Calculate standard resistor values in Excel

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http://www.edn.com/design/design-tools/development-kits/4404021/Calculate-standard-resistor-values-in-Excel

Using standard resistor values can greatly impact the accuracy and predictability of a circuit by eliminating rounding errors incurred at the end of the design. Selecting resistor values traditionally has been a manual process where the calculated value is matched to a real value in a printed lookup table. The Microsoft Excel add-in presented here automates the process by implementing a single user-defined function with an integrated lookup table.

Electronic Industries Association (EIA) values for 20 percent (E6) through 0.1 percent (E192) are stored in an excel spreadsheet (**Figure 1**). An included user-defined function (**Figure 2**) stored within the spreadsheet references these values when looking up the required resistance value. The final spreadsheet is saved as an Excel add-In (.xla). Installing the spreadsheet as an Excel add-in allows the function to be used seamlessly with any other spreadsheet.

	A	B	C	D	E	F
1	Standard EIA Decade Resistor Values					
2						
3	20%	10%	5%	2%	1%	0.5%, 0.25%, 0.1%
4	E6	E12	E24	E48	E96	E192
5	100	100	100	100	100	100
6						101
7					102	102
8						104
9				105	105	105
10						106
11					107	107
12						109
13			110	110	110	110
14						111
15					113	113
16						114
17				115	115	115
18						117
19					118	118
20						120
21		120	120	121	121	121
22						123
23					124	124
24						126
25				127	127	127
26						129
27					130	130
28						132
29				133	133	133
30				133		
	680					816
181		820	820	825	825	825
182						835
183					845	845
184						856
185				866	866	866
186						876
187					887	887
188						898
189			910	909	909	909
190						920
191					931	931
192						942
193				953	953	953
194						965
195					976	976
196						988
197	1000	1000	1000	1000	1000	1000

Figure 1. Excel stores a lookup table containing standard EIA decade resistor values for all desired tolerances.

```
Function STDEIA(Value, Tolerance, Optional RatioNumerical)
'Function returns closest EIA standard value
'By Donald Schelle, July 2011

'Dimension Values
Dim TempIndex As Integer
Dim TempMultiplier As Integer
Dim ValueMultiplier As Integer

Dim Smaller As Integer
Dim Larger As Integer
Dim RangeString As String
Dim RatioNum As Boolean

'Format Value for Processing and determine Valuemultiplier
ValueMultiplier = 0
Do
            If Value < 100 Then
                        Value = Value * 10 'Value is at least a decade too low
                        ValueMultiplier = ValueMultiplier - 1
```

```
            ElseIf Value >= 1000 Then
                        Value = Value / 10 'Value is at least a decade too high
                        ValueMultiplier = ValueMultiplier + 1
            Else
                        Exit Do  'Value is in line
            End If
Loop Until (ValueMultiplier > 13) Or (ValueMultiplier < -13)


'Determine which lookup table to use based on tolerance
Select Case Tolerance
            Case 0.2, "E6"                                  'E6 Tolerance
                        RangeString = "A5:A197": TempMultiplier = 5
            Case 0.1, "E12"                                 'E12 Tolerance
                        RangeString = "B5:B197": TempMultiplier = 4
            Case 0.05, "E24"                                'E24 Tolerance
                        RangeString = "C5:C197": TempMultiplier = 3
            Case 0.02, "E48"                                'E48 Tolerance
                        RangeString = "D5:D197": TempMultiplier = 2
            Case 0.01, "E92"                                'E96 Tolerance
                        RangeString = "E5:E197": TempMultiplier = 1
            Case 0.005, 0.0025, 0.001, "E192"                           'E192 Tolerance
                        RangeString = "F5:F197": TempMultiplier = 0
            Case Else   'Invalid Tolerance
                        Err.Raise (1)
            End Select

'Calculate closest smallest number
TempIndex = WorksheetFunction.Match(Value, ThisWorkbook.Worksheets("EIA
Tables").Range(RangeString), 1)
Smaller = WorksheetFunction.Index(ThisWorkbook.Worksheets("EIA Tables").Range(RangeString),
TempIndex, 1)

'Calculate closest largest number
TempIndex = TempIndex + 2 ^ TempMultiplier
Larger = WorksheetFunction.Index(ThisWorkbook.Worksheets("EIA Tables").Range(RangeString),
TempIndex, 1)

'Error checking for missing optional argument
If IsMissing(RatioNumerical) = True Then RatioNum = False
If IsMissing(RatioNumerical) = False Then RatioNum = RatioNumerical

'Calculate closest number based on numerical or ratiometric selection
Select Case RatioNum
            Case False  'Closest Numerical Value
                        Select Case (Larger - Value <= Value - Smaller)
                                    Case True: STDEIA = Larger 'Use larger number
                                    Case False: STDEIA = Smaller 'Use smaller number
                        End Select

            Case True 'Closest Ratiometric Value
                        Select Case (Value >= WorksheetFunction.GeoMean(Smaller, Larger))
                                    Case True: STDEIA = Larger 'Use larger number
                                    Case False: STDEIA = Smaller 'Use smaller number
                        End Select
End Select

'Rescale number with previously calculated multiplier
STDEIA = STDEIA * 10 ^ ValueMultiplier

End Function
```

Figure 2. VBA code identifies the closest numerical or ratiometric EIA resistance value given a desired tolerance.

Download a copy of the add-in from goo.gl/FxNHX. Follow these steps (Excel 2007) to install the add-in:

1. Click the Microsoft Office Button and select Excel Options.
2. Click the Add-Ins tab. Next to the Manage label select Excel Add-ins. Click the Go button.
3. Click the Browse button. Point to the location of the saved EIA_Standard_Values.xla file and select OK.
4. The add-in (Figure 3) should now be enabled for all spreadsheets.

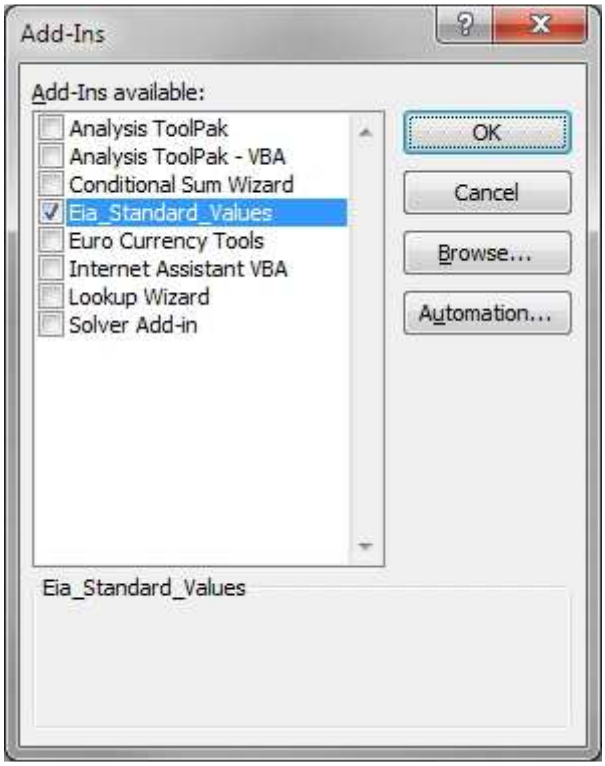

Figure 3: Installing the code as an Excel add-in ensures that the custom function will be available from any open spreadsheet.

Once installed, using the add-in is as easy as any standard Excel function. The function (STDEIA) has three arguments and returns a single value. The arguments are: 1) an arbitrary value in Ohms; 2) a desired tolerance value (1%, 2%, "E12," "E96," etc.); and 3) an optional value that selects the closest numerical value (FALSE or blank), or the closest ratiometric value (TRUE). Examples of the function are presented in **Figure 4**.

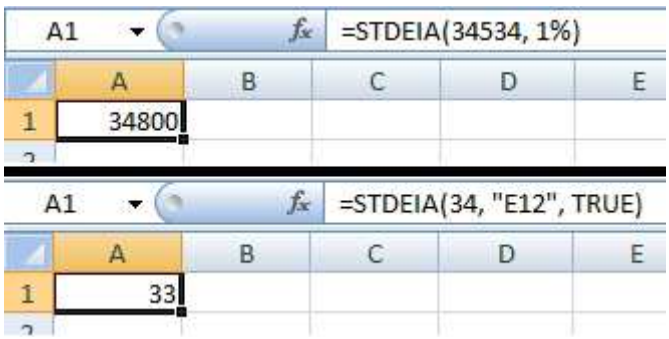

Figure 4: When installed, apply the code like a standard Excel function making it easy to integrate into existing spreadsheet calculations. The first example (top) looks for the closest numerical 1% (E96) resistance value for 35,534Ω. The second example (bottom) returns the closest 10% (E12) ratiometric value for 34Ω.

An Internet search yields many similar solutions. However, none of them are as complete or as flexible as the one presented here. Edit the code for your own purposes by downloading the .xls spreadsheet at: goo.gl/3C3vS**.**

References

Standard EIA Decade Resistor Values Table:
www.logwell.com/tech/components/resistor_values.html

About the Author

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