SONIN®

InchMate® PRO

Reference Guide

Professional Foot / Inch / Fraction Calculator

OPTICS PLANET INC™

Model DT210 CE

SONIN INC.
Phone: 800-223-7511 • Website: www.sonin.com

Printed in China 019-0000-0003 Rev.2

CONTENTS

CONTENTS

INTRODUCTION

If you build or design things you know the importance of working with accurate dimensions. The most frustrating and costly construction headaches can usually be traced to dimensional errors.

The INCH[MATE] PRO is part of the new generation of Sonin Feet-Inch-fraction Calculators… helping people who work with dimensions to simplify difficult and tedious calculations.

KEY PAD INFORMATION

General Purpose Keys

Note: The key to be pressed appears between the left and right brackets, e.g., **[+]** except when referring to numerals.

[On/Off] Turns calculator ON and OFF.
To save the battery, calculator will turn off automatically after approximately 10 - 12 minutes of inactivity at which time the displayed value and memory content will be cleared.

[CE/CLR] Press this key once clears the current entry. Pressing it twice clears display to "0". Memory register & default setting are not affected.

[0] to **[9]** Enters the numbers 0 thru 9 into the display.

KEY PAD INFORMATION

[+] [−] [×] [÷] Performs arithmetic operation.

[=] Completes all previously entered arithmetic operations and displays the result.

[·] Enters a decimal point.

[2ND] Activates the 2ND Function for designated keys. 2ND function is indicated above keys.

[%] **Percent** is used to find a given percentage of a number.

[2ND] [6] X^2 is used to take the square (quantity multiplied by itself) of the number on the display. No operation is performed if the square of an area or cubic dimensioned number is taken, Error will be displayed.

[2ND] [9] Square Root - $\sqrt{\ }$ takes the square root of a number. Error will display if you try to take square root of a linear or volume value.

Memory Keys

[M+] If memory is clear, enters displayed quantity into memory. If a value is already stored in memory this will add displayed quantity to memory.

KEY PAD INFORMATION

[2ND] [M+] **Subtracts** displayed quantity from memory. The result is then placed in memory.

[RCL] **Memory Recall** retrieves data from selected memory & displays it.
NOTE: To display & keep in memory press **[RCL] [M+]** . To display and remove from memory press **[RCL] [RCL]**.

[2ND] [RCL] **CLEARS MEMORY** without displaying it.

Other Functions Keys

[Cost] **Cost** is used when calculating the cost of items.

[2ND] [%] **Restore Defaults** allows the calculator to restore ALL changed default values (NOTE: effects Wt/Vol., fraction, stair, rake, jack & hip/valley settings).

[2ND] [3] π is used to insert the value of Pi (3.141592) onto the display for use in subsequent calculations, or for use as part of a mathematical process.

[2ND] [0] **English/Metric Mode** changes the first function Imperial unit keys to their corresponding metric unit functions. It allows the user to enter a series of

KEY PAD INFORMATION

metric values without having to use the second function key. The **Metric** icon is active when the metric mode has been selected. To return back to English mode press **[2ND] [0]** again.

[2ND] [=] **Paperless Tape Review** Access.

[2ND] [·] **Paperless Tape Review** Exit.

[2ND] [5] **Weight Per Volume** displays and enters a weight per volume (density) to be used in calculating weight. (see Default Values)

[2ND] [8] **Weight** is used to calculate the total weight of a volume of material.

[2ND] [–] **+/- Change Sign** changes the sign of displayed value between positive and negative.

[2ND] [÷] **Inverse** 1/X divides the number 1 by the number on the display

Dimension Keys

[Yard] **Yards** Use for entering or converting yards.

[Feet] **Feet** Use for entering or converting feet. You may stop entry after feet or continue by entering inches and fractions.

KEY PAD INFORMATION

[Inch] **Inch** Use for entering inches. You may continue by entering fractions. Or press twice for decimal inches.

[/ 2] [/ 4] [/ 8] [/ 16] [/ 32] [/ 64] **Fraction of an Inch Denominator keys-** They complete your fraction entries. Only fraction inches are defined.

[2ND] [Yard] **m** Use for entering or converting meters.

[2ND] [Feet] **cm** Use for entering or converting centimeters.

[2ND] [Inch] **mm** Use for entering or converting millimeters.

[Sq] **Square** Use for entering square units. Press the **[Sq]** key before the units key. Example: Enter **5 [Sq] [Feet]**

[2ND] [Sq] **Cube** Use for entering cubic units. Press **[2ND] [Sq]** before the entering units key. Example: Enter **5 [2ND] [Sq] [Feet]**

[2ND] [1] **Bd Ft** Use for entering or converting board feet.

[2ND] [7] **Circle** is used to find the circumference and area of a known diameter of a circle.

KEY PAD INFORMATION

[2ND] [4] **Arc** is used to find the length of an arc after diameter and angle are entered.

[2ND] [2] [/ 2] ⋮ [/ 64] **Fixed Fraction** mode is used to select a desired fraction result.

Triangle Keys

[Pitch] **Pitch** is used to calculate the pitch (slope) of a right triangle. Once pitch entered continued pressing of pitch key will cycle through Angle, Rise and Ratio.

[Run] **Run** is used to enter or calculate. To calculate the run, you must enter any two of the following: rise, pitch, diagonal (length).

[Rise] **Rise** is used to enter or calculate. To calculate the rise, you must enter any two of the following: run, pitch diagonal (length)

[Diag] **Diagonal**/Length is used to enter or calculate. To calculate the diagonal/length, you must enter any two of the following: Rise, Run, Pitch.

To activate battery, carefully remove plastic tab from battery compartment.

Your calculator utilizes chaining logic allowing you to carry our successive intermediate operations using the **[=]** key to finalize operations. See page 25 for Chaining

3 + 5 =	8.
9 − 5 =	4.
4 × 7 =	28.
7 2 ÷ 9 =	8.

Working with Dimensions and Units

When entering dimensional values, you must always enter the largest dimension first. When entering fractions, enter the numerator followed by the dedicated denominator key (**[/2] ... [/64]**). If an operation is performed with mixed units, your calculator will automatically convert the result to the units of first entry.

Addition:

Enter 5 Feet 7 Inch +
6 Feet 9 Inch 1 / 16 =

12 Ft - 4 1/16 INCH

Enter 5 · 7 Feet +
6 · 6 Feet =

12.3 Ft

Subtract:

Enter 9 Feet 1 1 Inch −
3 Feet 4 Inch 1 / 4 =

6 Ft - 6 3/4 INCH

Enter 2 0 Feet −
6 · 7 5 Feet =

13 Ft - 3 INCH

Multiply:

Enter 1 8 Feet ×
1 · 2 Feet =

21.6 SQ Ft

Enter 1 8 Inch × 3 =

54 INCH

Divide:

Enter 3 6 Inch ÷ 3 =

12 INCH

Enter 1 4 Feet 3 / 32 ÷ 2 =

7 Ft - 0 3/64 INCH

Enter 5 Inch ÷ 2 Inch =

2.5

DEFAULT SETTINGS

Reduced Fraction Mode

Your calculator is set to Reduced Fraction mode which give the most accurate result (to the /64th). To change your results to a Fixed Fraction you must press **[2ND] [2]** and desired denominator. The FIX icon will blink. To confirm your selection press **[2ND]** again.

Example: To change to /8th fixed fraction:
Press 2ND 2 / 8 2ND. Your calculations will now result to the nearest /8th.

To Restore back to Reduced Fraction Mode press **[2ND] [2]**

Weight/Volume

The density default values are 1.5 Tons/Cu Yd, 3000 lb/Cu Yd, and 1779.829 kg/Cu M. The density is used in calculating weight. When using English units, the density is entered as tons per cubic yard or pounds per cubic yard; when using metric units, the density is entered as kilograms per cubic meter.

You can recall the density by entering **[2ND] [5]**. Continuing to press 5 causes the calculator to cycle through the various units: Tons/Cu Yd, LB/Cu Yd and kg/Cu M. You can set a new density by entering the weight followed by **[2ND] [5]**.

Example: To change and work in a density of 4000 LB/CuYd.
Enter: 4 0 0 0
2ND 5 5
Display : **4000 LB/Cu Yd**

To store and proceed press **[CE/CLR]**. Your Wt/Vol. is now set at 4000 Lb/CuYD

CONVERSIONS

Linear Conversions

	Key Sequence	Result Displayed
To Convert 1 Yard	**1 [Yard]**	**1. Yd**
To Feet	**[Feet]**	**3. Ft**
To Inches	**[Inch]**	**36. INCH**
To Centimeters	**[2ND] [Feet]**	**91.44 CM**

To convert between decimal feet and feet, inch, fractions press the **[Feet]** key to cycle through them.

	Key Sequence	Result Displayed
Convert 1.6 feet	**1.6 [Feet]**	**1.6 Ft**
To feet, inch, fraction	**[Feet]**	**1 Ft- 7 13/64 INCH**

To convert a displayed fraction to another, only the desired fraction key need to be pressed

	Key Sequence	Result Displayed
Convert 7/32"	**7 [/32]**	**0 7/32 INCH**
To /16th	**[2ND] [/16]**	**0 4/16 INCH**

Area Conversions

	Key Sequence	Result Displayed
Convert 10.5625 Sq Ft	**10.5625 [Sq] [Feet]**	**10.5625 SQ Ft**
To Square Meters	**[2ND] [Yard]**	**0.981288 SQ M**
To Square Centimeters	**[2ND] [Feet]**	**9812.884 SQ CM**

Volume Conversions

	Key Sequence	Result Displayed
Convert 9 Cubic Meters	**9 [2ND] [Sq] [2ND] [Yard]**	**9. CU M**
To Cubic Feet	**[Feet]**	**317.832 CU Ft**
To Cubic Inches	**[Inch]**	**549213.7 CU INCH**

Temperature Conversion

	Key Sequence	Result Displayed
Convert 104°F To Celsius	**104 [F°] [2ND] [F°]**	**104. °F 40. °C**

Paperless Tape Review

The Paperless Tape Review feature allows you to review up to 20 entry steps and calculation results. The display will show the entered or calculated value, along with the entry step number.

Clear Calculator and enter a string of numbers (i.e. 2 + 3 + 4 - 6 + 7 = 10)

Enter Tape Review [2ND] [=] **Tape** icon is activated
Display will read **Tape 06 = 10.**

The **[+]** and **[-]** keys allow you to step forward and backward through the last 20 steps entered into the calculator. After the initial display of the result, the **[+]** key starts sequencing through the series of entries and calculations starting with the first step of the sequence. The **[-]** starts sequencing through the series in the reverse order starting with the next to last entry.

To review 2 + 3 + 4 - 6 + 7 = 10 in the forward direction

Key Sequence	Result Displayed	
[2ND] [=]	**Tape** 06=	**10.**
[+]	**Tape** 01	**2.**
[+]	**Tape** 02+	**3.**
[+]	**Tape** 03+	**4.**
[+]	**Tape** 04-	**6.**
[+]	**Tape** 05+	**7.**
[+]	**Tape** 06=	**10.**

GETTING STARTED

To review in the reverse direction

Key Sequence	Result Displayed	
[-]	Tape 05+	7.
[-]	Tape 04-	6.
Etc.		

Note: If more than one series of calculations have been performed, the Paperless Tape will only review the last series of calculations. Previous series of calculations will be deleted.

Example:

Enter Calculation Series #1:

[1] [+] [2] [+] [3] [+] [4] [=]

10.

Then Enter Calculation Series #2:

[2] [Feet] [×] [3] [Feet] [×] [4] [Feet] [=]

24 CU Ft

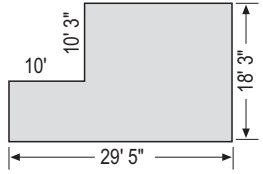
Your paperless tape will only review the Calculation Series #2

To exit Paperless Tape Review press [2ND] [·] .

EXAMPLE PROBLEMS

Complex Area

Determining the square feet of an "L" shaped room when depth is unknown.



Enter: [2ND] [RCL] to clear Memory.

Enter: [1] [8] [Feet] [3] [Inch] [×]
[2] [9] [Feet] [5] [Inch] [=]

Answer: **536.8542 SQ Ft**

Press: [M+] to store in memory.

Enter: [1] [0] [Feet] [×]
[1] [0] [Feet] [3] [Inch] [=]

Answer: **102.5 SQ Ft**

Press: [2ND] [M+] (to subtract from memory) then

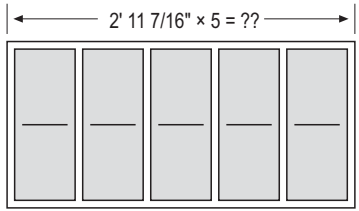
Press: [RCL] [RCL] to recall total **434.3542 SQ Ft**.

NOTE: **[RCL] [RCL]** should only be used when you no longer need to keep in memory otherwise use **[RCL] [M+]** to recall and keep in memory.

EXAMPLE PROBLEMS

Carpentry Rough Opening

Given 5 windows, each 2' 11 7/16" wide, find their overall width if they are placed side by side in a wall.

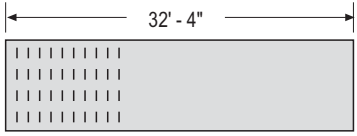


Enter: [2] [Feet] [1] [1] [Inch] [7] [/ 16]
[×] [5] [=]

Answer: **14 Ft- 9 3/16 INCH**

Carpentry – Joist Numbers

Find the number of joists on 16" centers needed for a 32' 4" long room.



Enter: [3] [2] [Feet] [4] [Inch] [÷]
[1] [6] [Inch] [=]

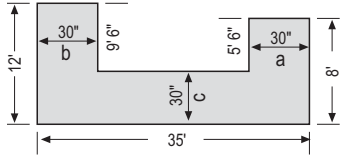
Answer: **24.25**

(Add 1 for the end = **25.25** and round up to **26**)

EXAMPLE PROBLEMS

Costing a Concrete Walkway

To find the cost of concrete for this courtyard when the concrete costs $50.00 per cubic yard:



Press [2ND] [RCL] to clear Memory.

First you must find the area of {a} – Enter:

[5] [Feet] [6] [Inch] [×] [3] [0] [Inch] [=]

Answer: **13.75 SQ Ft** Press [M+] to add to memory.

Find Area of {b} – Enter:

[9] [Feet] [6] [Inch] [×] [3] [0] [Inch] [=]

Answer: **23.75 SQ Ft** Press [M+] to add to memory.

Find Area of {c} – Enter:

[3] [5] [Feet] [×] [3] [0] [Inch] [=]

Answer: **87.5 SQFt** Press [M+] to store in memory.

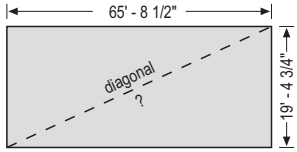
Press [RCL] [RCL] to recall 125 total SQ Ft
then multiply by depth [×] [4] [Inch] [=]
Answer: **41.66667 CU Ft**

To convert to Cubic Yards press [Yard]
Answer: **1.54321 CU Yd** Press: [×] [5] [0] [Cost]
Answer: **$77.16**

EXAMPLE PROBLEMS

Squaring a Foundation

Calculate the DIAGONAL of this rectangle



Press: [6] [5] [Feet] [8] [Inch] [1] [/ 2] [Run]
Then [1] [9] [Feet] [4] [Inch]
[3] [/ 4] [Rise] [Diag]

Answer: **68 Ft - 6 9/64 INCH**
To convert answer to /8ths press [2ND] [/ 8]

Board Feet Lumber

Find the total cost for eight 2 inch x 4 inch x 12 foot piece of lumber when the unit price is $1.60/Bd Ft.

Enter: [2] [×] [4] [×] [1] [2] [2ND] [1]
Answer: **8. B Ft**

Then press: [×] [8] [=]
Answer: **64. B Ft**

Then press: [×] [1] [·] [6] [Cost]
Answer: **$102.40**

Remember: 1 board foot is 144 cubic inches or 0.08333 cubic foot of lumber, conversions can only be done to and from other cubic measurements.

EXAMPLE PROBLEMS

Circle Solutions

After entering the diameter of a circle, the Circle function is used to find the circumference and area of a circle. After finding the circumference of a circle, the area of the circle may be found by entering **[7]** a second time. Entering **[7]** a third time displays the circle diameter.

Circumference & Area

To find the circumference and the area of a circle whose diameter is 10 inches.

Enter	*Display*
[1] [0] [Inch] [2ND] [7]	**DIA 10 INCH**
[7]	**CIRC 31 27/64 INCH**
[7]	**AREA 78.53982 SQ INCH**

Arc Length

The Arc function is used to find the length of an arc. Note that the circumference will display as soon as **[2ND] [7]** is pressed, and will remain on the display until **[2ND] [4]** is pressed. To find the arc length of an 85° arc whose diameter is 5 inches.

Enter	*Display*
[5] [Inch] [2ND] [7]	**DIA 5 INCH**
[8] [5] [2ND] [4]	**ARC 3 45/64 INCH**

EXAMPLE PROBLEMS

Simple Concrete Footings

Determine how much cement is needed to pour 5 concrete footings that have an 8 inch diameter and are 12 inches deep

Enter Diameter by pressing: [8] [Inch] [2ND] [7]

Find surface area by continuing to press the: [7] key twice.

Answer: **AREA 50.26548 SQ INCH**

Then compute volume by entering: [×] [1] [2] [Inch] [=]

Answer: **603.1858 CU INCH**

Then multiply: [×] [5] [=]

Answer: **3015.929 CU INCH**

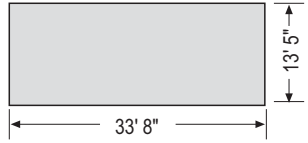
Convert to feet by pressing: [Feet]

Answer: **1.745329 CU Ft**

EXAMPLE PROBLEMS

Concrete Weight/Volume

Determine the weight and volume for this concrete patio. Use default 1.5Tn/Cu Yd and depth of 6"



First check weight/volume default by pressing **[2ND] [5]**. If not 1.5 Tn/Cu Yd see **"Default Section"**

Enter: [3] [3] [Feet] [8] [Inch] [×] [1] [3] [Feet] [5] [Inch] [×] [6] [Inch] [=]

Answer: **225.8472 CU Ft**

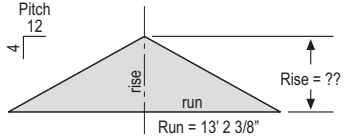
Convert to Cubic yards: Press [Yard]
Answer: **8.364712 CU Yd**

To determine weight: Press [2ND] [8]
Answer: **12.54707 Tn**

EXAMPLE PROBLEMS

Roof Rise

Given any two - pitch, rise, run or diagonal – will automatically solve for the other two. Here is a useful calculation in determining wall heights. This example will figure the RISE of a roof knowing the PITCH is 4 in 12 and the RUN is 13' - 2 3/8"

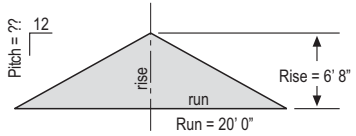


Remember: The PITCH of a roof equals its RISE in INCHES over a RUN of 12" thus a 4/12 roof has a SLOPE of 4". (when entering SLOPE always use inches) In Metric – pitch is expressed in millimeters over 1,000 millimeters of run.

Enter	*Display*
[4] [Inch] [Pitch]	**PTCH 4 INCH**
[1] [3] [Feet] [2] [Inch] [3] [/ 8] [Run]	**RUN 13 Ft - 2 3/8 INCH**
[Rise]	**RISE 4 Ft - 4 51/64 INCH**
[Diag]	**DIAG 13 Ft - 10 15/16 INCH**
[Pitch]	**PTCH 4 INCH**
[Pitch]	**PTCH 0.333333 (In Ratio)**
[Pitch]	**PTCH 18.43495°**

EXAMPLE PROBLEMS

Roof Pitch – Given Rise & Run



Enter	*Display*
6 Feet 8 Inch Rise	**RISE 6 Ft- 8 INCH**
2 0 Feet Run	**RUN 20 Ft- 0 INCH**
Pitch Pitch	**PTCH 4 INCH**

Remember: Pitch is always rise in inches over a run of 12 inches.

REFERENCE

Chaining

Your calculator utilizes chaining logic allowing you to carry out successive intermediate operations using the **[=]** key to finalize operations. Since the chaining logic works from left to right, you must use care when combining operation such as addition and multiplication by first addressing operations within brackets.

Example: 1 + 2 x 3 + 4 = 13 Enter the values and operators as they are written and press [=] to get the answer.

Example: (1 + 2) x (3 + 4) = 21
Enter… **1 [+] 2 [=] [M+]**
Then enter… **3 [+] 4 [x] [RCL] [M+] [=]**

NOTE:
To recall and remove from memory press **[RCL] [RCL]**.
To recall & keep in memory storage press **[RCL] [M+]**.

Error/Overflow

An error/overflow condition occurs when the result of a calculation has more than 7 digits to the left of the decimal point, or when you attempt to divide a value by zero or calculate mixed units that are not alike. An Error condition is indicated by the "**Error"** displayed. You must clear the calculator display by pressing **[CE/CLR]** before continuing operations. Clearing an Error condition will not clear values stored in the memory registers.

Auto-Range

If the input or calculation result with small units is out of the 7 digit range of the display, the answer will be expressed in

REFERENCE

the next larger units instead of showing "**Error"**

Care

Don't leave calculator in direct sunlight for long periods, or store it where excessive temperatures are possible. Don't leave the calculator on when not in use (NOTE- To save the battery, calculator will turn off automatically after 10-12 minutes of inactivity, at which time the displayed value and memory contents will be cleared.

Battery

This unit requires one 3V lithium battery (CR2016 or equivalent). The average battery operating life is 1000 hours. When the display slows down and/or becomes dim, it is time for a new battery.

To change the battery
1.) Turn power off.
2.) Remove screw from battery lid & slide cover off.
3.) Before removing the battery, be sure to touch a metal object. This is to avoid any accidental discharge of static electricity, which may harm the circuit board.
4.) Install new battery with the (+) side up.

Resetting Your Calculator

To reset your calculator, turn unit over and see "RESET". Press with point of ball point pen. You calculator is now reset.

NOTE: RESETTING YOUR CALCULATOR WILL ERASE ANYTHING IN MEMORY OR PAPERLESS TAPE.

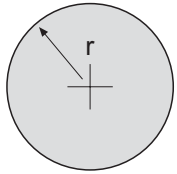
Conversion Tables

1 square inch	= 6.4515 sq centimeters
1 square foot	= 144 square inches
1 square foot	= 0.92903 sq meters
1 square yard	= 9 square feet
1 square yard	= 0.836127 sq meters
1 cubic inch	= 16.3871 cu centimeters
1 cubic foot	= 1728 cubic inches
1 cubic foot	= 0.02831 cu meters
1 cubic yard	= 27 cubic feet
1 cubic yard	= 0.76455 cu meters
1 mile	= 5,280 feet
1 mile	= 1.609344 kilometers
1 acre	= 43,560 square feet
1 ounce	= 28.349532 grams
1 pound	= 0.4535924 kilograms
1 (U.S.) gallon	= 3.7854118 liters
1 (U.K.) gallon	= 4.546090 liters
1 fluid ounce	= 29.574 milliliters
Fahrenheit	= 9/5 (C) + 32
Centigrade	= 5/9 (F - 32)
pi (π)	= 3.141593

Area Formulas

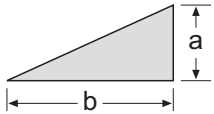
Circle

$$\pi r^2$$



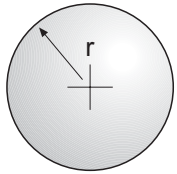
Triangle

$$\frac{ab}{2}$$



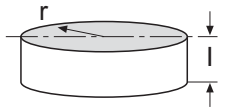
Sphere

$$4\pi r^2$$



Cylinder

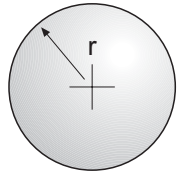
$$2\pi r(r+l)$$



Volume Formulas

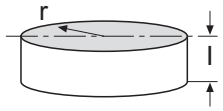
Sphere

$$\frac{4\pi r^3}{3}$$



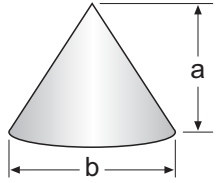
Cylinder

$$\pi r^2 l$$



Cone

$$\frac{\pi b^2 a}{12}$$



APPENDIX

Lumber Sizes

Normal Size	Actual Size (S4S)
1" x 2"	3/4" x 1 1/2"
1" x 3"	3/4" x 2 1/2"
1" x 4"	3/4" x 3 1/2"
1" x 6"	3/4" x 5 1/2"
1" x 8"	3/4" x 7 1/4"
1" x 10"	3/4" x 9 1/4"
1" x 12"	3/4" x 11 1/4"
2" x 2"	1 1/2" x 1 1/2"
2" x 3"	1 1/2" x 2 1/2"
2" x 4"	1 1/2" x 3 1/2"
2" x 6"	1 1/2" x 5 1/2"
2" x 8"	1 1/2" x 7 1/4"
2" x 10"	1 1/2" x 9 1/4"
2" x 12"	1 1/2" x 11 1/4"
4" x 4"	3 1/2" x 3 1/2"
4" x 6"	3 1/2" x 5 1/2"
4" x 8"	3 1/2" x 7 1/4"
4" x 10"	3 1/2" x 9 1/4"
4" x 12"	3 1/2" x 11 1/2"

APPENDIX

FCC Statement

This device has been tested and found to comply with the limits for a Class B device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This device generates, uses and can radiate radio frequency energy and, if not used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the device off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase separation between the device and receiver

CUSTOMER SERVICE

TECHNICAL ASSISTANCE

If you have any questions or need technical assistance, e-mail to:

technicalsupport@sonin.com

CUSTOMER SERVICE

SONIN takes pride in offering unmatched customer service to owners of SONIN products. If you have any questions or would like additional information, please call:

1 - 800 - 223 - 7511 (USA)

or e-mail to:

customerservice@sonin.com