

TEO400 FTIR Module

User's Guide

Inspection

As soon as the shipment arrives:

- Carefully check the exterior of the shipping container(s) for any external damages unusual marks on the container(s) may indicate exposure to water etc.
- If the shipping container(s) appear to be damaged (water damage, crushed package, etc.) contact your supplier and the carrier within immediately.

CAUTION!

Do not open the shipping containers at this time!

Do not accept packages with obvious puncture damage. All other damage should be noted on the shipping document and signed by the delivery agent. Check your sales invoice against the bill of lading and the identifying labels on the containers. Notify your supplier and the shipping agent of any apparent discrepancies. If you are sure that all boxes have been delivered and appear to be undamaged, place them where their contents can come to the recommended room temperature.

CAUTION!

Do not open any packages until the equipment in them has reached room temperature. This is to prevent possible condensation damage if the equipment is cold.

Unpacking

- Move the box to the location where the module will be used.
- Carefully unpack the instrument from the shipping container(s). (Save the packing material for use if the module needs to be returned to your supplier for service etc).
- Visually inspect all equipment in detail.
- Remove secondary fasteners, shipping tape, plastic wraps, etc.
- If you have any problems, such as obviously broken equipment, missing components, etc. notify your supplier immediately.

Contents of the MODULE box:

- Module
- User's Guide
- 1/16" hex wrench
- Spare IR source

Setting Up

Find the right location. The base of the module should be firm and without vibration. This means that the user should choose a good quality desk or laboratory bench. Find the right position. The position of the module should enable free access to the instrument.

Open the cover, remove secondary transport fasteners, shipping tape, plastic wraps, etc. inside the interferometer.

Before switching on the instrument check the grounding circuit. If in doubt consult your engineering or installations specialist.

The overall order of assembly of your FTIR system:

- Place the module and other major components of your system on the table in their approximate final position
- Connect the module to the power supply and to your system attaching the connectors of the cable to the corresponding connectors on the front side of the module.

What You Should Already Know

This user's guide assumes that you are already familiar with the basic features and operations of FTIR instrument. In particular you should know:

- How to handle FTIR equipment and interferometer
- How to connect FTIR module into your system optically
- How to connect power supply to the module
- How to connect digital signals of the module to your system
- How to connect your personal computer to your system
- PC hardware

Site Requirements

The conditions below are required for proper operation of the TEO400 FTIR module.

- * Temperature 150 C to 300 C
- * Temperature gradient 1K/hr maximum
- * Relative humidity must not exceed 65%, non condensing
- * Free from corrosive and flammable fumes
- * Free from or minimal vibration
- * Power supplies must be properly grounded in accordance with local regulations.

General Safety

The TEO400 FTIR module has been designed to comply with a wide variety of international standards governing the safety of laboratory equipment. In routine use, the TEO400 poses virtually no risk to you. If you take some simple, common-sense precautions, you can make sure that you maintain the continued safe operation of the instrument.

Do make sure that TEO400 is properly connected to the electrical supply; in particular make sure that the ground (earth) is securely connected.

Do not disconnect the electrical power cable before opening the covers of the module.

Do not keep the TEO400 module dry. Avoid spilling liquid into the instrument. Clean all external spills immediately. If anything that is spilled enters the main body of the module, switch off the power and call a service engineer.

Do not stare into the laser beam. The TEO400 module contains a low power, visible (red) laser; momentary exposure to the beam is not dangerous, but deliberate, direct viewing of the laser beam along its axis could damage your eye.

Do not use flammable gas in connection with the TEO400 module. The module contains a hot infrared source, and a fire or explosion may result. Only use clean, dry, oil-free nitrogen or air in case of need to purge the instrument.

If possible, avoid any adjustment, maintenance and repair of the opened, operating instrument. If any adjustment, maintenance and repair of the opened, operating instrument is necessary, this must only be done by a skilled person who is aware of the hazard involved.

Whenever it is likely that the TEO400 module is unsafe, make it inoperative. The instrument may be unsafe if it:

- Shows visible damage;
- Fails to perform the intended measurement;
- Has been subjected to prolonged storage in unfavourable conditions;
- Has been subjected to severe transport stresses

Electrical Safety

Connect the TEO400 to a power supply line that includes a switch or other adequate means of disconnection from the electricity supply.

Only plug the module into an electricity-supply socket that is provided with a protective earth connection.

When fuses need replacing, use only those with the required current rating and of the specified type.

When the instrument is connected to its electricity supply, terminals may be live and removal of the covers other than those which can be removed by hand is likely to expose live parts.

The module must be disconnected from all voltage sources before it is opened for any adjustment, replacement, maintenance or repair.

The TEO400 module has been designed and tested in accordance with the safety requirements of the International Electrotechnical Commission (IEC). The module conforms to IEC publication 1010.1 as it applies to IEC Class 1 (earthed) appliances.

The TEO400 module has:

- An IEC Installation Category II classification – suitable for connection to local level power supplies.
- An IEC Pollution Degree 2 classification – usually only non-conductive atmospheric pollution of the equipment occurs, however, a temporary conductivity caused by condensation must be expected.

Laser Safety

The TEO400 module complies with the following laser safety regulations:

- British Standard BS EN 60825 (1992) – “Radiation safety of laser products, equipment classification, requirements and user’s guide”. BS EN 60825 implements CENELEC European Normalization document EN 60825 (CENELEC is the European Committee for Electrotechnical Standardization).
- IEC Publication 825 (1984) – “Radiation safety of laser products, equipment classification, requirements and user’s guide” and “amendment 1 to Publication 825 (1990).

The TEO400 module contains a CDRH Class II (BS EN 60825 and IEC 825 Class 2) Helium Neon (HeNe) laser and diode laser module, which emit red visible, continuous wave radiation and has a maximum output power of less than 1 mW. A portion of the laser radiation with a maximum power level of less than 0.3 mW may be accessed in the module compartment after opening the cover, which classifies the instrument as a CDRH Class II, BS EN 60825 Class 2, and IEC 825 Class 2 laser product.

Module

The TEO400 FTIR module is a stable, rugged unit requiring the minimum of external utilities.

- The sealed, desiccated enclosure keeps the interferometer dry
 - The IR source does not require water cooling
 - The interferometer mechanical bearing does not require a gas supply.
-

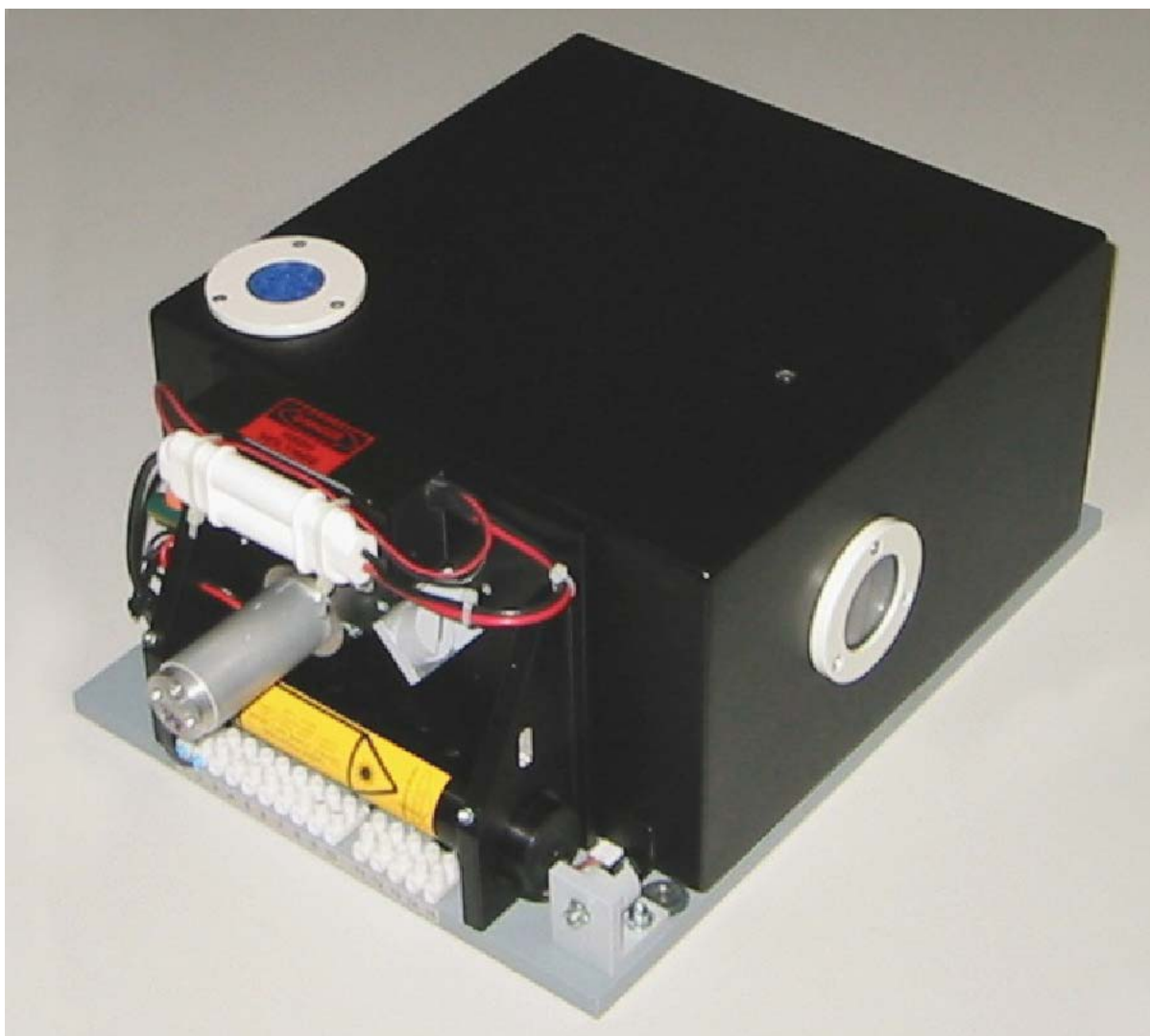


Fig. 1 TEO400 FTIR MODULE

For easy access, those system components which have a finite lifetime (i.e. laser, and IR radiation source) are located at the front side of the module. A yellow LED indicator indicates, when the scanning is turned on.

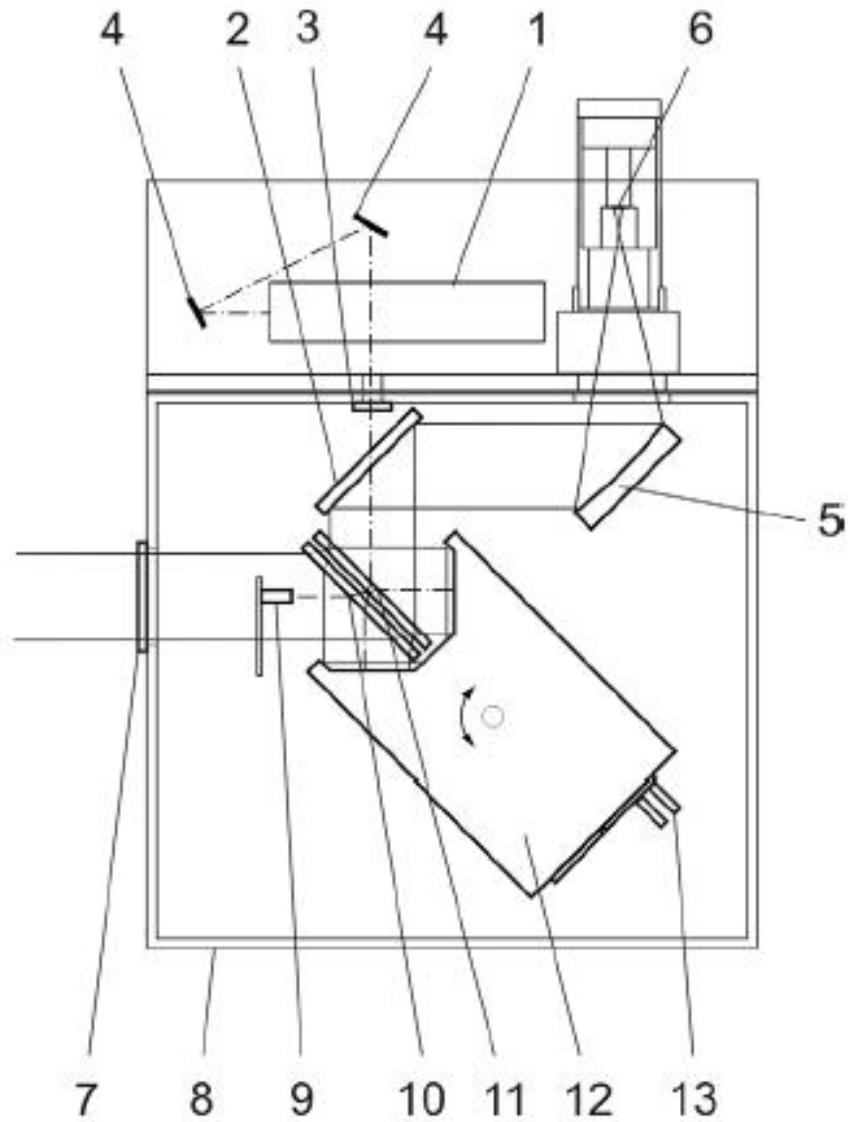


Fig. 2 Optical scheme

1 – HeNe laser, 2 – Flat mirror, 3 – Laser beam window, 4 – Laser beam mirrors, 5 – Off-axis paraboloid, 6 – IR source, 7 – KBr window, 8 – Cover, 9 – Laser fringe detector, 10 – Compensator, 11 – Beamsplitter, 12 – Scanning part of interferometer, 13 – Adjustment screws

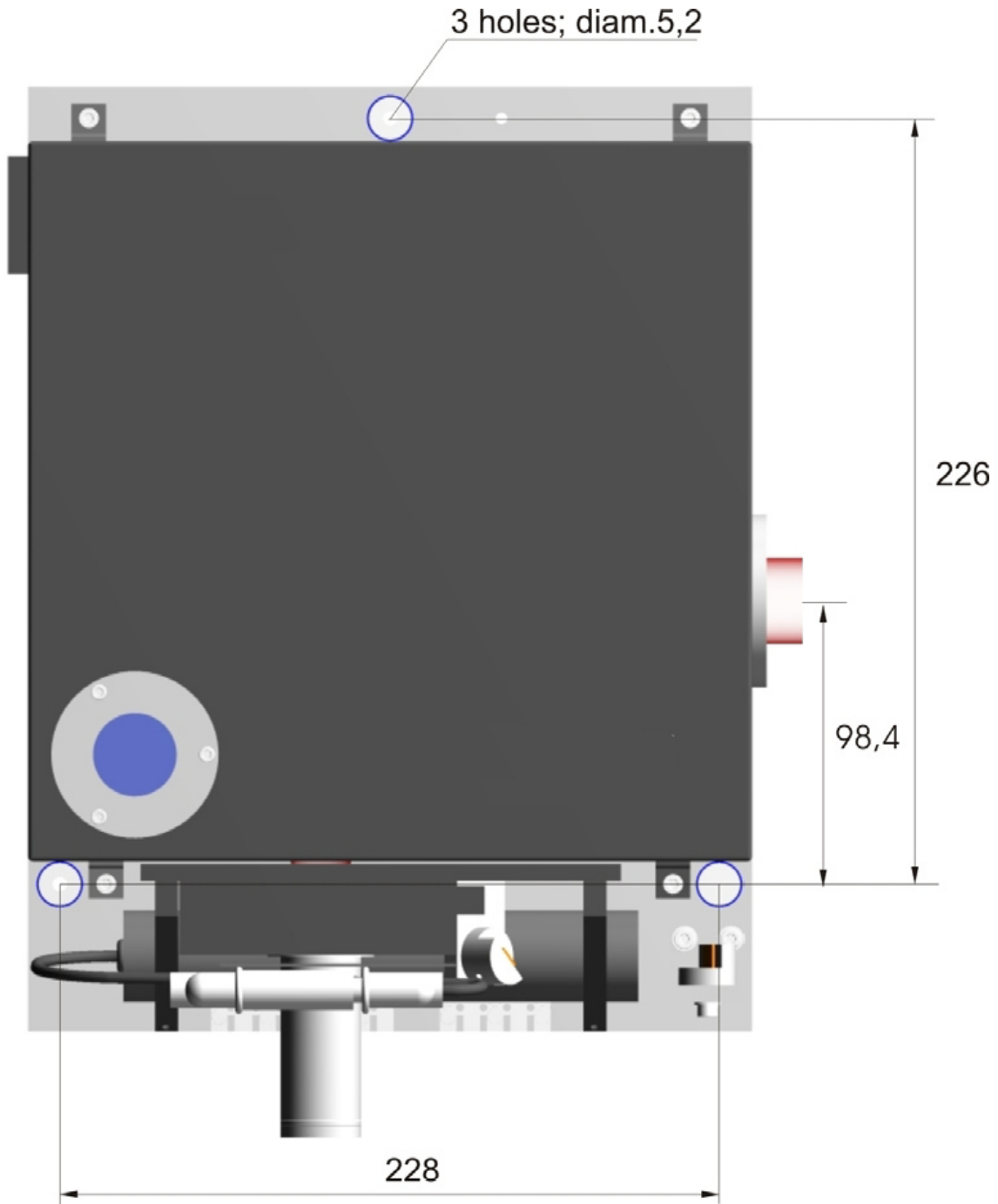


Fig. 3 Location of the fastener's places (holes) and output beam

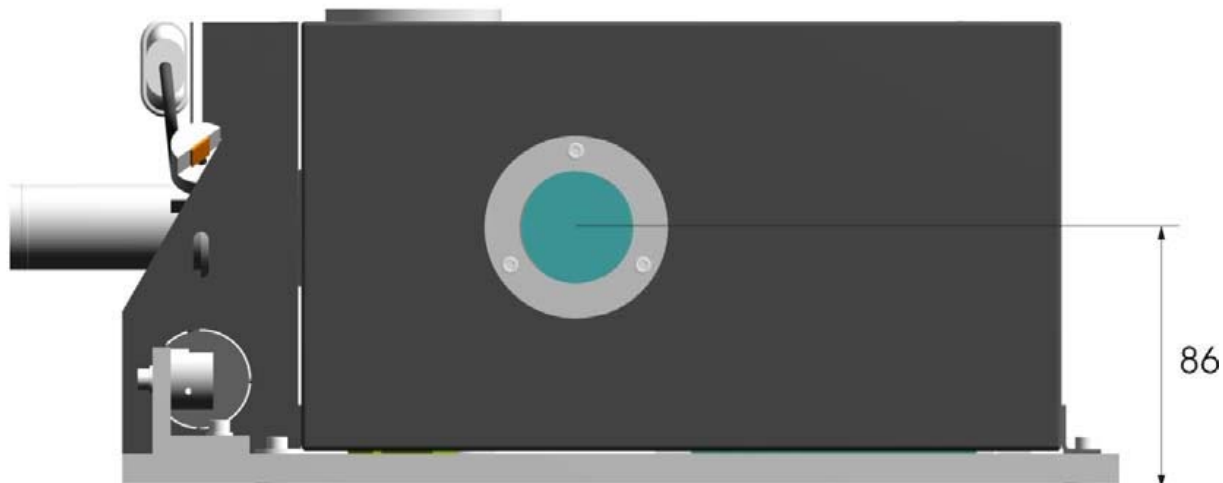


Fig.4 Height of the output beam optical axis

Specifications

Spectral range	7000 - 400 cm^{-1}
Resolution	2 cm^{-1} (1.0 and 0.5 cm^{-1} option)
Interferometer	Michelson type, self-compensated for tilt and shear
Output beam diameter	38 mm
Beam splitter	KBr substrate, multilayer coated (IR)
Scanner	pendulous scan
Scanning rate	2 mm OPD/s,
Frequency reference system	He-Ne laser, 633 nm
Source	Coilform, air cooled
Dimensions	330 x 250 x 160 mm
Weight	10 kg
Power consumption	+/- 12V, +5V, 2.35VDC, 35 W; (option 12 VDC)
Temperature environment	15 °C to 30 °C
Humidivironment	Below 65%, non-condensing

Interferometer

The interferometer compartment under cover is 250 x 250 mm wide and 140 mm high. The radiation from the IR source is collected by a 90° off-axis parabola and directed into the interferometer.

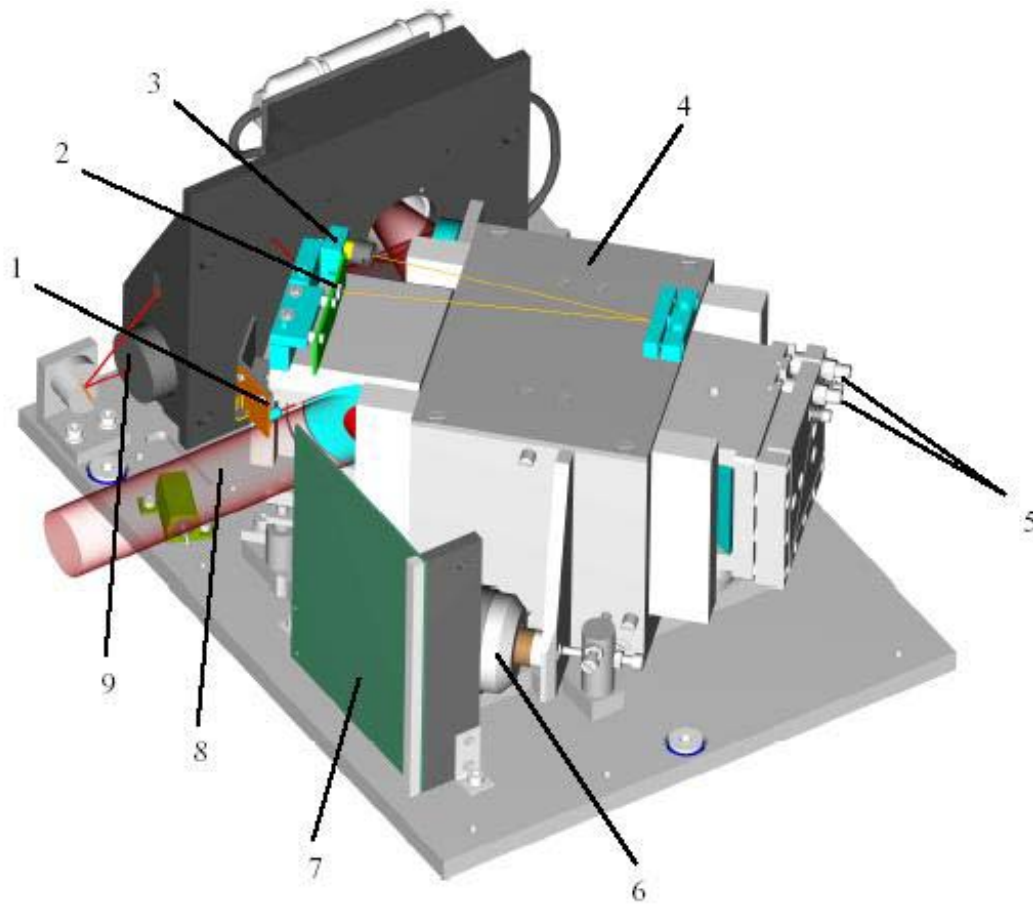


Fig. 5 Interferometer of the module

1- HeNe laser fringe photodiode, 2 – Centre pointer photodiode, 3 – Diode laser, 4 – Scanning part of the interferometer, 5 – Interferometer adjustment screws, 6 –Voice coil motor, 7 – electronics board, 8 – Output IR beam, 9 – HeNe Laser

The interferometer splits the radiation beam, modulates the intensity of all frequencies and then recombines the beams. The beamsplitter inside the interferometer separates the radiation beam into two beams of nearly equal intensity. Both beams are reflected from the end mirror-prisms back to the beamsplitter, where the beams recombine.

Radiation Source

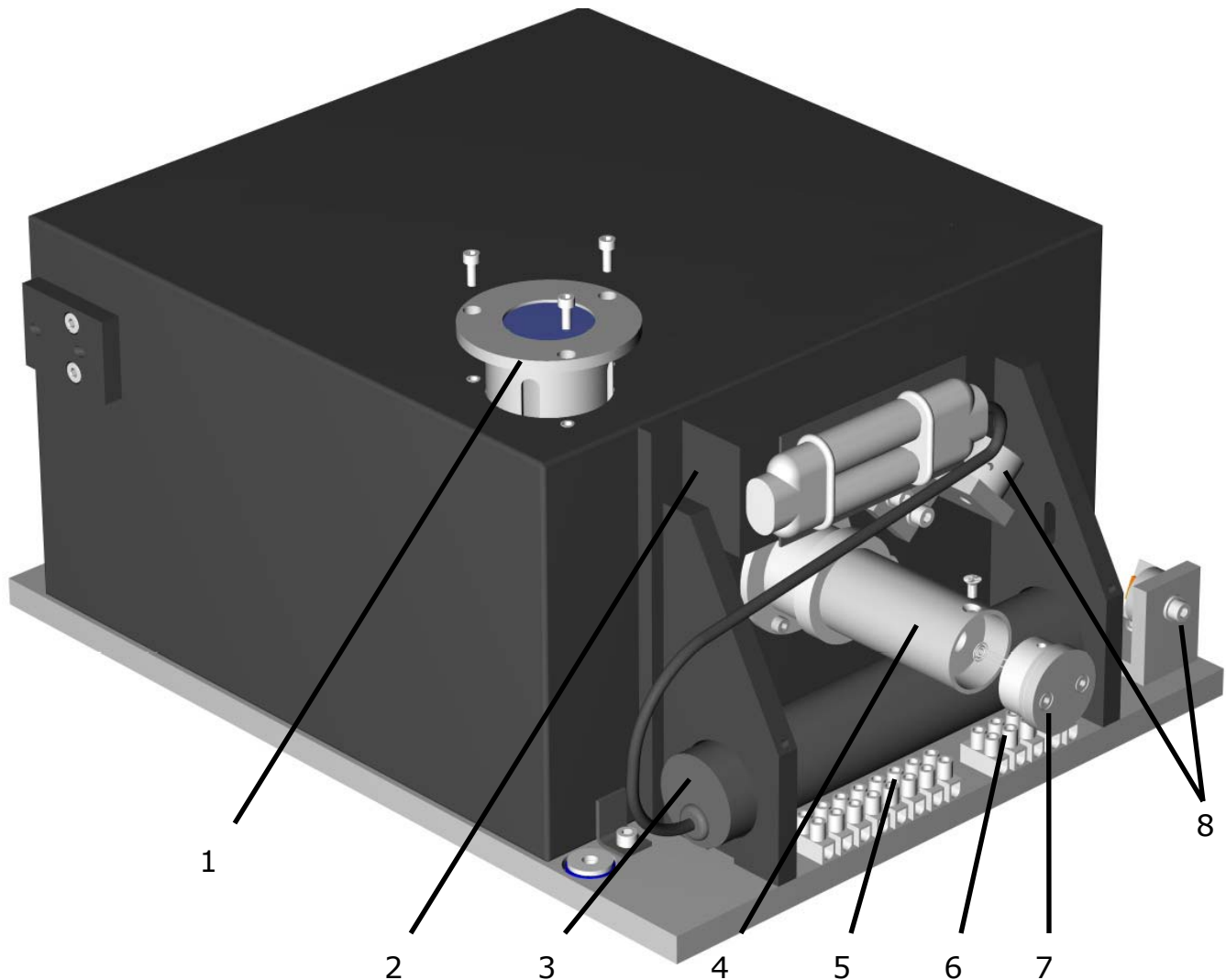


Fig. 6 Outside components of the module

- 1 – Desiccant cartridge
- 2 – HeNe laser power supply
- 3 – HeNe laser tube
- 4 – IR source main body

- 5 – Input power connectors
- 6 – Digital output signals connectors
- 7 – IR source replacement part
- 8 – Laser beam mirrors

The radiation source is situated on the front side of the module. The IR source is a high intensity long life device made from a special alloy wire to achieve excellent instrument sensitivity and stability. Neither cooling water nor purge gases are required for this unique low power infrared source. The source is housed so as to achieve a very high operating temperature with minimum power. The colour temperature of the source is about 1200 °C and the heating power is about 15 W. The applied voltage 2.35V must be stabilized using a feedback loop power supply.

To replace the IR source the following steps are needed:

1. Turn off your module;
2. Disconnect the source from the instrument power connectors;
3. Unscrew the captive screw, take the source replacement part away from the source main body;
5. Put carefully a new source replacement part into the source main body;
6. Fix the captive screw;
7. Connect the source back to the instrument power connectors;
8. Switch on the module.

Desiccant cartridge

There is one desiccant cartridge with colour changing crystals inside the interferometer compartment (Fig.6). If the desiccator has blue crystals that means the interferometer compartments are filled with dry air. When the colour of desiccant becomes half pink – half blue it is time to change the desiccant with the new and dry one. Unscrew the three M3 bolts with the 2.5 mm hex wrench and take the desiccant cartridges out. Turning the cartridge slightly about its window counterclockwise opens the cartridge. Change the old desiccant crystals with the new and dry one. Put the cartridge back to its place.

CAUTION

The KBr beamsplitter as well as the KBr compensator in the interferometer are highly sensitive to moisture. This is the reason why desiccators should be checked regularly for a blue colour. If the colour becomes half blue - half pink , replace the desiccator immediately. Moisture inside the interferometer compartment may cause damage of your instrument. During the following procedure, the purged optical system is exposed to the atmosphere. To minimize the loss of purge, have the new desiccant ready before you begin, and complete the procedure as quickly as possible. Do not start the procedure if the temperature of the module has not equilibrated with the ambient temperature of the laboratory. Do not start the procedure if the relative humidity of the laboratory is more than 65%.

Electrical connections




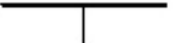
Connector No.

Purpose

Input power

1	IR source
2	IR source
3	2.35 VDC, 5.5A
4	2.35 VDC, 5.5A
5	+12V (nominal 0.5A, max. 1A)
6	GND
7	-12V (nominal 0.1A, max. 0.5A)
8	+5V (0.1A)
9	12V AC/DC (Heating resistors)
10	12V AC/DC (Heating resistors)

Digital output signals

11	GND
12	 Laser zero (~ 6 kHz, 45 000 laser zeros)
13	 Laser sync (~ 3 kHz, 22 500 laser syncs)
14	 Forw./Backw. (duration of scan ~7 sec.)
15	 Start of scan (1 microsec.)

Electronics

The electronics board is situated immediately near the interferometer (Fig.5). The electronics board is for the control of the interferometer scanning system .

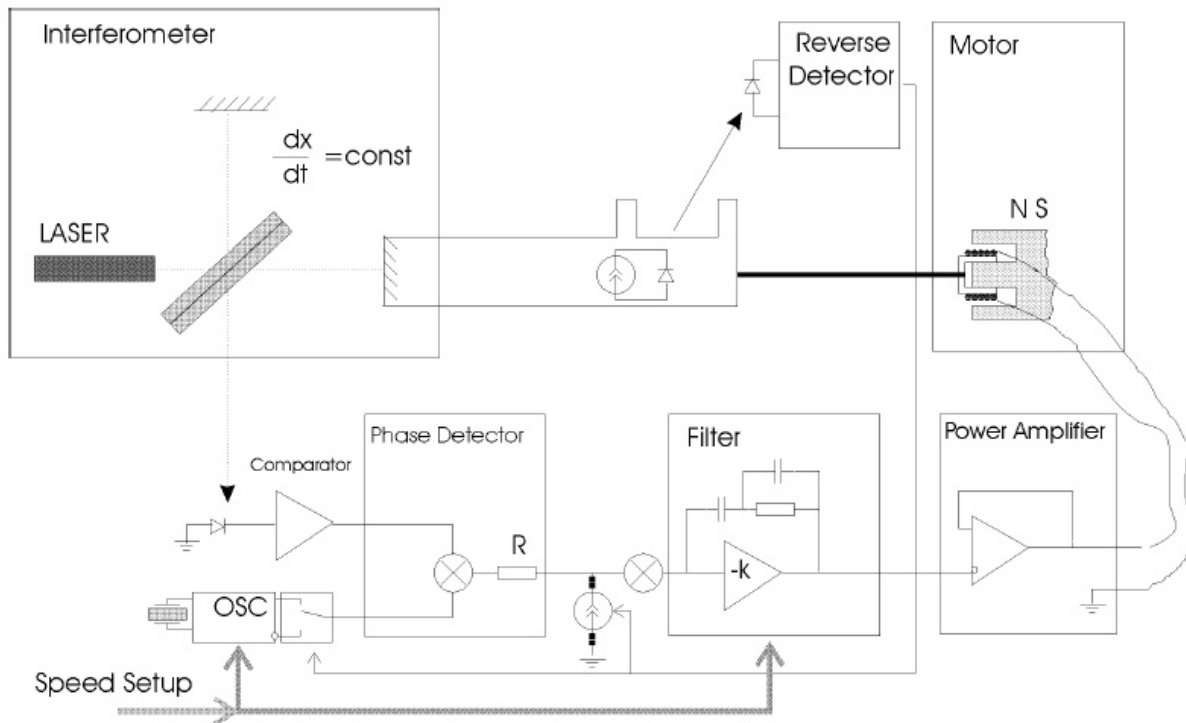


Fig. 7 Interferometer PLS scanning motor schematics

Checking the Sealing Window

The KBr window for output beam in the cover of the interferometer compartment is sensitive to moisture and should be checked regularly for cracks, discoloration and fogging. This is to ensure maximum transmittance.

If required, the window can be replaced by your nearest service agent or supplier. Window replacement is not complicated and is normally considered to be a customer procedure .

Troubleshooting: Aligning the interferometer

If the interferogram signal is lower than usually it is recommended to align the interferometer. Wait at least 15 minutes after turning on the module before aligning. Use your 1/16" hex wrench to align the interferometer.

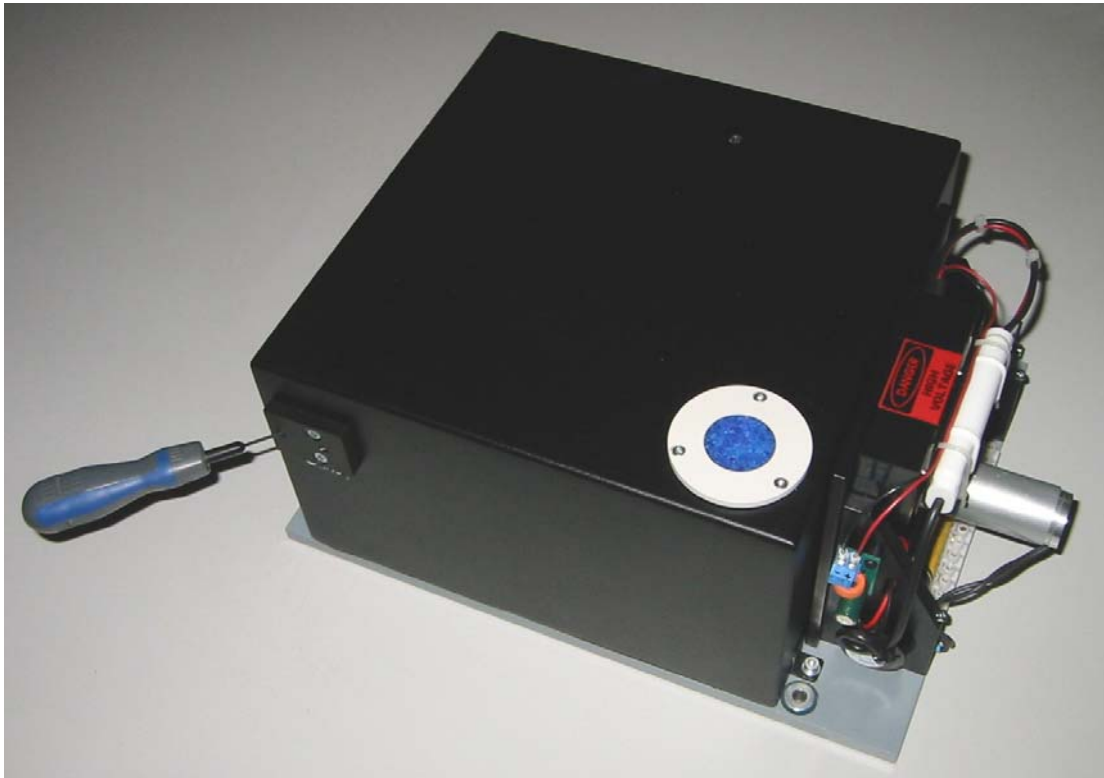


Fig. 8 Alignment of the interferometer

Make sure nothing is blocking the output beam from the module. Insert carefully your 1/16" hex wrench into one of the alignment directive holes. First you can feel a little obstacle – this is a rubber sheet protecting the interferometer from the outside environment. But there is a little opening (in fact it is closed as it is a rubber) in the rubber sheet letting the screwdriver to get through. After that push the screwdriver carefully further until you can feel that you have reached the adjustment screw nest (or socket). Use your module system monitor for displaying a live interferogram.

Turn your screwdriver less than half a degree clockwise. Watch the value of the interferogram in the monitor. If the interferogram signal increases, continue to turn the wrench in the same direction. If the interferogram height was decreased, turn the wrench counterclockwise. Continue turning the wrench step by step in the direction that increases the signal until the signal begins to drop. Wait after each turn for the interferometer to stabilize. When the interferogram signal begins to drop, turn the wrench in the opposite direction until you are back to the highest interferogram signal level. Repeat the abovementioned procedure using the other alignment hole (screw) until the highest possible interferogram level is obtained. You may need to repeat these steps several times (alternating between the two alignment screws (holes) for each step) before the interferometer is properly

aligned.

Troubleshooting: Aligning the laser mirrors

If the laser fringe detector is out of alignment the interferometer will not translate smoothly but will jump from one end to the other. The laser spot on the laser fringe detector (Fig.5) may be displaced from its correct position. Opening the cover and turning the laser mirror(s) (Fig. 6) try to direct the laser spot back onto the centre of the laser fringe detector. You can see a couple of laser spots near the laser detector. The centre spot (most intensive) is the right spot to align onto the detector. To find the most appropriate position you may use an oscilloscope and two-pin female connector. There is a two-pin male connector near the laser detector on the laser detector circuit board. Turning the laser mirror slightly try to find the position of the highest signal level from the laser detector (1.5 - 2 V). Fix the mirror. This alignment procedure may also be made with the scanning motor disconnected. You may disconnect the two-line cable of the scanning motor and move the scanning block by hand until you find the highest signal position for the mirror. After that connect the scanning motor to its power line. The interferometer should starts to rock smoothly. The laser mirror alignment may be required when replacing the laser. If your laser is either not working properly (blinking) or burnt out it will require changing. There is a HeNe laser model 1108P in your module manufactured by JDS Uniphase. When you replace the laser mirror adjustment may be required. Follow the abovementioned procedure to get the highest signal level from the laser fringe detector.

LIMITED ONE YEAR HARDWARE WARRANTY

The manufacturer, through its agents, representatives and overseas offices warrants each TEO400 FTIR module to be free from defects in material and workmanship for a period of one year from receipt by the end user (proof of purchase may be required).

EXCLUSIONS

The above warranty shall not apply to defects resulting from abuse, mishandling, misuse, accident, alteration, negligence, operation outside of the environmental specifications for the device, improper installation, site preparation or maintenance by the customer, customer supplied other systems or software or interfacing. Certain subassemblies, accessories or components may be specifically excluded from this warranty. Neither does the manufacturer warrant, guarantee, or make any representations regarding the use, or the results of such use, of the software or written material in terms of correctness, accuracy, reliability or otherwise. Sciencetech Inc. reserves the right to make changes to the specifications of the instrument, its software and the content of this short description, without obligation to notify any person or organization of such changes.

WARRANTY LIMITATIONS

The manufacturers make no other warranties, which extend beyond the description herein. This warranty is in lieu of, and excludes any and all other warranties or representations, expressed, implied or statutory, including merchantability and fitness, as well as any and all other obligations or liabilities of the manufacturer, including, but not limited to, incidental or consequential damage.

LICENCE

The TEO400 module may be sold with software for use on a single computer at any one time. Any form of multiple use, or unauthorized copy constitutes a license infringement for which we will wish to secure appropriate damages.

OBTAINING SERVICE DURING OR AFTER WARRANTY

Should your instrument fail during or out of the warranty period, you should then, contact your nearest sales office for further assistance.

If you ever wish to ship your module, be sure it is packed in a protective carton and that all locking screws and transit locks are secured. We recommend that you save the original shipping container for this purpose as in-transit damage is not covered by the warranty.

In the (unlikely) event that you experience problems that cannot be resolved by the supplier, please feel free to contact us at any time. Our address is as follows:

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London, ON
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CANADA
Tel: 1-519-668-0131
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Table of Contents

• Inspection	2
• Unpacking	2
• Setting up	2
• What you should already know	3
• Site Requirements	3
• General Safety.....	3
• Electrical Safety	4
• Laser safety	5
• Module	6
• Specifications	9
• Interferometer	10
• Radiation source	11
• Desiccant cartridge	12
• Electrical connections	13
• Electronics	14
• Checking the sealing window	14
• Troubleshooting: Aligning the interferometer	15
• Troubleshooting: Aligning the laser mirrors	16
• Limited one year hardware warranty	16
• Exclusions	16
• Warranty limitations	17
• Licence	17
• Obtaining service during or after warranty	17
• Notes	18
• Table of contents	19
