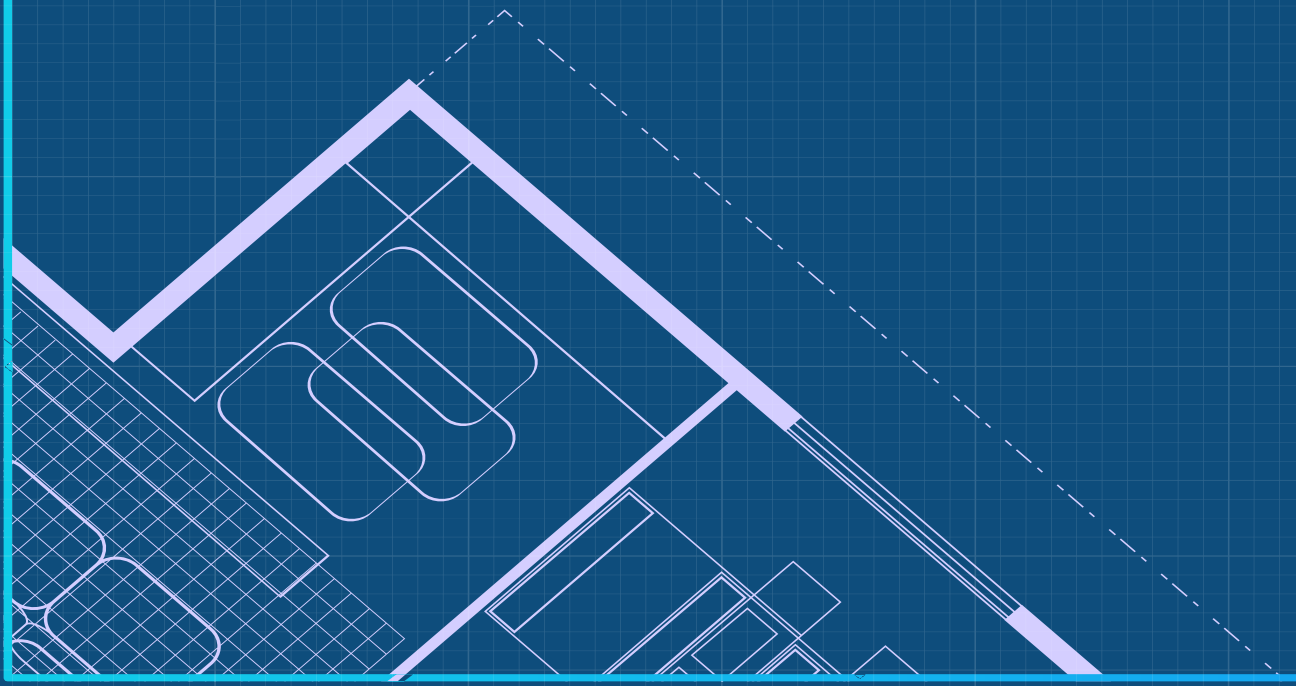

CAUTION
ENTERING
CONSTRUCTION
ZONE

CONSTRUCTION CALCULATORS



Chuck McCord

HHC 2025

September 2025

Rev J

CONSTRUCTION CALCULATORS

Topics

What is a Construction Calculator? 4 Defining Characteristics

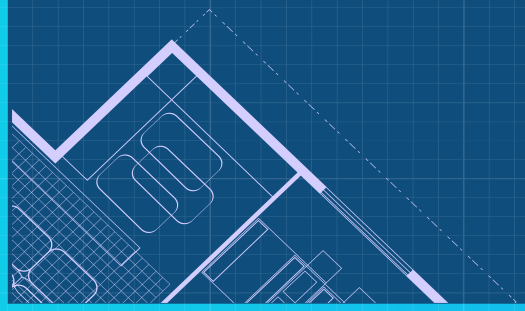
- Why Feet-Inches Input
- 2 Feet-Inches Input Methods & their displays & keyboards
  - Prompted Entry
  - Key Driven Entry
- Feet-Inch-Fraction Patents (shout-out to HP65 Users' Lib)
- Triangle Solvers

Models from 2 Manufacturers (Sonin, Calculated Industries Pics/Ads)

Extras (application solutions, numerical accuracy)

Availability / Where to buy

Doing this on HP calculators (including obligatory keystroke programs)



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CONSTRUCTION CALCULATORS

4 Defining Characteristics

Foot Inch Fraction Input and Display

Triangle Calculator (Stair and Roof Solvers)

Color (they're yellow)

Product name ("Construction" or "Inch" is in their name)

Construction Master, Construction Pro
INCHmate+®, InchMate® 2000…

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WHY FEET AND INCHES?

- It's how we think
  4.3125' vs. 4' 3 ¾ "
- Most rulers are in feet and inches

- Decimal feet is not directly usable unless you have an Engineering Scale tape like this:

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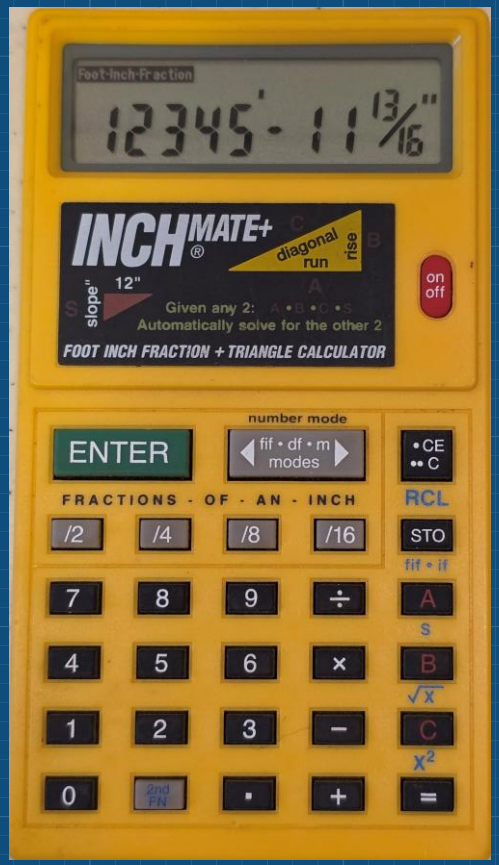
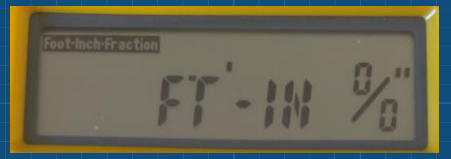
CONSTRUCTION CALCULATORS

Prompted Entry Sequence

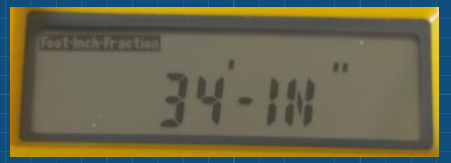


Flashing FT'



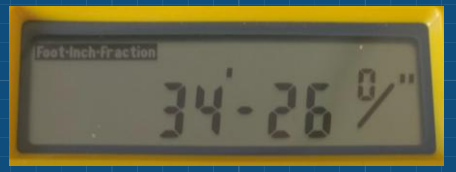
3 4 ENTER

Flashing IN"



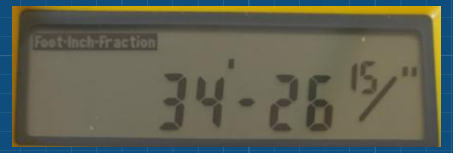
2 6 ENTER

Flashing 0/

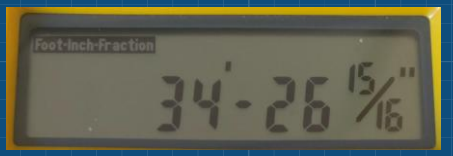


1 5

Flashing "



/16



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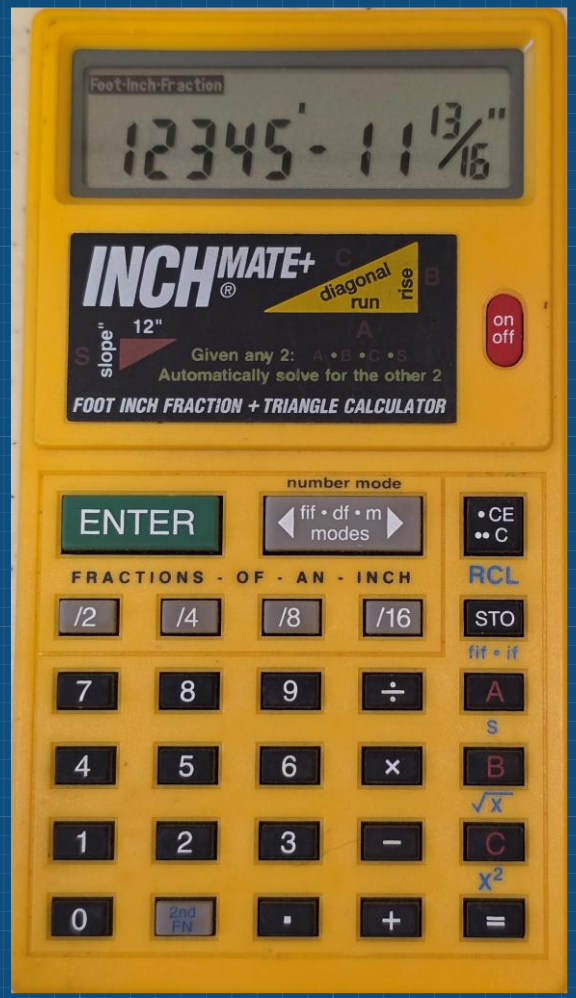
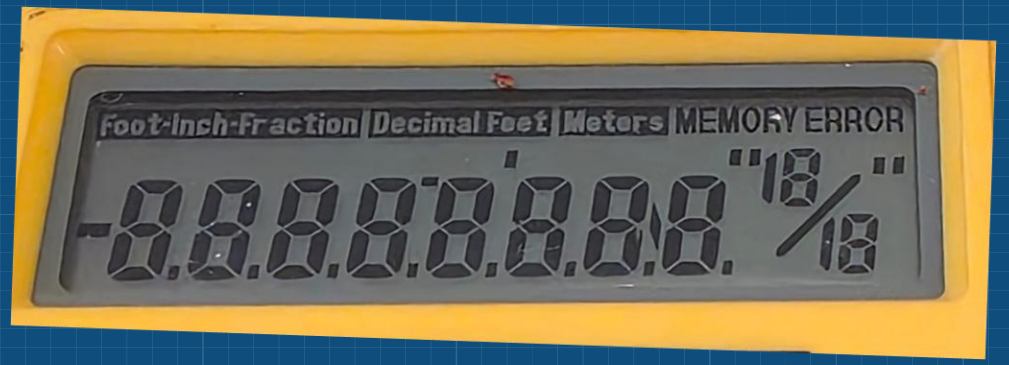
CONSTRUCTION CALCULATORS

Prompted Entry Calculator - Keyboard and Display





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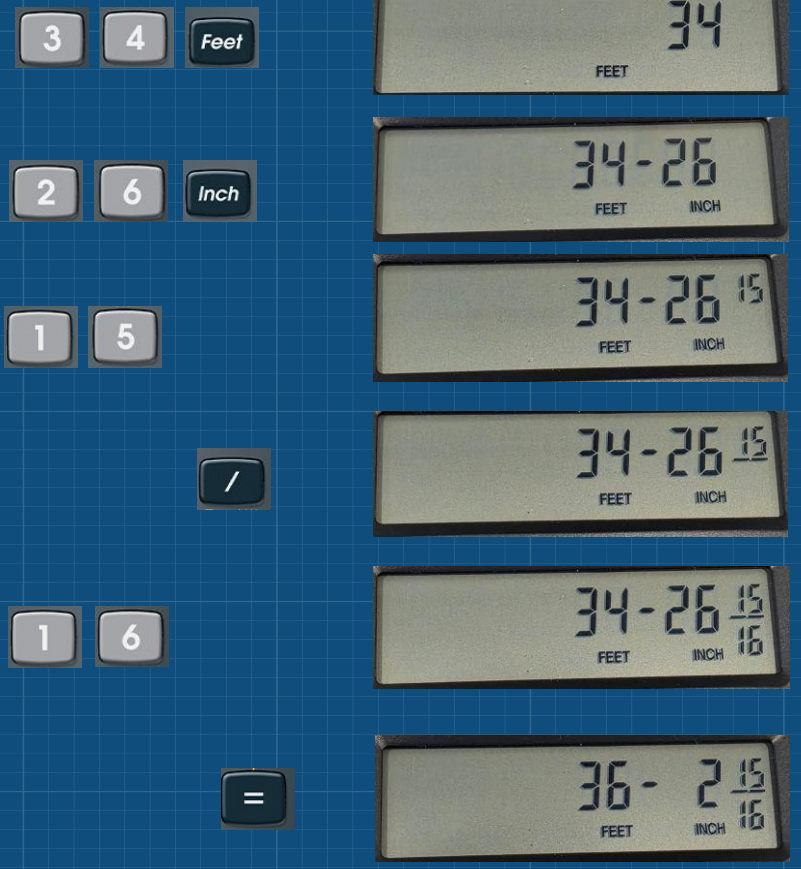
CONSTRUCTION CALCULATORS

Key Driven Entry Sequence



CONSTRUCTION CALCULATORS

Key Driven Entry Sequence + Math

3 4 Feet → 34 FEET

2 6 Inch → 34-26 FEET INCH

1 5 → 34-26 15 FEET INCH

/ → 34-26 15/16 FEET INCH

1 6 → 34-26 15/16 FEET INCH

+ → 36- 2 15/16 FEET INCH

7 Feet → 7 FEET

1 0 Inch → 7- 10 FEET INCH

3 8 → 7- 10 38 FEET INCH

/ → 7- 10 38/64 FEET INCH

6 4 → 7- 10 38/64 FEET INCH

= → 44- 1 17/32 FEET INCH

÷ 3 = → 14- 8 33/64 FEET INCH

× 2 = → 29- 5 1/64 FEET INCH

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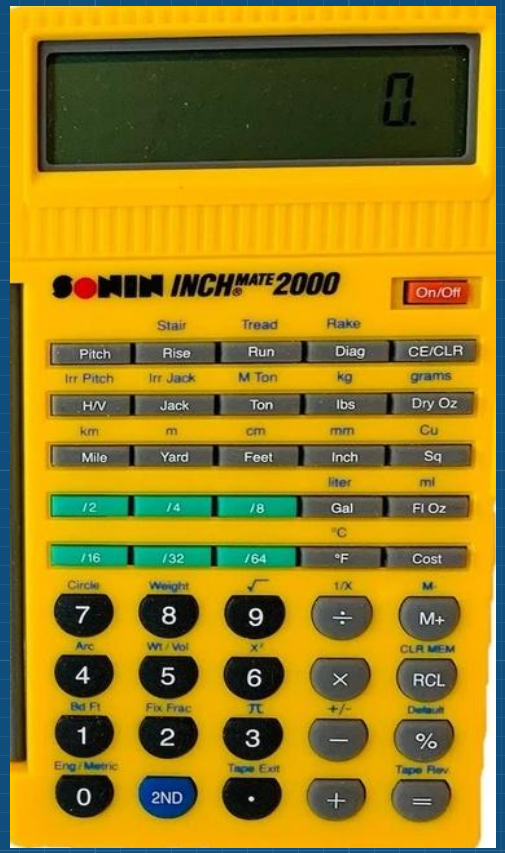
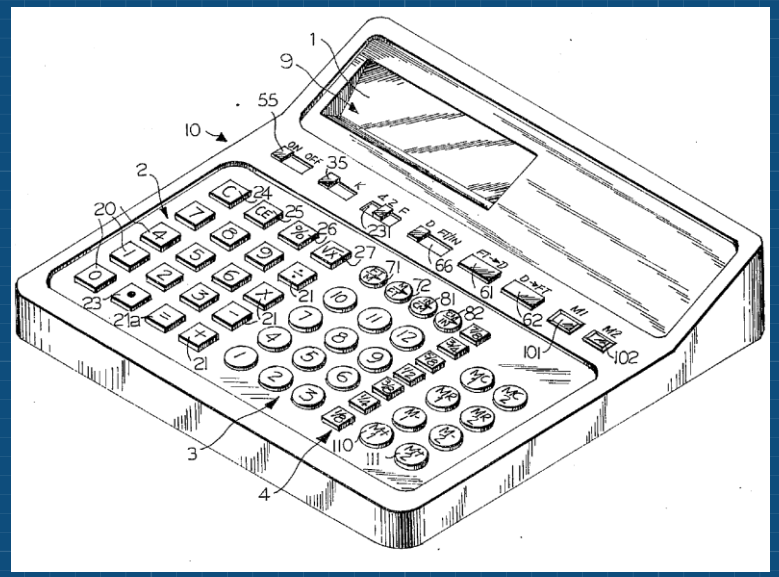
CONSTRUCTION CALCULATORS

Key Driven Entry - Keyboard and Display

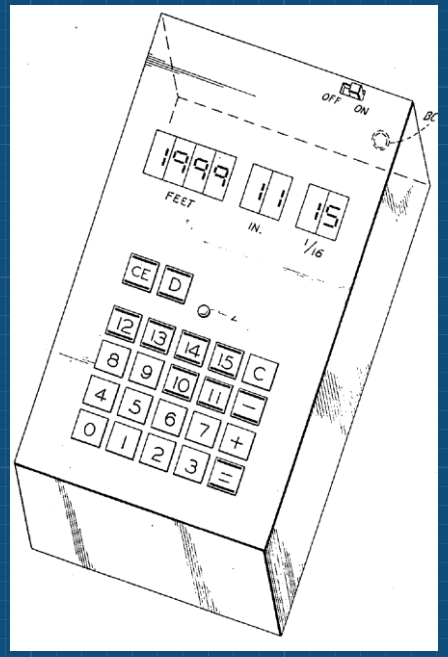


LCDs are complex with Prompt text segments on left, fractions on right and annunciators top and bottom. What *don't* you see?

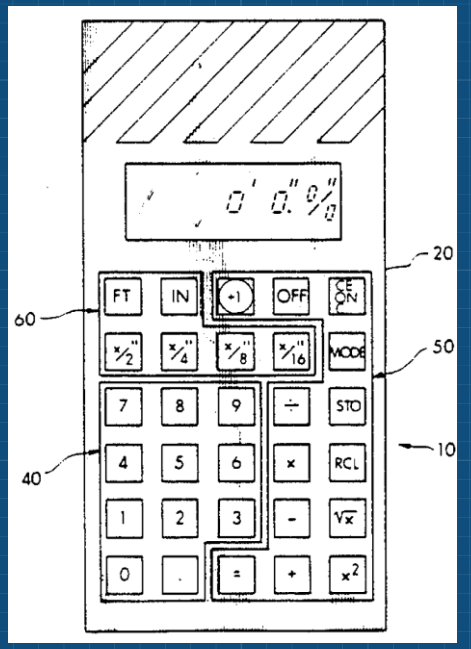
Feet-Inch-Fraction Patents



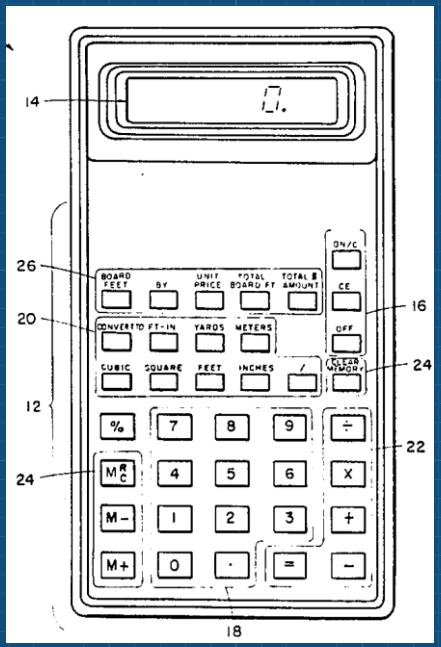
3,973,113



4,100,603

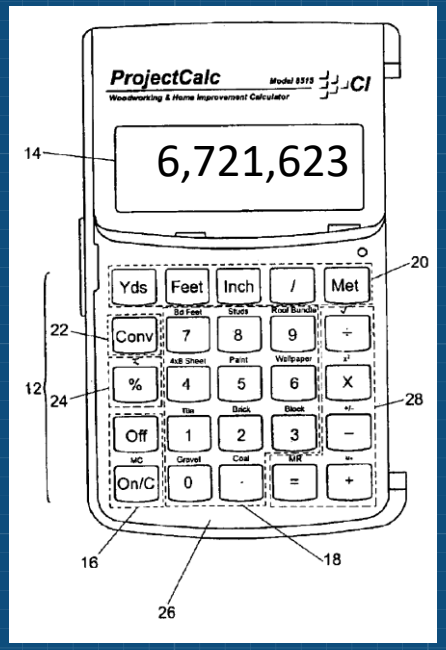


4,488,250



4,744,044

US Patent #	Date	Title
3,973,113	Aug. 3, 1976	Electronic Calculator for Feet-Inch-Fraction Numerics
4,081,859	Mar. 28, 1978	Electronic Calculator for Feet-Inch-Fraction Numerics
4,100,603	Jul. 11, 1978	Feet, Inches and Sixteenths Adder
4,488,250	Dec. 11, 1984	Hand-held Calculator for Performing Calculations In Feet, Inches and Fractions
4,744,044	May 10,1988	Hand-held Calculator for Dimensional Calculations
6,721,623	Apr. 13, 2004	Woodworking and Home Improvement Calculator



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CONSTRUCTION CALCULATORS

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Stover et al.

[11] **Patent Number: 4,744,044**

[45] **Date of Patent: May 10, 1988**

[54] **HAND-HELD CALCULATOR FOR DIMENSIONAL CALCULATIONS**

[75] Inventors: **Howard H. Stover**, Pasadena; **Kenneth E. Alexander**, Villa Park, both of Calif.; **Fred P. Alexander**, Stateline, Nev.

[73] Assignee: **Electronic Teacher's Aids, Inc.**, Orange, Calif.

[21] Appl. No.: **876,488**

[22] Filed: **Jun. 20, 1986**

[51] **Int. Cl.**[4] **G06F 11/00**; G06F 7/38

[52] **U.S. Cl.** **364/737**; 364/709; 364/715

[58] **Field of Search** 364/709, 710, 715, 737; 235/310, 311

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,593,313	7/1971	Tomaszewski et al.	364/200
3,739,161	6/1973	Gross et al.	364/709
3,863,060	1/1975	Rode et al.	235/156
3,973,113	8/1976	Goldsamt	364/709
4,048,484	9/1977	Brittan	235/156
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4,100,602	7/1978	Shapiro	364/715
4,100,603	7/1978	Boyd	364/771
4,195,348	3/1980	Kakutani	364/562
4,228,516	10/1980	Johnston, Sr.	364/602
4,282,514	8/1981	Elkin et al.	235/310
4,282,580	8/1981	McGuire et al.	364/734
4,319,130	3/1982	Spitzner	364/709
4,377,850	3/1983	Simpson	364/561
4,488,250	12/1984	Lipsey et al.	364/709
4,545,022	10/1985	Hughins	364/709

FOREIGN PATENT DOCUMENTS

2829247 1/1980 Fed. Rep. of Germany .

OTHER PUBLICATIONS

Hewlett Packard HP-65 Users' Library Catalog of Contributed Programs, Program Abstract 00437A entitled, "Fractional Arithmetic", Sep. 1974.

"Jobber II Instruction Manual", published by Calculated Industries, Inc. of Orange, California (Copyright 1983).

"Texas Instruments TI-55 II Scientific Calculator Sourcebook"; pp. i, ii, 1-39 and 1-42; Copyright 1977, 1981, 1983, 1984.

Primary Examiner—Gary V. Harkcom

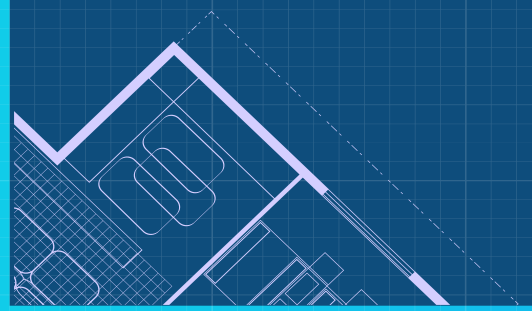
Assistant Examiner—Dale M. Shaw

Attorney, Agent, or Firm—Price, Heneveld, Cooper, DeWitt & Litton

[57] **ABSTRACT**

The specification discloses a hand-held calculator particularly adapted for dimensional or measurement calculations. The calculator includes keys for indicating a different dimension system (e.g. feet, yards, meters) associated with each number inputted, enabling calculations to be performed on numbers from mixed dimension systems. All inputted measurements are converted to decimal feet internally to simplify calculations and simplify conversion structure and routines. Preferably, a dimension power (e.g. square or cubic) can also be associated with each input number as necessary; and the calculator calculates and displays the proper dimension power resulting from any calculation. Further preferably, the calculator includes a keyboard enabling lumber dimensions to be easily inputted for board feet calculations.

8 Claims, 8 Drawing Sheets



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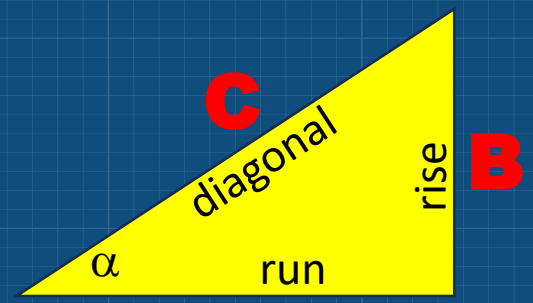
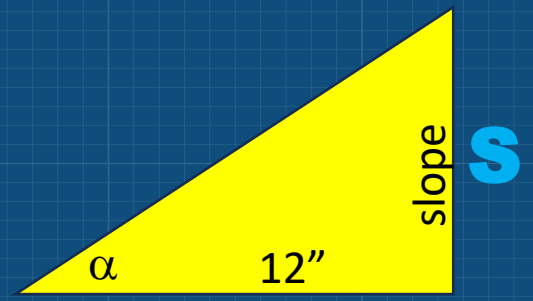
8 Claims, 8 Drawing Sheets

TRIANGLE SOLVERS

Enter 2 of A,B,C,S then solve for remaining 2





Flashing FT

ENTER

Flashing IN

3 4 B

0 ENTER

Flashing IN

2 6 A

C

2nd FN Entire Display Flashing S B

HP-65
STANDARD PAC

AREAS AND SOLUTION OF PT TRIANGLE STD 16A

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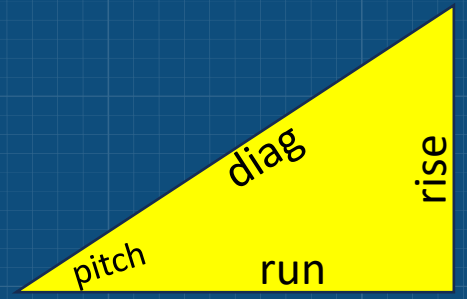
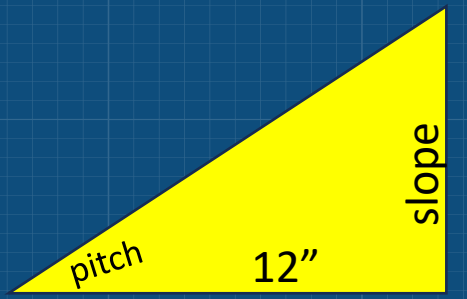
TRIANGLE SOLVERS

Enter 2 of Pitch, Rise, Run, Diag then solve for remaining 2





3 4 Inch Rise → RISE 34.

2 6 Inch Run → RUN 26 INCH

Diag → DIAG 42 13/16 INCH

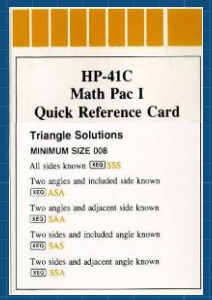
Pitch → PTCH 52.59°

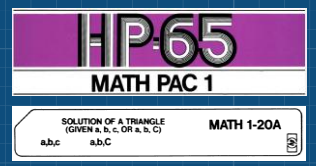
Pitch → %GRD 130.7692

Pitch → SLP 1.307692

slope

Pitch → PTCH 15 11/16 INCH





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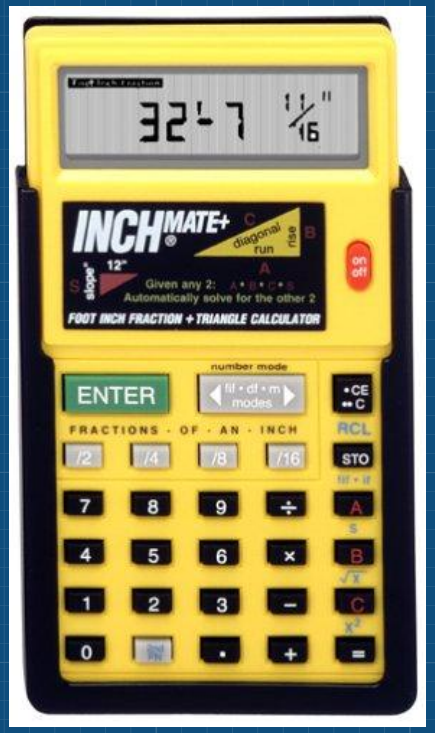
CONSTRUCTION CALCULATORS

Sonin Models



InchMate+®
Model DT110
2003

InchMate® 2000
Model DT210
2003

InchMate® 2000
Model DT220
1999

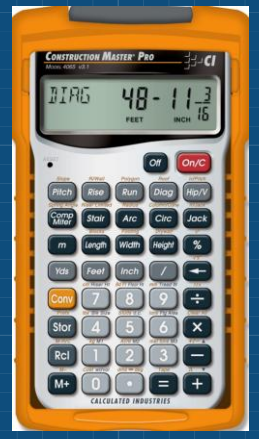
* Dates are Reference Guide © dates

CONSTRUCTION CALCULATORS

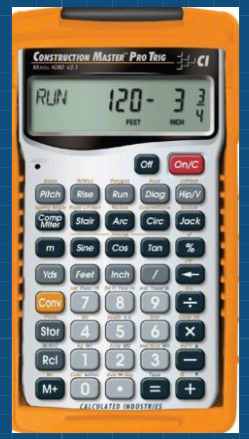
Some of the available Calculated Industry Models

Construction Master 5
Model 4050

Construction Master 5
En Espanol
Model 4054

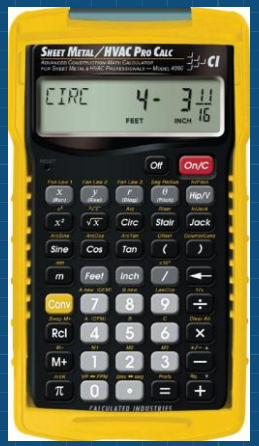


Construction Master Pro
Model 4065 V3.1



Construction Master Pro
Trig
Model 4080 V3.1

Measure Master Pro
Model 4020 V3.1



Sheet Metal/HVAC Pro
Calc
Model 4090

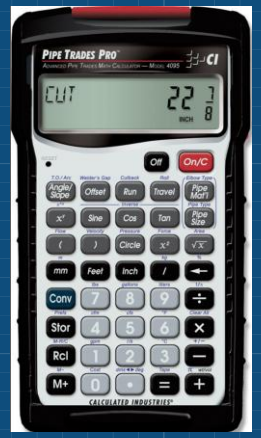
HeavyCalc Pro
Model 4325

ConcreteCalc Pro
Model 4225

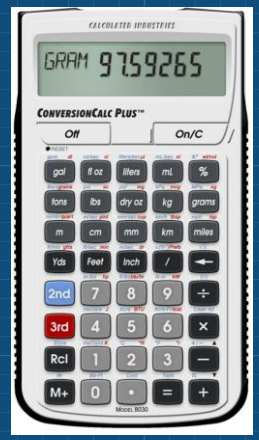
ProjectCalc Classic
Model 8503

Tradesman Calc
Model 4400

Material Estimator
Model 4019



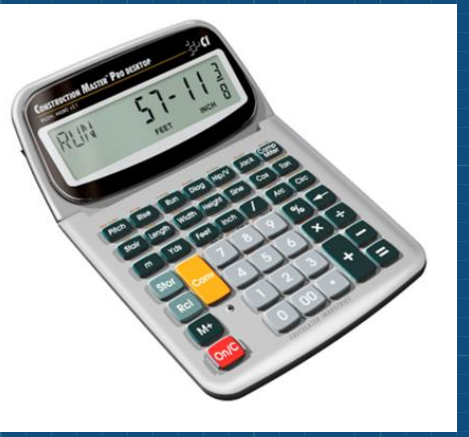
Pipe Trades Pro
Model 4095



ConversionCalc Plus
Model 8030

Ultra Measure Master
Model 8025

Home ProjectCalc
Model 8510



Construction Master Desktop
Model 44080 V3.1

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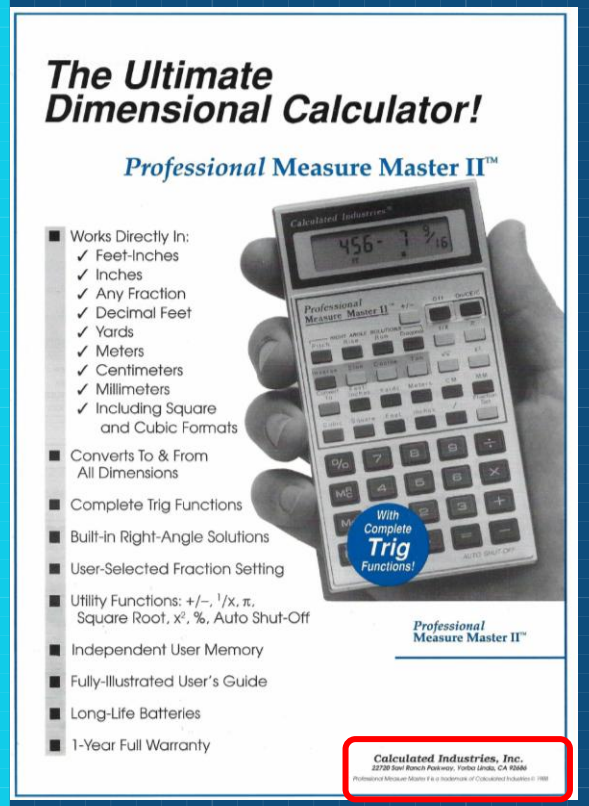
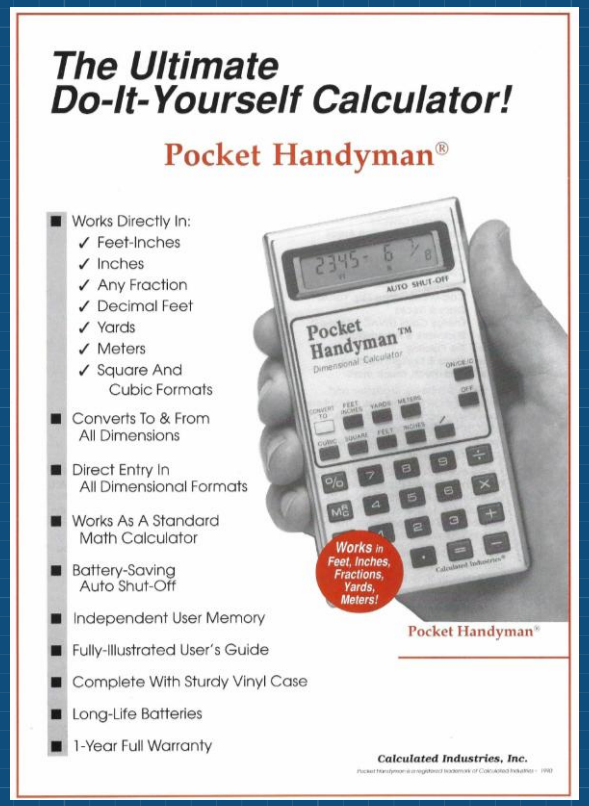
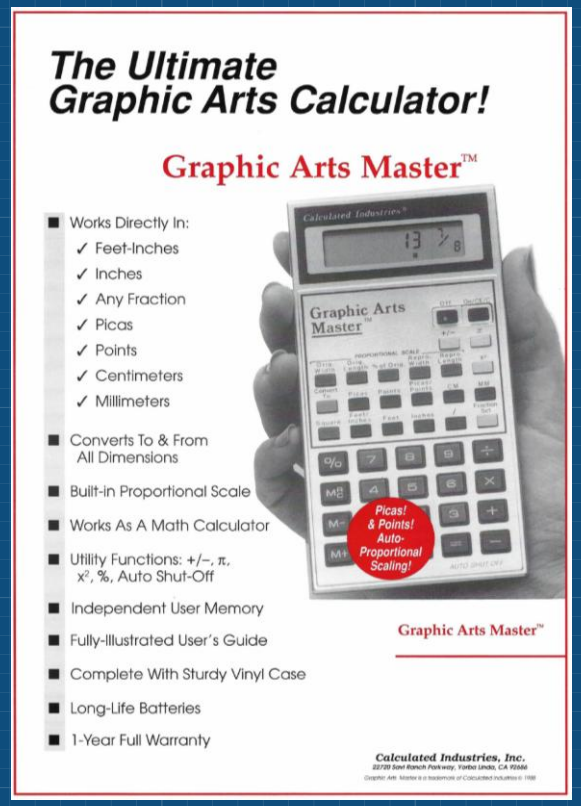
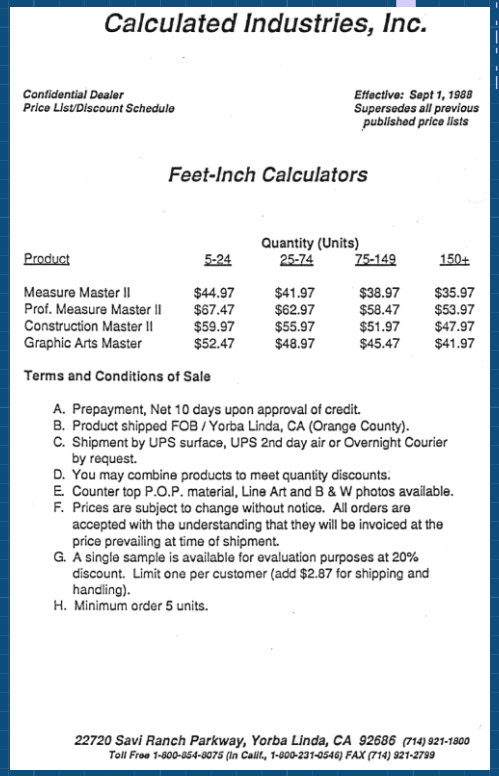
CONSTRUCTION CALCULATORS

Early Calculated Industries Construction Calculator Ads









Calculated Industries, Inc.

Confidential Dealer Price List/Discount Schedule

Effective: Sept 1, 1988 Supersedes all previous published price lists

Feet-Inch Calculators

Product	Quantity (Units) 5-24	25-74	75-149	150+
Measure Master II	$44.97	$41.97	$38.97	$35.97
Prof. Measure Master II	$67.47	$62.97	$58.47	$53.97
Construction Master II	$59.97	$55.97	$51.97	$47.97
Graphic Arts Master	$52.47	$48.97	$45.47	$41.97

Terms and Conditions of Sale

A. Prepayment, Net 10 days upon approval of credit.
B. Product shipped FOB / Yorba Linda, CA (Orange County).
C. Shipment by UPS surface, UPS 2nd day air or Overnight Courier by request.
D. You may combine products to meet quantity discounts.
E. Counter top P.O.P. material, Line Art and B & W photos available.
F. Prices are subject to change without notice. All orders are accepted with the understanding that they will be invoiced at the price prevailing at time of shipment.
G. A single sample is available for evaluation purposes at 20% discount. Limit one per customer (add $2.87 for shipping and handling).
H. Minimum order 5 units.

22720 Savi Ranch Parkway, Yorba Linda, CA 92686 (714) 921-1800
Toll Free 1-800-854-8075 (in Calif., 1-800-231-0546) FAX (714) 921-2799

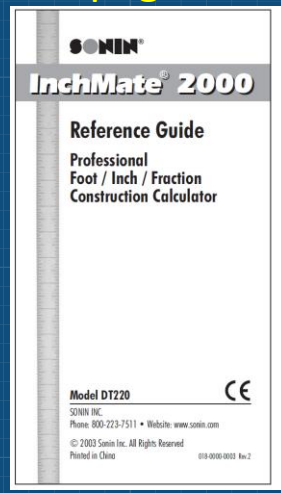
Thank you Jacob Schwartz!

HHC 2025

CONSTRUCTION CALCULATORS

Pages of Application Solutions in User Guide

15 pages


SONIN

InchMate® 2000

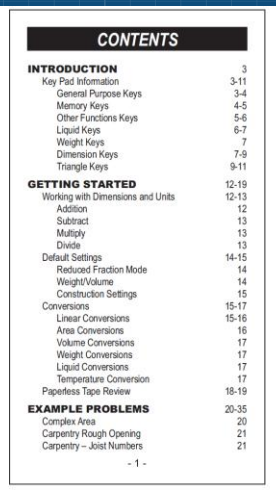
Reference Guide

Professional
Foot / Inch / Fraction
Construction Calculator

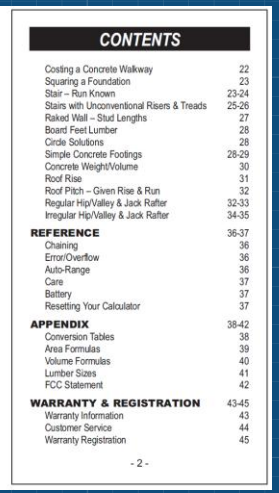
Model DT220

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

Printed in China


CONTENTS

- 1 -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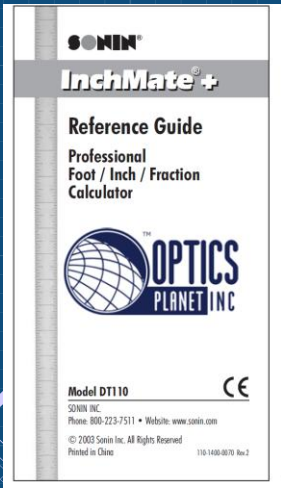
- 2 -

16 pages


SONIN

InchMate® +

Reference Guide

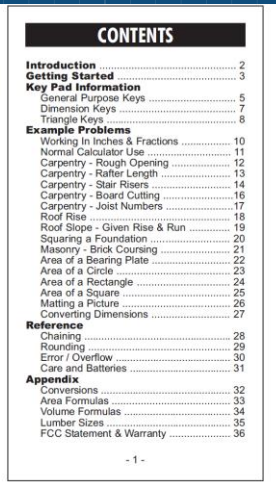
Professional
Foot / Inch / Fraction
Calculator

OPTICS PLANET INC

Model DT110

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

Printed in China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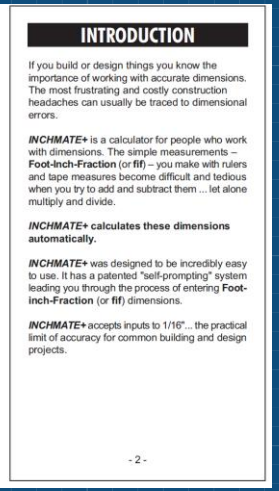
- 1 -


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.

INCHMATE+ is a calculator for people who work with dimensions. The simple measurements – **Foot-Inch-Fraction** (or **fif**) – you make with rulers and tape measures become difficult and tedious when you try to add and subtract them ... let alone multiply and divide.

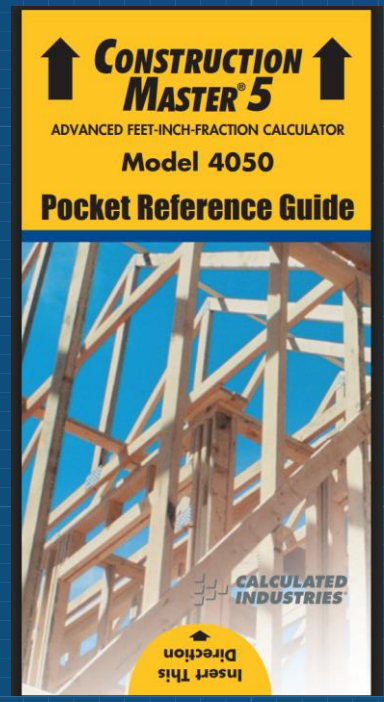
***INCHMATE+* calculates these dimensions automatically.**

INCHMATE+ was designed to be incredibly easy to use. It has a patented "self-prompting" system leading you through the process of entering **Foot-inch-Fraction** (or **fif**) dimensions.

INCHMATE+ accepts inputs to 1/16"... the practical limit of accuracy for common building and design projects.

- 2 -

21 pages


CONSTRUCTION MASTER® 5

ADVANCED FEET-INCH-FRACTION CALCULATOR

Model 4050

Pocket Reference Guide

CALCULATED INDUSTRIES

Insert This Direction

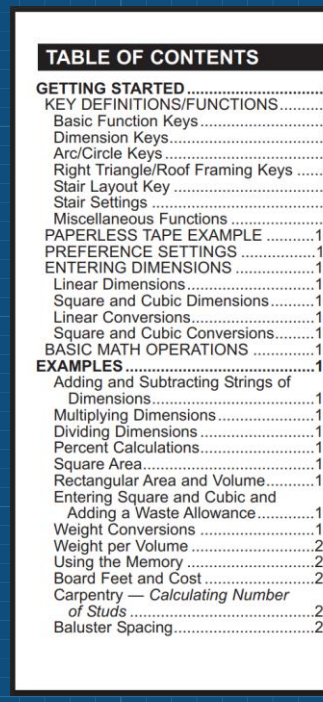
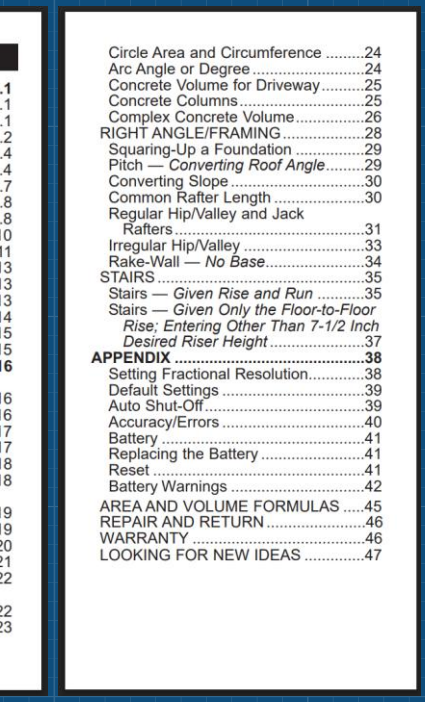
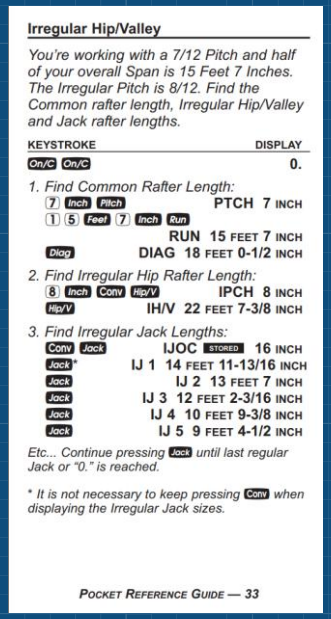


TABLE OF CONTENTS




Irregular Hip/Valley

You're working with a 7/12 Pitch and half of your overall Span is 15 Feet 7 Inches. The Irregular Pitch is 8/12. Find the Common rafter length, Irregular Hip/Valley and Jack rafter lengths.

KEYSTROKE — DISPLAY

On/C On/C — 0.

1. *Find Common Rafter Length:*
   7 Inch Pitch — PTCH 7 INCH
   1 5 Feet 7 Inch Run — RUN 15 FEET 7 INCH
   Diag — DIAG 18 FEET 0-1/2 INCH
2. *Find Irregular Hip Rafter Length:*
   8 Inch Conv Hip/V — IPCH 8 INCH
   Hip/V — IH/V 22 FEET 7-3/8 INCH
3. *Find Irregular Jack Lengths:*
   Conv Jack — IJOC STORED 16 INCH
   Jack* — IJ 1 14 FEET 11-13/16 INCH
   Jack — IJ 2 13 FEET 7 INCH
   Jack — IJ 3 12 FEET 2-3/16 INCH
   Jack — IJ 4 10 FEET 9-3/8 INCH
   Jack — IJ 5 9 FEET 4-1/2 INCH

Etc... Continue pressing Jack until last regular Jack or "0." is reached.

** It is not necessary to keep pressing Conv when displaying the Irregular Jack sizes.*

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CONSTRUCTION CALCULATORS

Numerical Accuracy

SONIN®

InchMate® +

Reference Guide

Professional Foot / Inch / Fraction Calculator

OPTICS PLANET INC

Model DT110 CE

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

Printed in China 110-1400-0070 Rev.2

REFERENCE

ROUNDING

INCHMATE+ rounds **Foot-Inch-Fraction** answers to the nearest 1/16" in the display, but an accurate decimal value is always contained in the internal memory.

In **DIVISION** problems, an error of up to 1/32" may be contained in answers if the numerator is not exactly divisible by 1/16". If you use such an answer repetitively, as in a stair riser calculation, this rounding error could accumulate into a larger error. There is an easy way to check if this is occurring...

Example: In the STAIR RISER problem found on page 14-15, a floor-to-floor height of 8'- 10 3 /4" is divided by 13 risers, displaying a riser height of 8 3/16 ". To check for an error in this answer, first clear the calculator. Then enter 8 3/16" and multiply it by 13 risers...

Press: [CE/C] [CE/C] [ENTER] [8] [ENTER] [3] [/ 16] [×] [1] [3] [=]

Answer: 8.86979 16'

REFERENCE

Since this result is 5/16" less than the original 8'- 10 3/4", YOU must lay out each riser a hair more than 8 3/16.

Remember: Only calculations using the DIVISION function can produce an error. The error will never exceed 1/32", so you only need to check the result of such calculations if you intend to multiply it by a large enough number to accumulate a significant error.

ERROR / OVERFLOW

An error/overflow condition occurs when the result of a calculation has more than 8 digits to the left of the decimal point, or when you attempt to divide a value by zero.

An error/overflow condition is indicated by the "**ERROR**" label in the upper right corner of the display. You must clear the calculator display by pressing the [CE/C] key twice before continuing operations. Clearing an error/overflow condition will not clear values stored in the memory registers.

CARE

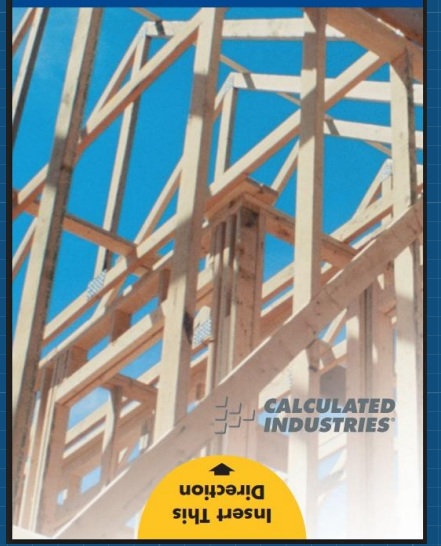
Don't leave calculator in direct sunlight for long periods, or store it where excessive temperatures are possible.

CONSTRUCTION MASTER® 5

ADVANCED FEET-INCH-FRACTION CALCULATOR

Model 4050

Pocket Reference Guide



Accuracy/Errors

Accuracy/Display Capacity — You may enter or calculate values up to 19,999,999.99. Each calculation is carried out internally to twelve digits.

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

Error Codes:

DISPLAY	ERROR TYPE
0FL0	Overflow (too large to display)
DIV Error	Divide by 0
DIM Error	Dimension error
ENT Error	Entry error
None	Attempt to calculate stairs without entering Rise and Run

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

CONSTRUCTION CALCULATORS

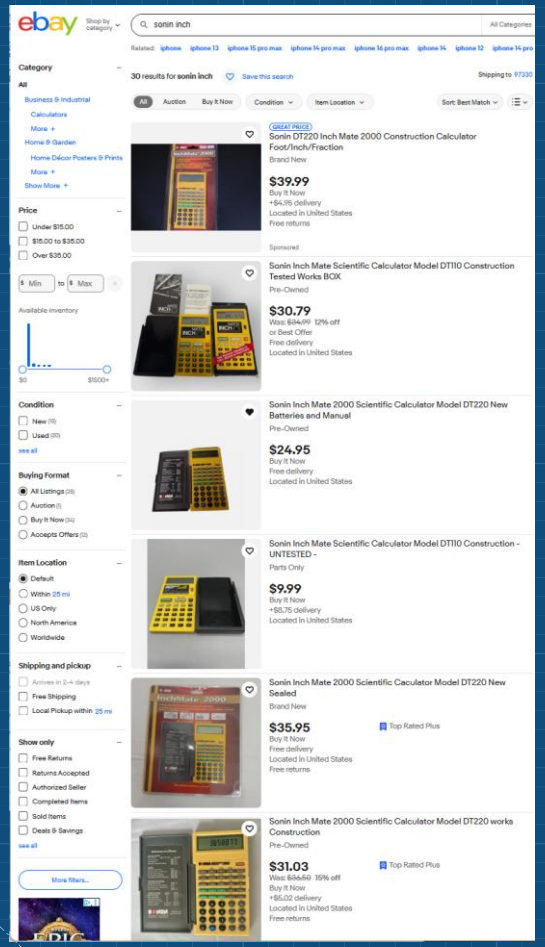
Where can I get them?

Sonin

No Longer in Production

Thrift Stores

eBay



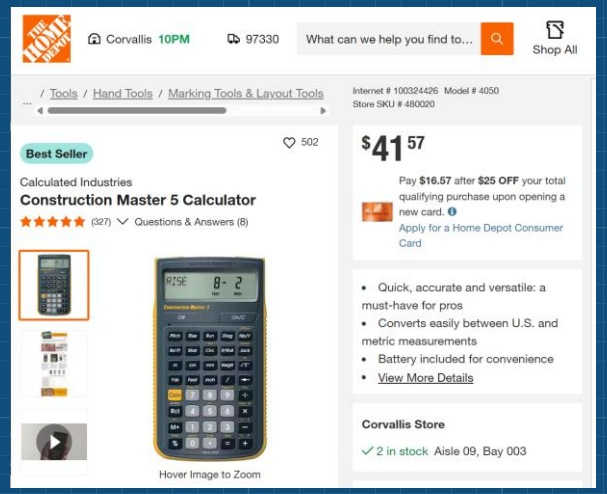
Calculated Industries

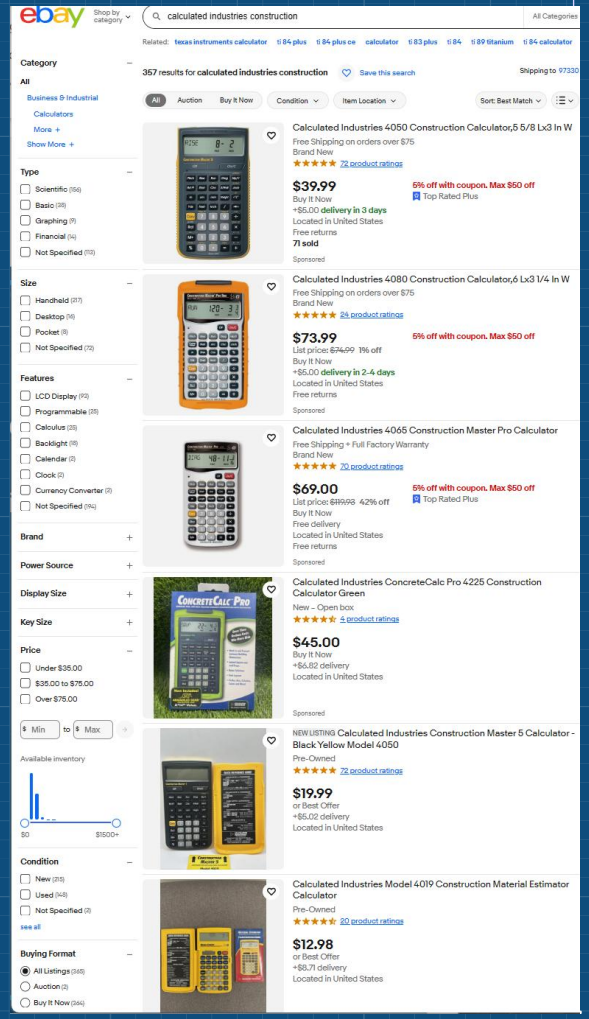
In Production

<u>Widely Available:</u>

Amazon, Lowes, Home Depot, Grainger,…

eBay





CONSTRUCTION CALCULATORS
THE NEXT GENERATION

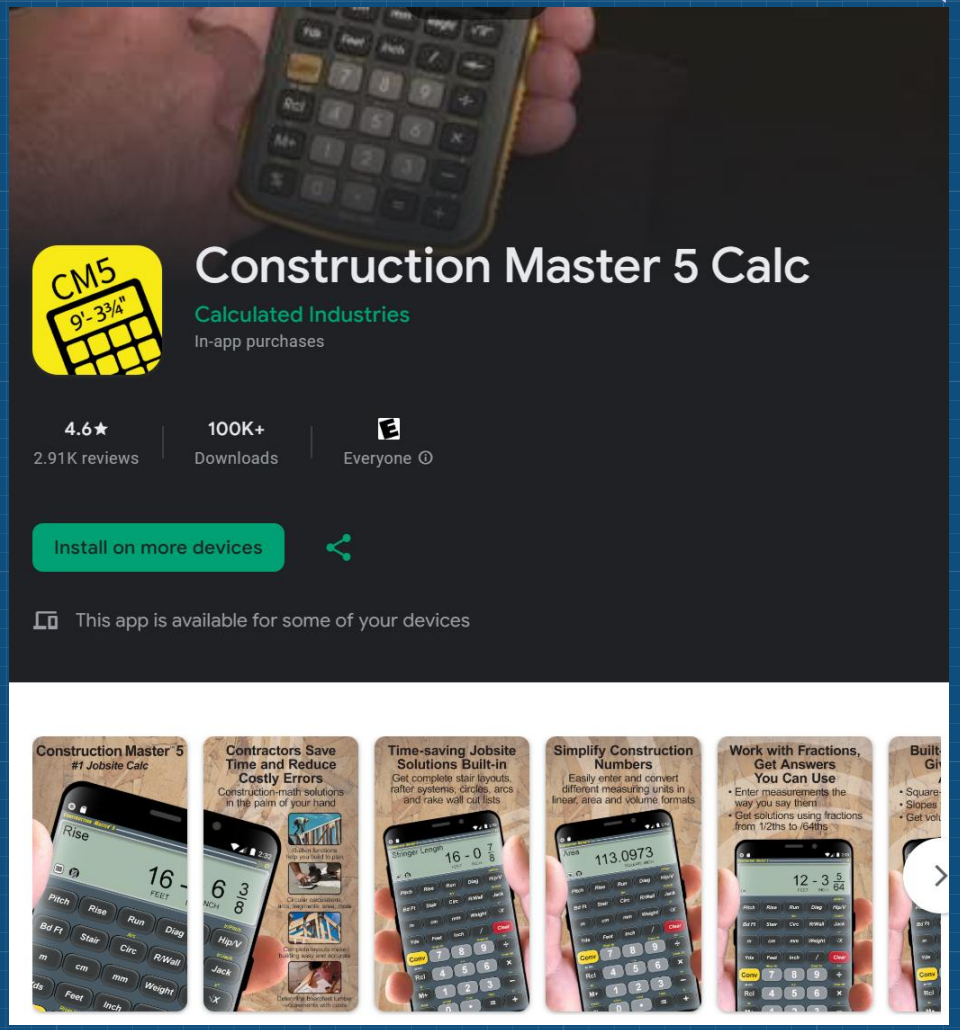
Add square and cubic math (ft^2 , ft^3)

Add Area calculations for different shapes

←Add Trigonometric Functions

Add Memories

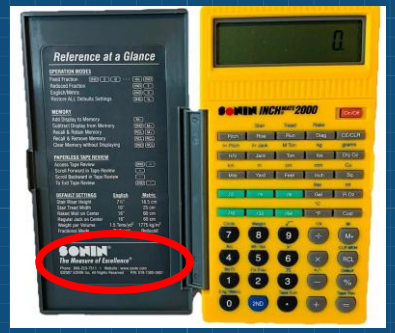
Android and IOS Application Subscriptions →



$34.99/yr
$ 3.99/mo

E.T. PHONE HOME

What happens when you call the phone # on a 25+ year old calculator?



Sonin

www.sonin.com

- Calls forwarded to voicemail, leave a message
- Sonin returned my call <1 week
- Representative was surprised I wanted to talk about calculators
- Sonin was acquired by current management 5 years ago
- Sonin now makes moisture measurement equipment, is not currently making calculators
- Representative surprised by the “pages and pages” of Sonin calculators on eBay
- They did have PDFs of their calculators’ User Guides in their archives

Calculated Industries

- No response to email sent to technical support

CONSTRUCTION CALCULATOR

Feature Implementations on HP Calculators?

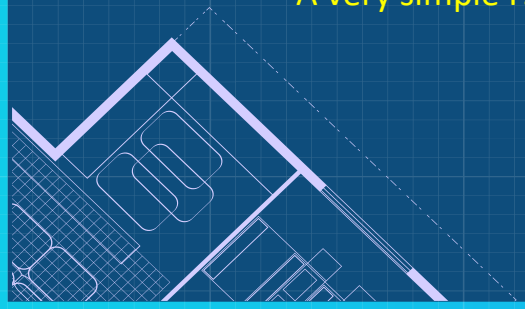
Triangle Solutions are in the HP-35 & HP-45 Solution Books, Programmable calculator Standard & Math Packs.

Feet, Inches entry & triangle programs were in the user libraries (Lost to landfills?, ☹)

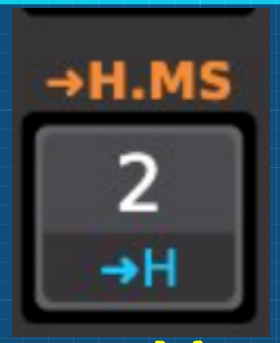
At least 4 FIF (feet inches fractions of an inch) programs are on last year's conference thumb drive.
(where they are is left as a challenge)

This year adds at least 3 more:

- Updates from Joe Horn for the HP-48 & HP-50 that work with both positive & negative values and has key driven entry like the Construction Master.
- A very simple F.IF ↔ F. for 41/classic/voyager calculators (next pages)



HHC 2025



CONSTRUCTION CALCULATOR

Using an H.MS-like solution as a Feet-Inch Interface

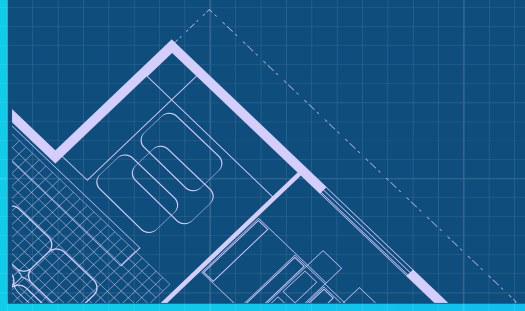
Many HP Calculators* had →H.MS, →H functions
to convert between h.mmss and decimal hours

2.2625 →H.MS 2.1545 (2:15 and 45 seconds)

2.1545 →H 2.2625

It is straight forward to create 2 functions to implement f.iinn↔decimal feet.

HP-41C Ft/In/16ths, RT Solve by Russ Porter
PPC Journal Volume 12 No 10 Pg 14 Oct, 1985



*
→H.MS, →H 11,15,25,27,29,32,33,34,55,67
→D.MS D.MS→ 65
HMS, HR 41

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feet↔f.iinn

By Chuck McCord

f.iinn → feet

INPUTS

X : feet.iinn

R01 : nn denominator (16,32,64, …)

OUTPUTS

X : decimal feet

Y : preserved

Z,T : Y

R00 : scratch

R01 :nn denominator

EXAMPLE

```
16
STO 01
9.0608
XEQ "FT"

9.5416867
```

```
01 LBL "FT"
02 STO 00
03 INT
04 ST- 00
05 RCL 00
06 100
07 *
08 STO 00
09 INT
10 ST- 00
11 12
12 /
13 +
14 RCL 00
15 100
16 *
17 STO 00
18 INT
19 ST- 00
20 RCL 01
21 /
22 12
23 /
24 +
25 RTN
```

```
26 LBL "FIN"
27 STO 00
28 INT
29 ST- 00
30 RCL 00
31 12
32 *
33 STO 00
34 INT
35 ST- 00
36 100
37 /
38 +
39 RCL 00
40 RCL 01
41 *
42 INT
43 100000
44 /
45 +
46 RTN
```

feet → f.iinn

INPUTS

X : decimal feet

R01 : nn denominator (16,32,64, …)

OUTPUTS

X : feet.iinn

Y : preserved

Z,T : Y

R00 : scratch

R01 :nn denominator

EXAMPLE

```
16
STO 01
9.54 16867
XEQ "FIN"

9.0608
```

HHC 2025

26

CONSTRUCTION CALCULATORS

Summary

What is a Construction Calculator? 4 Defining Characteristics (F-In I/O. ▽, ♦, name)

- Why Feet-Inches Input
- 2 Feet-Inches Input Methods & their displays & keyboards
  - Prompted Entry
  - Key Driven Entry
- Feet-Inch-Fraction Patents (shout-out to HP65 Users' Lib)
- Triangle Solvers (for stairs and roofs)

Models from 2 Manufacturers (Sonin, Calculated Industries Pics/Ads)

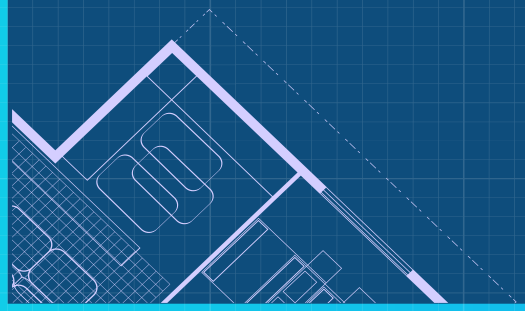
Value-Add Extras (application solutions, numerical accuracy)

Availability / Where to buy

THE NEXT GENERATION

E.T. Phone Home

Implementations on HP calculators (including obligatory keystroke programs)



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THANK YOU

Additional Acknowledgements:
Jacob Schwartz for early Calculated Industries Advertisements
Joe Horn ffi
Star Trek Next gen font by “Th3 C0n-MAN”
Google Patents


HHC
2025