

YL9170 RID (S.N number: SNLC-202107-02)

## How to adjust the optical system of YL9170 RID

Update date: July.22<sup>th</sup>, 2021

Adjustment procedure is necessary when you replace a light source or the optical balance value is out of normal operation range due to mobile phase change or any other service issue. There are two adjustment parts in the optic, one is a light source position and the other one is a mirror position. Light source is related to sum value of light energy and it is required to adjust the position of it so that the light beam passes properly into the slit. Mirror is related to difference value of light energy and the proportion of light energy on the photodiode between Sample and Reference is decided by the mirror position.

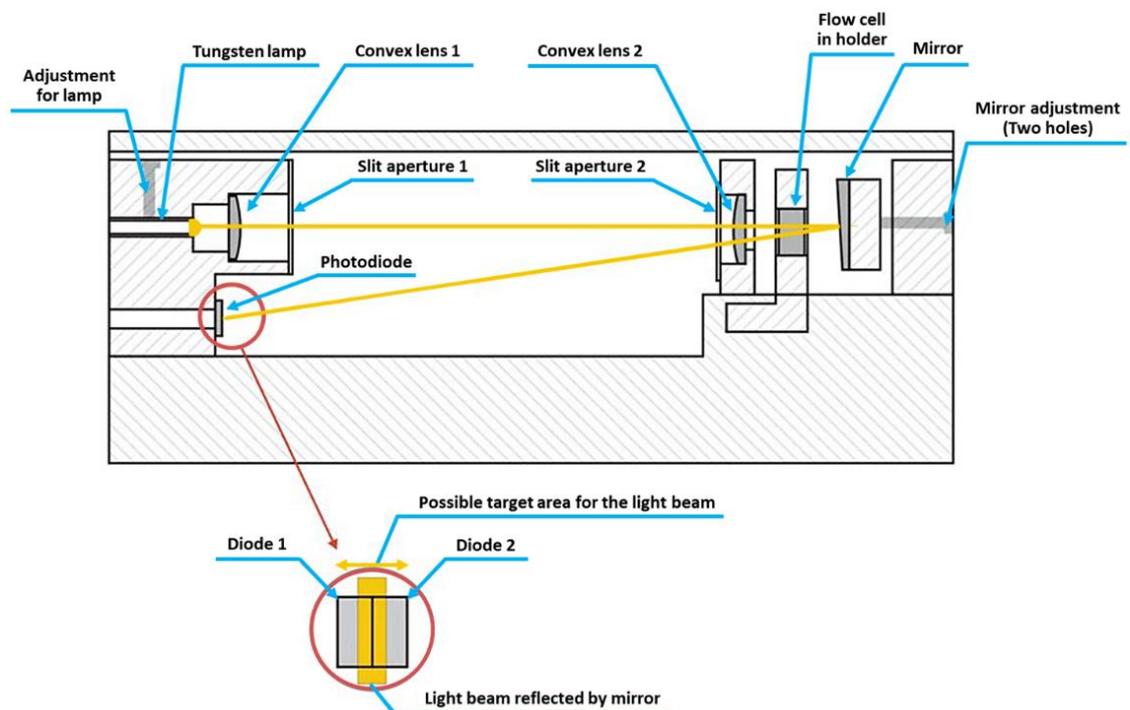


Figure 1. The optical system of YL9170 RID

## Service Note



### I. Open the cover of YL9170 RID

Lamp exchange and adjustment of the lamp might be possible that you need to re-adjust the light source due to some changes in the used light bulb due to the transport or you need to replace a burned out lamp. The adjustment of the light source is only possible when the housing is opened. To prepare for adjustment do the following steps.

1. Turn off the power of YL9170 RID.
2. Unplug the mains cable to prevent electrical shock when opening the housing.
3. Loosen four screws located rear side of YL9170 RID.
4. Open the cover of YL9170 RID.
5. Loosen the screws, open the outer housing of the optical bench, and remove the heat insulation on top of the optical bench in the order shown in Figure 2 so that you can see the inside of RID.

*\* Use a (+) screwdriver in step 1 and a 3 mm hex wrench in step 3 to loosen the screws.*

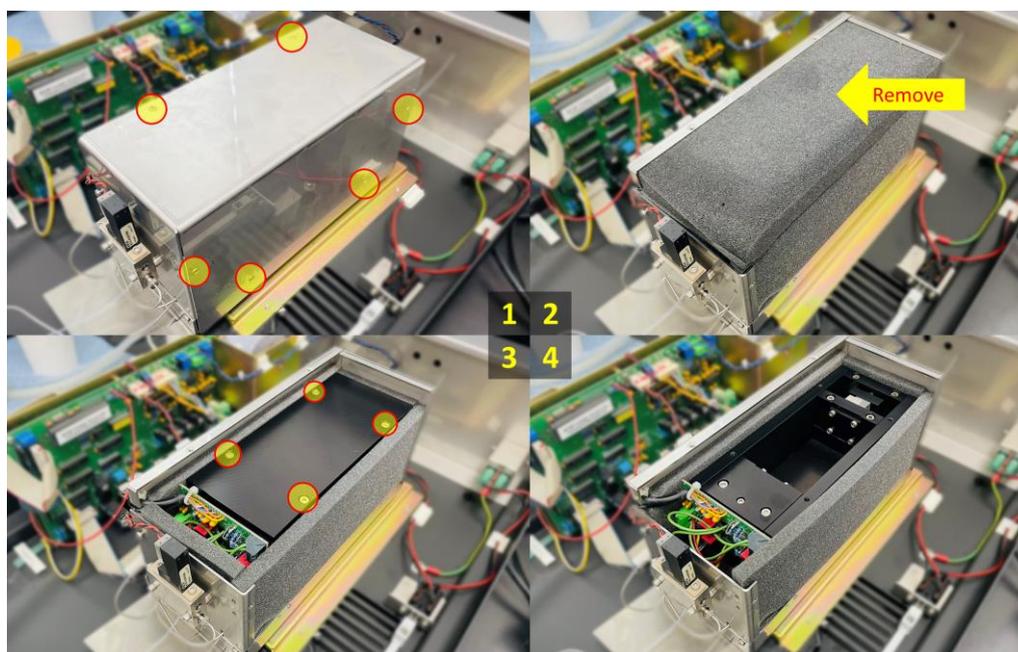


Figure 2. How to access the inside of RID detector

6. Turn on the power of YL9170 RID and wait for initialization is finished.
7. When you turn on the power of YL9170 RID, liquid crystal display (Figure 3) is turned on at the same time (installed on the left side of the RID from the front.).

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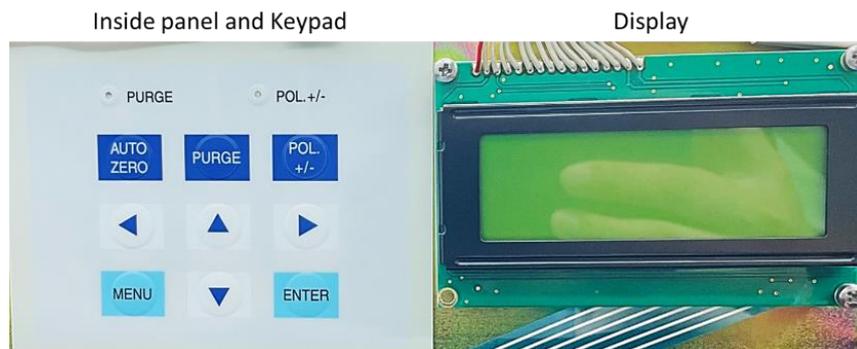


Figure 3. Inside keypad and display of YL9170 RID

## II. Fill the same liquid to the reference & sample flow cell

- To perform the adjustment, the sample chamber and the reference chamber of the flow cell have to be purged with distilled water.
- First, turn on the HPLC pump connected with YL9170 RID and turn on the flow.  
\* If you cannot use any pump, use a disposable syringe to press approx. 5 mL distilled water through the flow cell.
- Purge the reference chamber of the flow cell by pressing PURGE button (purge on) then stabilize for several minutes until the detector signal is stable.  
\* When purging is started by pressing the PURGE button, a green LED is ramp on located top of the purge valve, and a red LED is ramp on located on the keypad (see Figure 4).
- Then purge the sample chamber of the flow cell by pressing PURGE button again (purge off) then stabilize for several minutes until the detector signal is stable.

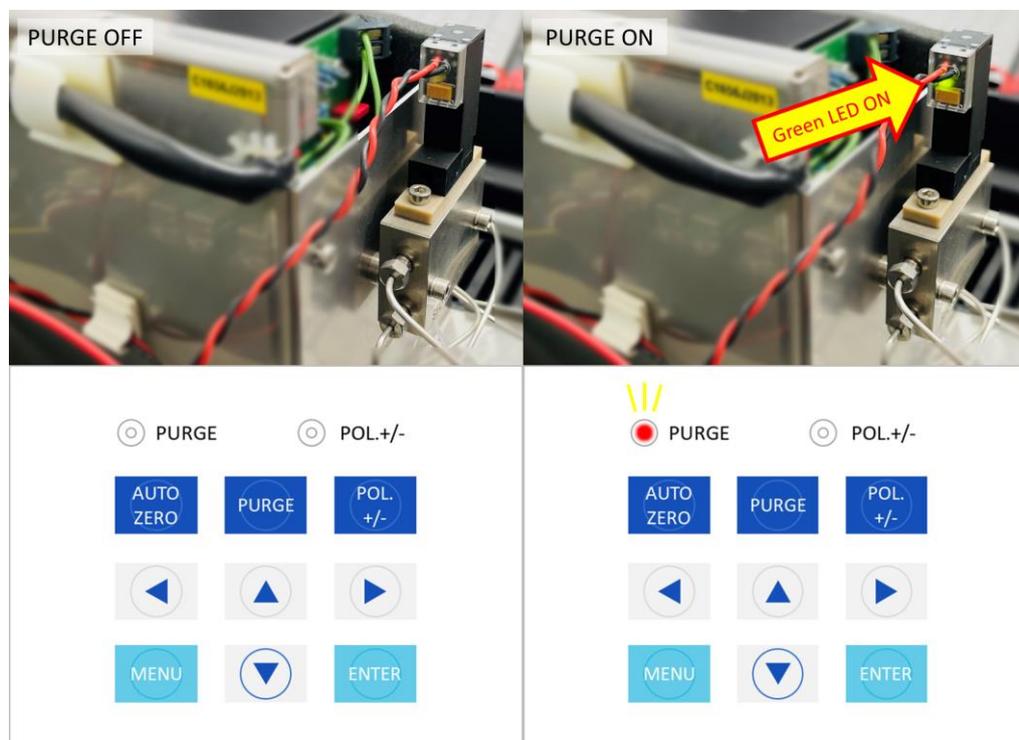


Figure 4. Purge On/Off indicator

## Service Note



### III. Checking 'Diff', 'Summ', 'Smpl', and 'Rfrn' voltages

These voltages result from different light intensities reaching the sample side and the reference side of the light sensor.

1. Make sure the YL9170 RID is turned on and both chambers of the flow cell are filled with distilled water (without air-bubbles).

*\* This process was finished earlier in chapter II. To ensure a stable temperature RID should be turned on for several hours before performing this operation.*

2. Activate the service mode of YL9170 RID by pressing the ArrowLeft (◀) and ArrowRight (▶) at the same time for approx. three seconds. Then display will change as shown in Figure 5.

```
Temp: +0028.500 °C
OptBal: +0013.425 %%
SIGNAL: +0031.700 mV
ServMode >> (E, ←, →)
```

Figure 5. Display – Service Mode

3. Press the MENU button until the status line in the display changes to ViewFine. Now press the ENTER button. The display will show four values (see Figure 6).

```
Check Source Unit ←↓
-0010 5030 2510 2520
SIGNAL: +0031.700 mV
ServMode >> ViewFine
```

Figure 6. Display – ViewFine

4. To find out which value is displayed in which column press the ENTER button. The display will change as shown in Figure 7.

```
Check Source Unit ←↓
Diff Summ Smpl Rfrn
SIGNAL: +0031.700 mV
ServMode >> ViewFine
```

Figure 7. Display – Check voltages

Table 1. Definition of each abbreviations

<i>Diff</i>	Represents the difference voltage (in mV) and corresponds to the difference of intensity reaching the sample side and the reference side of the light sensor.
<i>Summ</i>	Represents the sum voltage (in mV) and corresponds to the light intensity reaching both sides of the light sensor.
<i>Smpl</i>	Represents the sample voltage which corresponds to the light intensity reaching the sample side of the light sensor.
<i>Rfrn</i>	Represents the reference voltage which corresponds to the light intensity reaching the reference side of the light sensor.

*\* The voltages are calculated according to the following formulas (see equation 1).*

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Equation 1.

$$Diff = Smpl - Rfrn$$

$$Summ = Smpl + Rfrn$$

5. If you want to go back to the former view, press the ENTER button again.

#### IV. Acceptable values

1. Optical balance, 'Diff'

When both chambers contain the same liquid theoretically, the same light intensity should reach the sample side and reference side of the light sensor. In this case, the optical balance should be zero ( $0 \pm 10\%$  is acceptable normally).

2. Total voltage, 'Summ'

The sum voltage should be in the region of  $5,000 \pm 500$  mV. If this is not the case, adjust the lamp position or voltage by turning the potentiometer (R19) until the sum voltage is in the region of  $5,000 \pm 500$  mV. If not increased, replace the lamp.

*\* When you adjust the potentiometer, the lamp voltage should be  $3.3 \pm 0.3$  V.*

#### V. Adjustment of the lamp and mirror

For optimum RID adjustment, the lamp and mirror must be adjusted complementarily.

##### V-1. Lamp Adjustment

1. Open the outer housing of the optical bench and inner black housing of the optical bench (refer to chapter I.)
2. Loosen the holding screw (see Figure 8) of the light source slightly.

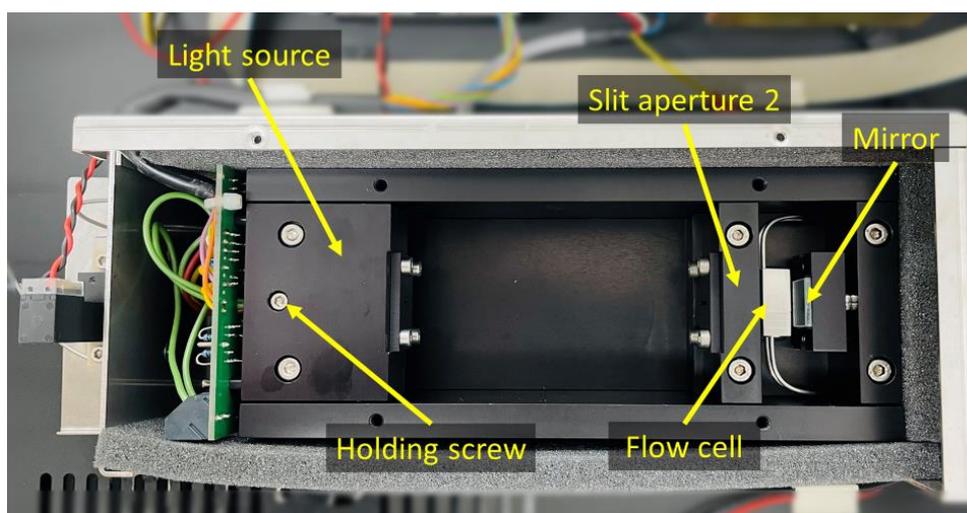


Figure 8. Components of YL9170 RID

3. Place the lamp in the holder resulting in a sharp picture of the illuminated area at the slit aperture 2. Usually the metal cover of the light bulb ends with the holder,

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sometimes the metal cover stands about 1 or 2 mm out of the metal block (see Figure 9).

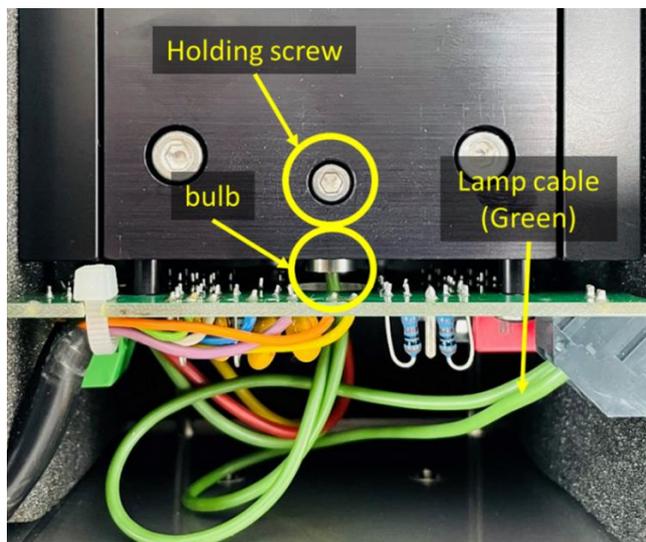


Figure 9. How to adjust the lamp bulb

- Turn the light bulb that the picture of the filament is parallel to the slit of the second slit aperture (refer to Figure 10).

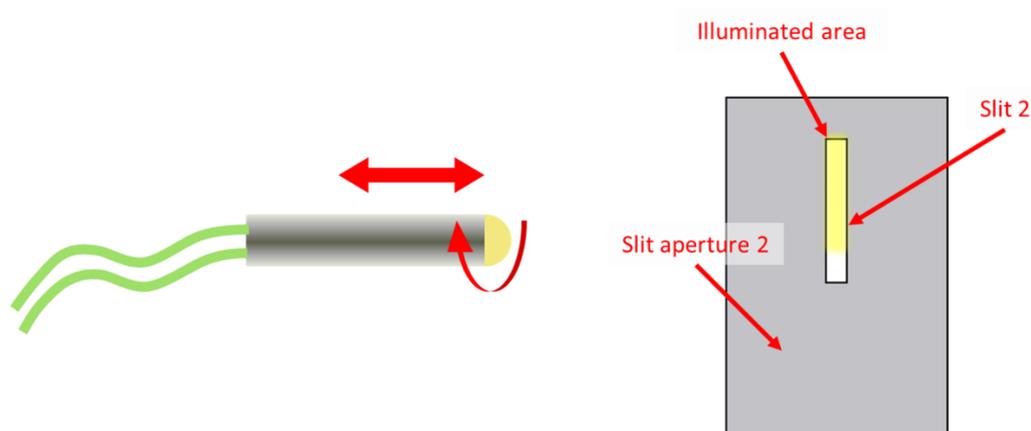


Figure 10. How to align the lamp position

- Make sure that only 2/3 of the slit are illuminated by the light source.
- Tighten the holding screw of the light source and close the inner black housing of the optical bench.
- Check the 'Diff' & 'Summ' values are within the acceptable range.
- Repeat 4-7 steps until all values are within the acceptable range.

\* If the sum value is low even if the lamp position is well adjusted, refer to the <Potentiometer Adjustment> on the next page to increase the voltage value.

Service Note



**<Potentiometer Adjustment>**

1. If the voltage of 'Summ' is too low no matter how much lamp is adjusted, you need to adjust the potentiometer.
2. Use a voltmeter to check the lamp voltage at the test points on the circuit board (as shown in Figure 11).

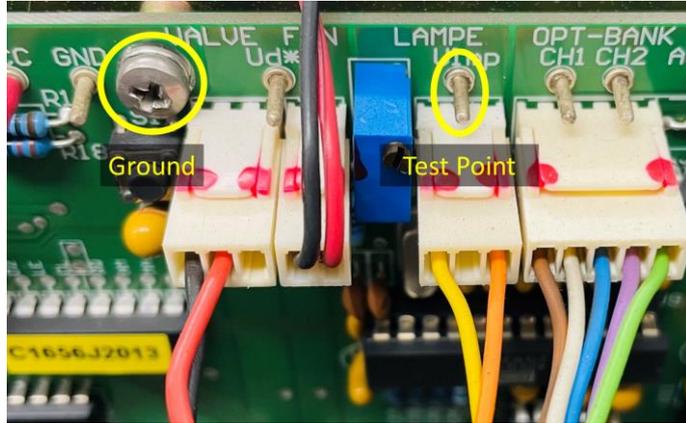


Figure 11. Test points on the mainboard

3. Check the voltage if the value should be  $3.3 \pm 0.3$  V.



Figure 12. Measuring voltage

4. If the voltage is too low, raise the voltage by turning (clockwise) the potentiometer (R19) at the main circuit board by using (-) screwdriver as shown in Figure 13.

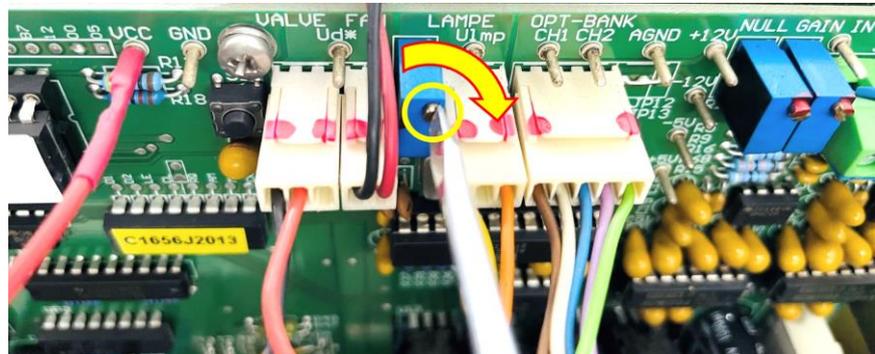


Figure 13. How to adjust the potentiometer

5. Make sure the 'Summ' value is raised enough and is within the acceptable range.

## Service Note

**V-2. Mirror Adjustment**

There are two holes at the rear side of the optic housing. If needed, the optical system of the detector can be adjusted using the 2.5 mm hex wrench. To adjust the mirror, place 2.5 mm hex wrench into the hole then precisely rotate the each hex screw.

1. Turn on the purge mode by pressing PURGE button and make sure the red purge LED is on.
2. Flush both chambers of the flow cell with distilled water for several minutes until the detector signal is stable (refer to chapter I.).
3. Turn off the purge mode (switch back to measuring mode) by pressing PURGE button and make sure the red purge LED is off.
4. Put the 2.5 mm hex wrench into one of the opened hole.

*\* There are two adjustment screws for the mirror and turn each screw one by one. You should turn the screws not more that  $\frac{1}{2}$  or  $\frac{3}{4}$  turns.*



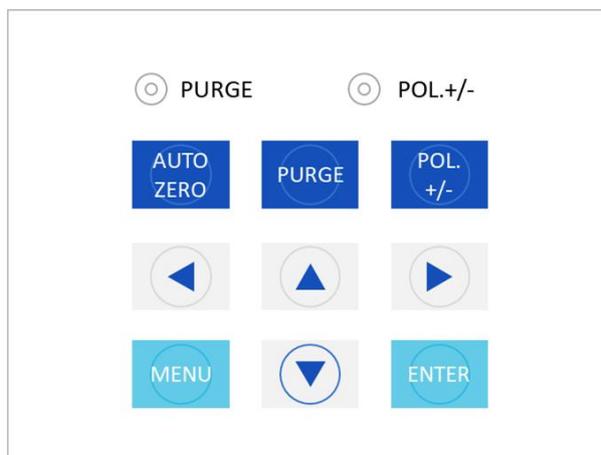
Figure 14. Mirror (left) and adjustment screw holes (right)

5. Adjust the screws until the optical balance reaches a value of  $0 \pm 10\%$ .

## Service Note

## Supplement 1. Functions of the Keypad &amp; Display

## a) Keypad



AUTOZERO	By pressing this button, the detector signal is internally set to Zero. To return to the initial signal, press this button for approx. three seconds.
PURGE	To flush the reference chamber of the flow cell with mobile phase, press this button once. If the purge mode is activated a red LED will light up. Press this button once again to deactivate the purge mode.
POL.+/-	By pressing this button, the polarity of the detector signal will be changed. A negative signal e.g. – 5 mV will be transformed into a positive signal +5 mV when the polarity mode is activated. A red LED will light up when this mode is activated.
ARROW	<p>The arrow buttons have several functions.</p> <p>Left&amp;Right – If only one button is pressed, you can change the settings of one parameter to smaller (◀) or bigger (▶) values. If both buttons are pressed together for about three seconds, the detector will be set to the service mode.</p> <p>This mode is used for detector diagnostics and maintenance purposes.</p> <p>Up&amp;Down – If different options for one parameter are available, you can select the desired option by using these arrow buttons. Up (▲) will switch to higher values and Down (▼) to smaller values. If the marker function is activated you can send a marker signal to the recorder output by pressing the Up (▲) button.</p>
MENU	By pressing this button, you can select a special sub menu or discard changes you performed on a parameter.
ENTER	Press this button to open the selected sub menu and to accept changes you performed on a parameter.

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**b) Display**

YL9170 RID is equipped with a liquid crystal display to show the current detector signal as well as system parameters. This display contains four lines with 20 characters each.

```

Temp : ----- 28.5 °C
OptBal : ----- 13.4 %%
SIGNAL : ----- 31.7 mV
NormMode >> (E,田,←)

```

Line 1 :	Show the current temperature of the optical bench (in °C).
Line 2 :	Show the optical balance (in %%).
Line 3 :	Show the current detector signal (in mV). The values shown here is identical to the digital output signal and to the analog signal which can be recorded at the recorder output.
Line 4 :	This line shows the status of YL9170 RID. Every few seconds the displayed parameter changes. By this, you can get a complete overview of all parameters in a short time.