GearPro Procedure

Pictured below is the GearPro main screen. In this manual the icons on the top right corner (Chapter 1), far left side (Chapters 2-5), and far right side (Chapters 6&7) will be discussed.
Chapter 1: Getting Started

1. With Calypso User Desk open, Click the Gear Icon in the top ToolBar.

2. Click the **Setup** button in GearPro in the upper right hand corner.

3. On the **Mode** tab, select **Involute Gears**, **Start with last loaded workpiece**, **Data output format**, and

4. In the **Input/Output Mode** section set the units to match print units. Change **Deviations to 1.2**. Click **OK** in **Setup—Mode**, Click **Apply**.

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**Image Descriptions:**
- **Image 1:** Gear Icon in the top Tool Bar.
- **Image 2:** Setup button in GearPro.
- **Image 3:** Mode tab with selected settings.
- **Image 4:** Input/Output Mode section.
5. Select the **Tolerance** tab and change **Evaluation** to AGMA_2000-A88. Beside **Set all features to quality class**, Select 8.
Click **Apply**, Click **OK**
Chapter 2: WorkPiece Documentation

In **WorkPiece Documentation** can be customized the inspection plan, Operator Name, Company, Machine used for measuring, path to which the program will be saved, description, and Units for measurement.

1. Click the icon in the upper left hand corner of the GearPro screen to open the **WorkPiece Documentation** screen.

2. In the **Identification** section enter the inspection plan name beside **Workpiece number**
3. In the **Documentation** section, enter **Operator** name, **Company** name, and the name of the **Measuring machine**.

![Documentation section with filled fields: Operator: Master, Company: Carl Zeiss, Measuring machine: Prismo]

4. In the **Adjustments** section, check the **Dimension units** and change if needed.

![Adjustments section with highlighted Dimension units]

Click **OK**

![Input/Output Mode with highlighted options for decimal places and units: Inch, Dimensions: 123.456]

Click **OK** in Workpiece Documentation
Chapter 3: Gear Geometry

Gear Geometry is the screen in which the nominals for the gear are entered.

1. Click the Gear icon on the left side of the GearPro screen, under the WorkPiece Documentation icon.

2. In Main Geometry, enter the Gear type (External or Internal), the Number of teeth, and the Diametral pitch. Beside Diametral pitch, select the dropdown arrow.
3. **In Input Type**, choose either **Module** for metric units or **Diametral pitch** for english units. Click **OK**

In the **Involute Geometry** section, enter the **Helix direction** (Left, Right, or Straight), the **Pressure angle** and **Tooth thickness modification x**. Click the dropdown arrow beside **Tooth thickness** modification.
In **Tooth Thickness Specification**, uncheck all **specification possibilities** except one specified on gear print.

Enter nominal values in white fields then press **CALCULATE** in the lower left hand corner. The value in the yellow field beside **Pitch Diameter** should match the value for the gear print.

After all nominals have been entered and match those on print, click **OK**

4. In the **GEAR GEOMETRY** screen enter nominals defining gear geometry in the white fields.

- **Root diameter** describes the minimum gear diameter. Also known as Minor diameter. Can be abbreviated as R.D. or M.D.

- **Tip diameter** describes the maximum gear diameter. This can also be called the Outer diameter. Can be abbreviated as O.D. or T.D.

- **Security diameter** is similar to clearance planes which are defined in Calypso. This is the distance, from center, at which the probe will travel around the gear geometry.
Choose a **Security diameter** large enough for the probe to clear the gear when traveling around the gear during measurement.

Remember that this dimension is diameter—As a general rule to find **Security diameter**, determine the distance from the gear needed for probe clearance, double that number and add it to **Tip diameter**.

- **Z-offset** is the distance from the z-origin that defines the top of the gear. The z-origin is the base alignment created in Calypso. Remember that **positive** values in this field are distances above the z-origin and **negative** values are distances below the z-origin.

- **Face width** is the length of the gear face. This value can be found on the gear print.

5. If there are teeth missing on the gear, press the SPECIAL button in the lower left hand corner.

In the **Probe Sectors and Missing Teeth** screen, click on the teeth that correspond to those missing on the gear part. Deleted teeth will appear outlined in blue like those below. To undelete simply click on that tooth and it will reappear as a light blue tooth outlined in blue. After making the tooth selections, click **OK**.
6. To generate a CAD model based on the gear geometry, click the DISPLAY GEO button in the lower left hand corner.

7. Click OK to return to main GearPro screen.
Chapter 4: Inspection Control

Inspection Control is the screen in which the measurement strategy for the gear is defined. This includes the five measurement processes – Feed In, Profile, Lead, Index, and Feed Out. For each of the processes can be defined specific teeth to measure, probes for measurement, and gear tolerances.

- Click on the Inspection Control icon on the far left side of the GearPro screen. The INSPECTION CONTROL screen should pop up along with a toolbar with the same five icons.

1. Global Technology

   A. Click on the GLOBAL TECHNOLOGY button in the lower left hand corner.
B. In the **Global Technology** screen click open the **Measuring Run** tab. In the **Inspection Sequence** section, choose **Control by Control** or **Tooth by Tooth/Gap by Gap**.

**Control by Control** will measure the gear Profile first, Lead second, and Index last. This will result in three separate measurement loops.

**Tooth by Tooth** will measure all characteristics for each tooth one tooth at a time. This will result in one measurement loop.

C. Click APPLY in the lower right hand corner

![Screenshot of Global Technology page showing the option to choose Control by Control or Tooth by Tooth/Gap by Gap.]()

D. Click open the **Measuring Data/Nominal Data** tab. In the **Actual Data** section, check **Filtering** and change **Wavelength** to 0.8mm. Click APPLY in the lower right hand corner.

![Screenshot of Global Technology page showing the option to filter and enter wavelength.]()
E. Click open the Inspection Mode tab and select Do not use RT. Click APPLY, Click OK

2. **Feed In**

   A. Double click the Feed In icon in the INSPECTION CONTROL screen
B. In the ALIGNMENT/FEED IN screen, check the probe number used for feed in and check to see the Rotary table check box is checked with Without RT checked.

Click OK.
3. **Profile**

A. Single click the **Profile** icon.

In the **Control Validity** section, check the box beside **arrange over** and type 4 into the white field beside **teeth**.

B. Check the box beside **manual probe selection** and enter the probe number associated with each tooth into the **Probes** fields.

C. Double click the **Profile** icon
Click on the **Standard Eval** tab.

D. Click and drag the orange lines in the diagram window to the inside of the purple lines. The tooth surface inside the orange lines is the portion of the gear tooth that will be measured by the probe.

E. In the **Inspection Ranges** section, click the box beside **Auto** and check that the percentage value in the white field is 3. The probe will measure 3% of the tooth surface outside the orange lines. The extra 3% will not be reported in the measurement results.

F. Click **APPLY** in the lower right hand corner.
G. Click the **Tolerances/Features** tab.

H. Check that the **Global Evaluation Settings** box has been checked and that the settings are correct.

I. In the **Individual Selections** section, click the **User-defined ranges** button and enter the profile tolerance from the print.

J. Click **APPLY**. Click **OK**.
4. Lead

A. Single click on Lead icon.
B. In Control Validity section, check box beside arrange over and enter 4 in the field beside teeth.
C. Check the box beside manual probe selection and enter the probe to be used to measure the gear teeth in the fields beside Probes.
D. Double click on the Lead icon.
E. In the **Lead Setup** screen, click on the **Standard Eval** tab and in the **Inspection Ranges** section, check that the box beside **Auto** is checked.

F. Click **APPLY**

G. Click the **Tolerances/Features** tab
H. Check to see the **Global Evaluation Settings** are correct.
I. Click the **User-defined ranges** button at the top right corner in the **Individual Selections** section.
J. Enter 0.001 for the upper tolerance for **Lead Total Deviation**.
K. Click **APPLY**, Click **OK**
5. Index

A. Single click the Index icon
B. Check the box beside all teeth
C. Check the box beside manual probe selection and enter the probe number associated with each gear tooth in the white fields by Probes.
D. Double click the Index icon.
E. Click the **Index Inspection** tab.

F. Click and drag the purple dot on the gear tooth diagram to the spot at which the tooth should be inspected. The location for inspection can also be set by entering numerical values in the pink fields under Inspection position. Enter the diameter and height at which the tooth should be probed.

G. After the index position has been set, click **APPLY**.
H. Click the **Tolerances/Features** tab.
I. Check that **Global Evaluation Settings** is checked and the values are correct.
J. Click the **User-defined ranges** button and enter the tolerances for **Spacing Deviation** and **Runout Deviation**.

K. Click **APPLY**
L. Click the **Tooth Thickness Values** tab.

M. Uncheck all boxes except one beside **Dimension over 2-ball**

N. Enter values for **Ball diameter**, **Nominal value**, and **min and max** tolerances from the gear print.

O. After having checked all values are correct, Click **OK**

P. Click **OK** in the **Inspection Control** window.
Chapter 5: Presentation

Presentation defines the style output GearPro generates after each run.

1. Click the Presentation icon on the left side of the GearPro screen.
2. In the Presentation screen, click the Form Adjustments tab.
3. In the Plotform Selection section, select letter_std.frm from the right-side dropdown.
4. Click APPLY.
5. Click the Output Device tab.
6. Uncheck the automatic printout box.
7. Click APPLY

8. Click the Drawing Attributes tab.
9. Enter values in the white fields under Line width to change the line width in the output plots.

10. Click APPLY, Click OK

Now is a good time to save your work.
Chapter 6: Running the GearPro measurement plan

1. Align tooth gap with x-axis

2. Drive probe until it is roughly centered on the tooth gap in the x-axis.

3. Click the Green stylus icon on the left side of the GearPro screen.

4. Click Execute
Chapter 7: GearPro Results

While The GearPro measurement plan is being run, the report will be simultaneously written. To return to the report without running the measurement plan, click the results icon on the left side of the GearPro screen.

In the Results screen, there are a few viewing options.

A. Press the + or – magnifying glasses to zoom in or out on the form plots.
B. Press the left or right arrows to scroll between the results pages.
C. Click the dropdown in Scale to select a zoom scale.
D. Choose an output format. Letter_std.frm should be the default output format.
E. Click to print the GearPro results.
F. Click to close the report and return to the GearPro main screen.
Chapter 8: Setting up the GearPro measurement plan in Calypso

1. Click the **Calypso** icon in the upper right hand corner of the GearPro screen. This should minimize the GearPro screen and open the Calypso screen.

2. Click on the **Features** Menu in the top toolbar, rest on **Additional Features**, select **Gear**.

3. A Gear Feature will appear in the feature list and a Gear Characteristic will appear in the characteristics list.

4. Select the gear from the Feature list.
5. In the Gear feature screen, click the **Selection** button.

![Gear feature screen](image)

6. In the **Workpiece Browser** window, double click the gear file created with GearPro.

![Workpiece Browser](image)

7. This will open the GearPro screen with the measurement plan.
8. Click the **Calypso** icon in the upper right hand corner.
9. Once the gear feature has been created, the GearPro measurement plan will be automatically run in Calypso as any other feature. It is not necessary that GearPro be open before running the measurement plan in Calypso.

10. In the gear feature, click the **Strategy** button.

11. Check that the appropriate stylus is active and drive the probe to the center gap used for the self-center lead-in point.

12. Click the **CMM position** button in the **Strategy** screen. A CMM position will appear in the window.

13. Click **OK** in the **Strategy** screen.
14. Click **OK** in the gear feature window.

Now is a good time to save the program. In Calypso, **Run** the measurement plan.