

Introduction

Your laser interferometer positioning system is a set of optics, electronics, and electro-optical products that measure distance very accurately. This chapter will give you the information you need to quickly set up your laser system and make measurements with it.

A one-axis example is used for simplicity

Each axis of a laser positioning system is set up, aligned, and operated in essentially the same way. A six-axis system is similar to a one-axis system; therefore, only a single-axis system will be described in this chapter. Additional axes are then operated like the axis in the example.

Basic steps apply to all laser systems

Specific products (identified by Agilent model number) are used in the example, but the installation and operation of other Agilent products are similar.

The example shows the use of PC-compatible electronics and a linear interferometer. If you are using a different interferometer, you may need to refer to the subchapter (Chapter 7x) in this manual that describes that interferometer for more details on optical alignment.

Regardless of the specific products you are using, the information and procedures presented in this chapter will help you get started quickly and easily.

Agilent laser inteferometer positioning systems at a glance

Figure 2-1 shows the components of a typical single-axis Agilent laser system. All Agilent laser systems combine optics (interferometer and reflector), electronics, and opto-electronics (laser head and receiver) to make a highly accurate positioning system.

Introduction

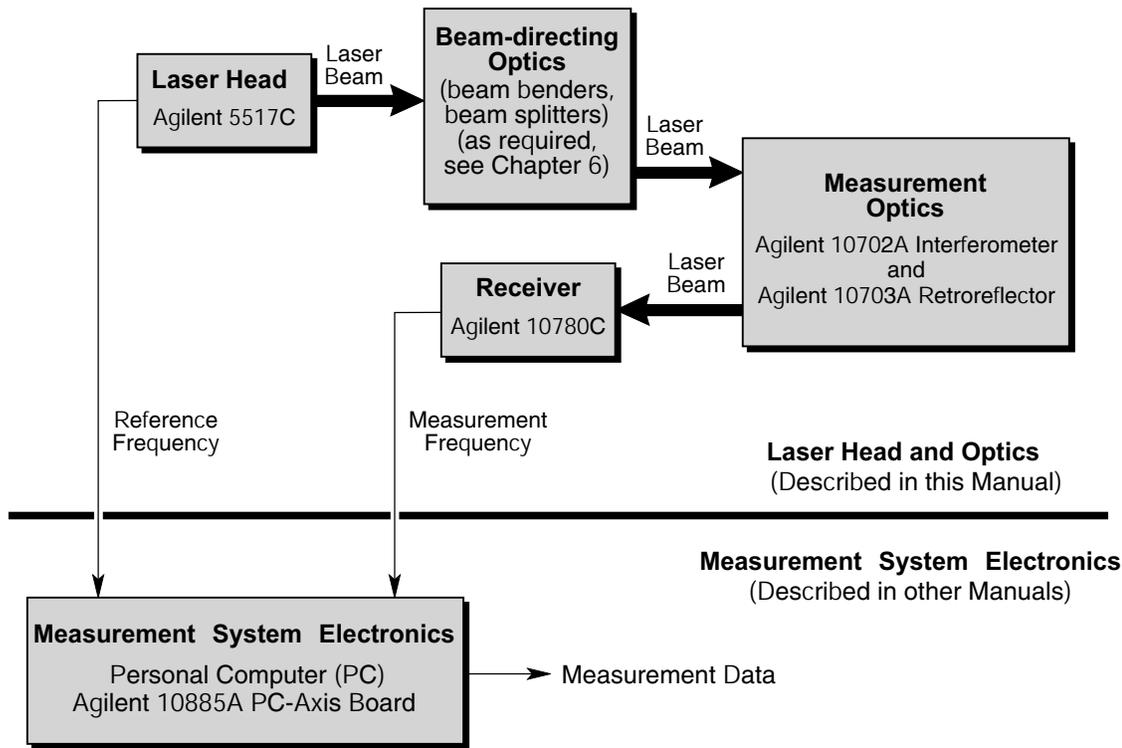


Figure 2-1. Typical single-axis Agilent Laser Interferometer Positioning System

All Agilent laser systems share a similar configuration

Figure 2-1 shows PC-compatible electronics and a linear interferometer, but the system configuration is the same for all types of Agilent electronics and interferometers.

All Agilent laser systems require a reference signal from the laser head and a measurement signal from the receiver to be connected to the electronics to determine relative movement between the optics.

All Agilent laser systems feature separate laser head, interferometer, and reflector. The laser beam must be aligned with the optical elements and the motion of the optics to preserve beam alignment and provide an accurate measurement. The optics and receiver must be aligned so the beam strikes the lens of the receiver to generate a measurement signal. Misalignment results in loss of the measurement signal.

Introduction

A controller is required for all laser positioning systems

A controller is needed to control the system electronics and provide a display of the distance measured. The PC is the controller for PC-compatible electronics. Software programs are provided with the Agilent PC-compatible electronics to set up the system and display the measurement. VMEbus electronics require a separate controller.

What follows?

The remaining sections of this chapter describe how to quickly set up and operate an Agilent laser interferometer positioning system, using PC-based electronics. Only essential information is included. Details not covered in this chapter are found in other chapters of this manual or in the manual(s) for the specific system electronics you are using.

The first step in system setup is connecting the system electronics. This includes installing the electronics boards in their backplane, connecting the cables from the laser head and receiver, and starting the software program.

The second step in system setup is aligning the optics. This step includes aligning the beam from the laser head parallel to the optics motion and aligning the optics and receiver lens so the beam enters the receiver lens during the entire range of motion.

The last step in system operation is making a measurement. This requires the software to be running on the controller to display measurement results.

Problem-solving is the last part in this chapter. The most common problems and their solutions are presented to help you operate your system successfully.

Setting Up the System Electronics

WARNING

THE PC POWER CORD MUST BE UNPLUGGED TO PREVENT PERSONAL INJURY AND DAMAGE TO THE ELECTRONICS.

To Install the Laser Electronics in the PC

- 1 Unplug the PC power cord.
- 2 Remove the cover on the PC. (See the manual for your PC for specific instructions for this step and the next few steps.)
- 3 Read and note the address on the Agilent 10885A PC Axis Board (see the top picture in *Figure 2-3 on page 2-4 of the Agilent 10885A Operating and Service Manual* for details.) The default address is set at the factory to &H100; you should leave the address set to the default value for initial operation of the single-axis system. (In a multiaxis system, each board must have its own unique address.)
- 4 Install the Agilent 10885A PC Axis Board in the PC.
- 5 Replace the PC cover.
- 6 Plug in the PC power cord, but leave the PC power off.

To Connect the Electronics Cables

- 1 Connect the largest connector on the laser head cable to the back of the laser head.
- 2 Connect the smallest connector on the laser head cable to the Reference connector on the Agilent 10885A PC Axis Board you just installed in your PC.
- 3 Connect the Agilent 10884A Laser Power Supply to the remaining connector (the medium-size DIN connector) of the laser cable.
- 4 Connect the receiver cable to the back of the receiver and to the MEASurement connector in the Agilent 10885A PC Axis Board.

Make sure the four pins of the cable connector align properly with the holes of the mating connector on the board.

Aligning the Optics

To Start the System

- 1 Turn on the power to your controller (the PC) and wait for the DOS prompt.
- 2 Plug the Laser Power Supply into line power (nominally 110 V or 230 V ac) to start the laser.

The laser head should emit a red laser beam within 45 seconds after receiving power. The laser head requires a four- to ten-minute warmup period to stabilize its frequencies before a reliable measurement can be made.

WARNING

DO NOT STARE DIRECTLY INTO THE BEAM (OR ITS REFLECTION FROM A POLISHED SURFACE) OR EYE DAMAGE COULD RESULT.

- 3 Insert the 3.5-inch disk that came with the Agilent 10885A PC Axis Board into your PC's disk drive.
- 4 Select the disk drive where the disk is installed.
- 5 Start the program on the disk by typing "DEMO" and pressing the "Return" ("Enter") key.
- 6 Enter hexadecimal value of the Agilent 10885A PC Axis Board's address you recorded earlier (the default address is "&H100") into your PC.
- 7 Unless the optics are already aligned, the controller will indicate system errors (for example, "Measurement loss of lock" and "System loss of lock").

Aligning the Optics

The laser head, optics, and receiver must be aligned so the laser beam from the optics returns to the receiver lens.

- 1 Set the laser head on a stable surface and point the beam in the direction you intend to move the optics.
- 2 Set the interferometer in the laser beam path so the beam enters the interferometer aperture perpendicular to the aperture. You may need to fasten the interferometer in place with a clamping fixture.

Making a Measurement

- 3** Set the reflector in the laser beam line coming from the interferometer. Adjust the reflector to reflect the beam back into the interferometer.
- 4** Place the receiver parallel to the laser beam from the laser head to the interferometer. The lens must be facing the interferometer. Fasten the receiver in place with a fixture or clamp.
- 5** Adjust the reflector and receiver to get the return beam on the receiver lens. When the **Laser Ready** indicator comes on, the green LED on the receiver will light when the beam alignment is satisfactory.
- 6** Block the beam from the interferometer to the receiver. The green LED on the receiver should go out. Unblock the beam and the green LED should light again. If this happens, optics alignment is complete, and you can skip step 7 of this procedure.

If the receiver's green LED stays on when the beam from the interferometer is blocked, the receiver gain is too high. Go to the next step.

- 7** With the beam blocked, turn the receiver's gain adjustment control until the LED goes out. When the beam is unblocked, the LED should light again, indicating that the optics are aligned properly.

If the green LED does not light, readjust beam alignment until it does light.

Making a Measurement

To make a measurement: 1) the electronics must be connected and on; 2) the laser beam must be aligned; and 3) the software program must be running in the controller.

- 1** Reset the program for the PC axis board by pressing "R" on the controller keyboard.
- 2** If the measurement units (mm or inches) indicated on the display are not what you want, press "U", then "T".
- 3** For this "getting started" exercise, we recommend that you use the default TCN (Total Compensation Number) value. If you want to use a different TCN value, enter it.
- 4** To choose a different optic type, press "O" (the letter, not the number), then press the number corresponding to the optic type:

Solving Problems

- a. for a linear interferometer
 - b. for a plane mirror interferometer, except the high-resolution plane mirror interferometer
 - c. for a high-resolution plane mirror interferometer
- 5 Move the measurement reflector.
 - 6 The indicated distance shown on the controller display should change as the reflector is moved.
 - 7 If you want to change the system (axis) direction sense, press “D”.
 - 8 To stop the program, press “S”.

Solving Problems

Here is information about three simple problems that may occur while you are trying to make a measurement.

- If there is no red beam from the laser head:
 - Ensure that the laser head cable is securely connected to the back of the laser head.
 - Ensure that the power supply is connected to the laser head cable.
 - Ensure that the power supply is plugged into an operating outlet and that the **POWER ON** light is lit.
- If the green LED on the receiver does not light:
 - Ensure that there is a red beam from the laser head.
 - Ensure that the laser beam passes through the large aperture in the laser head.
 - Ensure that the receiver cable is securely connected at the receiver and at the system electronics.
 - Ensure that the system electronics are connected to an operating power source and are turned on.
 - Ensure that the alignment of the laser head, optics, and receiver causes the beam from the interferometer to be centered on the receiver’s lens.
 - Block the beam between the interferometer and measurement reflector. The reference-path beam should be centered on the

Solving Problems

receiver's lens. When you unblock the measurement-path beam, it should overlap the reference-path beam on the receiver lens.

- If everything above seems correct, but the LED still doesn't light, adjust the receiver's gain control.
- If the controller does not indicate motion of the measurement reflector:
 - Ensure that there is a red beam from the laser head.
 - Ensure that the laser system electronics are powered.
 - Ensure that the laser beam is properly aligned and that the receiver's green LED is lighted.
 - If the receiver's green LED remains lighted when no measurement signal is present, reduce the receiver's gain via its gain control.
 - Ensure that the controller is on and the program is running.

Chapter 2 Familiarization and Initial Operation
Solving Problems

Product specifications and descriptions in this document subject to change without notice.
Copyright (C) 2002 Agilent Technologies
Printed in U.S.A. 07/02
This is a chapter from the manual titled:
Laser and Optics User's Manual
For complete manual, order:
Paper version: p/n 05517-90045
CD version: p/n 05517-90063
This chapter is p/n 05517-90102