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Torsional Analysis Calculator Tutorial

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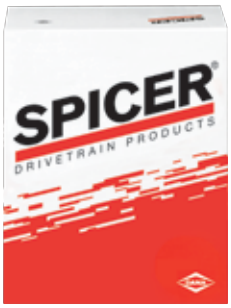
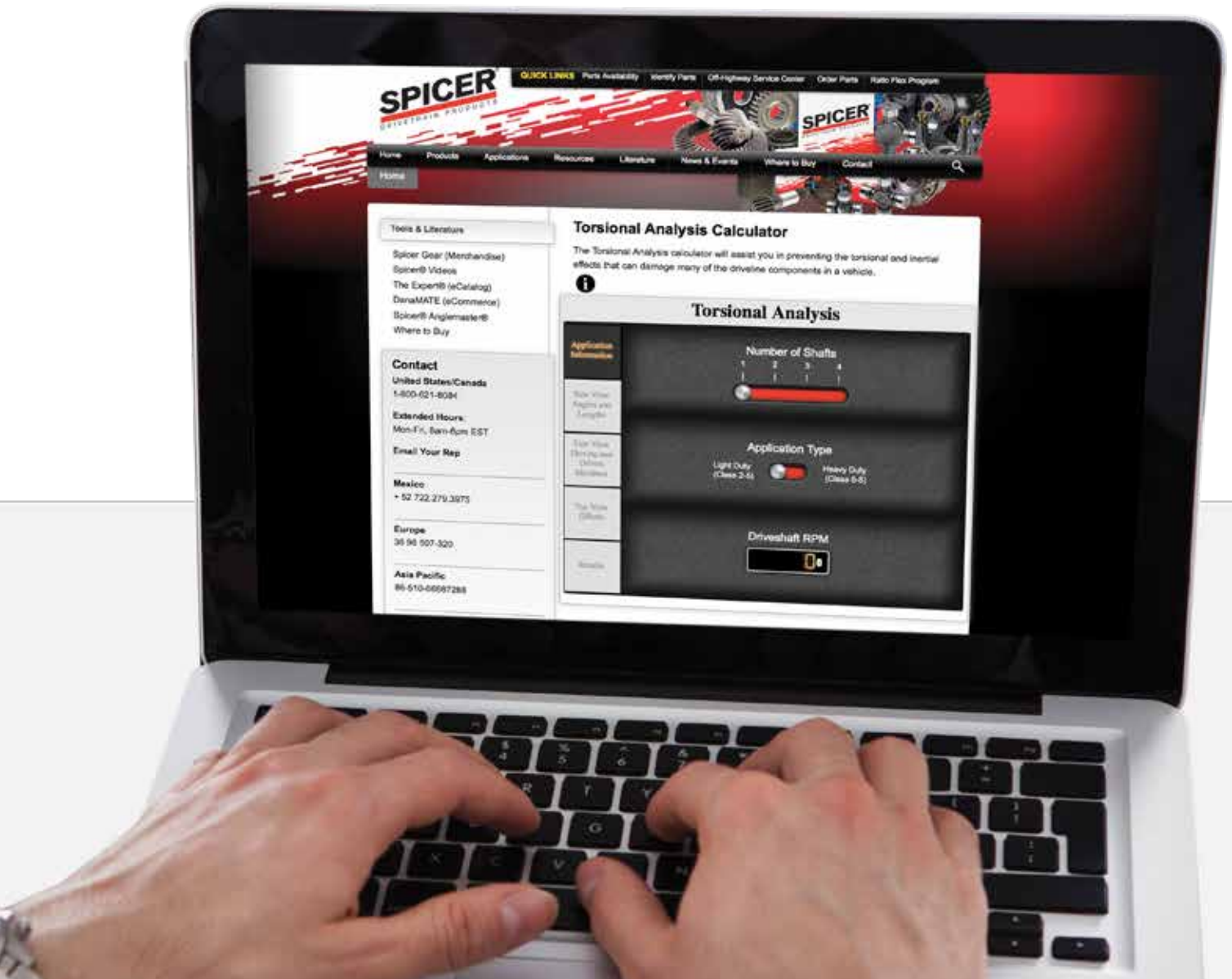


The Right Angle Makes All the Difference. Correct universal joint operating angles are crucial in preventing torsional and inertial effects, which create vibrations that can damage many of the driveline components in your vehicle. As parts and suspensions wear, driveshaft operating angles often change and therefore require adjustment. In the past, you would have to add or remove shims between the frame and axle, or between the center bearing and cross member. Then you would test drive the vehicle to see if it still vibrated, repeating the process until you eliminated the vibration. The Spicer® Torsional Analysis Calculator enables you to check a vehicle's driveline installation for torsional and inertia problems, right from your iPad, iPhone, or our website (www.SpicerParts.com). This tutorial will teach you how to use the Spicer Torsional Analysis Calculator to get the best results!

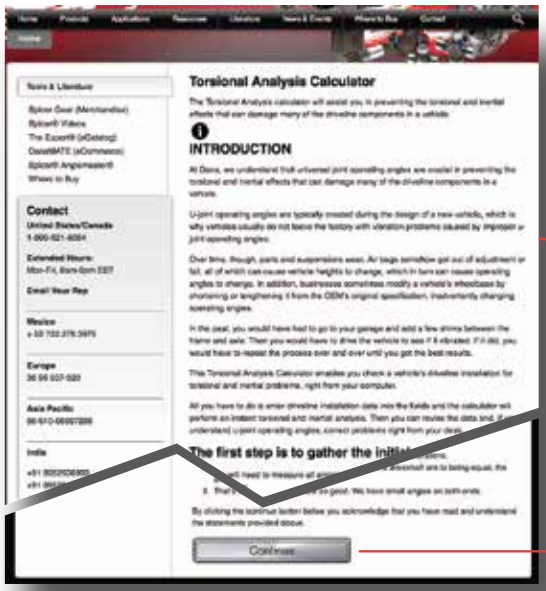
NOTE: The numbers provided throughout this tutorial are examples to be used for demonstration purposes only. You will need to enter your own figures when you use this calculator in real-world applications.



Example 1: One-Driveshaft Application

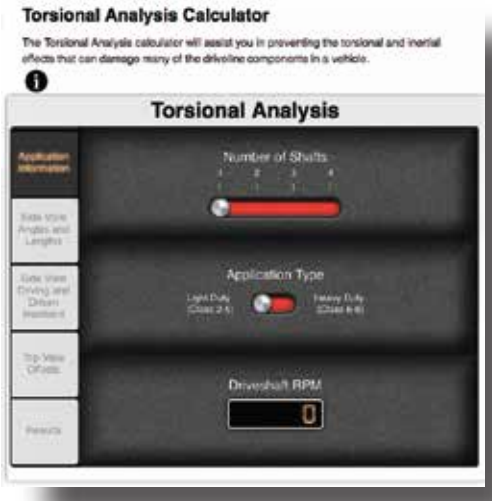
Click on Resouces, then Calculators from the SpicerParts.com home page

From the Calculators menu, click Torsional Analysis: The Torsional Analysis Calculator will then load, displaying an information window



Read the Introduction and Torsional Analysis information

Click the Continue button on the Torsional Analysis information window



The calculator is displayed with data entry controls, additional help features, and five tab buttons along the left side of the calculator window:

Application Information

Side View Angles and Lengths

Side View Driving and Driven Members

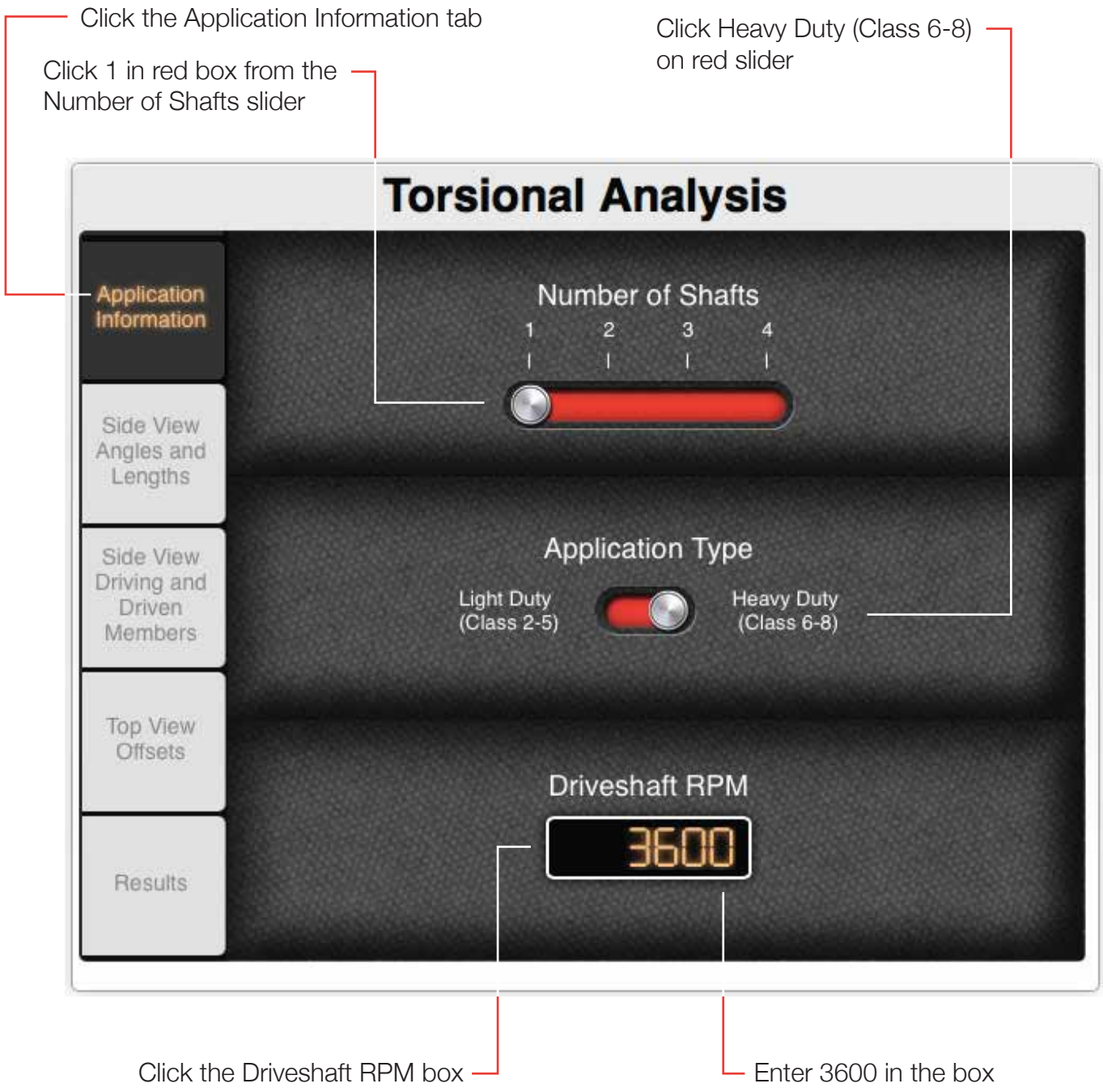
Top View Offsets

Results

Proceed to the first step

Note: All figures used throughout this tutorial are for example purposes only. You will need to input your real-world application data.

Example 1: One-Driveshaft Application
Step 1: Enter Application Information



Proceed to the next step by clicking the Side View Angles and Lengths tab

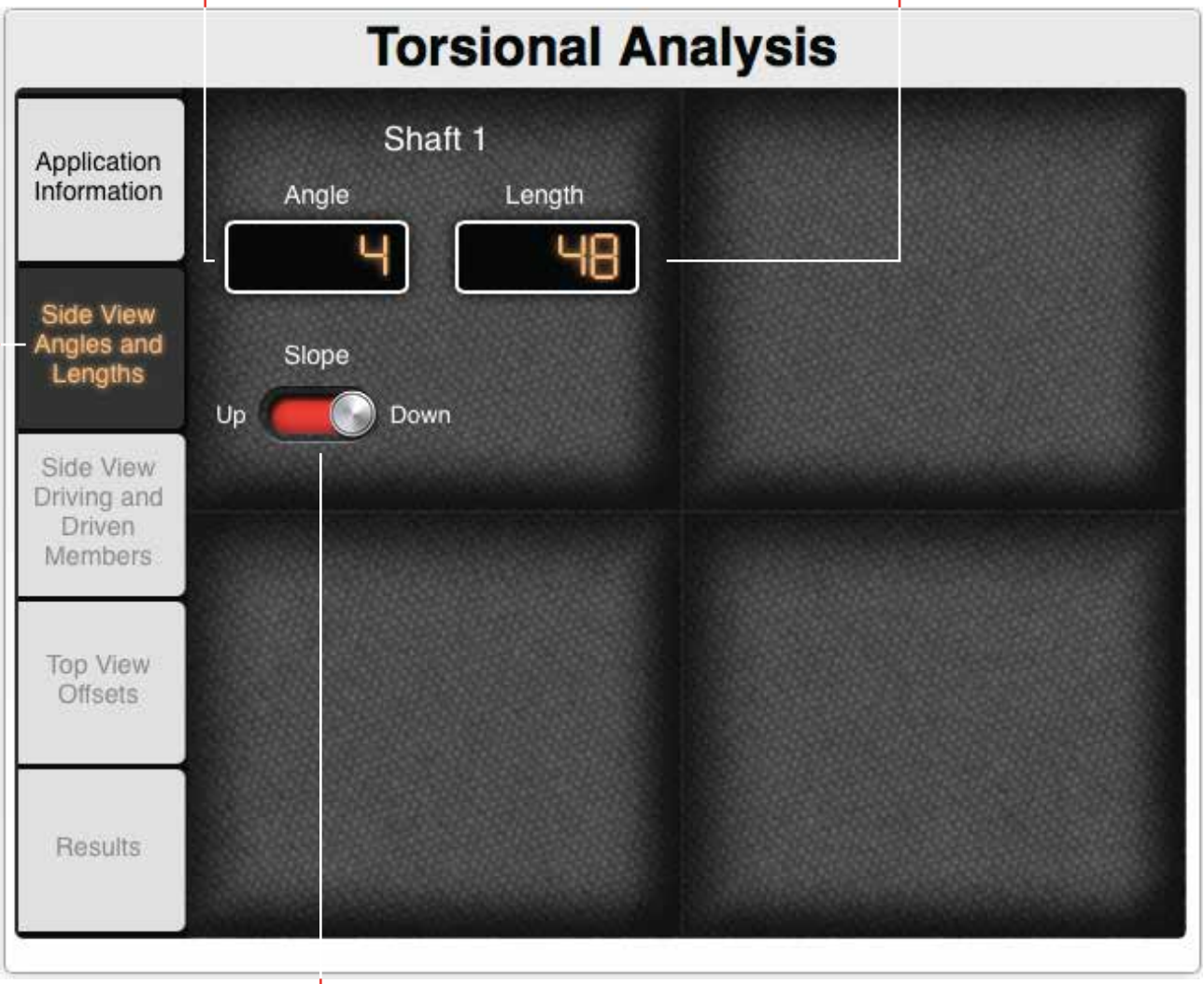
Note: All figures used throughout this tutorial are for example purposes only. You will need to input your real-world application data.

Example 1: One-Driveshaft Application
Step 2: Enter Side View Angles and Lengths Information

Click the Side View Angles and Lengths tab

Click the Angle box for Shaft 1
Enter 4 in the box

Click the Length box for
Shaft 1
Enter 48 in the box



Click the Down (Slope) side of the red slider

Proceed to the next step by clicking the Side View Driving and Driven Members tab

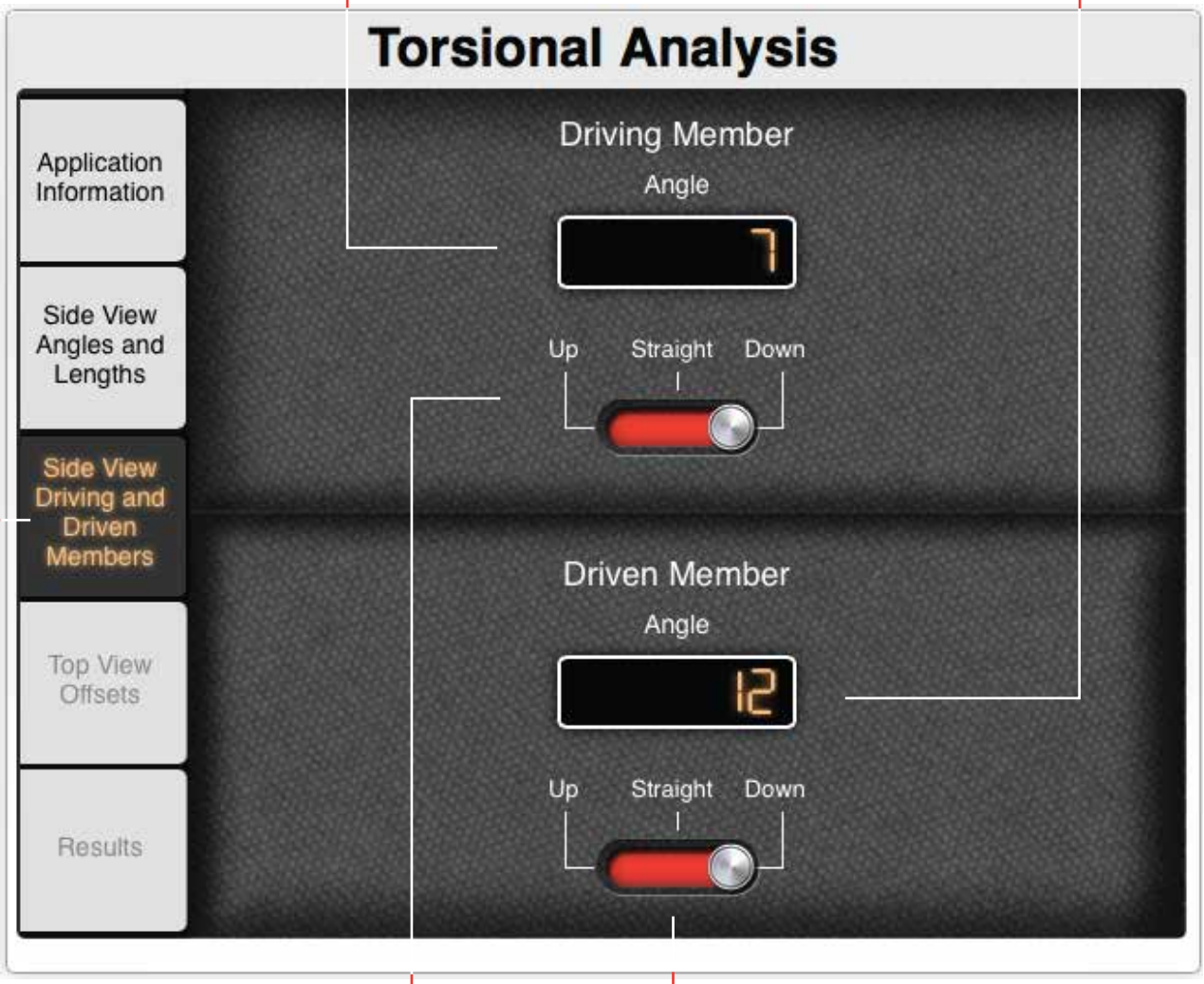
Note: All figures used throughout this tutorial are for example purposes only. You will need to input your real-world application data.

Example 1: One-Driveshaft Application
Step 3: Enter Side View Driving and Driven Members Information

Click the Side View Driving and Driven Members tab

Click the Driving Member Angle box
Enter 7 in the box

Click the Driven Member Angle box
Enter 12 in the box



Click the word Down on red slider

Click the word Down on the red slider

In this example there are no offsets in the top view, so you can move on to Results

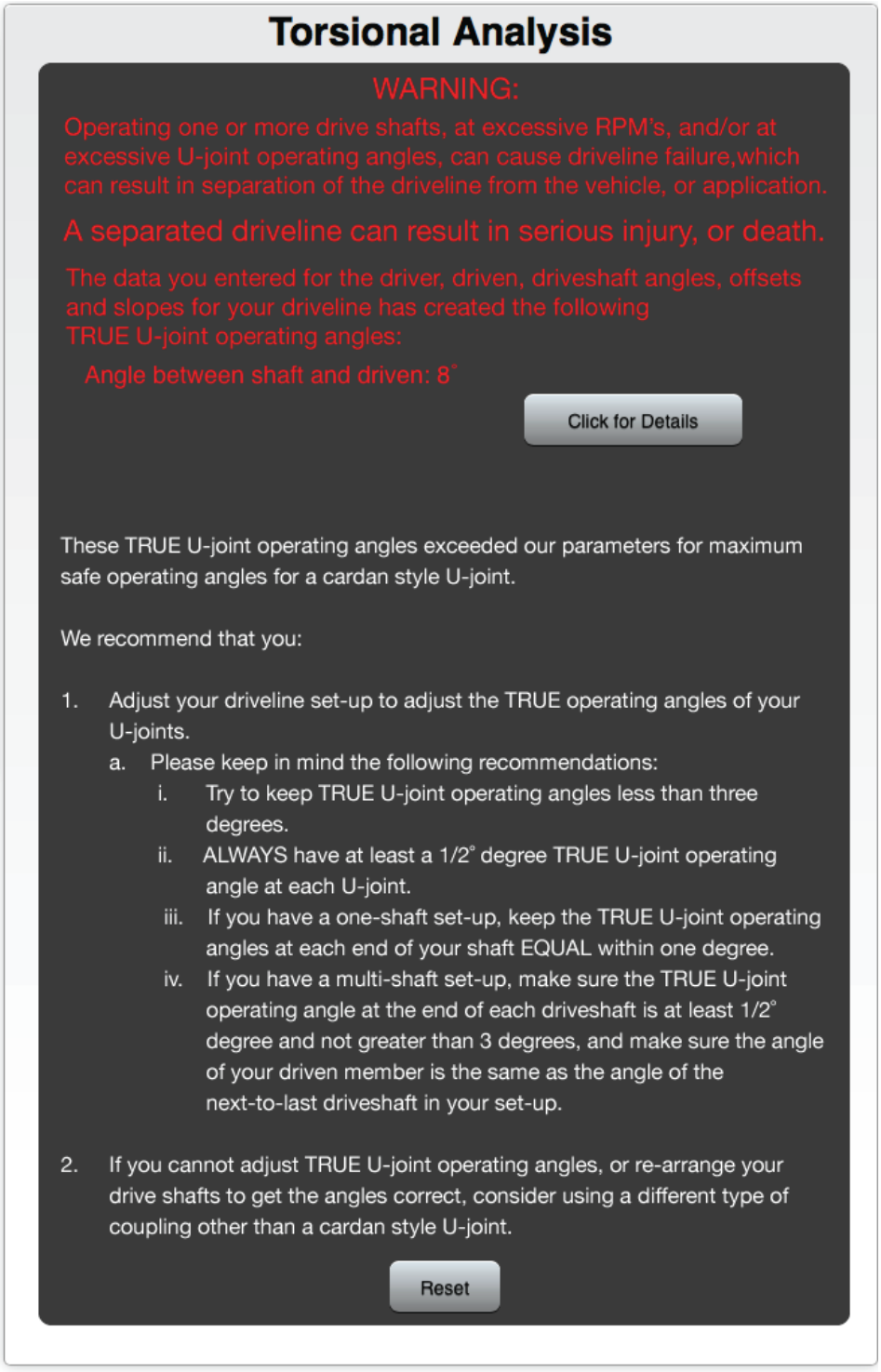
Click to Results

Note: All figures used throughout this tutorial are for example purposes only. You will need to input your real-world application data.

NOTE: The numbers provided in this tutorial example are intended to produce bad angles so as to produce the warning page pictured below.

It is important that you read and understand the information produced on this warning page.

It is also important to click the “Click for Details” button and to read and understand the Detail Information before proceeding to the “Reset” button.



Note: All figures used throughout this tutorial are for example purposes only. You will need to input your real-world application data.

Torsional Analysis

WARNING:

Operating one or more drive shafts, at excessive RPM's, and/or at excessive U-joint operating angles, can cause driveline failure which

Our torsional and inertia calculator will warn you if you enter initial data that creates U-joint operating angles outside of our recommended maximums for the RPM entered.

When excessive data is entered, the warning message pops up on the screen to alert you that the data you entered is excessive. If this happens during a check of an initial vehicle setup, it is a signal that something is seriously wrong and changes have to be made [to your setup]. Either the RPM has to be lowered (which is usually NOT an option), or one or more angles must be lowered to reduce U-joint operating angels.

Click the Reset button at the bottom of the page to start over with the tutorial and calculator.

Close Details

i. Try to keep TRUE U-joint operating angles less than three degrees.
ii. ALWAYS have at least a 1/2° degree TRUE U-joint operating angle at each U-joint.
iii. If you have a one-shaft set-up, keep the TRUE U-joint operating angles at each end of your shaft EQUAL within one degree.
iv. If you have a multi-shaft set-up, make sure the TRUE U-joint operating angle at the end of each driveshaft is at least 1/2° degree and not greater than 3 degrees, and make sure the angle of your driven member is the same as the angle of the next-to-last driveshaft in your set-up.

2. If you cannot adjust TRUE U-joint operating angles, or re-arrange your drive shafts to get the angles correct, consider using a different type of coupling other than a cardan style U-joint.

Reset

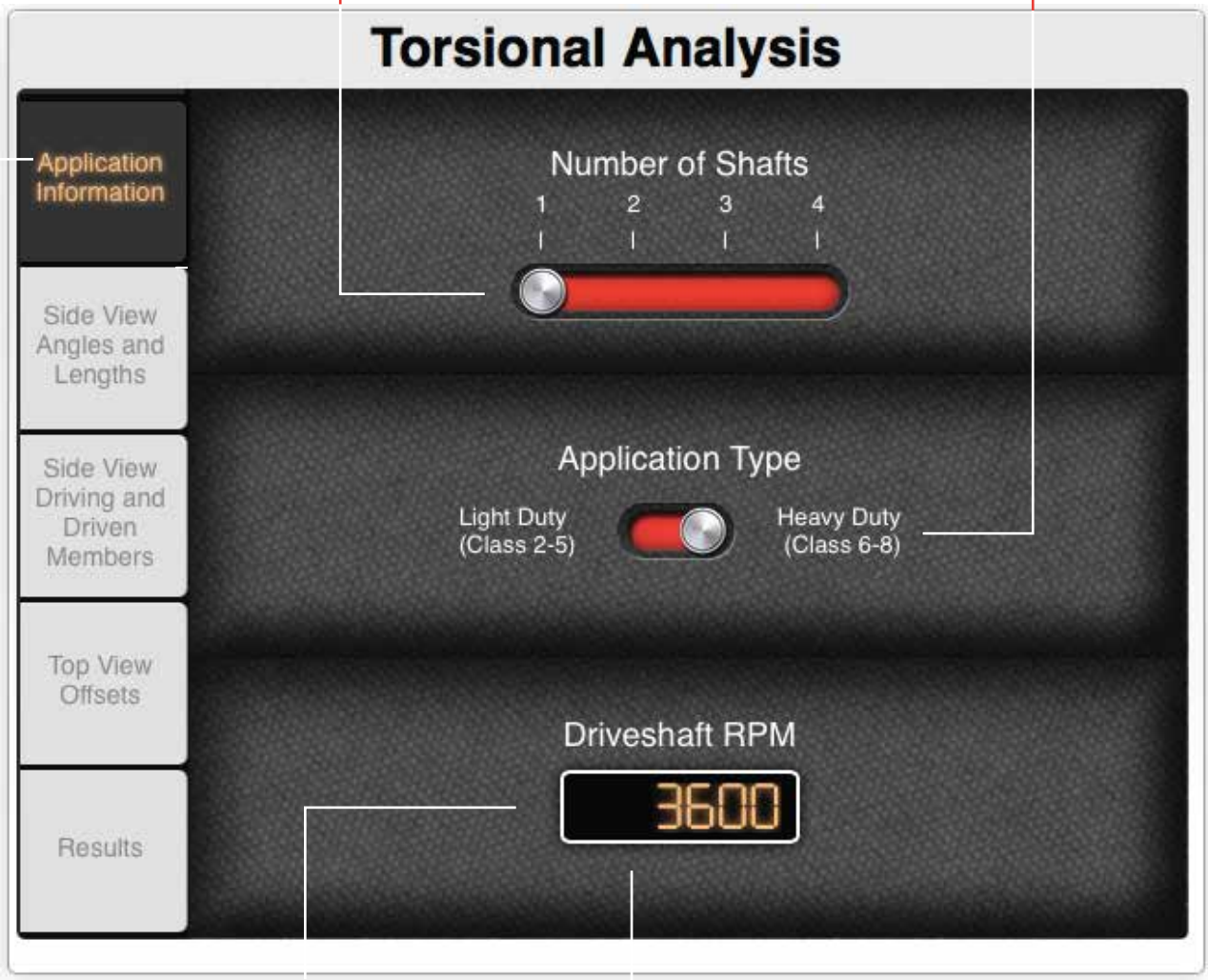
Note: All figures used throughout this tutorial are for example purposes only. You will need to input your real-world application data.

Example 1: One-Driveshaft Application
Step 5: Re-Enter More Realistic Data Application Information

Click the Application Information tab

Click 1 in red box from the Number of Shafts slider

Click Heavy Duty (Class 6-8) on red slider



Click the Driveshaft RPM box

Enter 3600 in the box

Proceed to the next step by clicking the Side View Angles and Lengths tab

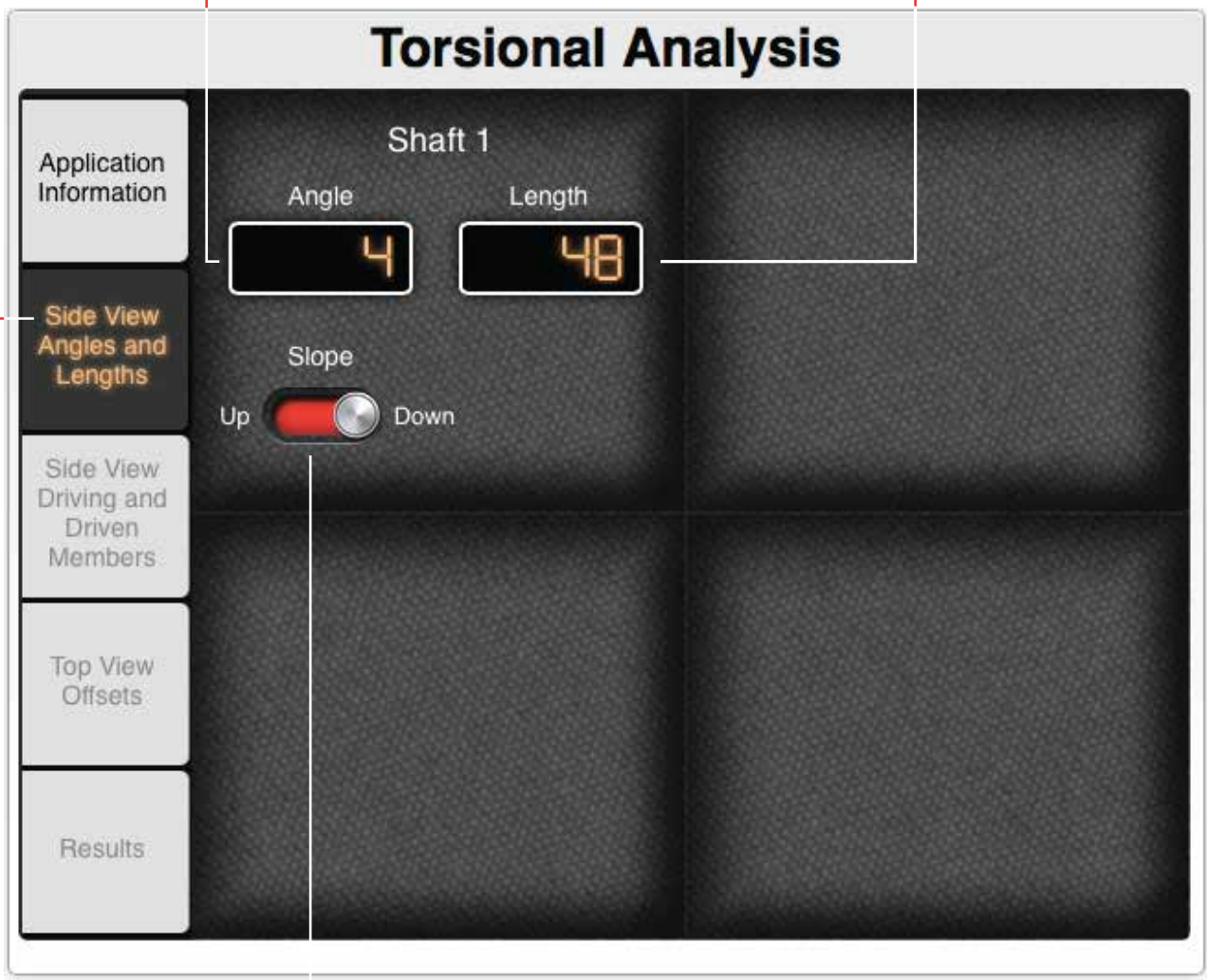
Note: All figures used throughout this tutorial are for example purposes only. You will need to input your real-world application data.

Example 1: One-Driveshaft Application
Step 6: Enter Side View Angles and Lengths Information

Click the Side View Angles and Lengths tab

Click the Angle box for Shaft 1
Enter 4 in the box

Click the Length box for
Shaft 1
Enter 48 in the box



Click the Down (Slope) side of the red slider

Proceed to the next step by clicking the Side View Driving and Driven Members tab

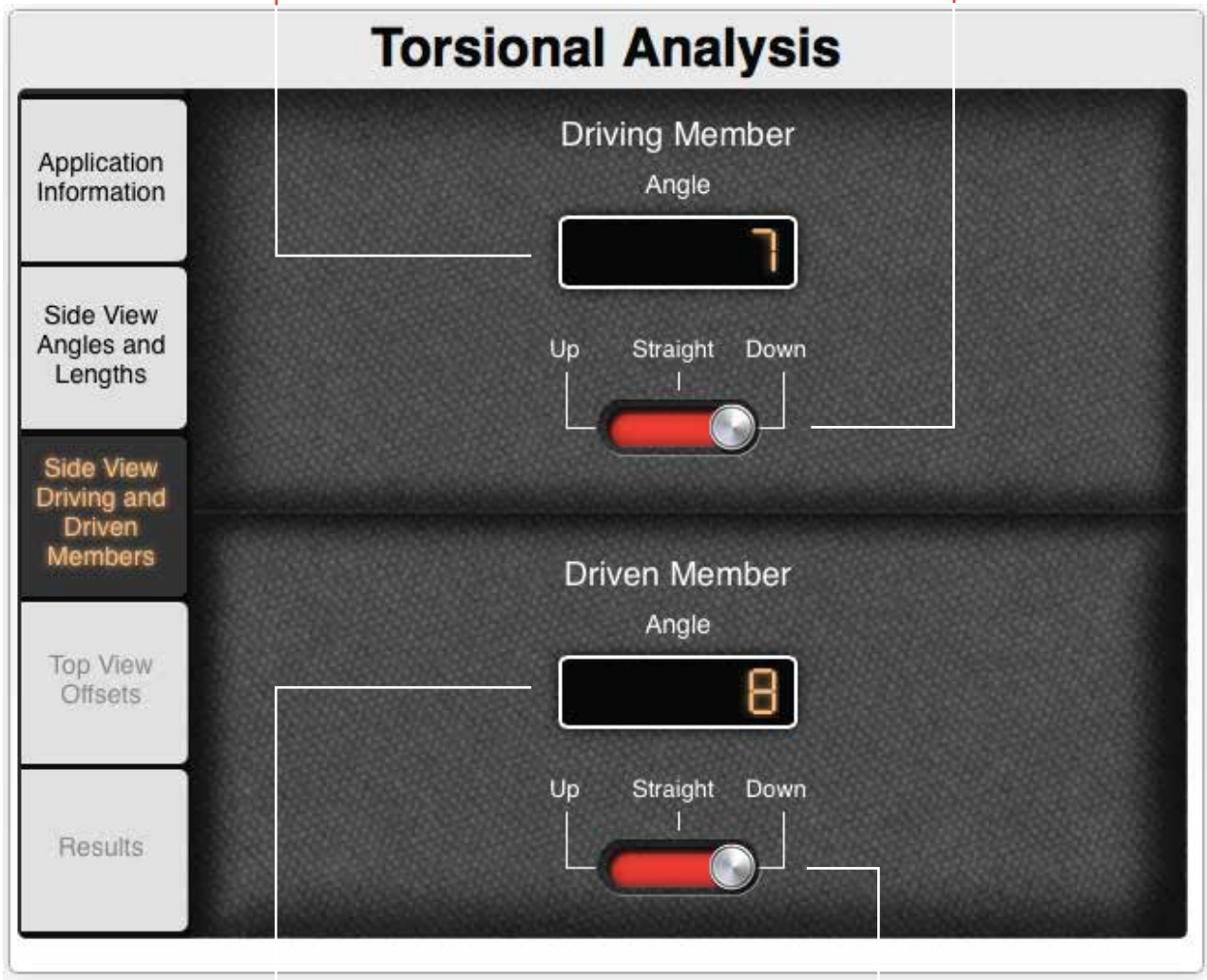
Note: All figures used throughout this tutorial are for example purposes only. You will need to input your real-world application data.

Example 1: One-Driveshaft Application
Step 7: Enter Side View Driving and Driven Members Information

Click the Side View Driving and Driven Members tab

Click the Driving Member Angle box. Enter 7 in the box

Click the word Down on red slider



Click the Driven Member Angle box Enter 8 in the box

Click the word Down on the red slider

In this example there are no offsets in the top view, so you can move on to Results

Click to Results

Note: All figures used throughout this tutorial are for example purposes only. You will need to input your real-world application data.

Example 1: One-Driveshaft Application
Step 8: Initial Results

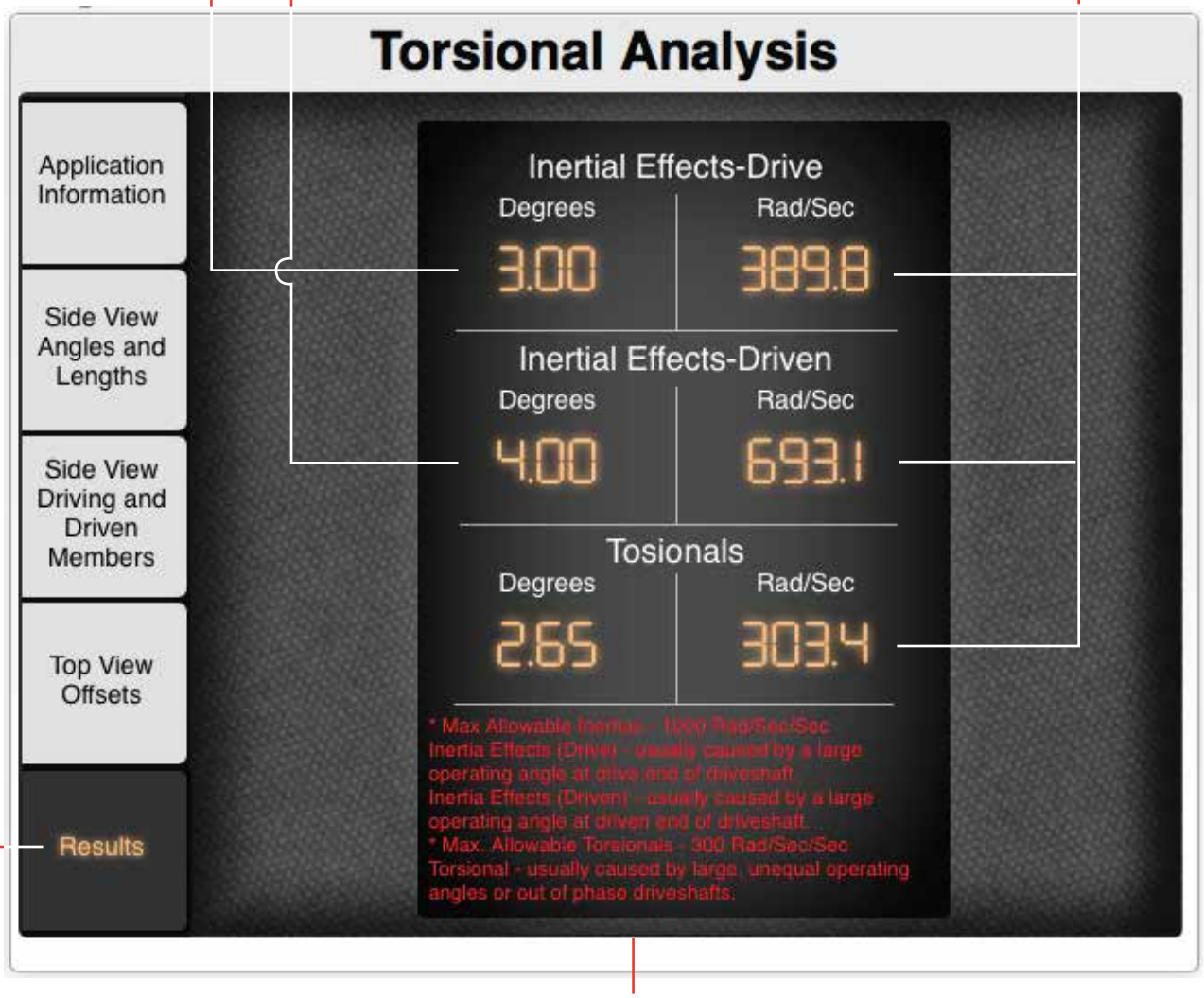
Look at the information entered and determine how it fits into our suggestions, shown on our introduction page, regarding sizes and cancellation of angles.
Here is what the results look like after you do the revised calculation.

Click the Results tab

7° driver angle minus 4° driveshaft angle = 3° operating angle at the driving end

8° driven angle minus 4° driveshaft angle = 4° operating angle at the driven end

Since the angles are large and unequal, you should expect to see large inertias and large torsional results



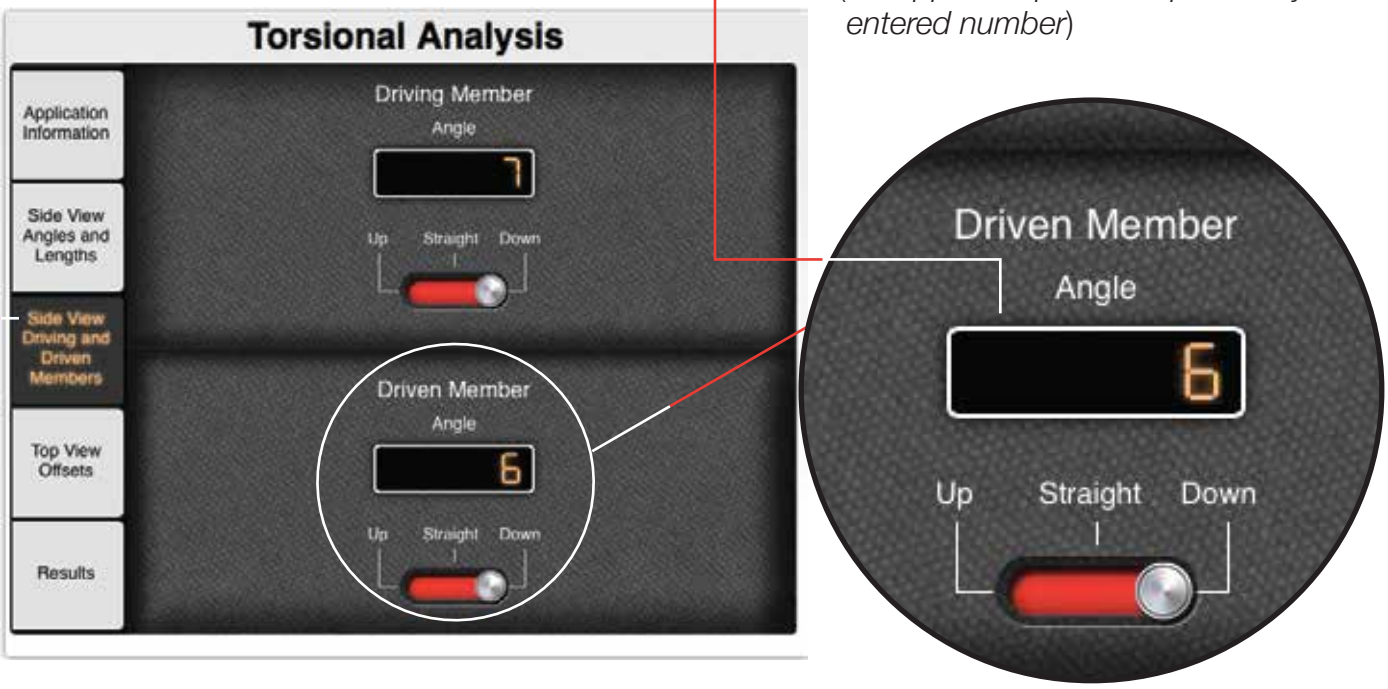
Note that the printing in red, signifying that these values are not acceptable and should be corrected. Look at the results: Torsionals are over our recommended 300 rads/sec and inertias are high on the driven end. That tells us that the operating angle is too high on the driven end of the driveshaft. Let's go back and shim the driven member to reduce angles.

Note: All figures used throughout this tutorial are for example purposes only. You will need to input your real-world application data.

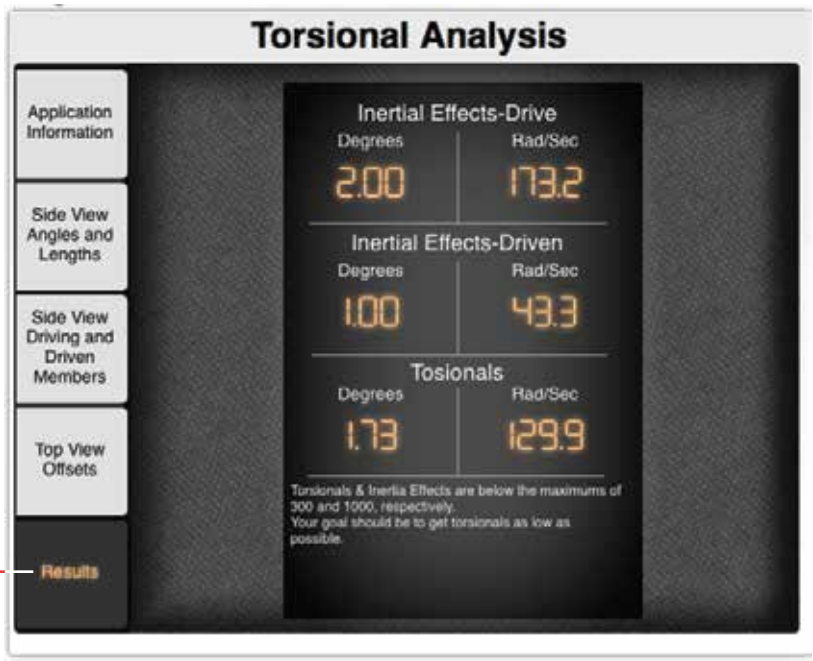
Example 1: One-Driveshaft Application
Step 9: Solutions

Click the Side View Driving and Driven Members tab

Click the Driven Member Angle box
Enter 6
(*the app will replace the previously entered number*)



Click the Results tab again



Here is what the screen looks like after changing the angle of the driven member to 6°. Inertia effects on the driven end came down; more importantly, torsionals came down as well.

Notice the red printing was replaced with white, indicating the results are acceptable.

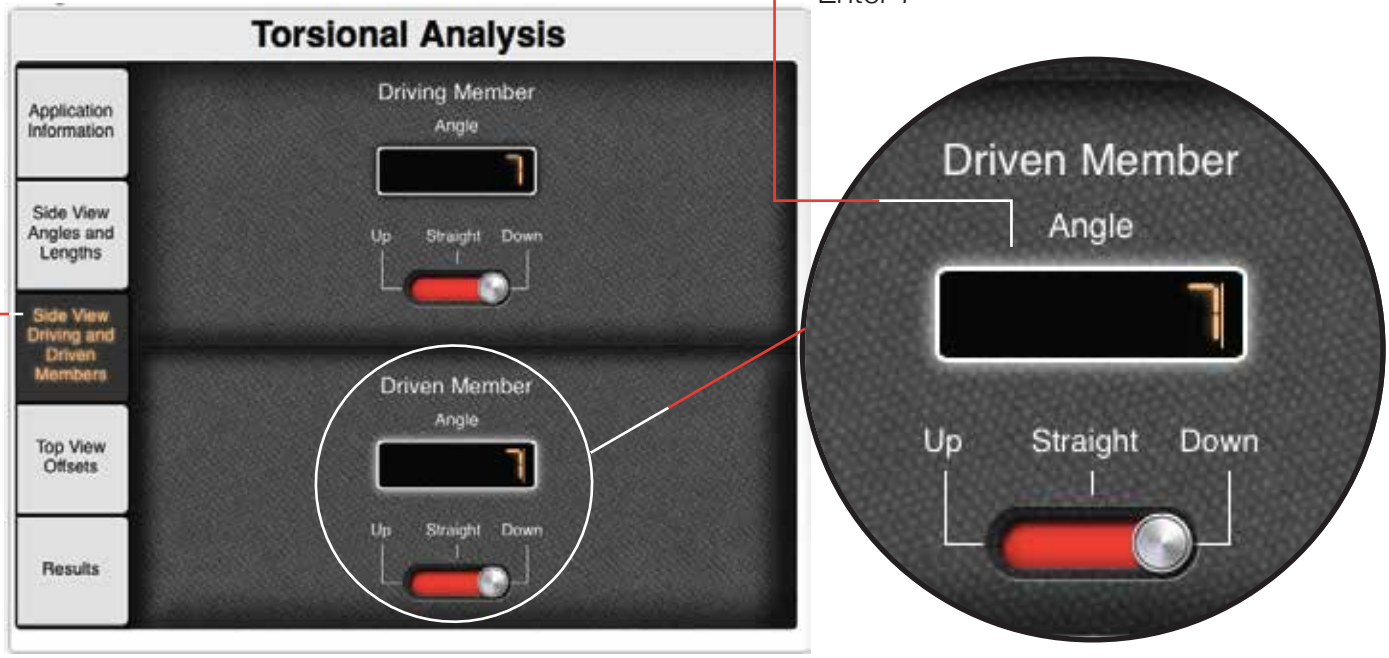
Note: All figures used throughout this tutorial are for example purposes only. You will need to input your real-world application data.

Example 1: One-Driveshaft Application
Step 10: Equal Operating Angles

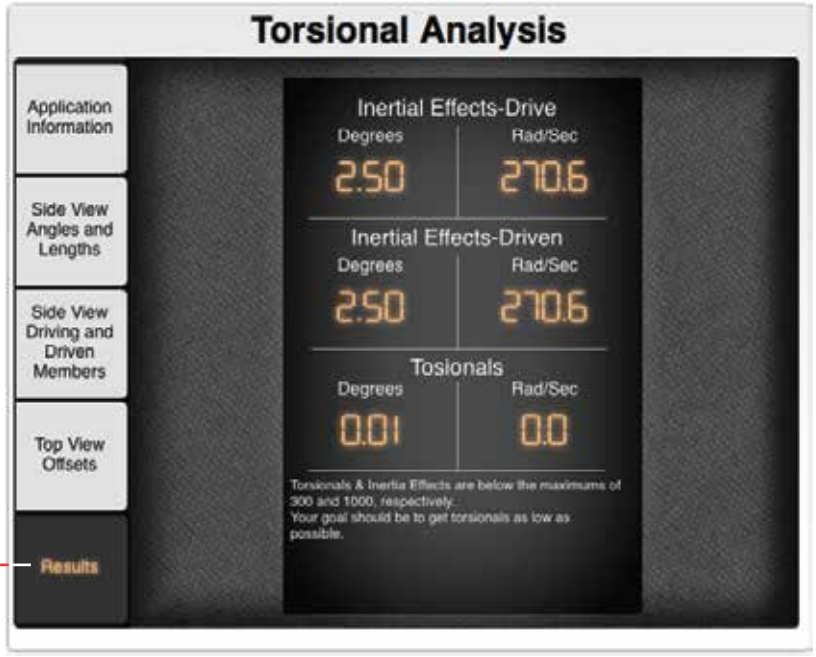
You could stop at this point, but since this is a learning tool, let's try one more thing. Let's purposely make the operating angles on each end of the driveshaft—the angle of the driver and the angle of the driven member—exactly equal: 7°.

Click the Side View Driving and Driven Members tab

Click the Driven Member Angle box
Enter 7



Click the Results tab again



Here is what the screen looks like after changing the angle of the driven member to 7°.
Note that torsionals are now 0 (zero). This is because we have the exact same operating angle at each end of our driveshaft, on our driving member and on our driven member.
Remember: if the driver and driven members are at the same angle, your torsionals will always be zero.

Proceed to Example 2

Note: All figures used throughout this tutorial are for example purposes only. You will need to input your real-world application data.

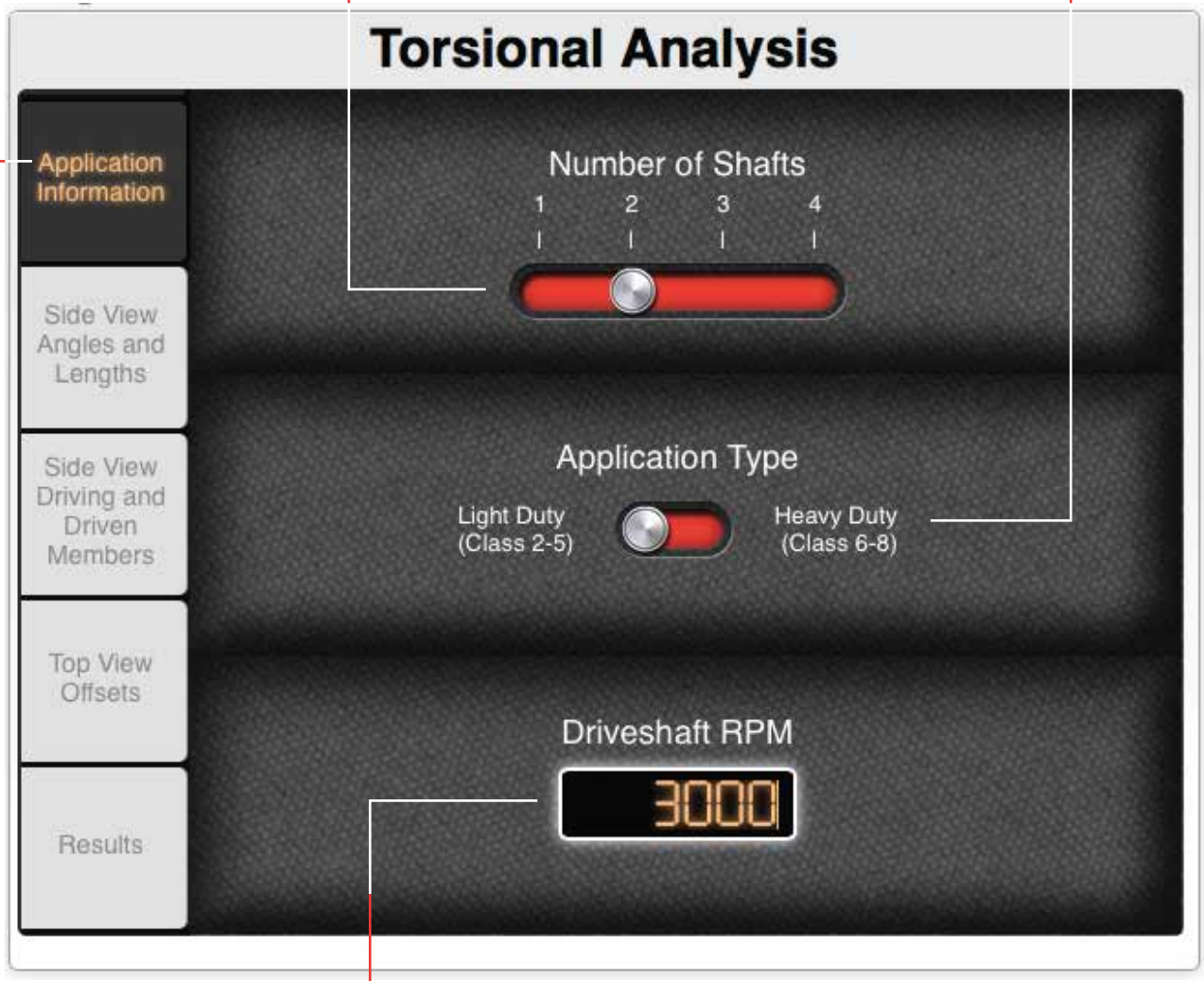
Example 2: Two-Driveshaft Application
Step 1: Enter Application Information

To ensure no data remains in the calculator from previous calculation events, always close out of the calculator and the re-open by selecting “Resources,” “Calculator,” “Torsional Analysis.”

Click the Application Info button on the Torsional Analysis information window.

Click 2 from the Number of Shafts slider

Click Light Duty (Class 2-5) from the Application Type slider



Click the Driveshaft RPM box
Enter 3000

Proceed to the next step by clicking the Side View Angles and Lengths tab

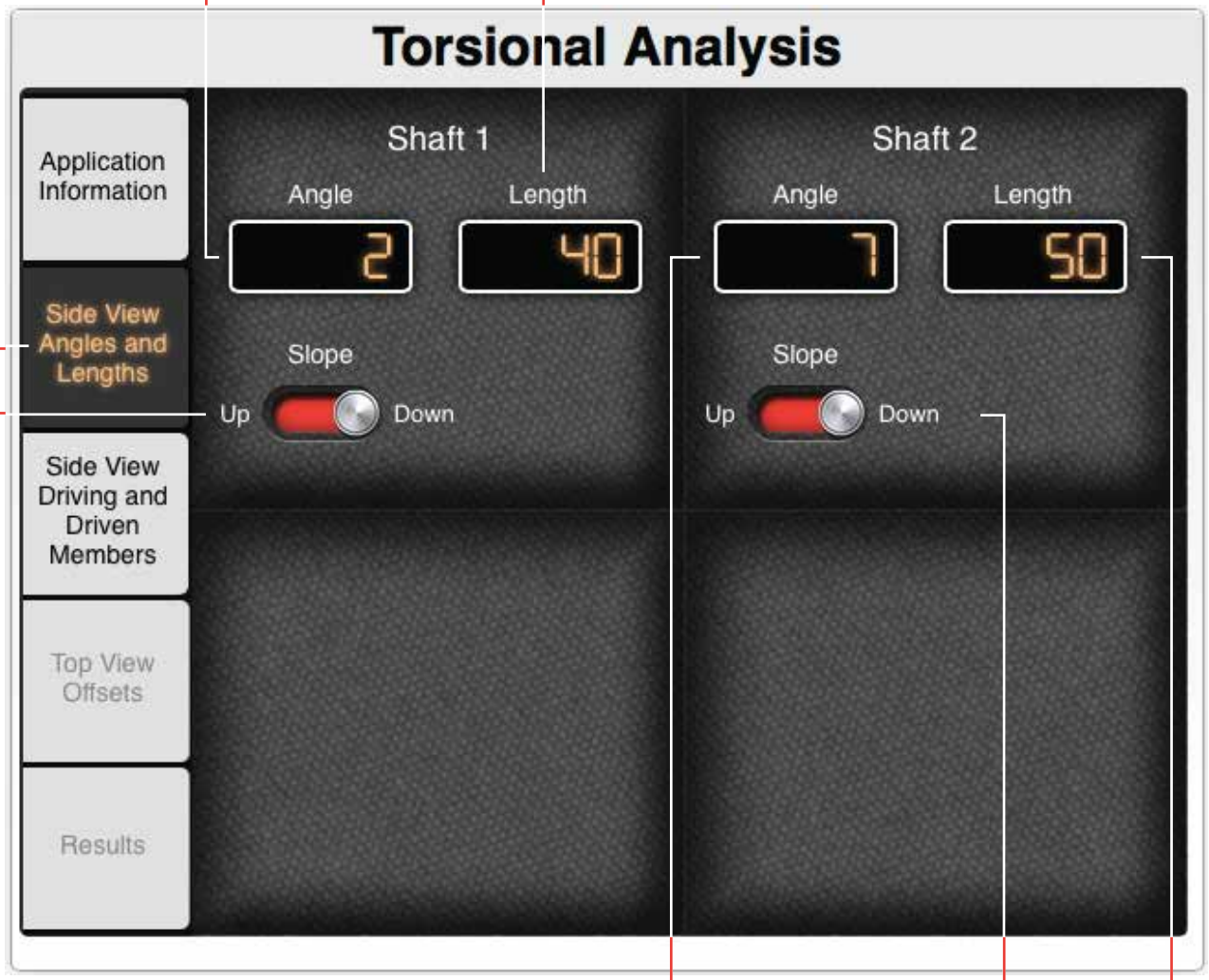
Note: All figures used throughout this tutorial are for example purposes only. You will need to input your real-world application data.

Example 2: Two-Driveshaft Application
Step 2: Enter Side View Angles and Lengths Information

Click the Side View Angles and Lengths tab

Click the Angle box for Shaft 1
Enter 2

Click the Length box for Shaft 1
Enter 40



Click Down

Click the Angle box for Shaft 2
Enter 7

Click Down

Click the Length box for Shaft 2
Enter 50

Proceed to the next step by clicking the Side View Driving and Driven Members tab

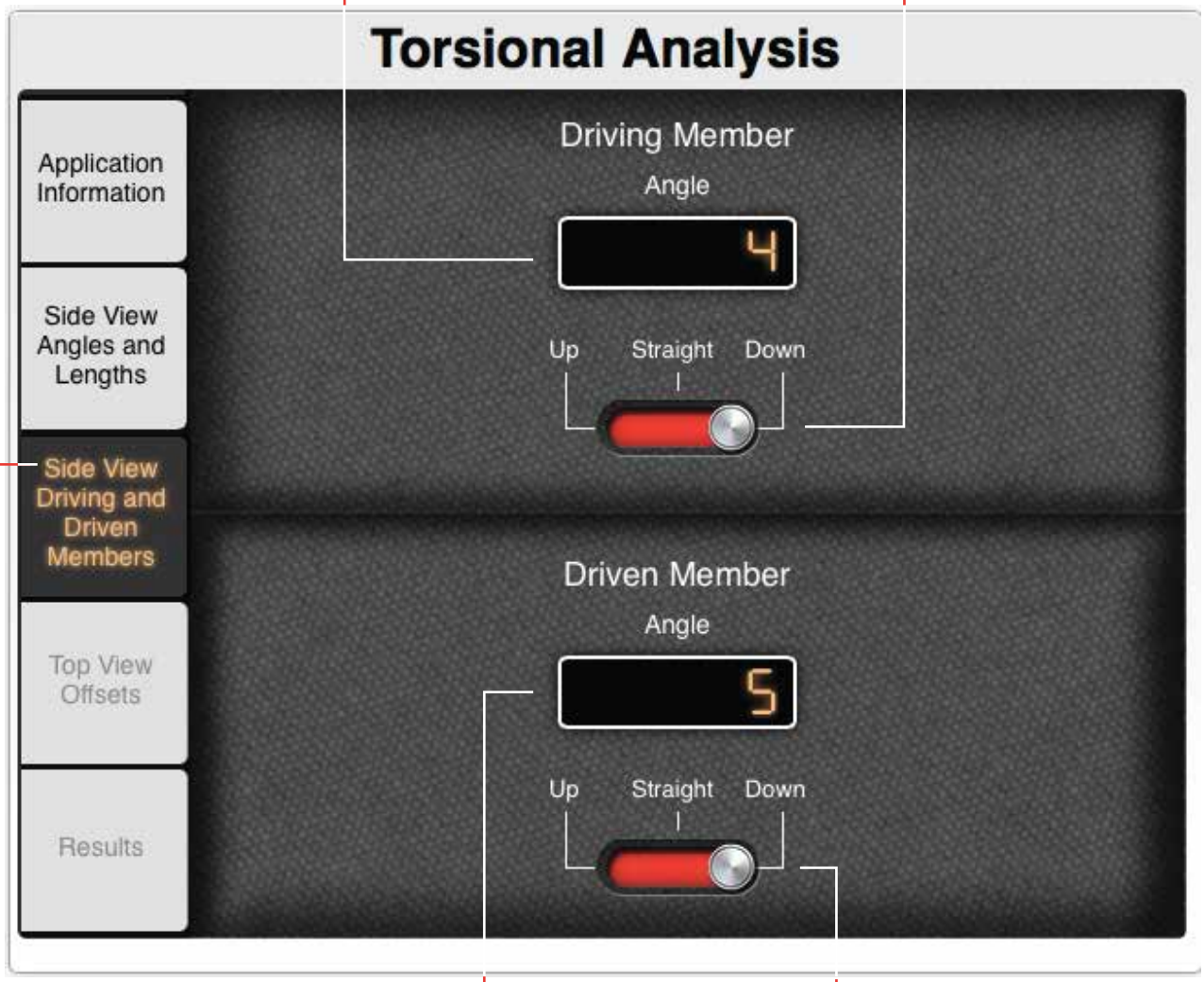
Note: All figures used throughout this tutorial are for example purposes only. You will need to input your real-world application data.

Example 2: Two-Driveshaft Application
Step 3: Enter Side View Driving and Driven Members Information

Click the Side View Driving and Driven Members tab

Click the Driving Member Angle box
Enter 4

Click Down slider for the
Driving Member



Click the Driven Member Angle box
Enter 5

Click Down slider for the
Driven Member

In this example there are no offsets in the top view, so you can move on to Results

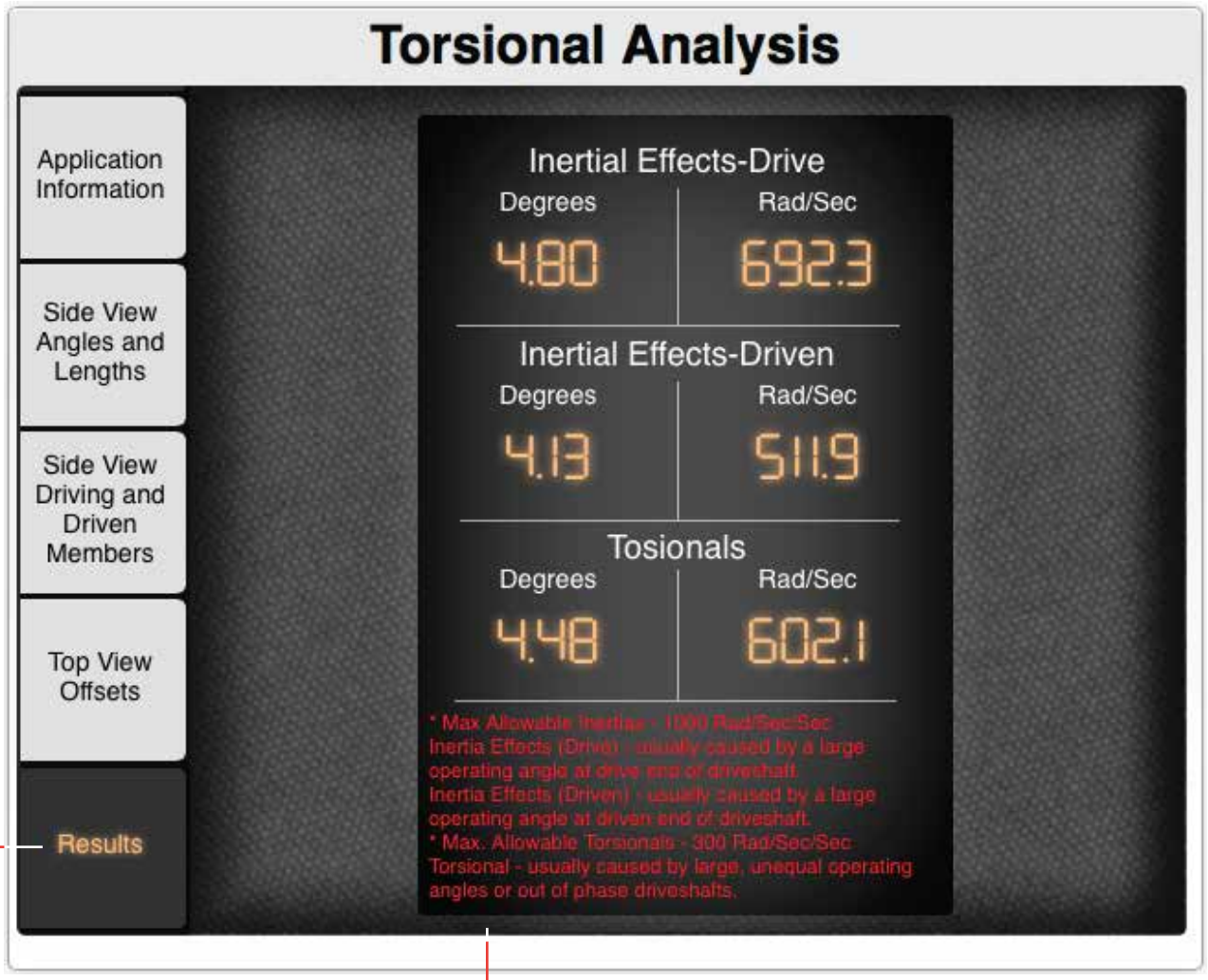
Click Results

Note: All figures used throughout this tutorial are for example purposes only. You will need to input your real-world application data.

Example 2: Two-Driveshaft Application
Step 4: Initial Results

Here is what the results look like after you do the initial calculation.

Click the Results tab



The printing is in red to signify that these values are not acceptable and should be corrected

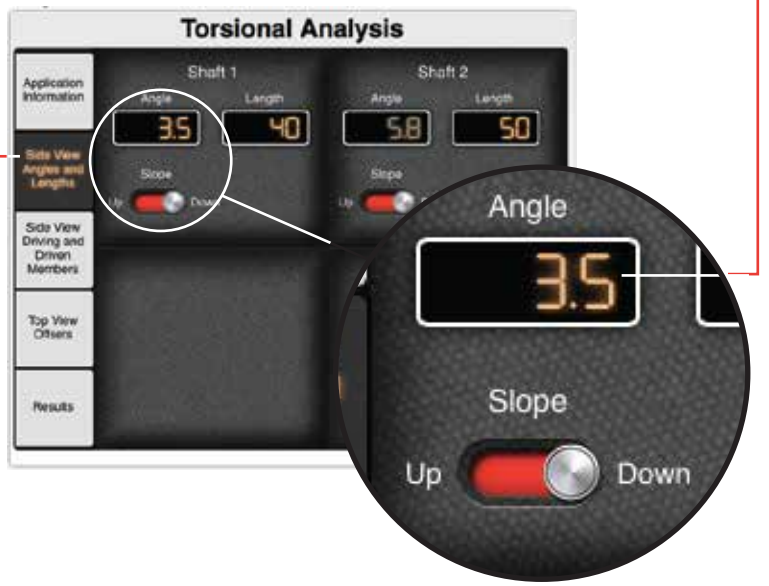
Note that torsionals are high and the inertia effects at the drive end of the shaft are excessive. That should tell you that your angles are not canceled and your operating angle at the drive end of your shaft is probably too large.

Proceed to Solution by Clicking Side View Angles and Lengths Tab

Note: All figures used throughout this tutorial are for example purposes only. You will need to input your real-world application data.

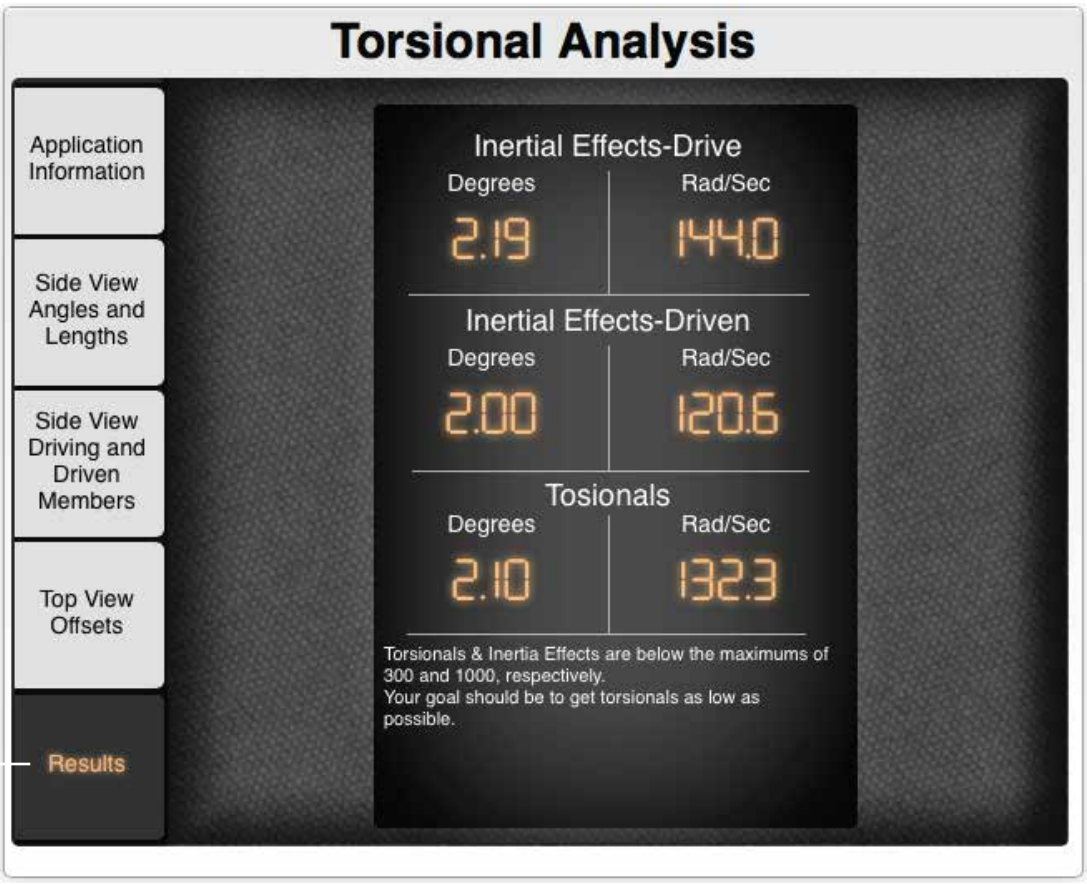
Example 2: Two-Driveshaft Application
Step 5: Solution

Click the Side View Angles and Lengths tab



We're going to reduce our operating angles by shimming our center bearing on Shaft 1. this will reduce the angle of Shaft 2, which will reduce the operating angle at our driven member. Click the Shaft 1 Angle box. Enter 3.5

Click the Results tab again



Here is what the screen looks like with the Shaft 1 angle changed to 3.5 degrees. Torsionals and inertias are now acceptable.

Note: All figures used throughout this tutorial are for example purposes only. You will need to input your real-world application data.

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Dana manufactures a wide range of Spicer parts that deliver original equipment quality to the aftermarket. Only Spicer parts meet the exacting specifications of Dana, the global leader in OE technology.

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Automotive Axle Components

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