
(Mathematical Operation)   **MATH OrdEr**
+   **MATH CHAIn**
+ *(repeats options)*   **MATH OrdEr**

ENTERING DIMENSIONS

Linear Dimensions

When entering feet-inch values, enter dimensions from largest to smallest — feet before inches, inches before fractions. Enter fractions by entering the numerator (top number), pressing **/** (Fraction Bar key) and then the denominator (bottom number).

Note: *If a denominator is not entered, the fractional setting value is used.*

Examples of how linear dimensions are entered (press **On/C** after each entry):

DIMENSIONS	KEYSTROKE
5 feet	**5 Feet**
5 feet, 1 ½ inches	**5 Feet 1 Inch 1 / 2**
17.5 meters	**1 7 • 5 Conv mm**
1250 millimeters	**1 2 5 0 mm**

Square and Cubic Dimensions

Examples of how square and cubic dimensions are entered (press **On/C** after each entry):

DIMENSIONS	KEYSTROKE
14 square inches	**1 4 Inch Inch**
11 square feet	**1 1 Feet Feet**
3.3 square meters	**3 • 3 Conv mm mm**
3 cubic feet	**3 Feet Feet Feet**

ENTERING CONVERSIONS

Linear Conversions

Convert 10 feet 6 inches to other dimensions, including metric:

KEYSTROKE	DISPLAY
① ⓪ Feet ⑥ Inch	**10 FEET 6 INCH**
Conv Feet *	**10.5 FEET**
Conv Inch *	**126. INCH**
mm *(mm)*	**3200.4 MM**
Conv mm *(m)*	**3.200 M**

*Repeated presses of Feet or Inch will toggle between feet-inch-fractions and decimal feet or inches.

Volume Conversions

Enter 8.5 gallons and convert to liters:

KEYSTROKE	DISPLAY
On/C On/C	**0.**
⑧ • ⑤ Conv ⑧	**GAL 8.5**
Conv ⑨	**LITR 32.176**

Weight/Volume Conversions

Convert 20 pounds to kilograms:

KEYSTROKE	DISPLAY
On/C On/C	**0.**
② ⓪ Conv ⑦ *(Pounds)*	**20 LB**
Conv / *(Kilograms)*	**9.071847 KG**

Convert 5 cubic feet of water to pounds. Then convert the pounds to kilograms:

KEYSTROKE	DISPLAY
On/C *On/C*	**0.**
5 *Feet* *Feet* *Feet*	**5 CU FEET**
Conv 7 *(Pounds)*	**312.1398 LB**
Conv */* *(Kilograms)*	**141.5842 KG**

Convert a cubic meter of concrete to pounds. The concrete weighs 111 lbs per cubic foot.

KEYSTROKE	DISPLAY
On/C *On/C*	**0.**
1 1 1 **Stor** **+** *(Wt/Vol)*	**111. LB PER CU FEET**
1 **Conv** *mm* *mm* *mm*	**1 CU M**
Conv 7 *(Pounds)*	**3919.928 LB**
Conv **X*****	**ALL CLEArEd**

*Restores default weight conversion to the weight of water (62.42796 lbs Per Cubic Foot).

Temperature Conversions

Enter a temperature value, then **Conv** followed by 6 or 3 for Fahrenheit or Celsius, respectively.

Convert 78 °F to a °C temperature:

KEYSTROKE	DISPLAY
On/C *On/C*	**0.**
7 8 **Conv** 6 *(°F)*	**78 ºF**
Conv 3 *(°C)*	**25.55556 ºC**

Convert 11 °C to a °F temperature:

KEYSTROKE	DISPLAY
On/C *On/C*	**0.**
1 1 **Conv** 3 *(°C)*	**11 ºC**
Conv 6 *(°F)*	**51.8 ºF**

Flow Rate Conversions

You can enter a Flow value in cubic feet per second, liters per second, cubic feet per minute, or gallons per minute, then convert to other units.

Enter 47 cfs, then convert to other units:

KEYSTROKE	DISPLAY
On/C *On/C*	**0.**
④ ⑦ **Conv** ⑤ *(cfs)*	**CFS 47**
Conv ② *(l/s)*	**L/S 1330.892**
Conv ④ *(cfm)*	**CFM 2820.**
Conv ① *(gpm)*	**GPM 21095.07**

BASIC MATH OPERATIONS

Adding and Subtracting Strings of Dimensions

Add the following measurements:
- 6 feet 2-1/2 inches
- 11 feet 5-1/4 inches
- 18.25 inches

Then subtract 2-1/8 Inches.

KEYSTROKE	DISPLAY
⑥ *Feet* ② *Inch* ① **/** ② ➕	
① ① *Feet* ⑤ *Inch* ① **/** ④ ➕	
① ⑧ • ② ⑤ *Inch* ➖	**19 FEET 2 INCH**
➖ ② *Inch* ① **/** ⑧ ➖	**18 FEET 11-7/8 INCH**

Multiplying Dimensions

Multiply 5 feet 3 inches by 11 feet 6-1/2 inches:

KEYSTROKE	DISPLAY
⑤ *Feet* ③ *Inch* ✖ ① ① *Feet*	
⑥ *Inch* ① **/** ② ➖	**60.59375 SQ FEET**

Dividing Dimensions

Divide 30 feet 4 inches by 7 inches:

KEYSTROKE	DISPLAY
③ ⓪ *Feet* ④ *Inch* ➗ ⑦ *Inch* ➖	**52.**

Divide 20 feet 3 inches by 9:

KEYSTROKE	DISPLAY
② ⓪ *Feet* ③ *Inch* ➗ ⑨ ➖	**2 FEET 3 INCH**

PERCENTAGE CALCULATIONS

The **Conv** **⬅** keys can be used for finding a given percent of a number or for working add-on, discount or division percentage calculations. It can be used with any type of number, in any dimension (feet, inch, millimeter, etc.) and any type of convention (non-dimensioned, linear, square or cubic).

Calculating Percentages

Find 18% of 500 feet:

KEYSTROKE	DISPLAY
On/C **On/C**	**0.**
5 **0** **0** *Feet* **✕** **1** **8**	
Conv **⬅**	**90 FEET 0 INCH**

Take 20% from 286 Feet 6 inches:

KEYSTROKE	DISPLAY
On/C **On/C**	**0.**
2 **8** **6** *Feet* **6** *Inch* **➖** **2** **0**	
Conv **⬅**	**229 FEET 2-3/8 INCH**

Add a 10% waste allowance to 275 feet of pipe:

KEYSTROKE	DISPLAY
On/C **On/C**	**0.**
2 **7** **5** *Feet* **➕** **1** **0** **Conv** **⬅**	**302 FEET 6 INCH**

MEMORY OPERATION

Whenever the **M+** key is pressed, the displayed value will be added to the Memory. Other memory functions:

FUNCTION	KEYSTROKE
Add to Memory	**M+**
Subtract from Memory	**Conv** **M+**
Recall total in Memory	**Rcl** **M+**
Display/Clear Memory	**Rcl** **Rcl**
Clear Memory	**Conv** **Rcl**

Memory is semi-permanent, clearing only when you:
   1) turn off the calculator;
   2) press **Rcl** **Rcl**;
   3) press **Conv** **Rcl**;
   4) press **Conv** **X** (Clear All).

When Memory is recalled (**Rcl** **M+**), consecutive presses of **M+** will display the calculated average and total count of the accumulated values.

Using M+

KEYSTROKE	DISPLAY
3 **5** **5** **M+**	**M+ 355.** Ⓜ
2 **5** **5** **M+**	**M+ 255.** Ⓜ
7 **4** **5** **Conv** **M+** *(M-)*	**M- 745.** Ⓜ
Rcl **M+**	**TTL – 135.** Ⓜ
M+	**AVG – 45.** Ⓜ
M+	**CNT 3.** Ⓜ
Rcl **Rcl**	**M+ – 135.**

Using Memory Storage Keys (M1 - M9)

In addition to the standard cumulative Memory (as previously described), your calculator has nine independent Storage Registers – M1 through M9 – that can be used to permanently store single, noncumulative values. The following example shows the use of M1 (**Stor** **1**). To use M2 - M9, replace the presses of the **1** key with presses of the corresponding number key (**2** - **9**).

You can replace a value in one of these Memory registers by storing a new value in place of the stored value.

FUNCTION	KEYSTROKE
Store single value in M1	**Stor** **1**
Clear M1	**0** **Stor** **1**
Recall M1	**Rcl** **1**

Example: Store 175 into M1, recall the value, and then clear the value:

KEYSTROKE	DISPLAY
1 **7** **5** **Stor** **1**	**M-1 175.**
Off **On/C**	**0.**
Rcl **1**	**M-1 175.**
0 **Stor** **1**	**M-1 0.**

PAPERLESS TAPE

The Paperless Tape allows you to display and review the last 30 entries of a calculation. **Conv** **⊟** accesses the tape mode and **⊞** or **⊟** scrolls forward or backward through the entries. *Note: The Paperless Tape is cleared each time* **On/C** *is pressed twice, the unit is shut off, or an All Clear (* **Conv** **✕** *) is performed.*

Paperless Tape Function — Normal Mathematics

1. Enter a string of numbers:

KEYSTROKE	DISPLAY
On/C **On/C**	**0.**
4 **Feet** **⊞**	**4 FEET 0 INCH**
5 **Feet** **⊞**	**9 FEET 0 INCH**
6 **Feet** **⊞**	**15 FEET 0 INCH**
7 **Feet** **⊟**	**22 FEET 0 INCH**

2. Access the Tape function:

Conv **⊟**	**TTL= 22 FEET 0 INCH**

3. Scroll from first value and total:

⊞	**01 4 FEET 0 INCH**
⊞	**02+ 5 FEET 0 INCH**
⊞	**03+ 6 FEET 0 INCH**
⊞	**04+ 7 FEET 0 INCH**
⊞	**TTL= 22 FEET 0 INCH**

4. Scroll to last two values:

⊟	**04+ 7 FEET 0 INCH**
⊟	**03+ 6 FEET 0 INCH**

5. Exit Tape function and continue:

⊟*	**TTL= 22 FEET 0 INCH**
⊞	**22 FEET 0 INCH**
2 **Feet** **⊟**	**24 FEET 0 INCH**

Displays total before exiting*.**

CALCULATE COSTS

The Cost function provides the total cost for material, based on a stored unit cost and an entered quantity of material. This is convenient for quickly calculating costs on a job that requires many of the same kind of items.

Example: You are doing an installation that includes 120 feet of pipe that comes in 10' lengths at $3.21 per 10' pipe.

KEYSTROKE	DISPLAY
Store the unit cost of the pipes needed:	
On/C *On/C*	**0.**
(3) (•) (2) (1) *Stor* (0)	**COST PER 3.21**
Enter the number required:	
(1) (2)	**12**
Calculate total cost:	
Conv (0) *(Cost)*	**TTL$ 38.[52]**

You can then quickly calculate costs for a different number of the same item.

KEYSTROKE	DISPLAY
On/C *On/C*	**0.**
(1) (7)	**17**
Conv (0) *(Cost)*	**TTL$ 54.[57]**

You can also find costs of different items on the fly without overwriting your stored unit cost.

Determine the cost of 17 fittings at $2.89 each:

KEYSTROKE	DISPLAY
Enter number of pipes needed:	
On/C *On/C*	**0.**
(1) (7)	**17**
Multiply by the cost:	
(✕) (2) (•) (8) (9)	**2.89**
Conv (0) *(Cost)*	**TTL$ 49.[13]**

Pipe Material Key

The Pipe Material key lets you choose a pipe material, which defines the available sizes and surface roughness used by the calculator. See Appendix A on page 53 for more information. The default material for the Pipe Trades Pro is Steel, but the user can choose from material types as shown.

KEYSTROKE	DISPLAY
On/C *On/C*	**0.**
Pipe Mat'l (Steel)	**MATL StEEL**
Pipe Mat'l (Stainless Steel)	**MATL S.StEEL**
Pipe Mat'l (Brass)	**MATL brASS**
Pipe Mat'l (Aluminum)	**MATL AL.**
Pipe Mat'l (Cast Iron)	**MATL CASt**
Pipe Mat'l (Plastic)	**MATL PLAStIC**
Pipe Mat'l (Copper)	**MATL COPPEr**

The last material setting displayed is selected, and the calculator will retain your setting even after the power has been turned off. Once a material is selected, you can easily toggle through the available types (Schedules, etc.) using the Pipe Type function (**Conv** *Pipe Size*). Available types of pipe are dependent upon the material setting.

Keystrokes below show the pipe types available for Plastic (press *Pipe Mat'l* until "PLAStIC" is shown in the display).

KEYSTROKE	DISPLAY
On/C *On/C*	**0.**
Rcl *Pipe Mat'l*	**MATL PLAStIC**
Conv *Pipe Size* (Schedule 40)	**TYPE 40 PLAStIC**

(cont'd)

KEYSTROKE	DISPLAY
🔳 *(Schedule 80)*	**TYPE 80 PLAStIC**
🔳 *(Schedule 120)*	**TYPE 120 PLAStIC**
🔳 *(SDR 21)*	**TYPE SD21 PLAStIC**
🔳 *(SDR 26)*	**TYPE SD26 PLAStIC**
🔳 *(SDR 32.5)*	**TYPE SD32 PLAStIC**
🔳 *(SDR 41)*	**TYPE SD41 PLAStIC**

You can also directly enter a Pipe Type, e.g., Schedule 80, by entering a number corresponding to the pipe type.

KEYSTROKE	DISPLAY
On/C On/C	**0.**
🔳	**MATL PLAStIC**
8 0 Conv 🔳	**TYPE 80 PLAStIC**

Pipe Size Key

When you have chosen a Pipe Material and Type and then enter Pipe Size, the pipe data will be displayed.

For this example we are using 3″ Steel, Schedule 80 pipe.

KEYSTROKE	DISPLAY
Conv ✕	**0.**

1. Choose the Pipe Material:
🔳	**MATL StEEL**

2. Enter the Pipe Type:
8 0 Conv 🔳	**TYPE 80 StEEL**

3. Enter the Pipe Size:
3 Inch	**3 INCH**

4. Toggle through the Pipe data:
🔳	**80 SIZE 3 INCH**
🔳 *(Outside Diameter)*	**OD SIZE 3.5 INCH**
🔳 *(Internal Diameter)*	**ID SIZE 2.9 INCH**
🔳 *(Wall Thickness)*	**THK SIZE 0.3 INCH**

[Pipe Size] *(Material)* MATL SIZE StEEL
[Pipe Size] *(Weight per Foot)* PIPE SIZE 10.2528 LB PER FEET
[Pipe Size] *(Filled Weight/Foot)* FILL SIZE 13.11634 LB PER FEET
[Pipe Size] *(Internal Area)* AREA SIZE 6.605199 SQ INCH

WARNING: If you are using 12" Schedule 40 pipe, the Wall Thickness and Weight outputs of the Pipe Size function are incorrect for the materials below. The error understates the LB/FEET Pipe Size outputs. This table has the corrected 12" Schedule 40 pipe data.

Material (12" SCHED 40)	Wall Thickness	LB/FEET	Filled LB/FEET
Steel	.406 INCH	53.5246	150.5755
Brass	.406 INCH	59.9475	156.9985
Aluminum	.406 INCH	18.7336	115.7845
Cast Iron	.406 INCH	48.7074	145.7583

Elbow Type

The Elbow Type function lets you chose between long or short radius, and between factory and field cut 45º Butt Weld (B.W.) elbow types. The default value is for long radius, factory cut 45º B.W. elbow type.

The Elbow option setting has an impact on the Take-Out calculations as the radii vary between long and short Butt Weld fittings. Additionally, factory made 45º B.W. elbow fittings can have a different Take-Out calculation from the field cut variants.

This function toggles the Elbow types between the following options:

Butt Weld – Long

Default. Use this option when utilizing 90° long radius or factory 45° long radius B.W. elbow fittings, or any odd-angle long radius fitting cut from a 90° B.W. elbow.

(cont'd)

Butt Weld – Short

Use this option when utilizing 90° short radius or factory 45° short radius fittings, or any odd-angle short radius fitting cut in the field from a 90° B.W. elbow.

Field Cut – Long

Use this option when utilizing long radius B.W. elbows, or any odd-angle long radius fitting cut from a 90° B.W. elbow, including a 45° B.W.

Field Cut – Short

Use this option when utilizing short radius B.W. elbows, or any odd-angle short radius fitting cut from a 90° B.W. elbow, including a 45° B.W.

KEYSTROKE	DISPLAY
Conv Pipe Mat'l *(Default)*	**BW-L EL. tYPE**
Pipe Mat'l	**BW-S EL. tYPE**
Pipe Mat'l	**FC-L EL. tYPE**
Pipe Mat'l	**FC-S EL. tYPE**
Pipe Mat'l *(Default)*	**BW-L EL. tYPE**

Simple Offset – Known Bend Angle

Find the center-to-center travel for a pipe offset with a 24" Offset using 45° factory made long radius butt weld elbows.

45º SIMPLE OFFSET · Travel · 24˝ Offset
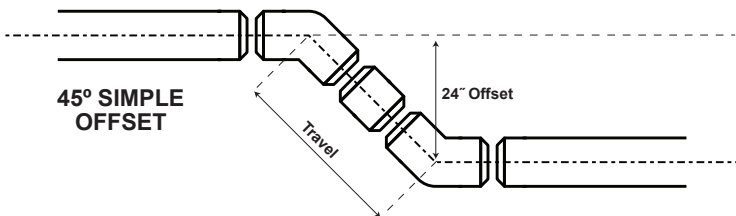
KEYSTROKE	DISPLAY

On/C *On/C*   **0.**

1. Enter Offset:
2 *4* *Inch* *Offset*   **OFST 24 INCH**

2. Enter bend angle:
4 *5* *Angle/Slope*   **∠Ø 45.00°**
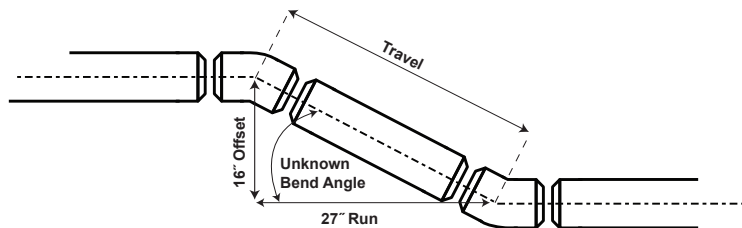
3. Find the pipe length:
Travel   **TRAV 33-15/16 INCH**

Simple Offset – Unknown Bend Angle

Find the center-to-center travel and unknown bend angle for a
pipe offset with a 16" Offset and 27" Run.

KEYSTROKE	DISPLAY

On/C *On/C*   **0.**

1. Enter Offset:
1 *6* *Inch* *Offset*   **OFST 16 INCH**

2. Enter Run:
2 *7* *Inch* *Run*   **RUN 27 INCH**

3. Find the pipe length:
Travel   **TRAV 31-3/8 INCH**

4. Find the bend angle:
Angle/Slope   **∠Ø 30.65°**

Continue pressing the Travel key to view all related values.

Simple Offset – Cut Length

Find the cut length (end-to-end) for a pipe offset with a 10"
Offset and a 12" Run. The bend angle is unknown. This example
assumes 6" Steel, factory made long radius butt weld elbows are
used. The following example shows an optional override of the
Welder's Gap when working with Stainless Steel.

Note: *All Take-Out calculations are based on Carbon Steel
O.D. See the **Cut Length – Known Take-Out Value** example
to solve Cut Lengths for known Take-Out values.*
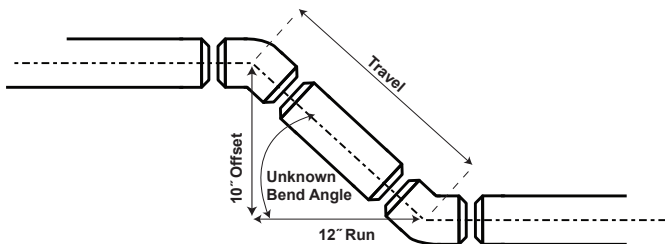
KEYSTROKE	DISPLAY
Conv **✕**	**ALL CLEArEd**
1. Select Stainless Steel:	
Pipe Mat'l Pipe Mat'l	**MATL S.StEEL**
2. Enter Pipe Size:	
6 Inch Pipe Size	**40 SIZE 6 INCH**
3. Enter 0 for Welder's Gap:	
0 Conv Offset	**GAP 0 INCH**
4. Enter Offset:	
1 **0** Inch Offset	**OFST 10 INCH**
5. Enter Run:	
1 **2** Inch Run	**RUN 12 INCH**
6. Find the pipe length:	
Travel	**TRAV 15-5/8 INCH**
Travel	**CUT 9-1/8 INCH**

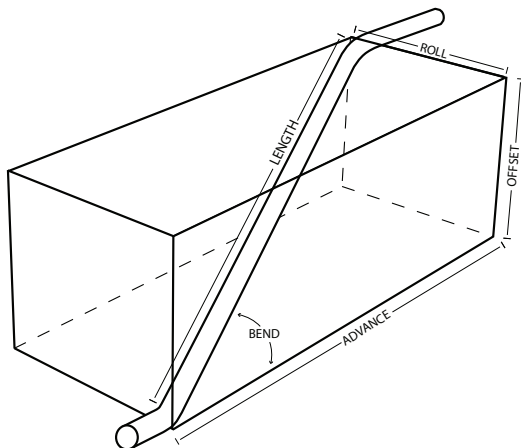| KEYSTROKE	DISPLAY
Travel	**TO 3-1/4 INCH**
Travel	**GAP 0 INCH**
Travel	**FIT° 39.81°**
Travel	**IARC 3-15/16 INCH**
Travel	**CARC 6-1/4 INCH**
Travel	**OARC 8-9/16 INCH**

The cut length for the pipe is 9 and 1/8 inches and bend angle is 39.81°. Included in the outputs are the arc lengths to be used to cut your butt weld elbow to the calculated bend angle. These are inner arc length of 3 and 15/16 inches, center arc length of 6 and 1/4 inches, and outer arc length of 8 and 9/16 inches.

Note: *To return the Welder's Gap to the default 1/8", press* Conv X *to reset your calculator back to default values.*

Rolling Offset – Known Bend Angle

Find the center-to-center travel for a rolling pipe offset with a 4" Roll and a 24" Offset using 45° factory-made long radius butt weld elbows.

Conv X	**ALL CLEArEd**

1. Enter Offset:

2 4 Inch Offset	**OFST 24 INCH**

2. Enter bend angle:

4 5 Angle/Slope	**∠Ø 45.00º**

3. Enter the Roll and calculate the pipe length:

4 Inch Conv Travel	**LNTH 34-7/16 INCH**

Continue pressing the Travel key to view all related values.

Rolling Offset – Unknown Bend Angle

Find the center-to-center travel for a rolling pipe offset with a 6 1/2" Roll, a 17" Offset, and an advance of 28". The bend angle is unknown. This example assumes factory made long radius butt weld elbows will be used to create degreed fittings.
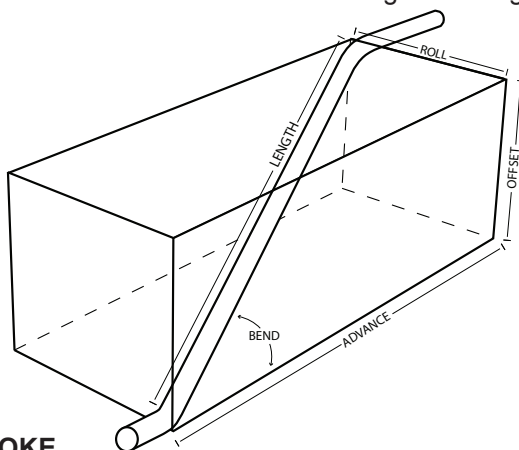
KEYSTROKE	DISPLAY

Conv X	**ALL CLEArEd**

1. Enter Offset:

1 7 Inch Offset	**OFST 17 INCH**

2. Enter the advance:

(2)(8) Inch Run *(Advance)*   **RUN 28 INCH**

3. Enter the Roll and calculate the pipe length and unknown
   bend angle:

(6) Inch (1) (/) (2) Conv Travel   **LNTH 33-3/8 INCH**
Travel   **FIT° 33.02°**

Continue pressing the Travel key to view all related values.

Rolling Offset – Cut Length

Find the end-to-end pipe length for a rolling pipe offset with a
13" Roll, a 24" Offset, and an advance of 32". The bend angle
is unknown. This example assumes 6" Steel, factory made long
radius butt weld elbows are used with a Welder's Gap of 3/32".
Note: the default Welder's Gap is 1/8".

Note: *All Take-Out calculations are based on Carbon Steel*
O.D. See the **Cut Length – Known Take-Out Value** *example*
to solve Cut Lengths for known Take-Out values.
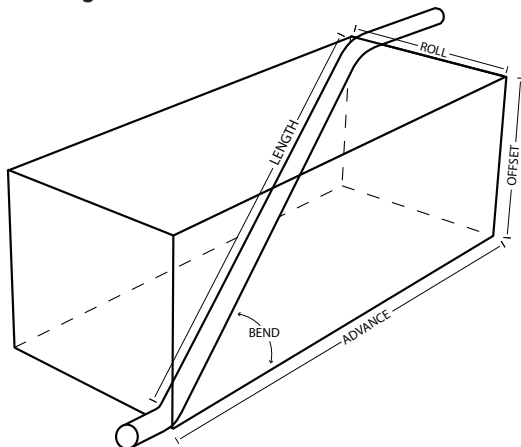
(cont'd)

KEYSTROKE	DISPLAY

Conv X   **ALL CLEArEd**

1. Enter Pipe Size:
6 Inch Pipe Size   **STD SIZE 6 INCH**

2. Change the default Welder's Gap from 1/8" to 3/32":
3 / 3 2 Conv Offset*   **GAP 0-3/32 INCH**

3. Enter Offset:
2 4 Inch Offset   **OFST 24 INCH**

4. Enter the advance:
3 2 Inch Run *(Advance)*   **RUN 32 INCH**

5. Enter the Roll and calculate the pipe length and unknown bend angle:

|	
1 3 Inch Conv Travel *(Roll)*	**LNTH 42-1/16 INCH**
Travel	**CUT 35-1/4 INCH**
Travel	**TO 3-5/16 INCH**
Travel	**GAP 0-3/32 INCH**
Travel	**FIT° 40.46°**
Travel	**IARC 4-1/32 INCH**
Travel	**CARC 6-11/32 INCH**
Travel	**OARC 8-11/16 INCH**

*Note: *Setting welder's gap to 3/32 inch will temporarily set the outputs to 1/32 fractional resolution. To keep outputs in their current fractional resolution (default is 1/16) press* **On/C** *once after entering the welder's gap. For example, if you keep the fractional resolution at 1/16, the outputs above for IARC would be 4 inches, and CARC would be 6-3/8 inches.*

The cut length for the pipe is 35 and 1/4 inches and bend angle is 40.46°. Included in the outputs are the arc lengths to be used to cut your butt weld elbow to the calculated bend angle. These are inner arc length of 4 and 1/32 inches, center arc length of 6 and 11/32 inches, and outer arc length of 8 and 11/16 inches.

Concentric Pipe Bend Cutback

Find the pipe Cutback when you are running pipes through a 45º bend with a 10" offset.
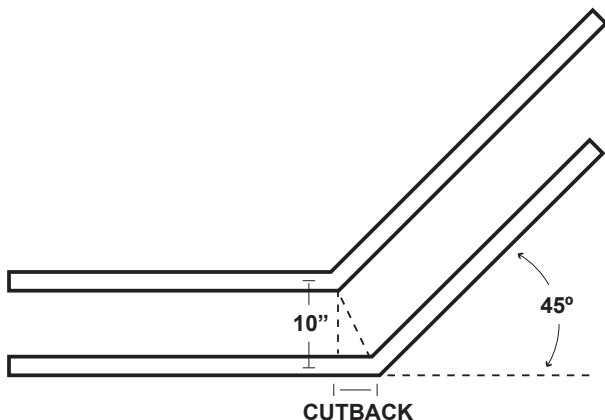
KEYSTROKE	DISPLAY
On/C *On/C*	**0.**
1. Enter the bend angle:	
4 **5** *Angle/Slope*	**∠Ø 45.00 º**
2. Enter the Offset:	
1 **0** *Inch* *Offset*	**OFST 10 INCH**
3. Calculate the Cutback:	
Conv *Run*	**CUT 4-1/8 INCH**

Calculate Take-Out and Butt Weld Elbow Cut Marks

The Take-Out function can be used to quickly solve a Take-Out and butt weld elbow cut marks for a known bend angle and Pipe Size.

Find the arc lengths for an odd bend angle of 37° for 12" pipe.

Note: *All Take-Out calculations are based on Standard type steel pipes. O.D. See the **Cut Length – Known Take-Out Value** example to solve Cut Lengths for known Take-Out values.*
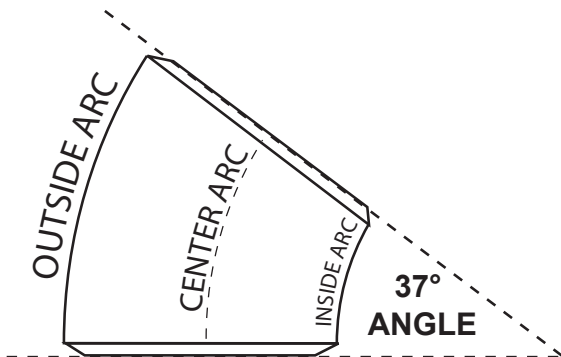
KEYSTROKE	DISPLAY
Conv **X**	**ALL CLEArEd**

1. Enter the Pipe Size:

① ② **Inch** **Pipe Size**	**STD SIZE 12 INCH**

2. Enter the known bend angle:

③ ⑦ **Angle/ Slope**	**∠Ø 37.00°**

3. Calculate the Take-Out and Arc Lengths:

Conv **Angle/ Slope**	**TO 6 INCH**
Angle/ Slope	**IARC 7-1/2 INCH**
Angle/ Slope	**CARC 11-5/8 INCH**
Angle/ Slope	**OARC 15-3/4 INCH**

*Continue pressing the **Angle/Slope** key to view all related values.*

Cut Length – Known Take-Out Value

The Pipe Trades Pro can solve cut lengths for materials and fittings not currently built into the calculator by entering a known Take-Out value.

Find the cut length (end-to-end) for a pipe offset with a 10" Offset and bend angle of 45°. This example assumes 4" Type 40 PVC, with a known Take-Out value of 2 and 3/16 inches.

Note: *Override the Welder's Gap for this example.*

KEYSTROKE	DISPLAY
On/C **On/C**	**0.**
1. Select PVC:	
Pipe Mat1 *(press until **PLAStIC** id displayed)*	**PLAStIC**
2. Enter Pipe Size:	
4 **Inch** **Pipe Size**	**40 SIZE 4 INCH**
3. Enter Offset:	
1 **0** **Inch** **Offset**	**OFST 10 INCH**
4. Enter bend angle:	
4 **5** **Angle/Slope**	**∠Ø 45.00°**
5. Enter known Take-Out:	
2 **Inch** **3** **/** **1** **6** **Conv** **Angle/Slope**	**TO 2-3/16 INCH**
6. Enter 0 for Welder's Gap:	
0 **Conv** **Offset**	**GAP 0 INCH**
7. Find the pipe cut length:	
Travel	**TRAV 14-1/8 INCH**
Travel	**CUT 9-3/4 INCH**
Travel	**TO 2-3/16 INCH**

*Continue pressing the **Travel** key to view all related values.*

The cut length for the Type 40 PVC pipe is 9 and 3/4 inches when using 4", 45° fittings with a user-defined Take-Out value of 2 and 3/16 inches.

Note: *To return the Welder's Gap to the default 1/8", press* **Conv** **X** *to reset your calculator back to default values.*

Combination Rolling Offset

Unlike a regular rolling offset, the entry and exit fittings for a combination rolling offset are on different planes and therefore have different fitting angles from each other.

Horizontal to Vertical

Find the pipe length, and entry and exit fitting angles for a combination rolling offset with a vertical pipe exit, given a Roll of 23", Offset of 15", and Advance of 29". Use the box in Diagram 1 to review the entry and exit pipe perspectives.

0' - 23"
Roll

0' - 15"
Offset

0' -29"
ADVANCE

Unknown
Entry Fitting
Angle

Diagram 1
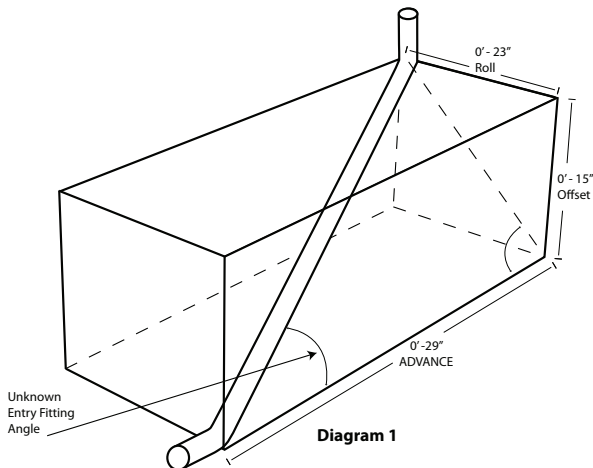
KEYSTROKE	DISPLAY
Conv ✕	**ALL CLEArEd**

1. Solve for the pipe length and entry fitting angle

1 5 *Inch* *Offset*	**OFST 15 INCH**
2 9 *Inch* *Run* (Advance)	**RUN 29 INCH**
2 3 *Inch* **Conv** *Travel* (Roll)	**LNTH 39-15/16 INCH**
Travel	**FIT° 43.44°**

Do not clear or reset the calculator.

If the box is oriented in a 2-dimensional perspective (Diagram 2),

a triangle is formed which will allow for an easy solution of the exit fitting angle in step 2.
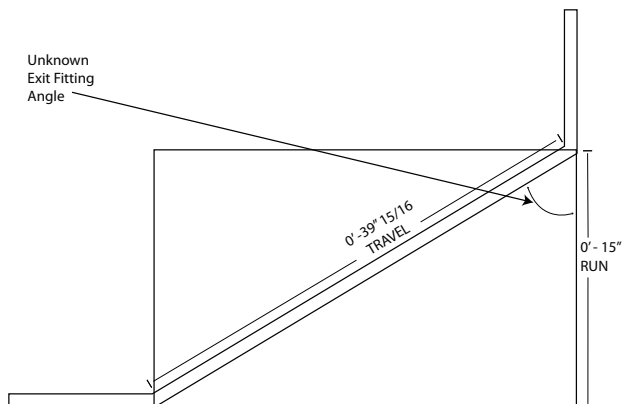

Unknown Exit Fitting Angle

0' - 39" 15/16 TRAVEL

0' - 15" RUN

Diagram 2

2. Next, use the Pipe Trades Pro's built-in right-angle functions to solve the triangle in Diagram 2 and calculate the exit fitting angle. Use the pipe length from step 1 as your Travel.

KEYSTROKE	**DISPLAY**
On/C *Conv* *Travel* *Travel* ▬	**39-15/16 INCH**
Travel	**TRAV 39-15/16 INCH**
1 5 *Inch* *Run*	**RUN 15 INCH**
Angle/Slope	**∠Ø 67.94°**

The entry fitting angle (lower pipe fitting in Diagram 1) is 43.44° and the exit fitting angle (upper pipe fitting in Diagram 2) is 67.94°.

Horizontal to Horizontal

In the next example, the same box dimensions are used except the exit fitting now creates a pipe exit horizontally instead of vertically. The entry fitting angle of 43.44° and pipe length of 39 and 15/16 inches remain the same since the dimensions in this example are the same (if they were different, steps 1 and 2 on the previous pages could be repeated to calculate them).

However, by re-orienting the box dimensions to show the Advance on the same plane as the horizontal exit fitting (Diagram 3), the exit fitting angle can easily be solved using the Rolling Offset feature.

Diagram 3
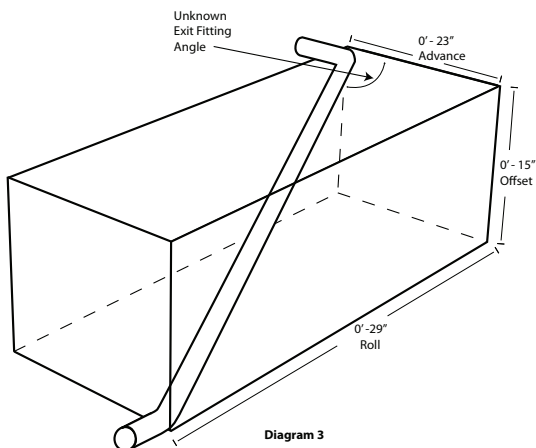
KEYSTROKE	**DISPLAY**

On/C *On/C*   **0.**

3. Calculate the exit fitting angle.

1 5 Inch Offset   **OFST 15 INCH**
2 3 Inch Run (Advance)   **RUN 23 INCH**
2 9 Inch Conv Travel (Roll)   **LNTH 39-15/16 INCH**
Travel   **FIT° 54.84°**

The entry fitting angle is still 43.44°. However, the exit fitting angle is calculated to be 54.84°.

Calculating Drop

If a pipe Run requires 1/8" drop per foot for drainage, how much total drop is required for a 25' Run?

KEYSTROKE	DISPLAY
On/C *On/C*	**0.**

1. Enter the Slope (Drop):
1 **/** **8** *Angle/Slope*   **SLP 0-1/8 INCH**

2. Calculate the total drop (Offset):
2 **5** *Feet* *Run* *Offset*   **OFST 0 FEET 3-1/8 INCH**

Find the slope of a pipe Run if it drops 6 inches over 50 feet. What is its Angle and Percent Grade?

KEYSTROKE	DISPLAY
On/C *On/C*	**0.**

1. Enter the Run:
5 **0** *Feet* *Run*   **RUN 50 FEET 0 INCH**

2. Enter the Offset:
6 *Inch* *Offset*   **OFST 6 INCH**

3. Calculate the Slope, Angle and Percent Grade:
Angle/Slope   **SLP 0-1/8 INCH**
Angle/Slope   **∠Ø 0.57º**
Angle/Slope   **% GRD 1.**
Angle/Slope   **GRD 0.01**

Calculating Flow Rate

If you know the Area and Velocity, you can calculate the Flow Rate. For this example, the velocity is 5 feet per second, and the Area is 1.8 square inches.

(cont'd)

KEYSTROKE	**DISPLAY**

| Conv X | **ALL CLEArEd** |

1. Enter the Velocity:

| 5 Conv) *(Velocity)* | **FPS 5.** |

2. Enter the Area:

| 1 • 8 Inch Inch Conv √x *(Area)* | **AREA 1.8 SQ INCH** |

3. Calculate Flow Rate (default is Gallons per Minute):

| Conv (*(Flow)* | **GPM 28.05195** |

4. Convert to different units of flow rates:

(*(Cubic Feet per Minute)*	**CFM 3.75**
(*(Cubic Feet per Second)*	**CFS 0.0625**
(*(Liters per Second)*	**L/S 1.769803**
(*(Cubic Meters per Second)*	**M3/S 0.00177**
(*(Gallons per Minute)*	**GPM 28.05195**

If you clear the display, you can recall the last Flow Rate shown.

KEYSTROKE	**DISPLAY**

| On/C | **0.** |
| Rcl Conv (| **GPM 28.05195** |

If you clear the calculator, you will only recall the last unit shown.

KEYSTROKE	**DISPLAY**

| On/C On/C | **0.** |
| Rcl Conv (| **GPM 0.** |

If you know the Flow Rate, you can convert to other dimensional units.

KEYSTROKE	**DISPLAY**

| Conv X | **ALL CLEArEd** |
| 5 Conv 1 *(Gallons per Minute)* | **GPM 5** |

(cont'd)

KEYSTROKE	DISPLAY
Conv **4** *(Cubic Feet per Minute)*	**CFM 0.668403**
Conv **5** *(Cubic Feet per Second)*	**CFS 0.01114**
Conv **2** *(Liters per Second)*	**L/S 0.315451**

Velocity

You can enter a known Velocity, calculate Velocity and convert between different units of Velocity.

If you know the Flow and Area, you can calculate Velocity and then convert to other Velocity units. The default is feet per second (FPS). For this example, we know that the Flow is 5 gallons per minute, and the Area is 1.8 square inches.

KEYSTROKE	DISPLAY
Conv **X**	**ALL CLEARED**
1. Enter the Flow:	
5 **Conv** **(** *(Flow)*	**GPM 5.**
2. Enter the Area:	
1 **•** **8** **Inch** **Inch** **Conv** **√x** *(Area)*	**AREA 1.8 SQ INCH**
3. Calculate Velocity:	
Conv **)** *(feet per second)*	**FPS 0.891204**
) *(feet per minute)*	**FPM 53.47222**
) *(meters per second)*	**M/S 0.271639**

If you clear the display, you can recall the last velocity shown.

KEYSTROKE	DISPLAY
On/C	**0.**
Rcl **Conv** **)**	**M/S 0.271639**

If you clear the calculator, you will only recall the last unit shown.

KEYSTROKE	DISPLAY

On/C **On/C**	**0.**
Rcl **Conv** **)**	**M/S 0.**

If you know the velocity, you can convert to other dimensional units.

KEYSTROKE	DISPLAY

Conv **X**	**ALL CLEArEd**
5 **Conv** **)** *(Velocity)*	**FPS 5.**
= **Conv** **)** *(feet per second)*	**FPS 5.**
) *(feet per minute)*	**FPM 300.**
) *(meters per second)*	**M/S 1.524**

Pressure Loss

If you know Flow/Velocity, Pipe Size and Length, you can calculate Pressure Loss. If no Run (Length) is entered, Pressure Loss per foot is calculated. For this example we will use the default Material, Steel. Calculate for 2" Pipe with a Flow Rate of 4 gallons per minute and then convert to different dimensional units.

KEYSTROKE	DISPLAY

Conv **X**	**ALL CLEArEd**

1. Enter the Pipe Size:

2 *Inch* *Pipe Size*	**STD SIZE 2 INCH**

2. Find the Area:

Conv **√x** *(Area)*	**AREA 3.355605 SQ INCH**

3. Enter the Flow Rate:

4 **Conv** **(**	**GPM 4.**

4. Calculate Pressure Loss:

Conv *Circle*	**PSI PER FEET 0.000205**
Circle	**REY 6120.09**
Circle	**PSF PER FEET 0.029469**

(cont'd)

(cont'd)

KEYSTROKE	DISPLAY
Circle	**inHG PER FEET 0.000417**
Circle	**HEAD PER FEET 0.000472**
Circle	**BAR PER FEET 0.000014**
Circle	**KPA PER FEET 0.001411**
Circle	**PSI PER FEET 0.000205**

Using values above, add the Run (Length) to calculate the Pressure Loss over the length of the pipe.

KEYSTROKE	DISPLAY
5 0 Feet Run	**RUN 50 FEET 0 INCH**

Calculate Pressure Loss

Conv Circle	**PSI 0.010232**
Circle	**REY 6120.09**
Circle	**PSF 1.47346**
Circle	**inHG 0.020833**
Circle	**HEAD 0.023603**
Circle	**BAR 0.000705**
Circle	**KPA 0.07055**
Circle	**PSI 0.010232**

You can also change the Flow Rate and recalculate the Pressure Loss.

KEYSTROKE	DISPLAY
4 0 Conv (	**GPM 40.**
Conv Circle	**PSI 0.575408**
Circle	**REY 61200.9**
Circle	**PSF 82.85877**
Circle	**inHG 1.171543**
Circle	**HEAD 1.32727**
Circle	**BAR 0.039673**
Circle	**KPA 3.9673**
Circle	**PSI 0.575408**

Pressure/Force

If you know the Force and Area, you can calculate Pressure and convert the solution to different units of Pressure. For this example the Force is 100 lbf and the Area is 2 square inches.

KEYSTROKE	DISPLAY
Conv X	**ALL CLEArEd**
1. Enter the Force:	
1 0 0 Conv x^2 *(Force)*	**LBF 100.**
2. Enter the Area:	
2 Inch Inch Conv $\sqrt{x}$ *(Area)*	**AREA 2. SQ INCH**
3. Calculate Pressure:	
Conv Circle	**PSI 50.**
Circle	**PSF 7200.**
Circle	**inHG 101.801**
Circle	**HEAD 115.3329**
Circle	**BAR 3.447379**
Circle	**KPA 344.7379**
Circle	**PSI 50.**

Area

If you know the Force and Pressure, you can calculate Area. For this example the Force is 85 lbf and the Pressure is 15 psi.

KEYSTROKE	DISPLAY
Conv X	**ALL CLEArEd**
1. Enter the Force:	
8 5 Conv x^2 *(Force)*	**LBF 85.**
2. Enter the Pressure:	
1 5 Conv Circle *(Pressure)*	**PSI 15.**
3. Calculate the Area:	
Conv $\sqrt{x}$ *(Area)*	**AREA 5.666667 SQ INCH**

Pipe Capacity

How many gallons of water will a 20' long 6" pipe hold?

KEYSTROKE	DISPLAY
On/C *On/C*	**0.**

1. Enter the Pipe Size:
6 *Inch* *Pipe Size* — **STD SIZE 6 INCH**

2. Find the Area:
Conv *√x* — **AREA 28.89026 SQ INCH**

3. Multiply by the Pipe length:
✕ *2* *0* *Feet* *=* — **4.012536 CU FEET**

4. Find the Pipe capacity:
Conv *8* — **GAL 30.01586**

Weight of Filled Pipe

Find the weight of a 10 foot length of 6 inch Type 5 stainless steel pipe filled with water:

KEYSTROKE	DISPLAY
On/C *On/C*	**0.**

1. Choose the Pipe Material:
Pipe Mat'l *Pipe Mat'l* — **MATL S.StEEL**

2. Choose the Pipe Type:
5 *Conv* *Pipe Size* — **TYPE 5 S.StEEL**

3. Choose the Pipe Size:
6 *Inch* *Pipe Size* — **5 SIZE 6 INCH**

4. Find the weight of one foot of water-filled pipe:
Pipe Size (6 times) — **FILL SIZE 21.71418 LB PER FEET**

5. Find the weight of the filled 10' length of pipe:
✕ *1* *0* *=* — **217.1418 LB**

(cont'd)

(cont'd)

Find the weight of the same length of pipe filled with ethanol (one gallon of ethanol weighs 6.59 lbs.) Do not clear previous keystrokes.

KEYSTROKE   **DISPLAY**

1. Enter the weight of one gallon of ethanol:
(6)(•)(5)(9) Stor (+)(+)(+)   **LB/G 6.59**

2. Find weight of one foot of ethanol-filled pipe:
Pipe Size (7 times)   **FILL SIZE 18.77419 LB PER FEET**

3. Find the weight of the filled 10' length of pipe:
(X)(1)(0)(=)   **187.7419 LB**
Conv (X)   **ALL CLEARed**
(Restores default weight conversion to the weight of water—62.42796 lbs per cubic foot.)

Force

Given Pressure and Area, you can calculate Force and convert between newtons and pound-force. For this example the Pressure is 100 PSI and the Area is 2 square inches.

KEYSTROKE   **DISPLAY**

Conv (X)   **ALL CLEARed**

1. Enter Pressure and Area
(1)(0)(0) Conv Circle   **PSI 100.**
(2) Inch Inch Conv $\sqrt{x}$ **AREA 2. SQ INCH**

2. Calculate Force
Conv x^2   **LBF 200.**
x^2   **NEWT 889.6443**

Circle Area and Circumference

Find the area and circumference of a circle with a diameter of 25 Inches:

KEYSTROKE	DISPLAY
On/C *On/C*	**0.**
2 *5* *Inch* *Circle*	**DIA 25 INCH**
Circle	**AREA 490.8739 SQ INCH**
Circle	**CIRC 78-9/16 INCH**

Basic D:M:S and Trigonometry Examples

Converting Degrees:Minutes:Seconds

Convert 23° 42' 39" to decimal degrees:

KEYSTROKE	DISPLAY
On/C *On/C*	**0.**
2 *3* *•* *4* *2* *•* *3* *9*	**DMS 23.42.39**
Conv *•* *(dms◄►deg)*	**23.71°**

Convert 44.29° to degrees:minutes:seconds format:

KEYSTROKE	DISPLAY
On/C *On/C*	**0.**
4 *4* *•* *2* *9* *Conv* *•* *(dms◄►deg)*	**DMS 44.17.24**

Note: Improperly formatted entries will be redisplayed in the correct convention after any operator key is pressed. For example, 30° 89' entered will be corrected and displayed at 31° 29' 0" or 31.48°.

Trigonometric Functions

Trigonometric functions are available on the Pipe Trades Pro calculator.

The drawing and formulas below list basic trigonometric formulas, for your reference:

(cont'd)

(cont'd)

a = 53.1301°
b = 36.8699°

A = 3'
C = 5'
B = 4'
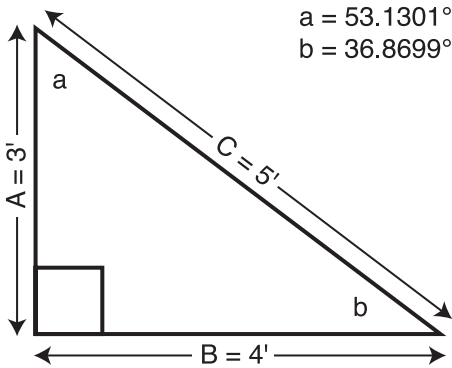
Given side A and angle a, find:
Side C   A ➗ a **Cos** ▤
(e.g., **3** **Feet** ➗ **5** **3** **•** **1** **3** **Cos** ▤)
Side B   A ✖ a **Tan** ▤
Angle b   90° ▬ a ▤

Given side A and angle b, find:
Side B   A ➗ b **Tan** ▤
Side C   A ➗ b **Sine** ▤
Angle a   90° ▬ b ▤

Given side B and angle a, find:
Side A   B ➗ a **Tan** ▤
Side C   B ➗ a **Sine** ▤

Given side C and angle a, find:
Side A   C ✖ a **Cos** ▤
Side B   C ✖ a **Sine** ▤

Given side A and side C, find:
Angle a   A ➗ C ▤ **Conv** **Cos**
Angle b   A ➗ C ▤ **Conv** **Sine**

Given side B and angle b, find:
Side C   B ➗ b **Cos** ▤
Side A   B ✖ b **Tan** ▤

APPENDIX A – Pipe Material, Pipe Type And Data Tables

After selecting a Pipe material, you can select Pipe Types for that material and get data for each type, including Outside Diameter, Internal Diameter, Wall Thickness, Pipe Weight per Foot, Filled Weight per Foot, and Internal Area.

Internal Diameter ←T→ **External Diameter**

T = Wall Thickness

= Internal Area
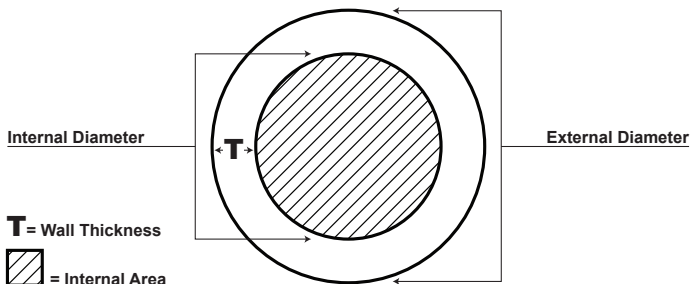
PIPE MATERIALS
Plastic, Copper, Steel, Stainless Steel, Brass, Aluminum and Cast Iron. The default is Steel. The calculator will recall the last material used. After a Clear All or Factory Reset, the default is displayed first.

PIPE TYPES FOR EACH MATERIAL

Stainless Steel
Schedules: 40-S, 80-S, 160, 5-S, 10-S

Plastic
Schedules: 40, 80, 120; SDR 21, SDR 26, SDR 32.5, SDR 41

Copper
Type L, Type K, Type M, Type DWV, Medical Type L, Medical Type K, ACR-Annealed, ACR-Drawn

Steel, Brass, Aluminum, Cast Iron
Schedules: Std, 40, 60; XS, 80, 100, 120, 140, 160; XSS, 10, 20, 30

APPENDIX B – Default Settings

After a Clear All (**Conv** ✖), your calculator will return to the following settings:

Stored Values	Default Value
Material	Steel
Pipe Type	Standard
Elbow Type	Long Radius Butt Weld
Weight to Volume	62.42796 pounds per cubic foot
Welder's Gap	1/8 inch

If you replace your batteries or perform a Full Reset* (press **Off**, hold down ✖, and press **On/C**), your calculator will return to the following settings (in addition to those listed above):

Preference Settings	Default Value
Fractional Resolution	1/16
Area Display	Standard
Volume Display	Standard
Meter Linear Display	0.000
Decimal Degree Display	0.00°
Fractional Mode	Standard
Mathematical Operations	Order of Operations Method

*Depressing the Reset button located above the **Angle/ Slope** *key will also perform a Full Reset.*

APPENDIX C – **Preference Settings**

The Pipe Trades Pro has Preference Settings that allow you to customize or set desired dimensional formats and calculations. If you replace your batteries or perform a Full Reset* (press **Off** hold down **X**, and press **On/C**), your calculator will return to the following settings (in addition to those listed on the previous page):

*Depressing the Reset button located above the 🔘 will also perform a Full Reset. Asterisks below indicate default values.

Preference	Options
1) Fractional Resolution	– ***1/16** (displays fractional values to the nearest 16th of an Inch) – **1/32** – **1/64** – **1/2** – **1/4** – **1/8**
2) Area Display Format	– ***Standard** (if units entered are the same—e.g., Feet x Feet—the answer will remain in this format (Square Feet), but if units entered are different — e.g., Inches x Feet—area answer will be displayed in Square Feet) – **Square Feet** (area answers always displayed in Square Feet, regardless of unit entry — e.g., Inches x Inches = Square Feet) – **Square Inches** (area answers always displayed in Square Inches — e.g., Feet x Feet = Square Inches) – **Square Meters** (area answers always displayed in Square Meters — e.g., Feet x Feet = Square Meters)

(cont'd)

(cont'd)

3) Volume Display Format – ***Standard** (if units entered are the same — e.g., Feet x Feet x Feet — the answer will remain in this format (cu. ft), but if units entered are different — e.g., Feet x Feet x Inches — vol. answer will always be displayed in Cubic Feet)

– **Cubic Feet** (vol. answers always displayed in Cubic Feet, regardless of unit entry — e.g., Inches x Inches x Inches = Cubic Feet)
– **Cubic Meters** (vol. answers always displayed in Cubic Meters, regardless of unit entry — e.g., Feet x Feet x Feet = Cubic Meters)

4) Meter Linear Display – ***0.000** (linear Meter answers are always displayed to third decimal place)
– **FLOAt** (linear Meter answers are displayed to the maximum number of decimal places — e.g., 1.2345 M + 2.56 M = 3.7945 M)

5) Decimal Degree Display – ***0.00°**
– **FLOAt**

6) Fractional Mode – ***Standard** (fractions are displayed to the nearest fraction)
– **Constant** (fractions are displayed in the set fractional resolution)

Note: To check the current Fractional Resolution, press **Rcl** **/** *. Either "Std" (standard fractional resolution) or "Cnst" (constant) will be displayed, along with the fractional resolution).*

7) Mathematical Operation – ***Order** (the calculator uses the Order of Operation Method (10 + 4 x 5 = 30)

– **Chain** (the calculator uses the Chaining Method of Operations (as entered: 10 + 4 x 5 = 70)

APPENDIX D – Constants

For material surface roughness, we use the following:

Material	Roughness Factor e (x 10^{-6} ft)
PVC	15.6
Copper	4.9
Steel (low carbon)	221
Stainless Steel (austenitic)	49.2
Brass	4.9
Aluminum	4.9
Cast Iron	850

For water properties:
  Viscosity = 0.001 Pascal-seconds
  Density = 1000 kg/m³

Depending upon flow type and Reynolds Number value, we use one of the following methods for computing Pressure Loss:

1) Laminar Flow method (if Reynolds Number < 3,000)

2) Smooth Pipe method (if Reynolds Number > 3,000 and Boundary Layer Thickness < Pipe Roughness)

3) Prandtl equation method (if Reynolds Number < 100,000 and Pipe Roughness > Boundary Layer Thickness)

4) Karman Equation method (all other conditions)

APPENDIX E – Care Instructions

Please follow the guidelines listed in this section for proper care and operation of your calculator. Not following the instructions listed below may result in damage not covered by your warranty. Refer to the Repair and Return section on page 62 for more details.

Do not expose calculator to temperatures outside the operating temperature range of 32ºF – 104ºF (0ºC – 40ºC).

Do not expose calculator to high moisture such as submersion in water, heavy rain, etc.

Accuracy/Errors

Accuracy/Display Capacity — Your calculator has a twelve-digit display made up of eight digits (normal display) and four fractional digits. You may enter or calculate values up to 19,999,999.99. Each calculation is carried out internally to twelve digits.

Errors — When an incorrect entry is made, or the answer is beyond the range of the calculator, it will display the word "**ERROR**." To clear an error condition you must hit the `On/C` button once. At this point you must determine what caused the error and re-key the problem.

Error Codes

DISPLAY	ERROR TYPE
OFLO	Overflow *(too large)*
MATH Error	Divide by 0
DIM Error	Dimension error
ENT Error	Invalid entry error

Auto-Range — If an "overflow" is created because of an input and calculation with small units that are out of the standard seven-digit range of the display, the answer will be automatically expressed in the next larger units (instead of showing "**ERROR**") — e.g., 20,000,000 mm is shown as 20,000 m. Also applies to inches and feet.

Auto Shut-Off

Your calculator is designed to shut itself off after about 8-12 minutes of non-use.

Batteries

The Pipe Trades Pro uses two LR-44 batteries.

Replacing Batteries

Should your calculator display become very dim or erratic, replace the batteries.

Note: Please use caution when disposing of your old batteries, as they contain hazardous chemicals.

Replacement batteries are available at most discount or electronics stores. You may also call Calculated Industries at **1-775-885-4900**.

Battery Replacement Instructions

To replace the batteries, slide open the battery door (at top backside of unit) and replace with new batteries. Make sure the batteries are facing positive side up.

Reset

If your calculator should ever "lock up", insert the tip of a paperclip into the small Reset hole located above the [Angle/Slope] key – to perform a total reset.

Area Formulas

a

Square
Area = a^2

a
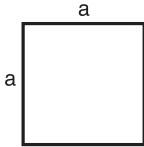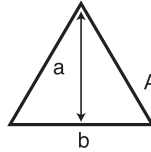
Triangle
Area = 1/2 a b

a

b

w

l
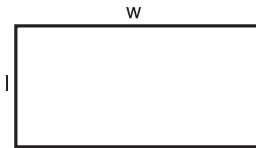
Rectangle
Area = l w

Octagon
Area = (d/2)^2 x 2.828

d
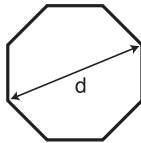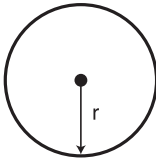
Circle
Circumference = 2πr
Area = πr^2

r

Ellipse
Area = πab

b

a
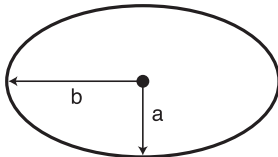
Surface Area/Volume Formulas
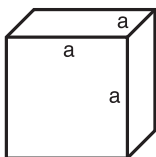
Cube
Surface Area = $6a^2$
Volume = a^3
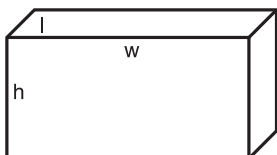
Rectangle
Surface Area =
$2hw + 2hl + 2lw$
Volume = l x w x h
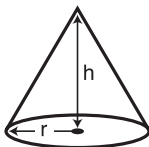
Cone
Surface Area = $\pi r \sqrt{r^2 + h^2}$
$(+ \pi r^2$ if you add the base)

Volume = $\dfrac{\pi r^2 h}{3}$
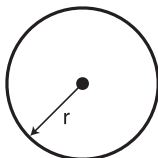
Sphere
Surface Area = $4\pi r^2$
Volume = $4/3\pi r^3$
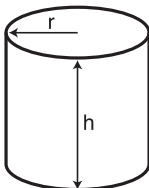
Cylinder
Surface Area = $2\pi r h + 2\pi r^2$
Volume = $\pi r^2 h$

WARRANTY, REPAIR AND RETURN INFORMATION

Return Guidelines

1. Please read the ***Warranty*** in this User's Guide to determine if your Calculated Industries product remains under warranty **before** calling or returning any device for evaluation or repairs.

2. If your product won't turn on, check the batteries as outlined in the User's Guide.

3. If you need more assistance, please go to the website listed below.

4. If you believe you need to return your product, please call a Calculated Industries representative between the hours of 7:00am to 4:30pm Pacific Time for additional information and a Return Merchandise Authorization (RMA).

Call Toll Free: 1-800-854-8075

Outside USA: 1-775-885-4900

www.calculated.com/warranty

Warranty

Warranty Repair Service – U.S.A.

Calculated Industries ("CI") warrants this product against defects in materials and workmanship for a period of **one (1) year from the date of original consumer purchase in the U.S.** If a defect exists during the warranty period, CI at its option will either repair (using new or remanufactured parts) or replace (with a new or remanufactured calculator) the product at no charge.

THE WARRANTY **WILL NOT APPLY** TO THE PRODUCT IF IT HAS BEEN DAMAGED BY MISUSE, ALTERATION, ACCIDENT, IMPROPER HANDLING OR OPERATION, OR IF UNAUTHORIZED REPAIRS ARE ATTEMPTED OR MADE. SOME EXAMPLES OF DAMAGES NOT COVERED BY WARRANTY INCLUDE, BUT ARE NOT LIMITED TO, BATTERY LEAKAGE, BENDING, A BLACK "INK SPOT" OR VISIBLE CRACKING OF THE LCD, WHICH ARE PRESUMED TO BE DAMAGES RESULTING FROM MISUSE OR ABUSE.

To obtain warranty service in the U.S., please go to the website.

A repaired or replacement product assumes the remaining warranty of the original product or 90 days, whichever is longer.

Non-Warranty Repair Service – U.S.A.

Non-warranty repair covers service beyond the warranty period, or service requested due to damage resulting from misuse or abuse. Contact Calculated Industries at the number listed above to obtain current product repair information and charges. Repairs are guaranteed for 90 days.

Repair Service – Outside the U.S.A.

To obtain warranty or non-warranty repair service for goods purchased outside the U.S., contact the dealer through which you initially purchased the product. If you cannot reasonably have the product repaired in your area, you may contact CI to obtain current product repair information and charges, including freight and duties.

Disclaimer

CI MAKES NO WARRANTY OR REPRESENTATION, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THE PRODUCT'S QUALITY, PERFORMANCE, MERCHANTABILITY, OR FITNESS

FOR A PARTICULAR PURPOSE. AS A RESULT, THIS PRODUCT, INCLUDING BUT NOT LIMITED TO, KEYSTROKE PROCEDURES, MATHEMATICAL ACCURACY AND PREPROGRAMMED MATERIAL, IS SOLD "AS IS," AND YOU THE PURCHASER ASSUME THE ENTIRE RISK AS TO ITS QUALITY AND PERFORMANCE.

IN NO EVENT WILL CI BE LIABLE FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECT IN THE PRODUCT OR ITS DOCUMENTATION.

The warranty, disclaimer, and remedies set forth above are exclusive and replace all others, oral or written, expressed or implied. No CI dealer, agent, or employee is authorized to make any modification, extension, or addition to this warranty.

Some states do not allow the exclusion or limitation of implied warranties or liability for incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific rights, and you may also have other rights, which vary from state to state.

FCC Class B

This equipment has been certified to comply with the limits for a Class B calculating device, pursuant to Subpart J of Part 15 of FCC rules.

Legal Notes

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Looking For New Ideas

Calculated Industries, a leading manufacturer of special-function calculators and digital measuring instruments, is always looking for new product ideas in these areas.

If you have a new product idea, please visit our "Bright Idea" page at www.calculated.com/brightidea.asp. For suggestions about improving this product or other products, please visit us at www.calculated.com under "Contact Us". Thank You.