



Steering System FARO Arm Setup

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. To provide general guidelines for setting up an Electric Power Steering (EPS) gear and Intermediate (I)-Shaft to in vehicle position for Hardware in the Loop (HIL) tuning. These position are set in the X, Y, and Z coordinate system (an example of this coordinate system is in Appendix A, Figure A3). This puts the steering system in the proper X, Y, and Z coordinates which allows tuning of an EPS system without the use of actual vehicle.

1.2 Applicability. This setup procedure is applicable to any electrically assisted rack and pinion steering system, including column EPS.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

None

2.3 Additional References.

- FARO Company, Lake Mary, Florida (www.faro.com)
- MTS Systems Corporation, Eden Prairie, Minnesota (www.mts.com)

3 Resources

3.1 Facilities.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 MTS Systems Corporation EPS hydraulic test stand.

3.2.2 FARO Arm (available from FARO Company).

3.2.3 Personal computer with CAM2Q software (available from FARO Company).

3.3 Test Vehicle/Test Piece. This test procedure applies to any electrically assisted rack and pinion steering system, including Column Electric Power Steering (CEPS).

3.3.1 Parts Required. The following parts are required to setup an EPS system:

- a. Manual, Dual Pinion, or Belt Drive Steering Gear complete with inner and outer tie rods.
- b. I-Shaft (I-Shaft upper and lower mounting screws).
- c. Steering column (with electric power steering motor for CEPS).

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- d. Output shaft of the steering column for rack assist gears (this part is needed to fabricate adapter to connect input of MTS machine to the I-Shaft).
- e. Gear mounting bolts.
- f. Fixtures for mounting steering rack to test stand specimen table (this fixture changes from specimen to specimen and needs to be built or modified).
- g. Proper wire harness.
- h. Excel sheet with steering system mounting points (Appendix A, Figure A4).
- i. I-shaft coordinates for specimen being setup (an example is in Appendix A, Figure A2).

3.4 Test Time.

Calendar time: 2 days
 Test hours: 16 hours
 Coordination hours: 0.5 hours

3.5 Test Required Information. The X, Y, and Z coordinates of the steering rack and I-Shaft for specimen under setup. Examples of these coordinates are in Appendix A, Figure A2 (I-Shaft) and Figure A4.

3.6 Personnel/Skills. A basic understanding of steering geometry, computer usage, and knowledge of FARO Arm.

4 Procedure

4.1 Preparation. In order to begin using the FARO Arm tool, it must first be secured near the object to be measured. This is done by releasing the magnetically secured base with the Allen screw located at the bottom. Once set in place and relocked, the power cable and Universal Serial Bus (USB) connections at the bottom must be made, and the power switch at the bottom must be turned on. The CAM2Q software now can be opened on the associated laptop computer (Windows password: Test:systems1).

Upon opening the software, a window may appear stating that the arm is not ready for use and illustrates a picture of extending the arm straight so that all of the joints are locked (Figure 1). Mimic this image with the arm and a confirmation should appear stating it is now ready for use.

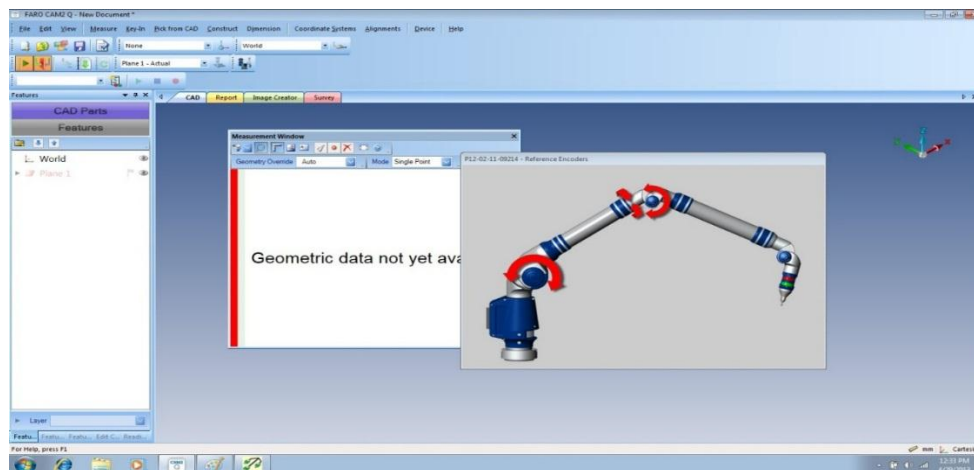


Figure 1: FARO Arm Not Ready

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The FARO arm buttons are shown in Figure 2.



Figure 2: FARO Arm Buttons

4.2 Conditions.

4.2.1 Environmental Conditions. Not applicable.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.3 Instructions.

4.3.1 Measurements to Create Coordinate System.

4.3.1.1 Measure a Plane. Click on the Measure dropdown tab on the top pane and select Plane as shown in Figure 3.

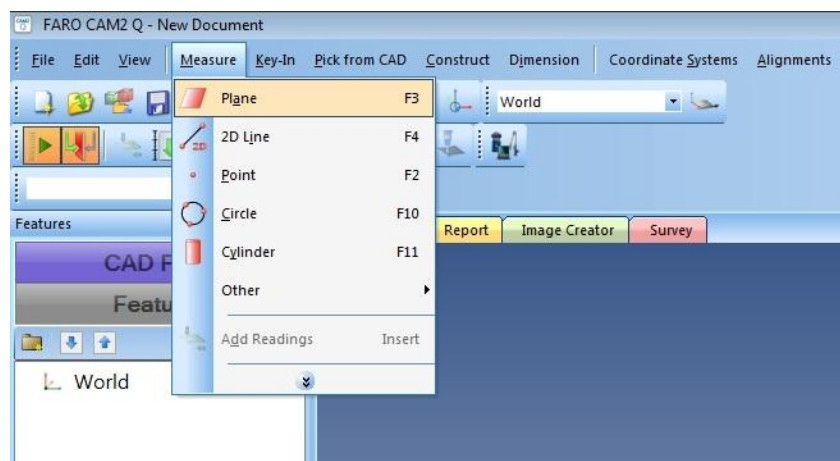


Figure 3: Plane Measurement

With plane selected place the ball tip in contact with the top surface of the specimen table. Press the green button once, move to another spot on the top face and press the green button once, move to a third spot on the top surface and press the green button once. Next press the red button twice. This exits the measurement window. The specimen table surface is shown in Figure 4.

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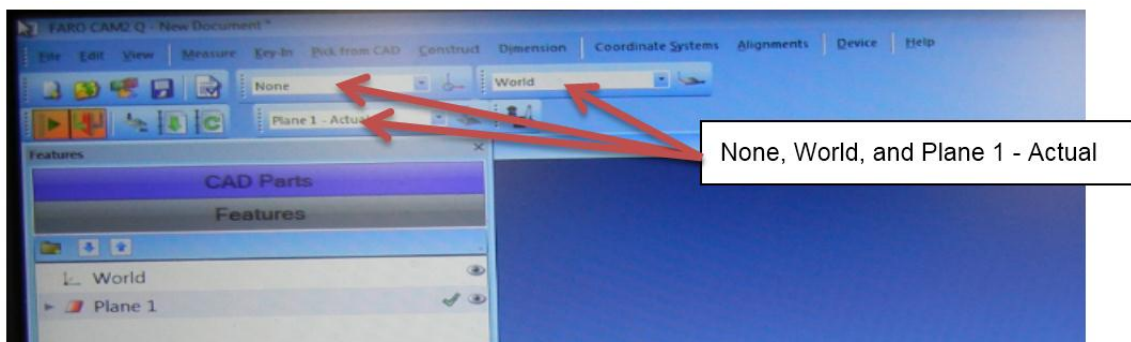
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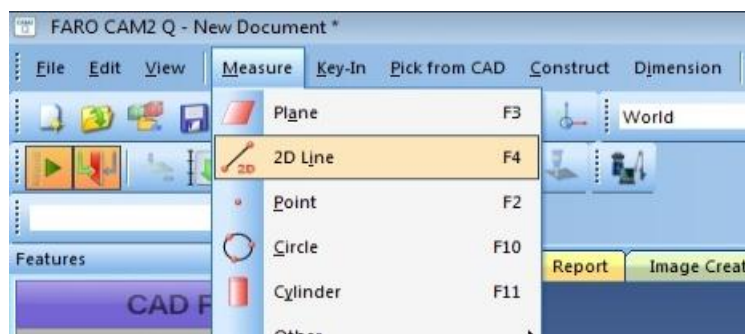
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**Figure 4: Specimen Table Surface**

When measuring the plane ensure the boxes are labeled correctly, None, World, and Plane 1 Actual. This is shown in Figure 5.

**Figure 5: Plane Box Labeling**

4.3.1.2 Measure a Two Dimensional (2D) Line. Click on the Measure dropdown tab on the top pane and select 2D Line as in Figure 6.

**Figure 6: 2D Line**

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Place the ball tip in the corner of the two surfaces at point labeled Point 1, click the green button once, move to Point 2, and click green button once. Next click the red button twice (the location for measurement is shown in Figure 7).

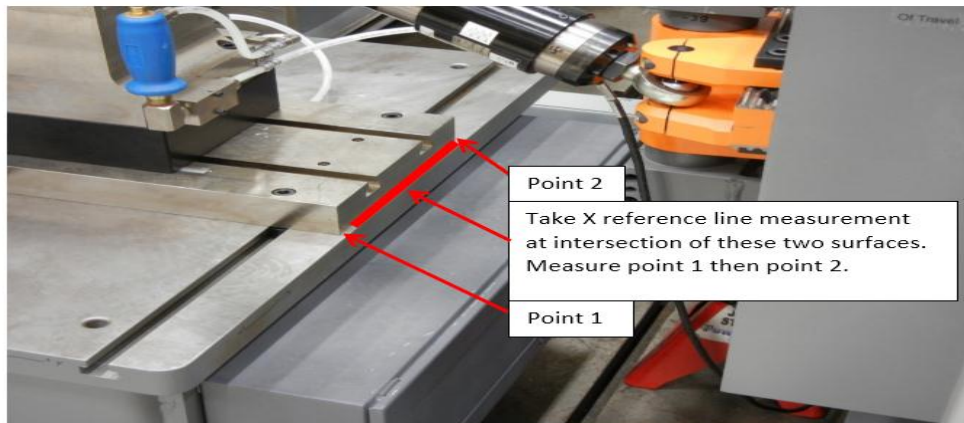


Figure 7: Reference Line Location

Ensure that boxes are labeled correctly for 2D Line. This is shown in Figure 8.

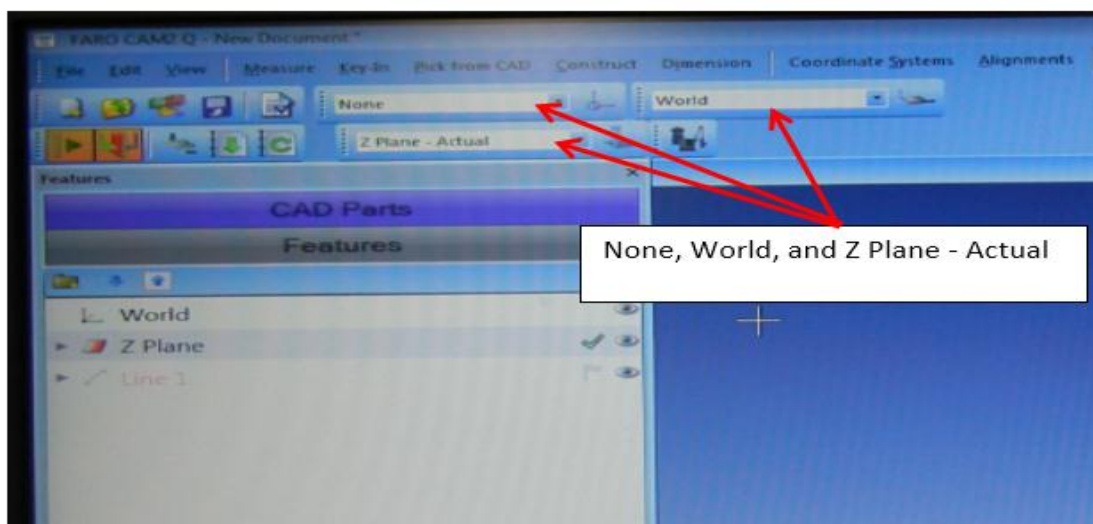


Figure 8: 2D Line Box Labeling

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4.3.1.3 Measure a Point. Click on the measure dropdown tab on the top pane and select point. This is shown in Figure 9.

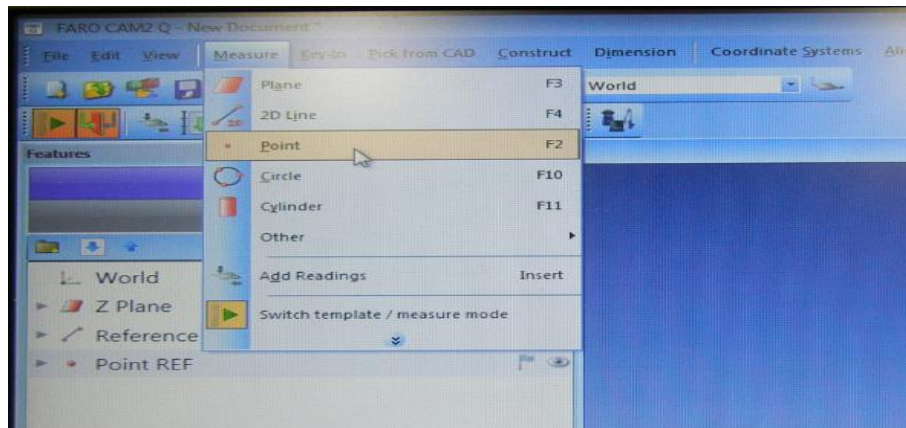


Figure 9: Point Selection

Move ball tip to point labeled REF (for Reference) on surface of specimen table. This is shown in Figure 10.



Figure 10: Reference Point

Click green button once and red button twice. Ensure that boxes are labeled correctly as shown in Figure 11.

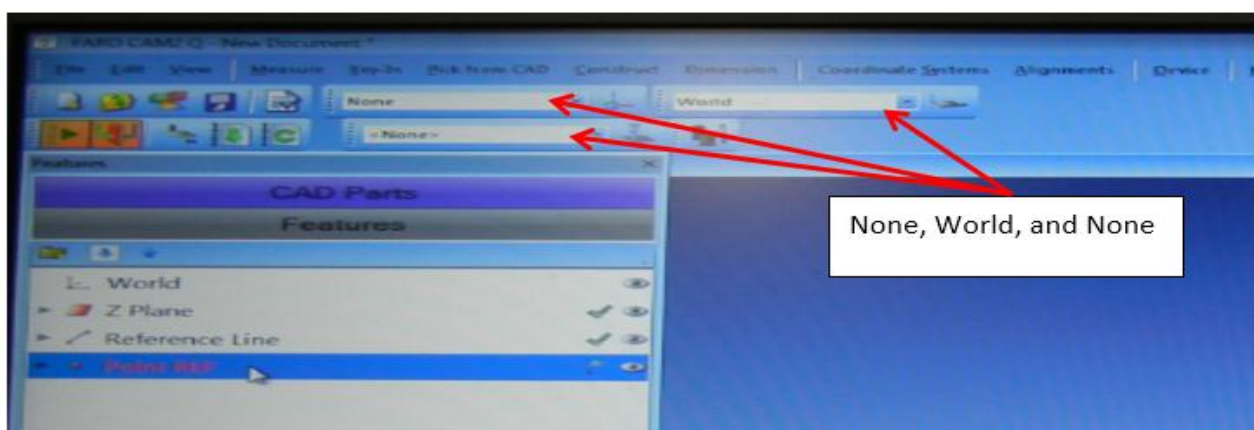


Figure 11: Point Box Labeling

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