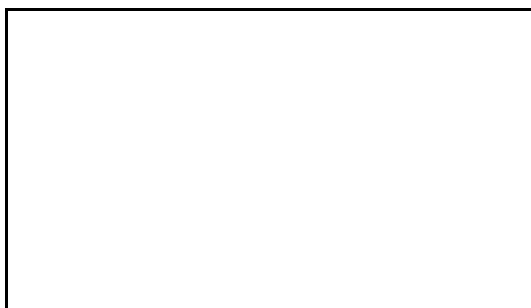


# Operating and Service Manual Autoloader (Laser controlled) Helios



Original

**ELTRA**  
ELEMENTAL ANALYSERS

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# 1 General information

## 1.1 Loader models

There are 3 standard loader models available:

130-crucibles version, 104-crucibles version and 36-crucibles version.

The difference between these models is the form of the loader's platform, i.e. the size of the loader. There is no difference with regard to loader arm, arm support and drive, lasers/sensors, chain drive, pneumatics and electronics. Therefore the adjustments, described in this manual are valid for all models.

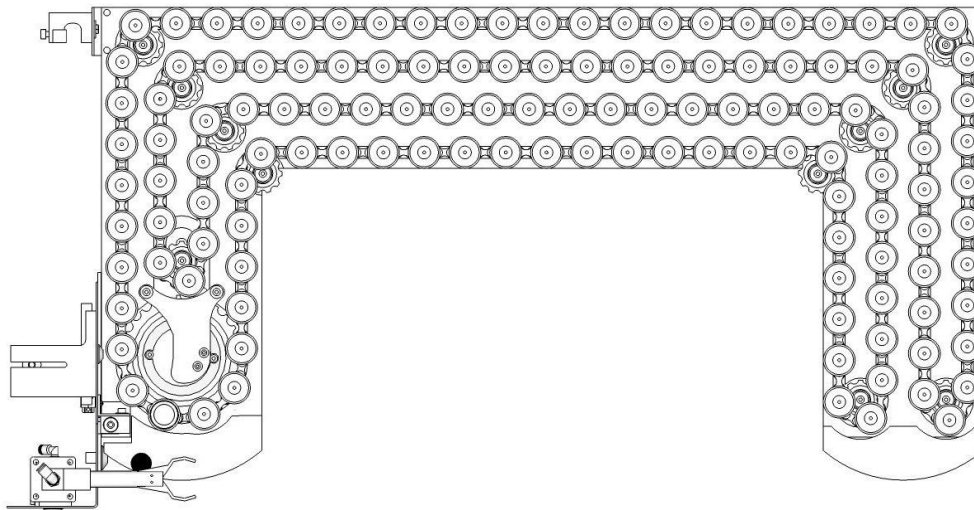


Fig. 1: Loader 130-crucibles version

The loader is supplied after testing without being completely dismantled. It is only detached from the analyser and the arm with the fingers are removed for safety reasons ( see Chapter “ **Arm installation**”). Therefore, an adjustment after installation may not be needed; however, the adjustments are described below. They may be necessary for accurate readjustment.

## 1.2 Space requirements

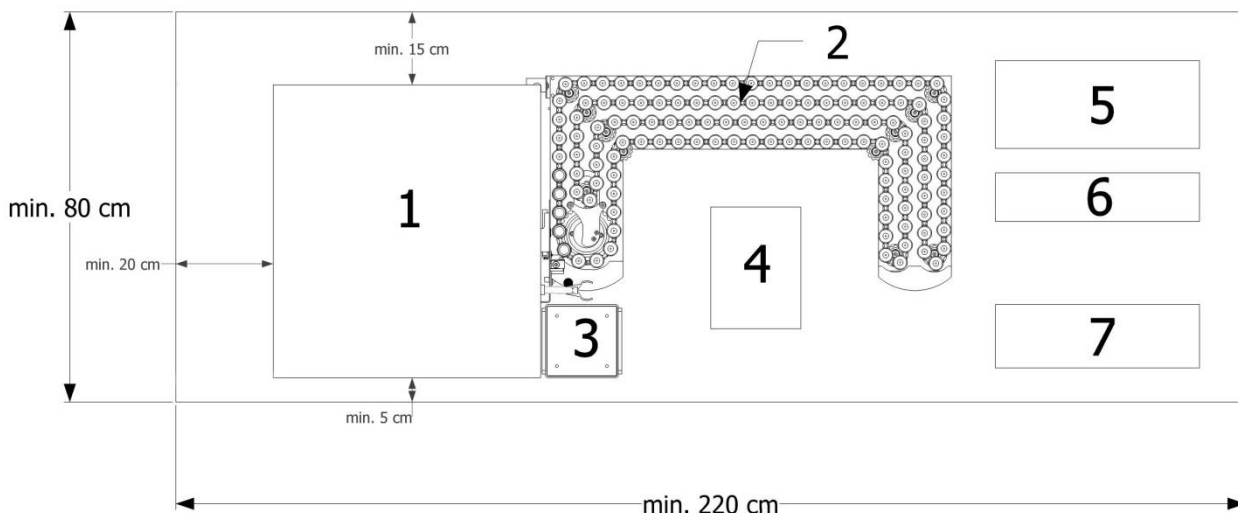


Fig. 2: Space requirements

1	Analyser	5	PC
2	Loader	6	Flat screen
3	Crucibles bin	7	PC keyboard
4	Balance		

Before installing the analyser with the loader, ensure that sufficient space of 220 ×80 cm is available. It is suggested to place the analyser in a position where the front end of the housing (1) has a distance at least 5 cm to the front end of the desk, otherwise there will not be enough space for placing the crucibles bin (3) on the desk.

**NOTICE**

Under no conditions should the analyser and loader be placed in direct sunlight or be exposed to the wind of air conditioners or to the wind blowing through open windows and doors

**1.3 Connecting and disconnecting plastic tubes**

The plastic tubes are connected by pushing them into the fittings. To connect the tube, simply push it into the fitting as far as it would go.

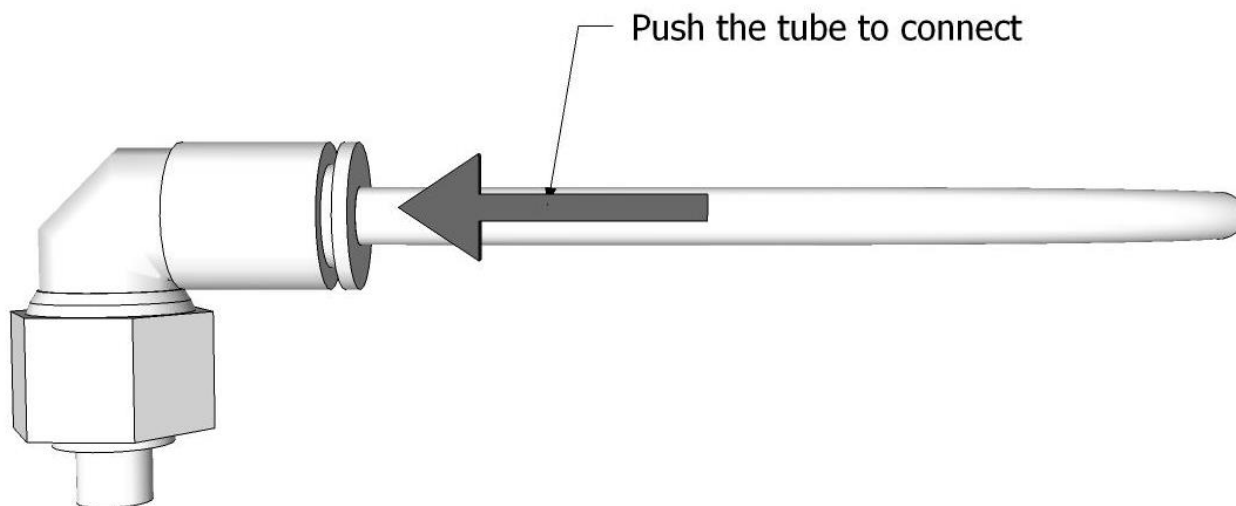


Fig. 3: Connecting plastic tubes

To disconnect the tube, first press the plastic ring of the fitting up to the metal ring, keep it properly pressed and pull the tube.

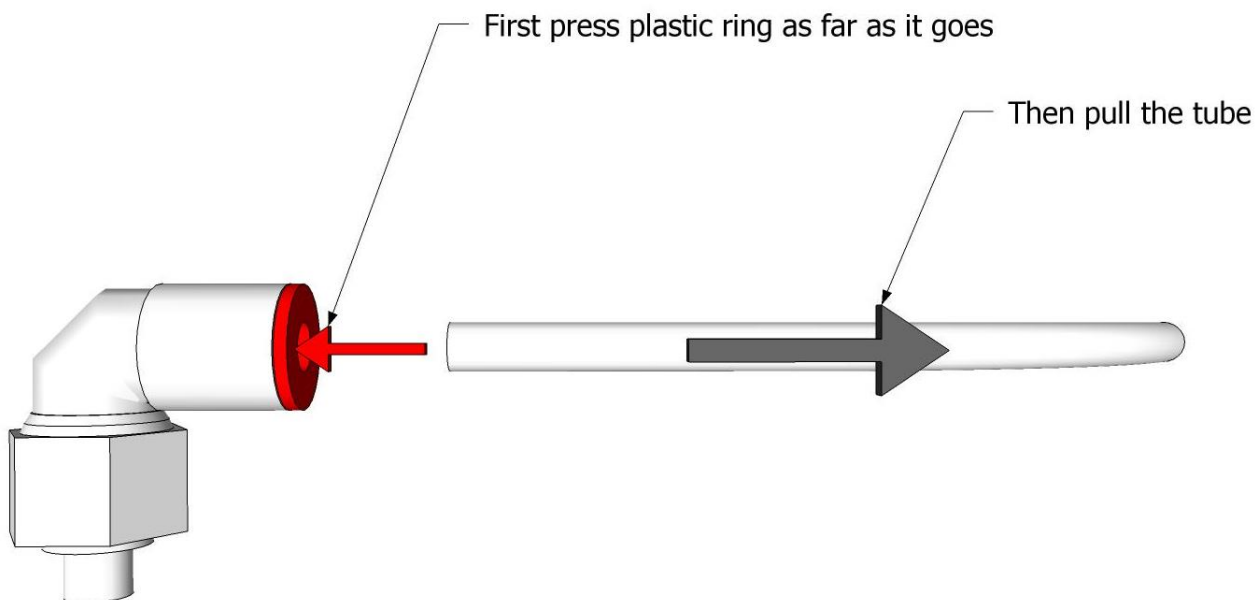


Fig. 4: Disconnecting plastic tubes

## 2 Chain tension adjustment

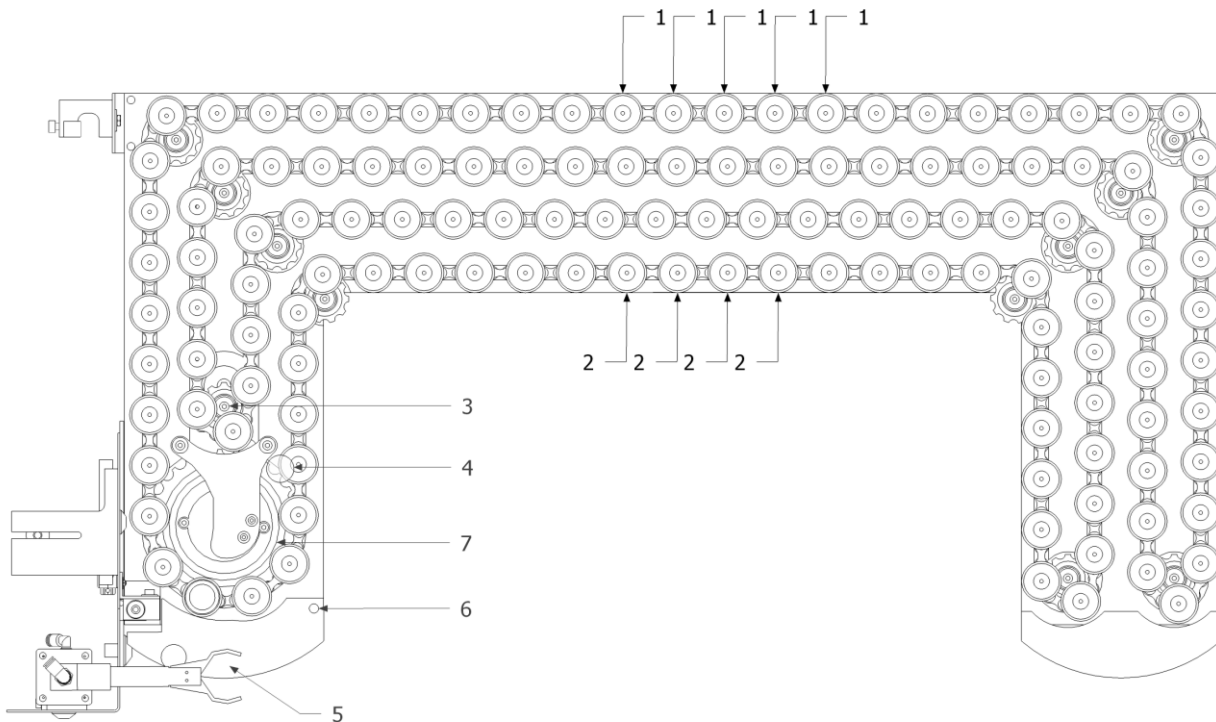


Fig. 5: Chain tension adjustment

The loader is supplied with the adjusted chain tension. If necessary, check the tension of the chain as follows:

1. Press and hold several crucible trays (1) of the rear row on the platform, so that they can not move.
2. Move a few trays (2) of the front row to the left and to the right. They should move for about 1 mm.
3. If not, loose the screw underneath the toothed wheel (3) and adjust by moving it back and forth.

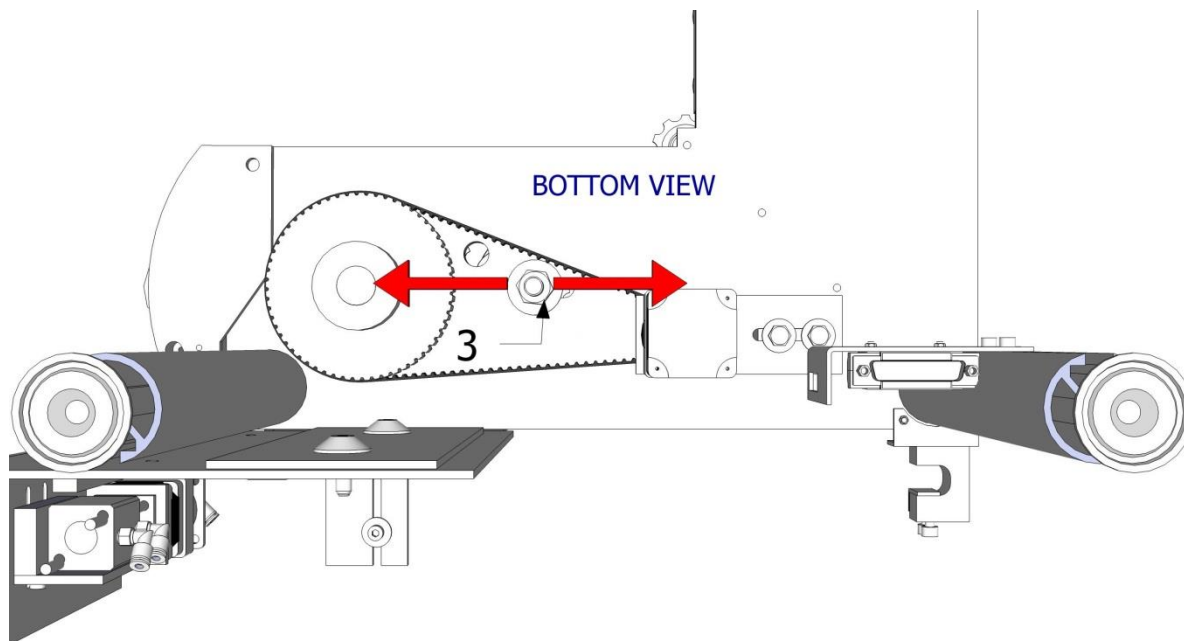


Fig. 6: Bottom view



4. Fix the screw (3) and check again.

**CAUTION**

A too strong tension can lead to a blockage when the crucibles are moved by the motor. If the chain plays too much, bent elements of the chain can block at the indicated point (4). Therefore keep about 1 mm play as described above.

5. Pull the front part (5) for about one or two millimetres. The turning point is (6). When you release it, it should return back pressing the crucible tray, which is at pick up position (see chapter "**Single step operation**"), to the wheel (7) behind the tray. This is to make sure that each crucible when at pick up position is always at the same place

### 3 Adjustment of the chain motor belt

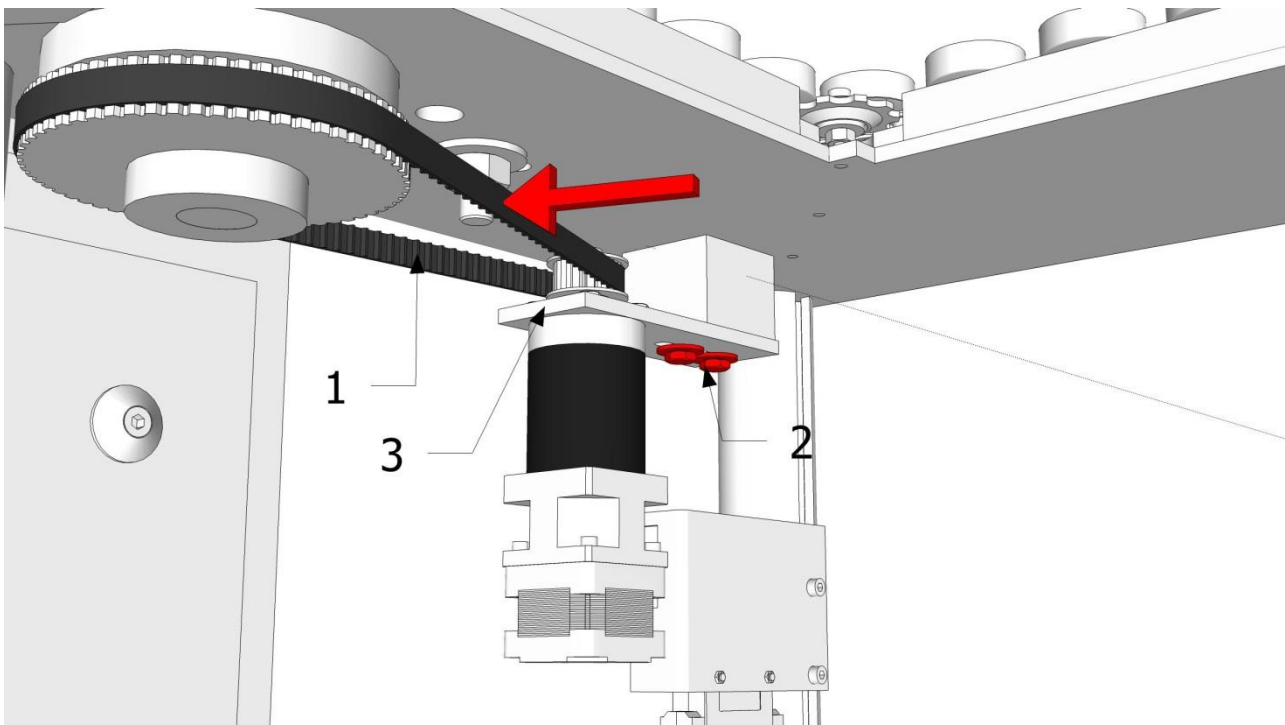


Fig. 7: Adjustment of the chain motor belt

The toothed belt of the chain motor is located underneath the left-hand section of the loader's platform. The mechanical tension of the toothed belt (1) can be checked by applying the force to the belt, as shown on the picture by the red arrow. If the belt has more than 10mm deflection, an adjustment is necessary. Loose the two screws (2), push the plate (3) to the back in order to create an appropriate tension of the belt (1) and drive the screws (2). After fixing the screws, check the tension of the belt (1) again.

In case of replacing the belt, the adjustment is made the same way.

## 4 Finger adjustment

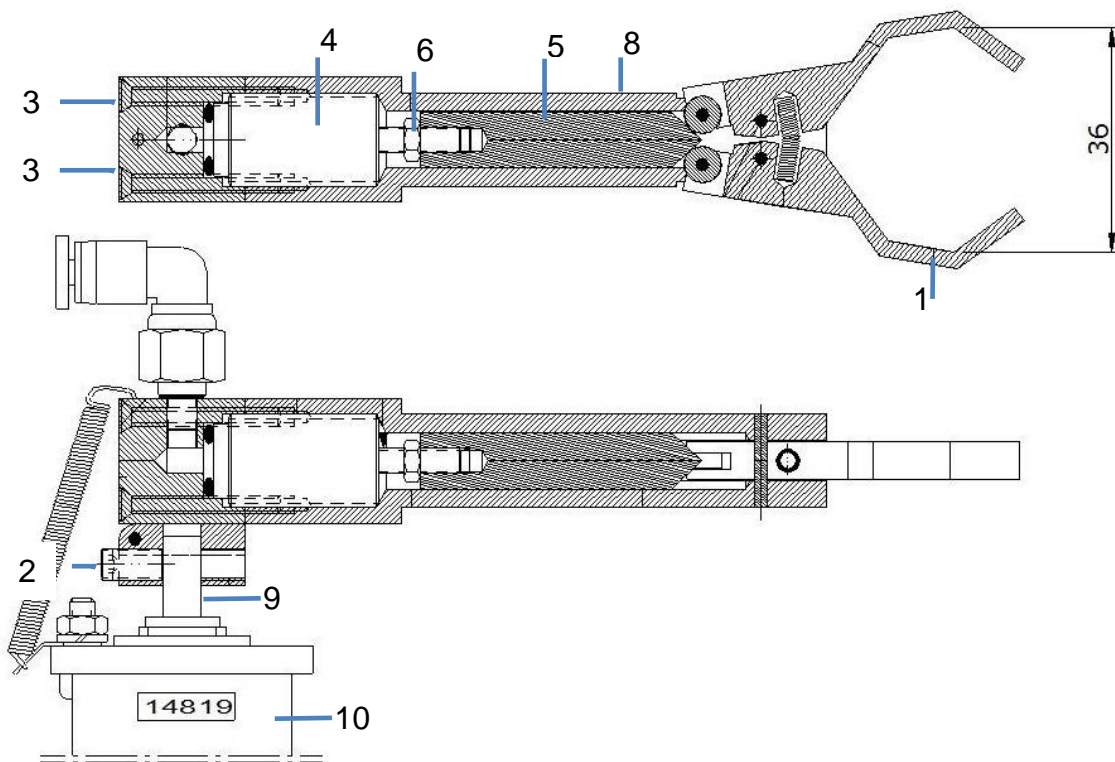


Fig. 8: Finger adjustment

The loader is supplied with the arm already adjusted. The readjustment may only be necessary in case problems arise or if the arm was disassembled for repair, etc.

The maximum distance inside the fingers (1) should be about 36 mm.

1. Loose the screw (2).
2. Move the assembly up to take it off the shaft (9) of the motor resp. off the gear box (10).
3. Unscrew the four screws (3).
4. Remove the piston (4) with the plunger (5).
5. Loose the nut (6).
6. Screw the plunger (5) to the piston (4) clockwise for making the fingers' (1) distance bigger. Fix the nut (6) again.
7. Unscrew the plunger (5) from the piston (4) (counter clockwise) for reducing the distance between the fingers (1). Fix the nut (6) again.
8. Make sure that the plunger (5) is clean.
9. Make sure that also the inside surface of the arm (8) is clean from dust, grease etc.

## 5 Arm installation

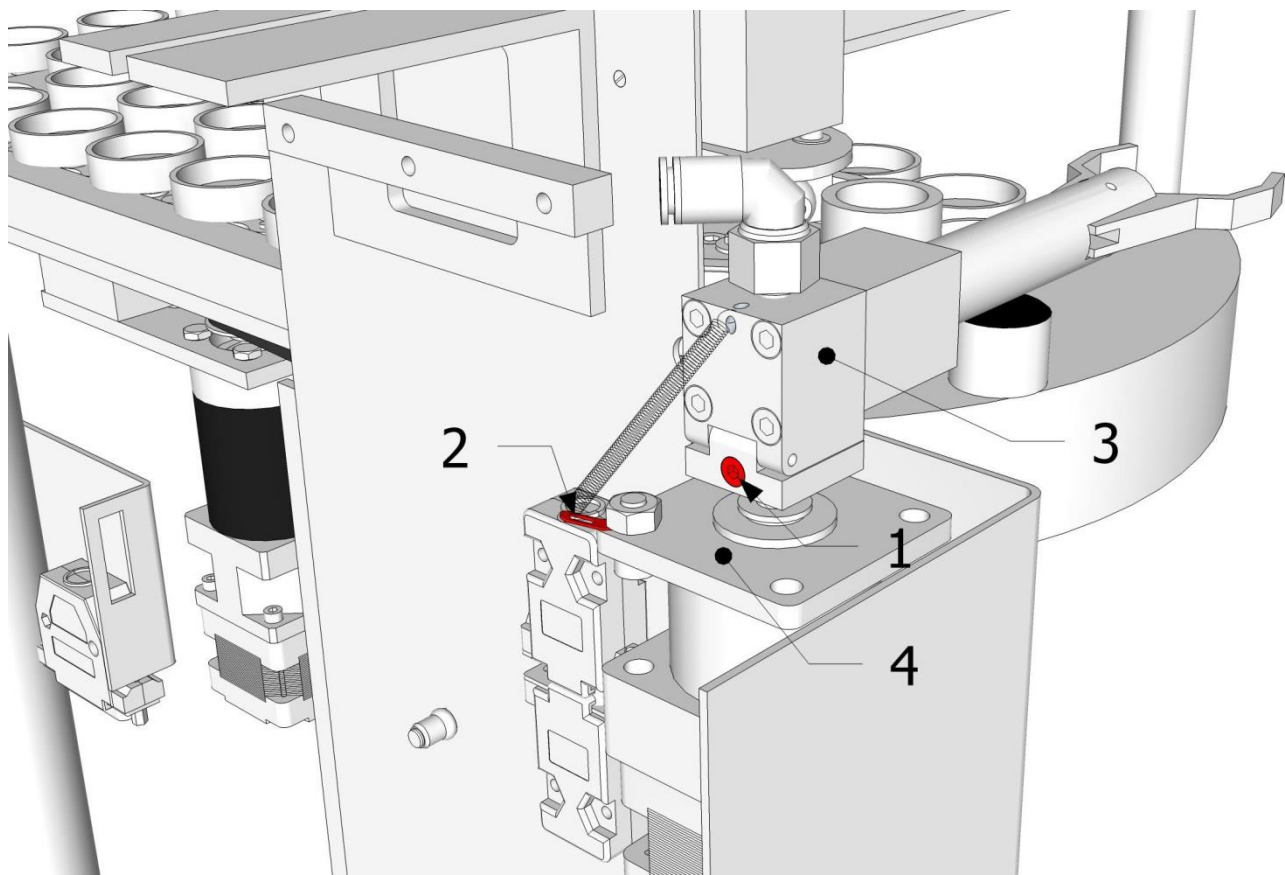


Fig. 9: Arm installation

Install the assembly of the arm (3) by driving the screw (1) to fix this assembly on the shaft of the gear motor (4). Handle with care considering the thin shaft of the gear and the small screw (1) for fixing. Make sure that the screw will press the flat side of the gear's shaft.

## 6 Mechanical connection to the analyser

The loader is mechanically connected to the analyser at 2 points. at the rear vertical bar of the analyser's cabinet and at the lower combustion tube support plate

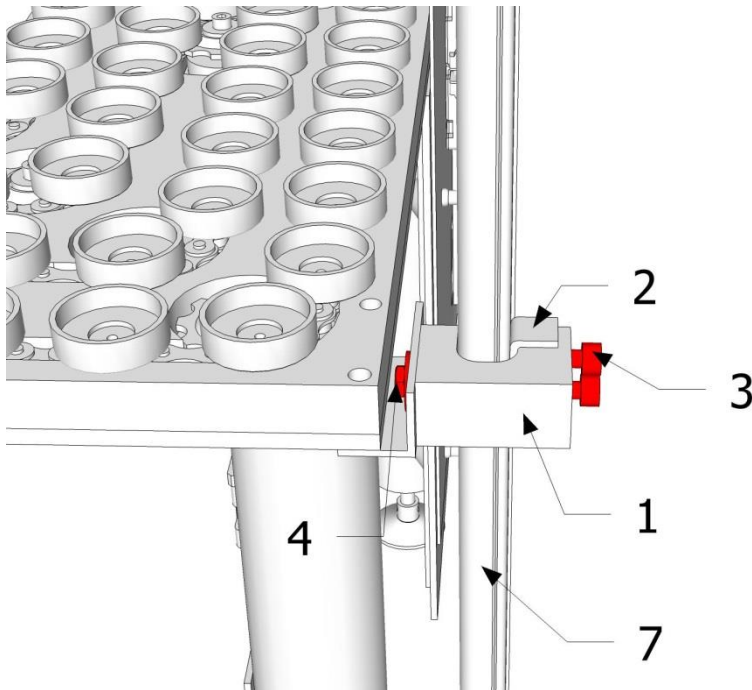


Fig. 10: Mechanical connection 1

Place the loader the way as on the picture above; Place the protective angle (2) between attachment piece (1) and the vertical edge (7) of the analyser's cabinet. Drive in the screws (3) and (4), but not completely, because the loader will still be moved during adjustments.

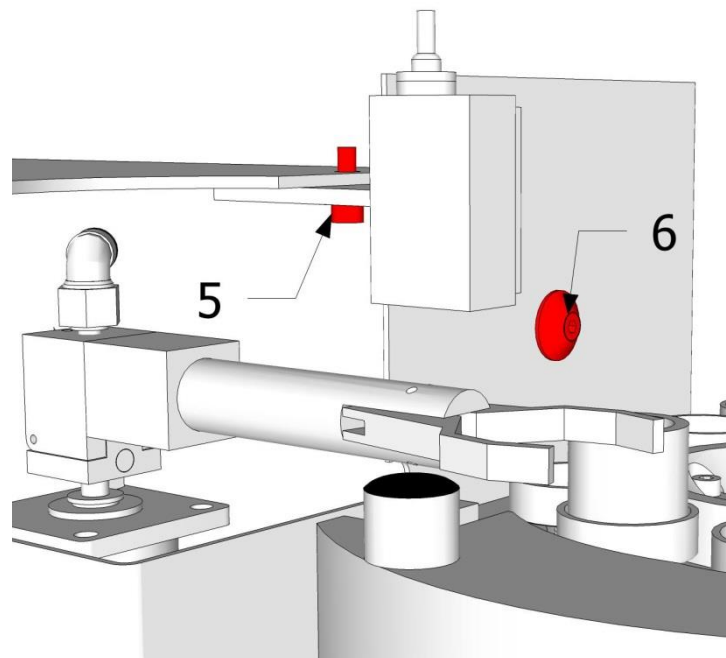


Fig. 11: Mechanical connection 2

Loosen screw (6)

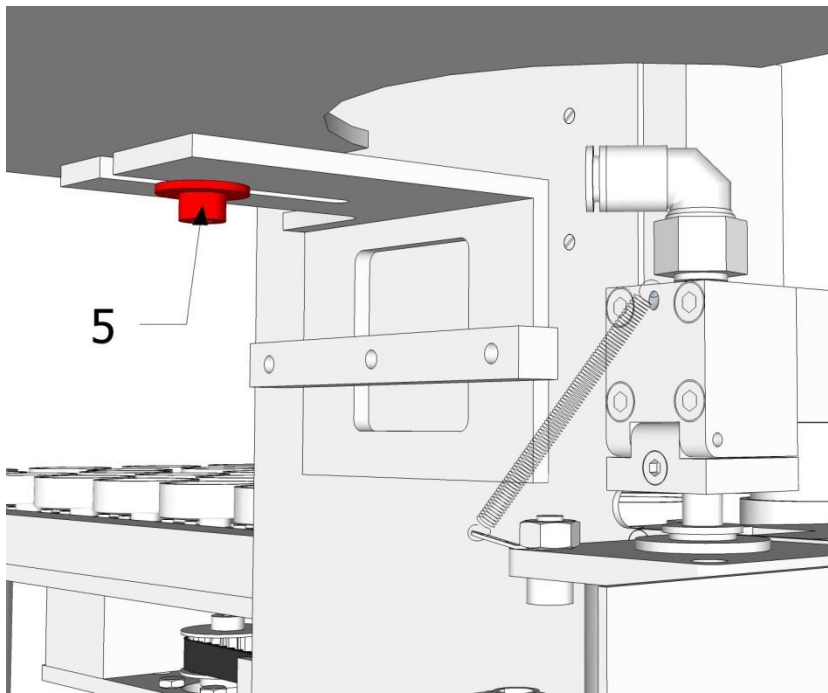


Fig. 12: Mechanical connection 2

Drive the screw (5) in.

Do not fix the screws (5) and (6) completely, because the loader will still be moved during adjustments.

## 7 Electrical connection

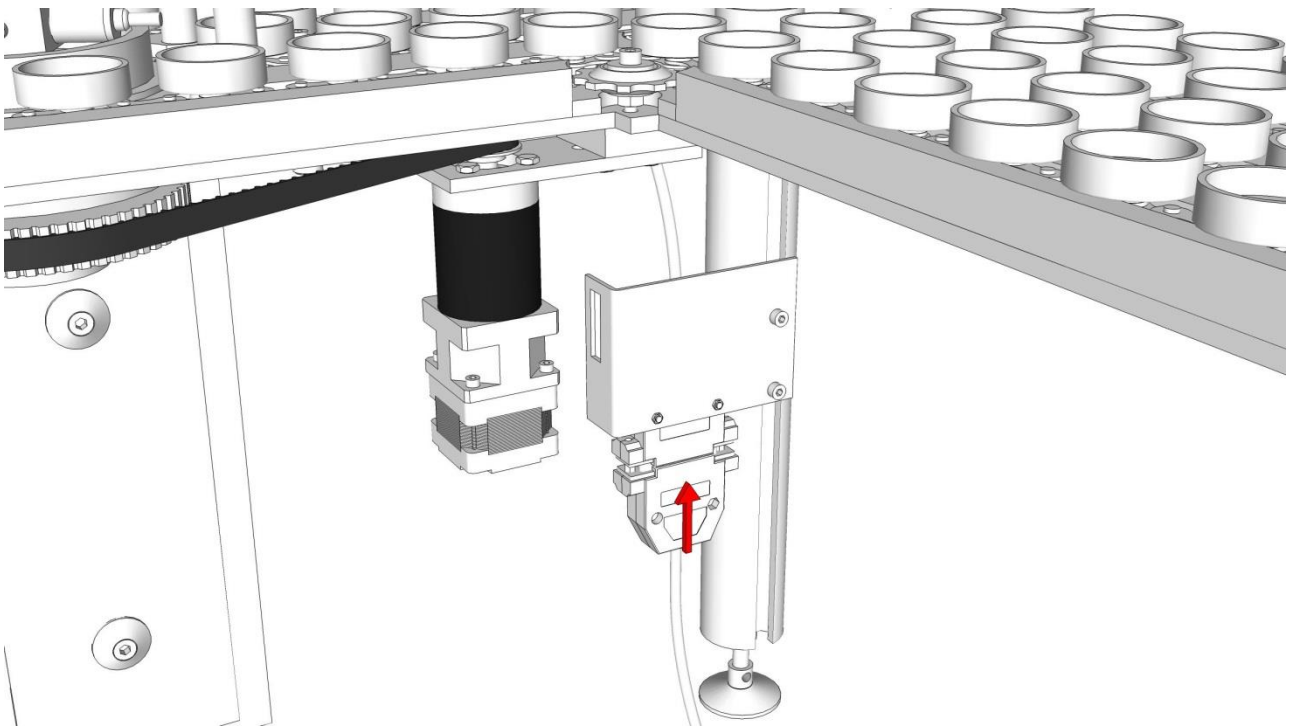


Fig. 13: Electrical connections

Locate the electrical cable with a 37-pin plug, coming out of the hole near the left lower corner of the analyser's rear panel. Plug it in the 37-pin socket, as on the picture above.



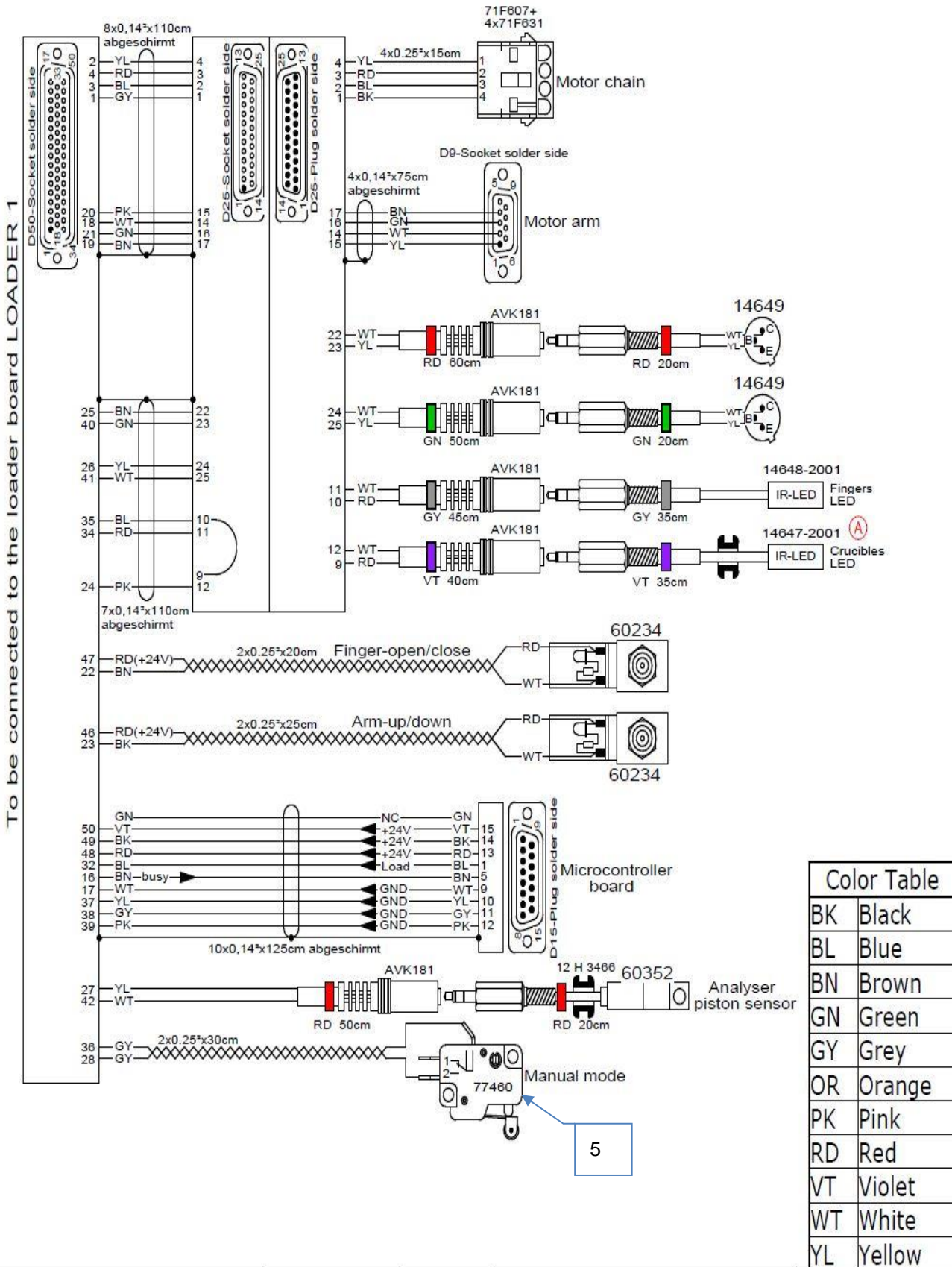


Fig. 14: Loader signal and control cable



## 8 Pneumatic connection

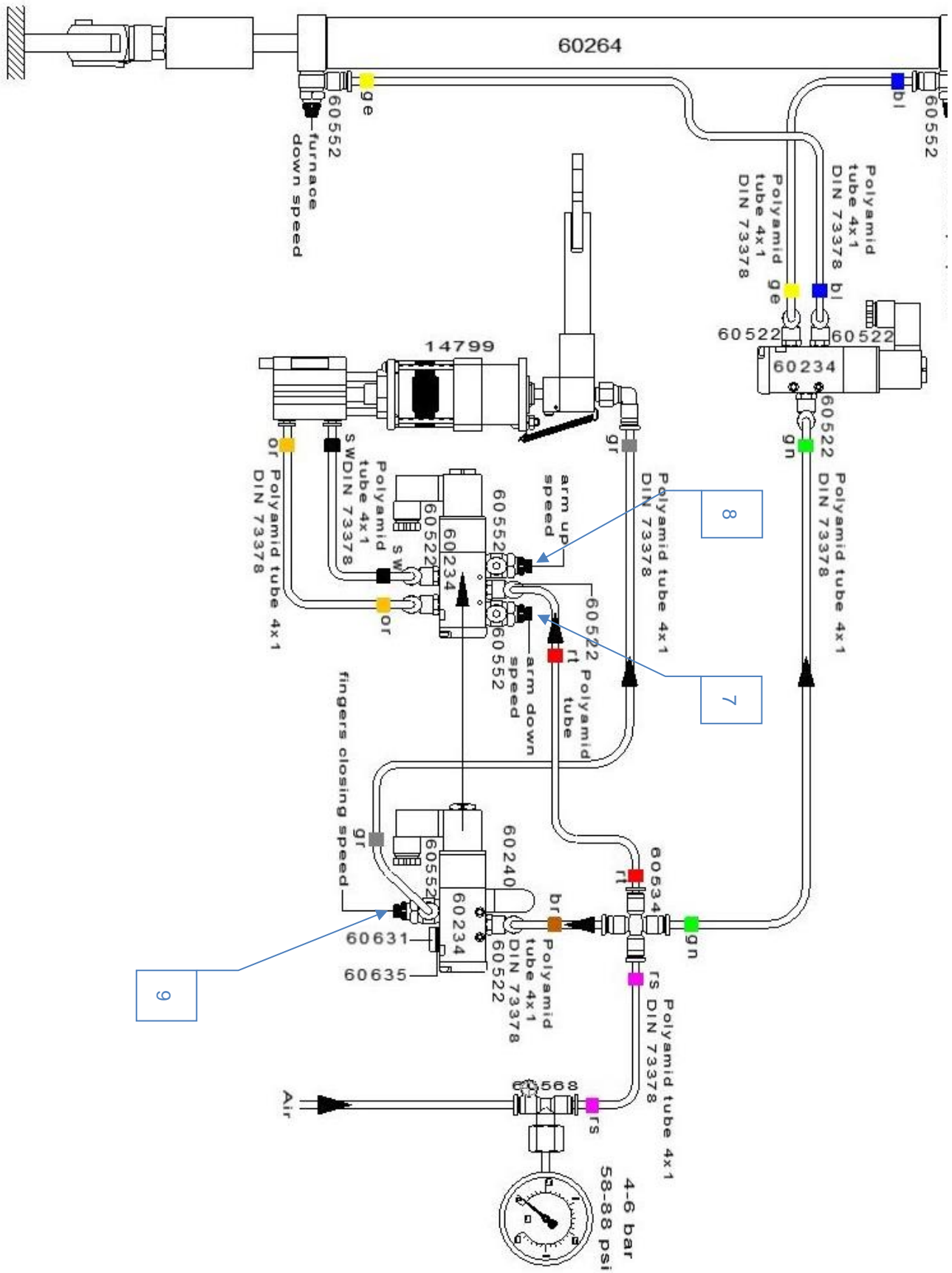


Fig. 15: Pneumatic connections

## 9 Step by step

### 9.1 Single step operation for mechanical adjustments

The software of the loader controller board can operate in 2 modes: continuous (automatic) mode and step-by-step mode. Normally the loader controller board is operating in the continuous mode. The step-by-step mode is necessary for mechanical adjustments of the loader.

In order to put the board in the step-by-step mode, it has to be powered up with the button (5) (see Fig: Loader signal and control cable and following figure) pressed.

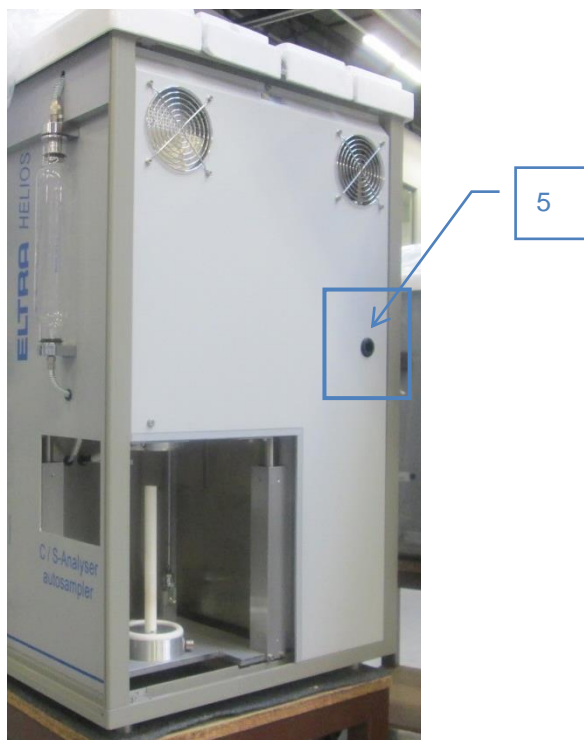


Fig 16: Single step operation, button

It is done as follows:

1. Press the button (5) and keep it pressed.
2. Turn the mains switch of the analyser from position 0 to position 1.
3. Release the button immediately after the first beep of the beeper on the loader controller board.

From now on, the board will work in a cycle, which consists of the following steps. Every step is initiated by pressing the button (5) shortly.

The positions of the arm in a loading sequence are illustrated on the following picture:

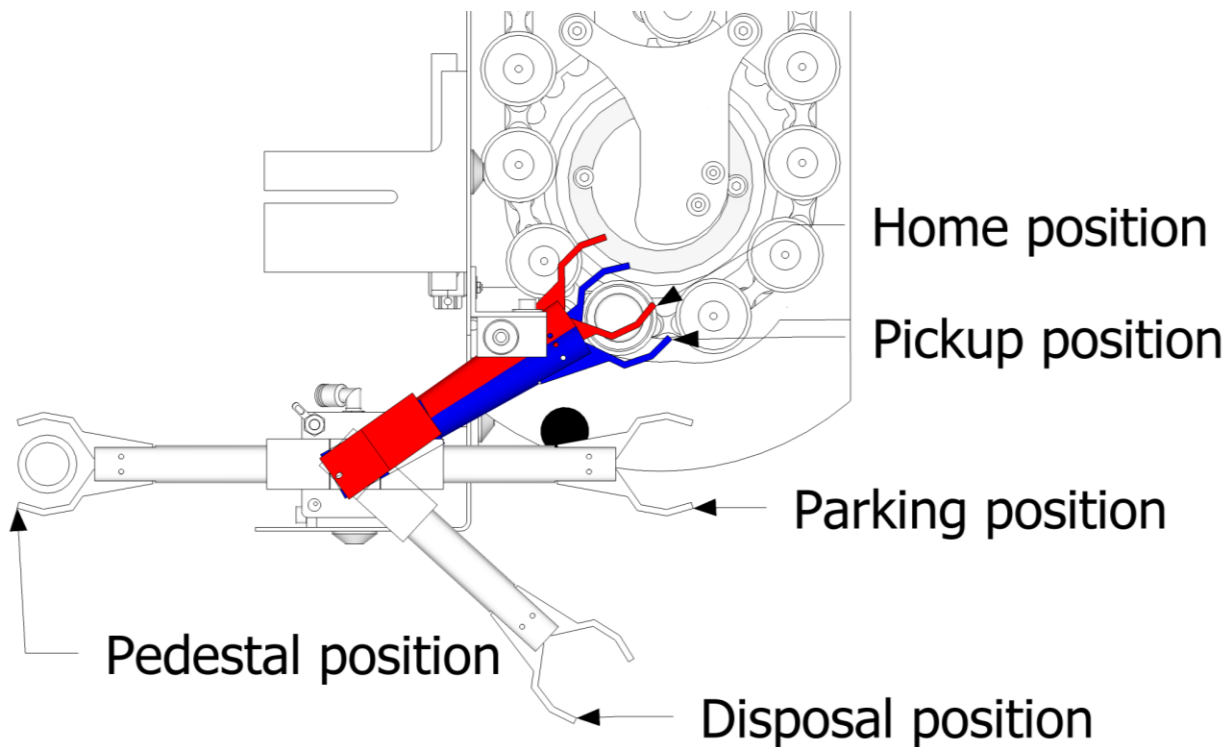


Fig. 17: Single step operation

<b>Home position</b>	Point, where the beam of vertical Laser is interrupted by the arm. Used to establish the exact position of the arm. The arm never stays in this position, but goes to the pickup position and then parking position, depending on the step of the crucible loading sequence.
<b>Pickup position</b>	Point above the prepositioned crucible for picking it up.
<b>Parking position</b>	Point, where the arm is located, when loader is idle (between loading sequences, when analysis is running).
<b>Disposal position</b>	Point above used crucibles bin, to dispose used crucible.
<b>Pedestal position</b>	Point above pedestal to place crucible before analysis and remove it after the analysis.

**The loading sequence:**

<b>These steps are performed only once</b>	a) Vertical Laser check. See chapter 9.2.
	b) Horizontal Laser check. See chapter 9.3.
	c) Fingers Laser on. Arm goes to vertical Laser, until its beam is interrupted (to position the arm exactly). This is home position of the arm. Then goes to parking position. Furnace position check (magnetic switch on the pneumatic cylinder). If the furnace is not in the lower position or if the magnetic switch is not adjusted the error will be signalled by continuous beeping. See chapter 9.4.
<b>Step-by-step loop. Every step is initiated by pressing the button shortly.</b>	1. Crucibles Laser on. Chain is rotated until the beam of the crucibles Laser is interrupted (to position the crucible exactly). Arm goes to home position, then to pickup position. If the beam is not interrupted after aprox. 22 trays have passed the Laser, error 3 is signalled by beeping (see chapter 11).
	2. Arm to parking position.

	3.	Furnace position check (magnetic switch on pneumatic cylinder). If the furnace is open, arm goes from parking position to the pedestal. Otherwise error number 7, signalled by beeping (see chapter 11).
	4.	Arm down.
	5.	Fingers close.
	6.	Arm up.
	7.	Arm to the disposal position.
	8.	Fingers open.
	9.	Arm to home position, then pickup position.
	10.	Arm down.
	11.	Fingers close.
	12.	Arm up.
	13.	Crucibles Laser is switched on to check, whether the crucible is removed from the tray. If yes, arm to parking position. If not, error number 6 is signalled by beeping (see chapter 11).
	14.	Arm to pedestal.
	15.	Arm down.
	16.	Fingers open.
	17.	Arm up.
	18.	Arm to home position, then pickup position.
	19.	Arm to parking position.

## 9.2 Vertical Laser

 **CAUTION**

V0075

- **Don't look directly into the Laser beam.**

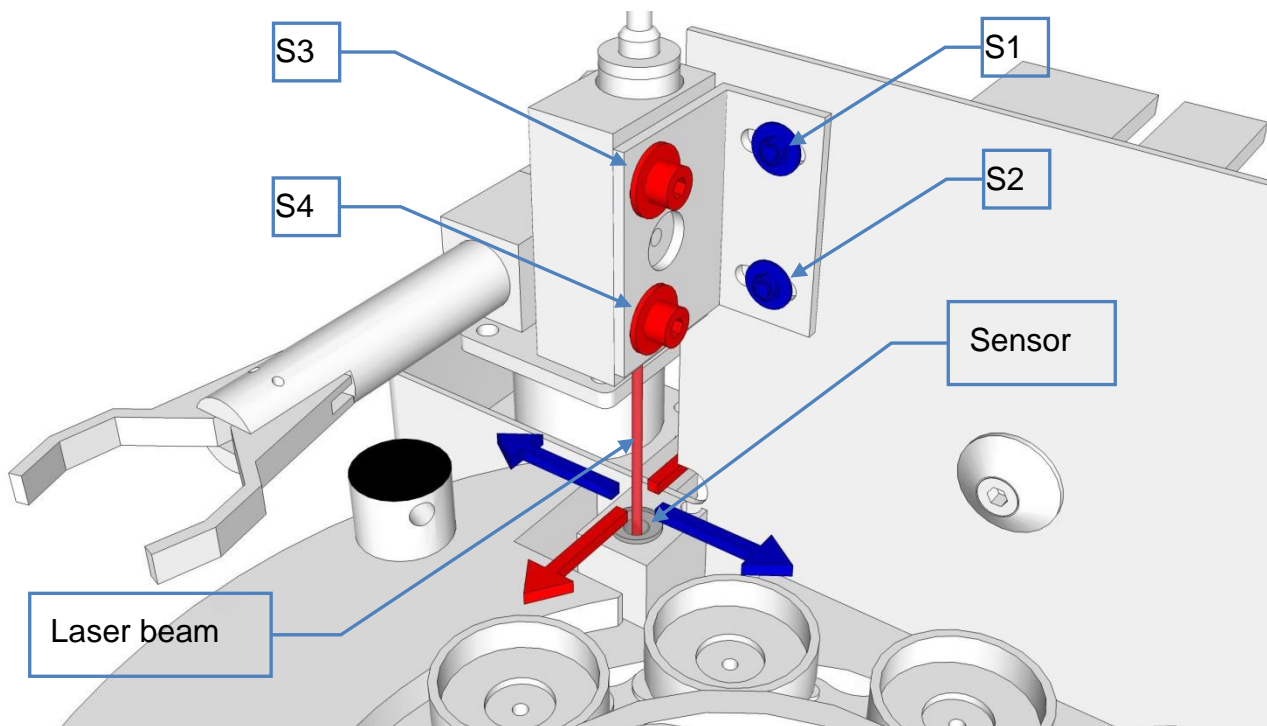


Fig. 18: Vertical Laser

At this step the vertical Laser for sensing the home position of the arm is continuously ON. This can be seen by looking at the sensor underneath the Laser.

If the Laser is ON and there is no beeping to hear, it means that the sensor is sensing the Laser beam.

Interrupt the beam between the Laser and the sensor to verify the correct functioning of sensor and beeper.

If the Laser is ON and the beeper is beeping, although the beam is not interrupted, this means that the beam doesn't hit the sensor. The beeper signals this condition. In this case the Laser should be mechanically adjusted so that the beam will be in the middle of the sensor. The adjustment is made by loosening the screws (**S1,S2,S3,S4**) and by turning and moving the Laser until the beeping stops. It is not enough if simply the beeping stops. Make sure that the beam is in the middle of the sensor.

Press the adjust bottom (5) (see Fig.: **Loader signal and control cable**) again for only about one second to proceed to the next step – horizontal Laser check.

### 9.3 Horizontal Laser



1.V0075

- Don't look directly into the Laser beam.

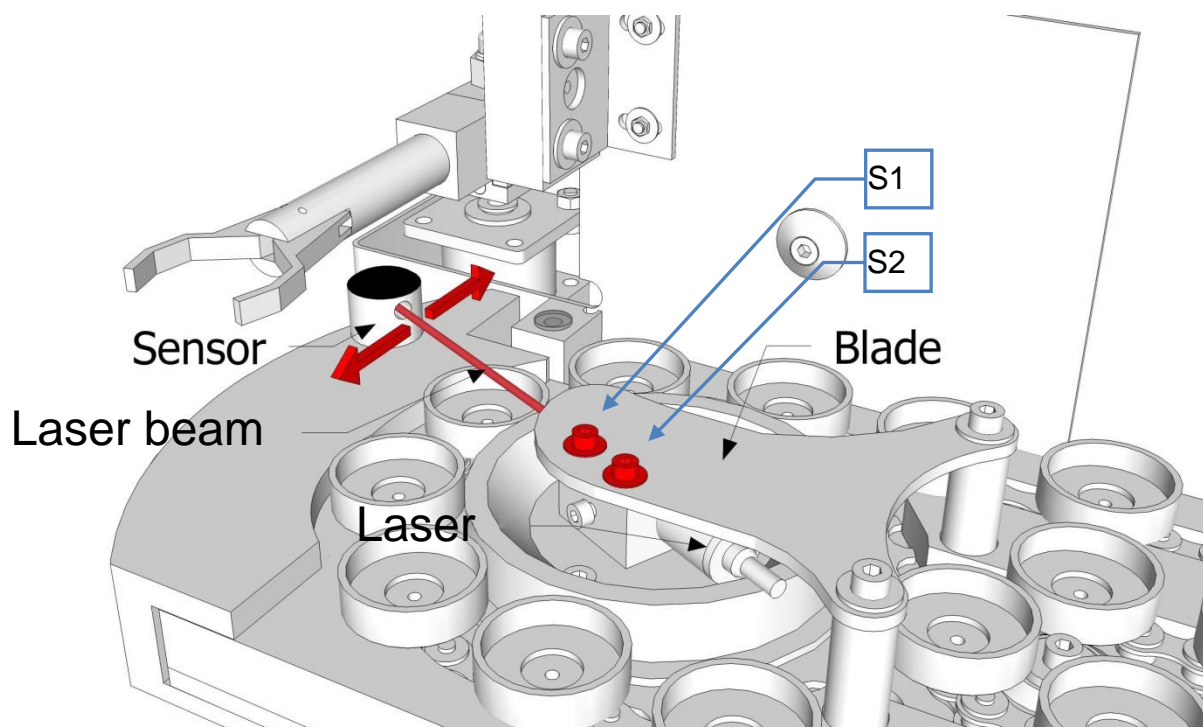


Fig. 19: Horizontal Laser

Now the horizontal Laser for sensing the position of the crucibles is continuously ON. This can be seen by looking at the sensor in front of the Laser.

If the Laser is ON and there is no beeping to hear, it means that the sensor is sensing the Laser beam. For this, make sure that there is no crucible or anything else between the Laser and the sensor preventing the beam from reaching the sensor.

Interrupt the beam between the Laser and the sensor to verify the correct functioning of detector and beeper.

If the Laser is ON and the beeper is beeping, although the beam is not interrupted, this means that the beam doesn't hit the sensor. The beeper signals this condition. In this case the Laser should be mechanically adjusted so that the beam will be in the middle of the sensor. In case of proper adjustment the beeper will stop beeping.

The adjustment is made by loosening the screws (**S1**, **S2**) and by turning and moving the Laser until the beeping stops. If necessary, pull up or press down the blade for vertical adjustment.

**NOTICE** It is very essential to adjust the Laser for the whole beam to reach the detector. If you see a part of the beam hitting the aluminium detector housing around the detector's hole, readjust until you don't see any Laser radiation on the aluminium housing.

## 9.4 Adjusting the Position of magnetic switch



1.G0002

Mortal danger from electric shock  
Exposed power contacts - High Voltage



Every time the arm of the loader has to go to pedestal, the position of the furnace platform is checked. It is done by means of the magnetic switch, situated on the pneumatic cylinder, which actuates the furnace platform.

If the error 7 occurs when loader is in automatic operation (but the furnace platform is really at the lower position) or there is an error, signalled by continuous short beeps, in single step-operation after the horizontal Laser check (see chapter "Single step operation"), then the position of the magnetic switch has to be adjusted.

Adjustment procedure:

1. Remove the panel, marked red on the lower picture to get access to magnetic switch.
2. Toggle the loader control board to single-step operation (see chapter "9.1 Single step operation").
3. Advance to the step c) of the sequence.
4. Ensure that the furnace is open and the furnace platform is in the lower position. Ensure that there is nothing under the furnace platform, preventing it from going to the lower position. If it is the case and the position of the magnetic switch is wrong, it will be signalled by continuous beeping
5. Loose the lock-nut (4) of the screw (5) on the clamp (3), holding the magnetic switch (2) on the pneumatic cylinder (1); then loose the screw (5).
6. Move magnetic switch (2) upwards or downwards, until the beeping stops, mark the position of the magnetic switch on the cylinder at one of its edges.
7. Continue moving the magnetic switch (2) in the same direction, until the beeping comes again. Mark the position on the cylinder (1) at the same edge of the magnetic switch (2), as before. Now the "active zone" on the cylinder is confined by the two markings.
8. Place the magnetic switch (2) in the middle of the "active zone".
9. Fix the magnetic switch (2), by driving the screw (5) on the clamp (3), and then fix the lock-nut (4).

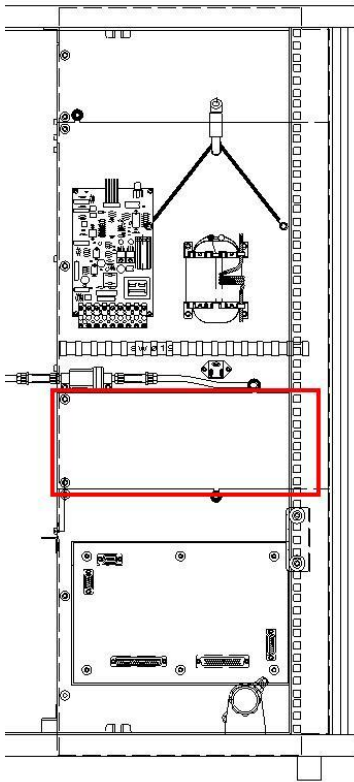


Fig. 20: Panel to remove

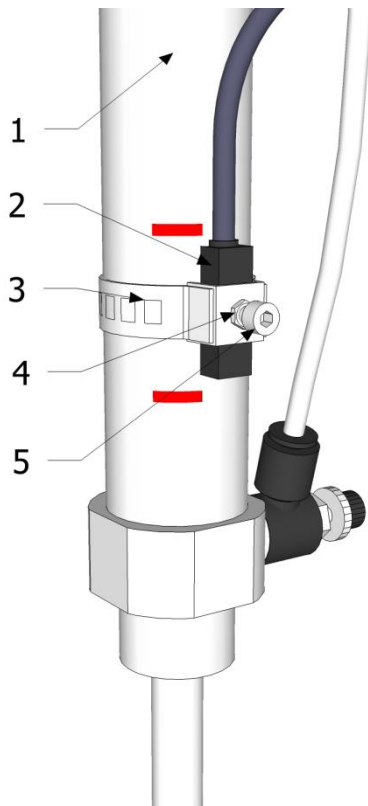
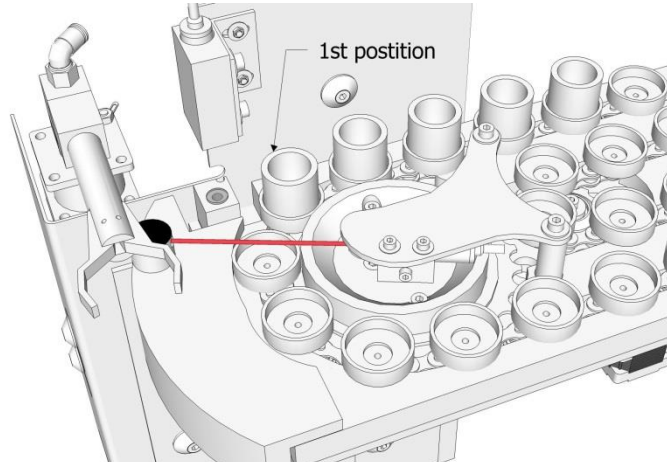
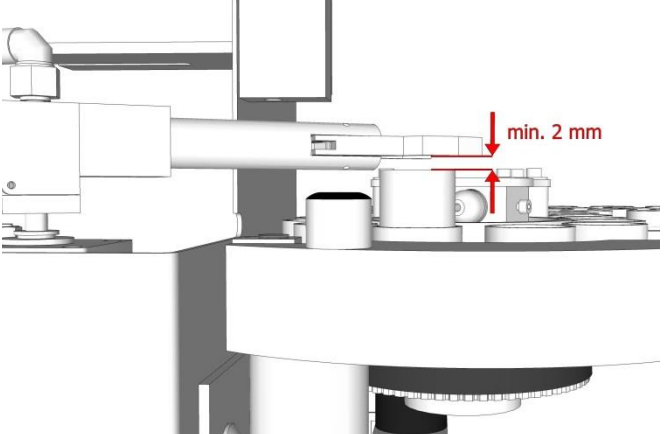
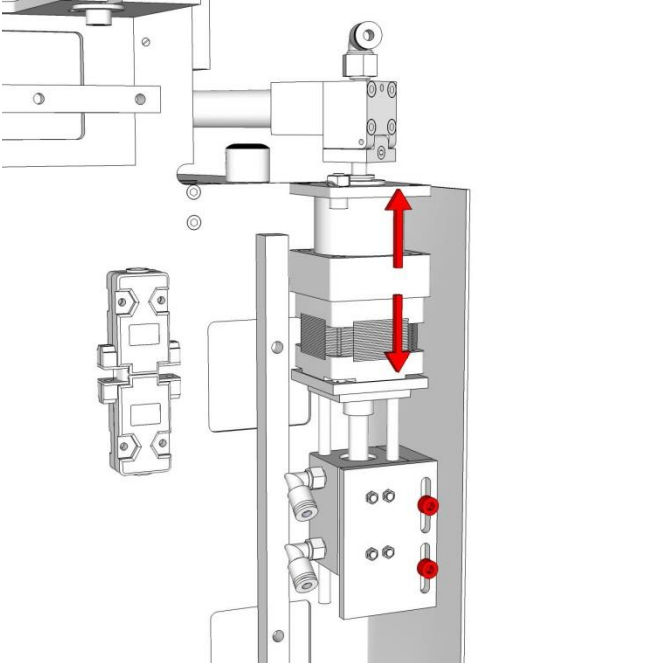


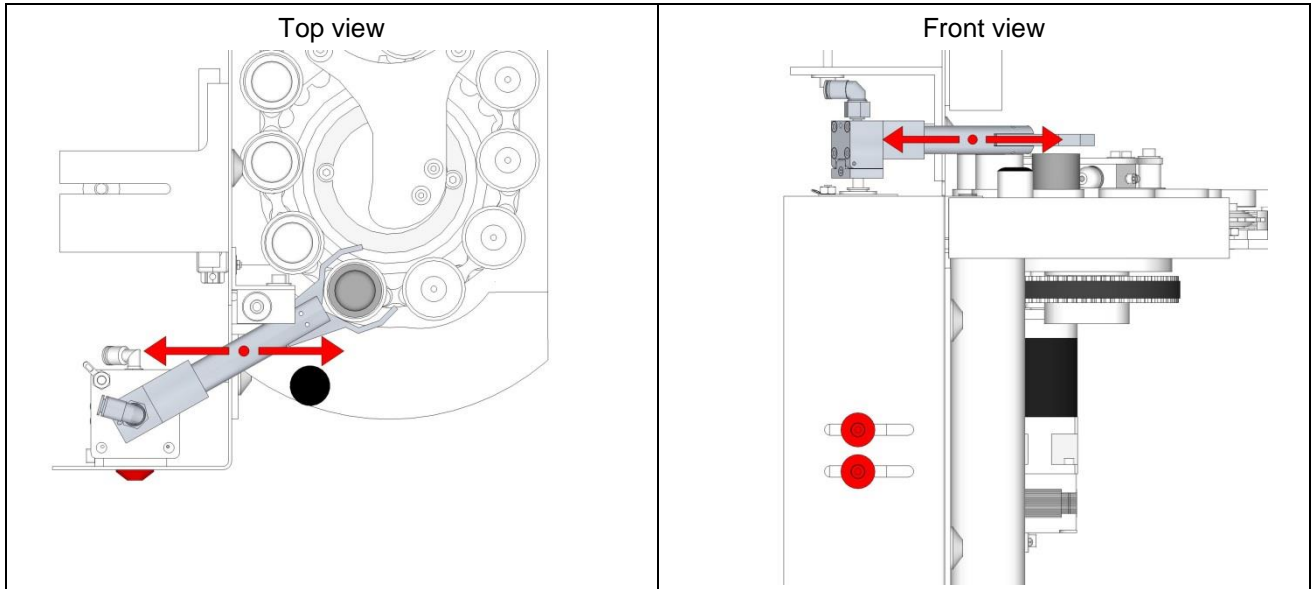
Fig. 21: Magnetic switch



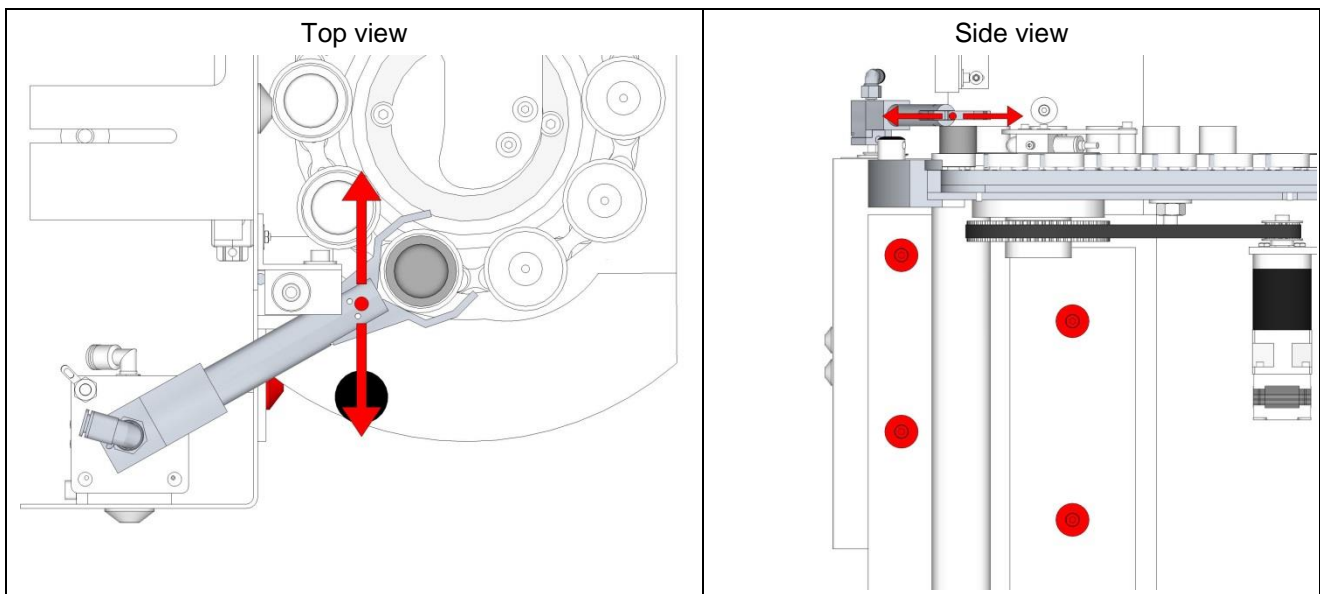
### 9.5 Adjustment of the arm at the crucible pick-up position

	<p>Place several crucibles into the trays as on the picture to the left. Press the adjustment button shortly so many times, until step 9 (arm at pick up position over crucible) of the sequence is reached (see chapter “9.1 Single step operation for mechanical adjustments”).</p>
	<p>First, the height of the arm over the crucible has to be adjusted. Ensure that the lower edge of the fingers is approx. 2 mm over the upper edge of the crucible. If the distance between them is less than 1 mm, then there is considerable risk, that the arm may hit the crucible, when rotating, because the crucibles may have slightly different height due to the tolerances of manufacturing.</p>
	<p>The screws for adjustment of the arm height are marked red on the picture to the left. As the arm is mechanically attached to the pneumatic cylinder and geared motor, all assembly will move. Loose the screws, adjust the appropriate height of the arm over the crucible (see picture above), fix the screws.</p>

Second, the position of the arm has to be adjusted the way that the crucible is situated centrally between the fingers.



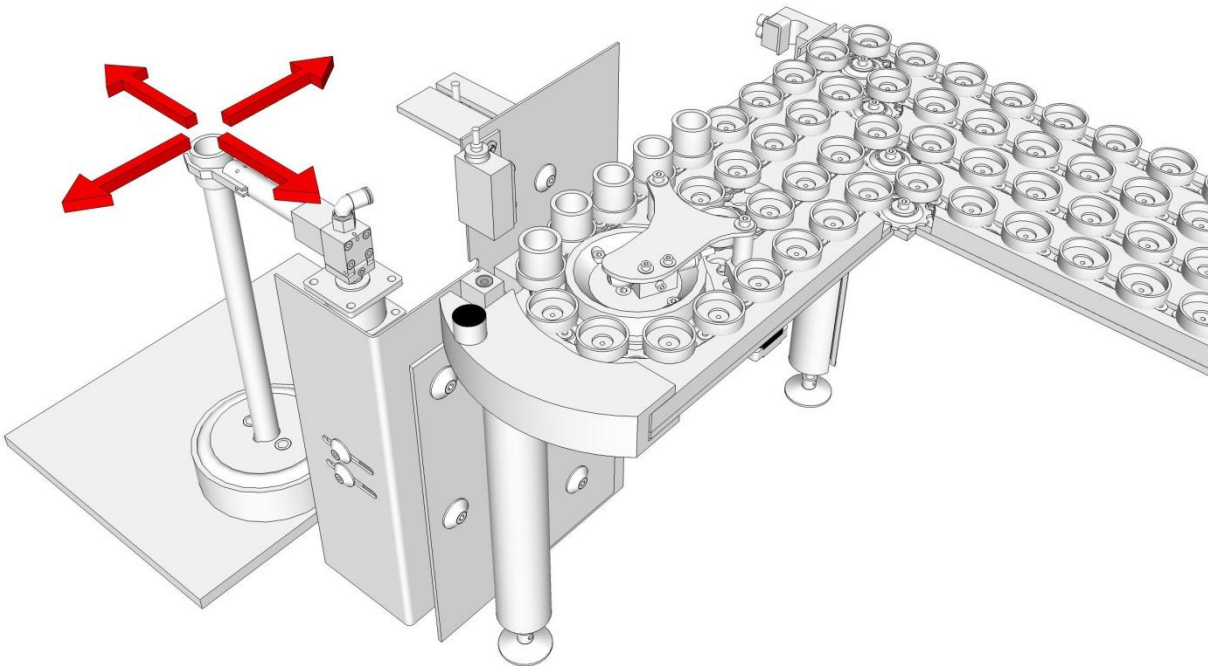
To adjust the position of the arm in this direction the whole assembly of the arm support (pneumatic cylinder and geared motor) is moved. Take a lot of care to move the assembly horizontally and avoid the tilt of the arm.



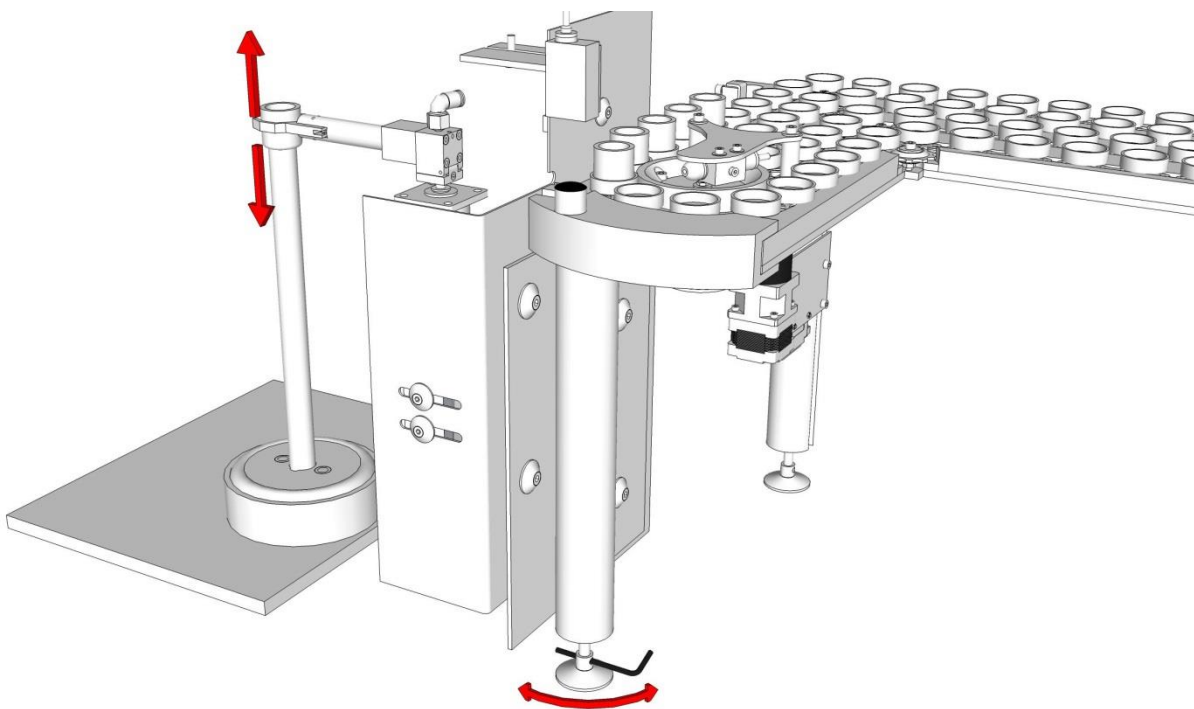
To adjust the position of the arm in this direction the whole angle is moved, where the arm support assembly is fixed on, as well as vertical Laser and sensor. Take a lot of care to move the angle horizontally and avoid the tilt of the arm also in this direction.

The adjustment should be checked once again, when the arm goes down, after pressing the adjustment button once again (step 10 of the sequence). At next press on the button fingers will close. If the crucible does not move, when fingers close, the adjustment is correct.

## 9.6 Adjustment of the loader position when placing the crucible on the pedestal



Press the adjustment button shortly so many times, until the step 14 of the sequence is reached and the crucible in the fingers is situated over the pedestal. Move the complete loader to the position when the crucible is situated centrally over the pedestal. Look from the front and from the side to be able to estimate the position of the crucible.



Adjust the height of the complete loader the following way. Loose the safety nut on the feet of the loader, rotate the feet of the loader using a hex key or a screw driver until the appropriate height of the crucible over the pedestal is adjusted. The height is adjusted correctly if the arm and crucible do not move at the moment, when fingers open and the crucible is released. Fix the safety nut. Adjust all the feet the same way to ensure that the complete loader platform is positioned horizontally and there is no tilt of the platform, resp. the arm.

## 9.7 Adjustment of the up/down speed of the arm

The downwards speed of the fingers can be adjusted by the left hand adjustable restrictor (7), see image pneumatic connections. The upwards speed of the fingers can be adjusted with the restrictor (8). After adjusting, fix the knurled nuts.

1. Fingers close and take the crucible. If the adjustment of the fingers position is coaxial to the pedestal resp. to the crucible, the crucible will not move in horizontal direction when the fingers close.

The closing speed of the fingers can be adjusted with the adjustable restrictor (9) see image pneumatic connections.

2. Fingers up.
3. Fingers turn to the disposal position.
4. The fingers open and the crucible is dropped.
5. The arm goes first to the home position and then it turns back to the pick-up position
6. Fingers down.

## 9.8 Repeating the single step cycle

It is advisable to make a couple of cycles with single step to make sure that the mechanical adjustments, described before, are accurate. Continue pressing the adjustment button shortly to advance to the next steps of the sequence. Check all adjustments.

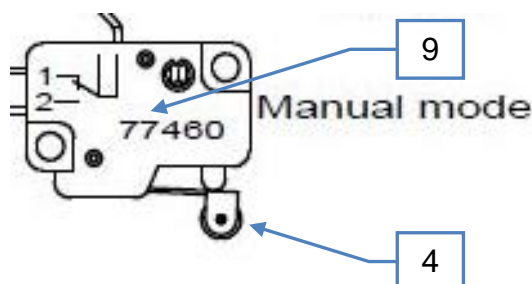
When the adjustments are finished, fix the screws ensuring mechanical connection of the loader to the analyser, see chapter 6 "Mechanical connection to the analyser".

## 9.9 Non-stop cycle

In some cases the automatic repetition of complete cycles is required. For example, in case of a continuous test of the loader by placing 130 empty crucibles for the loader to run 130 cycles in unattended operation. Also at exhibitions the non stop mode without combustion is required. This is obtained by keeping the switch pressed already before switching on the power, and by keeping it pressed as long as the cycles have to run.

To do this:

1. Place the required number of crucibles on the loader.
2. In order to avoid the need of continuous manual pressing of the button, it can be mechanically fixed in pressed position before switching on the analyser, by mechanically connecting the button (4) with the connector (9) using a rubber ring.



3. The analyser is switched from position 0 to position 1 of the mains power switch.
4. After the last crucible is taken from the platform, the loader will turn the chain for a while, looking for any more crucibles. If no crucible is found, the chain will stop turning. The loader electronics will signalise the missing crucibles by triple beeping. See ERROR MESSAGES.

## **10 Continuous operation**

To operate the analyser and carry out analyses, the loader controller board must run in continuous mode.

To put back the loader controller board to continuous mode after adjustments are done, switch off the analyser (mains switch to position 0) and switch it on again (mains switch to position 1), without keeping the adjustment button of the loader controller board pressed.

## 11 Error messages

The loader electronic board contains a buzzer for signaling errors. The number of beeps in a row specifies the problem according to the table below.

No. of beeps	Error description
1	The beam of the vertical laser cannot be detected. Defective laser or detector, dirt in between, arm in between.
2	The beam of the vertical laser is continuously detected. Error of the finger's motor.
3	No crucible on the loader although the loader received the command to load the next crucible.
4	The beam of the horizontal laser cannot be detected. Defective laser or detector, crucibles don't move due to blockage, defective motor, etc.
5	The furnace is not opened for the loader to place a crucible on to the pedestal. Error in the piston control or piston sensor.
6	The fingers didn't take the crucible. The crucible blocks in its tray, no compressed air, faulty laser or sensor, etc.
7	The loader received the command for loading but the furnace is not open, or the piston came down with big delay.
8	One dispenser empty.
9	One dispenser empty.
∞	Infinitive number of beeps in manual mode. Piston sensor disadjusted (low end of furnace cylinder).

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