

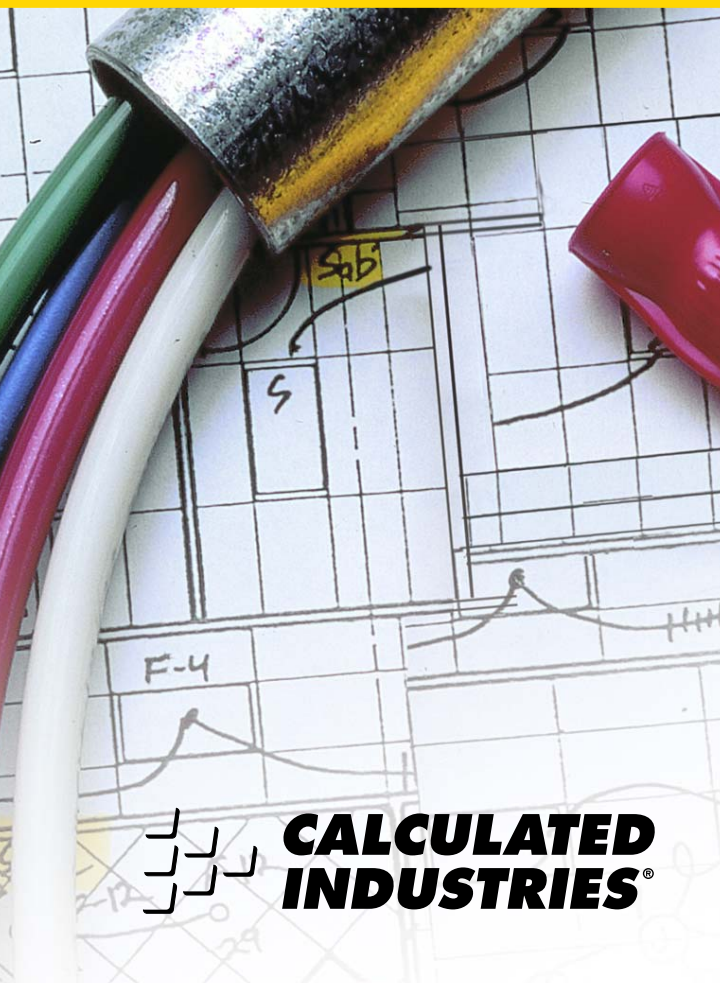
# **ELECTRICAL<sup>®</sup> PRO**

NEC<sup>®</sup> COMPLIANT

UPDATEABLE ELECTRICAL CODE CALCULATOR

**Model 5065**

## **User's Guide**



**CALCULATED  
INDUSTRIES<sup>®</sup>**

Introducing the

# ElectriCalc<sup>®</sup> Pro

***Now NEC<sup>®</sup>-Updateable!***

The *ElectriCalc<sup>®</sup> Pro* is an invaluable calculator for today's busy electrical professional. Unlike a regular calculator, it has intuitively labeled "electrical keys" and conforms to the 2008 (and 2005, 2002, 1999, 1996) and future *National Electrical Codes*, allowing you to solve Code-related problems quickly and accurately. The most common NEC tables are now at your fingertips!

An important feature of the *ElectriCalc Pro* is that it is programmed to accept future NEC changes, allowing you to conveniently install future Code editions in a few simple steps.

The *ElectriCalc Pro* instantly solves for the following:

- *Kirchhoff's Law*
- *Ohm's Law*
- *Volts, Amps, Volt-Amps, Watts, kVA, kW, PF%, EFF%, and Resistance*
- *Copper or Aluminum Wire Sizes*
- *Parallel and Derated Wire Sizes*
- *Voltage Drop Wire Sizes, % and Actual Voltage Drops, Voltage Drop Distances and Wire Resistances*
- *Kilowatt hours and BTU's*
- *Parallel Resistance*
- *Grounding Conductors Sizes*
- *Motor Full-Load Amps*
- *Overload Protection Sizes*
- *NEMA Starter Sizes*
- *Conduit Sizes*
- *And much more!*

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Your *ElectriCalc Pro* is now updateable for future National Electrical Code® editions that are updated every three (3) years. To upgrade your unit, follow the instructions below:

- 1) Purchase the NEC Update from CI (see pricing / details from CI's Web site: [www.calculated.com](http://www.calculated.com) or call 1-800-854-8075). This Update is in the form of a chip that contains the new Code.
- 2) Once you receive the NEC Update chip, you need to install it in your *ElectriCalc Pro*:
  - a) Turn calculator off.
  - b) As a precaution, remove the battery (located back of calculator, top of unit) by sliding battery door out with your thumbnail. Set aside.
  - c) Using a screwdriver, pop out the square tab located in the middle section on the back of your calculator.
  - d) Replace it with the new update tab by inserting it into the slot.
  - e) Replace the battery door.
  - f) Turn calculator on. Your calculator is now updated and ready to use.

# Key Definitions

## Standard Calculator Functions

### **On/C** — *On/Clear*

Turns on power. Pressing once clears the last entry and the display. Pressing twice clears all non-permanent values.

### **Off** — *Off*

Turns all power off. Clears the Memory and most internal registers.

### **+** **-** **X** **÷** **=**

Arithmetic operation keys.

### **0** **1** **2** **3** **4** **5** **6** **7** **8** **9** **●**

Used for keying in numbers.

### **%** — *Percent*

Four function (+, -, x, ÷) Percent key.

### **Set** **VD%** — *Reciprocal (1/x)*

Finds the reciprocal of a number (e.g., **8** **Set** **VD%** 0.125).

### **←** — *Back Space Function*

Used to delete entries one keystroke at a time (unlike the **On/C** function, which deletes the entire entry).

### **Set** — *Second Function*

Used with other keys to access secondary functions.

### **Stor** — *Store*

Used with function keys to store values.

**Displays: STOR**

**Rcl** — *Recall*

Recalls a value stored in a register (e.g., to recall voltage drop % press **Rcl** **VD%**).

**Displays: RCL**

**Set** **+** — *Pi* ( $\pi$ )

Constant = 3.1415927

**Set** **-** — *Change Sign* (+/-)

Toggles the sign of the displayed value from positive to negative or from negative to positive.

**Set** **%** —  $x^2$ 

Squares the displayed value.

**Set** **←** — *Square Root* ( $\sqrt{x}$ )

Square Root function.

**Stor** **0** — *Cumulative Memory* ( $M+$ )

Adds displayed value to Memory (e.g., **1** **0** **Stor** **0**, **2** **0** **Stor** **0**, **Rcl** **0** = 30). To subtract from Memory, you must add a negative value to the cumulative Memory (e.g., **1** **0** **Stor** **0**, **5** **Set** **-** **Stor** **0**, **Rcl** **0** = 5). Clears when the calculator is shut off.

**Rcl** **0** — *Memory Recall*

Displays the value saved in ( $M+$ ).

**Rcl** **Rcl** — *Display/Clear Memory* ( $M-R/C$ )

Displays and clears the value saved in ( $M+$ ).

**Set** **Rcl** — *Clear Memory*

Clears the value saved in ( $M+$ ) without changing displayed value.

### **Stor** ① - ⑨ — *Memory Storage*

When pressed after the **Stor** key, the ① through ⑨ keys will store the displayed values into non-cumulative Memory.

### **Rcl** ① - ⑨

Recall M1 – M9.

## **Mode Set-up Functions**

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### **Set** **X** — *Clear All*

Clears all values, including Memory. Resets settings to default values, except preference settings which are retained.

### **Set** **÷** — *Preferences (Prefs)*

Use to set default settings or modes (see “Preference Settings”).

### **Set** ① — *Single-Phase (1Ø)*

Sets calculator to single-phase mode.

**Displays:** 1Ø

### **Set** ③ — *Three-Phase (3Ø)*

Sets calculator to three-phase mode.

This is the default setting. **Displays:** 3Ø

### **Set** ② — *Ambient Temperature (AMB°)*

Permanently enters ambient temperature for determining ampacity derived wire sizes. Ambient temperature will only change when entering a new value or by resetting the calculator. Defaults to 30°C (86°F). **Amb** will display when the ambient temperature is other than 30°C (86°F). **Displays:** AMB°

(Cont'd)



(Cont'd)

**NOTE:** The temperature units can be displayed in Celsius (°C) or Fahrenheit (°F) by changing the preference setting (see “Preference Settings”).

**Set 4 — Copper/Aluminum (Cu/Al)**

Used to toggle between copper (default) and aluminum wire types. When the wire type is revised, any calculated wire size will be re-calculated automatically. If a wire size is entered with the wrong wire type, pressing **Set 4** will change the material type without changing the size. **Displays: Al or Cu**

**Set 5 — Free Air (FrAir)**

Sets calculator into Free Air mode, which refers to NEC Table 310-17 for wire size calculations. **Displays: FrAir**

**Set 6 — 60°C Wire Insulation**

Sets calculator to 60°C wire insulation type for wire size calculations. This is the default setting. **Displays: 60**

**Set 7 — 75°C Wire Insulation**

Sets calculator to 75°C insulation type for wire size calculations. **Displays: 75**

**Set 9 — 90°C Wire Insulation**

Sets calculator to 90°C insulation type for wire size calculations. **Displays: 90**

## Electrical Functions

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### **kilo-** — *kilo-*

This key is used with Watts, Amps, Volts, and Volt-amps keys to identify “kilo-” values.

### **Set kilo-** — *milli-*

This key sequence is used with Watts, Amps, Volts, and Volt-amps keys to identify “milli-” values.

### **Amps** — *Amps*

Enters or calculates Amps (using Volts and VA or Watts). **Displays: AMPS, KAMP or mAMP**

### **Volts** — *Volts*

Enters or calculates Volts (using Amps, HPth, and VA or Watts). Default value is 240 Volts. **Displays: VOLT, KV, or mV**

### **VA** — *Volt-Amps*

Enters or calculates Volt-amps (using Amps, Volts and Horsepower or Watts). **Displays: VA, KVA, or mVA**

### **Watts** — *Watts*

Enters or calculates Watts (using Amps, Volts, and VA or Horsepower). **Displays: WATT, KW, or mW**

### **Set Amps** — *DC Amps (Idc)*

Enters or calculates DC Amps (using DC Volts and Resistance). **Displays: Idc**

**Set** **Volts** — *DC Volts (Vdc)*

Enters or calculates DC Volts (using DC Amps and Resistance). **Displays: Vdc**

**Set** **VA** — *DC Resistance (R)*

Calculates and displays DC resistance in Ohms (using DC Volts and DC Amps). **Displays: R**

**Set** **Watts** — *Power Factor (PF%)*

Enters or calculates power factor percentage (based on Watts and VA). Defaults to 100%. Entered or calculated power factors greater than 100% will result in an error. **Displays: PF%**

**HPth** — *Horsepower (Theoretical)*

Enters or calculates theoretical Horsepower (based on Amps, VA, Watts, efficiency%, PF%, and/or Volts). 1.0 HPth correlates to 746 Watts at 100% efficiency. **Displays: HPth**

**Set** **HPth** — *Efficiency (Eff%)*

Enters or calculates the percent ratio between real power (Watts) and theoretical Horsepower. Default: 100%. Entered or calculated efficiencies greater than 100% will result in an error.

**Displays: EFF%**

**Set**  — *Kilowatt-Hours to BTU*

*(Kw-hr ► Btu)* Calculate BTU (British Thermal Unit) based on an entered Kilowatt-Hour value. **Displays: KW-H**

**Set** **≡** — **BTU to Kilowatt-Hours**  
(*Btu* ► *Kw-hr*) Calculate Kilowatt-Hours based on an entered BTU (British Thermal Unit) value. **Displays: BTU**

**Set** **Stor** — **Parallel Resistance**  
(*Par Res*) Calculate total resistance based on an entered series of resistance values. **Displays: P-RS**

## **Motor Horsepower Functions**

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The *ElectriCalc Pro* can be used to determine motor full-load current (Amps) based on entries for motor Horsepower (HPmotor), Phase and Voltage.

You can also find an equivalent motor Horsepower if you have entered Voltage and full load current values. Only HP motor and Voltage entries as defined by NEC Tables 430-247, 430-248 and 430-250 can be used to determine motor loads.

**Set** **8** — **Induction/Synchronous/DC Motor Toggle (Ind/Sync/DC)**  
Toggles between induction, synchronous, and direct current motor types. **Displays: IND** (induction - default), **SYNC** (synchronous) or **DC** (direct current).

**HPmotor** — **Motor Horsepower**  
Enters or calculates motor Horsepower. **Displays: IND HP** (induction – default), **SYNC HP** (synchronous) or **DC HP** (direct current).

## **Ampacity Tables**

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The *ElectriCalc Pro* uses NEC Table 310-16 (310-17 for Free Air) to find wire sizes and ampacity ratings of wires. The calculator uses the following data to calculate wire size: 1) insulation temperature rating (60°C, 75°C and 90°C); 2) wire material (copper or aluminum); and 3) ambient temperature. Standard AWG wire sizes and Circular Mils are used by the *ElectriCalc Pro*. Wire size entries less than or equal to 2000 are accepted as AWG wire sizes; entries greater than 2000 are accepted as Circular Mil entries and display the corresponding AWG wire size. Entries must match the standard wire sizes or Circular Mils; otherwise, “nonE” will be displayed (Invalid entry).

**NOTE:** 1/0, 2/0, 3/0 and 4/0 wires are entered using the **0** key (e.g., 0, 00, 000 and 0000).

### **WireSz** — **Wire Size/Ampacity**

Enters or calculates wire size based on ampacity and Voltage drop, if a Voltage drop length has been entered.

#### ◆ *First Press*

If a wire length has been entered, the first press will show the larger of the ampacity or voltage drop derived wire size. The calculator will use the larger value when calculations require a wire size. If no Voltage drop length has been entered, the calculator will display the calculated ampacity rated wire size.

### **8 — ElectriCalc Pro**

◆ *Second Press*

If a wire length has been entered, the second press displays the smaller of the two wire sizes. If not solving for Voltage drop wire size, then displays the maximum ampacity.

◆ *Third Press*

Displays the wire size in Circular Mils.

**Displays: CMIL**

◆ *Fourth Press*

If a wire length has been entered, displays the minimum wire ampacity rating. If no wire length has been entered, displays the NEC table referenced for the calculation.

**Displays: NEC 310.16**

**Set WireSz** — *125% Ampacity*

Used for motor wire sizing when the wire must not exceed 80% of its rated ampacity (125%A). This keystroke calculates wire size based on 125% of the entered or calculated Amps value. **Displays: 125%**

**ParSz** — *Parallel Size*

Used to find the size of parallel conductors using amperage and an entered quantity of wires. Parallel wire size calculations smaller than 1/0 are displayed as “none” (display shows “nonE”) as the NEC does not allow parallel wire runs smaller than 1/0.

◆ *First Press*

When preceded by a number, calculates the applicable wire size for that quantity of wires in parallel.

**Displays: PAR WIRE SIZE**

(Cont'd)

(Cont'd)

◆ *Second Press*

Displays the maximum adjusted ampacity of the calculated parallel wire size.

**Displays: WIRE A**

**NOTE:** No adjustments are made for deration.

**Set ParSz** — **Derated Wire Size (D/R Size)**

Used to calculate derated wire sizes and allowable ampacity based on the entered quantity of wires, NEC Table 310-16 and NEC Table 310-15(b)(2)(a). Derated wire sizes are not calculated when there are less than four wires, or when the unit is in Free Air mode.

◆ *First Press*

Calculates the derated wire size, if you have entered the number of wires, for example, **4** **Set ParSz**

**Displays: D/R WIRE SIZE**

◆ *Second Press*

Displays the maximum adjusted ampacity of the derated wire size.

**Displays: D/R WIRE A**

◆ *Third Press*

Displays the derated adjustment factor per the NEC Table 310-15(b)(2)(a).

**Displays: ADJ %**

◆ *Fourth Press*

Displays the NEC table referenced for the calculation. **Displays: NEC 310.15**

## **Voltage Drop Solutions**

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The *ElectriCalc Pro* will calculate maximum lengths, minimum wire sizes or actual voltage drops given the other two values. Voltage drop solutions are based on the DC resistance values found in NEC Chapter 9, Table 8.

**NOTE:** *Voltage drop solutions may vary slightly from actual AC circuit values as the calculator does not incorporate factors such as inductive reactance, skin effect, raceway material, etc.*

### **VD%** — **Percent Voltage Drop**

Used to enter or calculate voltage drop. The default voltage drop is 3%. If wire size or wire length values are not available, “nonE” will display since the voltage drop cannot be found.

#### ◆ *First Press*

Enters a maximum allowable voltage drop percentage (**Displays: V DROP %**) or calculates actual Voltage drop (**Displays: V DROP**).

#### ◆ *Second Press*

Calculates actual percent Voltage drop.  
**Displays: V DROP %**

### **Length** — **Length**

Enters or calculates the length of a run for Voltage drop calculation.

**Displays: FEET or MET**

**NOTE:** *Units of length can be set to Feet or Meters by changing the preference setting (see “Preference Settings”).*



### **Set Length** — *Wire Resistance (Wire Res)*

Displays the actual resistance per 1,000 feet of the wire size in **WireSz** based on NEC Chapter 9, Table 8.

**Displays: OHMS WIRE**

## **Ground Function Keys**

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### **Grnd** — *Ground*

An output-only key used to find the grounding electrode conductor size for AC systems based on NEC Table 250-66 and an entered or calculated service-entrance conductor (largest size). Only actual wire sizes are considered valid entries.

#### ◆ *First Press*

Calculates the copper grounding electrode conductor size if you have entered a valid wire size.

**Displays: GRND CU WIRE SIZE**

#### ◆ *Second Press*

Displays the aluminum grounding electrode conductor size.

**Displays: GRND AL WIRE SIZE**

#### ◆ *Third Press*

Displays the Circular Mil area used to calculate the grounding electrode conductor size. **Displays: CMIL WIRE**

◆ *Fourth Press*

Displays the NEC table referenced for the calculation. **Displays: NEC 250.66**

**Set Grnd** — *Equipment Ground (EqGrnd)*

This function uses NEC Table 250-122 to calculate the minimum equipment grounding conductor size, given an entered amperage rating or setting for an over-current device up line (e.g., 300

**Set Grnd**).

**NOTE:** *This function deviates from the NEC Table 250-122 in that 1250 MCM AL is used instead of 1200 as specified in NEC Table 250-122.*

◆ *First Press*

Displays the copper grounding conductor size for the entered Amp rating. **Displays: EQPG WIRE SIZE CU**

◆ *Second Press*

Displays the aluminum grounding conductor size. **Displays: EQPG WIRE SIZE AL**

◆ *Third Press*

Displays the NEC table referenced for the calculation. **Displays: NEC 250.122**

## **Fuse/Breaker Keys**

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The *ElectriCalc Pro* has special keys that automatically calculate the Amp ratings of the following over-current protection devices: Dual Element Fuses (Time Delay), Single Element Fuses (Non-Time Delay), Instantaneous Trip Breakers (Type 1), Inverse Time Breakers (Type 2), and Overload Protection Devices.

These fuse and circuit breaker sizes are derived using the “Percent of Full-Load Current” multipliers listed in NEC Table 430-52.

You can also calculate the full Voltage starter size for non-plugging and non-jogging duty motors based on phase, Voltage, motor HP and NEMA table specifications.

If a parameter is missing or invalid, the calculator will display “nonE.”

### **Set O-Load — Motor Type (M-Type)**

Based on NEC Table 430-52, this key selects the motor type used to define the percent factors for breakers/fuses. Once set, the motor type remains fixed until you change it or perform a Clear All (**Set X**).

#### ◆ *First Press*

Displays the current motor type. Note there is no motor type in single-phase mode.

◆ *Second Press*

In three-phase mode only, subsequent presses of **O-Load** will select and display the next motor type from this list: **SQ-C non-B** (Squirrel Cage, non-Design B), **SQ-C B** (Squirrel Cage, Design B), **SYNC no code** (Synchronous), **WND no code** (Wound Rotor).

**DEFuse** — *Dual Element Fuse*

◆ *First Press*

Calculates the minimum Amp rating for a Dual Element Fuse.

**Displays: AMPS dE.**

◆ *Second Press*

Displays the full-load current percent multiplier used to determine fuse size.

**Displays: %FLC**

**Set DEFuse** — *Single Element Fuse (SEFuse)*

◆ *First Press*

Displays the minimum Amp rating based on Phase, motor type, and amperage.

**Displays: AMPS SE**

◆ *Second Press*

Displays the full-load current percent multiplier value used to determine fuse size. Subsequent presses repeat this cycle. **Displays: %FLC**

## **Set InvTime** — *Instantaneous Trip Circuit Breaker (InsTrip)*

### ◆ *First Press*

Displays the minimum Amp rating for an Instantaneous Trip Circuit Breaker, based on the phase, motor type, and amperage. **Displays: AMPS b1**

### ◆ *Second Press*

Displays the full-load current percent multiplier value used to determine breaker size. **Displays: %FLC**

## **InvTime** — *Inverse Time Breaker*

### ◆ *First Press*

Calculates the minimum Amp rating for an Inverse Time Breaker, based on the phase, motor type, and amperage. **Displays: AMPS b2**

### ◆ *Second Press*

Displays the full-load current percent multiplier value used to determine breaker size. **Displays: %FLC**

## **O-Load** — *Overload Protection*

### ◆ *First Press*

Displays the overload amperage requirement based on the full-load current shown on the motor nameplate. Multiplies the entered motor nameplate full-load current (stored in the **Amps** registers) by 115% or the value you enter.

Conforms to NEC Section 430-32 (a)(1) value of 115% unless you enter another value. For example, entering 125 **O-Load** would calculate overload protection based on 125% of the entered amperage.

**Displays: AMPS ol**

◆ *Second Press*

Displays the full-load current percent multiplier value used to determine the overload current protection size. Subsequent presses of **O-Load** repeat the cycle. **Displays: %FLC**

**Set HPmotor** — **Starter Size (Starter)**

Displays the starter size (from NEMA publication ICS 2-1988 Tables 2-327-1 and 2-327-2) based on the phase, Voltage, and motor Horsepower settings.

**Displays: STAR SIZE**

**NOTE:** *Horsepower values not identified in NEMA tables will cause the calculator to round up to the next larger starter size in the table.*

## Conduit Sizing Keys

The *ElectriCalc Pro* calculates conduit size using NEC Tables 1, 3, 4, and 5 of Chapter 9 (given insulation type, wire size, and quantity of wires). It will also calculate the number of wires of a specified insulation type and wire size that will fit in a defined conduit size. Acceptable conduit sizes (depending on the type of conduit used) are as follows: 1/2", 3/4", 1", 1-1/4", 1-1/2", 2", 2-1/2", 3", 3-1/2", 4", 5", and 6". Conduit sizes are entered using decimal equivalents (e.g., 1-1/2" is entered as 1.5, 3/4" is entered as .75, etc.).

**#THW**, **#XHH**, **#THHN**  
**#THHW**, **#XHHW**, **#THWN** — **Number of Wires**

Used to enter or calculate the number of wires in a raceway and calculate cross-sectional wire area.

### ◆ *First Press*

Enters number of wires or calculates maximum number of wires in conduit.

**Displays: TTL WIRES** (calculated) or **WIRES** (entered).

### ◆ *Second Press*

Shows total cross-sectional area for all entered wires. **Displays: WIRE AREA** (entered) or **TTL WIRE AREA** (calculated).

### ◆ *Third Press*

Shows total cross-sectional area of all entered wires of the selected wire insulation. **Displays: TTL WIRE AREA**

## **CondsSz** — *Conduit Size*

Used to find conduit sizes based on the total area of the entered wire types and sizes (up to 15 at one time). If the quantity and insulation type has not been entered, the calculator will assume 2 THHN wires for single-phase or 3 THHN wires for three-phase calculations.

### ◆ *First Press*

Enters or calculates conduit size.

**Displays: COND SIZE**

**NOTE:** *If a wire size has not been entered or calculated, or an invalid conduit size is entered, the calculator will display “nonE.”*

### ◆ *Second Press*

Shows total number of wires in the conduit for calculated conduit size. Shows the conduit internal area for an entered conduit. **Displays: TTL WIRES** (calculated) or **COND AREA** (entered).

**NOTE:** *Third through fifth presses display only for calculated conduit sizes.*

### ◆ *Third Press*

Shows fill percentage for the calculated conduit size as determined by Table 1, Chapter 9. **Displays: COND FILL %**

### ◆ *Fourth Press*

Shows the total wire area for all entered wires. **Displays: FILL TTL WIRE AREA**

*(Cont'd)*



(Cont'd)

◆ *Fifth Press*

Shows remaining fill area. This value may be negative if all wires are the same size due to Note 7 in NEC Chapter 9, Table 1.

**Displays: REM WIRE AREA**

**Set CondSz** — *Conduit Type (Cond Type)*

◆ *First Press*

Displays the currently selected conduit type.

◆ *Second Press*







Subsequent presses will display and select the next conduit type from this list:

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

To select a specific conduit type, enter the corresponding number of the conduit and then press **Set CondSz**. If you press this keystroke without entering a number, the calculator will switch to the next conduit type on the list.

## Preference Settings

Your calculator has the following Preference Settings that you can access and change at any time.

Access the Preference Settings by pressing **Set** . Then, to access each category, press the  key until the desired setting is reached. *Within each category*, press the  or  keys to toggle between individual selections (note: the  will advance, the  will back-up).

You can change these settings at any time by repeating the above, and setting in a new preference.

**NOTE:** *To return the Preferences to the default settings, perform a full reset (press **Off**, hold down **X**, and press **On/C**), or manually set them back using the keystrokes below.*

The Preference Settings are (default settings shown first):

**To Set 2008, 2005, 2002, 1999, or 1996  
NEC code:**

---

<b>Set</b>  (1st press of  )	<b>NEC 2008</b>
	<b>NEC 1996</b>
	<b>NEC 1999</b>
	<b>NEC 2002</b>
	<b>NEC 2005</b>

## To Set Ambient Temp. to °C or °F:

**⊕** (2nd press of **⊕**)      **AMB° 30 °C**  
**+**      **AMB° 86 °F**

## To Set Length to Feet or Meter:

**⊕** (3rd press of **⊕**)      **FEET 1.**  
**+**      **MET 1.**

## **Default Settings**

When you first receive your calculator, it is pre-set to the default settings listed below. You can always return your calculator to these default values by performing a Clear All (**Set X**).

<b>Ambient Temperature</b>	<b>30°C</b>
<b>Insulation Rating</b>	<b>60°C</b>
<b>Material</b>	<b>Copper (Cu)</b>
<b>Phase</b>	<b>3Ø</b>
<b>Volts</b>	<b>240 V</b>
<b>Efficiency</b>	<b>100%</b>
<b>Power Factor</b>	<b>100%</b>
<b>Voltage Drop Percent</b>	<b>3%</b>
<b>Wire Environment (vs Free Air)</b>	<b>Raceway</b>

## Basic Math Operations

This calculator uses standard chaining logic, which simply means that you enter your first value, the operator (**+**, **-**, **X**, **÷**), the second value and then the equals sign **=**.

- A. **3** **+** **2** **=** 5.  
B. **3** **-** **2** **=** 1.  
C. **3** **X** **2** **=** 6.  
D. **3** **÷** **2** **=** 1.5

## Percent Calculations

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

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

The Percent key also allows you to change percentages to decimals (e.g., **2** **5** **%** 0.25).

# Memory Operations

Whenever the **Stor** **0** keys are pressed, the displayed value will be added to the Memory. Other Memory functions:

FUNCTION	KEYSTROKES
Add to Memory	<b>Stor</b> <b>0</b>
Subtract from Memory	<b>Set</b> <b>-</b> <b>Stor</b> <b>0</b>
Recall total in Memory	<b>Rcl</b> <b>0</b>
Display/Clear Memory	<b>Rcl</b> <b>Rcl</b>
Clear Memory	<b>Set</b> <b>Rcl</b>

Memory is semi-permanent, clearing only when you:

- 1) turn off the calculator;
- 2) press **Rcl** **Rcl**;
- 3) press **Set** **Rcl**;
- 4) press **Set** **X** (*Clear All*).

When Memory is recalled (**Rcl** **0**), consecutive presses of **Rcl** **0** will display the calculated average and total count of the accumulated values.

## Using M+

KEYSTROKES	DISPLAY
<b>3</b> <b>5</b> <b>5</b> <b>Stor</b> <b>0</b>	M+ 355. <b>M</b>
<b>2</b> <b>5</b> <b>5</b> <b>Stor</b> <b>0</b>	M+ 255. <b>M</b>
<b>7</b> <b>4</b> <b>5</b> <b>Set</b> <b>-</b> <b>Stor</b> <b>0</b>	M+ - 745. <b>M</b>
<b>Rcl</b> <b>0</b>	TTL - 135. <b>M</b>
<b>Rcl</b> <b>0</b>	AVG - 45. <b>M</b>
<b>Rcl</b> <b>0</b>	CNT 3. <b>M</b>
<b>Rcl</b> <b>Rcl</b>	- 135.

## Using Memory Storage Keys (M1 - M9)

In addition to the standard cumulative Memory (as previously described), your calculator has nine independent Storage Registers – M1 through M9 – that can be used to permanently store single, noncumulative values. The following example shows the use of M1 (**Stor** **1**). To use M2 through M9, replace the presses of the **1** key with presses of the corresponding number key (**2** through **9**).

You can replace a value in one of these Memory registers by storing a new value in place of the stored value.

<u>FUNCTION</u>	<u>KEYSTROKES</u>
Store single value in M1	<b>Stor</b> <b>1</b>
Clear M1	<b>0</b> <b>Stor</b> <b>1</b>
Recall M1	<b>Rcl</b> <b>1</b>

*Examples:*

*Store 175 into M1, recall the value, and then clear the value.*

<u>KEYSTROKES</u>	<u>DISPLAY</u>
<b>1</b> <b>7</b> <b>5</b> <b>Stor</b> <b>1</b>	M-1 175.
<b>Off</b> <b>On/C</b>	0.
<b>Rcl</b> <b>1</b>	M-1 175.
<b>0</b> <b>Stor</b> <b>1</b>	M-1 0.

## Kirchhoff's Law

The *ElectriCalc Pro* utilizes Kirchhoff's Law in finding Volts, Amps, Volt-amps, Watts, Horsepower (theoretical), efficiency and power factor.

### Finding Voltage

Find the Voltage supply to a single-phase load drawing 14,605 Volt-amps and 115 Amps.

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 1-phase	<b>Set</b> (1)	1 PH
Enter VA	(1) (4) (6) (0) (5) <b>VA</b>	VA 14,605.
Enter Amps	(1) (1) (5) <b>Amps</b>	AMPS 115.
Solve for Volts	<b>Volts</b>	VOLT 127.

### Finding Amps

What is the current (Amps) for a load drawing 8,250 Volt-Amps on a 240 Volt, three-phase circuit?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 3-phase	<b>Set</b> (3)	3 PH
Enter VA	(8) (2) (5) (0) <b>VA</b>	VA 8,250.
Enter Volts	(2) (4) (0) <b>Volts</b>	VOLT 240.
Solve for Amps	<b>Amps</b>	AMPS 19.846416

## Finding Current Load

A building with 120/240 Volt 1Ø service has the following loads:

Range = 7,800 VA                      Heating = 15,100 VA  
Dryer = 5,100 VA                      Appliances = 8,900 VA  
Lighting = 6,470 VA

What is the service load (Amps) of the circuit supplying this building?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 1-phase	<b>Set</b> <b>1</b>	1 PH
Add VA loads:	<b>7</b> <b>8</b> <b>0</b> <b>0</b> <b>+</b> <b>1</b> <b>5</b> <b>1</b> <b>0</b> <b>0</b> <b>+</b> <b>5</b> <b>1</b> <b>0</b> <b>0</b> <b>+</b> <b>8</b> <b>9</b> <b>0</b> <b>0</b> <b>+</b> <b>6</b> <b>4</b> <b>7</b> <b>0</b> <b>=</b>	43,370.
Enter as VA	<b>VA</b>	VA 43,370.
Enter Volts	<b>2</b> <b>4</b> <b>0</b> <b>Volts</b>	VOLT 240.
Solve for Amps	<b>Amps</b>	AMPS 180.70833

## Finding Amps from Kilowatts

What is the amperage for a 75 kW load connected in a 120/208 Volt, 3Ø circuit?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 3-phase	<b>Set</b> <b>3</b>	3 PH
Enter kilowatts	<b>7</b> <b>5</b> <b>kilo-</b> <b>Watts</b>	KW 75.
Enter Volts	<b>2</b> <b>0</b> <b>8</b> <b>Volts</b>	VOLT 208.
Solve for Amps	<b>Amps</b>	AMPS 208.17918



## Finding Volt-Amps

---

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

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 1-phase	<b>Set</b> <b>1</b>	1 PH
Enter Volts	<b>1</b> <b>2</b> <b>0</b> <b>Volts</b>	VOLT 120.
Enter Amps	<b>2</b> <b>2</b> <b>Amps</b>	AMPS 22.
Solve Volt-amps	<b>VA</b>	VA 2,640.
Solve for kVA	<b>kilo-</b> <b>VA</b>	KVA 2.64

## Finding kVA Rating

---

What is the kVA rating for a 120/208 Volt, three-phase, 65 Amp transformer?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 3-phase	<b>Set</b> <b>3</b>	3 PH
Enter Volts	<b>2</b> <b>0</b> <b>8</b> <b>Volts</b>	VOLT 208.
Enter Amps	<b>6</b> <b>5</b> <b>Amps</b>	AMPS 65.
Solve for kVA	<b>kilo-</b> <b>VA</b>	KVA 23.417327

## Finding Wattage

---

A 120 Volt, single-phase, 45 Amp electrical motor has an 87% power factor. What is its wattage?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 1-phase	<b>Set</b> <b>1</b>	1 PH
Enter Volts	<b>1</b> <b>2</b> <b>0</b> <b>Volts</b>	VOLT 120.
Set power factor	<b>8</b> <b>7</b> <b>Set</b> <b>Watts</b>	PF% 87.
Enter Amps	<b>4</b> <b>5</b> <b>Amps</b>	AMPS 45.
Solve for Watts	<b>Watts</b>	WATT 4,698.

## Finding kW Rating

What's the kW rating for a 90 Amp, 208 Volt, three-phase broiler with 100% power factor?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 3-phase	<b>Set</b> <b>3</b>	3 PH
Set power factor	<b>1</b> <b>0</b> <b>0</b> <b>Set</b> <b>Watts</b>	PF%100.
Enter Amps	<b>9</b> <b>0</b> <b>Amps</b>	AMPS 90.
Enter Volts	<b>2</b> <b>0</b> <b>8</b> <b>Volts</b>	VOLT 208.
Solve for kW	<b>kilo-</b> <b>Watts</b>	KW 32.423991

## Ohm's Law

The *ElectriCalc Pro's* built-in Ohm's Law functions allow you to easily solve for Voltage (Volts), current (Amps), or resistance (Ohms) by entering in any two variables (e.g, Volts and Amps) and solving for the third (e.g., Ohms).

$$\text{Ohm's Law: } V = I \times R$$

The Ohm's Law functions on the *ElectriCalc Pro* are identified as follows:

- Vdc = Voltage, in Volts
- Idc = current, in Amps
- R = resistance, in Ohms

## Finding Volts

---

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

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Enter current	<b>0</b> <b>1</b> <b>2</b> <b>5</b> <b>Set</b> <b>Amps</b>	Idc 0.0125 A
Enter resistance	<b>4</b> <b>8</b> <b>0</b> <b>Set</b> <b>VA</b>	OHMS 480.
Find Voltage	<b>Set</b> <b>Volts</b>	Vdc 6. V

## Finding Amps

---

An 120k electrical resistor is plugged into a 12 volt circuit. Find the current (in Amps).

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Enter resistance	<b>1</b> <b>2</b> <b>0</b> <b>kilo-</b> <b>Set</b> <b>VA</b>	KOHM 120.
Enter Voltage	<b>1</b> <b>2</b> <b>Set</b> <b>Volts</b>	Vdc 12. V
Find current	<b>Set</b> <b>Amps</b>	Idc 0.0001 A

## Finding Ohms

---

An electrical circuit operating at 240 Volts has a current of 14.6 Amperes. Find the total resistance (in Ohms) of the circuit.

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Enter Voltage	<b>2</b> <b>4</b> <b>0</b> <b>Set</b> <b>Volts</b>	Vdc 240. V
Enter current	<b>1</b> <b>4</b> <b>Set</b> <b>Amps</b>	Idc 14.6 A
Find resistance	<b>Set</b> <b>VA</b>	OHMS 16.438356

## Motor Horsepower

The *ElectriCalc Pro* can calculate the full load current (Amps) of a motor, based on phase, Voltage and motor (synchronous, induction, or DC). It uses NEC Tables 430-247, 430-248 and 430-250 to determine the motor full load current. (If you enter a value for HP or Voltage that does not correspond to these tables, the unit will display nonE).

The *ElectriCalc Pro* can also calculate an equivalent Horsepower for an induction, synchronous or direct current motor based on a Voltage, phase and full load current. When calculating motor HP from an entered amperage, a result not directly matching a value in NEC Table 430-247, 430-248 or 430-250 will cause the calculator to choose the next higher table value for motor Horsepower.

### Finding Single-Phase Full Load Current

A 2 HP induction motor operates on 230 Volt, single-phase power. What is the full load current for this motor?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 1-phase	<b>Set</b> <b>1</b>	1 PH
Enter Volts	<b>2</b> <b>3</b> <b>0</b> <b>Volts</b>	VOLT 230.
Enter HP	<b>2</b> <b>HPmotor</b>	IND 2. HP
Find full load Amps	<b>Amps</b>	FLC 12. A

## Finding Motor Wire Size and Ampacity

---

Find the wire size required to connect a continuous run, 3Ø, 3 HP induction motor into a 230V circuit.

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 3-phase	<b>Set</b> <b>3</b>	3 PH
Enter Volts	<b>2</b> <b>3</b> <b>0</b> <b>Volts</b>	VOLT 230.
Enter HP	<b>3</b> <b>HPmotor</b>	IND 3. HP
Find load current	<b>Amps</b>	FLC 9.6 A
Find 125% A size	<b>Set</b> <b>WireSz</b>	AWG 14 CU WIRE SIZE 125%
Find max ampacity	<b>WireSz</b>	14* 20.0 WIRE A125%

*\*Display will show wire size in the upper left when displaying wire ampacity rating.*

## Finding Synchronous Motor Horsepower

---

A synchronous motor is defined as having a 27 Amp load on a 240 Volt, 3Ø circuit. What is its Horsepower?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 3-phase	<b>Set</b> <b>3</b>	3 PH
Set to synch.	<b>Set</b> <b>8</b>	SYNC 0.
Enter Volts	<b>2</b> <b>4</b> <b>0</b> <b>Volts</b>	VOLT 240.
Enter Amps	<b>2</b> <b>7</b> <b>Amps</b>	AMPS 27.
Solve for HP	<b>HPmotor</b>	SYNC 25. HP
Set to ind. motor	<b>Set</b> <b>8</b> <b>Set</b> <b>8</b>	IND 0.

## Finding Direct Current Motor Horsepower

---

A direct current motor is defined as having a 10 Amp load on a 180 Volt circuit. What is its horsepower?

<b>Steps</b>	<b>Keystrokes</b>	<b>Display</b>
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to DC motor	<b>Set</b> <b>(8)</b> <b>Set</b> <b>(8)</b>	DC 0.
Enter Volts	<b>(1)</b> <b>(8)</b> <b>(0)</b> <b>Volts</b>	VOLT 180.
Enter Amps	<b>(1)</b> <b>(0)</b> <b>Amps</b>	AMPS 10.
Solve for HP	<b>HPmotor</b>	DC 2. HP
Set to ind. motor	<b>Set</b> <b>(8)</b>	IND 0.

## Ampacity Wire Sizing

The required wire size of a service conductor can be determined based on the specified electrical requirements and the **WireSz** key. The wire size is automatically recalculated whenever the wire insulation (temperature) ratings or wire material (copper or aluminum) types are revised. Wire sizing is based on the requirements defined in NEC Tables 310-16 and 310-17.

### Wire Sizing Based on Insulation Rating

Wiring is being installed in a 240 Volt, single-phase system rated at 30 kVA. What is the wire size needed if you use 60°C copper wire?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 1-phase	<b>Set</b> <b>1</b>	1 PH
Enter kVA	<b>3</b> <b>0</b> <b>kilo-</b> <b>VA</b>	KVA 30.
Enter Volts	<b>2</b> <b>4</b> <b>0</b> <b>Volts</b>	VOLT 240.
Find Amps	<b>Amps</b>	AMPS 125.
Find wire size	<b>WireSz</b>	AWG 0 CU WIRE SIZE
Display Wire Ampacity	<b>WireSz</b>	0 125.0 Cu WIRE A
Display CMIL	<b>WireSz</b>	CMIL 105,600 WIRE
Display NEC Table	<b>WireSz</b>	NEC 310.16

## Re-sizing Wire Based on Different Insulation Ratings

---

What wire size is required for a 3Ø, 75°C copper branch circuit carrying a load of 260 Amps? What would the wire size be if 90°C copper is used?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 3-phase	<b>Set</b> <b>3</b>	3 PH
Set to 75°C	<b>Set</b> <b>7</b>	3Ø 75 Cu 3 PH
Enter Amps	<b>2</b> <b>6</b> <b>0</b> <b>Amps</b>	AMPS 260.
Find wire size	<b>WireSz</b>	AWG 300 CU WIRE SIZE
Change to 90°	<b>Set</b> <b>9</b>	AWG 0000 CU WIRE SIZE
Reset to 60° and Clear	<b>Set</b> <b>6</b> <b>On/C</b>	3Ø 60 Cu 0.

## Wire Sizing Based on Ambient Temperature

---

Find the 90°C copper wire size needed to connect a 47,700 Volt-amp load to a 240 Volt, single-phase source. What is the adjusted wire size, if the ambient temperature rating is changed from the default 30°C to 40°C?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 1-phase	<b>Set</b> <b>1</b>	1 PH
Set to 90°C	<b>Set</b> <b>9</b>	1Ø 90 Cu 1 PH
Enter VA	<b>4</b> <b>7</b> <b>7</b> <b>0</b> <b>0</b> <b>VA</b>	VA 47,700.

(Cont'd)



(Cont'd)

<b>Steps</b>	<b>Keystrokes</b>	<b>Display</b>
Enter Volts	<b>2</b> <b>4</b> <b>0</b> <b>Volts</b>	VOLT 240.
Find Amps	<b>Amps</b>	AMPS 198.75
Find wire size	<b>WireSz</b>	AWG 000 CU WIRE SIZE
Change ambient temperature	<b>2</b> <b>0</b> <b>Set</b> <b>2</b>	AMB° 20.°C
Find adjusted wire size	<b>WireSz</b>	AWG 00 CU Amb WIRE SIZE
Display Wire Ampacity	<b>WireSz</b>	00 202.8 Amb WIRE A
Display CMIL	<b>WireSz</b>	CMIL 133,100. WIRE
Display NEC Table	<b>WireSz</b>	NEC 310.16
Reset ambient temperature	<b>3</b> <b>0</b> <b>Set</b> <b>2</b>	AMB° 30.°C

**NOTE:** See “Settings” for a list of Permanent Values/settings. Changing these settings may affect your calculations.

## 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?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 3-phase	<b>Set</b> <b>3</b>	3 PH
Set to 75°C	<b>Set</b> <b>7</b>	3Ø 75 Cu 3 PH
Enter Amps	<b>2</b> <b>6</b> <b>5</b> <b>Amps</b>	AMPS 265.
Find wire size	<b>WireSz</b>	AWG 300 CU WIRE SIZE
Change to alum.	<b>Set</b> <b>4</b>	AWG 400 AL WIRE SIZE
Display Wire Ampacity	<b>WireSz</b>	400 270.0 AL WIRE A
Display CMIL	<b>WireSz</b>	CMIL 400,000 WIRE
Display NEC Table	<b>WireSz</b>	NEC 310.16
Reset to copper and Clear	<b>Set</b> <b>4</b> <b>On/C</b>	3Ø 75 Cu 0.

**NOTE:** See “Settings” for a list of Permanent Values/settings. Changing these settings may affect your calculations.

## Sizing Parallel Conductors

---

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 amb. temp.)? What size for 2 parallel conductors? For 3 conductors?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 60°C	<b>Set</b> <b>6</b>	3Ø 60 Cu 0
Set free air mode	<b>Set</b> <b>5</b>	3Ø 60 FrAir Cu 0.
Enter Amps	<b>5</b> <b>0</b> <b>0</b> <b>Amps</b>	AMPS 500.
Find 1 wire size	<b>WireSz</b>	AWG 500 CU FrAir WIRE SIZE
Find 2 wire size	<b>2</b> <b>ParSz</b>	PAR 000 CU FrAir WIRE SIZE
Find 3 wire size	<b>3</b> <b>ParSz</b>	PAR 0 CU FrAir WIRE SIZE
Exit Free Air Mode and Clear	<b>Set</b> <b>5</b> <b>On/C</b>	3Ø 60 Cu 0.

**NOTE:** Parallel wire sizes smaller than 1/0 will be displayed as nonE.

**NOTE:** See “Settings” for a list of Permanent Values/settings. Changing these settings may affect your calculations.

## Finding Derated Wire Size

---

What is the derated wire size required for nine 75°C copper wires, each carrying a maximum load of 65 Amps?

<b>Steps</b>	<b>Keystrokes</b>	<b>Display</b>
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 75°C	<b>Set</b> <b>7</b>	3Ø 75 Cu 0.
Enter Amps	<b>6</b> <b>5</b> <b>Amps</b>	AMPS 65.
Find normal wire size	<b>WireSz</b>	AWG 6 CU WIRE SIZE
Find derated wire size	<b>9</b> <b>Set</b> <b>ParSz</b>	D/R 3 CU WIRE SIZE
Display Wire Ampacity	<b>ParSz</b>	D/R 45.5 WIRE A
Display Adjustment Factor	<b>ParSz</b>	ADJ 70. %
Display NEC Table	<b>ParSz</b>	NEC 310.15

**NOTE:** See “Settings” for a list of Permanent Values/settings. Changing these settings may affect your calculations.

## Sizing Temperature-Adjusted Derated Wires

A circuit was built with 60°C copper wire connecting a 47,650 Volt-amp load to a 240 Volt, three-phase source. Ambient temperature is 50°C. What is the derated wire size required if eight current-carrying THHN wires were installed in the raceway?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 60°C	<b>Set</b> <b>6</b>	3Ø 60 Cu 0.
Enter Volt-amps	<b>4</b> <b>7</b> <b>6</b> <b>5</b> <b>0</b> <b>VA</b>	VA 47,650.
Enter Volts	<b>2</b> <b>4</b> <b>0</b> <b>Volts</b>	VOLT 240.
Set to 50°C amb	<b>5</b> <b>0</b> <b>Set</b> <b>2</b>	AMB° 50. °C
Find adj. wire size	<b>WireSz</b>	AWG 250 CU Amb WIRE SIZE
Find derated wire size	<b>8</b> <b>Set</b> <b>ParSz</b>	D/R 500 CU Amb WIRE SIZE
Display Wire Ampacity	<b>ParSz</b>	D/R 46.5 Amb WIRE A
Display Adjust. Factor	<b>ParSz</b>	ADJ 41. % Amb
Display NEC Table	<b>ParSz</b>	NEC 310.15
Set to 30°C and Clear	<b>3</b> <b>0</b> <b>Set</b> <b>2</b> <b>On/C</b>	0.

**NOTE:** All Settings should be changed back to default to avoid conflicts in answers throughout the rest of this manual. See “Settings” for a list of Permanent Values/settings. Changing these settings may affect your calculations.

## Voltage Drop

The reduction in Voltage between the power source and the load can be determined by entering the Phase, Volts, Amps, wire material, Voltage drop wire size and length of run. The calculator determines resistance and then the Voltage reduction. Voltage drop can be displayed as Volts dropped, or as a percent reduction of potential load.

This calculator also finds Voltage drop wire size once you have entered or calculated the phase, Volts, Amps, Length, wire type, and allowable VD percentage. It will solve for the distance (**Length**) once you have entered or calculated the phase, Volts, Amps, wire type, Voltage drop wire size, and allowable VD percentage. The *ElectriCalc Pro* uses resistance values found in NEC Table 8 Chapter 9 to determine Voltage drop.

**NOTE:** *Voltage drop solutions may vary slightly from actual AC circuit measurements as the calculator does not incorporate factors such as inductive reactance, skin effect, raceway material, etc. In most situations, the DC Voltage Drop calculation method is sufficient to meet safety standards for AC systems.*

## IMPORTANT NOTE ON VOLTAGE DROP CALCULATIONS

The *ElectriCalc Pro* calculates Voltage drop and wire size using DC resistance as defined by the 2008 NEC. To find the Voltage drop for a *specific* wire size, you must *first enter Amps and the one-way wire Length* (and other required variables), entering the specific wire size *last*.

Otherwise, for your safety the calculator will recalculate the wire sizes based on the NEC Ampacity Tables and maximum allowable Voltage drop.

### Finding Single-Phase 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?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 1-phase	<b>Set</b> <b>1</b>	1 PH
Set to 75°C	<b>Set</b> <b>7</b>	1Ø 75 Cu 1 PH
Enter Amps	<b>1</b> <b>1</b> <b>Amps</b>	AMPS 11.
Enter Volts	<b>2</b> <b>0</b> <b>8</b> <b>Volts</b>	VOLT 208.
Enter Length	<b>1</b> <b>7</b> <b>5</b> <b>Length</b>	FEET 175.
Enter wire size*	<b>8</b> <b>WireSz</b>	AWG 8 CU WIRE SIZE
Solve volt. drop	<b>VD%</b>	DROP 3.0 V
Solve % v.drop	<b>VD%</b>	DROP 1.4 V %

\* *Wire size can also be entered in Circular Mils (e.g., **1** **6** **5** **1** **0** **WireSz** enters 16,510 CMILs and displays 8 AWG wire size).*

## Finding Three-Phase Voltage Drop

A 20 Amp, three-phase load is being fed by a 230 Volt source located 150 Feet away. The installation specifications require 75°C #10 THW stranded copper conductor. What is the Voltage drop on this branch circuit?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 75°C	<b>Set</b> <b>7</b>	3Ø 75 Cu 0.
Set to 3-phase	<b>Set</b> <b>3</b>	3Ø 75 Cu 3 PH
Enter Amps	<b>2</b> <b>0</b> <b>Amps</b>	AMPS 20.
Enter Volts	<b>2</b> <b>3</b> <b>0</b> <b>Volts</b>	VOLT 230.
Enter Length(feet)	<b>1</b> <b>5</b> <b>0</b> <b>Length</b>	FEET 150.
Find VD wire size	<b>WireSz</b>	AWG 10 CU VD WIRE SIZE
Solve volt. drop	<b>VD%</b>	DROP 6.4 V
Solve % v.drop	<b>VD%</b>	DROP 2.8 V %

**NOTE:** See “Settings” for a list of Permanent Values/settings. Changing these settings may affect your calculations.



## **Finding Voltage Drop Wire Size**

A 20 Amp, three-phase 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?

<b>Steps</b>	<b>Keystrokes</b>	<b>Display</b>
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 75°C	<b>Set</b> <b>7</b>	3Ø 75 Cu 0.
Enter Amps	<b>2</b> <b>0</b> <b>Amps</b>	AMPS 20.
Enter Volts	<b>2</b> <b>0</b> <b>8</b> <b>Volts</b>	VOLT 208.
Enter distance	<b>1</b> <b>7</b> <b>5</b> <b>Length</b>	FEET 175.
Enter allow. VD%	<b>3</b> <b>VD%</b>	DROP 3.0 V %
Find wire size	<b>WireSz</b>	AWG 8 CU VD WIRE SIZE

Find actual

Voltage drop **VD%** DROP 4.7 V

Find % v.drop **VD%** DROP 2.3 V %

**NOTE:** See “Settings” for a list of Permanent Values/settings. Changing these settings may affect your calculations.

## 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.

<b>Steps</b>	<b>Keystrokes</b>	<b>Display</b>
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 60°C	<b>Set</b> <b>6</b>	3Ø 60 Cu 0.
Enter Amps	<b>1</b> <b>5</b> <b>Amps</b>	AMPS 15.
Enter Volts	<b>2</b> <b>4</b> <b>0</b> <b>Volts</b>	VOLT 240.
Enter wire size*	<b>1</b> <b>0</b> <b>WireSz</b>	AWG 10 Cu WIRE SIZE
Enter 3% VD	<b>3</b> <b>VD%</b>	DROP 3.0 V %
Find distance	<b>Length</b>	FEET 234.86987
Find actual Voltage drop	<b>VD%</b>	DROP 7.2 V
Find % v.drop	<b>VD%</b>	DROP 3.0 V %

\* Wire size can also be entered in Circular Mils (e.g., **1** **0** **3** **8** **0** **WireSz** enters 10,380 CMILs and displays 10 AWG wire size).

**NOTE:** The calculator automatically makes adjustments for resistance using NEC Chapter 9, Table 8, if the insulation type is other than 75°C.

See “Settings” for a list of Permanent Values/settings. Changing these settings may affect your calculations.

## Finding Voltage Drop Resistance

What is the resistance of 85 Feet of #2 90°C copper conductor?

<u>Steps</u>	<u>Keystrokes</u>	<u>Display</u>
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 90°C	<b>Set</b> <b>9</b>	3Ø 90 Cu 0.
Enter wire size*	<b>2</b> <b>WireSz</b>	AWG 2 CU WIRE SIZE
Find resistance	<b>Set</b> <b>Length</b>	OHMS 0.2033993 WIRE
Find 85 ft resist**	<b>÷</b> <b>1</b> <b>0</b> <b>0</b> <b>0</b> <b>X</b> <b>8</b> <b>5</b> <b>=</b>	0.0172889

\* Wire size can also be entered in Circular Mils (e.g., **6** **6** **3** **6** **0** **WireSz** enters 66,360 CMILs and displays 2 AWG wire size).

\*\* Given resistance per 1000 Feet, divide by 1000 to get a per Foot resistance, then multiply by 85.

**NOTE:** See “Settings” for a list of Permanent Values/settings. Changing these settings may affect your calculations.

## Finding DC Resistance

What is the equivalent resistance of a 12 Volt DC circuit pulling 5 Amps?

<u>Steps</u>	<u>Keystrokes</u>	<u>Display</u>
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Enter Voltage	<b>1</b> <b>2</b> <b>Set</b> <b>Volts</b>	Vdc 12.
Enter Amps	<b>5</b> <b>Set</b> <b>Amps</b>	Idc 5.
Find resistance	<b>Set</b> <b>VA</b>	OHMS 2.4

## Ground Conductor Wire Size

You can use single or multiple service entrance conductor(s) to find the grounding electrode conductor for AC systems. When using multiple conductors, the *ElectriCalc Pro* uses the equivalent Circular Mils to find the grounding electrode conductor (based on NEC Table 250-66).

Find the grounding electrode conductor wire size required when 2/0 is the largest 3-phase 75°C copper service-entrance conductor being used. What is the equivalent aluminum size? What is the equivalent Circular Mils?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 3-phase	<b>Set</b> <b>3</b>	3 PH
Set to 75° C	<b>Set</b> <b>7</b>	3Ø 75 Cu 3 PH
Enter wire size*	<b>0</b> <b>0</b> <b>WireSz</b>	AWG 00 CU WIRE SIZE
Find ground wire size	<b>Grnd</b>	GRND 4 CU WIRE SIZE
Find aluminum size	<b>Grnd</b>	GRND 2 AL WIRE SIZE
Find Circular Mils	<b>Grnd</b>	CMIL 133,100. WIRE
Display NEC Table	<b>Grnd</b>	NEC 250.66

\* Wire size can also be entered in Circular Mils (e.g., **1** **3** **3** **1** **0** **0** **WireSz** enters 133,100 CMILs and displays 00 AWG wire size).

## Equipment Grounding Conductor Wire Size

The **Set Grnd** keystroke can be used to find the grounding conductor size for raceways and “over-current devices in circuit ahead” equipment. The calculator uses the displayed amperage value to solve for 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 and 90° copper is being used in the installation. What is the equivalent aluminum size?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 90°C	<b>Set</b> <b>9</b>	3Ø 90 Cu 0.
Enter Amp rating	<b>4</b> <b>5</b> <b>Amps</b>	AMPS 45.
Find equipment ground wire size	<b>Set</b> <b>Grnd</b>	EQPG 10 CU WIRE SIZE
Find aluminum size	<b>Grnd</b>	EQPG 8 AL WIRE SIZE
Display NEC Table	<b>Grnd</b>	NEC 250.122
Reset to 60°C and Clear	<b>Set</b> <b>6</b> <b>On/C</b>	3Ø 60 Cu 0.

## Fuse and Circuit Breaker Size

What is the calculated dual element and single element fuse size for a 230 Volt, 3-phase, 50 HP induction motor? What are the Instantaneous Trip and Inverse Time Circuit Breaker requirements?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 3-phase	<b>Set</b> <b>3</b>	3 PH
Enter Volts	<b>2</b> <b>3</b> <b>0</b> <b>Volts</b>	VOLT 230.
Enter HP	<b>5</b> <b>0</b> <b>HPmotor</b>	IND 50. HP
Find full current	<b>Amps</b>	FLC 130. A
Find DE fuse size	<b>DEFuse</b>	AMPS 227.5 dE
Display % used	<b>DEFuse</b>	%FLC 175.
Find SE fuse size	<b>Set</b> <b>DEFuse</b>	AMPS 390. SE
Display % used	<b>DEFuse</b>	%FLC 300.
Find inv. time brkr	<b>InvTime</b>	AMPS 325. b2
Display % used	<b>InvTime</b>	%FLC 250.
Find ins. trip breaker size	<b>Set</b> <b>InvTime</b>	AMPS 1,040. b1
Display % used	<b>InvTime</b>	%FLC 800.

## Starter Size

What NEMA size starter is required for a 575 volt, 3Ø, 20 HP induction motor?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 3-phase	<b>Set</b> <b>3</b>	3 PH
Enter Volts	<b>5</b> <b>7</b> <b>5</b> <b>Volts</b>	VOLT 575.
Enter HP	<b>2</b> <b>0</b> <b>HPmotor</b>	IND 20. HP
Solve for starter size	<b>Set</b> <b>HPmotor</b>	STAR 2 SIZE

## Overload Protection Size

What overload protection device size is required for a 460 Volt, 3-phase, 15 HP induction motor with a nameplate current rating of 19.2 Amps and a 1.0 service factor? What is the required overload rating at 125% (for a 1.15 service factor)?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 3-phase	<b>Set</b> <b>3</b>	3 PH
Enter Volts	<b>4</b> <b>6</b> <b>0</b> <b>Volts</b>	VOLT 460.
Enter Horsepower	<b>1</b> <b>5</b> <b>HPmotor</b>	IND 15. HP
Enter nameplate current	<b>1</b> <b>9</b> <b>.</b> <b>2</b> <b>Amps</b>	AMPS 19.2
Find overload size	<b>O-Load</b>	AMPS 22.08 ol
Display % used	<b>O-Load</b>	%FLC 115.
Find 125% load	<b>1</b> <b>2</b> <b>5</b> <b>O-Load</b>	AMPS 24. ol
Display % used	<b>O-Load</b>	%FLC 125.
Reset overload rating and clear	<b>1</b> <b>1</b> <b>5</b> <b>O-Load</b> <b>On/C</b>	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. The calculator uses NEC values for area of THW/THHW, XHH/XHHW, and THHN/THWN wires. When using the actual wire areas (and following the guidelines in NEC Chapter 9, Tables 1, 3, 4 and 5), the calculator can calculate a conduit size based on the conduit type and the same or different wire types and sizes.

To select a specific conduit type, enter the corresponding number of the conduit and then press **Set** **CondSz**. The numbers and types are:

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

When you enter a new conduit type or scroll through the types, you will see the updated conduit size (if you have entered the wire type and quantity).



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

What size THHN copper wire and RMC conduit are needed to connect a 10 HP 1Ø induction motor to a 115 Volt source?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 1-phase	<b>Set</b> <b>1</b>	1 PH
Set to 60° C	<b>Set</b> <b>6</b>	1Ø 60 Cu 1 PH
Enter Volts	<b>1</b> <b>1</b> <b>5</b> <b>Volts</b>	VOLT 115.
Enter Horsepower	<b>1</b> <b>0</b> <b>HPmotor</b>	IND 10. HP
Enter cond. type	<b>8</b> <b>Set</b> <b>CondSz</b>	RMC nonE COND
Display full load Amps	<b>Amps</b>	FLC 100. A
Find wire size	<b>Set</b> <b>WireSz</b>	AWG 0 CU WIRE SIZE 125%
Find wire ampacity	<b>WireSz</b>	0 125.0* WIRE A125%
Find conduit size	<b>CondSz</b>	RMC 1.25 in COND SIZE
Find total # wires	<b>CondSz</b>	2. TTL WIRES
Find conduit fill %	<b>CondSz</b>	FILL 24.3 COND %
Find act. fill area	<b>CondSz</b>	FILL 0.3710 TTL WIRE AREA
Find rem. area	<b>CondSz</b>	REM 0.1021 WIRE AREA
Set to 3-phase and Clear	<b>Set</b> <b>3</b> <b>On/C</b>	3Ø 60 Cu 0.

*\* If a wire size has been calculated or stored, and the wire type/quantity is not defined, the calculator will assume 2 THHN wires for 1Ø and 3 THHN wires for 3Ø when calculating conduit size. Display will also show wire size in upper left when displaying maximum ampacity rating.*

**NOTE:** See “Settings” for a list of Permanent Values/settings. Changing these settings may affect your calculations.

## **Finding Conduit Sizes for Multiple Conductors — Same Wire Type and Size**

Find the minimum IMC conduit size for eleven #6 THHN copper wires.

<b>Steps</b>	<b>Keystrokes</b>	<b>Display</b>
Clear calculator	<b>On/C On/C</b>	0.
Enter cond. type	<b>4 Set CondSz</b>	IMC nonE COND
Enter wire size*	<b>6 WireSz</b>	AWG 6 CU WIRE SIZE
Enter # THHN	<b>1 1 #THHN #THWN</b>	THHN 11. WIRES
Find conduit size	<b>CondSz</b>	IMC 1.25 in COND SIZE

*\* Wire size can also be entered in Circular Mils (e.g., **2 6 2 4 0 WireSz** enters 26,240 CMILs and displays 6 AWG wire size).*

## Finding Number of Wires in Existing Conduit — Same Size, Various Types

Find the maximum number of #10 THHN copper wires that can be pulled through an existing 3 Inch EMT conduit. How many XHHW wires? How many THW wires?

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Enter cond. type	<b>1</b> <b>Set</b> <b>CondSz</b>	EMT nonE COND
Enter wire size*	<b>1</b> <b>0</b> <b>WireSz</b>	AWG 10 CU WIRE SIZE
Enter conduit size	<b>3</b> <b>CondSz</b>	EMT 3.00 in COND SIZE
Find max THHN #	<b>#THHN</b> <b>#THWN</b>	THHN 167. TTL WIRES
Find max XHHW#	<b>#XHH</b> <b>#XHHW</b>	XHHW 145. TTL WIRES
Find max THW #	<b>#THW</b> <b>#THHW</b>	THW 145. TTL WIRES

\* Wire size can also be entered in Circular Mils (e.g., **1** **0** **3** **8** **0** **WireSz** enters 10,380 CMILs and displays 10 AWG wire size).

## Finding Conduit Size - Multiple Conductors Different Wire Sizes and Types

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Three 1/0 THWN 75°C conductors and one #2 XHHW 75°C copper conductor are to connect to a panel board using a single conduit. What is the cross-sectional area of wires, conduit size and actual fill area? (Note: The cross-sectional areas are the same for both THHN and THWN; display will show as THHN.)

Steps	Keystrokes	Display
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Set to 75°	<b>Set</b> <b>7</b>	3Ø Cu 75 0.
Enter cond. type	<b>3</b> <b>Set</b> <b>CondSz</b>	FMC nonE COND
Enter 1st wire sz*	<b>0</b> <b>WireSz</b>	AWG 0 CU WIRE SIZE
Enter #, type wire	<b>3</b> <b>#THHN</b> <b>#THWN</b>	THHN 3. WIRES
Find cross-section wire area	<b>#THHN</b> <b>#THWN</b>	THHN 0.5565 WIRE AREA
Enter 2nd wire sz*	<b>2</b> <b>WireSz</b>	AWG 2 CU WIRE SIZE
Enter #, type wire	<b>1</b> <b>#XHH</b> <b>#XHHW</b>	XHHW 1. WIRE
Find cross-sect.	<b>#XHH</b> <b>#XHHW</b>	XHHW 0.1146 WIRE AREA
Find conduit size	<b>CondSz</b>	FMC 1.50 in COND SIZE (Cont'd)

(Cont'd)

<b>Steps</b>	<b>Keystrokes</b>	<b>Display</b>
Find total # wires	<b>CondSz</b>	4. TTL WIRES
Find conduit fill %	<b>CondSz</b>	FILL 36.1 COND %
Find actual fill area	<b>CondSz</b>	FILL 0.6711 TTL WIRE AREA
Find remaining area	<b>CondSz</b>	REM 0.0717 WIRE AREA

\* Wire size can also be entered in Circular Mils (e.g., **1 0 5 6 0 0 WireSz** enters 105,600 CMILs and displays 0 AWG wire size; **6 6 3 6 0 WireSz** enters 66,360 CMILs and displays 2 AWG wire size).

**NOTE:** See “Settings” for a list of Permanent Values/settings. Changing these settings may affect your calculations.

## Converting KW-HR and BTU

Find the equivalent BTU rating of a 3.5 kw-hr rated furnace.

<b>Steps</b>	<b>Keystrokes</b>	<b>Display</b>
Clear calculator	<b>On/C On/C</b>	0.
Enter Kilowatt Hours	<b>3 ● 5</b>	3.5
Find Equivalent BTU	<b>Set ●</b>	BTU 11,953.552

What is the kw-hr rating for a 4,500 BTU heater?

<b>Steps</b>	<b>Keystrokes</b>	<b>Display</b>
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Enter BTU Rating	<b>4</b> <b>5</b> <b>0</b> <b>0</b>	4,500.
Find Equivalent Kilowatt Hours	<b>Set</b> <b>=</b>	KW-H 1.3176

## Parallel Resistance

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

<b>Steps</b>	<b>Keystrokes</b>	<b>Display</b>
Clear calculator	<b>On/C</b> <b>On/C</b>	0.
Enter 1 <sup>st</sup> Resistor	<b>1</b> <b>0</b> <b>Set</b> <b>Stor</b>	P-RS 10.
Enter 2 <sup>nd</sup> Resistor	<b>2</b> <b>0</b> <b>Set</b> <b>Stor</b>	P-RS 6.666667
Enter 3 <sup>rd</sup> Resistor	<b>5</b> <b>0</b> <b>Set</b> <b>Stor</b>	P-RS 5.8823529

**NOTE:** The total is recalculated with each additional resistor value entered.

## Error Codes

The error codes for the *ElectriCalc Pro* are listed below (Note: To clear an error, perform a Clear All **Set** **X**):

DISPLAY	ERROR DESCRIPTION
OFLO	Answer too large to display
ENT Error	Invalid or out-of-scale entry
POWR Error	PF or EFF calculated above 100%
nonE	Conduit Size beyond limits of table Unable to calculate Voltage Drop wire Size ( <i>Amps/Length too high</i> ) Temperature setting out of range for wire calculation.
HP Error	Invalid HP entry per NEC table
FULL Error	Entered or calculated more than 15 different wires sizes
EROM Error	Bad EROM
MATH Error	Math error (i.e., divide by zero)

## Battery Information

The calculator is powered by a single 3-Volt Lithium CR-2032 battery. This should last upwards of 800 hours of actual use (One year plus for most people). If the display becomes very dim or erratic, replace the battery.

**NOTE:** Please use caution when disposing of your old batteries as they contain hazardous chemicals.

### Battery Replacement Instructions:

- 1) Hold calculator upright with back of calculator toward you.
- 2) Lift battery holder out from the top of the calculator.
- 3) Remove the old battery.
- 4) Place new battery with positive side against the bottom of the holder.
- 5) Insert holder into calculator with positive side of battery facing back of calculator.



## **2008 NEC References**

**Table 250.66**

**Table 250.122**

**Table 310.15(b)(2)(a)**

**Table 310.16**

**Table 310.17**

**Chapter 9, Table 1, 4, 5 and 8**

**Section 430.32**

**Table 430.148**

**Table 430.150**

**Table 430.152**

**Appendix C**

*National Electrical Code® and NEC® are registered trademarks of the National Fire Protection Association, Inc., Quincy, MA 02269*

*All listed table references are based on NEC 2008. Previous code years may have different table references.*



## Updating Future Code Revisions

This model is updateable for future NEC Editions. For information on future codes, contact the dealer where this calculator was purchased or you may contact Calculated Industries, Inc. in the fall of the year prior.

## Settings

### Permanent Values/Settings

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Values and settings maintained in permanent Memory can only be changed (1) by pressing **Set** **X** (resets calculator to default settings), or (2) by changing each one or all of these settings. The following are permanent values:

- (1) **Selectable (60°C/75°C/90°C) insulation ratings and CU/AL wire type ratings**
- (2) **Phase setting (1Ø/3Ø)**
- (3) **The entered values for Volts, Voltage Drop %, Power Factor % and Efficiency %**
- (4) **Ambient Temperature setting**
- (5) **Feet/Meters setting**

### Semi-Permanent Values

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The following semi-permanent values are cleared to default settings when the calculator is shut-off:

- (1) **Cumulative Memory (M+)**
- (2) **Free Air mode**

# Repair and Return

## Return Guidelines

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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 will not 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 and 4:00pm Pacific Time for additional information and a Return Merchandise Authorization (RMA).

**Call Toll Free: 1-800-854-8075**

**Outside USA: 1-775-885-4900**

**[www.calculated.com/warranty](http://www.calculated.com/warranty)**

## Warranty

### Warranty Repair Service – U.S.A.

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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.**

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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 U.S.A.**

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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**

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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 Notices**

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