USER'S GUIDE

PLUMBINGCALC™ PRO

Flow & Dimensional Math Calculator

Model 4094

CALCULATED INDUSTRIES®

FAST. ACCURATE. RELIABLE.

Designing and building new calculators like the Pipe Trades Pro™ Advanced Pipe Trades Math Calculator and the PlumbingCalc™ Pro Flow & Dimensional Math Calculator could not have been done without the support of pipefitting and plumbing professionals. Calculated Industries gratefully acknowledges the many individuals and organizations who were so generous with their time and expertise.

- *United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada*
    - *David Kendrick, Secretary-Business Manager, Greater Kansas City Building and Construction Trades Council, AFL-CIO*
    - *Sprinkler Fitters Local 314*
    - *Plumber & Gas Fitters Local 8*
    - *Pipe Fitters Local 533*
- *Neil M. McCain, McCain Institutes*
- *Pete Nicacio, Training Coordinator, Plumbers & Steamfitters 598*
- *John Williams, Plumbing Technology Instructor, Kirkwood Community College*
- *Pipe Fitters Local 350*

PLUMBINGCALC™ PRO

The PlumbingCalc Pro Flow & Dimensional Math Calculator has been specifically designed for today's plumbing professionals. Calculate Volumetric Flow Rates, Pressure, Force and Area. Select Pipe Material and Type, then enter Pipe Size and instantly display O.D., I.D., wall thickness, internal area, and weight per foot. Get all these calculations and more on the jobsite or in the office.

- *Built-in data and Pipe Sizing for 7 different Pipe Materials*
- *Calculate Volumetric Flow Rate*
- *Calculate Pressure and Convert to different Pressure formats*
- *Enter or compute Force and convert between lbf and newtons*
- *Compute Area given values of Force and Pressure*
- *Linear Offsets*
- *Feet-Inch-Fractions, Metric Dimensional Problems and Conversions*
- *Problems Involving All Architectural Fractions — 1/2-1/64ths And more!*

TABLE OF CONTENTS

GETTING STARTED

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.

KEY DEFINITIONS

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	Identifies/Converts to gallons per minute (gpm)
Conv 2	Identifies/Converts to liters per second (l/s)
Conv 4	Identifies/Converts to cubic feet per minute (cfm)
Conv 5	Identifies/Converts to cubic feet per second (cfs)
Conv 3	Identifies/Converts to ºC
Conv 6	Identifies/Converts to ºF
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.
m	***Meters –*** Enters or converts to meters.
Conv m	***Millimeters –*** Enters or converts to millimeters.
Conv 8	***Gallons –*** Enters or converts to gallons.
Conv 9	***Liters –*** Enters or converts to liters.

Plumbing Project Keys

Angle/ Slope	Enters or calculates a slope ratio or slope angle.
Conv Angle/ Slope	***(%Grade) –*** Used to enter or solve Percent Grade. Calculates Percent Grade based on entered Offset

and Run or Slope.

Offset	Enters, calculates or stores the Offset (Rise).
Run	Enters or calculates the Run.
Travel	Enters or calculates the Travel (Diagonal). Used to calculate pipe length.
Pipe Mat'l	Defines the pipe material used for various pipe sizes used in Pressure Loss calculations.
Pipe Size	Defines the nominal Pipe Size being used.
Conv Pipe Size	Defines the Pipe Type based on Pipe Material.
Flow	Enter or calculate volumetric Flow Rate through a Pipe.
Conv Flow	***(Velocity) –*** Enter or calculate Velocity and convert between feet per second, feet per minute and meters per second.
Pressure	Enter value for Force/Area calculations. Calculate Pressure Loss. Convert between units of pressure.
Force	Calculate Force and convert between lbf, newton.
Area	Enter for Flow, Velocity, Pressure, Force calculations. Calculate Area given values for Flow/ Velocity or Force/Area. If a Pipe Size has been selected, Area will match Inside Dimension for pipe of the current material and type.

Miscellaneous Functions

Conv +	Displays value of π (3.141593).
Conv −	(+/–) Toggle displayed value between minus and plus value.
Conv ×	***Clear All –*** Returns all stored values to the default settings. (Does not affect Preference settings.)
Conv ÷	Square root function

Conv / Squares the value in the display.

Conv ← Percent function

Conv 0 Cost function

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).

Stor 1-9 Used to store values in Memory registers 1-9.

PREFERENCE SETTINGS

Press Conv, then Stor to access the Preferences menu. Continue pressing Stor to toggle through different Preferences. Press + or − keys to toggle between options of the different Preferences. Press On/C to exit Preferences. Your calculator will keep Preference settings until a Full Reset alters your settings to the default values.

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

➕ (repeats options)	**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 CHA1n**
➕ (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	KEYSTROKES
5 feet	5 Feet
5 feet, 1 ½ inches	5 Feet 1 Inch 1 / 2
17.5 meters	1 7 • 5 m
1250 millimeters	1 2 5 0 Conv m

Square and Cubic Dimensions

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

DIMENSIONS	KEYSTROKES
14 square inches	1 4 Inch Inch
11 square feet	1 1 Feet Feet
3.3 square meters	3 • 3 m m
3 cubic feet	3 Feet Feet Feet

ENTERING CONVERSIONS

Linear Conversions

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

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

*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.

KEYSTROKES	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

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.

KEYSTROKES	DISPLAY
On/C On/C	0.
7 8 Conv 6 (°F)	78 °F

Conv 3 (°C)	**25.55556 °C**

Convert 11 °C to a °F temperature.

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

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.*

KEYSTROKES	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.

KEYSTROKES	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:

KEYSTROKES	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:

KEYSTROKES	DISPLAY
3 0 Feet 4 Inch ÷ 7 Inch =	52.

Divide 20 feet 3 inches by 9:

KEYSTROKES	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:

KEYSTROKES	DISPLAY
On/C On/C	0.
5 0 0 Feet × 1 8 Conv ←	90 FEET 0 INCH

Take 20% from 286 Feet 6 inches:

KEYSTROKES	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:

KEYSTROKES	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	KEYSTROKES
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 × (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+

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

KEYSTROKES	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:

KEYSTROKES	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.*

KEYSTROKES	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.

KEYSTROKES	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:

KEYSTROKES	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**

USING THE PLUMBINGCALC PRO

Note: *The PlumbingCalc Pro's built-in right-angle functions, including Offset, Run, and Travel, are designed to calculate centerline lengths only and do not account for take outs or welder's gaps.*

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. The default material for the PlumbingCalc Pro is Plastic, but you can choose from material types as shown.

KEYSTROKES	DISPLAY
On/C On/C	0.
Pipe Mat'l (Plastic)	MATL PLASTIC
Pipe Mat'l (Copper)	MATL COPPER
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

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).

KEYSTROKES	DISPLAY
On/C On/C	0.
Rcl Pipe Mat'l	MATL PLASTIC
Conv Pipe Size (Schedule 40)	Type 40 PLASTIC
Pipe Size (Schedule 80)	Type 80 PLASTIC

Pipe Size (Schedule 120)	**Type 120 PLASTIC**
Pipe Size (SDR 21)	**Type SD21 PLASTIC**
Pipe Size (SDR 26)	**Type SD26 PLASTIC**
Pipe Size (SDR 32.5)	**Type SD32 PLASTIC**
Pipe Size (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.

KEYSTROKES	DISPLAY
On/C On/C	**0.**
Pipe Matl	**MATL PLASTIC**
8 0 Conv Pipe Size	**80 Type PLASTIC**

Pipe Size Key

Pipe sizes are entered with the Pipe Size key. There is a list of valid pipe sizes for each Pipe Material in the Appendix. When you have chosen a Pipe Material and Type and then enter Pipe Size, the following data will be displayed.

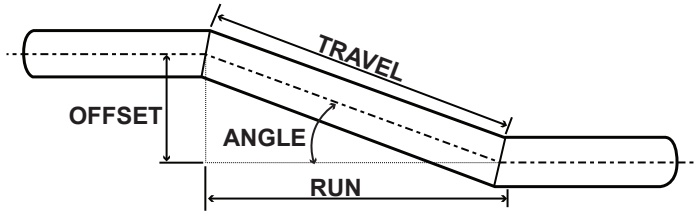
For this example we are using 3" Plastic, Schedule 80 pipe.

KEYSTROKES	DISPLAY
On/C On/C	**0.**
1. Choose the Pipe Material:	
Pipe Matl	**MATL PLASTIC**
2. Enter the Pipe Type:	
8 0 Conv Pipe Size	**Type 80 PLASTIC**
3. Enter the Pipe Size:	
3 Inch Pipe Size	**80 - SIZE 3 INCH**
4. Toggle through the Pipe data:	
Pipe Size (Outside Diameter)	**OD SIZE 3.5 INCH**
Pipe Size (Internal Diameter)	**ID SIZE 2.9 INCH**
Pipe Size (Wall Thickness)	**THK SIZE 0.3 INCH**
Pipe Size (Material)	**MATL SIZE PLASTIC**

Pipe Size (Weight per Foot) **PIPE SIZE 2.019802 LB Per FEET**
Pipe Size (Filled Weight/Foot) **FILL SIZE 4.883337 LB Per FEET**
Pipe Size (Internal Area) **AREA SIZE 6.605199 SQ INCH**

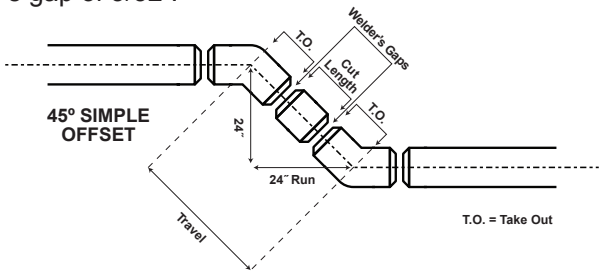
Angle, Offset, Run and Travel

Find the length (Travel) of a pipe over a Run of 45’ 6” with an Offset of 23’ 8”.



KEYSTROKES	DISPLAY
On/C On/C	0.
1. Enter the Offset:	
2 3 Feet 8 Inch Offset	OFST 23 FEET 8 INCH
2. Enter the Run:	
4 5 Feet 6 Inch Run	RUN 45 FEET 6 INCH
3. Find the Travel:	
Travel	TRAV 51 FEET 3 - 7/16 INCH

Find the cut length for a pipe that has a 24” Run and 45° simple offset. Example assumes a 6” 45° butt weld elbow and a welder’s gap of 3/32”.



KEYSTROKE	DISPLAY
On/C On/C	0.
1. Enter Run:	
2 4 Inch Run	RUN 24 INCH
2. Enter bend angle:	
4 5 Angle/ Slope	/0 45.00°
3. Find the Travel:	
Travel	33 15/16 INCH
4. Subtract 2 times the elbow take out (2 x 3 ¾") from the calculated centerline Travel:	
− 2 × 3 Inch 3 / 4 =	26 7/16 INCH
5. Subtract 2 times the welder's gap (2 x 3/32"):	
− 2 × 3 / 3 2 =	26 1/4 INCH

Calculating Pipe Drop (Offset)

Find the slope of a Pipe Run if it drops 6 Inches over 50 Feet. What is its Angle and Percent Grade?

KEYSTROKES	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 Percent Grade, Slope and Angle:	
Conv Angle/ Slope	% GRD 1.
Angle/ Slope	GRD 0.01
Angle/ Slope	SLP 0 - 1/8 INCH
Angle/ Slope	<Ø 0.57°

If a Pipe Run requires 1/8” Drop (Slope) per foot for drainage, how much total drop is required for a 25’ Run?

KEYSTROKES	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

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.

KEYSTROKES	DISPLAY
Conv ⊠	ALL CLEARED
1. Enter the Velocity:	
5 Conv Flow	FPS 5
2. Enter the Area:	
1 • 8 Inch Inch Area	AREA 1.8 SQ INCH
Calculate Flow Rate (default is Gallons per Minute):	
Flow *(Gallons per Minute)*	GPM 28.05195
Flow *(Cubic Feet per Minute)*	CFM 3.75
Flow *(Cubic Feet per Second)*	CFS 0.0625
Flow *(Liters per Second)*	L/S 1.769803
Flow *(Cubic Meters per Second)*	M3/S 0.00177

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

KEYSTROKES	DISPLAY
On/C	0.
Rcl Flow	M3/S 0.00177

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

KEYSTROKES	DISPLAY
On/C On/C	0.
Rcl Flow	M3/S 0.

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

KEYSTROKES	DISPLAY
Conv ⊠	ALL CLEARED
5 Conv 1 *(Gallons per Minute)*	GPM 5
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.

KEYSTROKES	DISPLAY
Conv ⊠	ALL CLEARED
1. Enter the Flow:	
5 Flow	GPM 5
2. Enter the Area:	
1 • 8 Inch Inch Area	AREA 1.8 SQ INCH
3. Calculate Velocity and convert to other units:	
Conv Flow *(Feet per Second)*	FPS 0.891204
Flow *(Feet per Minute)*	FPM 53.47222
Flow *(Meters per Second)*	M/S 0.271639

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

KEYSTROKES	DISPLAY
On/C	0.
Rcl Conv Flow	M/S 0.271639

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

KEYSTROKES	DISPLAY
On/C On/C	0.
Rcl Conv Flow	M/S 0.

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

KEYSTROKES	DISPLAY
Conv ⊠	ALL CLEARED
1. Enter the Velocity:	
5 Conv Flow	FPS 5.
2. Convert to other Units:	
= Conv Flow *(Feet per Second)*	FPS 5.
Flow *(Feet per Minute)*	FPM 300.
Flow *(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, Plastic. Calculate for 2” Pipe with a Flow rate of 4 gallons per minute and then convert to different dimensional units.

KEYSTROKES	DISPLAY
Conv ⊠	ALL CLEARED
1. Enter Pipe Size:	
2 Inch Pipe Size	40 SIZE 2 INCH
2. Enter the Area:	
Area	AREA 3.355605 SQ INCH

3. Enter Flow Rate:

4 Flow	**GPM 4.**

Calculate Pressure Loss and toggle through units:

Pressure	**PSI PER FEET 0.000205**
Pressure	**REY 6120.09**
Pressure	**PSF PER FEET 0.029469**
Pressure	**inHG PER FEET 0.000417**
Pressure	**HEAD PER FEET 0.000472**
Pressure	**BAR PER FEET 0.000014**
Pressure	**KPA PER FEET 0.001411**
Pressure	**PSI PER FEET 0.000205**

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

KEYSTROKES	DISPLAY
5 0 Feet Run	**RUN 50 FEET 0 INCH**
Calculate Pressure Loss	
Pressure	**PSI 0.010232**
Pressure	**REY 6120.09**
Pressure	**PSF 1.47346**
Pressure	**inHG 0.020833**
Pressure	**HEAD 0.023603**
Pressure	**BAR 0.000705**
Pressure	**KPA 0.07055**
Pressure	**PSI 0.010232**

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

KEYSTROKES	DISPLAY
4 0 Flow	**GPM 40.**
Pressure	**PSI 0.575408**
Pressure	**REY 61200.9**
Pressure	**PSF 82.85877**
Pressure	**inHG 1.171543**
Pressure	**HEAD 1.32727**
Pressure	**BAR 0.039673**

Pressure	**KPA 3.9673**
Pressure	**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.

KEYSTROKES	DISPLAY
Conv ⊠	**ALL CLEARED**
1. Enter Force and Area:	
1 0 0 Force	**LBF 100.**
2. Enter the Area:	
2 Inch Inch Area	**AREA 2 SQ INCH**
3. Calculate Pressure:	
Pressure	**PSI 50.**
Pressure	**PSF 7200.**
Pressure	**inHG 101.801**
Pressure	**HEAD 115.3329**
Pressure	**BAR 3.447379**
Pressure	**KPA 344.7379**
Pressure	**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.

KEYSTROKES	DISPLAY
Conv ⊠	**ALL CLEARED**
1. Enter the Force:	
8 5 Force	**LBF 85.**
2. Enter thePressure:	
1 5 Pressure	**PSI 15.**

3. Find the Area:

Area — **AREA 5.666667 SQ INCH**

Pipe Capacity

How many gallons of water will a 20' long 6" Type 40 Plastic pipe hold?

KEYSTROKE	DISPLAY
On/C On/C	**0.**
1. Enter the Pipe Size:	
6 Inch Pipe Size	**40 SIZE 6 INCH**
2. Find the Area:	
Area	**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' length of 3 inch Type 40 plastic pipe filled with water.

KEYSTROKE	DISPLAY
On/C On/C	**0.**
1. Choose the Pipe Material:	
Pipe Mat'l	**MATL PLASTIC**
2. Choose the Pipe Type:	
Conv Pipe Size (Pipe Type)	**TYPE 40 PLASTIC**
3. Choose the Pipe Size:	
3 Inch Pipe Size	**40 SIZE 3 INCH**
4. Find the weight of one foot of water-filled pipe:	
Pipe Size **(6 times)**	**FILL SIZE 4.697352 LB Per FEET**

5. Find the weight of the filled 10' length of pipe:

[×] [1] [0] [−] **46.97352 LB**

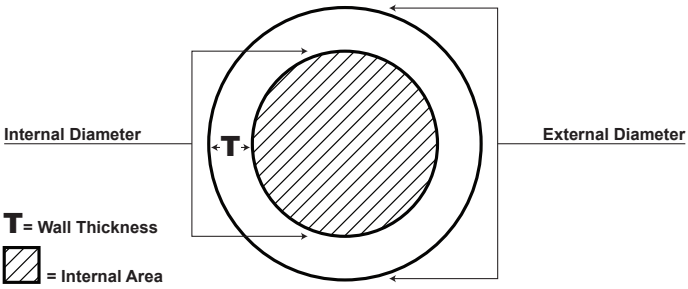
Force

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.

KEYSTROKES	DISPLAY
[Conv] [×]	**ALL CLEARED**
1. Enter Pressure and Area	
[1] [0] [0] [Pressure]	**PSI 100.**
2. Enter Area:	
[2] [Inch] [Inch] [Area]	**AREA 2. SQ INCH**
3. Calculate Force, convert between units:	
[Force]	**LBF 200.**
[Force]	**NEWT 889.6443**

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.



PIPE MATERIALS

Plastic, Copper, Steel, Stainless Steel, Brass, Aluminum and Cast Iron. The default is Plastic. 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	Plastic
Pipe Type	40

If you replace your batteries or perform a Full Reset* (press [Off], hold down ⊠, and press On/C Off, 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°
Standard or Constant Fractional Resolution	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 PlumbingCalc 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 ⊠, 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 Angle/Slope 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)
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)

HOW TO SET PREFERENCES

The following sections detail Preference Setting options for the PlumbingCalc 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 + to 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.

KEYSTROKES	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**
Second press of **Stor**:	
(Area displays)	**AREA Std.**
➕	**AREA 0. SQ FEET**
➕	**AREA 0. SQ INCH**
➕	**AREA 0. SQ M**
➕ (repeats options)	**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 CHA1n**
➕ (repeats options)	**MATH OrdEr**

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 39 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.

APPENDIX F –
Accuracy/Errors, Auto Shut-Off, Batteries, Reset

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 PlumbingCalc 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 battery, as it contains 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

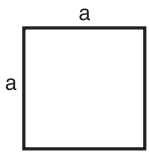
To replace the batteries, slide open the battery door (at top backside of unit) and replace with new batteries. Make sure the batteries are facing positive side up.

RESET

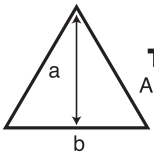
If your calculator should ever “lock up”, insert the tip of a paperclip into the small Reset hole located above the Angle/Slope key – to perform a total reset.

APPENDIX G – Formulas

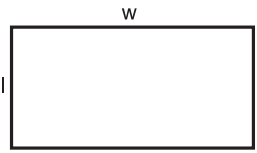
AREA FORMULAS



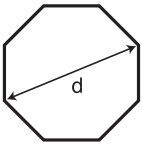
Square
Area = a^2



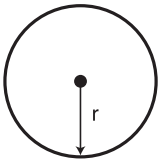
Triangle
Area = 1/2 ab



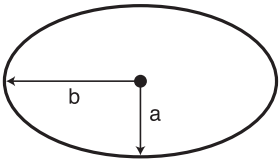
Rectangle
Area = lw



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

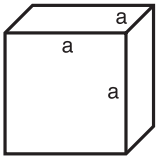


Circle
Circumference = $2\pi r$
Area = πr^2

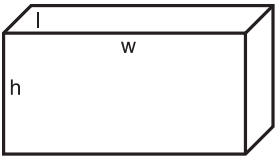


Ellipse
Area = πab

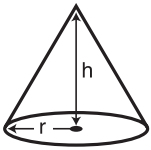
SURFACE AREA/VOLUME FORMULAS



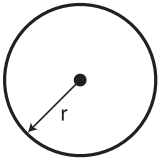
Cube
Surface Area = $6a^2$
Volume = a^3



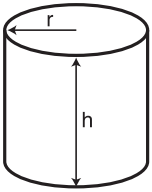
Rectangle
Surface Area =
$2hw + 2hl + 2lw$
Volume = l x w x h



Cone
Surface Area = $\pi r \sqrt{r^2 + h^2}$
($+ \pi r^2$ if you add the base)
Volume = $\frac{\pi r^2 h}{3}$



Sphere
Surface Area = $4\pi r^2$
Volume = $4/3\pi r^3$



Cylinder
Surface Area = $2\pi rh + 2\pi r^2$
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 8:00am to 4:00pm 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

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 an idea, or a suggestion for improving this product or User's Guide, please submit your comments online at: www.calculated.com under "Contact Us", "Product Idea Submittal Agreement". Thank you.

CALCULATED INDUSTRIES®

4840 Hytech Drive
Carson City, NV 89706 U.S.A.
1-800-854-8075 • Fax: 1-775-885-4949
E-mail: info@calculated.com
www.calculated.com

CALCULATED INDUSTRIES®

Designed in the United States of America.
Printed in China.
4/09

UG4094E-A