REMOTE INTERFEROMETER
10565B

ACCESSORY FOR 5526A
LASER MEASUREMENT SYSTEM
INSTRUCTION MANUAL

SERIAL PREFIX: 1232A

This manual applies directly to Hewlett-Packard Model 10565B Remote Interferometer with serial prefix 1232A. For units with different serial prefixes a manual change sheet is supplied.

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HEWLETT hp PACKARD

SAFETY PRECAUTIONS

WARNING

LASER BEAM

This instrument emits laser light. The power output of the HP laser is low in comparison to most other lasers, either continuous wave or pulsed, but due to the high brilliance factor, the output beam of any laser should never be allowed to strike the eye directly. It is the considered opinion of Hewlett-Packard Company that the light beam from this device presents NO hazard to health and safety. However, the existence of newly enacted federal regulations with respect to laser devices together with the lack of any widely accepted standards of laser power safety thresholds requires the insertion of this cautionary statement.

WARNING

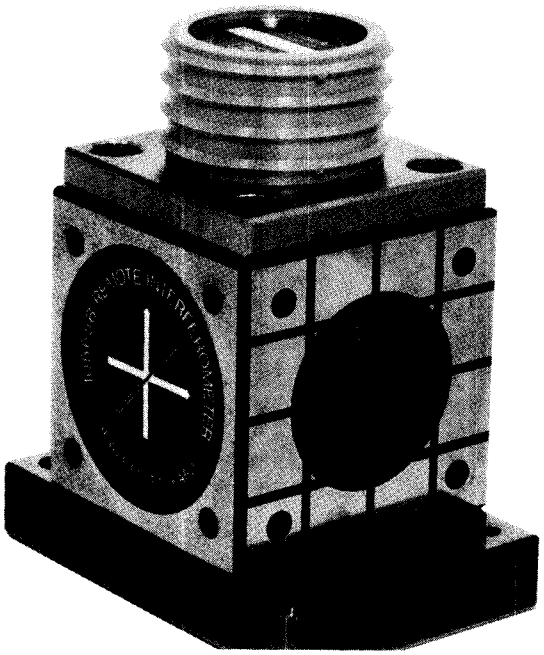
HIGH VOLTAGE

High voltages are generated within the laser housing. The cover of the Model 5500C Laser is provided with an interlock to prevent accidental access to these voltages. There are no high voltages on the interconnecting cable however, should it become cut or disconnected.

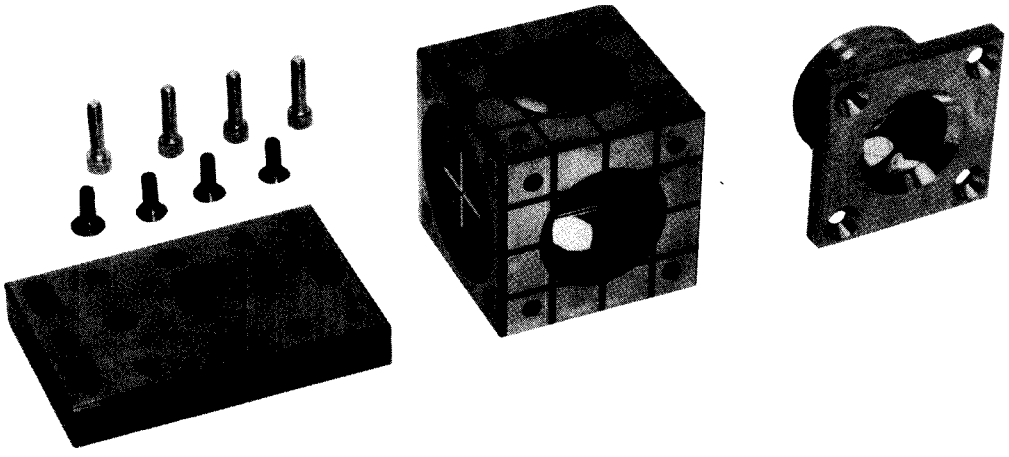
CAUTION

The 10556A Retroreflector and 10565B Remote Interferometer have precision ground and accurately lapped external surfaces. DO NOT scratch, mar, dent, gouge or injure these surfaces. Even small scratches can cause measurement errors. Do keep the precision surfaces clean. Even small dust particles can cause errors in measurements.

Figure 1. Model 10565B Remote Interferometer Shown with Major Components Separated



Model 10565B



Major Components

INTRODUCTION

The Hewlett-Packard Model 10565B Remote Interferometer (Figure 1) is an accessory for the 5526A Laser Measurement System. With the 10565B Remote Interferometer and a 10556A Retroreflector, the 5526A Laser Measurement System can perform linear distance measurements. Also, the Model 10565B Remote Interferometer can be converted, with a 10581A Plane Mirror Converter, to a Plane Mirror Interferometer, enabling the system to make plane mirror measurements.

DESCRIPTION

The 10565B Remote Interferometer is a stainless steel, two inch cube with a polarizing beam splitter mounted inside at a 45° angle to either of the laser beam inlet ports. The polarizing beam splitter is composed of two right angle prisms cemented together on the hypotenuse faces. The hypotenuse faces are coated with a dielectric material which reflects the vertically polarized component of the laser beam and passes the horizontally polarized component.

The 10565B Remote Interferometer has four optical windows, which permit the conversion of the Model 10565B to a Plane Mirror Interferometer. The 10565B Remote Interferometer is similar to the 10565A Remote Interferometer. The Model 10565A has only three optical windows. The 10565B Remote Interferometer can be substituted for the A model in any application and can be used with the 5525B Laser Interferometer.

The 10565B Remote Interferometer includes one Model 10556A Retroreflector.

5526A LASER MEASUREMENT SYSTEM AND ITS PUBLICATIONS

Each component of the 5526A system and each standard option are described in separate publications. A current listing of all publications about the 5526A Laser Measurement System is available from:

Hewlett-Packard Company
5301 Stevens Creek Boulevard
Santa Clara, California, 95050

Attention: Laser Publications

5526A LASER MEASUREMENT SYSTEM

The Hewlett-Packard 5526A Laser Measurement System measures linear distances with one millionth of an inch (.01 micron) resolution. The wavelength of light emitted by a helium-neon gas laser is used as the basic length standard.

INSTRUMENT IDENTIFICATION

Each Hewlett-Packard instrument has a ten-character serial number (e.g., 0000A00000). The four-digit serial prefix identifies a group of identical instruments, and the five-digit suffix is a serial number unique to each instrument. If the serial prefix on your instrument is not on the title page of this manual, your instrument is different from this manual. A manual change sheet is included with this manual to describe the differences. If the manual change sheet is missing, request one from the nearest Hewlett-Packard Sales and Service office listed at the back of this manual.

SPECIFICATIONS

Specifications for the 10565B Remote Interferometer are as follows:

Dimensions: See Figure 2.
Weight: 2.7 pounds (1.1 kilograms)
Beam Alignment: Exit beam parallel to incoming beam to within ±30 arc-seconds. Reflected beam perpendicular to exit beam to within ±30 arc-seconds provided exit beam is perpendicular to exit face.
Operating Range: Up to 700 feet, depending on conditions.
Linear Measurement Accuracy: Same as 5526A Laser Measurement System without 10565B Remote Interferometer.

INSTRUMENT COMPONENTS SUPPLIED

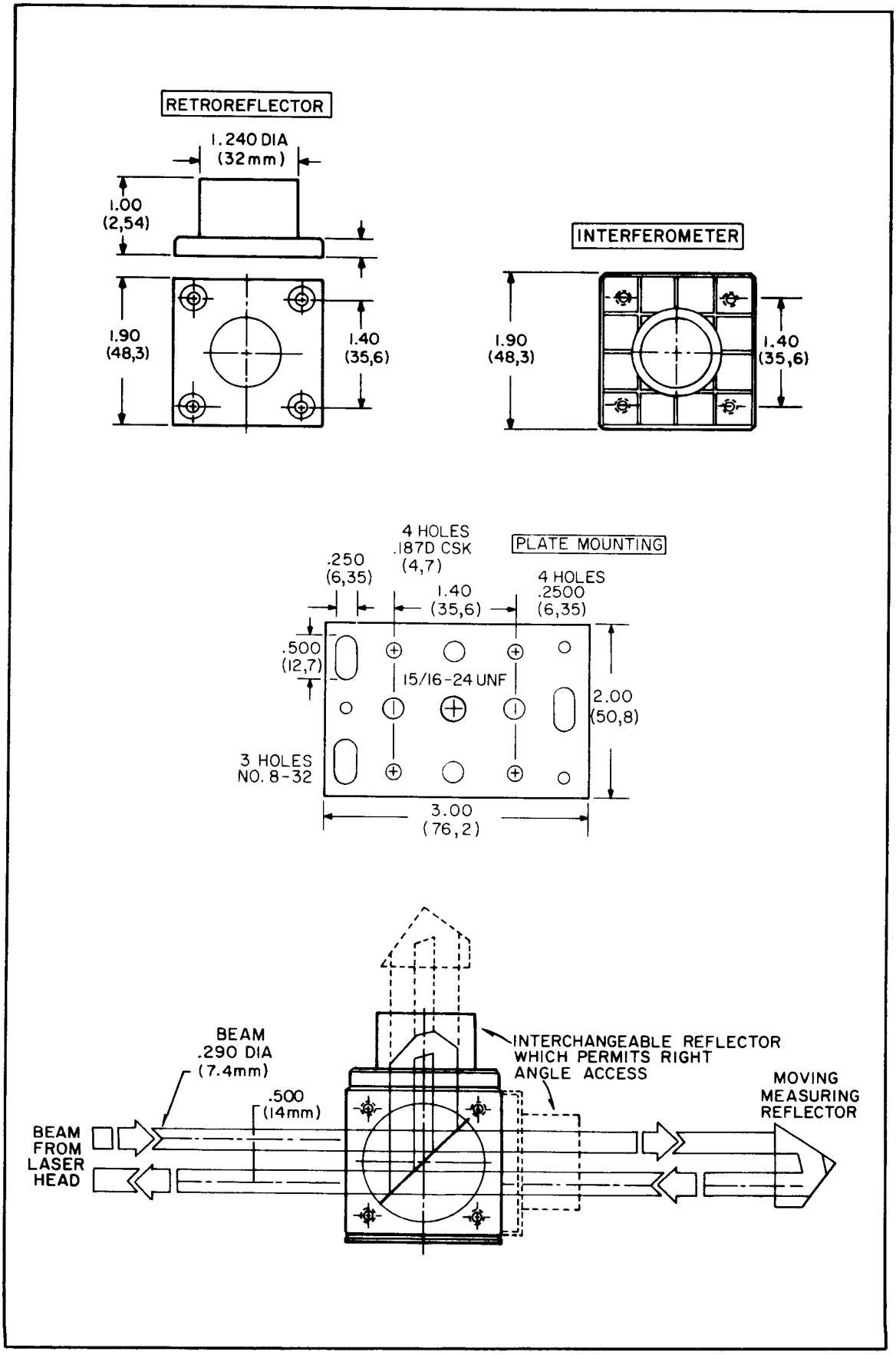
The remote interferometer includes the following items.

Table 1. Components Supplied

Description	HP Part No.	Quantity
Interferometer assembly	10565-60001	one
Reflector assembly	10565-60002	one
Mounting plate	10565-20004	one
#8-32 x 1/2″ screw flat head cap hex (Use 9/64″ hex hey)	3030-0019	four
Case, wooden storage	9211-1615	one
Instruction manual	—	one
Hex L wrench 3/32″	1470-0003	one
Hex L wrench 9/64″	8710-0060	one

*The part number for this manual is printed on the back cover.

Figure 2. Remote Interferometer Dimensions



INSTALLATION AND OPERATION

INTRODUCTION

This section provides installation and operating instructions for the 10565B Remote Interferometer.

UNPACKING AND INSPECTION

Prior to shipment, this instrument was inspected and met all specifications previously listed. Inspect the shipping container and, if damaged, remove and inspect the Remote Interferometer. If the Remote Interferometer is damaged, file a claim with the carrier and notify Hewlett-Packard immediately.

INSTALLATION

With the 5526A Laser Measurement System, the operator has the option of mounting the Remote Interferometer either inside the Laser Head or at some external and remote location. In two axis measurement applications the Remote Interferometer must be mounted externally. Refer to Option 010 supplement to the basic 5526A Operator's Handbook for fixturing instructions.

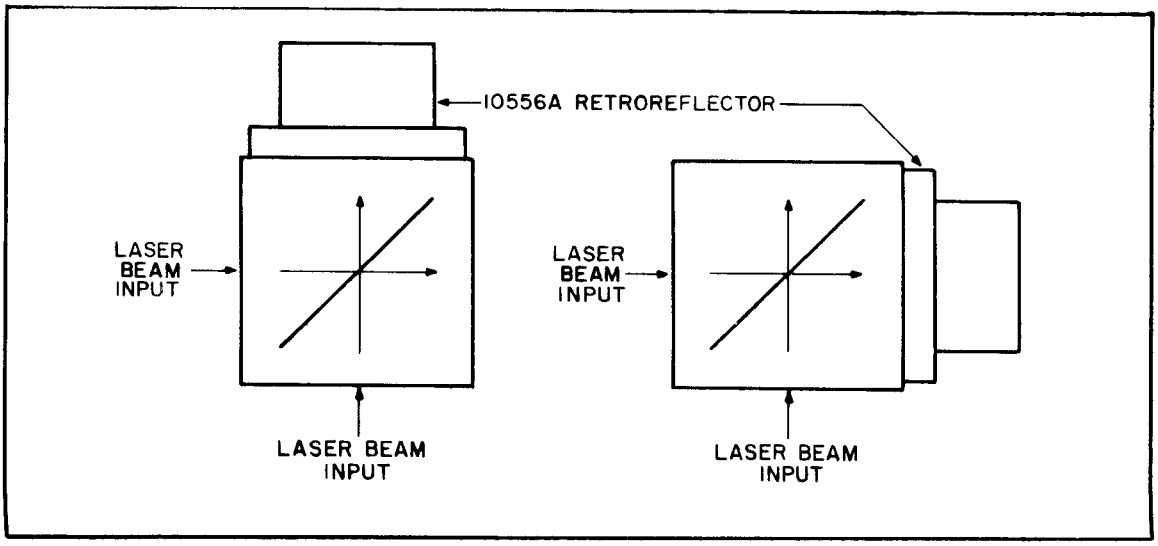
NOTE

If the sales and service office determines that the optic device was damaged as a result of mishandling or abuse, the warranty outlined in the 5526A Service Manual will be null and void.

10556A Retroreflector

The 10565B Remote Interferometer is equipped with one 10556A Retroreflector. To mount the Retroreflector to the Remote Interferometer, use the four 8x32" flat head hex socket screws supplied with the Remote Interferometer. Except with plane mirror applications, the Retroreflector must be mounted to one of the two laser beam outlet ports. The laser beam output of the Laser Head must be directed to one of the two inlet ports. The outlet and inlet ports of the Remote Interferometer are indicated by the direction of the arrows located on the side of the Remote Interferometer. For plane mirror mounting configurations, refer to the 10581A PLANE MIRROR CONVERTER INSTRUCTION MANUAL. Figure 3 illustrates the mounting of the Retroreflector.

Figure 3. Retroreflector Mounting



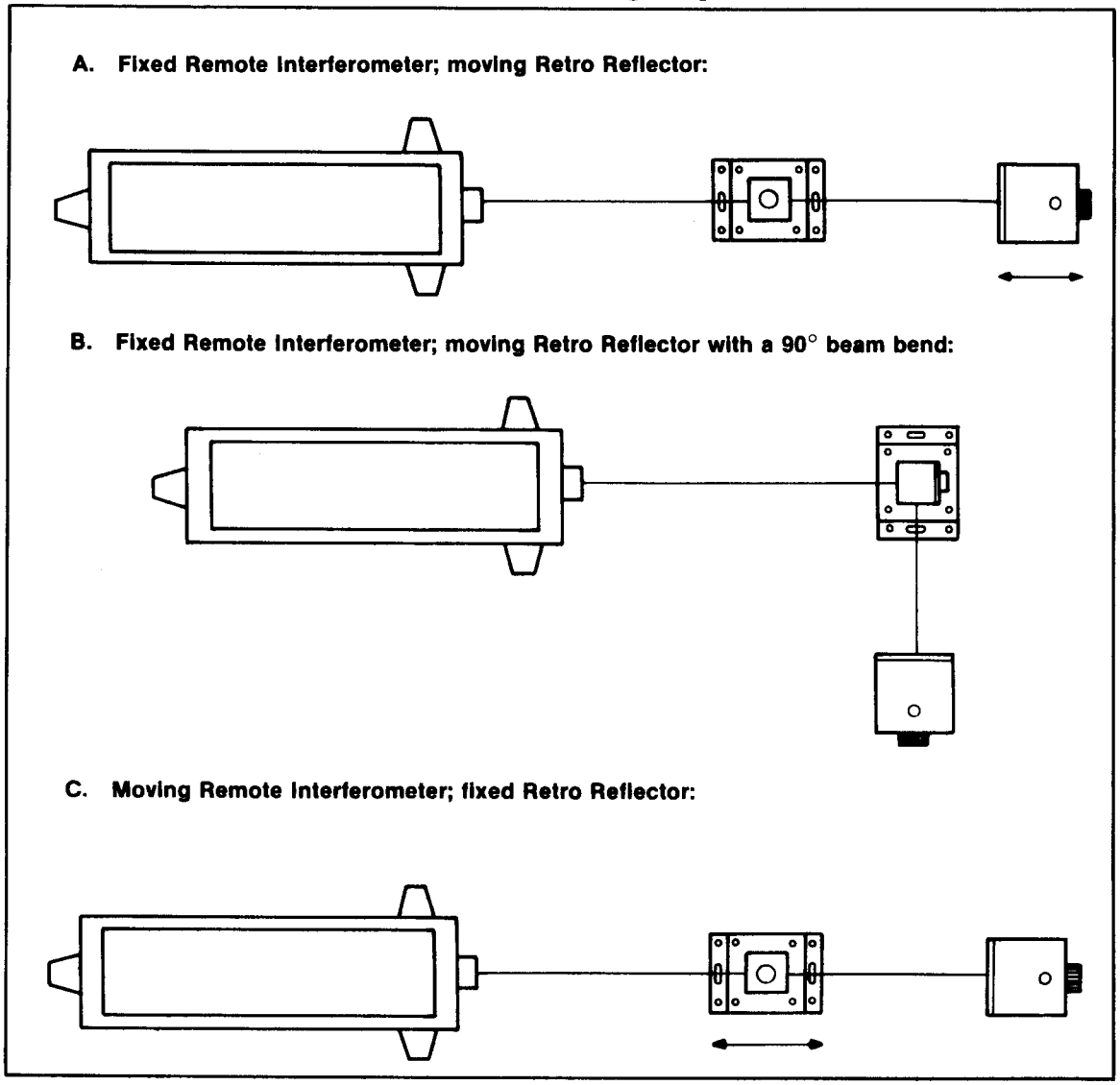
OPERATION

There are two basic methods of performing linear distance measurements with the 5526A Laser Measurement System. One method requires the basic system (Laser Head and Laser Display), the Remote Interferometer, and an additional Retroreflector. The second method requires the basic system, the Remote Interferometer, a Retroreflector, the Plane Mirror Converter, and a plane mirror reflector. Refer to Options 012/013 supplement to the Operator's Handbook for operating instructions on plane mirror measurements.

Measuring Setups

The first step is to determine the set-up configuration. This is dictated by the fixturing facilities for the three components of the system: The Remote Interferometer, the Retroreflector and the Laser Head. Top views of the three basic set-ups are shown below:

Figure 4. Measuring Setups



There can be several bends in the beam between the 5500C Laser Head and the remote interferometer, using the 10551A Beam Bender, 10557A Turning Mirror or equivalent. But these would not affect the method of alignment. It should, however, be noted that beam bending can only be made either parallel or at a right angle to, the mounting plane of the base of the laser head.

Operation Test

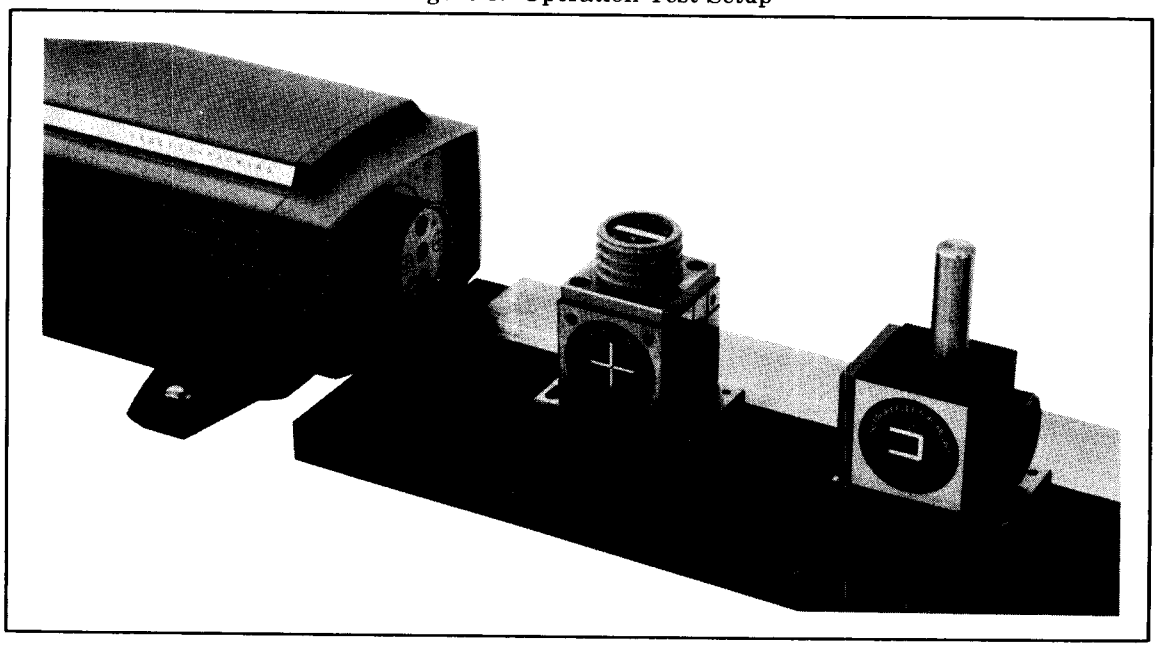
1. Set the Laser Head on a flat and stable surface.

2. Put the Laser Reflector* in line with the beam output of the Laser Head as shown in Figure 5.

3. Align the Laser Reflector so the beam goes back to one of the Display A beam return ports.

4. Put the Remote Interferometer between the Laser Head and the Laser Reflector. The position of the Remote Interferometer is illustrated in Figure 5.

Figure 5. Operation Test Setup



5. Align the Remote Interferometer until the two reflected beams are superimposed on the same Display A beam return port.

6. Adjust the Remote Interferometer and Laser Reflector carefully while watching the BEAM ALIGNMENT meter on the Laser Display for maximum swing to the right in the green region. When the ALIGNMENT meter is near 8, press the RESET button. Observe that flashing stops.

7. With good alignment purposely break the beam with a piece of paper and observe that the RESET light flashes. Again press the RESET button. Press the SMOOTH, X10, and VELOCITY buttons in turn while moving the reflector. Note that the Display indicates the characteristics of each mode. (Refer to the Operator's Handbook.)

8. On the Laser Display press the TUNE ←→ switch to the left and the LASER TUNING meter needle should move to the left. Hold the TUNE switch left until the TUNING meter needle moves into the red area, then release the switch. The RESET light should begin flashing about five seconds after the TUNE switch is released.

9. Push the TUNE switch to the right until the LASER TUNING meter needle is near the middle of the green area, and then release the switch. Press the RESET button and its light should stop flashing.

*The Model 10550B Laser Reflector includes one Model 10556A Retroreflector and an adjustable holder for the Retroreflector.

10. Press the TUNE switch to the right, and check that the LASER TUNING meter needle moves to the right. Check that the RESET light begins flashing after the LASER TUNING meter remains in the red area for a few seconds with the TUNE switch released.

11. Center the LASER TUNING meter needle by holding the TUNE switch in the direction the meter needle should go. Press the RESET button.

12. Slide the Laser Reflector slowly sideways so the corresponding half of the laser beam begins to miss part of the return port on the Laser Head. Continue to slide the Reflector slowly until the BEAM ALIGNMENT meter needle moves slowly to the left until the needle is in the red area. The RESET light should begin flashing.

The test is complete.

The operational test for two axis measurement is similar to the one axis operation test described in the preceding paragraphs. Dual axis measurements require the Model 10567A Beam Splitter. After the placement of the Beam Splitter, each separate axis is aligned in the same manner as the single axis.

For more detailed information regarding the operation and alignment of Remote Interferometer applications, refer to the LASER MEASUREMENT SYSTEM 5526A OPERATOR'S HANDBOOK supplement OPTIONS 010/011.

MAINTENANCE

GENERAL

Maintenance of the Remote Interferometer consists of cleaning the metal and glass surfaces.

CLEANING

Use a soft camel-hair lens brush to remove dust from the interferometer windows. (A good camera lens brush with a rubber bulb blower is recommended.) Dampen a few optical lens cleaning tissues with optical grade ethyl alcohol, shake off excess alcohol and wipe across window once. Use fresh tissue dampened with alcohol for each wipe. Allow alcohol to dry naturally.

NOTE

DO use only camera or better grade lens tissue.

DO NOT use any of the various impregnated eye glass tissues.

DO NOT use harsh solvents such as acetone or MEK to clean the interferometer.

DO NOT use excessive amounts of alcohol.

DO NOT wipe window if there is any abrasive dust or grit on it.

STORAGE

Keep the Remote Interferometer in its wooden storage box when it is not in use.

THEORY OF OPERATION

5526A LASER MEASUREMENT SYSTEM

The 5526A Laser Measurement System measures only the change in distance of the 10556A Retroreflector relative to the 10565B Remote Interferometer. Changes in distance, or in atmospheric conditions, between the Laser Head and the Remote Interferometer do not affect measurement accuracy. Since the Remote Interferometer is small and can be located very close to the measurement path, deadpath is virtually eliminated. Deadpath is the minimum separation distance between the Remote Interferometer and the Retroreflector. Deadpath is undesirable because it cannot be fully compensated for and any changes during a measurement cannot be isolated. To minimize deadpath error fixture the Remote Interferometer and Retroreflector to be as close as possible without touching at their nearest points.

10565B REMOTE INTERFEROMETER

Figure 6 illustrates the operation of the 10565B Remote Interferometer. The laser light beam containing frequencies f_1 and f_2, of orthogonal linear polarization, leaves the center aperature of the 5500C Laser Head and enters the inlet port of the 10565B Remote Interferometer. The polarized beam splitter, mounted in the Remote Interferometer, reflects the f_1 component and passes the f_2 component. The f_1 and f_2 components are reflected back to the polarized beam splitter by their respective Retroreflectors. The reflected beams recombine at a different point on the polarized beam splitter, resulting in a beam composed of $f_1 - f_2$. Any movement of the movable Retroreflector along the beam path results in a Doppler shift in frequency of the reflected beam and hence a difference Δf, in the fringe rate.

10556A RETROREFLECTOR

The Retroreflector is an optically ground and polished glass trihedral prism. The three reflecting faces are mirror silvered while the front face is anti-reflection coated. The prism is mounted, with the front fact out, in a precision ground and lapped stainless magnetic mounting. The Retroreflector (or cube corner) reflects the laser beam back in a line parallel with the original beam, but displaced laterally by a distance determined by the displacement of the corner apex from the original beam line.

Figure 6. Model 10565B Remote Interferometer