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Designing enclosures to mount printed circuit boards (PCB) using Protocase Designer®

(All dimensions are in inches)

Purpose:

Many electrical designers are familiar with the principles of designing and procuring printed circut boards (PCB's) But what about designing the enclosure that perfectly accommodates those printed circuit boards? Protocase Designer was created to allow electrical designers to quickly and efficiently design enclosures to accommodate their PCB's. This tutorial was designed to outline the steps necessary to design an enclosure that can house a PCB .

Introduction:

This tutorial will use our free downloadable enclosure design application; Protocase Designer®, which was released in 23 November of 2005. Protocase Designer® is simple to use and learn, and allows clients to design their own custom enclosure quickly and efficiently. This tutorial outlines a straightforward example of designing an enclosure to accommodate a printed circuit board.

Project objective:

This project uses Protocase Designer® to design an enclosure for housing a stepper motor controller board. The requirement was to produce a simple custom metal box to house the controller for use in an industrial environment.

General background: Tips on optimizing your PCB design

If you are sourcing your pc board as an off-the-shelf item, then you have no control over the location of board connectors or mounting holes. However, as with the board used here in our example from JR Kerr Controls, most OEM boards are designed with mechanical mounting in mind. But if you are designing your board from scratch, there are a few key items to keep in mind when locating pc board mounting holes and panel mount connectors. Here are a couple of design tips:

1. If your pc board needs to be mounted close to a wall of your enclosure, don't place your mounting holes too close to the edge of the pc board. The two examples below (figure 1) show pc boards, each with two mounting holes and a DB-9 panel mount connector. Note with the board on the left (A) the connector holes are located 0.150" from the edge of the board, but with the JR Kerr module on the right (B) the mounting holes are placed well back from the edge of the board. The difficulty with this board on the left is the fact that since this board has a DB-9 panel connector; this board must be placed sufficiently close to the rear panel of the enclosure so as to allow the DB-9 to pass through the enclosure rear panel. In order to get the board close enough to the vertical side of the enclosure to accommodate the DB-9 connector, the required mounting hardware for the pc board must be installed so close to the edge of the enclosure that it will interfere with the enclosure bend radius, making it difficult to manufacture, if not impossible. With the JR Kerr module there is no problem as the mounting holes are far enough back to prevent any inter-

ference. A good general rule of thumb is to leave at least 0.375" between the centre of your mounting hole and the edge of your pc board.

Figure 1

2. Always make sure to mount panel mount connectors (such as those shown in Figure 2) so that they are not flush with the edge of the board. Diagram A has the connector mounted so close to the edge of the board that the board will have to be mounted with it's edge just touching the vertical side of the enclosure so that it can accommodate the connector. Allowing for manufacturing tolerances means the board may be jammed into position when it is mounted thus inducing stress on the board and compromising its electrical integrity. Diagram B is is done properly.

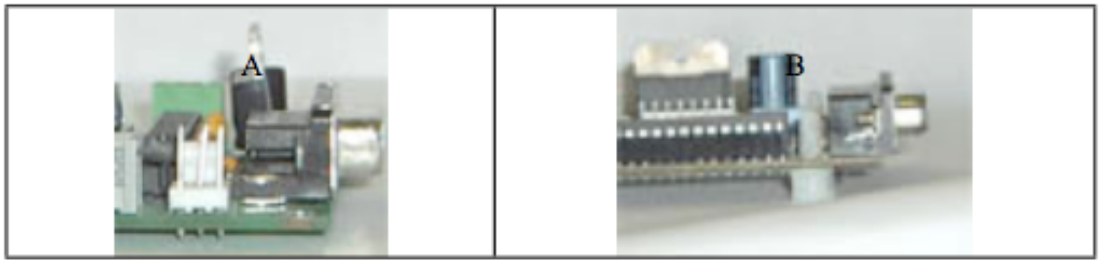


Figure 2

Now that we have some of the issues related to pc board design out of the way, let's now focus on the enclosure.

Enclosure Requirements:

The requirements of this project are to mount a single JR Kerr module in small metal enclosure, containing a single cutout for one DB-9 serial connector and one cutout to allow the connection of DC + and – power leads to screw terminal connectors and also provide a minimum amount of ventilation. Although this is a very simple design in terms of requirements, much more complicated designs can be dealt with in an identical fashion using Protocase Designer®.

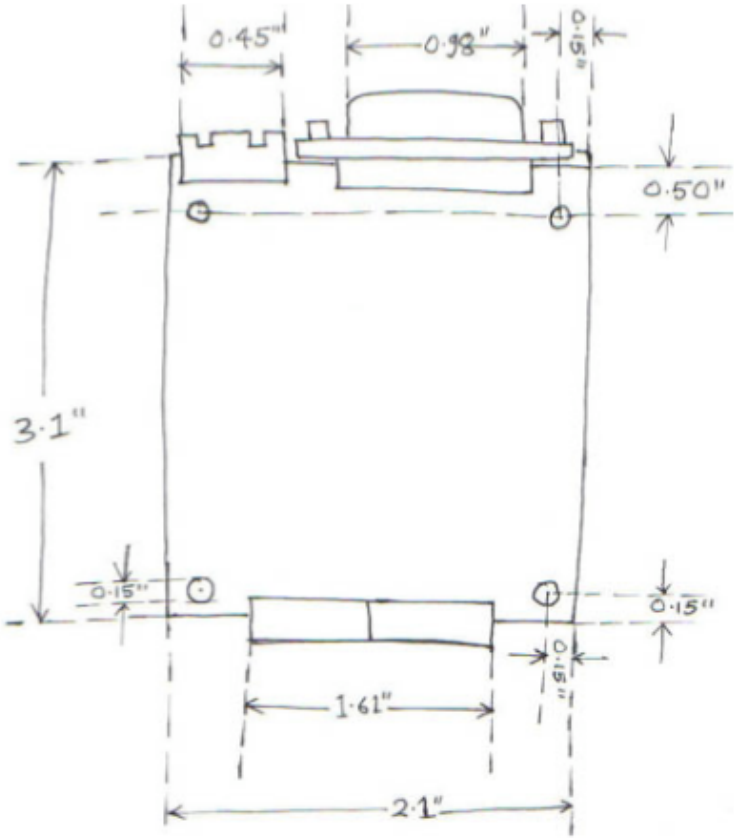
A simple clam shell (U-shape) enclosure is all that is required for this application. This is the simplest of base enclosures and can be found in Protocase Designer® as one of the standard template designs. Besides the two cutouts and ventilation described above, four mounting studs are required

to mount the pc board to the enclosure. Protocase offers a host of self clinching fasteners to be used in mounting the pc board to the enclosure.

Collect Necessary Data:

In order to design our enclosure we need all relevant measurements of the pc board. The figures (figure 3 – A, B, C and D) below show a rough sketch of the example PCB with their measurements. All measurements are measured using mechanical calipers.

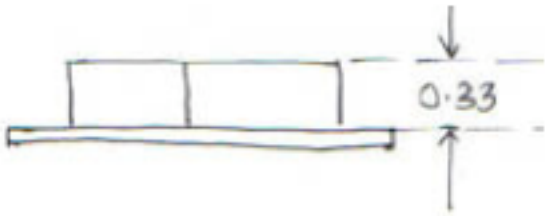
Figure 3 (A)



Top view:

Figure 3 (A) shows key dimension including the mounting holes, the db cutout and the connectors.

Figure 3 (B)



Side view:

Figure 3 (B) shows key dimension of the connector.

Figure 3 (C)

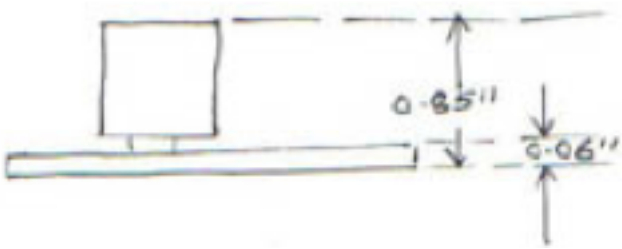


Figure 3 (C) shows the height of 0.85". However, we will add height clearance of 0.15". Thus the total height would be 1" (= 0.85" + 0.15")

Figure 3 (D)

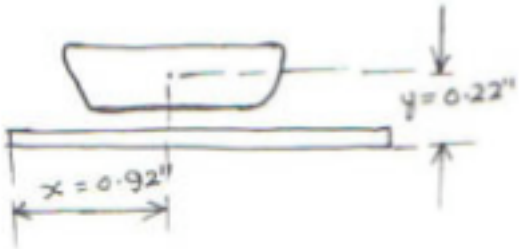


Figure 3 (D) shows the dimension of the DB-9 cutout. This dimension will help us to locate the center point on the board.

Now as we have all the relevant data, we can begin designing our enclosure using Protocase Designer®

Designing the enclosure using Protocase Designer®

1. Open Protocase Designer® (If you don't have copy of Protocase designer®, visit our website at www.protocasedesigner.com/download.html and download the latest version.

2. Specify the dimension of the board:

Please insert the values in the Parameter box. The width, height and depth is shown in figure 3 (A) and figure 3 (C).

W x H x D = 2.1" x 1 x 3.1"

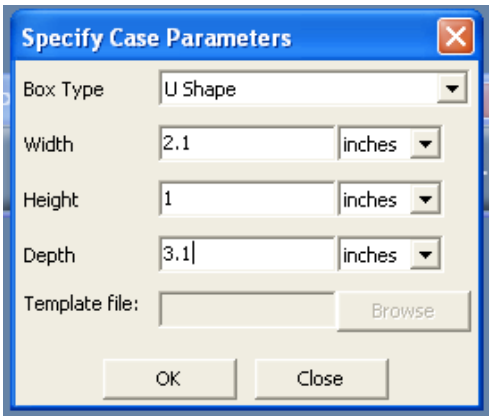


Figure 4

3. View your enclosure in 3D. You will get a screen as shown below in figure 5.

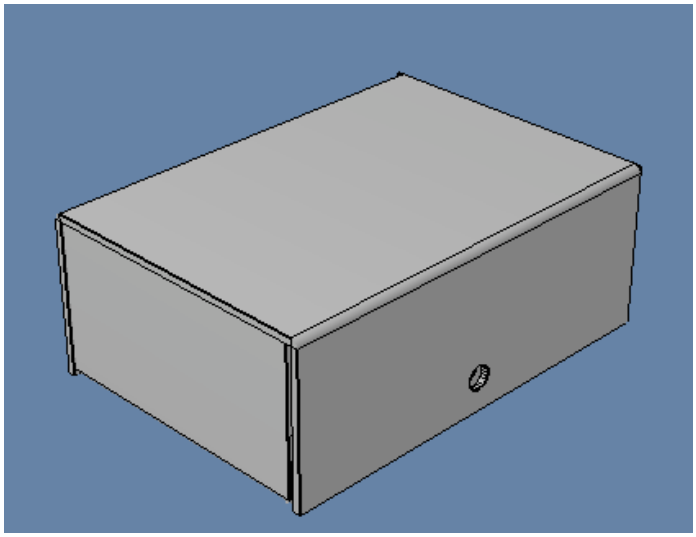


Figure 5

4. Now select a face to draw the DB-9 cutout and connector cutout. The DB-9 cutout can be found in Place -> Port -> DB9. You should submit the location of the DB-9 cutout and the connector cut-out. You will get a screen as shown below in figure 6.

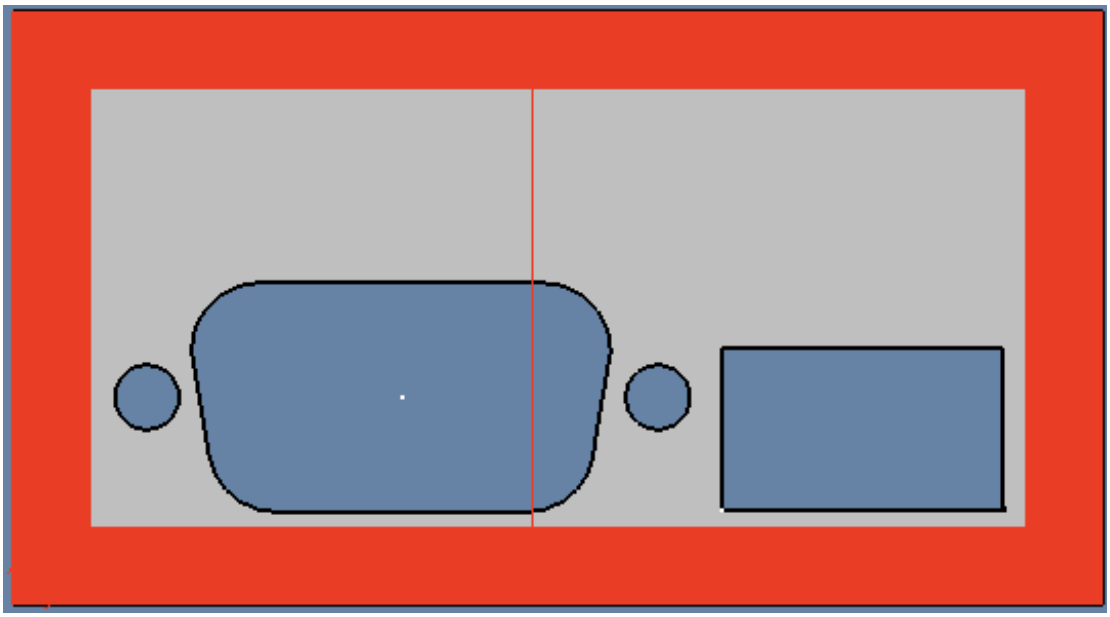


Figure 6

Now close the screen. You will get a screen as shown below in figure 7.

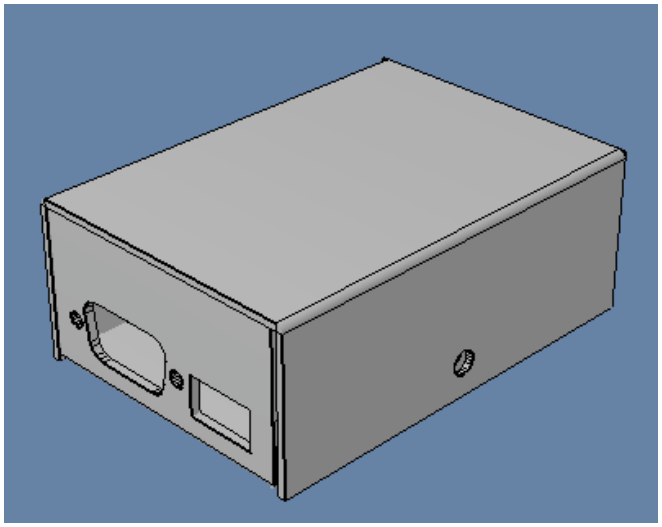


Figure 7

6. We will now add the cutouts for the connectors. Please refer to figure 3 (A) and figure 3 (B) for the location and the dimensions of this cutout. After you add the cutout you should get a screen as shown below in figure 8.

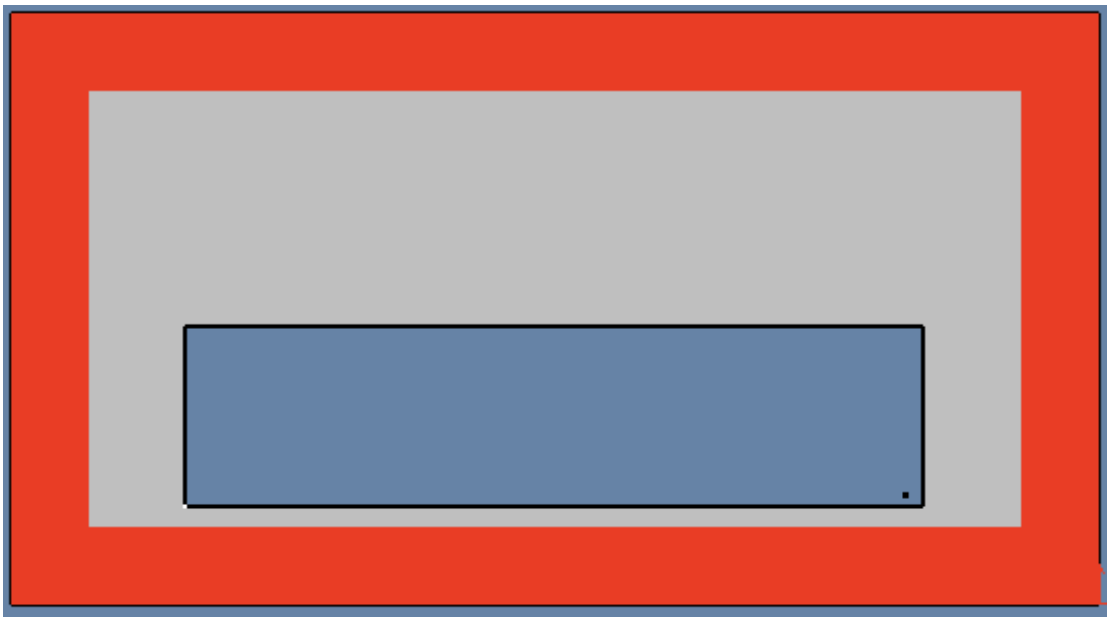


Figure 8

Now close the screen. You will get a screen as shown below in figure 9.

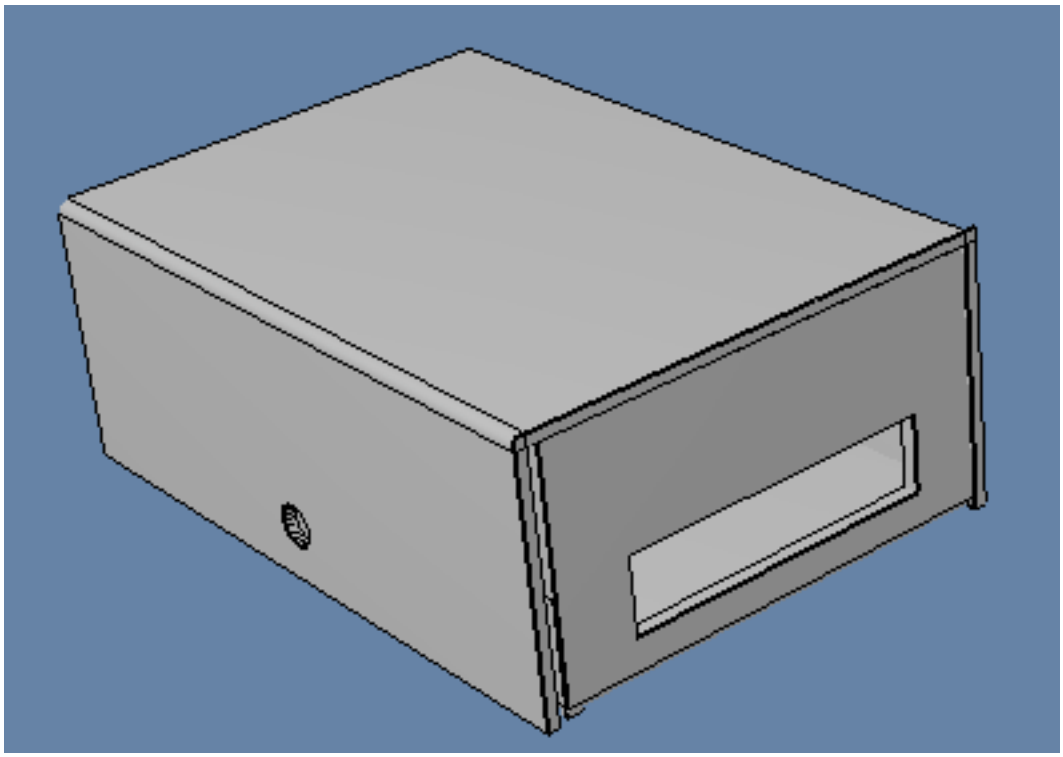


Figure 9

7. Standoffs

Now add standoffs. To do so, first remove the cover 'View -> Remove Cover'. You will get a screen as shown below in figure 10.

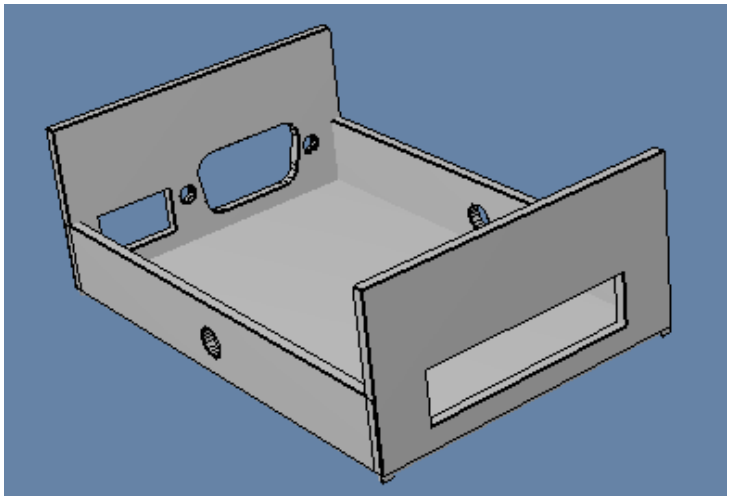


Figure 10

Now select the bottom face and add 6-34 ¼" standoffs at the location shown in figure 3 (A). You will get a screen as shown below in figure 11.

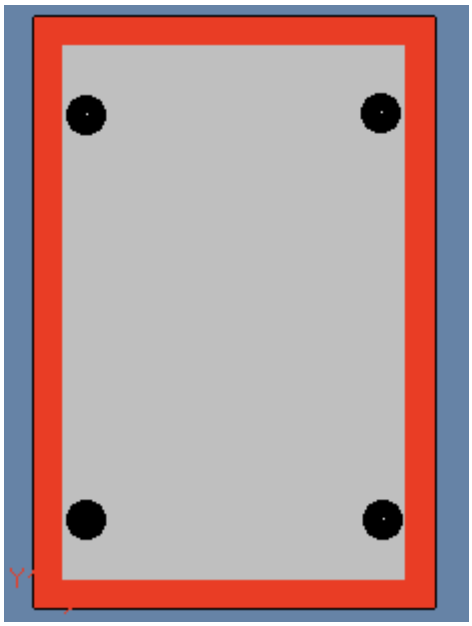


Figure 11

Explanation required on the stand-off selection.

9. Now put the cover back by selecting 'View -> Remove Cover'. The drawing for your enclosure is now complete. The final screen should look as shown below in figure 12.

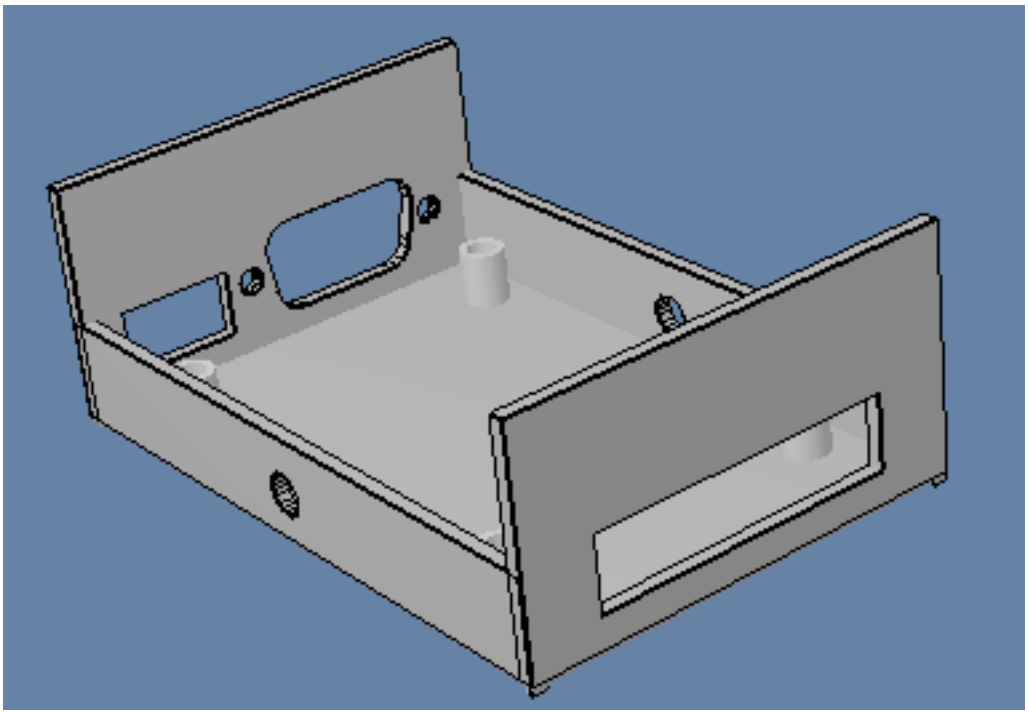


Figure 12

You can also rotate the 3D enclosure. If you do so, you should see the diagram as shown below in figure 13.

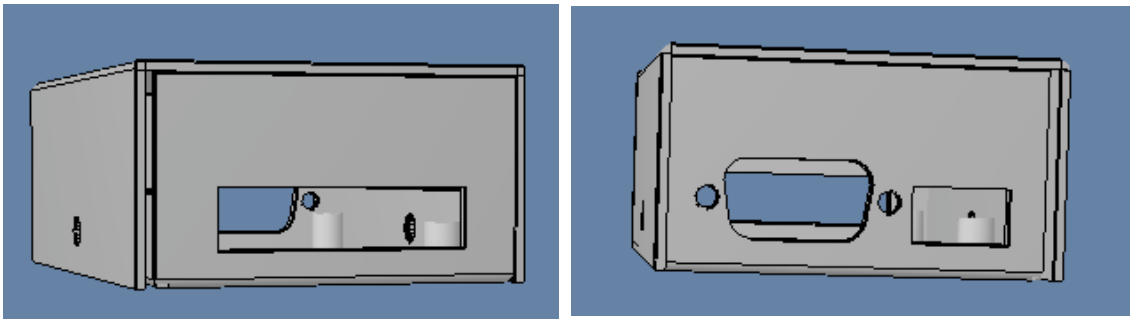


Figure 13

10. Estimate the cost for the enclosure:
After the drawing is finished you can calculate the price by selecting 'Order -> Estimate Price'.

PROTOCASE DESIGNER
Estimate

This is your price estimate for **Quote # 658**.

To order your enclosure, simply return to Protocase Designer, and choose "Purchase" from the main menu.
You may close this browser window and return to Protocase Designer at any time.

Quote # 658

Quantity to update quantity enter amount, then click "Update", and note the change in the Price Quote section below.

Quantity:	1	Update

Price Quote # 658

Quantity:	Item:	Unit:	Price in: CAD
1	u-shape(h:1 w:2.1 d:3.1)	$122.10	$122.10
1	Setup Fee:	$40.00	$40.00
		Sub-Total Price:	**$162.10**

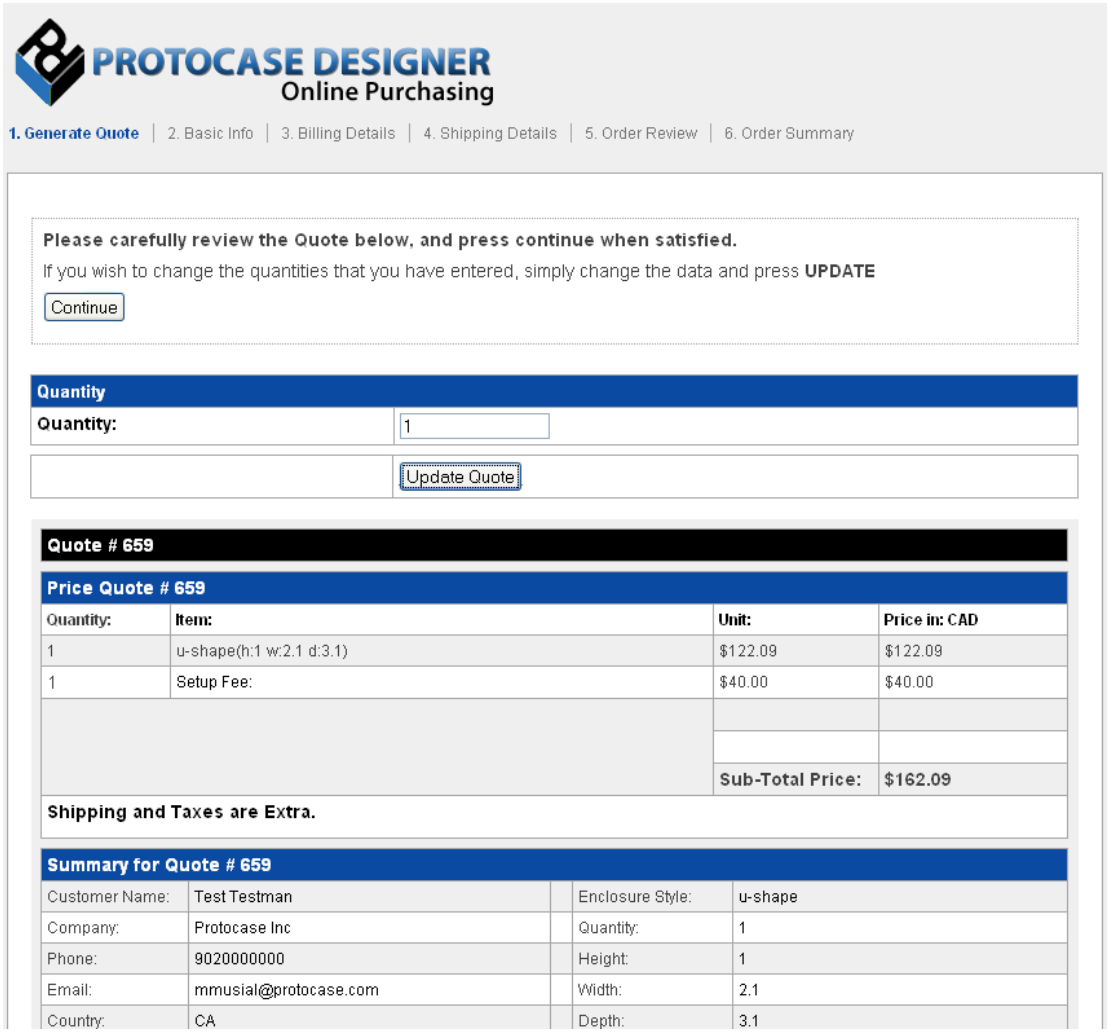
Shipping and Taxes are Extra.

Summary for Quote # 658

Customer Name:	Test Testman		Enclosure Style:	u-shape
Company:	Protocase Inc		Quantity:	1
Phone:	9020000000		Height:	1
Email:	mmusial@protocase.com		Width:	2.1
Country:	CA		Depth:	3.1
Filename:			Number of Cutouts:	3
			Number of PEMs:	4

11. Place an order:

To place an order please select 'Order -> Place an order' and submit the information.



PROTOCASE DESIGNER
Online Purchasing

1. Generate Quote | 2. Basic Info | 3. Billing Details | 4. Shipping Details | 5. Order Review | 6. Order Summary

Please carefully review the Quote below, and press continue when satisfied.

If you wish to change the quantities that you have entered, simply change the data and press **UPDATE**

Continue

Quantity	
Quantity:	1
	Update Quote

Quote # 659

Price Quote # 659

Quantity:	Item:	Unit:	Price in: CAD
1	u-shape(h:1 w:2.1 d:3.1)	$122.09	$122.09
1	Setup Fee:	$40.00	$40.00
		Sub-Total Price:	$162.09

Shipping and Taxes are Extra.

Summary for Quote # 659

Customer Name:	Test Testman	Enclosure Style:	u-shape
Company:	Protocase Inc	Quantity:	1
Phone:	9020000000	Height:	1
Email:	mmusial@protocase.com	Width:	2.1
Country:	CA	Depth:	3.1