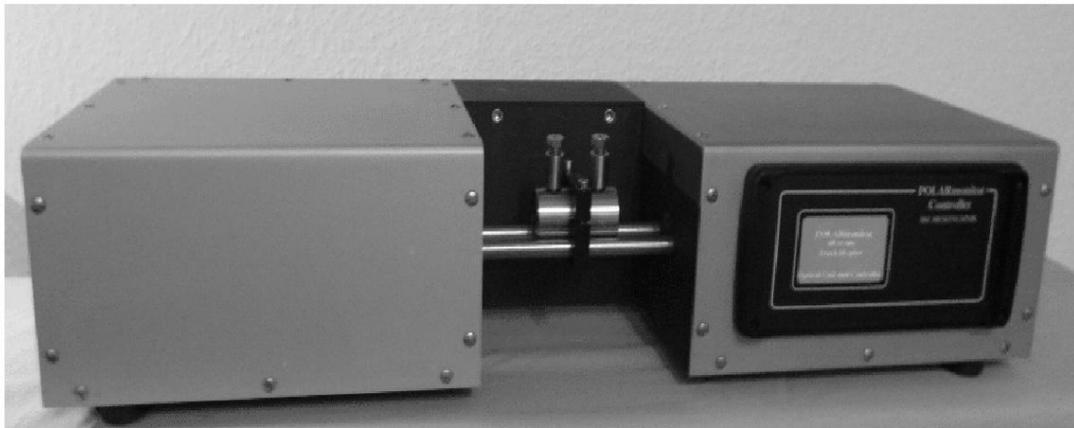


POLARmonitor

Version All-in-one

Technical Manual

REV. 2016



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Technical Manual

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1. Notes and Warnings

This apparatus has been designed and manufactured in accordance with 2014/30/EU (EMI) / 2014/35/EU (EMC) resp. IEC / CE and has left the factory in perfect condition as regards the relevant safety and CE regulations.

In order to maintain this perfect condition and to ensure safe operation, the user should observe the notes and warnings contained herein.

Prior to switching this apparatus on, please make sure that the mains voltage corresponds to the voltage stated on the apparatus and that the mains supply is correctly grounded. The protective effect must not be reduced by any unearthed extension lead.

Any interruption of the earth wire inside or outside the apparatus or loosening of the earth wire connection can make an apparatus dangerous. Intentional interruption is not permissible.

Opening of covers or removing of parts may expose live parts. Connections points may also be live !

Before making any adjustments, servicing, overhauls or before replacing any parts, the apparatus must be disconnected from the mains supply, if it needs to be opened.

If it becomes necessary to work on the apparatus whilst it is open, this must only be carried out by a skilled person, who is familiar with the dangers involved.

Care has to be taken to ensure that only fuses of the indicated type and nominal amperage are used. It is neither permissible to use mended fuses nor to short-circuit the fuse holder. The apparatus should not be operated, if there are any doubts about its safety, and it should then be taken out of service and secured against unintentional use.

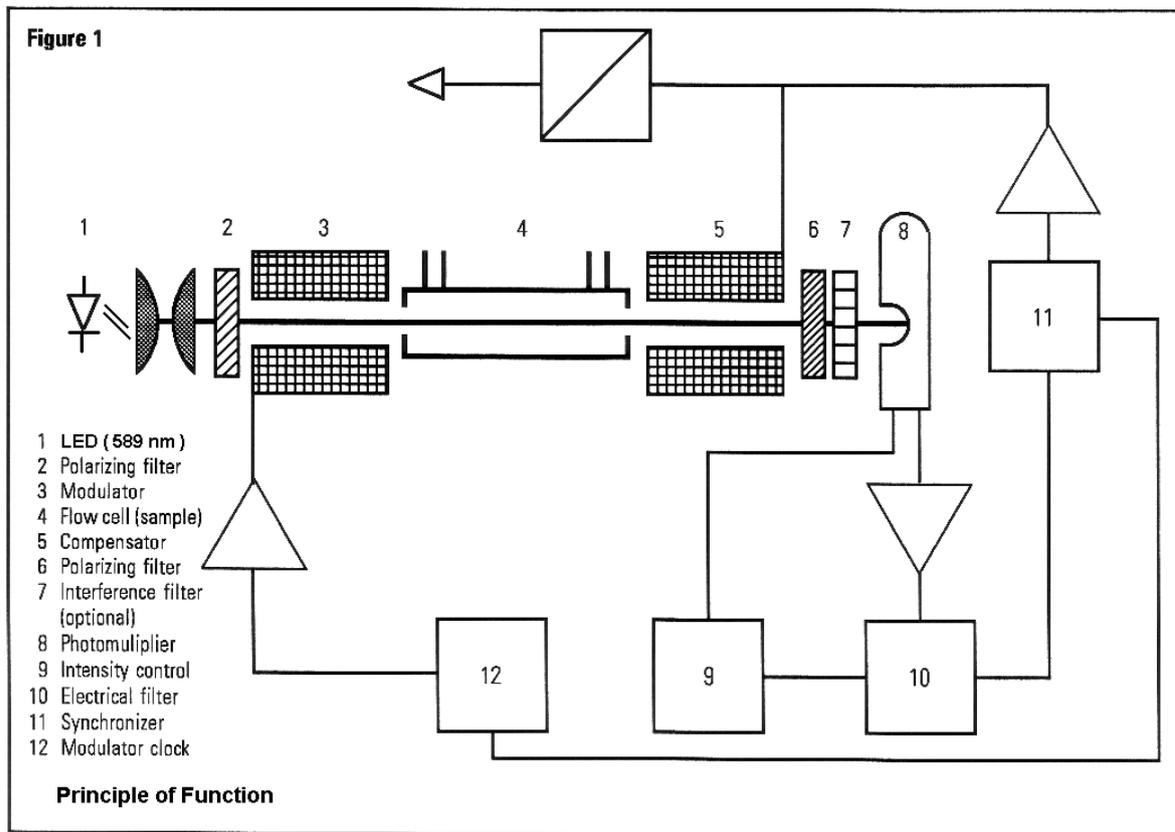
Reasons for suspecting the apparatus to be unsafe, include the following:

- visible damage,**
- no function,**
- prolonged storage under unfavourable conditions,**
- severe stresses due to unsuited transport.**

2. Principle of Function

Light from the LED light source (1) is linear polarized by the first polarization filter (2) and then sinusously modulated by the Faraday modulator (3). The modulated light passes the measuring cell (4) and the compensator coil (5) and comes to the second polarization filter (6), which is cross arranged to the first polarization filter (2). Due to this cross arrangement, maximum light extinction is obtained and the intensify-controlled photomultiplier (8,9) receives a zero position signal.

This zero position signal is changed by an optically active sample in the measuring cell and causes a current flow (electro-magnetic field), generated by the electronics (10,11) into the compensator coil (5). This current flow compensates proportionally (Faraday compensation) the optical rotation of the sample as long as the zero position signal is obtained again and then is displayed.



3. Connecting Diagram

Before connecting the POLARmonitor to mains, make sure that your voltage (mains) corresponds to the voltage labeled at the rear side of the instrument and is grounded properly.

Installation must only be done by a skilled person familiar with the dangers eventually involved.

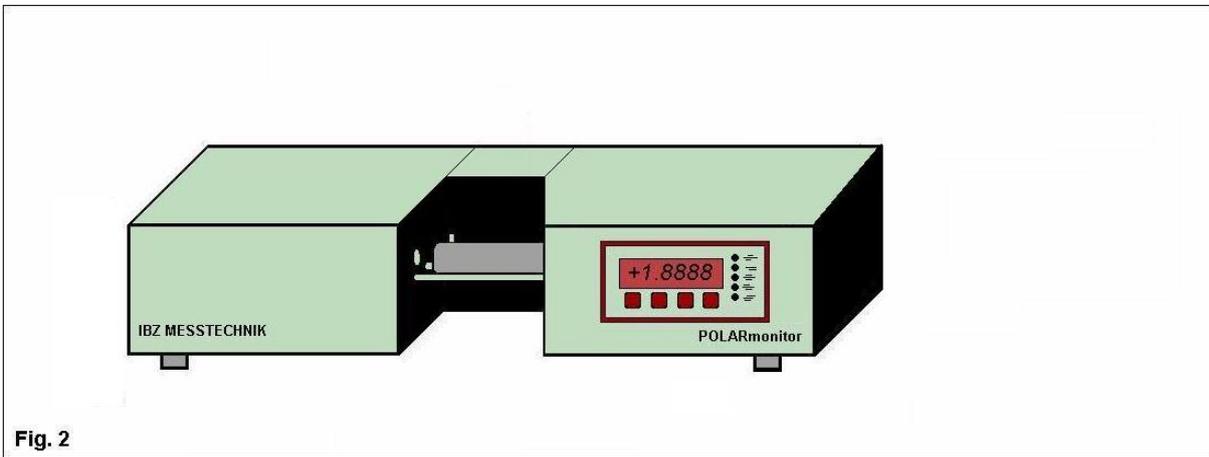
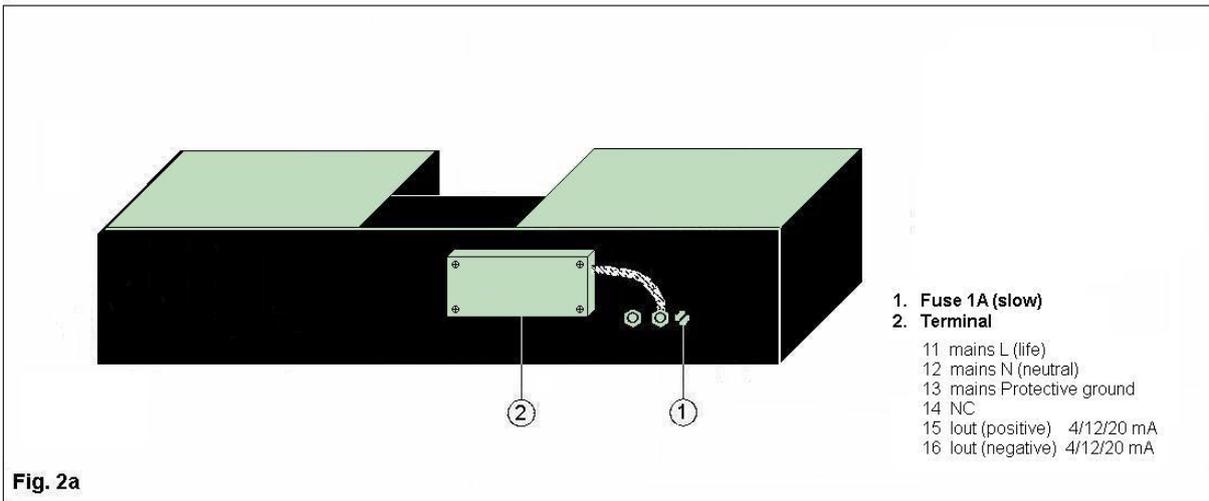


Fig. 2

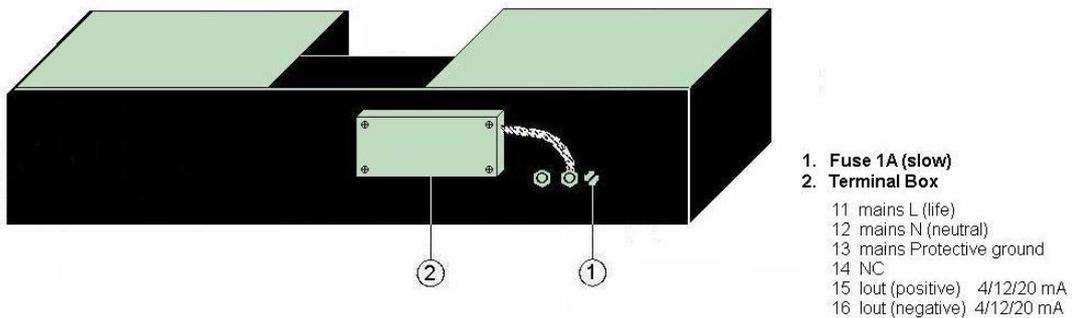


- 1. Fuse 1A (slow)
- 2. Terminal
- 11 mains L (live)
- 12 mains N (neutral)
- 13 mains Protective ground
- 14 NC
- 15 Iout (positive) 4/12/20 mA
- 16 Iout (negative) 4/12/20 mA

Fig. 2a

3.1 Terminal Box

The terminal box is located at the rear side of the instrument.



Terminal connectors

- 11 mains L (live)
- 12 mains N (neutral)
- 13 mains Protective ground
- 14 NC (no connection)
- 15 Analog out positive potential (current or voltage)
- 16 Analog out negative potential (current or voltage)

IMPORTANT

Analog out have floating potential and must not be connected to mains protective ground nor common ground.

Close the PG 7.5 fittings with a rubber membrane when not in use.

4. Measuring Cell

The length of the measuring cell is inverse proportional to the measuring range. Half length doubles the measuring range. The quality of the measurement relates closely to the correct choice of the cell. Generally, the instrument system noise increases with a smaller diameter. Ensure that the flow through the cell is in the correct direction.

Like that, separation in LC will get worse if volume is too high.

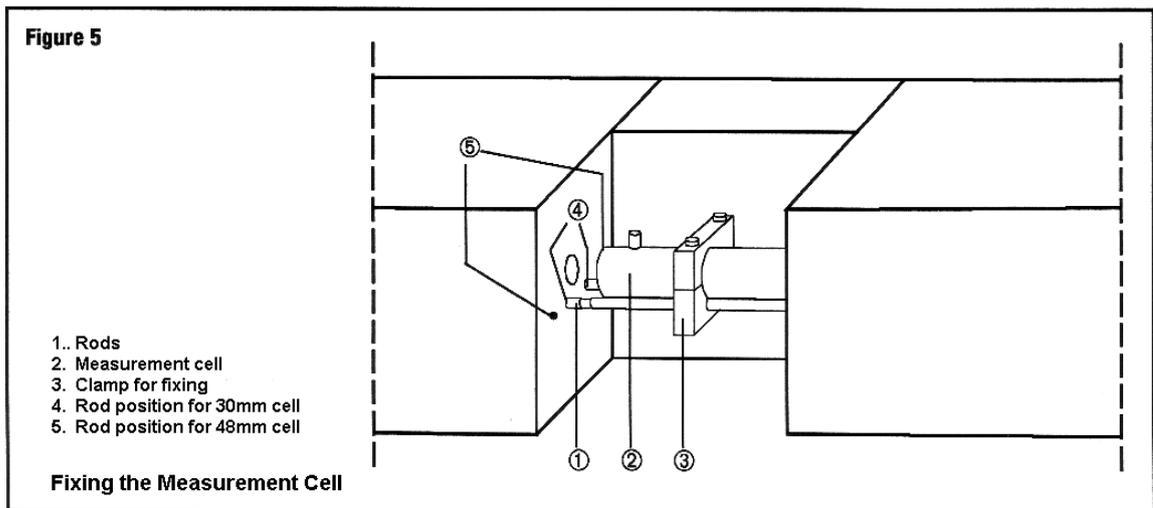
By loading under higher pressure, use appropriate high pressure cells. Beside this, take care of digestibility of the mobile phase and the sealings. For temperature sensitive compounds use thermostatable cells.

4.1 Fixing the Measuring Cell

The measuring cell (2) is fixed by a clamp (3) midside on the rods (4 or 5). Because every cell causes a inherent rotation depending on its position, make sure that the cell is firmly secured during the measurement.

The position (radial or axial) of the cell must not vary while measurement.

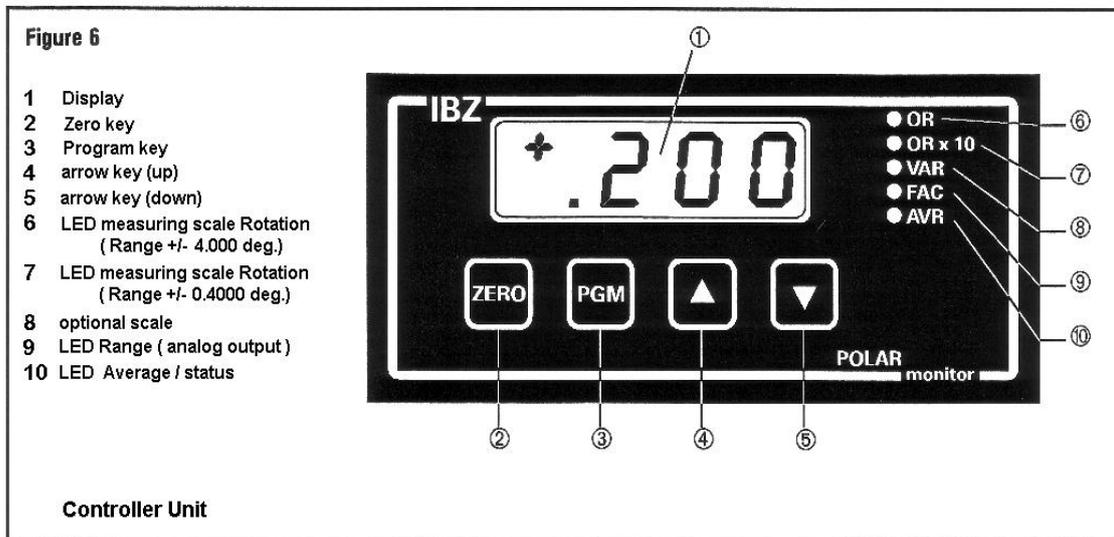
The position of the rods has to be symmetrically, position (4) corresponds to 30 mm diameter cell and position (5) to 48 mm diameter. Fix the rods by using a 9 mm wrench, threads to the left.



5. Controller Unit

The Controller consists of a precision amplifier, microprocessor controlled, which makes the use of the instrument easy and guarantees reproducible settings. All operations can be set by using the frontal keyboard or the serial interface.

LED diodes indicate the corresponding status of the instrument.



5.1 Analog Output

The **current output** must not have ground/earth connection (floating mode). Maximum load is 200 ohm. The range corresponds to the settings in the FAC mode (see 6.1, FAC). Factory adjustments on the right.

4 / 12 / 20 mA (zero at + 12 mA)

The **voltage output** must not have ground/earth connection (floating mode). Minimum load is 100 kiloohm. The range corresponds to the settings in the FAC mode (see 6.1, FAC). Factory adjustments on the right.

0 / 500 / 1000 mV (zero at 500 mV)

5.2 Serial Interface

The serial interface has RS 232c standard format. Data output on the TxD (transmit data) is obtained by sending “?” on the RxD (receive data) line. See appendix 9. (page 15) for all control codes. All data are transmitted as ASCII character. In the case inadmissible absorbance due to bubbles, a continously data string “ENERGY” is sent.

Data format (9600/8/1)

9600 baud
8 data bit
1 start / stop bit , no parity

6. Start of Measurement

Apply mains to the terminal box.

A separate switch to disconnect mains is recommended. After a short self- diagnostic the instrument starts automatically. The status LED "OR" will light up and the LED "AVR" indicates by short constant flashes that measuring values are processed. The instrument offset (rotation offset) will be displayed.

If this offset exceeds 300 digits, the optical balance has to be adjusted manually (see 8.2, optical balance).

Pushing the ZERO key resets the offset and the instrument is ready for operation with the following standard (default) values:

OR	(Range $\pm 4.000^\circ$)
FAC 4000	(Analog output $\pm 4.000^\circ$)
AVR 4	(4 cycles per measurement)

6.1 Change of Default Settings

By pressing the PGM key, the following settings can successively be done. Within the settings, select values by Up- and Down Arrow key.

- OR : Optical Rotation
Range + / - 4000 m° (default setting)
Resolution 0.001°
- OR x 10 : Optical Rotation Skala,
Range + / - 0.4000 °,
Resolution 0.0001°
- VAR : Optional scale,
Baseline offset (option)
Concentration (user / option)
- FAC : Analog output
current / voltage
Select with Up- and Down Arrow key.
- AVR : Average
(cycle per measurement).
Select with Up- and Down Arrow key.

Range + / - 4.000 °

Range + / - 0.4000 °

VAR 0060 for current output
4 /12 /20 mA

VAR 0050 for voltage output
0/500/1000 mV

FAC ± 4.000 (only OR)
FAC ± 2.000 (only OR)
FAC ± 0.4000 (only ORx10)
FAC ± 0.2000 (only ORX10)

2 minimum (fast)
100 maximum (slow)

After you have changed the settings, go back to the optical rotation scale "OR" or "ORx10" by selecting via the PGM key and then press the ZERO key to perform an autozero. The instrument is now ready for operation with the selected settings.

7. Trouble Shooting

Message / Fault	Possible cause	Rectification
<p>No indication on display</p> <p>AVR LED not flashing in OR (ORx10) scale</p> <p>Optical offset higher than 300 digits after switching instrument on</p> <p>Display alternates between 0000 / 8888</p> <p>Display shows HHHH or LLLL</p> <p>FAC and AVR LED are flashing alternately</p> <p>Displayed values are unstable or show drift</p> <p>Displayed values show drift</p> <p>Displayed values change when voltage-/current output is connected</p>	<p>No mains applied or fuse blown</p> <p>Program is not running</p> <p>Instrument offset too high</p> <p>Air bubble in flow cell or absorption too high</p> <p>Measuring range overflow (HHHH) or underflow (LLLL)</p> <p>current / voltage output overrange</p> <p>Air bubble in flow cell Cell windows broken</p> <p>Instrument not yet thermically balanced. Cell windows mechanically stressed</p> <p>voltage-/current output connected to ground/earth</p>	<p>Check mains supply Change fuse</p> <p>Switch instrument off and restart as usual</p> <p>Adjust manually Optical Balance (see 8.2)</p> <p>Purge flow cell</p> <p>Increase Range or use shorter flow cell</p> <p>Increase analog range by FAC setting or use shorter flow cell</p> <p>Purge flow cell Change cell windows (see 8.1)</p> <p>Wait until instrument is balanced. Open cell and fix windows with low torque (see 8.1)</p> <p>Disconnect ground/earth connection from output</p>

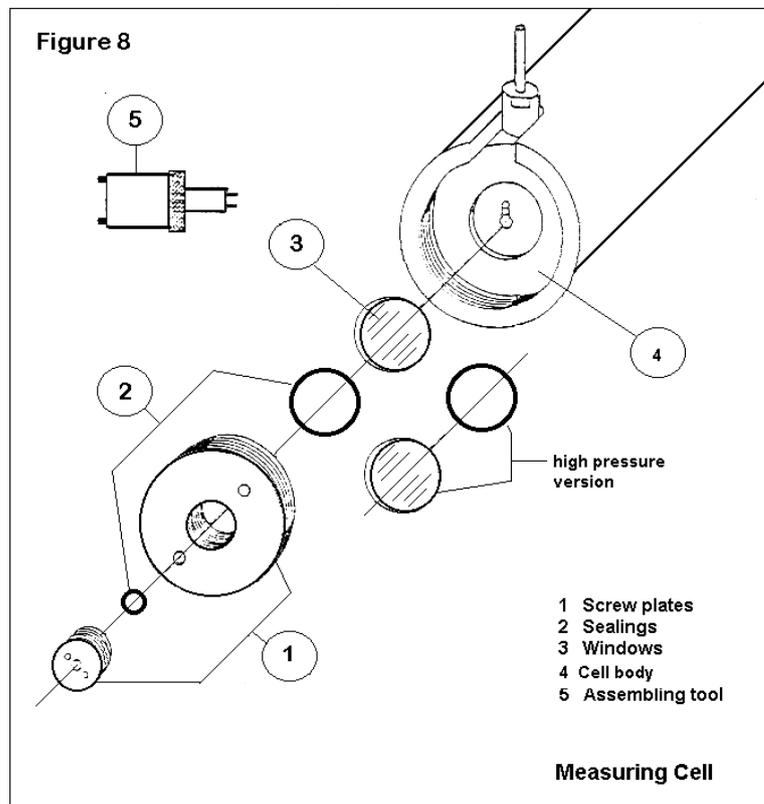
8. Service Instructions

This service instructions must only be carried out by skilled person

8.1 Replace cell windows

The cell windows have to be replaced if they are broken or unclean.
 Open both screw plates (1) by means of the supplied assembling tool (5).
 Remove the defective window (3) and the sealing (2). Before putting the new window in place, ensure that the supporting area at the cell body (4) is absolutely clean.
 Pay attention to the correct sequence of the parts. Depending on “normal pressure” or “high pressure” version, windows and sealings and cell body are different and are not interchangeable.

Assemble the larger screw plate first with low force until you feel a slight resistance indicating contact to the sealing / window.
 Then assemble the small screw plate in the same matter.
 Always work with low force otherwise windows will be stressed and show drift effects or even get broken.
 Repeat procedure in this mind with the other side of the cell.



8.2 Optical Balance Adjustment

The optical balance has to be adjusted after replacement of the LED light source or the cell windows. It is also necessary if the instrument's offset had become too high (more than 300 digits) and the symmetrical measuring range has to be re-established again.

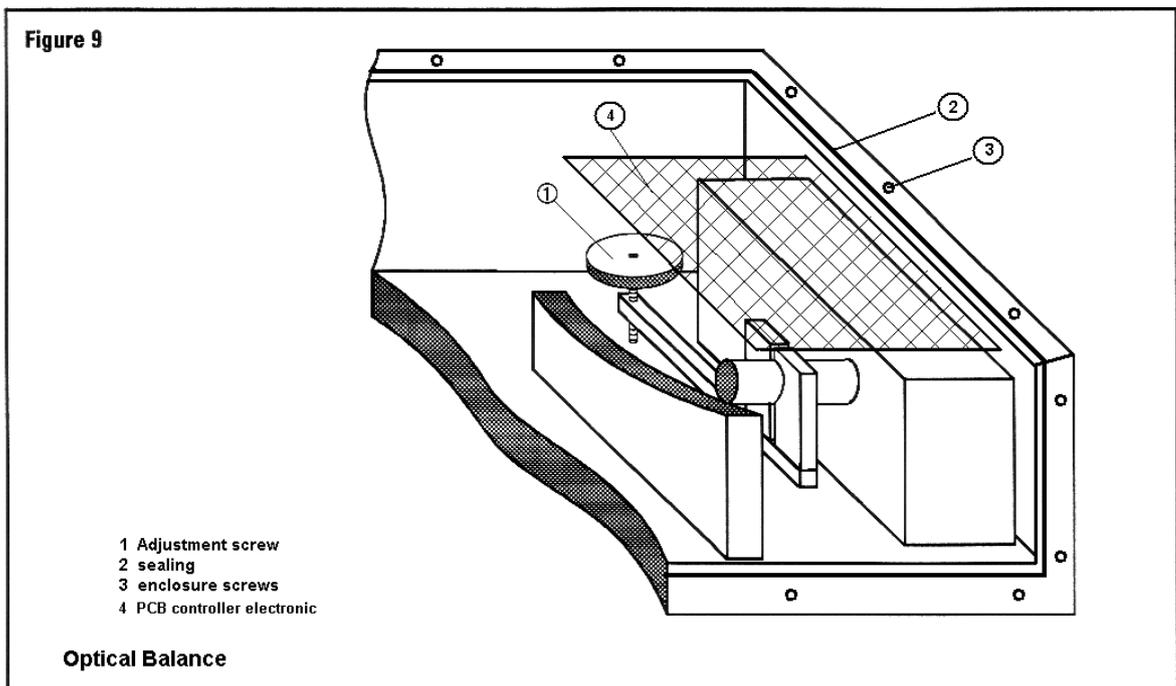
The measuring cell should be absolutely dry (blow with pressed air) or completely filled (no bubbles !) with water.

Remove the right cover of the optical unit by open the enclosure screws. Switch instrument on and do **NOT** push the ZERO key. The instrument's rotation offset will be displayed.

Turn the adjustment screw (1) very slowly clockwise a half turn and watch the display. If the displayed value becomes lower, then turn the adjustment screw in the same direction as long as the display shows values below ± 100 digits.

If the displayed values becomes higher, then turn the adjustment screw anti-clockwise to get values below ± 100 digits.

Close the cover and fix the enclosure screws (3) Take care for correct position of the surrounding sealing (2).



9. Appendix

Control codes for serial interface

Remote control via serial interface RS 232c

version: POLARcontroller1

Status	Send (from host)	Action	Receive (to host)
operation	?	enable data	DATA
operation	Z	set ZERO	
operation	P	enable program	?
program	100 [CR]	enable operation (OR scale)	DATA
program	200 [CR]	enable operation (OR x10 scale)	DATA
program	300 [CR]	actual baseline setting	VAR
program	301 ... 398 [CR]	change baseline setting	VAR
program	400 [CR]	actual recorder setting	FAC
program	401 ... 403 [CR]	change recorder setting	FAC
program	500 [CR]	actual average setting	AVR
program	502 ... 598 [CR]	change average setting	AVR

RS232c : 9600 baud, 1 stop, 1 start, no parity

Printout: **DATA:** *POL x.xxx(x)*
 VAR: *Baseline offset xx %*
 FAC: *RECORDER 2000 / 200 / 20 milligrad / 2V*
 AVR: *AVERAGE: xx*

Example 1: Request for measuring data

Send ?
 Receive **DATA** Format (*POL x.xxx(x)*)
 continue operation

Example 2: Change recorder setting

Send **P**
 Receive ?
 Send **402 (CR)** (*carriage return*)
 Receive **FAC** Format (*RECORDER 200 milligrad / 2V*)

 Send **P**
 Receive ?
 Send **100 (CR)** (*carriage return*)
 Receive **DATA** Format (*POL x.xxx*)
 continue operation