USER'S GUIDE

MACHINIST CALC® PRO 2

ADVANCED MACHINING MATH + MATERIALS

Model 4088

CALCULATED INDUSTRIES®

FAST. ACCURATE. RELIABLE.

MACHINIST CALC® PRO 2

The *Machinist Calc® Pro 2* Advanced Machining Math + Materials calculator (Model 4088) provides hundreds of fast, precise machining-specific solutions for turning, drilling, boring and face, end and slot milling. Built-in tables for 20 materials, 6 processes and 3 tools will let you spend much less time looking up your most-needed calculations on charts, in books or on the Internet and more time machining.

The *Machinist Calc Pro 2* gives you hundreds of calculations, including:

- Speeds and Feeds
- Built-in Drill and Thread Size reference tables
- Drill Point Cut Depth solutions
- Bolt Pattern hole layouts with center x, y coordinates
- Right triangle math
- Trigonometric solutions
- Wire Sizes and 3-Wire Measurements

Work in and convert between U.S. and Metric units, including:

- Decimal Inches/Mils
- Feet-Inch-Fractions
- m, mm, cm
- Area, Volume and Weight

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GETTING STARTED

KEY DEFINITIONS

You may want to practice getting a feel for your calculator keys by reading through the key definitions and learning how to enter data, how to store values, etc., before proceeding to the examples.

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.
Conv On/C	***Off*** **—** Turns all power off. Clears all non-permanent values.
+ − × ÷ =	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.
Conv Rcl	***Store*** **—** Used for storing values.
Conv Rcl 1 - 9	***Storage Registers M1 through M9*** **—** Used to store values in memory registers 1 through 9.
Rcl	***Recall*** **—** Used with other keys to recall stored values and settings.
Rcl Rcl	***Memory Clear*** **—** Clears Accumulative Memory and displays total.
M+	***Accumulative Memory*** **—** Adds displayed value to Accumulative Memory.
Conv M+	***M-*** **—** Subtracts displayed value from Accumulative Memory.

Dimensional Function Keys

mm	***Millimeters (mm)*** **—** Identifies entry as millimeters, with repeated presses toggling between linear, area and volume units. Also converts dimensional value to units of millimeters, with repeated presses toggling between millimeters and meters.

Conv 5 **_Centimeters (cm)_ —** Identifies entry as centimeters, with repeated presses toggling between linear, area and volume units.

Conv 9 **_Meters (m)_ —** Identifies entry as meters, with repeated presses toggling between linear, area and volume units.

Conv 7 **_Feet_ —** Identifies entry as Feet, with repeated presses of Conv 7 toggling between linear, area and volume units. Also used with Inch and / for entering Feet-Inch values. Repeated presses of Conv 7 during conversions toggle between Feet-Inch-Fractions and decimal Feet.

Inch **_Inch_ —** Identifies entry as Inches, with repeated presses toggling between linear, area and volume units. 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 dimensional fractional format.

/1000" **_1/1000" (mils)_ —** Multiplies a dimensionless entry by 0.001 Inch and displays the result as Inches. Converts a linear entry to decimal Inches. For both methods, the result is rounded and displayed to three decimal places.

Weight and Volume Function Keys

Conv 6	***Tons* —** Enters or converts a weight or volume value to tons.
Conv 4	***Pounds (lbs)* —** Enters or converts a weight or volume value to pounds.
Conv 3	***Metric tons (met tons)* —** Enters or converts a weight or volume value to metric tons.
Conv 2	***Grams* —** Enters or converts a weight or volume value to grams.
Conv 1	***Kilograms (kg)* —** Enters or converts a weight or volume value to kilograms.
Conv 0	***Weight per Volume (wt/vol)* —** Stores a new weight per volume as pounds per cubic foot or other format as shown below. Default value is 490 pounds per cubic foot of steel. ● Pounds per cubic foot ● Pounds per cubic inch ● Metric tons per cubic meter ● Kilograms per cubic meter

Trigonometric Function Keys

Conv Adj (x)	***Sine* —** Calculates the Sine of an entered degree or unitless value.
Conv mm	***ArcSine* —** Calculates the angle for the entered or calculated Sine value.
Conv Opp (y)	***Cosine* —** Calculates the Cosine of an entered degree or unitless value.
Conv Inch	***ArcCosine (ArcCos)* —** Calculates the angle for the entered or calculated Cosine value.
Conv Hyp (r)	***Tangent (Tan)* —** Calculates the Tangent of an entered degree or unitless value.

Conv ÷	***ArcTangent (ArcTan)*** **—** Calculates the angle for the entered or calculated Tangent value.

Miscellaneous Functions

Conv •	***Degrees:Minutes:Seconds (dms◄►deg) —*** Converts between D:M:S and decimal degree formats; repeated presses will toggle between the two formats.
%	***Percentage*** **—** Used to find a given percent of a number.
Conv %	***x^2*** **—** Squares the value on the display.
←	***Backspace Function*** **—** Used to delete entries one keystroke at a time (unlike the On/C function, which deletes the entire entry).
Conv ←	***Square Root ($\sqrt{x}$)*** **—** Calculates the Square Root of the number on the display.
Conv ÷	***Reciprocal (1/x)*** **—** Finds the Reciprocal of a number (e.g., 8 Conv ÷ = **0.125**).
Conv ×	***Clear All*** **—** Returns all stored values to the default settings. Does not affect Preference Settings.
Conv −	***Change Sign (+/-)*** **—** Toggle displayed value between negative and positive value.
Conv +	***Pi*** **—** Displays value of π (3.1415927).
Conv =	***Preference Settings (Prefs)*** **—** Accesses various customizable settings, such as dimensional answer formats (see ***Preference Settings*** section).

Machinist Function Keys

Note: *Unitless entries are assumed to be inches in U.S. mode, millimeters in Metric mode.*

Diam — ***Diameter*** **—** Enters a Diameter. Calculates circle Area and Circumference given entered Diameter.

Conv Diam — ***Bolt Pattern*** **—** Enters the number of holes in a Bolt Pattern. Calculates the hole Center-to-Center Spacing and the *x* and *y* coordinates for each hole in a Bolt Pattern given entered Diameter, Number of Bolt Holes, Starting Angle (optional) and Center *x* and *y* coordinates.

Mat'l — ***Material*** **—** Scrolls through 20 Material types. Materials are assigned numbers from 1-20, which can be used to select a particular Material. Materials are used to determine tabular Feed and Speed values. See Materials section on page 16 for the complete list of available materials.

Conv Mat'l — ***Depth of Cut (DOC)*** **—** Enters a Cut Depth for use in determining tabular Feed and Speed values, as well as Material Removal Rate.

Proc — ***Process*** **—** Scrolls through six Processes:

1. Face Milling (default)
2. End Milling
3. Slot Milling
4. Turning
5. Boring
6. Drilling

Used to determine tabular Feed and Speed values. Assigned number can be used to select a particular Process.

Conv Proc — ***Width of Cut (WOC)*** **—** Enters a Cut Width for use in determining tabular Feed and Speed values, as well as Material Removal Rate and Radial Chip Thinning Adjustment Factor.

Tool — ***Tool*** **—** Scrolls through three Tool Types:

1. High Speed Steel (default)
2. Carbide
3. High Performance

Used to determine tabular Feed and Speed values. Assigned number can be used to select a particular Tool Type.

Conv Tool — ***Length of Cut (LOC)* —** Enters a Cut Length to calculate Cut Time.

SFM — ***Surface Feet per Minute* —** Enters or calculates Cutting Speed. Unitless entries are assumed to be Feet in U.S. mode, meters in Metric mode. Calculates Cutting Speed given entered Diameter and RPM. Provides tabular Cutting Speed based on Process, Material, Tooling, Depth of Cut, Width of Cut and Diameter.

Conv SFM — ***Wire Size* —** Enters or calculates Wire Size for 3-Wire Measurements. Calculates the recommended Ideal, Maximum and Minimum Wire Sizes given an entered Thread Size.

RPM — ***Revolutions per Minute* —** Enters or calculates RPM (Spindle Speed). Calculates RPM given entered Diameter and Cutting Speed. Result is displayed as a whole number.

Conv RPM — ***3-Wire Measurement (3W Measure)* —** Enters or calculates a Three-Wire Measurement. Calculates the minimum and maximum Three-Wire Measurements and Pitch Diameters given entered Thread Size and Wire Size, assuming an External thread type. If a Three-Wire Measurement value is entered, the Pitch Diameter calculation is based on this entered measurement.

IPT — ***Inches per Tooth* —** Enters or calculates Chipload or Feed per Tooth (IPT), the chip size of material cut by each tooth. Typically used in Milling operations. Automatically adjusts for Radial Chip Thinning, if applicable, when Process is set to Face or End Milling. Provides tabular Feed per Tooth based on Process, Material, Tooling, Depth of Cut, Width of Cut and Diameter.

Conv IPT — ***Inches per Revolution (IPR)* —** Enters or calculates Cutting Feed or Feed per Revolution (IPR). Provides tabular Feed per Revolution based on Process, Material, Tooling and Depth of Cut.

IPM — ***Inches per Minute* —** Enters or calculates Feed Rate or Feed per Minute (IPM). When applicable, also provides Material Removal Rate and Cut Time.

Conv IPM — ***Number of Teeth (#Teeth)* —** Enters the Number of Teeth on a tool. Default value is 1.

Drill Size — ***Drill Size* —** Enters a numeric, letter, fractional or metric Drill Size, displaying the decimal Inch (U.S. mode) or millimeter (Metric mode) equivalent of the Drill Size. The nearest Drill Size is displayed if the entered value doesn't match a Drill Size. Repeated presses of Drill Size or + scroll through Drill Sizes in increasing order. Presses of – scroll through Drill Sizes in decreasing order. Selected Drill Size is stored upon exiting function.

Conv Drill Size — ***Drill Point* —** Enters the Cutting Angle of a Drill Point. Calculates the Drill Point Cut Depth that needs to be taken into account when it's necessary to maintain a specific full diameter depth.

Conv Angle (θ) — ***% of Thread* —** Enters a non-standard Thread Grip Percentage for use in determining screw Tap Drill Sizes. Default value is 75%.

Thread Size — ***Thread Size* —** Enters a numeric, fractional or metric Thread Size and provides Thread characteristics such as Cut Tap Drill Size, Minimum Major Diameter, etc. See ***Thread Sizing*** section for further details on entry format, valid entries and a listing of the resulting Thread characteristics.

Conv Thread Size | ***Thread Classification (Thread Class)* —** Used to select the Thread Class for numeric and fractional Threads and the Tolerance Class for metric Threads. The default Class for numeric and fractional Thread Sizes is 2B (Internal) and the default Tolerance Class for metric Thread Sizes is 6H (Internal). See ***Thread Sizing*** section for further details on available Classes.

Conv 8 | ***Alpha* —** Enters alphabet character selection mode. While in this mode, a letter can be selected and used with Drill Size to enter a letter Drill Size. Entering this mode with a unitless entry between 1 and 26 will display the corresponding letter of the alphabet (i.e., 5 Conv 8 displays the letter **E**). While in Alpha mode, presses of 8 or + scroll forward through the alphabet, while presses of − scroll backward.

Adj (x) | ***Adjacent (x)* —** Enters or calculates the Adjacent (horizontal) leg of a right triangle. Calculates Adjacent value given two other right-triangle values. Also enters the Center x-coordinate of a Bolt Pattern.

Opp (y) | ***Opposite (y)* —** Enters or calculates the Opposite (vertical) leg or height of a right triangle. Calculates Opposite value given two other right-triangle values. Also enters the Center y-coordinate of a Bolt Pattern.

Hyp (r) | ***Hypotenuse (r)* —** Enters or calculates the Hypotenuse (diagonal) of a right triangle. Calculates Hypotenuse value given two other right-triangle values.

Angle (θ) **_Angle (θ)_ —** Enters or calculates an Angle, providing the Adjacent Angle for both instances. Calculates an Angle given two other right-triangle values. Also enters Lead Angle adjustment for Face Milling, as well as Starting Angle of the first hole of a Bolt Pattern, with 0° being the three o'clock position and the rotation going counterclockwise.

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

Memory is semi-permanent, clearing only when you do one of the following:

— turn off the calculator

— press Rcl Rcl

— 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+

3 5 5 M+

M+	
M	355.

(cont'd)

(cont'd)

2 5 5 M+	M+ M 255.
7 4 5 Conv M+ *(M-)*	M- M 745.
Rcl M+	TOTAL VALUE M+ M - 135.
M+	AVERAGE VALUE M+ M - 45.
M+	TOTAL ENTRIES M+ M 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 (Conv Rcl 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	Conv Rcl 1
Clear M1	0 Conv Rcl 1
Recall M1	Rcl 1

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

1 7 5 Conv Rcl 1	MEMORY M-Ø1 175.
Conv On/C On/C	0.
Rcl 1	MEMORY M-Ø1 175.
0 Conv Rcl 1	MEMORY M-Ø1 0.

USING THE *MACHINIST CALC PRO 2*

U.S. AND METRIC MODE SETTINGS

The *Machinist Calc Pro 2* allows you to set the calculator to use either U.S. Mode or Metric Mode. The default setting is U.S. units. You can change to Metric Mode by changing your Preference setting (see page 65). The examples in this User's Guide are done in U.S. Mode.

MATERIALS, PROCESSES AND TOOLS

Materials

The *Machinist Calc Pro 2* has 20 built-in Material types that can be used to determine tabular Feed and Speed values. You can scroll through the available Materials by repeatedly pressing the Mat'l key, or by pressing the + key or − key to scroll forward and backward through the Materials.

You can also enter the assigned number (see listing on next page), then press the Mat'l key to select the Material, which will be set until you select another Material or perform a Clear All (Conv ×).

0. No Material (Default)
1. 1020 Low-Carbon Steel
2. 1045 Medium-Carbon Steel
3. 1060 High-Carbon Steel

(cont'd)

(cont'd)

4. 4140 Chromium-Molybdenum Alloy Steel
5. 4340 Nickel-Chromium-Molybdenum Alloy Steel
6. 52100 Chromium Alloy Steel
7. 304 Austenitic Stainless Steel
8. 316 Austenitic Stainless Steel
9. 410 Martensitic Stainless Steel
10. 430 Ferritic Stainless Steel
11. P20 Mold Type Tool Steel
12. H13 Hot Work Tool Steel
13. 2024-T3 Wrought Aluminum Alloy
14. 6061-T6 Wrought Aluminum Alloy
15. A390.0-T5 Cast Aluminum Alloy
16. Ti-6Al-4V Alpha-Beta Titanium Alloy
17. Ti-10V-2Fe-3Al Beta Titanium Alloy
18. Alloy 718 Nickel-Based Heat Resistant Alloy
19. Alloy X Nickel-Based Heat Resistant Alloy
20. Haynes Alloy 188 Colbalt-Based Heat Resistant Alloy

Note: *There is a Workpiece Materials Conversion Table in Appendix A.*

Processes

The *Machinist Calc Pro 2* has six built-in Processes that can be used to determine tabular Feed and Speed values.

You can scroll through the available Processes by repeatedly pressing the Proc key, or by pressing the + key or – key to scroll forward and backward through the Processes.

You can also enter the assigned number (see following page), then press the Proc key to select the Process, which will be set until you select another Process or perform a Clear All (Conv ×).

1. Face Milling *(Default)*
2. End Milling
3. Slot Milling
4. Turning
5. Boring
6. Drilling

Tools

The *Machinist Calc Pro 2* has three built-in Tool Types that can be used to determine tabular Feed and Speed values.

You can scroll through the available Tool Types by repeatedly pressing the Tool key, or by pressing the + key or – key to scroll forward and backward through the Tools.

You can also enter the assigned number (see listing below), then press the Tool key to select the Tool Types, which will be set until you select another Tool or perform a Clear All (Conv ×).

1. High Speed Steel *(Default)*
2. Carbide
3. High Performance

RPM (SPINDLE SPEED)

RPM is the rotational speed of the spindle in revolutions per minute. In a milling machine or drill, the Spindle Speed is the rotation of the attached cutting tool. In a turning machine, it is the rotation of the attached workpiece. RPM can be calculated given values for Diameter and Cutting Speed.

RPM - *Basic*

Calculate the RPM when milling with a 0.375" bit at a Cutting Speed of 300 sfm (surface feet per minute):

On/C On/C	0.

1. Enter the bit Diameter:

(cont'd)

(cont'd)

• 3 7 5 Diam

DIAMETER	
	0.375 INCH

2. Enter the Cut Speed:

3 0 0 SFM

CUT SPEED	
/MIN	300. FEET

3. Calculate the Spindle Speed (RPM):

RPM

RPM	
	3056.

RPM – *Face Milling*

Find the Spindle Speed when milling 1060 Hi-Carbon Steel (3) with a 0.5" High Performance bit (3) at a Depth of Cut of 0.25":

1. Clear the calculator:

On/C On/C

0.

2. Set Process to Face Milling:

1 Proc

FACE MILLING	
	1.

3. Set Tooling to High Performance:

3 Tool

HIGH PERFORMANCE	
TOOL	3.

4. Set Material to 1060 Hi-Carbon Steel:

3 Mat'l

1060-HI C. STEEL	
MATL	3.

5. Enter Depth of Cut:

• 2 5 Conv Mat'l *(DOC)*

DEPTH OF CUT	
	0.25 INCH

6. Enter Tool Diameter:

• 5 Diam

DIAMETER 0.5 INCH

7. Calculate RPM:

RPM

RPM 4584.

8. Show tabular Cut Speed:

RPM

CUT SPEED /MIN 600. FEET

9. Now, change the Depth of Cut to 0.1" and find new RPM and tabular Cut Speed:

Keystrokes	Display
• 1 Conv Mat'l *(DOC)*	DEPTH OF CUT 0.1 INCH
RPM	RPM 6875.
RPM	CUT SPEED /MIN 900. FEET

RPM – *End Milling*

Find the Spindle Speed when milling 316 Stainless Steel with a 1" 4-fluted Uncoated Carbide bit at a 0.5" radial Width of Cut. Then, change the Depth of Cut to 0.25" and recalculate:

1. Clear the calculator:

On/C On/C

0.

2. Set Process to End Milling:

2 Proc

END MILLING 2.

3. Set Tooling to Carbide:

2 Tool

CARBIDE TOOL 2.

4. Set Material to 316 Stainless Steel (selection #8):

8 Mat'l

316-AUS. S. STEEL	
MATL	8.

5. Enter Width of Cut:

• 5 Conv Proc *(WOC)*

WIDTH OF CUT	
	0.5 INCH

6. Enter Tool Diameter:

1 Diam

DIAMETER	
	1. INCH

7. Calculate RPM:

RPM

RPM	
	802.

8. Show tabular Cut Speed:

RPM

CUT SPEED	
/MIN	210. FEET

9. Now, change Width of Cut to 0.25" and find new RPM and tabular Cut Speed:

• 2 5 Conv Proc *(WOC)*

WIDTH OF CUT	
	0.25 INCH

RPM

RPM	
	859.

RPM

CUT SPEED	
/MIN	225. FEET

FEED RATE - IPM

Feed Rate (IPM) is the speed of the cutting tool's movement relative to the workpiece as the tool makes a cut. You can calculate Feed Rate given values for RPM and either Feed per Tooth (IPT) and number of teeth for Milling operations, or Feed per Revolution (IPR) for all other machine operations.

Feed Rate – *Based on Cutting Feed and RPM (for Turning)*

Calculate the Feed Rate if you are turning a 1" steel round stock down using a Cutting Feed of 0.031 Inches per Revolution and a rotational speed of 900 RPM:

On/C On/C	0.

1. Enter the Feed per Revolution:

• 0 3 1 Conv IPT *(IPR)*	FEED/REV. 0.031 INCH

2. Enter the RPM:

9 0 0 RPM	RPM 900.

3. Calculate the Feed Rate:

IPM	FEED/MINUTE 27.900 INCH

Feed Rate – *Based on Cutting Feed and RPM (for Drilling)*

Calculate the Feed Rate for a Drilling operation that is using a recommended Cutting Feed of 0.004 Inches per Revolution at 800 RPM:

On/C On/C	0.

1. Enter the Cutting Feed:

4 /1000" Conv IPT *(IPR)*	FEED/REV. 0.004 INCH

2. Enter the RPM:

8 0 0 RPM	RPM 800.

3. Calculate the Feed Rate:

(cont'd)

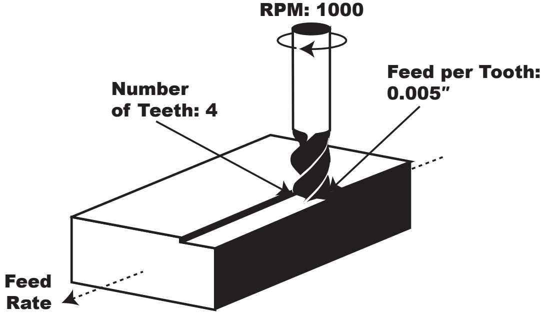
(cont'd)

IPM

FEED/MINUTE
3.200 INCH

Feed Rate – *Based on Feed per Tooth, RPM and # of Teeth*

Calculate the Feed Rate for a four-fluted end mill using a Feed per Tooth (Chip Load) of 0.005" turning at 1,000 RPM:



Conv ×

ALL CLEARED 0.

1. Enter the Feed per Tooth:

5 /1000" IPT

FEED/TOOTH
0.005 INCH

2. Enter the Number of Teeth:

4 Conv IPM *(#Teeth)*

NUMBER OF TEETH
4.

3. Enter the RPM:

1 0 0 0 RPM

RPM
1000.

4. Calculate the Feed Rate:

IPM

FEED/MINUTE
20.000 INCH

Feed Rate – *End Milling*

For End Milling (2), find the Feed Rate (IPM) using 1020 Low-Carbon Steel (1) and a 4-Tooth High Speed Steel Tool (1) with a Diameter of 0.5", a 0.25" Width of Cut and a 20" Length of Cut. Then, change the Width of Cut to 0.15" to show the Adjusted Feed per Tooth and the RCT Adjustment Factor. Then, add a 0.125" Depth of Cut and find the Material Removal Rate, Spindle Power and Spindle Torque:

Keystrokes	Display
Conv ×	ALL CLEARED 0.

1. Select the Process:

Keystrokes	Display
2 Proc	END MILLING 2.

2. Select the Tool:

Keystrokes	Display
1 Tool	HIGH SPEED STEEL TOOL 1.

3. Select the Material:

Keystrokes	Display
1 Mat'l	1020-LO C. STEEL MATL 1.

4. Enter the # of Teeth:

Keystrokes	Display
4 Conv IPM *(#Teeth)*	NUMBER OF TEETH 4.

5. Enter the Width of Cut:

Keystrokes	Display
• 2 5 Conv Proc *(WOC)*	WIDTH OF CUT 0.25 INCH

6. Enter the Length of Cut:

Keystrokes	Display
2 0 Conv Tool *(LOC)*	LENGTH OF CUT 20. INCH

(cont'd)

(cont'd)

7. Enter the Diameter:

[•] [5] [Diam]

DIAMETER	
	0.5 INCH

8. Calculate the Feed Rate:

[IPM]

FEED/MINUTE	
	3.667 INCH

9. Calculate the Cut Time:

[IPM]

CUT TIME	
MIN	5.454

10. Calculate the RPM:

[IPM]

RPM	
	917.

11. Change the Width of Cut (Radial Chip Thinning Adjustment):

[•] [1] [5] [Conv] [Proc] *(WOC)*

WIDTH OF CUT	
	0.15 INCH

12. Recalculate Feed Rate, Cut Time and RPM:

[IPM]

FEED/MINUTE	
	9.336 INCH

[IPM]

CUT TIME	
MIN	2.142

[IPM]

RPM	
	1070.

13. Show Adjusted Feed per Tooth and RCT Adjustment Factor:

[IPM]

FEED/TOOTH	
ADJ.	0.002 INCH

IPM

RCT. ADJ. FACTOR 1.091

14. Now, add a 0.125" Depth of Cut and find the Material Removal Rate, Spindle Power and Spindle Torque:

Keystrokes	Display
• 1 2 5 Conv Mat'l *(DOC)*	DEPTH OF CUT 0.125 INCH
IPM	FEED/MINUTE 9.336 INCH
IPM	MATERIAL REMOVAL /MIN 0.175 CU INCH
IPM	SPINDLE POWER HP 0.123
IPM	SPINDLE TORQUE LBFT 0.602

CUTTING SPEED - SFM

Cutting Speed (SFM) is the speed of the workpiece surface relative to the edge of the cutting tool during a cut, typically measured in Surface Feet per Minute. You can calculate Cutting Speed by entering the Diameter of the tool or material you're using and the RPM (Spindle Speed).

Cutting Speed – *Turning*

Calculate the Cutting Speed when turning a 4" rod running at 300 RPM:

Keystrokes	Display
On/C On/C	0.

1. Enter the Diameter of the rod:

Keystrokes	Display
4 Diam	DIAMETER 4. INCH

2. Enter the RPM:

(cont'd)

(cont'd)

3 0 0 RPM

RPM 300.

3. Calculate the Cutting Speed:

SFM

CUT SPEED /MIN 314. FEET

Cutting Speed – *End Milling*

Find the Cutting Speed when End Milling (2) using 1060-High Carbon Steel (3) using a High Performance 0.5" bit (3) and 0.1" radial Width of Cut:

On/C On/C

0.

1. Select the Process:

2 Proc

END MILLING 2.

2. Select the Tooling:

3 Tool

HIGH PERFORMANCE TOOL 3.

3. Select the Material:

3 Mat'l

1060-HI C. STEEL MATL 3.

4. Enter the Width of Cut:

• 1 Conv Proc *(WOC)*

WIDTH OF CUT 0.1 INCH

5. Enter the Diameter:

• 5 Diam

DIAMETER 0.5 INCH

6. Find the Cutting Speed:

SFM

CUT SPEED	
/MIN	370.

7. Calculate the RPM:

SFM

RPM	
	2827.

Cutting Speed – *Drilling*

Find the Cutting Speed for Drilling (6) 1020-Low Carbon Steel (1) with a 0.5" HSS (1) drill:

Conv ×

ALL CLEARED	0.

1. Select the Process:

6 Proc

DRILLING	
	6.

2. Select the Tooling:

1 Tool

HIGH SPEED STEEL	
TOOL	1.

3. Select the Material:

1 Mat'l

1020-LO C. STEEL	
MATL	1.

4. Enter the Drill Size:

• 5 Drill Size

1/2" DRILL	
SIZE	0.500 INCH

5. Find the Cutting Speed:

SFM

CUT SPEED	
/MIN	85. FEET

6. Calculate the Spindle Speed:

SFM

RPM	
	649.

(cont'd)

(cont'd)

7. *Change the Material to 1060-High Carbon Steel and recalculate:*

Keystrokes	Display
3 Mat'l	1060-HI C. STEEL MATL 3.
SFM	CUT SPEED /MIN 65. FEET
SFM	RPM 497.

FEED PER TOOTH/CHIP LOAD - IPT

Feed per Tooth (IPT), or Chip Load, is the distance that the workpiece feeds into each tooth on a multi-point cutting tool as it rotates. You can calculate Feed per Tooth given values for Number of Teeth and Cutting Feed (IPR). If the Cutting Feed is not known, the Feed per Tooth can be calculated given values for Number of Teeth, Feed Rate (IPM) and RPM (Spindle Speed).

Feed per Tooth – *Based on Cutting Feed and # of Teeth*

Calculate Feed per Tooth (IPT) with a Cutting Feed (IPR) of 0.024" for 4 Teeth:

Keystrokes	Display
Conv ×	ALL CLEARED 0.

1. *Enter the Cutting Feed:*

Keystrokes	Display
• 0 2 4 Conv IPT *(IPR)*	FEED/REV. 0.024 INCH

2. *Enter the Number of Teeth:*

Keystrokes	Display
4 Conv IPM *(#Teeth)*	NUMBER OF TEETH 4.

3. *Calculate the Feed per Tooth:*

Keystrokes	Display
IPT	FEED/TOOTH 0.006 INCH

Feed per Tooth – *Based on Feed Rate, RPM and # of Teeth*

Calculate Feed per Tooth (IPT) with a Feed Rate (IPM) of 12.8" per Minute, 4 Teeth and a Spindle Speed of 775 RPM:

On/C On/C — 0.

1. Enter the Feed Rate:

1 2 • 8 IPM — FEED/MINUTE 12.8 INCH

2. Enter the Number of Teeth:

4 Conv IPM *(#Teeth)* — NUMBER OF TEETH 4.

3. Enter the RPM:

7 7 5 RPM — RPM 775.

4. Calculate the Feed per Tooth:

IPT — FEED/TOOTH 0.004 INCH

Feed per Tooth – *Face Milling*

Find the Feed per Tooth (IPT) for Face Milling (2) using 4140-Alloy Steel for Material (4) and a 2-fluted High Speed Steel Tool (1) with a Diameter of 1" and a 0.1" Depth of Cut. Then, add a 0.15" Width of Cut and 45º Lead Angle:

Conv × — ALL CLEARED 0.

1. Select the Process:

1 Proc — FACE MILLING 1.

2. Select the Tool:

(cont'd)

(cont'd)

1 Tool

HIGH SPEED STEEL
TOOL 1.

3. *Select the Material:*

4 Mat'l

4140-ALLOY STEEL
MATL 4.

4. *Enter the Number of Teeth:*

2 Conv IPM *(#Teeth)*

NUMBER OF TEETH
2.

5. *Enter the Depth of Cut:*

• 1 Conv Mat'l *(DOC)*

DEPTH OF CUT
0.1 INCH

6. *Enter the Diameter:*

1 Diam

DIAMETER
1. INCH

7. *Find the Feed per Tooth and other values:*

Key	Display
IPT	FEED/TOOTH 0.012 INCH
IPT	FEED/MINUTE 12.376 INCH
IPT	NUMBER OF TEETH 2.
IPT	RPM 516.

8. *Now, add a Width of Cut to 0.15" and a 45° Lead Angle and recalculate:*

• 1 5 Conv Proc *(WOC)*

WIDTH OF CUT
0.15 INCH

4 5 Angle (θ)	ANGLE (Θ) 45.°
IPT	FEED/TOOTH ADJ. 0.024 INCH
IPT	FEED/MINUTE 24.508 INCH
IPT	NUMBER OF TEETH 2.
IPT	RPM 516.
IPT	RCT. ADJ. FACTOR 1.400
IPT	LEAD ANGLE ADJ. 1.414

CUTTING FEED – IPR

Cutting Feed is the distance the cutting tool or workpiece advances during one revolution of the spindle, typically measured in Inches per Revolution (IPR). You can calculate Cutting Feed given values for the Feed per Tooth or Chip Load (IPT) and Number of Teeth. If these values are unknown, you can calculate Cutting Feed with Feed Rate (IPM) and RPM (Spindle Speed).

Cutting Feed – *Based on Feed per Tooth and # of Teeth*

Calculate the Cutting Feed (IPR) with a Feed per Tooth (IPT) of 0.005" and 4 Teeth:

Conv ×	ALL CLEARED 0.

1. Enter the Feed per Tooth:

(cont'd)

(cont'd)

[•] [0] [0] [5] [IPT]

FEED/TOOTH
0.005 INCH

2. Enter the Number of Teeth:

[4] [Conv] [IPM] *(#Teeth)*

NUMBER OF TEETH
4.

3. Calculate the Cutting Feed:

[Conv] [IPT] *(IPR)*

FEED/REV.
0.020 INCH

Cutting Feed – *Based on Feed Rate and RPM*

Calculate the Cutting Feed (IPR) using a 15" Feed Rate (IPM) and a Spindle Speed of 800 RPM:

[On/C] [On/C]

0.

1. Enter the Feed Rate:

[1] [5] [IPM]

FEED/MINUTE
15. INCH

2. Enter the Spindle Speed:

[8] [0] [0] [RPM]

RPM
800.

3. Calculate the Cutting Feed:

[Conv] [IPT] *(IPR)*

FEED/REV.
0.019 INCH

Cutting Feed – *Turning*

Find the Cutting Feed (IPR) when Turning (4) 1", 1020 Low-Carbon Steel (1) at a 0.1" Depth of Cut using a High Speed Steel (1) bit:

Keystrokes	Display
Conv X	ALL CLEARED 0.

1. Select the Process:

Keystrokes	Display
4 Proc	TURNING 4.

2. Select the Material:

Keystrokes	Display
1 Mat'l	1020-LO C. STEEL MATL 1.

3. Select the Tool:

Keystrokes	Display
1 Tool	HIGH SPEED STEEL TOOL 1.

4. Enter the Depth of Cut:

Keystrokes	Display
• 1 Conv Mat'l *(DOC)*	DEPTH OF CUT 0.1 INCH

5. Enter Diameter:

Keystrokes	Display
1 Diam	DIAMETER 1. INCH

6. Find the Cutting Feed:

Keystrokes	Display
Conv IPT *(IPR)*	FEED/REV. 0.015 INCH

DRILL SIZES

The [Drill Size] key allows the selection of a desired Drill Size, which can be entered as a:

- Numeric value (whole digits 1 through 97)
- Letter between A and Z
- Fractional or decimal Inch value (max. of 3-1/2")
- Millimeter value (max. of 78 mm).

The selected Drill Size is displayed along with its decimal Inch equivalent. If the entered value doesn't match a Drill Size, the nearest Drill Size is displayed. You can scroll through the available sizes in increasing order with either the [Drill Size] key or the [+] key. The [–] key displays the available sizes in decreasing order. To set the displayed Drill Size, press [On/C] (or any other key).

Numeric Drill Size Entry

Enter a #36 Drill and scroll through the next larger available sizes:

[On/C] [On/C]	**0.**

1. Enter the Drill Size:

[3] [6] [Drill Size]	**#36 DRILL SIZE 0.107 INCH**

2. Display the next larger available sizes:

[Drill Size]	**2.75mm DRILL SIZE 0.108 INCH**
[Drill Size]	**7/64" DRILL SIZE 0.109 INCH**
[Drill Size]*	**#35 DRILL SIZE 0.110 INCH**

** Repeated presses of [Drill Size] display the next larger Drill Sizes. The [+] and [–] keys will scroll forward and backward, respectively, through all available Drill Sizes.*

Letter Drill Size Entry

You can enter letter Drill Sizes by selecting an alphabet character via Alpha Mode (Conv 8) and then storing it using the Drill Size key. The desired letter can be selected by scrolling through Alpha Mode until the letter is reached or by specifying the numerical order of the letter within the alphabet prior to entering Alpha Mode. Both methods are shown below.

Select Drill Size E by scrolling through Alpha Mode. Then, select Drill Size G by entering the numerical order of the letter (the letter G is 7th in the alphabet):

Keystrokes	Display
On/C On/C	0.

1. Enter Alpha Mode:

Keystrokes	Display
Conv 8 *(Alpha)*	**ALPHA CHARACTER** **A 1.**

2. Scroll until the letter E is displayed:

Keystrokes	Display
8 8 8 8	**ALPHA CHARACTER** **E 5.**

3. Enter as Drill Size:

Keystrokes	Display
Drill Size	**"E" DRILL** **SIZE 0.250 INCH**

4. View next larger available sizes:

Keystrokes	Display
Drill Size	**6.40mm DRILL** **SIZE 0.252 INCH**
Drill Size	**6.50mm DRILL** **SIZE 0.256 INCH**
Drill Size	**"F" DRILL** **SIZE 0.257 INCH**

(cont'd)

(cont'd)

5. Enter order of letter G and enter Alpha Mode:

[7] [Conv] [8] *(Alpha)*

ALPHA CHARACTER	
G	7.

6. Enter as Drill Size:

[Drill Size]*

"G" DRILL	
SIZE	0.261 INCH

** Repeated presses of [Drill Size] display the next larger Drill Sizes. The [+] and [–] keys will scroll forward and backward, respectively, through all available Drill Sizes.*

Inch Drill Size Entry

Enter hole sizes of 0.3", 1" and 1-19/64". After entering each size, scroll through the available sizes to view the next larger and next smaller sizes:

[On/C] [On/C]

	0.

1. Enter the 0.3" hole size and view next larger and next smaller sizes:

Keys	Display	
[•] [3] [Inch] [Drill Size]	7.60mm DRILL SIZE	0.299 INCH
[Drill Size]	"N" DRILL SIZE	0.302 INCH
[–] [–]	19/64" DRILL SIZE	0.297 INCH

2. Enter the 1" hole size and view next larger and next smaller sizes:

Keys	Display	
[1] [Inch] [Drill Size]	1" DRILL SIZE	1.000 INCH
[Drill Size]	25.50mm DRILL SIZE	1.004 INCH
[–] [–]	63/64" DRILL SIZE	0.984 INCH

3. Enter the 1-19/64" hole size and view next larger and next smaller sizes:

Keystrokes	Display
1 Inch 1 9 / 6 4 Drill Size	**1-19/64" DRILL SIZE 1.297 INCH**
Drill Size	**33.00mm DRILL SIZE 1.299 INCH**
– –	**1-9/32" DRILL SIZE 1.281 INCH**

Millimeter Drill Size Entry

Enter a 5.7 mm hole size and scroll through the available sizes to view the next larger and next smaller sizes:

Keystrokes	Display
On/C On/C	**0.**

1. Enter the hole size as millimeters:

Keystrokes	Display
5 • 7 mm Drill Size	**5.70mm DRILL SIZE 0.224 INCH**

2. View next larger and next smaller sizes:

Keystrokes	Display
Drill Size	**5.75mm DRILL SIZE 0.226 INCH**
– –	**#2 DRILL SIZE 0.221 INCH**

DRILL POINT

The Drill Point function calculates the Drill Point Cut Depth (length) of the stored Drill Size. By default, the calculation is based on a Cutting Angle of 118°. If a different Angle is desired, it can be stored using the Drill Point function (for example, 1 2 0 Conv Drill Size stores 120°).

Find the Drill Point Cut Depth for a 1/2-Inch drill with a 118° Cutting Angle. Then, find the Cut Depth using a 127° Angle:

(cont'd)

(cont'd)

Keystrokes	Display
On/C On/C	0.

1. Enter the Drill Size:

Keystrokes	Display
1 / 2 Drill Size	1/2" DRILL SIZE 0.500 INCH

2. Enter 118° Angle and calculate the Drill Point Cut Depth:

Keystrokes	Display
1 1 8 Conv Drill Size *(Drill Point)*	DRILL POINT CUT DPTH 0.150 INCH
Drill Size	DRILL CUT ANGLE 118.000°
Drill Size	1/2" DRILL SIZE 0.500 INCH

3. Enter 127° Angle and calculate the Drill Point Cut Depth:

Keystrokes	Display
1 2 7 Conv Drill Size	DRILL POINT CUT DPTH 0.125 INCH

THREAD SIZING

The Thread Size key allows you to enter a numeric, fractional or metric Thread Size and then scroll through the various available Thread characteristics, as shown in the tables provided later in this section.

When using the Thread Size key, the first entry is considered the Thread Size. Upon entering the Thread Size, the Threads per Inch (TPI) or Pitch is required. If the entered Thread Size is a standard size, continuous presses of the Thread Size key will toggle through the available common TPI or Pitches.

Once the desired TPI/Pitch is reached, pressing On/C stores the Thread Size. If the Thread Size you enter is not a standard size or if you have a non-common TPI/Pitch, you will need to directly enter the TPI/Pitch value, pressing Thread Size after entering it in order to store the Thread Size.

The following specifies the entry ranges that the calculator allows for the Thread Size and TPI/Pitch values for numeric, fractional and metric Thread Sizes:

	Thread Size	**TPI/Pitch**
Numeric	0, 1, 2, 3, 4, 5, 6, 8, 10, 12, 14	less than 100
Fractional	0.06" to 6"	less than 100
Metric	1.6 mm to 300 mm	less than or equal to 10

Note: *Entries outside of the ranges mentioned above will result in an Entry Error.*

The following tables list the available Thread characteristics provided by the Thread Size function. Note that there are two separate listings, one for Internal Threads and one for External Threads. The listing shown within the Thread Size function is determined by the set Thread Classification (see ***Thread Classification*** section).

INTERNAL THREAD

Thread Size

Thread Pitch*

Cut Tap Drill Size**

Roll Tap Drill Size**

Close Fit Drill Size**

Free Fit Drill Size**

Minimum Pitch Diameter

Maximum Pitch Diameter

Minimum Minor Diameter

Maximum Minor Diameter

Minimum Major Diameter

** Thread Pitch is only displayed for Numeric and U.S. Thread Sizes.*

*** If the resulting hole size is greater than 2 Inches or 50 mm, the actual hole size will be displayed instead of adjusting to the closest Drill Size.*

EXTERNAL THREAD

Thread Size	Minimum Pitch Diameter
Thread Pitch*	Maximum Major Diameter
Cut Rod Size	Minimum Major Diameter
Roll Shank Size	Maximum Minor Diameter
Maximum Pitch Diameter	

** Thread Pitch is only displayed for Numeric and U.S. Thread Sizes.*

THREAD CLASSIFICATION

With the *Machinist Calc Pro 2* you can choose between Internal and External Threads. Entering a U.S. Thread Size will allow you to choose among U.S. Thread Classes as shown below.

THREAD TYPE	U.S. THREAD CLASSES		
Internal	1B	2B*	3B
External	1A	2A	3A

Entering a Metric Thread will allow you to choose among Metric Thread Tolerance Classes as shown below.

THREAD TYPE	METRIC THREAD TOLERANCE CLASSES						
Internal	3G 3H	4G 4H	5G 5H	6G 6H*	7G 7H	8G 8H	9G 9H
External	3g 3h 3e 3f	4g 4h 4e 4f	5g 5h 5e 5f	6g 6h 6e 6f	7g 7h 7e 7f	8g 8h 8e 8f	9g 9h 9e 9f

** Default settings*

Changing Thread Classes

To display the current Thread Classification, press Conv Thread Size. Repeated presses of Thread Size will toggle between External and Internal Thread Types. You can change the number of a Thread Class by entering the number of the desired class/ grade and pressing Conv Thread Size.

Changing a U.S. Thread Classification

Keystroke	Display
Conv X	ALL CLEARED 0.

1. Recall the current Thread Classification:

Keystroke	Display
Conv Thread Size *(Thread Class)*	U.S. INT. THREAD 2B 2.

2. Change to U.S. External Thread Class 2:

Keystroke	Display
Thread Size	U.S. EXT. THREAD 2A 2.

3. Change to U.S. External Thread Class 1:

Keystroke	Display
1 Conv Thread Size *(Thread Class)*	U.S. EXT. THREAD 1A 1.

4. Change to U.S. Internal Thread Class 1:

Keystroke	Display
Thread Size	U.S. INT. THREAD 1B 1.

Changing a Metric Thread Classification

Changing a Metric Thread Tolerance Class is done in the same manner, with several selections available for Internal and External Threads.

Keystroke	Display
Conv X	ALL CLEARED 0.

1. Enter a Tolerance Grade of 4:

(cont'd)

(cont'd)

4 Conv Thread Size *(Thread Class)*	**MM INT. THREAD** **4H 4.**

2. *Scroll through the available Tolerance Positions for the entered Grade:*

Thread Size	**MM EXT. THREAD** **4g 4.**
Thread Size	**MM EXT. THREAD** **4h 4.**
Thread Size	**MM EXT. THREAD** **4e 4.**
Thread Size	**MM EXT. THREAD** **4f 4.**
Thread Size	**MM INT. THREAD** **4G 4.**
Thread Size	**MM INT. THREAD** **4H 4.**

3. *Enter a Tolerance Grade of 6 and scroll through the available Tolerance Positions for the entered Grade:*

6 Conv Thread Size *(Thread Class)*	**MM INT. THREAD** **6H 6.**
Thread Size	**MM EXT. THREAD** **6g 6.**
Thread Size	**MM EXT. THREAD** **6h 6.**
Thread Size *	**MM EXT. THREAD** **6e 6.**

** Repeated presses of Thread Size will continue to scroll through the available Tolerance Positions of the specified Grade.*

Note: *The number 3 can be entered to select both U.S. and Metric classes. To select either, go to Preferences and set the calculator to either U.S. Mode or Metric Mode.*

Numeric Thread Size

Enter an 8-32 screw and scroll through the available Internal Thread (Class 2B) characteristics, then switch to External Thread (Class 2A) and scroll through the available Thread characteristics:

Note: *The default U.S. Thread Class is 2B (Internal). To view the current Thread Class, press* Conv Thread Size*. To change the class, press* Thread Size *again.*

Thread Size calculations for Pitch, Major, and Minor Diameter attributes are compliant with ANSI/ASME B.1.1-2003 and ANSI/ ASME B.1.13M-2005.

Keys	Display
Conv ✕	ALL CLEARED 0.

1. Verify Thread Class is set to 2B:

Keys	Display
Conv Thread Size *(Thread Class)*	U.S. INT. THREAD 2B 2.

2. Enter the Thread Size:

Keys	Display
8 Thread Size	THREAD SIZE 2B 8 -

3. Enter the TPI:

Keys	Display
3 2 Thread Size	THREAD SIZE 2B 8 - 32

4. Find the available Internal Thread characteristics:

Keys	Display
Thread Size	THREAD PITCH 0.031 INCH
Thread Size	TAP DRILL SIZE #29 0.136 INCH
Thread Size	ROLL TAP DRILL 3.750 MM

(cont'd)

(cont'd)

Keystroke	Display
Thread Size	CLOSE FIT DRILL #18 0.170 INCH
Thread Size	FREE FIT DRILL #16 0.177 INCH
Thread Size	PITCH DIAMETER MIN 0.144 INCH
Thread Size	PITCH DIAMETER MAX 0.147 INCH
Thread Size	MINOR DIAMETER MIN 0.130 INCH
Thread Size	MINOR DIAMETER MAX 0.139 INCH
Thread Size	MAJOR DIAMETER MIN 0.164 INCH

5. *Switch to Thread Class 2A:*

Keystroke	Display
Conv Thread Size Thread Size *(Thread Class)*	U.S. EXT. THREAD 2A 2.

6. *Clear the display and find the available External Thread characteristics:*

Keystroke	Display
On/C	0.
Thread Size	THREAD SIZE 2A 8 - 32
Thread Size	THREAD PITCH 0.031 INCH
Thread Size	ROD SIZE 0.164 INCH
Thread Size	COLD FORM SIZE 0.141 INCH
Thread Size	PITCH DIAMETER MAX 0.143 INCH

[Thread Size]	PITCH DIAMETER MIN 0.140 INCH
[Thread Size]	MAJOR DIAMETER MAX 0.163 INCH
[Thread Size]	MAJOR DIAMETER MIN 0.157 INCH
[Thread Size]	MINOR DIAMETER MAX 0.126 INCH

Fractional Thread Size

Find the available Internal and External Thread characteristics for a 1/4 Inch, 28 TPI screw:

[Conv] [×]	ALL CLEARED 0.

1. Verify Thread Class is set to 2B:

[Conv] [Thread Size] *(Thread Class)*	U.S. INT. THREAD 2B 2.

2. Enter the Thread Size:

[1] [/] [4] [Thread Size]	THREAD SIZE 2B 0.25 - INCH

3. Enter the TPI and store the final Thread Size:

[2] [8] [Thread Size]	THREAD SIZE 2B 0.25 - 28 INCH

4. Find the available Internal Thread characteristics:

[Thread Size]	THREAD PITCH 0.036 INCH
[Thread Size]	TAP DRILL SIZE #3 0.213 INCH
[Thread Size]	ROLL TAP DRILL 5.900 MM

(cont'd)

(cont'd)

Thread Size	CLOSE FIT DRILL F 0.257 INCH
Thread Size	FREE FIT DRILL H 0.266 INCH
Thread Size	PITCH DIAMETER MIN 0.227 INCH
Thread Size	PITCH DIAMETER MAX 0.231 INCH
Thread Size	MINOR DIAMETER MIN 0.211 INCH
Thread Size	MINOR DIAMETER MAX 0.220 INCH
Thread Size	MAJOR DIAMETER MIN 0.250 INCH

5. Switch to Thread Class 2A:

Conv Thread Size Thread Size *(Thread Class)*	U.S. EXT. THREAD 2A 2.

6. Clear the display and find the available External Thread characteristics:

On/C	0.
Thread Size	THREAD SIZE 2A 0.25 - 28 INCH
Thread Size	THREAD PITCH 0.036 INCH
Thread Size	ROD SIZE 0.250 INCH
Thread Size	COLD FORM SIZE 0.224 INCH
Thread Size	PITCH DIAMETER MAX 0.226 INCH

Keystroke	Display
Thread Size	PITCH DIAMETER MIN 0.223 INCH
Thread Size	MAJOR DIAMETER MAX 0.249 INCH
Thread Size	MAJOR DIAMETER MIN 0.243 INCH
Thread Size	MINOR DIAMETER MAX 0.207 INCH

Metric Thread Size

Find the available Internal and External Thread characteristics for a 5 mm, 0.75 mm Pitch screw with a Tolerance Class of 4H:

Note: *The default Metric Tolerance Class is 6H (Internal). To view the current Tolerance Class, press Conv Thread Size after entering the desired Thread Size. To change the class, press Thread Size again.*

Keystroke	Display
Conv ×	ALL CLEARED 0.

1. Set Tolerance Class to Internal 4H:

Keystroke	Display
4 Conv Thread Size *(Thread Class)*	MM INT. THREAD 4H 4.

2. Enter the Thread Size:

Keystroke	Display
5 mm Thread Size	THREAD SIZE 4H 5. - MM

3. Enter the Thread Pitch and store the final Thread Size:

Keystroke	Display
• 7 5 Thread Size	THREAD SIZE 4H 5. - 0.75 MM

4. Find the available Internal Thread characteristics:

Keystroke	Display
Thread Size	TAP DRILL SIZE 4.250 MM

(cont'd)

(cont'd)

Thread Size	ROLL TAP DRILL #14 0.182 INCH
Thread Size	CLOSE FIT DRILL 5.300 MM
Thread Size	FREE FIT DRILL 5.800 MM
Thread Size	PITCH DIAMETER MIN 4.513 MM
Thread Size	PITCH DIAMETER MAX 4.588 MM
Thread Size	MINOR DIAMETER MIN 4.188 MM
Thread Size	MINOR DIAMETER MAX 4.306 MM
Thread Size	MAJOR DIAMETER MIN 5.000 MM

5. *Switch to External 4g Tolerance Class:*

Conv Thread Size Thread Size *(Thread Class)*	MM EXT. THREAD 4g 4.

6. *Clear the display and find the available External Thread characteristics:*

On/C	0.
Thread Size	THREAD SIZE 4g 5. - 0.75 MM
Thread Size	ROD SIZE 5.000 MM
Thread Size	COLD FORM SIZE 4.452 MM
Thread Size	PITCH DIAMETER MAX 4.491 MM

Keys	Display
Thread Size	PITCH DIAMETER MIN 4.435 MM
Thread Size	MAJOR DIAMETER MAX 4.978 MM
Thread Size	MAJOR DIAMETER MIN 4.888 MM
Thread Size	MINOR DIAMETER MAX 4.166 MM

Custom Thread Percentage

The *Machinist Calc Pro 2* uses a default Thread Grip Percentage of 75% when calculating Tap Drill sizes. With the custom Percentage Thread function, you can enter a different value to calculate Tap Drill sizes.

Calculate the Tap Drill Size for a 0.25 Inch, 26 TPI screw, then change the Thread Grip Percentage to 50% and calculate the new Tap Drill Size:

Keys	Display
Conv ✕	ALL CLEARED 0.

1. *Enter the Thread Size and calculate the Cut Tap and Roll Tap Drill Sizes:*

Keys	Display
• 2 5 Inch Thread Size	THREAD SIZE 2B 0.25 - INCH
2 6 Thread Size	THREAD SIZE 2B 0.25 - 26 INCH
Thread Size	THREAD PITCH 0.038 INCH
Thread Size	TAP DRILL SIZE #3 0.213 INCH
Thread Size*	ROLL TAP DRILL 5.900 MM

(cont'd)

(cont'd)

2. Change the Thread Grip Percentage to 50% and calculate the new Cut Tap and Roll Tap Drill Sizes:

Keystrokes	Display
5 0 Conv Angle (θ) *(% of Thread)*	**THREAD % - GRIP** **50.**
Thread Size	**THREAD SIZE** **2B 0.25 - 26 INCH**
Thread Size	**THREAD PITCH** **0.038 INCH**
Thread Size	**TAP DRILL SIZE** **#1 0.228 INCH**
Thread Size	**ROLL TAP DRILL** **6.000 MM**

** Repeated presses of Thread Size will scroll through the inputs and outputs starting with the close Fit Drill Size.*

WIRE SIZES AND 3-WIRE MEASUREMENTS

Wire Size

If you know your Thread Size, you can find the Ideal, Maximum and Minimum Wire Sizes you can use for that size Screw Thread.

Find the Ideal, Maximum and Minimum Wire Sizes for measuring a 0.375" Thread with 16 Threads per Inch:

Keystrokes	Display
On/C On/C	**0.**

1. Enter the Thread Size:

Keystrokes	Display
• 3 7 5 Inch Thread Size	**THREAD SIZE** **2B 0.375 - INCH**

2. Enter the Threads per Inch:

Keystrokes	Display
1 6 Thread Size	**THREAD SIZE** **2B 0.375 - 16 INCH**

3. Find the Ideal, Maximum and Minimum Wire Sizes:

Conv SFM *(Wire Size)*	IDEAL WIRE SIZE 0.036 INCH
SFM	MAX WIRE SIZE 0.056 INCH
SFM	MIN WIRE SIZE 0.035 INCH

3-Wire Measurement – *Known Thread Size and Wire Size*

You can find the Minimum and Maximum 3-Wire Measurements as well as the Pitch Diameters if you know the Thread Size and the Wire Size you want to use.

Note: *When solving for 3-Wire Measurements and Pitch Diameters, the calculator assumes the equivalent External Thread Type if an Internal Thread Type is set (i.e., Internal 2B is assumed External 2A for U.S. Threads; Internal 6H is assumed External 6h for Metric Threads).*

Find the Minimum and Maximum allowable 3-Wire Measurements and Pitch Diameters for a 0.375 – 16, Class 2A (External) screw using 0.040 Inch wire:

On/C On/C	0.

1. Set the Thread Class to 2A:

2 Conv Thread Size* *(Thread Class)*	U.S. EXT. THREAD 2A 2.

** If necessary, continue pressing Thread Size until the desired External Thread Class is displayed.*

2. Enter the Thread Size:

• 3 7 5 Inch Thread Size	THREAD SIZE 2A 0.375 - INCH

3. Enter the Threads per Inch:

(cont'd)

(cont'd)

1 6 Thread Size

THREAD SIZE	
2A	0.375 - 16 INCH

*4. Enter the Wire Size**:*

• 0 4 Conv SFM *(Wire Size)*

STORED WIRE SIZE	
	0.04 INCH

5. Find the Minimum 3-Wire Measurement:

Conv RPM *(3W Measure)*

3-WIRE MEASURE	
MIN	0.395 INCH

6. Find the Maximum 3-Wire Measurement:

RPM

3-WIRE MEASURE	
MAX	0.399 INCH

7. Find the Minimum Pitch Diameter:

RPM

PITCH DIAMETER	
MIN	0.329 INCH

8. Find the Maximum Pitch Diameter:

RPM

PITCH DIAMETER	
MAX	0.333 INCH

RPM

STORED WIRE SIZE	
	0.04 INCH

*** If no Wire Size is entered, the calculated Ideal Wire Size will be used to find the 3-Wire Measurement.*

Pitch Diameter – *Known 3-Wire Measurement and Wire Size*

You can also find the measured Pitch Diameter if you know the 3-Wire Measurement and the Wire Size used to obtain the measurement.

Find the Pitch Diameter of a 0.375 -16, Class 2A (External) screw with a 3-Wire Measurement of 0.3975 Inches obtained using a 0.040 Inch wire:

On/C On/C

0.

1. *If necessary, set the Thread Class to 2A:*

[2] [Conv] [Thread Size]* *(Thread Class)*

U.S. EXT. THREAD
2A 2.

* *If necessary, continue pressing [Thread Size] until the desired External Thread Class is displayed.*

2. *Enter the Thread Size:*

[•] [3] [7] [5] [Inch] [Thread Size]

THREAD SIZE
2A 0.375 - INCH

3. *Enter the Threads per Inch:*

[1] [6] [Thread Size]

THREAD SIZE
2A 0.375 - 16 INCH

4. *Enter the Wire Size**:*

[•] [0] [4] [Conv] [SFM] *(Wire Size)*

STORED WIRE SIZE
0.04 INCH

5. *Enter the 3-Wire Measurement:*

[•] [3] [9] [7] [5] [Conv] [RPM] *(3-W Measure)*

3-WIRE MEASURED
0.3975 INCH

6. *Find the Pitch Diameter:*

[RPM]

PITCH DIAMETER
0.332 INCH

[RPM]

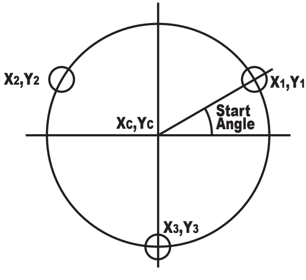
STORED WIRE SIZE
0.04 INCH

***If no Wire Size is entered, the calculated Ideal Wire Size will be used to find the Pitch Diameter.*

BOLT PATTERN

With the *Machinist Calc Pro 2*, you can determine a Bolt Pattern by entering the Bolt Circle Diameter, the Number of Bolt Holes and the Angle of the first bolt hole (optional). You can also enter an optional center x and y-coordinate of the Bolt Pattern.

In addition to calculating the x and y-coordinates for each bolt hole, the Bolt Pattern function also calculates the hole center-to-center spacing (i.e. On-center distance from hole to hole).



Bolt Pattern

Calculate the Bolt Pattern for a layout with a 3.5" Diameter, a 20° Start Angle and 3 Bolts. The center x-coordinate is 10" and the center y-coordinate is 15".

Note: *When determining angles, 0° is at the 3 o'clock position and the rotation goes counterclockwise.*

Keystrokes	Display
On/C On/C	0.

1. Enter the center x-coordinate:

Keystrokes	Display
1 0 Inch Adj (x)	ADJACENT (x) 10. INCH

2. Enter the center y-coordinate:

Keystrokes	Display
1 5 Inch Opp (y)	OPPOSITE (y) 15. INCH

3. Enter the Start Angle:

2 0 Angle (θ)

ANGLE	
(Θ)	20.°

4. Enter Bolt Circle Diameter:

3 • 5 Diam

DIAMETER	
	3.5 INCH

5. Enter the Number of Bolts:

3 Conv Diam *(Bolt Pattern)*

NUMBER OF BOLTS	
	3.

6. Calculate center-to-center Spacing and the x and y coordinates:

Key	Display	
Diam	OC SPACING	3.031 INCH
Diam	BOLT POSITION X-Ø1	11.644 INCH
Diam	BOLT POSITION Y-Ø1	15.599 INCH
Diam	BOLT POSITION X-Ø2	8.659 INCH
Diam	BOLT POSITION Y-Ø2	16.125 INCH
Diam	BOLT POSITION X-Ø3	9.696 INCH
Diam	BOLT POSITION Y-Ø3	13.277 INCH
Diam	BOLT CIRCLE DIA X-Ø2	3.500 INCH
Diam	BOLT PATTERN CTR X-ØØ	10.000 INCH

(cont'd)

(cont'd)

Diam

BOLT PATTERN CTR Y-ØØ 15.000 INCH

Diam

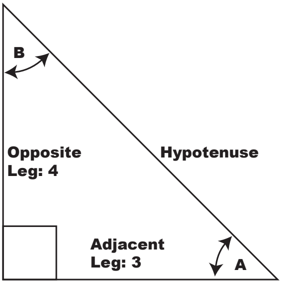
STARTING ANGLE 20.000 °

RIGHT TRIANGLE FUNCTIONS

With the *Machinist Calc Pro 2*, you can easily solve Right Triangle problems by simply entering two of four variables: Adjacent, Opposite, Hypotenuse or Angle.

Right Triangle – *Based on Adjacent and Opposite Legs*

Calculate the Hypotenuse, Angle and Adjacent Angle of a right triangle with an Adjacent Leg of 3 Inches and an Opposite Leg of 4 Inches:



On/C On/C → 0.

1. Enter the Adjacent Leg Length:

3 Inch Adj (x) → ADJACENT (x) 3. INCH

2. Enter the Opposite Leg Length:

4 Inch Opp (y) → OPPOSITE (y) 4. INCH

3. Solve for the Hypotenuse:

[Hyp (r)]

HYPOTENUSE	
(r)	5.000 INCH

4. Solve for the Angle (A):

[Angle (θ)]

ANGLE	
(Θ)	53.130°

5. Solve for the Adjacent Angle (B):

[Angle (θ)]

ADJACENT ANGLE	
	36.870°

Right Triangle – *Based on Hypotenuse and Angle*

Calculate the Adjacent Angle, Adjacent Leg and Opposite Leg of a right triangle with a Hypotenuse of 12 Inches and a known Angle of 35.34°:

[On/C] [On/C]

0.

1. Enter the Hypotenuse:

[1] [2] [Inch] [Hyp (r)]

HYPOTENUSE	
(r)	12. INCH

2. Enter the known Angle:

[3] [5] [•] [3] [4] [Angle (θ)]

ANGLE	
(Θ)	35.34°

3. Solve for the Adjacent Angle:

[Angle (θ)]

ADJACENT ANGLE	
	54.660°

4. Solve for the Adjacent Leg:

[Adj (x)]

ADJACENT	
(x)	9.789 INCH

(cont'd)

(cont'd)

5. Solve for the Opposite Leg:

Keystroke	Display
Opp (y)	OPPOSITE (y) 6.941 INCH

CIRCLE CALCULATIONS

Circumference and Area – *Based on Diameter*

Find the Area and Circumference of a circle with a Diameter of 11 Inches:

Keystroke	Display
On/C On/C	0.
1 1 Inch Diam	DIAMETER 11. INCH
Diam	CIRCULAR AREA 95.033 SQ INCH
Diam	CIRCUMFERENCE 34.558 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)*	23.710833°

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 as 31° 29' 0" or 31.483333°.*

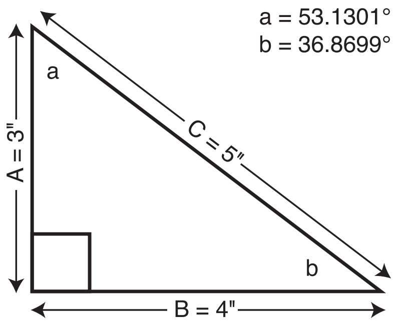
Time Calculations Using D:M:S

Add 7 Hours 45 Minutes 33 Seconds to 11 Hours 16 Minutes 20 Seconds:

On/C On/C	0.
7 • 4 5 • 3 3 +	DMS 7.45.33°
1 1 • 1 6 • 2 0 =	DMS 19.01.53°

Trigonometric Functions

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



Given Side A and angle a, find:

Side C — A ÷ a Conv Opp (y) *(Cos)* =

(e.g., 3 Inch ÷ 5 3 • 1 3 Conv Opp (y) *(Cos)* =)

Side B — A × a Conv Hyp (r) *(Tan)* =

Angle b — 90° − a =

Given Side A and angle b, find:

Side B — A ÷ b Conv Hyp (r) *(Tan)* =

Side C — A ÷ b Conv Adj (x) *(Sine)* =

Angle a — 90° − b =

(cont'd)

(cont'd)

Given Side B and angle a, find:

Side A	B ÷ a Conv Hyp(r) *(Tan)* =
Side C	B ÷ a Conv Adj(x) *(Sine)* =

Given Side C and angle a, find:

Side A	C × a Conv Opp(y) *(Cos)* =
Side B	C × a Conv Adj(x) *(Sine)* =

Given Side A and Side C, find:

Angle a	A ÷ C = Conv Inch *(ArcCos)*
Angle b	A ÷ C = Conv mm *(ArcSine)*

Given Side B and Angle b, find:

Side C	B ÷ b Conv Opp(y) *(Cos)* =
Side A	B × b Conv Hyp(r) *(Tan)* =

APPENDIX A - WORKPIECE MATERIAL CONVERSION TABLE

WORKPIECE MATERIALS CONVERSION TABLE (1 of 3)

Material	Hardness	AISI/ASTM/ SAE	DIN	WR (DIN)	JIS	BS	SS
Low-carbon Steel	120-170 HB	1020	C22	1.0402	S 20 C; S 20 CK S 22 C	055 M 15	1450
Medium-carbon Steel	160-210 HB	1045	C45 Ck 45	1.0503 1.1191	S 45 C S 48 C	080 M 46	1672; 1650
High-carbon Steel	180-230 HB	1060	C60 Ck 60	1.0601 1.1221	S 58 C	060 A 62	1665 1678
Chromium-molybdenum Alloy Steel	175-225 HB	4140	41CrMo4 42CrMo4	1.7223 1.7225	SCM 4 SCM 440 SCM 440 (H) SNB 7	708 M 40	2244
Nickel-chromium-molybdenum Alloy Steel	175-225 HB	4340	40NiCrMo8-4 34CrNiMo6 36CrNiMo4 40NiCrMo6	1.6562 1.6582 1.6511 1.6565	SNB 24-1-5 SNCM 447 SNCM 439	816 M 40; 817 M 40 817 M 37 817 A 37; 818 M 40	2541
Chromium Alloy Steel	175-225 HB	52100	100Cr6	1.3505	SUJ 2	2 S 135; 535 A 99	2258

(cont'd)

(cont'd)

WORKPIECE MATERIALS CONVERSION TABLE (2 of 3)

Material	Hardness	AISI/ASTM/ SAE	DIN	WR (DIN)	JIS	BS	SS
Austenitic Stainless Steel	150-200 HB	304	X5CrNi18-9 X2CrNi19-1; GX2CrNiN18-9 X2CrNiN18-10 X5CrNi18-10 (X4CrNi18-10)	1.4306 1.4311 1.4301	SCS 19, SUS 304 L SUS 304LN SUS 304	304 S 11; LW 20, LWCF 20, S. 536, T. 74, 304 C 12 (LT 196), 305 S 11, 304 S 61, 304 S 15; 304S16; 304 S 17; LW21; LWCF 21; 304 S 31	2352 2371 2332 2333
Austenitic Stainless Steel	150-200 HB	316	X5CrNiMo 17-12-2 (X4CrNiMo 17-12 2) X3CrNiMo 17-13-3 (X5CrNiMo 17-13-3) X6CrNiMoNb 17-12-2	1.4401 1.4436 1.4580	SUS 316	316S13, 17, 19, 31, 33 LW23; LWCF 23 318 S 17	2347 2343
Martensitic Stainless Steel	150-200 HB	410	X6Cr13, X7Cr14 X12Cr13; X10Cr13; GX12Cr13	1.4000; 1.4001 1.4006	SUS 403, 410 S, 429 SUS 410	403 S 17 410S21; 410 C 21; ANC 1A	2301 2302
Ferritic Stainless Steel	135-185 HB	430	X6Cr17	1.4016	SUS 430	430S17; 430 S 18	2320
Mold type Tool Steel	150-200 HB	P20		1.2330			
Hot work type Tool Steel	200-250 HB	H13	X40CrMoV51	1.2344	SKD61	BH13	2242
Copper Al Alloy	120 HB	2024-T3	AlCuMg2	3.1355	A2024, A3x4	2L97, 2L98	

WORKPIECE MATERIALS CONVERSION TABLE (3 of 3)

Material	Hardness	AISI/ASTM/ SAE	DIN	WR (DIN)	JIS	BS	SS
Magnesium and Silicon Al Alloy	95 HB	6061-T6	AlMgSiCu	3.3211	A6061, A2x4	6061, H20, L117, L118	
Silicon, Copper, and Magnesium Cast Al	125 HB	A390.0-T5					
Ti-6Al-4V Alloy	32-36 HRC	Alpha-beta alloy	TiAl6V4			TA 10-13; TA 28	
Ti-10V-2Fe-3Al Alloy	38-41 HRC	Beta alloy					
Nickel-base Heat Resistant alloys	36 HRC	Alloy 718	NiCr19Fe19NbMo	2.4668		HR8	
Nickel-base Heat Resistant alloys	89 HRB	Alloy X	NiCr22FeMo	2.4665		HR6,204	
Cobalt-base Heat Resistant alloy	37 HRC	Haynes alloy 188					

APPENDIX B – DEFAULT SETTINGS

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

STORED VALUES	DEFAULT VALUE
Material	**None**
Process	**Face Milling**
Tool	**High Speed Steel Tool**
Number Of Teeth	**1**
Drill Cut Angle	**118°**
Weight per Volume	**490 Pounds Per Cubic Foot**
% Thread Grip	**75%**
Thread Classification	
U.S. Threads	**Internal 2B**
Metric Threads	**Internal 6H**

If you replace your batteries or perform a Full Reset (turn calculator 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
Default Unit Format Mode	**U.S. Mode**
Fractional Resolution	**1/64"**
Functional Result Rounding	**0.0000**
Area Answer Format	**Standard**
Volume Answer Format	**Standard**
Fractional Mode	**Standard**
Mathematical Operation	**Order of Operations**

** Depressing the Reset button located above the Diam key will also perform a Full Reset.*

APPENDIX C – PREFERENCE SETTINGS

The *Machinist Calc Pro 2* has Preference Settings that allow you to customize or set desired unit formats and calculations. If you replace your batteries or perform a Full Reset* (turn calculator off, hold down ×, and press On/C), your calculator will return to the following settings (in addition to those listed on the previous page), with the default setting for each preference listed first:

**Depressing the Reset button located above the* Diam *key will also perform a Full Reset.*

PREFERENCE	OPTIONS
1) Default Unit Format Mode	– **U.S. MODE:** unitless values stored within Machinist functions are automatically assigned the corresponding default U.S. units of the selected function. – **METRIC MODE:** unitless values stored within Machinist functions are automatically assigned the corresponding default Metric units of the selected function.
2) Fractional Resolution	– **1/64:** displays fractional values to the nearest 64th of an Inch. – **1/2:** displays fractional values to the nearest half Inch. – **1/4:** displays fractional values to the nearest quarter of an Inch. – **1/8:** displays fractional values to the nearest 8th of an Inch. – **1/16:** displays fractional values to the nearest 16th of an Inch. – **1/32:** displays fractional values to the nearest 32nd of an Inch.

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3) Functional Result Rounding	– **0.000 (FIX):** calculation results using Machinist functions are always displayed to three decimal places. – **0.0000 (FIX):** calculation results using Machinist functions are always displayed to four decimal places. – **0. (ACTUAL):** calculation results using Machinist functions are always displayed to the maximum number of decimal places.
4) Area Answer Format	– **STANDARD:** if units entered are the same – e.g., Inch x Inch – area answers will remain in this format (Square Inch), but if units entered are different – e.g., Inches x Feet – area answers 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, regardless of unit entry – e.g., Feet x Feet = Square Inches. – **SQUARE METERS:** area answers always displayed in Square Meters, regardless of unit entry – e.g., Feet x Feet = Square Meters.

5) Volume Answer Format	– **STANDARD:** if units entered are the same – e.g., Inch x Inch x Inch – the answer will remain in this format (Cubic Inch), but if units entered are different – e.g., Feet x Feet x Inches – volume answer will be displayed in Cubic Inch. – **CUBIC FEET:** volume answers always displayed in Cubic Feet, regardless of unit entry – e.g., Inches x Inches x Inches = Cubic Feet. – **CUBIC METERS:** volume answers always displayed in Cubic Meters, regardless of unit entry – e.g., Feet x Feet x Feet = Cubic Meters. – **CUBIC INCHES:** volume answers always displayed in Cubic Inches, regardless of unit entry – e.g., Feet x Feet x Feet = Cubic Inches.
6) Fractional Mode	– **STANDARD:** fractions are displayed to the nearest Fractional Resolution. – **CONSTANT:** fractions are displayed in the set Fractional Resolution.
7) Mathematical Operation	– **ORDER OF OPERATIONS:** the calculator uses the Order of Operations Method (10 + 4 x 5 = 30). – **ORDER OF ENTRY:** the calculator uses the Order of Entry Method (as entered: 10 + 4 x 5 = 70).

APPENDIX D – BASIC CALCULATOR FUNCTIONS AND DIMENSIONAL MATH OPERATIONS

ENTERING DIMENSIONS

Note: *Unlike other Calculated Industries/Construction Master calculators, the* Machinist Calc Pro 2 *does not have a dedicated Feet key. Feet is a secondary function located above the* 7 *key, so you have to use the* Conv *key, then* 7 *to enter or calculate dimensions using Feet. Below are some examples.*

Enter 2 Feet, then label as square and cubic units:

2 Feet	2 Conv 7	**2 FEET**
2 square Feet	Conv 7	**2 SQ FEET**
2 cubic Feet	Conv 7	**2 CU FEET**

Enter 2 Feet, 3 Inches:

2 Conv 7 3 Inch	**2 FEET 3 INCH**

Linear Dimensions

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

23 mils	2 3 /1000"
4.5 Inches	4 • 5 Inch
95 millimeters	9 5 mm
1,320 Feet	1 3 2 0 Conv 7
201 meters	2 0 1 Conv 9

Square and Cubic Dimensions

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

14 square Inches	1 4 Inch Inch
11 square millimeters	1 1 mm mm
1.5 cubic meters	1 • 5 Conv 9 9 9
3 cubic Feet	3 Conv 7 Conv 7 Conv 7

CONVERSIONS

Linear Conversions

Convert 10 Feet 6 Inches to other dimensions, including metric:

On/C On/C	**0.**
1 0 Conv 7 6 Inch	**10 FEET 6 INCH**
Conv /1000" *	**126.000 INCH**
Conv 7 *(Feet)*	**10.5 FEET**
Conv Inch	**126. INCH**
Conv mm	**3200.4 MM**
Conv 5 *(cm)*	**320.04 CM**
Conv 9 *(m)*	**3.2004 M**

** Converting a linear value using the /1000" key will result in the decimal Inch equivalent of the value, rounded to three decimal places. Only unitless values are multiplied by 0.001 Inches when using this key.*

Convert 15 Feet 9-1/2 Inches to decimal Feet. Then convert back to Feet-Inch-Fractions.

On/C On/C	**0.**
1 5 Conv 7 9 Inch 1 / 2	**15 FEET 9-1/2 INCH**
Conv 7 *(Feet)*	**15.791667 FEET**
Conv 7	**15 FEET 9-1/2 INCH**

(cont'd)

(cont'd)

Convert 17.32 Feet to Feet-Inch-Fractions:

On/C On/C	0.
1 7 • 3 2 Conv 7 *(Feet)*	17.32 FEET
= Conv 7	17 FEET 3-27/32 INCH
Conv 7	17.32 FEET
Conv Inch	207.84 INCH
Conv 7 Conv 7	17 FEET 3-27/32 INCH

Convert 8-1/8 Inches to decimal Inches. Then convert to decimal Feet:

On/C On/C	0.
8 Inch 1 / 8	8-1/8 INCH
Conv Inch	8.125 INCH
Conv 7 *(Feet)*	0.6770833 FEET

Convert 9.0625 Inches to decimal Feet.

On/C On/C	0.
9 • 0 6 2 5 Inch	9.0625 INCH
Conv 7 *(Feet)*	0.7552083 FEET

Square and Cubic Conversions

Convert 6 square Feet to other square dimensions:

On/C On/C	0.
6 Conv 7 Conv 7 *(Feet)*	6 SQ FEET
Conv mm	557418.24 SQ MM
Conv 9 *(m)*	0.5574182 SQ M
Conv 5 *(cm)*	5574.1824 SQ CM

Convert 0.05 cubic meters to other dimensions:

On/C On/C	0.
• 0 5 Conv 9 9 9 *(m)*	0.05 CU M
Conv mm	50000000. CU MM
Conv 5 *(cm)*	50000. CU CM
Conv Inch	3051.1872 CU INCH
Conv 7 *(Feet)*	1.7657333 CU FEET

Weight Conversions

Convert 1.5 tons to pounds and kilograms:

On/C On/C	0.
1 • 5 Conv 6 *(tons)*	1.5 TON
Conv 1 *(kg)*	1360.7771 KG
Conv 4 *(lbs)*	3000. LBS

Weight per Volume and Volume Conversions

Convert 2 cubic Feet of stainless steel to pounds, tons, kilograms, and metric tons if the steel weighs 7,480 kilograms per cubic meter:

On/C On/C	0.

1. Store the weight per volume:

7 4 8 0 Conv 0 0 0 0* *(wt/vol)*	KG/CU. METER 7480.

2. Enter steel volume:

2 Conv 7 Conv 7 Conv 7	2 CU FEET

3. Convert to pounds, tons, kilograms and metric tons:

Conv 4 *(lbs)*	LBS. 933.92229

(cont'd)

(cont'd)

Conv 6 *(tons)*	TON 0.4669611
Conv 1 *(kg)*	KG 423.62003
Conv 3 *(met tons)*	MTON 0.42362

4. Change the weight per volume back to the default value:

4 9 0 Conv 0 0 *(wt/vol)*	LBS./ CU. FEET 490.

** The number of 0 presses may vary, depending on the last units displayed when wt/vol was last recalled/stored. By default, pounds per cubic foot is displayed first.*

Calculating Percentages

The % key 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).
Find 18% of 50 Feet:

On/C On/C	0.
5 0 Conv 7 × 1 8 %	9. FEET

Take 20% from 17 Feet 6 Inches:

1 7 Conv 7 6 Inch − 2 0 %	14 FEET 0 INCH

BASIC MATH OPERATIONS

Adding and Subtracting 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:

6 Conv 7 2 Inch 1 / 2 +	6 FEET 2-1/2 INCH
1 1 Conv 7 5 Inch 1 / 4 +	17 FEET 7-3/4 INCH
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:

5 Conv 7 3 Inch ×	5 FEET 3 INCH
1 1 Conv 7 6 Inch 1 / 2 =	60.59375 SQ FEET

Multiply 2 Feet 7 Inches by 10:

2 Conv 7 7 Inch × 1 0 =	25 FEET 10 INCH

Dividing Dimensions

Divide 30 Feet 4 Inches by 7 Inches:

3 0 Conv 7 4 Inch ÷ 7 Inch =	52.

Divide 20 Feet 3 Inches by 9:

2 0 Conv 7 3 Inch ÷ 9 =	2 FEET 3 INCH

APPENDIX E – ACCURACY/ERRORS, AUTO SHUT-OFF, BATTERIES, RESET

ERROR CODES

DISPLAY	ERROR TYPE
OVERFLOW	Overflow (too large)
MATH ERROR	Divide by 0
DIMENSION ERROR	Dimension error
ENTRY ERROR	Invalid entry error

AUTO SHUT-OFF

Your calculator is designed to shut off after about 4 minutes of non-use.

BATTERY

The *Machinist Calc Pro 2* uses one CR2025 (included). This should last approximately 800 hours of actual use. Should your calculator display become very dim or erratic, replace the battery.

***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

While the calculator is off, turn the calculator over and use a #1 Phillips screwdriver to remove the battery holder screw located near the center at the top. With the screw removed, pull battery holder out, remove old battery, and slide new battery into holder. The negative side of the battery should be facing you as you insert the battery holder into the calculator. Replace screw using a #1 Phillips screwdriver.

RESET

If your calculator should ever "lock up," insert the tip of a paperclip or a small diameter wire into the small Reset hole above the **Diam** key.

REPAIR AND RETURN

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 battery 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 from 7 a.m. to 4 p.m. Pacific Time for additional information and a Return Authorization (RA).

Call Toll Free: 1-800-854-8075
Outside USA: 775-885-4900
www.calculated.com/warranty

WARRANTY

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 measuring instruments, is always looking for new product ideas in these areas.

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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

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