# EXERCISE 15

# *Lug Model*

Class clevis_ui

Class clevis_loads

Class dimension

lug_create ( )
lug_mesh ( )
lug_load ( )

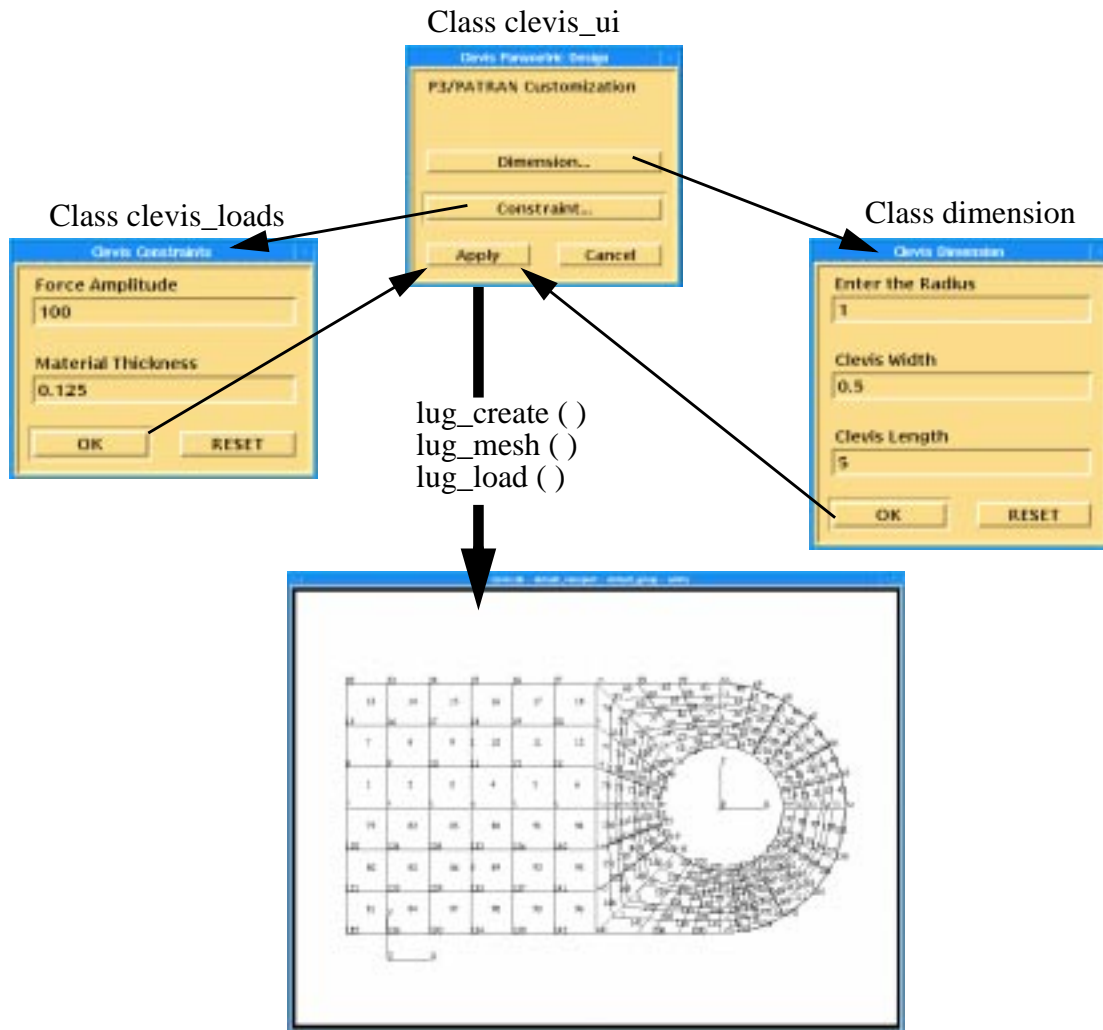## Objectives:

■     Write three classes to take user defined dimensions for the clevis and apply the user defined loads.

■     Create a form that calls other forms.

## Exercise Description:

In this exercise, you will create three classes to control three forms as shown in the figure on page 15-1. Buttons in the *Clevis Parametric Design* form will bring up the two subsequent forms. Finally, upon clicking on Apply in the *Clevis Parametric Design* form, the user specified values for load amplitude, material thickness, clevis radius, width and length will be retrieved from the databoxes and three functions, lug_create (), lug_mesh(), and lug_load() created in the previous exercises, will be called to create the lug.

Class clevis_ui, creates a form with four buttons. Two buttons, Dimension and Constraint, display other menus, and apply and cancel buttons perform their respective actions.

Dimension class contains three databoxes, radius, width, and length, with OK and Reset buttons. Upon clicking on the OK button, data entered in the databoxes will be stored globally for their subsequent use in the lug_create function.

Constraint class creates two databoxes, force and thickness, along with OK and Reset buttons. These databox values will be stored in global variables also, to allow lug_load to access them.

Thus, from a blank database, the three classes and functions will create: the geometry, mesh, material and element properties, and loads for the 2-dimensional clevis model.

## Exercise Procedure:

1.  Enter the vi editor and create three PCL classes in the following files: *exercise_15a.pcl* (clevis parametric design form), *exercise_15b.pcl* (clevis constraints form), *exercise_15c.pcl* (clevis dimension form).

Here is an example of the clevis parametric design form for you to reference.
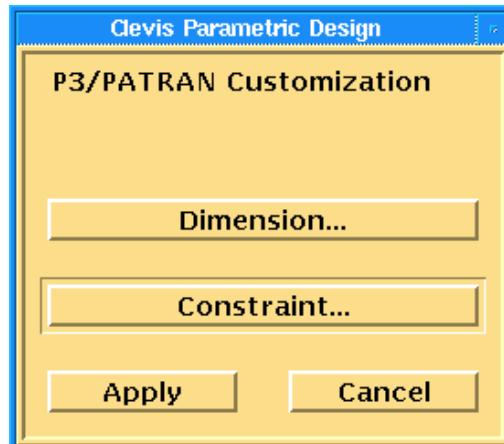


The following are examples of the secondary forms for you to reference.

You may also use the template file your instructor will provide for you to add the missing PCL code.
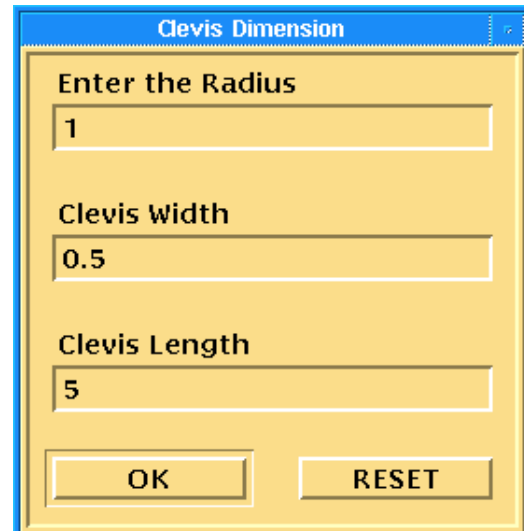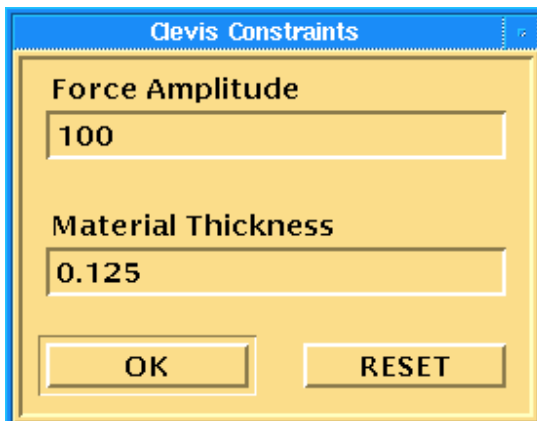




When you have completed the code for generating the functions, and classes, C Pre-Process the files. The command to do this is shown below. Once again refer to exercise 13 in order to use the machine specific commands

%cpp -I/patran/patran3/customization PCL_Program.pcl PCL_Program.cpp

2.    Compile the three PCL functions you have created.

3.    Start the PCL compiler by typing in the following

command:

**p3pclcomp**

Use the **!!input** command to compile the functions. Be sure to compile all three functions

All the error messages and diagnostics will be written to the xterm window, below the previous lines.

4.  Create a p3epilog.pcl in the directory from which you are going to invoke p3. The file should contain:

```
!!input lug_create.pcl
!!input lug_mesh.pcl
!!input lug_load.pcl
!!input clevis_ui.cpp
!!input clevis_loads.cpp
!!input dimension.cpp
!!input training.pcl
training.init ()
```

5.  Pull down the Training menu in the Main Window. Select the Exercise 15 option.

| Training/Exercise 15 | |
| --- | --- |
| **Dimension ...** | |
| *Force Amplitude* | **100** |
| *Material Thickness* | **0.125** |
| **OK** | |
| **Constraint ...** | |
| *Enter the Radius* | **1** |
| *Clevis Width* | **0.5** |
| *Clevis Length* | **5** |
| **OK** | |
| **Apply** | |

6.  Open a new database and test the function.

Enter the dimensions of radius = .5, width = 2, length = 5. Enter the constraints of force amplitude = 100, thickness = 0.125. Your model should appear as shown below.
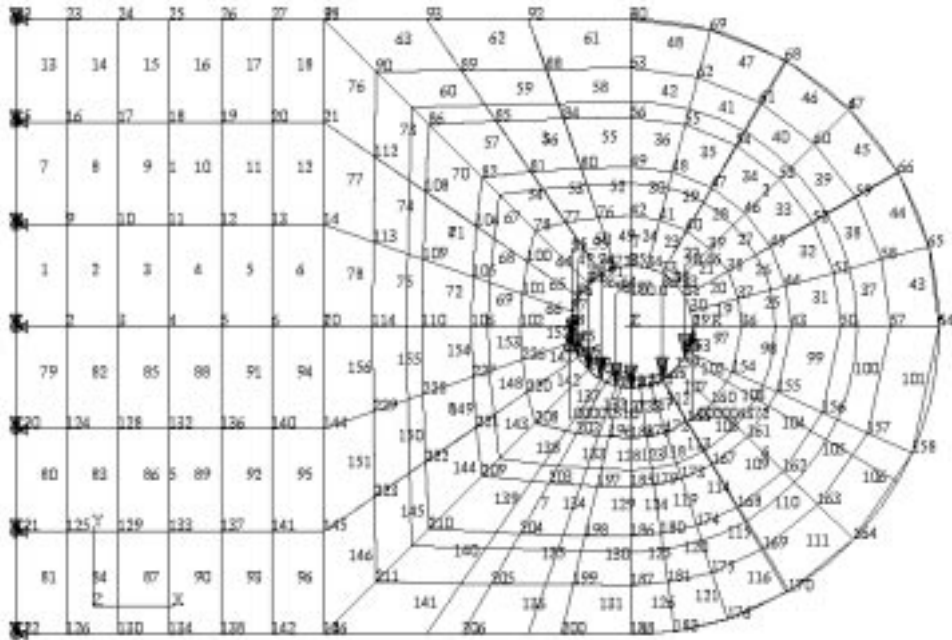
# Sample Solution:

:::::::::::::::
clevis_ui.pcl
:::::::::::::::

```
/*$$ Use of PCL in creating customized forms/widgets
 *
 * Purpose:
 *          Create the user interface for the Clevis Design Project.
 *
 * Input:
 *          <None>
 *
 * Output:
 *          <None>
 *
 * Log:
 *
 * Notes:
 *
 */


#include "appforms.p"

CLASS clevis_ui



 /* Variable initialization */

     CLASSWIDE              widget form_id,              @
                       dimension_button,                 @
                       constraint_button,                @
                          apply_button,                  @
                          cancel_button

     FUNCTION INIT()

        REAL y_loc

       /*
        * Create the form
        */

        form_id=ui_form_create(                          @
          /*   callback   */     "",                         @
          /*       x      */     FORM_X_LOC,                 @
          /*       y      */     FORM_Y_LOC,                 @
          /*   position   */     "UL",                       @
          /*    width     */     FORM_WID_SML,               @
          /*    height    */     FORM_HGT_FULL,              @
          /*    label     */     "Clevis Parametric Design", @
          /*   iconname   */     ""                          )

        y_loc = FORM_T_MARGIN
```

```
      /*
       * Create a descriptive label
       */

      ui_label_create(                                    @
          /*    parent    */    form_id,                  @
          /*  lab_name    */    "",                       @
          /*      x       */    UNFRAMED_L_MARGIN,        @
          /*      y       */    y_loc,                    @
          /*  lab_text    */    "P3/PATRAN Customization" )

      y_loc += 3*LABEL_HGT + INTER_WIDGET_SPACE

       /*
       * Create the "Dimension" button
       */

      dimension_button = ui_button_create(                @
          /*    parent    */    form_id,                  @
          /*  callback    */    ****1****                 @
          /*      x       */    BUTTON_FULL_X_LOC1,       @
          /*      y       */    y_loc,                    @
          /*    width     */    BUTTON_WID_FULL,          @
          /*   height     */    0.0,                      @
          /*    label     */    "Dimension...",           @
          /* labelinside  */    TRUE,                     @
          /*  highlight    */    FALSE                     )

      y_loc += BUTTON_HGT + BUTTON_DEFAULT_BORDER_HGT + @
                  2*INTER_WIDGET_SPACE
      /*
       * Create the "Constraint button
       */

      constraint_button = ui_button_create(               @
          /*    parent    */    form_id,                  @
          /*  callback    */    ****2****                 @
          /*      x       */    BUTTON_FULL_X_LOC1,       @
          /*      y       */    y_loc,                    @
          /*    width     */    BUTTON_WID_FULL,          @
          /*   height     */    0.0,                      @
          /*    label     */    "Constraint...",          @
          /* labelinside  */    TRUE,                     @
          /*  highlight    */    FALSE                     )

       y_loc += BUTTON_HGT + BUTTON_DEFAULT_BORDER_HGT + @
               2*INTER_WIDGET_SPACE
       /*
       * Create the "Apply" button
       */

      apply_button = ui_button_create(                    @
          /*    parent    */    form_id,                  @
          /*  callback    */    ****3****                 @
          /*      x       */    BUTTON_HALF_X_LOC1,       @
          /*      y       */    y_loc,                    @
          /*    width     */    BUTTON_WID_HALF,          @
          /*   height     */    0.0,                      @
          /*    label     */    "Apply",                  @
          /* labelinside  */    TRUE,                     @
          /*  highlight    */    TRUE                      )
```

```
      /*
      * Create the "Cancel" button
      */

      cancel_button = ui_button_create(                    @
          /*    parent    */    form_id,                    @
          /*   callback   */    ****4****                   @
          /*       x      */    BUTTON_HALF_X_LOC2,         @
          /*       y      */    y_loc,                      @
          /*     width    */    BUTTON_WID_HALF,            @
          /*    height    */    0.0,                        @
          /*     label    */    "Cancel",                   @
          /* labelinside  */    TRUE,                       @
          /*  highlight   */    FALSE                        )

      y_loc = y_loc + BUTTON_DEFAULT_HGT + FORM_B_MARGIN
      ui_wid_set( form_id, "HEIGHT", y_loc )

END FUNCTION

FUNCTION DISPLAY()

      ui_form_display( "clevis_ui")

END FUNCTION

FUNCTION dimension_cb()

              *************5*************

END FUNCTION /* constraint_cb end of Function */

FUNCTION constraint_cb()

          *************6**************

END FUNCTION /* constraint_cb end of Function */
FUNCTION apply_cb()

        /*
        * calling the routines to create the Clevis Design
        */

        **************7*****************
        **************7*****************


  END FUNCTION /* apply_cb */

  FUNCTION cancel_cb()

        /*
        * Save the data entered in the dimension & constraint forms
        * and hide all of the forms!!
        */

        ui_form_hide( "clevis_ui")

  END FUNCTION /* cancel_cb */

END CLASS /* clevis_ui */
```

*1* "dimension_cb"
*2* "constraint_cb"
*3* "apply_cb",
*4* "cancel_cb"
*5* ui_exec_function("dimension", "display")
*6* ui_exec_function("clevis_loads", "display")
*7* lug_create()
    lug_mesh()
    lug_load()

```
:::::::::::::::
clevis_loads.pcl
:::::::::::::::
 /*$$ Use of PCL in creating customized forms/widgets
 *
 * Purpose:
 *          Create a form with three databoxes, apply and cancel buttons.
 *          The callback for the apply button will get the string entered
 *          in the databoxes and write them into a global variable.
 *
 * Input:
 *          <None>
 *
 * Output:
 *          <None>
 *
 * Log:
 *
 * Notes:
 *
 */

#include "appforms.p"

CLASS clevis_loads

     /* Variable initialization */

     CLASSWIDE              widget form_id,          @
                                   dbx1_id,          @
                                   dbx2_id,          @
                                   ok_button,        @
                                   reset_button

     FUNCTION INIT()

        REAL y_loc, form_x_location
        GLOBAL REAL amplitude, thickness

        form_x_location = FORM_X_LOC-FORM_WID_SML - @
                          FORM_L_BORDER - @
                          FORM_R_BORDER

       /*
        * Create the form
        */

        form_id=ui_form_create(                        @
           /*  callback   */     "",                   @
           /*      x      */     form_x_location,      @
           /*      y      */     FORM_Y_LOC ,          @
           /*  position   */     "UL",                 @
           /*   width     */     FORM_WID_SML,         @
           /*   height    */     FORM_HGT_FULL,        @
           /*   label     */     "Clevis Constraints ",     @
           /*  iconname   */     ""                    )

        y_loc = ***************1***************
```

```
         /*
          * Create the "Enter the Force Amplitude data box"
          */

         dbx1_id= ui_databox_create(                            @
             /*    parent    */     form_id,                     @
             /*  callback    */     "",                          @
             /*      x       */     UNFRAMED_L_MARGIN,           @
             /*      y       */     y_loc,                       @
             /* label_length */     0.0,                         @
             /* box_length   */     DBOX_WID_SINGLE,             @
             /*    label     */     "Force Amplitude",           @
             /*    value     */     str_from_real( amplitude ),@
             /* label_above  */     TRUE,                        @
             /*  datatype     */     "REAL",                     @
             /*  num_vals     */     1                            )

     y_loc += ************************2******************


         /*
          * Create the " Material Thickness data box"
          */

         dbx2_id= ui_databox_create(                            @
             /*    parent    */     form_id,                     @
             /*  callback    */     "",                          @
             /*      x       */     UNFRAMED_L_MARGIN,           @
             /*      y       */     y_loc,                       @
             /* label_length */     0.0,                         @
             /* box_length   */     DBOX_WID_SINGLE,             @
             /*    label     */     "Material Thickness",        @
             /*    value     */     str_from_real( thickness ),@
             /* label_above  */     TRUE,                        @
             /*  datatype     */     "REAL",                     @
             /*  num_vals     */     1                            )

     y_loc += *************************3*******************


          /*
           * Create the "ok" button
           */

         ok_button = ui_button_create(                          @
             /*    parent    */     form_id,                     @
             /*  callback    */     "ok_cb",                     @
             /*      x       */     BUTTON_HALF_X_LOC1,          @
             /*      y       */     y_loc,                       @
             /*   width      */     BUTTON_WID_HALF,             @
             /*   height     */     0.0,                         @
             /*    label     */     "OK",                        @
             /* labelinside  */     TRUE,                        @
             /*  highlight    */     TRUE                         )
```

```
        /*
        * Create the "Reset" button
        */

        reset_button = ui_button_create(                  @
            /*    parent    */    form_id,                 @
            /*   callback   */    "reset_cb",              @
            /*       x      */    BUTTON_HALF_X_LOC2,      @
            /*       y      */    y_loc,                   @
            /*    width     */    BUTTON_WID_HALF,         @
            /*    height    */    0.0,                     @
            /*    label     */    "RESET",                 @
            /* labelinside  */    TRUE,                    @
            /*  highlight   */    FALSE                    )

    y_loc += ********************4*********************

    ui_wid_set( form_id, "HEIGHT", y_loc )


END FUNCTION

FUNCTION DISPLAY()

    GLOBAL REAL thickness, amplitude

    ui_wid_set( dbx1_id,"VALUE", amplitude )
    ui_wid_set( dbx2_id,"VALUE", thickness )
    ui_form_display( "clevis_loads")

END FUNCTION

FUNCTION ok_cb()

    GLOBAL REAL thickness, amplitude

    UI_WID_GET (dbx1_id,"VALUE", amplitude )
    UI_WID_GET (dbx2_id,"VALUE", thickness )

    UI_WID_SAVE ("clevis_loads")
    UI_FORM_HIDE( "clevis_loads")
    select_focus.exit()


END FUNCTION /* ok_cb end function */

FUNCTION reset_cb()

    UI_WID_RESTORE ("clevis_loads")

END FUNCTION /* restore_cb end function */

END CLASS /* clevis_loads class */
```

*1* `FORM_T_MARGIN`
*2* `DBOX_HGT_LABOVE + 2*INTER_WIDGET_SPACE`
*3* `DBOX_HGT_LABOVE + 2*INTER_WIDGET_SPACE`
*4* `BUTTON_DEFAULT_HGT + FORM_B_MARGIN`

# *Lug Model*

```
:::::::::::::::
dimension.pcl
:::::::::::::::
/*$$ Use of PCL in creating customized forms/widgets
 *
 * Purpose:
 *         Create The Dimension form for the Clevis Design Project. This
 *         form will allow the user to enter the Radius of the Clevis Hole
 *         and the width of the 2-D Clevis assembly as well as the length from
 *         the support to the center of the hole.
 *
 * Input:
 *         <None>
 *
 * Output:
 *         <None>
 *
 * Log:
 *
 * Notes:
 *
 */


#include "appforms.p"

CLASS dimension

    /* Variable initialization */

    CLASSWIDE             widget form_id,          @
                                 dbx1_id,          @
                                 dbx2_id,          @
                                 dbx3_id,          @
                              ok_button,           @
                           reset_button

    FUNCTION INIT()

        GLOBAL REAL radius, width, length
        REAL y_loc, form_x_location

        form_x_location = FORM_X_LOC-FORM_WID_SML - @
                          FORM_L_BORDER - @
                          FORM_R_BORDER

       /*
        * Create the form
        */

       form_id=ui_form_create(                              @
           /*  callback   */     "",                        @
           /*      x      */     form_x_location,           @
           /*      y      */     FORM_Y_LOC,                @
           /*  position   */     "UL",                      @
           /*    width    */     FORM_WID_SML,              @
           /*    height   */     FORM_HGT_FULL,             @
           /*    label    */     "Clevis Dimension ",       @
           /*  iconname   */     ""                         )

       y_loc = FORM_T_MARGIN
```

```
/*
 * Create the "Enter the Hole Radius data box"
 */

dbx1_id= ui_databox_create(                        @
    /*    parent    */    form_id,                 @
    /*  callback    */    "",                      @
    /*       x      */    UNFRAMED_L_MARGIN,       @
    /*       y      */    y_loc,                   @
    /* label_length */    0.0,                     @
    /* box_length   */    DBOX_WID_SINGLE,         @
    /*     label    */    "Enter the Radius",      @
    /*     value    */    str_from_real( radius ), @
    /* label_above  */    TRUE,                    @
    /*  datatype     */    "REAL",                 @
    /*  num_vals     */    1                        )

y_loc += DBOX_HGT_LABOVE + 2*INTER_WIDGET_SPACE


/*
 * Create the "Enter the Clevis Width data box"
 */

dbx2_id= ui_databox_create(                        @
    /*    parent    */    form_id,                 @
    /*  callback    */    "",                      @
    /*       x      */    UNFRAMED_L_MARGIN,       @
    /*       y      */    y_loc,                   @
    /* label_length */    0.0,                     @
    /* box_length   */    DBOX_WID_SINGLE,         @
    /*     label    */    "Clevis Width",          @
    /*     value    */    str_from_real( width ),  @
    /* label_above  */    TRUE,                    @
    /*  datatype     */    "REAL",                 @
    /*  num_vals     */    1                        )

y_loc += DBOX_HGT_LABOVE + 2*INTER_WIDGET_SPACE


/*
 * Create the "Enter the Clevis length data box"
 */

dbx3_id= ui_databox_create(                        @
    /*    parent    */    form_id,                 @
    /*  callback    */    "",                      @
    /*       x      */    UNFRAMED_L_MARGIN,       @
    /*       y      */    y_loc,                   @
    /* label_length */    0.0,                     @
    /* box_length   */    DBOX_WID_SINGLE,         @
    /*     label    */    "Clevis Length",         @
    /*     value    */    str_from_real( length ), @
    /* label_above  */    TRUE,                    @
    /*  datatype     */    "REAL",                 @
    /*  num_vals     */    1                        )

y_loc += DBOX_HGT_LABOVE + 2*INTER_WIDGET_SPACE
```

```
    /*
     * Create the "ok" button
     */

    ok_button = ui_button_create(                      @
        /*    parent    */    form_id,                  @
        /*   callback   */    "ok_cb",                  @
        /*      x       */    BUTTON_HALF_X_LOC1,       @
        /*      y       */    y_loc,                    @
        /*    width     */    BUTTON_WID_HALF,          @
        /*    height    */    0.0,                      @
        /*    label     */    "OK",                     @
        /* labelinside  */    TRUE,                     @
        /*  highlight   */    TRUE                      )

    /*
     * Create the "Reset" button
     */

    reset_button = ui_button_create(                   @
        /*    parent    */    form_id,                  @
        /*   callback   */    "reset_cb",               @
        /*      x       */    BUTTON_HALF_X_LOC2,       @
        /*      y       */    y_loc,                    @
        /*    width     */    BUTTON_WID_HALF,          @
        /*    height    */    0.0,                      @
        /*    label     */    "RESET",                  @
        /* labelinside  */    TRUE,                     @
        /*  highlight   */    FALSE                     )

    y_loc += BUTTON_DEFAULT_HGT + FORM_B_MARGIN

    ui_wid_set( form_id, "HEIGHT", y_loc )


END FUNCTION
      FUNCTION DISPLAY()

    GLOBAL REAL radius, width, length

    *****************1************************
    Display the global values for radius, width, and length in databoxes
    *****************1************************
    ui_form_display( "dimension")

END FUNCTION

FUNCTION ok_cb()

    GLOBAL REAL radius, width, length

    *****************2*********************
    Get the values of radius, width, length from the databoxes
    *****************2*********************

    ! the Radius of Clevis = `radius`
    ! the Width of Clevis = `width`
    ! the length of Clevis = `length`

    *****************3**************** save the form
    *****************4****************hide the form
```