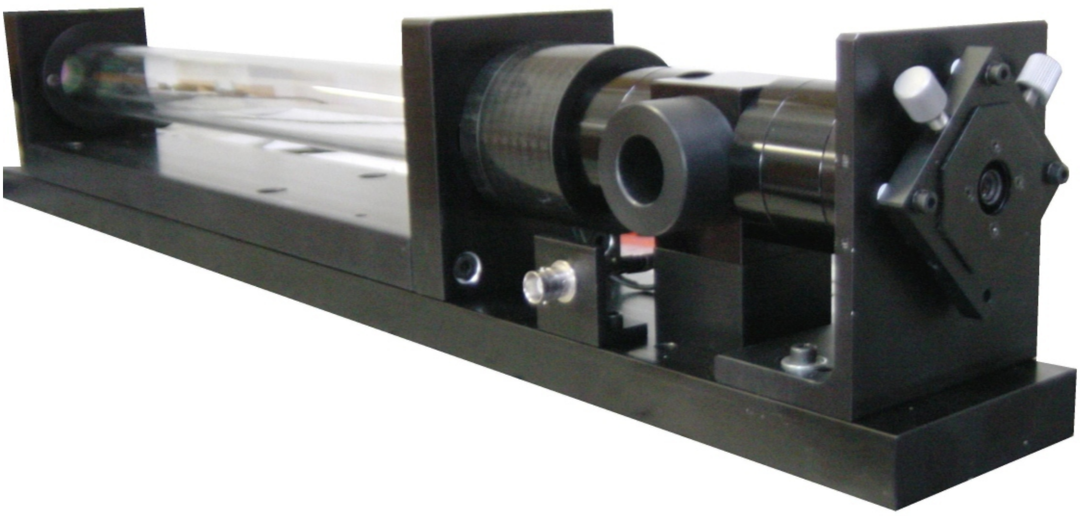
CONFOCAL FABRY-PEROT INTERFEROMETER

CFP-1

INSTRUCTION MANUAL



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Introduction

The confocal Interferometer CFP-1 is a very high resolution spectrometer. The 500mm confocal cavity gives a resolution approaching 5MHz. Optics are included to allow an optic fibre to be optimally coupled to the cavity. A very narrow bandpass interference filter rejects stray light, and a glass plate beam splitter couples out a small amount of the incoming light for reference purposes.

The cavity has been factory-preadjusted to achieve optimum performance and requires no subsequent adjustment – however alignment screws are provided for the unlikely event that further adjustment is needed.

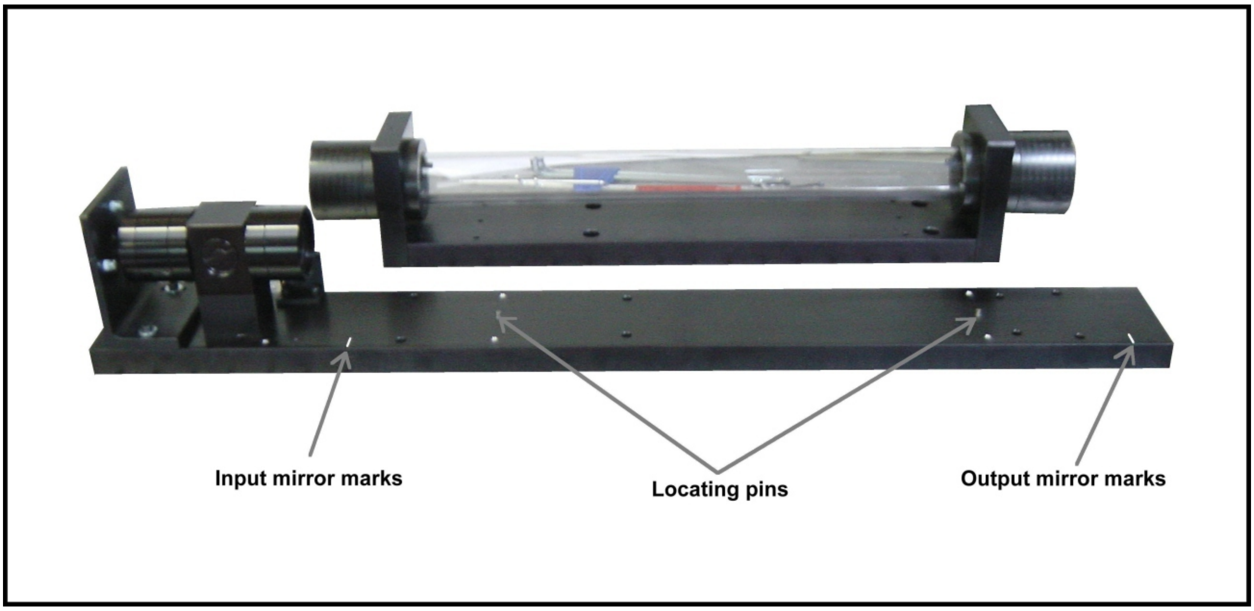
Highly sensitive piezoelectric scanning is employed, requiring about 1.75V per order at a wave-length of 532nm.

1. Installation

The interferometer cavity has been aligned to couple to an axial beam at a height of 75mm above the supporting surface. The first step in installation is therefore to adjust the light beam to be measured so that it lies on this axis. Follow the procedure below:

1 Remove the cover from the interferometer, unplug the cable just behind the BNC socket, and remove the four M4 screws which attach the interferometer to its base plate. The interferometer can now be lifted vertically from the base. Note the two locating pins and the two marks which denote the approximate positions of the interferometer mirrors (see figure 1).

Fig. 1



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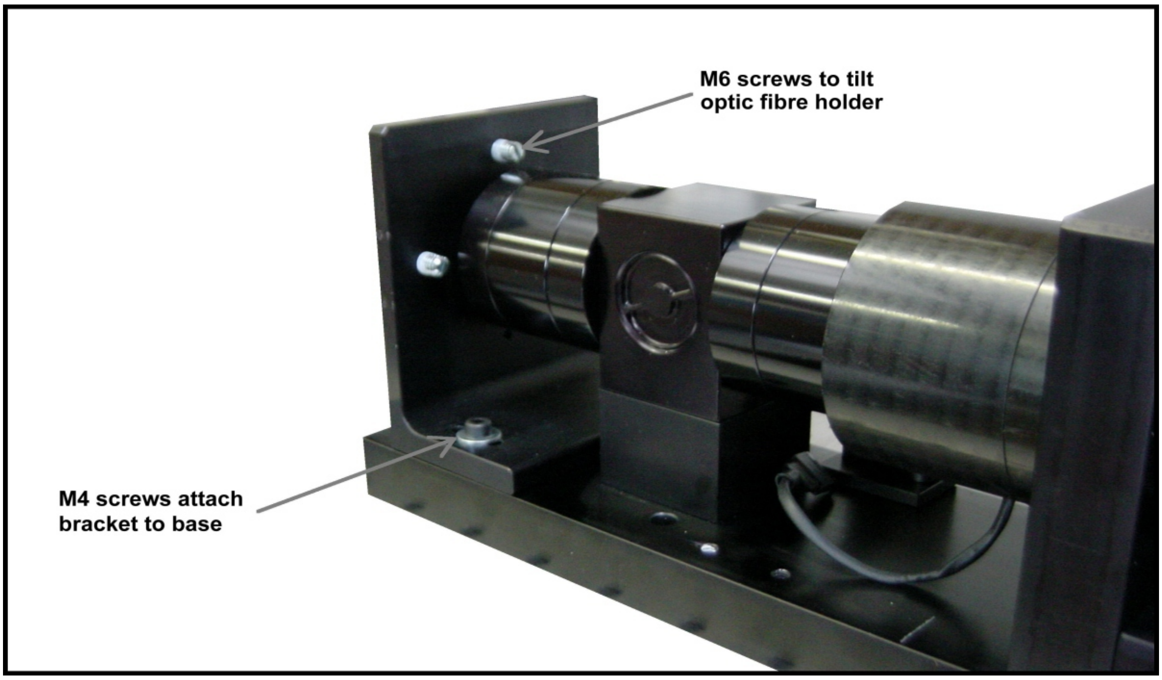
2 Attach the optical fibre and feed with a suitable light source. Place the metal post provided on the second locating pin (furthest from the light source). The cross shows the position of the optical axis.

3 Loosen the two M4 screws, figure 2, which attach the bracket of the optical fibre holder to the base plate and slide the bracket until the light spot seen on the post is as small and as sharp as possible (it should not be larger than about 7-8mm or the resolution of the instrument will be compromised). Adjust the two X,Y screws (see figure 3) on the optical fibre holder so as to centre the light spot on the optical axis.

Fig. 2



4 Now move the gauge to the position of the first mirror. The beam here should also be centred on the optical axis. If this is not the case (because the light is not leaving the fibre on axis) the fibre holder may be tilted slightly, **although in our experience this adjustment is not strictly necessary**. To raise or lower the beam, slightly loosen the upper M3 lock screw (see figure 3) and adjust the corresponding M6 screw. Retighten the M3 screw to lock. To move the beam to the left or right, follow the above procedure but using one or both of the lower M6 screws. Do not forget to lock after adjustment. (Alternatively it is also possible to move the beam left and right by rotating the bracket of the optical fibre mount as in #3 above).

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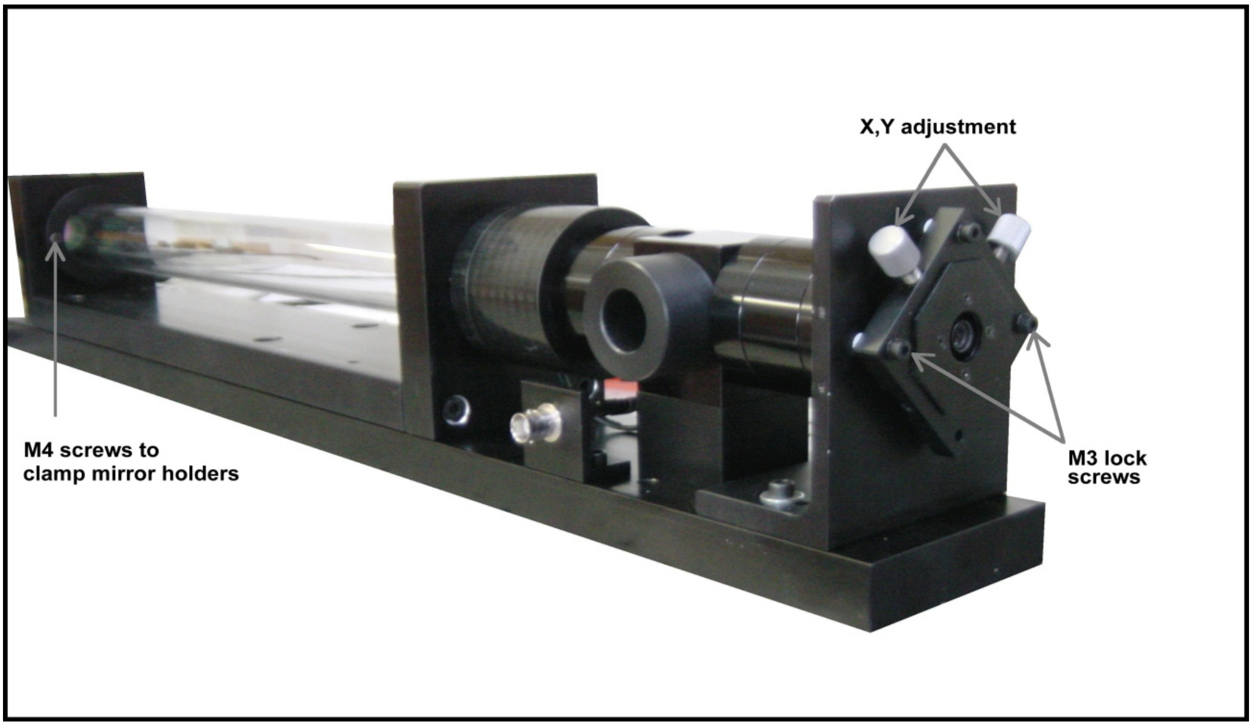
Fig. 3



5 Move the gauge back to the original position and recheck for best focus and position. Repeat #4 as necessary.

6 Reattach the interferometer to the base plate and plug in the cable. The interferometer is now ready for use.

7 Check the correct orientation of the cavity by applying a variable scan voltage and observing the transmitted light on a piece of paper held about 10-15cm from the output mirror. The observed light spot should be sharp and with a diameter of about 12mm. If the spot is double it will be necessary to slightly realign the cavity by slackening the two M4 screws shown in fig. 3 above and moving the rear end of the cavity until the images are superimposed.

NOTE:

- The piezoelectric transducers can be damaged if too much voltage is applied. Under no circumstances should the range **–10V to +100V** be exceeded.
- The three screws visible at the output end of the interferometer (see figure 4) control the length of the cavity and orientation of the output mirror. Do not try to adjust these screws unless you are very familiar with the operation of a confocal cavity.
- The narrow band interference filters supplied have a very precise pass band. No tilting of the filter is necessary and no adjustment has been provided.

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2. Adjustment of Interferometer cavity

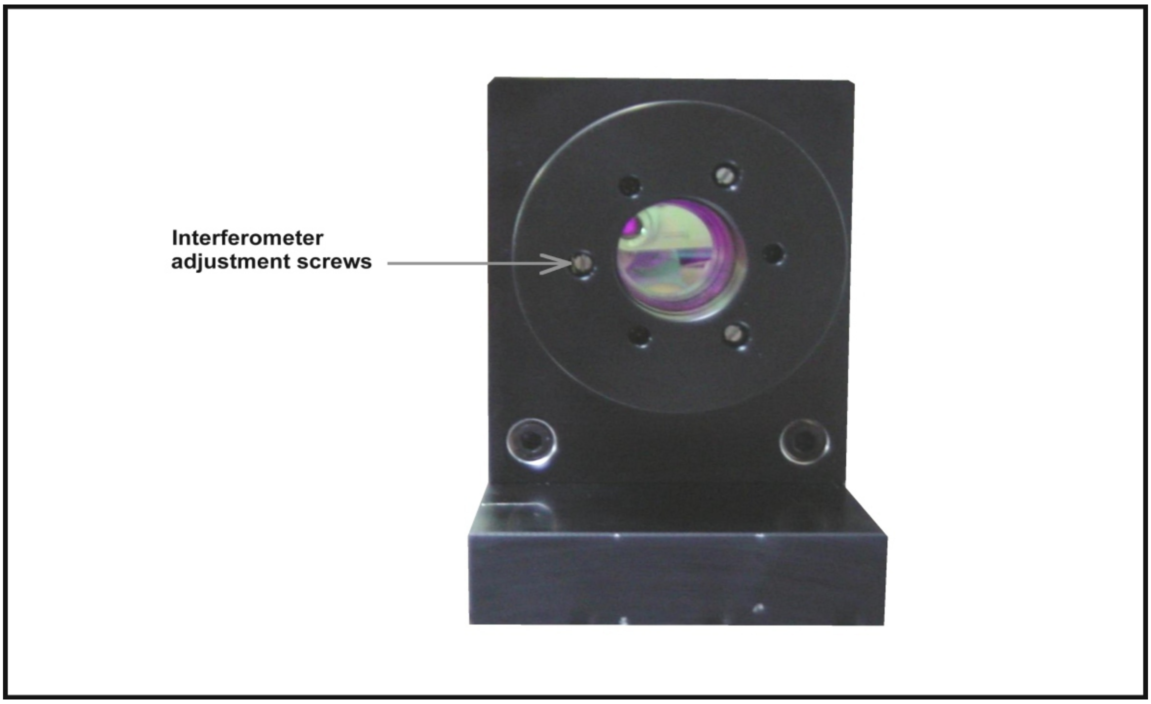
This operation has been carried out at the factory to give optimum performance of the interferometer. Do not try to make corrections to the cavity unless you have experience in operating with confocal interferometers.

To adjust the cavity a laser beam is required with a diameter of approximately 10mm incident on the first mirror and focussed to a point about 500mm distant (i.e. near the output mirror). In the factory this has been set up by replacing the optical fibre holder by a small lens with f = 10mm. By illuminating the whole surface of this lens with a laser beam the required cavity illumination can be achieved. The following steps must now be followed:

1 Slightly loosen the two M4 screws (see figure 3) which clamp the output mirror holder of the interferometer. It will now be possible to slide the output end of the interferometer. Check the light reflected from the interferometer back towards the laser – there will be a divergent beam which was reflected from the curved surface of the input mirror. By sliding the output mirror holder this divergent beam can be centred on the optical axis. Tighten the M4 screws again.

2 Place a paper screen about 150mm beyond the output mirror and observe the transmitted beam as a small voltage is applied to the BNC input. Adjust the voltage to give maximum transmission. Now carefully adjust the three screws (figure 4) to obtain the best circular shape of the transmitted beam. Try looking through the quartz tube to the input mirror surface and see how a small adjustment of the screws will bring the multiple reflections into coincidence.

Fig. 4



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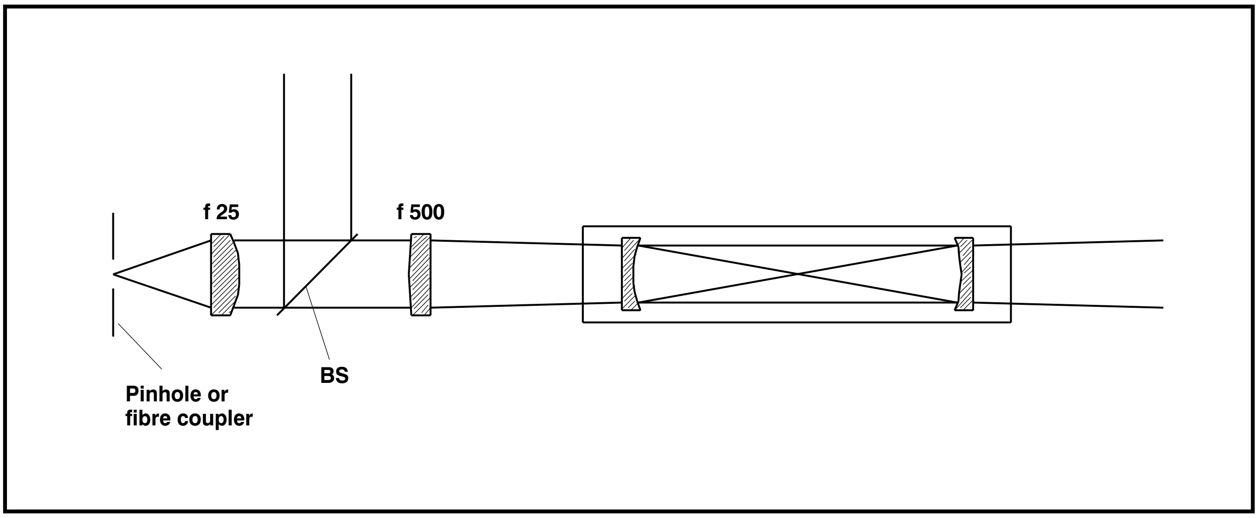
3 At this point the cavity is aligned but may not have the optimum spacing. Observe the transmitted beam as an increasing positive signal is applied to the BNC. If the cavity length is not optimum you will see rings which expand or contract. If the rings expand with increasing positive voltage then the cavity is too long, and vice versa. To reduce the cavity length turn all three screws by a small amount anti-clockwise. Never turn by more than 1/10 of a turn at a time. Check the shape of the transmitted beam and test cavity length as above. Repeat as necessary.

4 Finally recheck the form of the transmitted beam. If the alignment is near perfect you will see some straight line fringes. Readjust the mirror alignment until just a few fringes are seen. The cavity is now optimally aligned. Note that these fringes will only be observed with a small light source and will not appear under illumination from an extended source.

Optical Diagram

Fig 5



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Specifications

INTERFEROMETER

Cavity length 500mm corresponding to a free spectral range of 150MHz.

Mirror reflectivity 95% +/- 1% giving a reflectivity finesse of approximately 30.

Temperature compensated construction based on a quartz glass tube.

Piezoelectrically scanned with a sensitivity about 1.75V per order at 532nm.
Maximum voltage range of -10V to +100V.

Lowest mechanical resonance frequency of cavity is approximately 3.8KHz.

INPUT OPTICS

Collimating lens f = 25mm. Numerical aperture 0.25

Interference filter with centre wavelength 532nm and bandwidth less than 1nm.

Uncoated glass plate as beam splitter for reference beam.

Focussing lens f = 500mm.

Notes on Equipment Safety

The Confocal Interferometer CFP-1 has been designed, manufactured and tested to conform to the safety regulations for measurement- and control-equipment DIN EN 61010-1 (IEC 1010-1) and satisfies the relevant requirements of EEC Directive 73/23. The system conforms to EEC Directive 89/336 (electro-magnetic compatibility).