

**Digital Radius Slide
Operation Manual
OMP-0325B**



Zygo Corporation
Laurel Brook Road
P.O. Box 448
Middlefield, Connecticut 06455-0448

Telephone: (860) 347-8506
Fax: (860) 346-4188
E-mail: inquire@zygo.com
Website: www.zygo.com

MANUAL REVISION INFORMATION

The document (OMP) number and latest publication date for this manual appear on the title page. Any revision letter following the document number indicates that the manual has been revised. Revision letters also appear at the bottom of each revised page.

<u>Revision</u>	<u>Publication Date</u>
Basic Issue	April 1992
Revision B	October 1997

MANUAL NOTATIONS



Warning! Denotes a hazard that could cause injury to personnel, and can also cause damage to the equipment.

Note: Provides helpful information.

ZYGO TECHNICAL SUPPORT

For help within the United States, Canada, and Mexico, please use the contacts listed below. For help in other countries, please contact your local Zygo representative.

Be sure to supply the instrument model and serial number, and the software version.



PHONE (860) 704-5191 Customer Support Center, 8 a.m. - 8 p.m. (EST)
(860) 347-8506 Zygo Corporation



FAX (860) 347-3968, 24 hours per day



WRITE Zygo Corporation
Laurel Brook Road
P.O. Box 448
Middlefield, Connecticut USA 06455-0448

NOTICE: The descriptions, drawings, and specifications contained herein are subject to change. Zygo is not responsible for errors or omissions herein or for incidental damages in connection with the furnishing or use of this information. This document shall not be reproduced, photocopied, or duplicated, in whole or in part, without prior written approval of Zygo Corporation.

ZYGO STATEMENT OF WARRANTY AND PRODUCT SUPPORT

Zygo Corporation provides this warranty to protect its customers from defects in product workmanship or product materials. This warranty covers all products manufactured by Zygo Corporation. Zygo warrants that the equipment purchased will be free from any defects in material and/or workmanship under normal operating conditions for a period of one year from the date of shipment.

In addition, being committed to providing our customers with superior service, Zygo will support all standard products for a period of five years after the sale of the last newly-manufactured unit. Beyond this five-year period, we will continue to support these products on a "best-effort" basis.

WARRANTY SERVICE

Zygo's responsibility under this warranty shall be limited to the repair or replacement (at Zygo's option) of defective equipment at no cost to the buyer, except for transportation, cleaning, and recalibration charges.

Zygo will perform warranty service by: (1) sending replacement parts with appropriate installation instructions to the buyer, the buyer returning his defective part to Zygo or; (2) repairing the product at a Zygo repair facility after it has been returned freight prepaid, or; (3) at the buyer's request, dispatching a service representative to the buyer's facility. The buyer shall pay Zygo's travel and living expenses as well as travel time.

Defective products or parts will be repaired or replaced with new or like-new parts. These replacement parts will be warranted for a period of 90 days after they are shipped, or for the remainder of the original warranty period, whichever is longer. Warranty service will be performed only if the buyer notifies Zygo within 14 days of discovering any defects. Equipment or parts that are to be returned to Zygo must be issued a Return Authorization number. This number can be obtained by contacting the Zygo Service Department. Should Zygo's subsequent inspection reveal that the parts were not defective, all expenses incurred by Zygo shall be charged back to the buyer. Defective equipment that is replaced shall become the property of Zygo.

Warranty period begins when the product is shipped from Zygo. Replacement parts, service workmanship, used equipment, and refurbished equipment are warranted for a period of 90 days.

RETURNS

Unused and undamaged products, in their original shipping containers, may be returned for credit within 30 days of receipt. All such products will be subject to a restocking fee equal to 20 percent of the purchase price. Custom products are not returnable.

EXCLUSIONS

The above warranty and product support statement applies only to equipment that is an integral part of a Zygo manufactured product. It does not apply to peripheral equipment manufactured by others, such as: computers, printers, vibration isolation tables, etc. In such cases, the warranty and the support that the original manufacturer supplies will apply.

In addition, warranty service does not include or apply to any product or part which, in Zygo's judgment:

- a. Has been repaired by others, improperly installed, altered, modified, or damaged in any way.
- b. Malfunctions because the customer has failed to perform maintenance, calibration checks or good operating procedures.
- c. Is expendable or consumable (such as panel lights, fuses, batteries, windows, and filters) if such items were operable at the time of initial use.
- d. Requires replacement because of decomposition due to chemical action.
- e. Fails because of poor facility, operating conditions, or utilities.

Other than expressly described above, Zygo makes no express or implied warranties, including any regarding merchantability or fitness for a particular purpose relating to the use or performance of the equipment. Zygo will not be liable for personal injury or property damage (unless caused solely by its own negligence), loss of profit or other incidental or consequential damages arising out of the use or inability to use the equipment. Nor does this warranty apply to any equipment which has been subject to misuse, neglect or accident; or repaired or altered by other than service representatives qualified by Zygo.

01/96

CONTENTS

1.	INTRODUCTION	1-1
	General Description.....	1-1
	Power Requirements	1-1
	Accuracy	1-2
2.	INSTALLATION AND ALIGNMENT	2-1
	Dovetail Pin Replacement	2-1
	Digital Radius Slide (DRS) Installation	2-3
	Alignment.....	2-6
3.	OPERATION	3-1
	Starting the System.....	3-1
	Measuring Radius of Curvature.....	3-1
4.	CARE AND MAINTENANCE.....	4-1
	General Information.....	4-1
	Guide Rail.....	4-1
	Transducer.....	4-1

Chapter 1

INTRODUCTION

IN THIS CHAPTER:

- Description of the Digital Radius Slide
- Power Requirements
- Accuracy

GENERAL DESCRIPTION

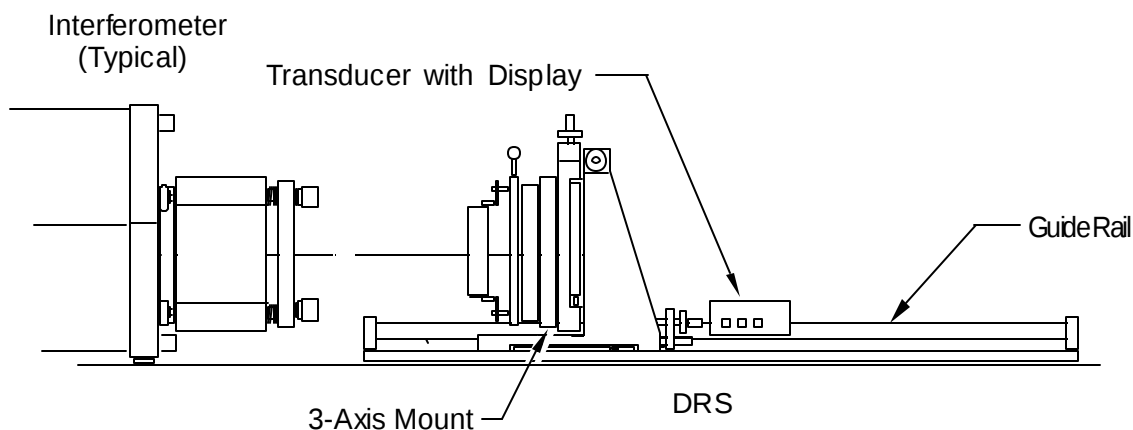
See Figure 1-1.

The Digital Radius Slide (DRS) may be used with a Zygo GPI or Mark IV series interferometer to measure the radius of curvature of an optical surface. The DRS consists of a transducer with integral display and a guide rail. The DRS is designed to be used with a 3-axis mount.

The guide mechanism is composed of a one-inch square guide rail, mounting blocks to secure it to the table, mounting blocks to attach the transducer to the guide rail, and an interface mechanism to couple the mount to the transducer. The transducer consists of its own rail and a display box which houses the electronics and battery power source.

POWER REQUIREMENTS

The DRS operates on Type SR44 batteries (provided).



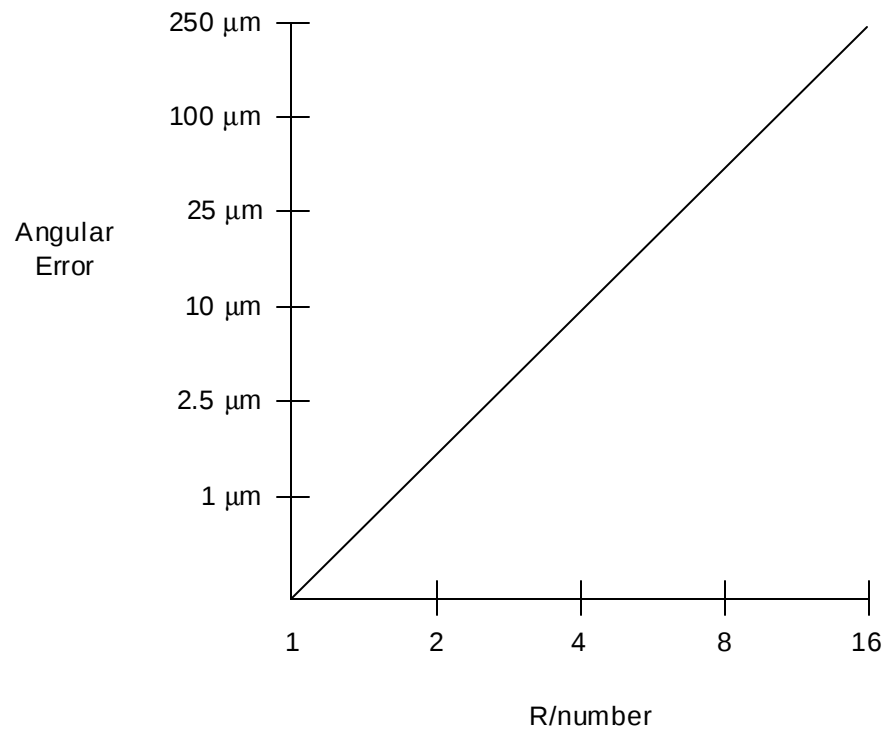
Digital Radius Slide and Interferometer Mainframe (Typical)

Figure 1-1

ACCURACY

An Abbe offset error is present in the DRS because the optical axis (radius measurement axis) is offset from the axis of the measurement transducer. The accuracy is therefore predicated on the straightness of the guide bar and the flatness of the surface on which the 3-axis mount slides. In the horizontal plane, this offset is 5 1/4 inches; therefore, an angular error of one arc second will introduce an error in the measured radius of 0.66 micron (μm) or 27 microinches. In the vertical plane, this offset is 1-1/2 inches; therefore, an angular error of one arc second will introduce an error in the measured radius of 0.19 micron (μm) or 8 microinches. If the relative angle of the 3-axis mount with respect to the carriage changes during a measurement, a similar error is introduced in the radius measurement.

The accuracy with which the best focus positions can be determined in making measurements is a function of the R/number of the transmission sphere being used. In this case, the R/number is defined as the radius of curvature of the reference surface divided by the aperture diameter of the reference surface. See Figure 1-2 for a plot of focusing accuracy versus R/number; data is based on judging fringe straightness to an accuracy of 1/10 of a fringe space.



Focusing Accuracy Versus R/Number

Figure 1-2

Chapter 2

INSTALLATION AND ALIGNMENT

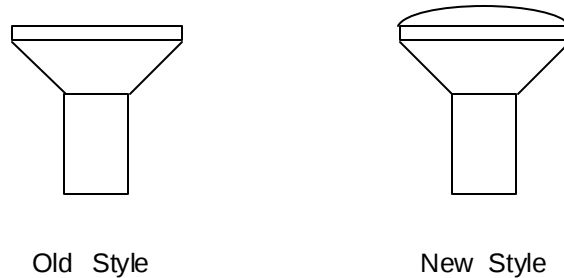
IN THIS CHAPTER:

- Dovetail Pin Replacement
- Installation of the Digital Radius Slide
- Alignment

DOVETAIL PIN REPLACEMENT

If you have two “old style” pins (Figure 2-1) in your P/N 6090-0230-01 3-axis Mount, they should be replaced with the new pins supplied with your Digital Radius Slide Kit. (If you would prefer to have Zygo perform this procedure for you, please contact your Zygo representative.)

Note: If you already have the new style pins, disregard this information.



Old and New Style Dovetail Pins

Figure 2-1

Removing Old Pins

The existing pins are held in place with Loctite 680, which is a high strength adhesive. Firmly grip each pin; then use a twisting motion to break the bond and free the pin. When the bond is broken, continue the twisting and pulling motion to remove both pins.

Installing New Pins

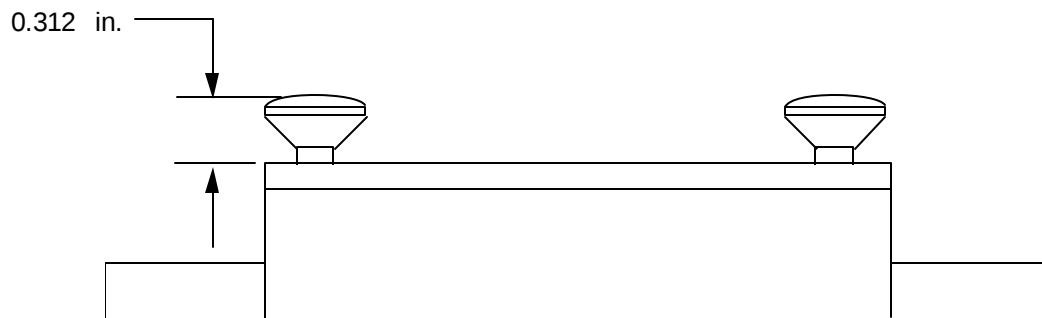


Warning! Be careful when using Acetone; it is both toxic and flammable.

Using Loctite Primer N, clean the mounting holes and the new pins supplied. If Primer N is not available, use acetone to clean out the old adhesive.

Apply a small amount of Loctite 680 to the outer diameter of the shaft on each pin. Install each pin into the mount so that it protrudes 0.312 inch from the mount, as illustrated in Figure 2.

Allow one hour to cure before use.



3-axis Mount (Top View)

Pins Installed in Mount

Figure 2-2

DIGITAL RADIUS SLIDE INSTALLATION



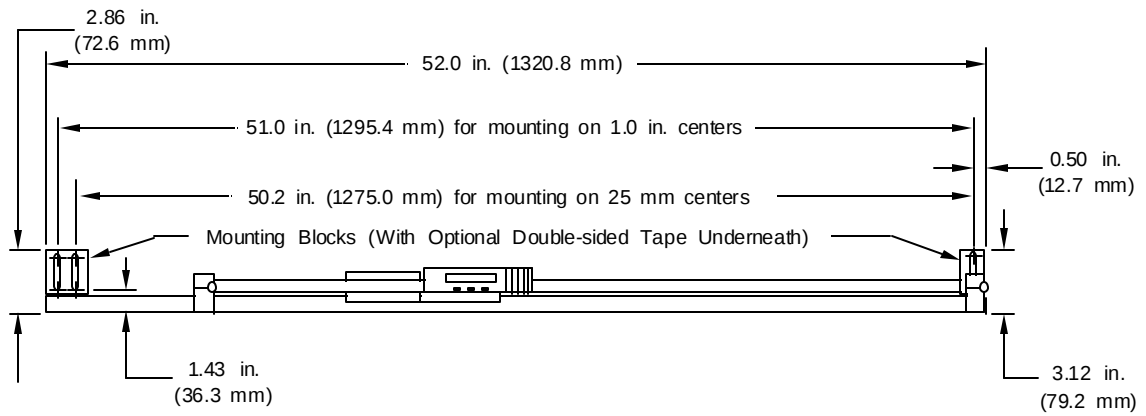
Warning! Always keep the 3-axis Mount in contact with the rail while the pin is engaged in the interface mechanism; otherwise, you may damage the transducer. Be especially careful when handling and positioning the assembly.

1. Remove the DRS and 3-axis Mount from their respective shipping containers.
2. Position the assemblies on the table next to the interferometer. See Figure 2-3. The distance between the DRS and the interferometer will vary depending on the f/number of the transmission sphere and radius of curvature of the optic under test.
3. The DRS can be attached to the table with four 1/4-20 x 1-1/2 inch or M6 - 1.0 x 35 mm screws if the table has holes on 1 inch or 25 mm centers, respectively; otherwise, use the doublesided tape provided.

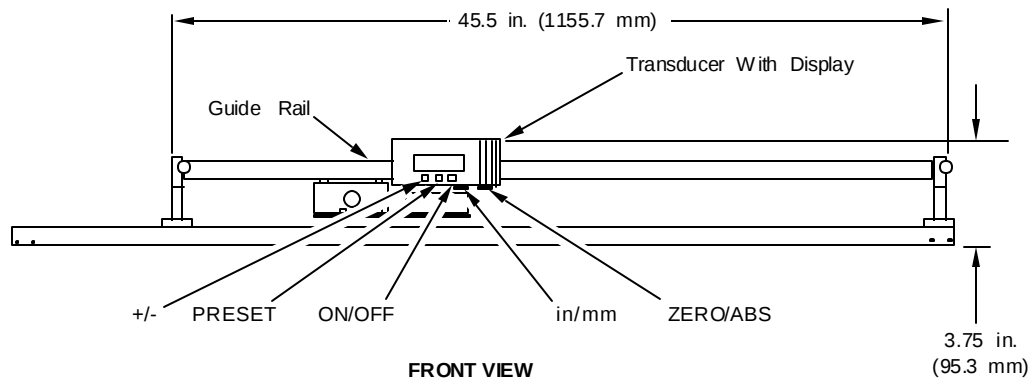
Attach only the end blocks to the table. This allows for removal of the rail by detaching the rail from the end blocks by unscrewing them. See Figure 2-4.

4. Attach the pin to the 3-axis Mount with two 4-40 x 1/2 screws.

Digital Radius Slide (DRS)



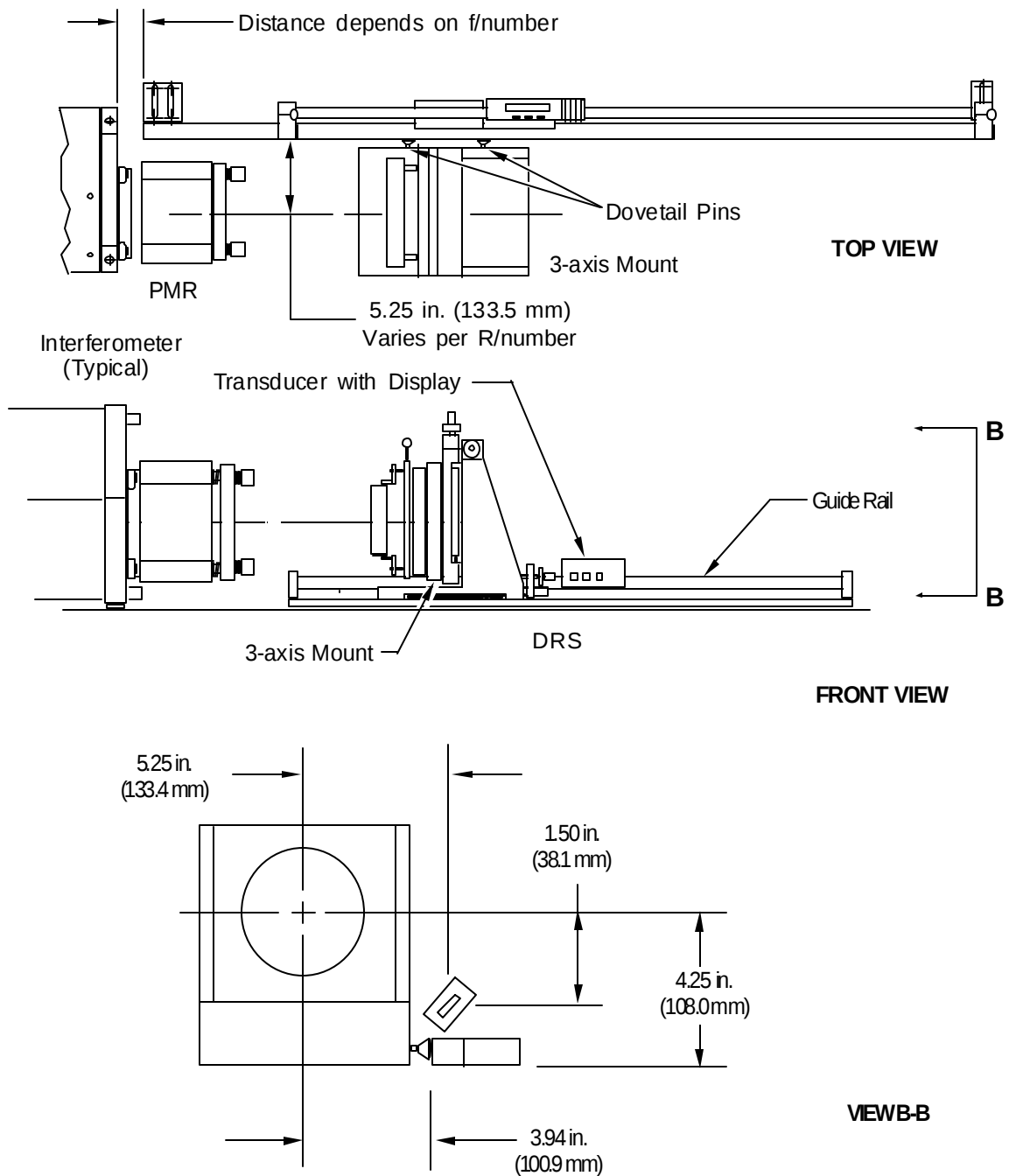
TOP VIEW



FRONT VIEW

DRS Assembly Dimensions

Figure 2-3



DRS Assembly and 3-axis Mount

Figure 2-4

ALIGNMENT

Align the rail to the optical axis of the interferometer as follows:

1. Attach the 3-axis Mount to the interface mechanism by inserting the tapered pin into the hole near the display.
2. Insert the pin until the 2 spherical pins contact the rail. The rail may move since it is not yet attached to the table.
3. Insert a transmission or reference flat into the 3-axis Mount.
4. Temporarily place a piece of string across the center of the output aperture of the interferometer and across the center of the flat on the 3-axis Mount.
5. Make sure that the X-axis of the 3-axis Mount is centered (side to side) in its travel.
6. With the 3-axis Mount at the left end of the rail, adjust the mount/rail pair angle, using the auto align feature of the interferometer, so that the return spot falls on the center of the crosshair. Go to the **VIEW** mode.
7. Repeat this step until the 2 vertical lines (strings) are superimposed on one another.
8. Slide the mount to the other end of the rail and repeat so the two vertical lines are superimposed.

Note: It may be necessary to use the auto align feature to reestablish an image when in the **VIEW** mode until the rail is more accurately aligned.

9. Repeat this procedure until the 2 vertical lines are superimposed at both ends of the rail.
10. Secure the end blocks to the table. If you have an NRC table, mount with two 1/4-20 x 1-1/2 inch screws through each block. If you are using a granite table, temporarily remove the blocks from the rail, remove the backing from the doublesided tape on the bottom of the blocks, and carefully place the blocks back on the table next to the rail.
11. Reattach the rail to the blocks. (An alternative method is to secure the rail to the table and move the interferometer.)

Chapter 3

OPERATION

IN THIS CHAPTER:

- Starting the System
- Measuring Radius of Curvature

STARTING THE SYSTEM

1. Turn on the Digimatic Scale by pressing the **ON/OFF** button on the front of the digital display.
2. Press the **in/mm** button to select the desired measurement units.
3. The display will start up in the Absolute Measurement (ABS) mode. To select the Incremental Measurement (INC) mode, press the **ZERO/ABS** button once. To return to the ABS mode, press and hold this button again.

The display is now set up to provide a digital readout of the radius of curvature of an optical surface. To clear the display while in the INC mode, press the **INC/ABS** button again. To select the counting direction, press the **+/-** button.

Note: For more information about the DRS Unit, refer to the separate instruction booklet provided with the unit.

MEASURING RADIUS OF CURVATURE

See Figure 3-1.

Note: For detailed information about operation of your interferometer system, refer to the operation manual for your specific system.

1. Place an appropriate transmission sphere in the Accessory Receptacle of the interferometer and align it, using the Auto-Align system.
2. Mount the sample whose radius is to be measured on the front plate of the 3-axis Mount. The self-centering element holder provides a convenient means of doing this.
3. Translate the mount and interface mechanism to place the sample surface at the focus of the output beam from the Transmission Sphere, as shown in Figure 3-1. Carefully adjust the Z axis of the 3-axis Mount for straight (or most symmetrical) fringes. This is called the “cat’s eye”.

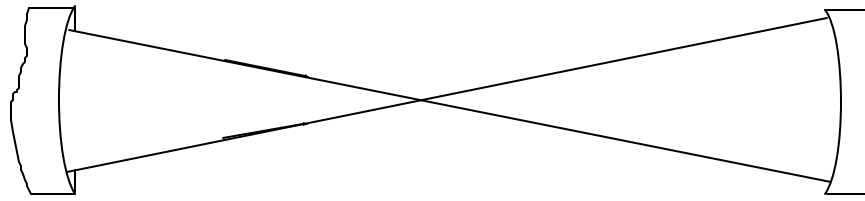
Note: Do NOT try to adjust the X or Y stages of the 3-axis Mount during this step.

4. With the interferometer in the normal viewing mode, carefully adjust the Z axis (focus) of the 3-axis Mount to optimize the straightness of the fringes.

Digital Radius Slide (DRS)

5. Press the **CLR** button to zero the radius measurement shown on the display.
6. Translate the 3-axis Mount and interface mechanism in the Z plane (closer and farther away), and adjust the X and Y stages on the 3-axis Mount to position the sample so that its center of curvature coincides with the focus of the beam emerging from the transmission sphere. This is the confocal position. See Figure 3-1. The Acquisition Target and Auto-Align feature will assist with the alignment.
7. The radius of curvature of the sample will now be displayed on the digital readout display.

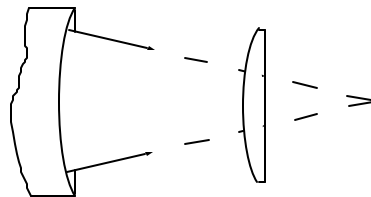
Transmission
Sphere



Output Beam from
Interferometer

Concave Sample
Confocal Position

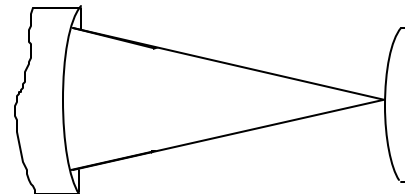
Transmission
Sphere



Convex Sample
Confocal Position

Output Beam
from
Interferometer

Transmission
Sphere



Concave or Convex
Sample "Cat's Eye"
Position

Output Beam from
Interferometer

Measuring Radius of Curvature
Figure 3-1

Chapter 4

CARE AND MAINTENANCE

GENERAL INFORMATION

Your DRS system utilizes solid state electronics and is designed to give long hours of troublefree operation with a minimum of attention.

GUIDE RAIL

The one-inch square guide rail is hardened and coated with ARMALLOY™ to prevent corrosion and surface damage. Periodically wipe down the rail with a clean cloth to prevent dust buildup.

TRANSDUCER

The design of the transducer is very tolerant to wear and misalignment problems but with certain limitations. Be sure the mount and slide assembly rests on a flat surface, such as a granite table.

Periodically wipe down the transducer rail with a clean cloth to prevent dust buildup.



Warning! Do not allow the 3-axis Mount to lose contact with the rail while the pin is engaged in the interface mechanism; this may cause damage to the transducer. Be especially careful during handling and positioning of the assembly.