



ELECTRICALC[®] PRO

The *ElectriCalc[®] Pro* is an invaluable calculator for today's busy electrical professional. It has intuitively labeled "electrical keys" and conforms to 1996 through 2011 and future National Electrical Codes. The most common NEC tables are now at your fingertips!



The *ElectriCalc[®] Pro* instantly solves for:

- Volts, Amps, Volt-Amps, Watts, PF%, and EFF%
- Cu and Al Wire Sizes
- Parallel and Derated Wire Sizes
- Voltage Drop Wire Sizes, and Lengths
- Kilowatt hours and BTU's
- Parallel Resistance
- Grounding Conductors
- Motor FLC
- Fuse/Breaker Sizes
- Conduit Sizes
- And much more!



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GETTING STARTED

KEY DEFINITIONS

Basic Function Keys

On/C *On/Clear Key* — Turns on power, clears the last entry and clears all temporary values.

Off *Off* — Turns all power off.

+ - X
÷ = Arithmetic operation keys.

0 - 9
and **◉** Keys used for entering numbers.

Set *Second Function* — Used to access secondary functions.

Stor *Store* — Stores values.

Stor
1 - 9 *Storage Registers* — Store values in Memory.

Rcl *Recall* — Used to recall stored values and settings.

Rcl **Rcl** *Memory Clear* — Clears M+ and displays total.

Stor **0** *M+* — Adds value to Accumulative Memory.



Rcl **0**

Memory Recall —

Displays the value saved in M+.

Set **Rcl**

Memory Clear (M-R/C)

— Clears M+ without changing current display.

%

Percentage — Standard % function.

Set **%**

x^2 — Squares the value on the display.

←


Backspace Function

— Used to delete entries one keystroke at a time.



Set **←**

\sqrt{x} — Calculates the Square Root of the displayed value.



Set **VD%**

$1/x$ — Finds the Reciprocal of a number.

Set **X**

Clear All — Reset all settings, other than preferences to default.

Set **±**

+/- — Toggles sign of value.

Set **+**

Pi — Displays value of π (3.1415927).



Mode Set-up Keys

- Set** \div **Prefs** — Use to define calculator modes.
- Set** ① **1 \emptyset** — Sets calculator to Single-Phase mode.
- Set** ③ **3 \emptyset** — Sets calculator to Three-Phase mode.
- Set** ② **Amb $^{\circ}$** — Enters ambient temperature for finding Wire Sizes.
- Set** ④ **Copper/Aluminum (Cu/Al)** — Toggles between Copper and Aluminum Wire.
- Set** ⑤ **Free Air (FrAir)** — Sets calculator to Free Air mode.
- Set** ⑥ **60 $^{\circ}$ C Wire Insulation** — Sets to 60 $^{\circ}$ C Wire.
- Set** ⑦ **75 $^{\circ}$ C Wire Insulation** — Sets to 75 $^{\circ}$ C Wire.
- Set** ⑨ **90 $^{\circ}$ C Wire Insulation** — Sets to 90 $^{\circ}$ C Wire.



Electrical Keys

- kilo-** **kilo-** — Used to identify “kilo-” values.

Set kilo-

milli- — Used to identify “milli-” values.

Amps

Amps — Enters or calculates Amps.

Volts

Volts — Enters or calculates Volts.

VA

Volt-Amps — Enters or calculates Volt-Amps.

Watts

Watts — Enters or calculates Watts.

Set Amps

DC Amps (Idc) — Enters or calculates DC Amps.

Set Volts

DC Volts (Vdc) — Enters or calculates DC Volts.

Set VA

DC Resistance (R) — Enters or calculates DC Resistance in Ohms.

Set Watts

Power Factor (PF%) — Enters or calculates Power Factor.

HPth

Theoretical Horsepower — Enters or calculates Theoretical Horsepower.

Set HPth

Efficiency (Eff %) — Enters or calculates the Power Efficiencies.

(cont'd)


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Set  **Kw-hr ► Btu** —
Converts Kw-hr to Btu.

Set  **BTU to Kilowatt-Hours
(Btu ► Kw-hr)** —
Converts Btu to Kw-hr.

Set **Stor** **Parallel Resistance
(Par Res)** — Calculates
total Resistance of
Parallel Resistors.

Motor Keys

Set  **Ind/Sync/DC** — Toggles
between Motor Types.

HPmotor **Motor Horsepower** —
Enters or calculates
Motor Horsepower.

Set **HPmotor** **Starter Size (Starter)** —
Displays the Starter Size.

Wire Sizing Keys

WireSz **Wire Size/Ampacity** —
Enters or calculates Wire
Size. Additional presses
show smaller wire size
(if Length defined),
Ampacity, Circular Mils,
and referenced table.



Set WireSz **125% Ampacity** — Used to calculate Wire Size using 125% of Amps. Also shows Ampacity, Circular Mils and NEC table reference with repeated presses.

ParSz **Parallel Size** — Provides Wire Sizes using Parallel Conductors. A second press displays the Ampacity.

Set ParSz **Derated Wire Size (D/R Size)** — Calculates Derated Wire Sizes given a number of wires in the raceway. Also shows Adjusted Ampacity, Deration Factor and NEC table reference.



Voltage Drop Keys

VD% **Percent Voltage Drop** — Toggles between Actual Voltage Drop and Percent Voltage Drop with repeated presses.

Length **Length** — Enters or calculates the Length used for Voltage Drop.

(cont'd)



(cont'd)

Set Length **Wire Resistance**
(Wire Res) — Displays
the Wire Resistance per
1,000 Feet.

Grounding Conductor Keys

Grnd **Ground** — Displays the
Copper and Aluminum
grounding electrode sizes
given an entered Wire
Size. Also shows Wire
Circular Mils and NEC
reference with additional
key presses.

Set Grnd **Equipment Ground**
(EqGrnd) — Provides
the Copper Equipment
Ground size given an
entered Wire Size.
Additional key presses
show Aluminum Ground
Size and the NEC
reference.

Fuse/Breaker Keys

O-Load **Overload Protection**
— Enters a percent
Overload Factor and
shows the Overload
required based on stored
Amps. The percent
multiplier is shown on the
second key press.

Set O-Load

Motor Type (M-Type)

— Displays the current Motor Type for use with Breaker/Fuse sizing. Additional presses toggle between Motor Types.

DEFuse

Dual Element Fuse

Set DEFuse

Single Element Fuse (SEFuse)

InvTime

Inverse Time Breaker

Set InvTime

Instantaneous Trip Circuit Breaker (InsTrip)

— Displays the minimum Amp rating and percent multiplier.

Conduit Sizing Keys

**#THW
#THHW,**

**#XHH
#XHHW,**

**#THN
#THWN**

Number of Wires —

Used to enter or calculate the Number of Wires in a raceway and calculate Wire Area. Also shows total Number of Wires and the total area of all wires entered.

(cont'd)

(cont'd)

CondSz

Conduit Size — Enters or calculates Conduit Size. Additional presses show the total number of Wires, Percent Fill, Total Wire Area and remaining Wire Area when Conduit Size is calculated.

Set CondSz

Conduit Type (Conduit Type) — Defines Conduit Type by entering the number correlating to the Types shown below. Repeated presses of **Set CondSz** also toggles through the Conduit Types.

- | | |
|---------|----------|
| 1) EMT | 7) LFMC |
| 2) ENT | 8) RMC |
| 3) FMC | 9) P-80 |
| 4) IMC | 10) P-40 |
| 5) LFNB | 11) P-A |
| 6) LFNA | 12) P-EB |

PREFERENCE SETTINGS

Press **Set**, then **÷** to access the Preferences. Continue pressing **÷** to toggle through different settings. Press **+** or **-** keys to toggle between options. Press any other key to exit Preferences.

KEYSTROKE	DISPLAY
-----------	---------

Set ÷ (<i>Prefs</i>) (<i>NEC Code</i>)	
---	--

	NEC 2011
--	----------

+	
----------	--

	NEC 1996
--	----------

+	
----------	--

	NEC 1999
--	----------

+	
----------	--

	NEC 2002
--	----------

+	
----------	--

	NEC 2005
--	----------

+	
----------	--

	NEC 2008
--	----------

+ (<i>repeats options</i>)	
-------------------------------------	--

	NEC 2011
--	----------

Second press of ÷ : (<i>Ambient</i>	
--	--

<i>Temperature Units</i>)	
----------------------------	--

	AMB° 30. °C
--	-------------

+	
----------	--

	AMB° 86. °C
--	-------------

+ (<i>repeats options</i>)	
-------------------------------------	--

	AMB° 30. °C
--	-------------

Third press of ÷ : (<i>Length Units</i>)	
--	--

	FEET 1.
--	---------

+	
----------	--

	MET 1.
--	--------

+ (<i>repeats options</i>)	
-------------------------------------	--

	FEET 1.
--	---------

BASIC MATH OPERATIONS

This calculator uses standard chaining logic, calculating values in order entered.

KEYSTROKE	DISPLAY
3 + 2 =	5.
3 - 2 =	1.
3 X 2 =	6.
3 ÷ 2 =	1.5

PERCENT CALCULATIONS

The **%** key can be used for finding a given percentage of a number or for working add-on, discount or division percentage calculations.

KEYSTROKE	DISPLAY
3 5 5 X 1 5 %	53.25
2 5 0 +	
6 • 5 %	266.25
2 5 - 5 %	23.75
1 0 0 ÷ 5 0 %	200.

MEMORY OPERATIONS

The Cumulative Memory is located above **0**. Single value storage positions can also be found within digits **1** through **9**.

Using M+

KEYSTROKE	DISPLAY
-----------	---------

1. Add to Memory:

3 5 5 **Stor** **0** (M+) M+ 355. **M**

2 5 5 **Set**

- **Stor** **0** (M+) M+ -255. **M**

2. Recall Total:

Rcl **0** TTL 100. **M**

Rcl **0** AVG 50. **M**

Rcl **0** CNT 2. **M**

3. Display/Clear Memory:

Rcl **Rcl** 100.

Using Memory Storage Keys (M1- M9)

KEYSTROKE	DISPLAY
-----------	---------

1 7 5 **Stor** **1** M-1 175.

Off **On/C** 0.

Rcl **1** M-1 175.

USING THE *ELECTRICALC PRO*

KIRCHHOFF'S LAW

The *ElectriCalc Pro* can easily find Volts, Amps, VA, Watts, HP (theoretical), Efficiency and Power Factor.

Finding Voltage

Find the Voltage supply to a 1 \emptyset load drawing 14,605 VA and 115 Amps.

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
------------------	----

1. Set to 1-Phase:

Set 1 (1 \emptyset)	1 \emptyset 1 PH
--------------------------------------	--------------------

2. Enter VA:

1 4 6 0 5 VA	VA 14,605.
--	------------

3. Enter Amps:

1 1 5 Amps	AMPS 115.
--	-----------

4. Solve for Volts:

Volts	VOLT 127.
--------------	-----------

Finding Amps

What is the current for a load drawing 8,250 VA on a 240V, 3 \emptyset circuit?

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
------------------	----

1. Set to 3-Phase:

Set 3 (3 \emptyset)	3 \emptyset 3 PH
--------------------------------------	--------------------

2. Enter VA:

8 2 5 0 VA	VA 8,250.
---	-----------

3. Enter Volts:

2 4 0 Volts	VOLT 240.
---	-----------

4. Solve for Amps:

Amps	AMPS 19.846416
-------------	----------------

Finding Volt-Amps

What is the VA rating for a 120 Volt, 22 Amp, 1Ø circuit?

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
------------------	----

1. Set to 1-Phase:

Set 1 (1Ø)	1 Ø 1 PH
--------------------------	----------

2. Enter Volts:

1 2 0 Volts	VOLT 120.
---	-----------

3. Enter Amps:

2 2 Amps	AMPS 22.
-------------------------------	----------

4. Solve for Volt-Amps:

VA	VA 2,640.
-----------	-----------

Finding kW Rating

What's the kW rating for a 90 Amp, 208V, 3Ø boiler with 100% Power Factor?

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
------------------	----

1. Set to 3-Phase:

Set 3 (3Ø)	3Ø 3 PH
--------------------------	---------

2. Set Power Factor:

1 0 0 Set Watts (PF%)	PF% 100.
---	----------

3. Enter Amps:

9 0 Amps	AMPS 90.
-------------------------------	----------

(cont'd)

(cont'd)

KEYSTROKE	DISPLAY
-----------	---------

4. Enter Volts:

2 **0** **8** **Volts**

VOLT 208.

5. Solve for kW:

kilo- **Watts**

KW 32.423991

OHM'S LAW

The *ElectriCalc Pro* uses Ohm's Law solve for DC Voltage, Current, or Resistance.

Finding Volts

The Current in a circuit is 0.0125 Amps, and the total Resistance is 480 Ohms. Find the Voltage.

KEYSTROKE	DISPLAY
-----------	---------

On/C **On/C**

0.

1. Enter Current:

0 **0** **1** **2** **5**

Set **Amps** (*I*_{dc})

I_{dc} 0.0125 A

2. Enter Resistance:

4 **8** **0**

Set **VA** (*R*)

OHMS 480.

3. Find Voltage:

Set **Volts** (*V*_{dc})

V_{dc} 6. v

Finding Amps

A 120k electrical resistor is plugged into a 12 volt circuit. Find the Current.

KEYSTROKE DISPLAY

On/C On/C 0.

1. Enter Resistance:

1 2 0 **kilo-**

Set VA (R) KOHM 120.

2. Enter Voltage:

1 2

Set Volts (Vdc) Vdc 12. v

3. Find Current:

Set Amps (Idc) Idc 0.0001 A

Finding Resistance (Ohms)

An electrical circuit operating at 240 Volts has a Current of 14.6 Amperes. Find the total Resistance.

KEYSTROKE DISPLAY

On/C On/C 0.

1. Enter Voltage:

2 4 0

Set Volts (Vdc) Vdc 240. v

2. Enter Current:

1 4 . 6

Set Amps (Idc) Idc 14.6 A

3. Find Resistance:

Set VA (R) OHMS 16.438356

MOTOR FUNCTIONS

The *ElectriCalc Pro* can calculate the Full-Load Current (Amps) of a motor, based on Phase, Voltage and Motor (Synchronous, Induction, or DC) Horsepower using NEC Tables 430.247, 430.248 and 430.250.

Finding Full-Load Current

A 2 HP Induction motor operates on 230 Volt, Single-Phase power. What is the Full-Load Current for this motor?

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
------------------	----

1. Set to 1-Phase:

Set 1 (1Ø)	1 Ø 1 PH
--------------------------	----------

2. Enter Volts:

2 3 0 Volts	VOLT 230.
---	-----------

3. Enter HP:

2 HPmotor	IND* 2. HP
-------------------------	------------

* Press **Set** **8** until **IND** is displayed in the upper left area of the display.

4. Find Full-Load Current:

Amps	FLC 12. A
-------------	-----------

Finding Motor Wire Size

Find the Wire Size required to connect a continuous run, 3Ø, 10 HP Induction motor into a 230V circuit.

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
------------------	----

1. Set to 3-Phase:

Set 3 (3Ø)	3Ø 3 PH
--------------------------	---------

2. Set to 60° C:

Set 6 (60°)	3Ø 60 3 PH
---------------------------	------------

3. Set to Copper (if necessary):

Set 4 (Cu/Al)	3Ø 60 Cu 3 PH
-----------------------------	---------------

4. Enter Volts:

2 3 0 Volts	VOLT 230.
---	-----------

5. Enter HP:

1 0 HPmotor	IND* 10. HP
----------------------------------	-------------

* Press **Set** **8** until **IND** is displayed in the upper left area of the display.

6. Find Full-Load Current:

Amps	FLC 28. A
-------------	-----------

7. Find 125% Ampacity Wire Size:

Set WireSz (125%)	AWG 8 CU WIRE SIZE 125%
---------------------------------	----------------------------

AMPACITY WIRE SIZING

Wire Sizing is based on Ampacity requirements used in NEC Tables 310.15(B)(16) and 310.15(B)(17).

Wire Sizing

Wiring is being installed for a 240V, 1Ø system rated at 30 kVA. What is the 60° C Copper Wire Size?

(cont'd)

(cont'd)

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
------------------	----

1. Set to 1-Phase:

Set 1 (1Ø)	1 Ø 1 PH
-------------------	----------

2. Set to 60° C:

Set 6 (60°)	1 Ø 60 1 PH
--------------------	-------------

3. Set to Copper (if necessary):

Set 4 (Cu/Al)	1 Ø 60 Cu 1 PH
----------------------	----------------

4. Enter kVA:

3 0 kilo- VA	KVA 30.
---------------------	---------

5. Enter Volts:

2 4 0 Volts	VOLT 240.
--------------------	-----------

6. Find Amps:

Amps	AMPS 125.
-------------	-----------

7. Find Wire Size:

WireSz	AWG 0 CU WIRE SIZE
---------------	--------------------

Wire Sizing Based on Material Type

Find the Wire Size for a 75°C Copper Wire carrying a 3Ø load of 265 Amps. What is the equivalent Aluminum Wire Size?

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
------------------	----

1. Set to 3-Phase:

Set 3 (3Ø)	3Ø 3 PH
-------------------	---------

2. Set to 75° C:

Set 7 (75°)	3Ø 75 3 PH
--------------------	------------

3. Set to Copper (if necessary):

Set **4** (Cu/Al) 3Ø 75 Cu 3 PH

4. Enter Amps:

2 **6** **5** **Amps** AMPS 265.

5. Find Wire Size:

WireSz AWG 300 CU WIRE SIZE

6. Change to Aluminum:

Set **4** (Cu/Al) AWG 400 AL WIRE SIZE

Sizing Parallel Conductors (Free Air)

What size 60°C insulated Copper Wire is required for a single conductor carrying a 500 Amp load in a Free Air environment (30°C Ambient Temperature.)? What size for two Parallel conductors?

KEYSTROKE	DISPLAY
On/C On/C	0.
1. Set to 60° C:	
Set 6 (60°)	60 0.
2. Set to Copper (if necessary):	
Set 4 (Cu/Al)	60 Cu 0.
3. Set to Free Air mode:	
Set 5 (FrAir)	60 Cu FrAir 0.
4. Enter Amps:	
5 0 0 Amps	AMPS 500.
5. Find Wire Size for one conductor:	
WireSz	AWG 500 CU WIRE SIZE

(cont'd)

(cont'd)

KEYSTROKE	DISPLAY
-----------	---------

6. Find Wire Size for two conductors:

2 ParSz	PAR 000 CU WIRE SIZE
-----------------------	-----------------------------

7. Exit Free Air Mode and Clear:

Set 5 On/C	60 Cu 0.
---------------------------------	-----------------

Finding Derated Wire Size

A circuit was built with 60°C Copper wire connecting a 47,650 VA load to a 240 Volt, 3Ø source. Ambient Temperature is 50°C. What is the Derated Wire Size required if eight current-carrying THHN wires are installed in the raceway?

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
-------------------------	-----------

1. Set to 3-Phase:

Set 3 (3Ø)	3Ø 3 PH
--------------------------	----------------

2. Set to 60° C:

Set 6 (60°)	3Ø 60 3 PH
---------------------------	-------------------

3. Set to Copper (if necessary):

Set 4 (Cu/Al)	3Ø 60 Cu 3 PH
-----------------------------	----------------------

4. Enter Volt-Amps:

4 7 6 5 0 VA	VA 47,650.
--	-------------------

5. Enter Volts:

2 4 0 Volts	VOLT 240.
---	------------------

6. Find Amps:

Amps	AMPS 114.62808.
-------------	------------------------

7. Set to 50° C Ambient Temperature:

5 0 **Set** **2**

(Amb°)

Amb **AMB° 50. °C**

8. Find Derated Wire Size:

8 **Set** **ParSz**

(D/R Size)

D/R 500 CU WIRE SIZE

9. Reset Ambient Temperature
and Clear:

3 0 **Set** **2** **On/C**

3Ø 60 Cu 0.

VOLTAGE DROP

The *ElectriCalc Pro* uses Resistance values found in NEC Table 8 Chapter 9 to determine Voltage Drop, Wire Lengths or Wire Sizes given a maximum Voltage Drop percentage.

Finding Voltage Drop

You are installing 175 Feet of 75°C, #8 THW branch circuit Copper conductors to supply an 11A load on a 208V 1Ø system. What is the source Voltage Drop at the load?

KEYSTROKE

DISPLAY

On/C On/C

0.

1. Set to 1-Phase:

Set **1** (1Ø)

1 Ø 1 PH

2. Set to 75 ° C:

Set **7** (75°)

1 Ø 75 1 PH

(cont'd)

(cont'd)

KEYSTROKE	DISPLAY
-----------	---------

3. Set to Copper (if necessary):

Set **4** (Cu/Al) 1 Ø 75 Cu 1 PH

4. Enter Amps:

1 **1** **Amps** AMPS 11.

5. Enter Volts:

2 **0** **8** **Volts** VOLT 208.

6. Enter Length:

1 **7** **5** **Length** FEET 175.

7. Enter Wire Size:

8 **WireSz** AWG 8 CU WIRE SIZE

8. Solve Voltage Drop:

VD% DROP 3.0 v

9. Solve percent Voltage Drop:

VD% DROP 1.4 % v

Finding Voltage Drop Wire Size

A 20 Amp, 3Ø 208 Volt load will be located 175 Feet away from the source. Assuming a 3% allowable Voltage Drop, what is the size of 75°C conductor required for this branch circuit?

KEYSTROKE	DISPLAY
-----------	---------

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

1. Set to 3-Phase:

Set **3** (3Ø) 3Ø PH

2. Set to 75° C:

Set **7** (75° C) 3Ø 75 3 PH

3. Set to Copper (if necessary):

Set **4** (Cu/Al) 3Ø 75 Cu 3 PH

4. Enter Amps:

2 **0** **Amps** AMPS 20.

5. Enter Volts:

2 **0** **8** **Volts** VOLT 208.

6. Enter Length:

1 **7** **5** **Length** FEET 175.

7. Enter allowable VD%:

3 **VD%** DROP 3.0 % V

8. Find Wire Size:

WireSz AWG 8 CU VD WIRE SIZE

Finding Voltage Drop Distance

How far from a Three-Phase 240 Volt source can you install a 15 Amp load using 60°C #10 Copper branch circuit conductors? Assume a 3% allowable Voltage Drop.

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
-------------------------	----

1. Set to 3-Phase:

Set **3** (3Ø) 3Ø 3 PH

2 Set to 60° C:

Set **6** (60°) 3Ø 60 3 PH

3. Set to Copper (if necessary):

Set **4** (Cu/Al) 3Ø 60 Cu 3 PH

(cont'd)

(cont'd)

KEYSTROKE	DISPLAY
-----------	---------

4. Enter Amps:

1 5 Amps	AMPS 15.
-------------------------------	----------

5. Enter Volts:

2 4 0 Volts	VOLT 240.
---	-----------

6. Enter Wire Size:

1 0 WireSz * AWG 10 CU	WIRE SIZE
--	-----------

7. Enter 3% allowable Voltage Drop:

3 VD%	DROP 3.0 % V
---------------------	--------------

8. Find distance:

Length	FEET 234.86987
---------------	----------------

Finding Voltage Drop Resistance

What is the Resistance per 1,000 Ft.
of #2 90° C Copper conductor?

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
-------------------------	----

1. Set to 90° C:

Set 9 (90°)	90 0.
---------------------------	-------

2. Set to Copper (if necessary):

Set 4 (Cu/Al)	90 Cu 0.
-----------------------------	----------

3. Enter Wire Size:

2 WireSz * AWG 2 CU	WIRE SIZE
--	-----------

4. Find Resistance:

Set Length	
(Wire Res)	OHMS 0.2033993 WIRE

GROUND CONDUCTOR WIRE SIZE

The *ElectriCalc Pro* uses NEC Table 250.66 to find the Grounding Electric Conductor Size for an entered Feeder Size.

Find the Grounding electrode conductor Wire Size required when a 2/0 Copper service-entrance conductor is being used.

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
------------------	-----------

1. Enter Wire Size and find Ground Wire Size:

0 0 Grnd	GRND 4 CU WIRE SIZE
-----------------	----------------------------

2. Find Aluminum size:

Grnd	GRND 2 AL WIRE SIZE
-------------	----------------------------

EQUIPMENT GROUNDING CONDUCTOR WIRE SIZE

The *ElectriCalc Pro* uses an external amperage to find the Equipment Grounding conductor based on NEC Table 250.122.

Find the Equipment Grounding conductor size required when the circuit breaker is rated at 45 Amps.

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KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
------------------	----

1. Find Equipment Ground Wire Size:

4 5 Set

Grnd (EqGrnd) EQPG 10 CU WIRE SIZE

2. Find Aluminum size:

Grnd EQPG 8 AL WIRE SIZE

FUSE AND CIRCUIT BREAKER SIZE

Fuse and Breaker sizing is determined by NEC Table 430.52. Once the Motor Type is defined via **Set O-Load**, a Full-Load Current amperage value can be used to find the Fuse Breaker Sizes.

What is the Dual Element Fuse size for a 230 Volt, 3-Phase, 50 HP Induction motor?

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
------------------	----

1. Set to 3-Phase:

Set 3 (3Ø) 3Ø 3 PH

2. Enter Volts:

2 3 0 Volts VOLT 230.

3. Enter HP:

5 0 HPmotor IND* 50. HP

* Press **Set 8** until **IND** is displayed in the upper left area of the display.

4. Find Full-Load Current:

Amps FLC 130. A

5. Find Dual Element Fuse size:

DEFuse AMPS 227.5 dE

STARTER SIZE

What size NEMA Starter is required for a 575 Volt, 3Ø, 20 HP Induction motor?

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
------------------	----

1. Set to 3-phase:

Set 3 (3Ø)	3Ø 3 PH
--------------------------	---------

2. Enter Volts:

5 7 5 Volts	VOLT 575.
---	-----------

3. Enter HP:

2 0 HPmotor	IND* 20. HP
----------------------------------	-------------

* Press **Set** **8** until **IND** is displayed in the upper left area of the display.

4. Solve for Starter Size:

Set HPmotor (Starter)	STAR SIZE 2
-------------------------------------	-------------

OVERLOAD PROTECTION SIZE

What Overload Protection device size is required for an Induction motor with a nameplate rating of 19.2 Amps and a 1.0 service factor? What is the required Overload at 125% (for a 1.15 service factor)?

(cont'd)

(cont'd)

KEYSTROKE	DISPLAY
-----------	---------

On/C On/C	0.
------------------	----

1. Enter nameplate Current:

1 9 2 Amps	AMPS 19.2
-------------------	-----------

2. Find Overload size:

1 1 5 O-Load	AMPS 22.08 o l
---------------------	----------------

3. Display percent used:

O-Load	%FLC 115. %
---------------	-------------

4. Find 125% Load:

1 2 5 O-Load	AMPS 24. o l
---------------------	--------------

5. Display percent used:

O-Load	%FLC 125. %
---------------	-------------

6. Reset Overload rating and Clear:

1 1 5 O-Load On/C	0.
--------------------------	----

CONDUIT SIZE

The *ElectriCalc Pro* can calculate the size of Conduit required when running single or multiple Wires using the **CondSz** key and the calculator's internal tables. To select a specific Conduit Type, enter the corresponding number of the Conduit as shown below and then press **Set CondSz**.

1) EMT 4) IMC 7) LFMC 10) P-40

2) ENT 5) LFNB 8) RMC 11) P-A

3) FMC 6) LFNA 9) P-80 12) P-EB

Finding Motor Branch-Circuit Wire Size and Conduit Size — Same Wire Type and Size

What size THHN Copper Wire and RMC Conduit are needed to connect a 10 HP 1Ø Induction motor to a 115 Volt source?

KEYSTROKE **DISPLAY**

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

1. Set to 1-Phase:

Set 1 (1Ø) **1 Ø 1 PH**

2. Set to 60° C:

Set 6 (60°) **1 Ø 60 1 PH**

3. Set to Copper (if necessary):

Set 4 (Cu/Al) **1 Ø 60 Cu 1 PH**

4. Enter Volts:

1 1 5 Volts **VOLT 115.**

5. Enter Horsepower:

1 0 HPmotor **IND 10. HP**

* Press **Set 8** until **IND** is displayed in the upper left area of the display.

6. Display Full-Load Amps:

Amps **FLC 100. A**

7. Find Wire Size at 125% Ampacity:

Set WireSz (125%) **AWG 0 CU**
WIRE SIZE 125%

8. Find Wire Ampacity:

WireSz **Ø 125.0 WIRE A125%**

(cont'd)

(cont'd)

KEYSTROKE	DISPLAY
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9. Enter Conduit Type and find

Conduit Size:

8 **Set** **CondSz**

(Cond Type) RMC 1.25 in COND SIZE

10. Find total number of Wires:

CondSz 2. TTL WIRES

11. Find Conduit Fill Percent:

CondSz FILL 24.3 % COND

12. Find actual Fill Area:

CondSz FILL 0.3710 TTL WIRE AREA

13. Find Remaining Area:

CondSz REM 0.1021 WIRE AREA

Finding Conduit Size — Multiple Conductors, Different Wire Sizes and Types

Three 1/0 THWN conductors and one #2 XHHW conductor are to connect to a panel board using a single Conduit. What is Conduit Size needed and actual Fill Area?

KEYSTROKE	DISPLAY
-----------	---------

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

1. Enter Conduit Type:

3 **Set** **CondSz** FMC nonE COND

(Cond Type)

2. Enter first Wire Size:

0 **WireSz** * AWG 0 CU WIRE SIZE

3. Enter number of THWN Wires:

3 **#THHN** **#THWN** THHN 3. WIRES

4. Enter second Wire Size:

2 **WireSz** * AWG 2 CU WIRE SIZE

5. Enter number of XHHW Wires:

1 **#XHH** **#XHHW** XHHW 1. WIRE

6. Find Conduit Size:

CondSz FMC 1.50 in COND SIZE

7. Find total number of Wires:

CondSz 4. TTL WIRES

8. Find Conduit Fill Percent:

CondSz FILL 36.1 % COND

9. Find actual Fill Area:

CondSz FILL 0.6711 TTL WIRE AREA

10. Find Remaining Area:

CondSz REM 0.0717 WIRE AREA

CONVERTING KILOWATT-HOUR AND BTU

Find the equivalent BTU rating of a
3.5 kilowatt-hour rated furnace.

KEYSTROKE

DISPLAY

On/C On/C 0.

1. Enter kilowatt hours:

3 **0** **5** 3.5

2. Find equivalent BTU:

Set **0** (Kw-hr ► Btu) BTU 11,953.552

(cont'd)

(cont'd)

What is the kilowatt-hour rating for a 4,500 BTU heater?

KEYSTROKE	DISPLAY
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On/C On/C	0.
------------------	----

1. Enter BTU rating:

4 5 0 0	4,500.
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2. Find equivalent kilowatt hours:

Set = (Btu► Kw-hr)	KW-H 1.3176
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PARALLEL RESISTANCE

Find the equivalent Resistance for 10 Ohm, 20 Ohm, and 50 Ohm resistors placed in parallel.

KEYSTROKE	DISPLAY
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On/C On/C	0.
------------------	----

1. Enter first Resistor:

1 0 Set Stor	P-RS 10.
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(Par Res)

2. Enter second Resistor:

2 0 Set Stor	P-RS 6.666667
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(Par Res)

3. Enter third Resistor:

5 0 Set Stor	P-RS 5.8823529
---------------------	----------------

(Par Res)

Note: The total is recalculated with each additional Resistor value entered.

APPENDIX A — DEFAULT SETTINGS

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

STORED VALUES	DEFAULT VALUE
Insulation Rating	60° C
Wire Material	Copper
Phase	3Ø
Ambient Temperature	30° C (86° F)
Volts	240V
Voltage Drop %	3%
Power Factor %	100%
Efficiency %	100%
Motor Type	Induction
Conduit Type	EMT
Fuse/Breaker	Squirrel Cage
Motor Type	non Design E
Overload FLC%	115%
Free Air Mode*	Off

* This setting will also return to its default upon turning the calculator off and back on.

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

(cont'd)

(cont'd)

PREFERENCE SETTINGS	DEFAULT VALUE
NEC Code	2011
Temperature Units	°C
Length Units	FEET

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

APPENDIX B — CARE INSTRUCTIONS

Please follow the guidelines listed in this section for proper care and operation of your calculator. Not following the instructions listed below may result in damage not covered by your warranty. Refer to the **Warranty** section on page 61 of the **User's Guide** for more details..

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


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




APPENDIX C — ACCURACY/ERRORS, AUTO SHUT-OFF, BATTERIES, RESET

Accuracy/Errors

Accuracy/Display Capacity — Your calculator has an eight-digit display. You may enter or calculate values up to 99,999,999. Each calculation is carried out internally to 12 digits.



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



Error Codes

DISPLAY	ERROR TYPE
OFLO	Overflow; answer too large to display
ENT Error	Invalid entry
POWR Error	Power Factor (PF) or Efficiency (EFF) calculated above 100%

(cont'd)

(cont'd)

nonE	Unable to calculate or not available
HP Error	Invalid Horse-power entry per NEC table
FULL Error	Entered or calculated more than 15 different Wires Sizes
EROM Error	Bad EPROM
MATH Error	Math error (i.e., divide by zero)

AUTO SHUT-OFF

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

BATTERY

The *ElectriCalc Pro* uses one CR2016 battery. Should your calculator display become 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 or go to www.calculated.com.

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,” press Reset — a small hole located below the **Off** key — to perform a total reset.





REPAIR AND RETURN

RETURN GUIDELINES

1. Please read the **Warranty** in the 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 between the hours of 7:00am to 4:30pm Pacific Time for additional information and a Return Merchandise Authorization (RMA).
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Call Toll Free: 1-800-854-8075
Outside USA: 775-885-4900
www.calculated.com/warranty



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