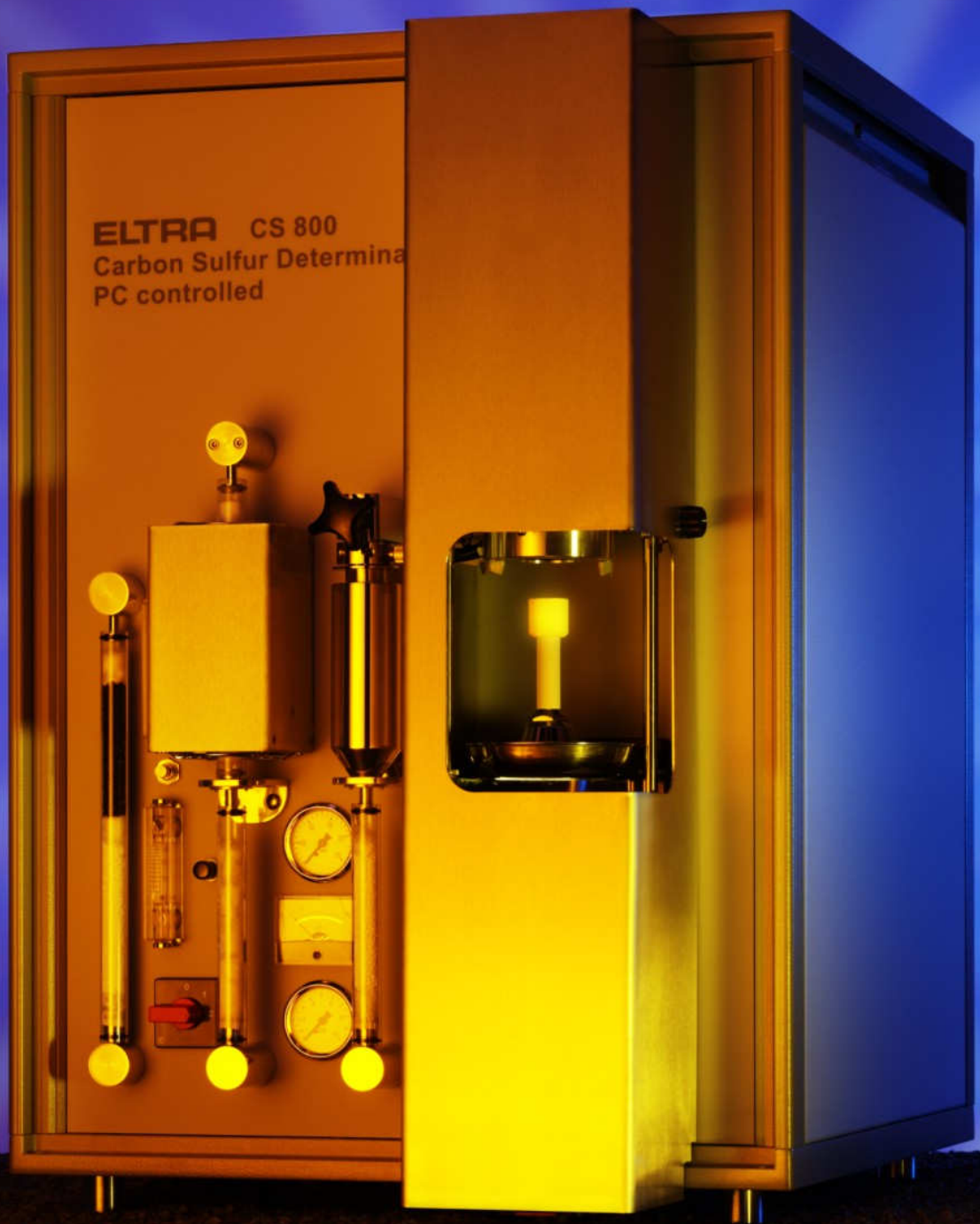
CS - 800 Double Dual Range

Carbon / Sulfur
Determinator

ELTRA
Analysers made in Germany

SERVICE MANUAL



ELTRA GmbH Mainstr. 85 Block 20

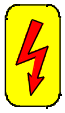
D - 41469 Neuss
Germany
☎ : +49 2137 - 12822
Fax: +49 2137 - 12513
analysers@eltragmbh.com
www.eltragmbh.com

NOTE :

In this Service Manual, no information is repeated from the Operation Manual, as it may be appreciated.

Service should only be done by persons who have mastered the servicing and maintenance of this device, as well as having further qualifications, especially in the areas of electronics and physics.

We ask the users of this Service Manual bring to our attention any possible mistakes. We would also appreciate any suggestions for supplements and improvements to this Service Manual.

CAUTION ! 

Before opening this device, always unplug the main power !

Service Manual CS-800

as from Serial No. 0951000xxx

0.1 Overview of the CS-800 modifications....0.1-5

1 FAULTS

1.1 IR-cell test display ++++ see 2. 3 ....1.1-1
1.2 Gas flow too high or too low....1.2-1
1.3 The gas flow rate fluctuates....1.3-1
1.4 No combustion....1.4-1
1.5 Bad combustion....1.5-1
1.6 Electronic drivers malfunctioning....1.6-1
1.7 The furnace does not close....1.7-1
1.8 The analysis takes too long....1.8-1
1.9 Development of dust when closing the furnace....1.9-1
1.10 Erratic results....1.10-1
1.11 The results are always 0.0000% or 00.0 ppm....1.11-1
1.12 Beeper responding....1.12-1
1.13 The life time of the combustion tube is too short....1.13-1
1.14 The LED for the infrared cell temperature regulation does not flash....1.14-1
1.15 The fuse burns out at the beginning of combustion....1.15-1
1.16 The fuse blows at the end of the analysis....1.16-1
1.17 Large collection of dust when opening the furnace....1.17-1
1.18 No or low oxygen pressure....1.18-1
1.19 Saved data are lost....1.19-1
1.20 Noise or drift of the infrared baseline....1.20-1
1.21 Dust in the oxygen carrying tube when the furnace opens....1.21-1
1.22 The word Eltra appears on the display....1.22-1
1.23 The oxygen pressure falls when the furnace opens....1.23-1
1.24 Combustion without pressing " START "....1.24-1
1.25 The crucible cracks or melts....1.25-1
1.26 The analysis doesn´t start....1.26-1
1.27 Vibrations on setting 2....1.27-1
1.28 The analysis cycle stops only 25 seconds after start....1.28-1
1.29 The chopper motor doesn`t rotate....1.29-1
1.30 High carbon results are erretic....1.30-1

2 ADJUSTMENT, TEST AND FUNCTION EXPLANATIONS

2.1 Gas flow controller adjustment and jumper setting....2.1-1
2.2 Pressure switch....2.2-1
2.3 Infrared zero-baseline, control and adjustment....2.3-1
2.4 IR-source voltage setting....2.4-1
2.5 Temperature regulation of the IR-cell....2.5-1
2.6 Pneumatics....2.6-1
2.7 Pressure regulation....2.7-1
2.8 Closing cone, adjustment....2.8-1
2.9 Linearisation....2.9-1
2.10 Programming the balance....2.10-1
2.11 ....2.11-1
2.12 Induction generator control....2.12-1
2.13 Diagnostic printous....2.13-1
2.14 Setting check up....2.14-1

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3 SERVICE

3.1 IR-paths, cleaning and replacing 3.1-1
3.2 IR-source 3.2-1
3.3 Infrared electronics 3.3-1
3.4 Infrared power supply 3.4-1
3.5 Chopper ++++ see **3. 2** 3.5-1
3.6 Infrared temperature regulation 3.6-1
3.7 Leak checking 3.7-1
3.8 Replacing EPROMs 3.8-1
3.9 Clearing memory 3.9-1
3.10 Electronic reset 3.10-1
3.11 Coding IR-ranges 3.11-1
3.12 Adding new channels 3.12-1
3.13 Cleaning the solenoid valves 3.13-1
3.14 Replacing the flow sensor 3.14-1
3.15 Installing an AC-power stabiliser 3.15-1
3.16 Additional safety features for furnace pneumatics (optional) 3.16-1
3.17 Installing a halogen trap 3.17-1
3.18 Gas saving mode 3.18-1
3.19 Upgrade for copper analysis without accelerators 3.19-1
3.20 Upgrading of analysers with electronic rack for using the new Windows software 3.20-1
3.21 Preventive Maintenance checklist 3.21-1

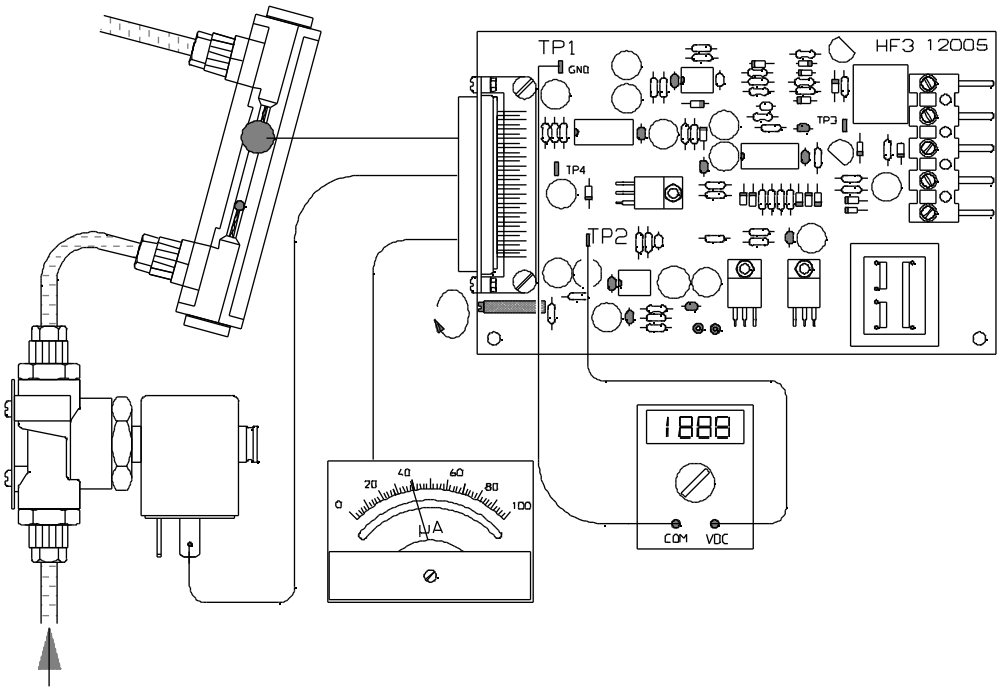
4 MISCELLANEOUS

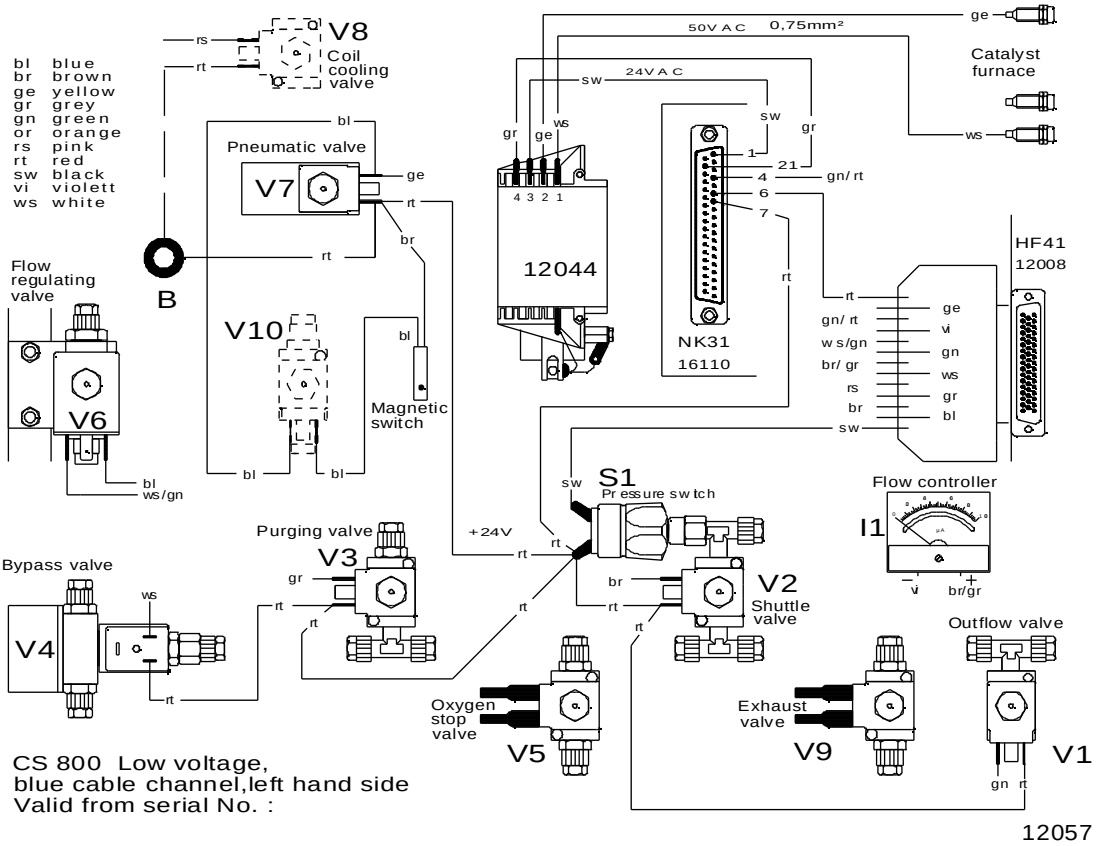
4.1 Ordering numbers 4.1-1
4.2 Wiring and gas flow diagrams 4.2-1
4.3 Starting through external key 4.3-1
4.4 External report of analysis condition 4.4-1
4.5 Spare parts kits 4.5-1
4.6 Maintenance CS-800 ..... 4.5-1

0.1 Overview of the CS-800 modifications:

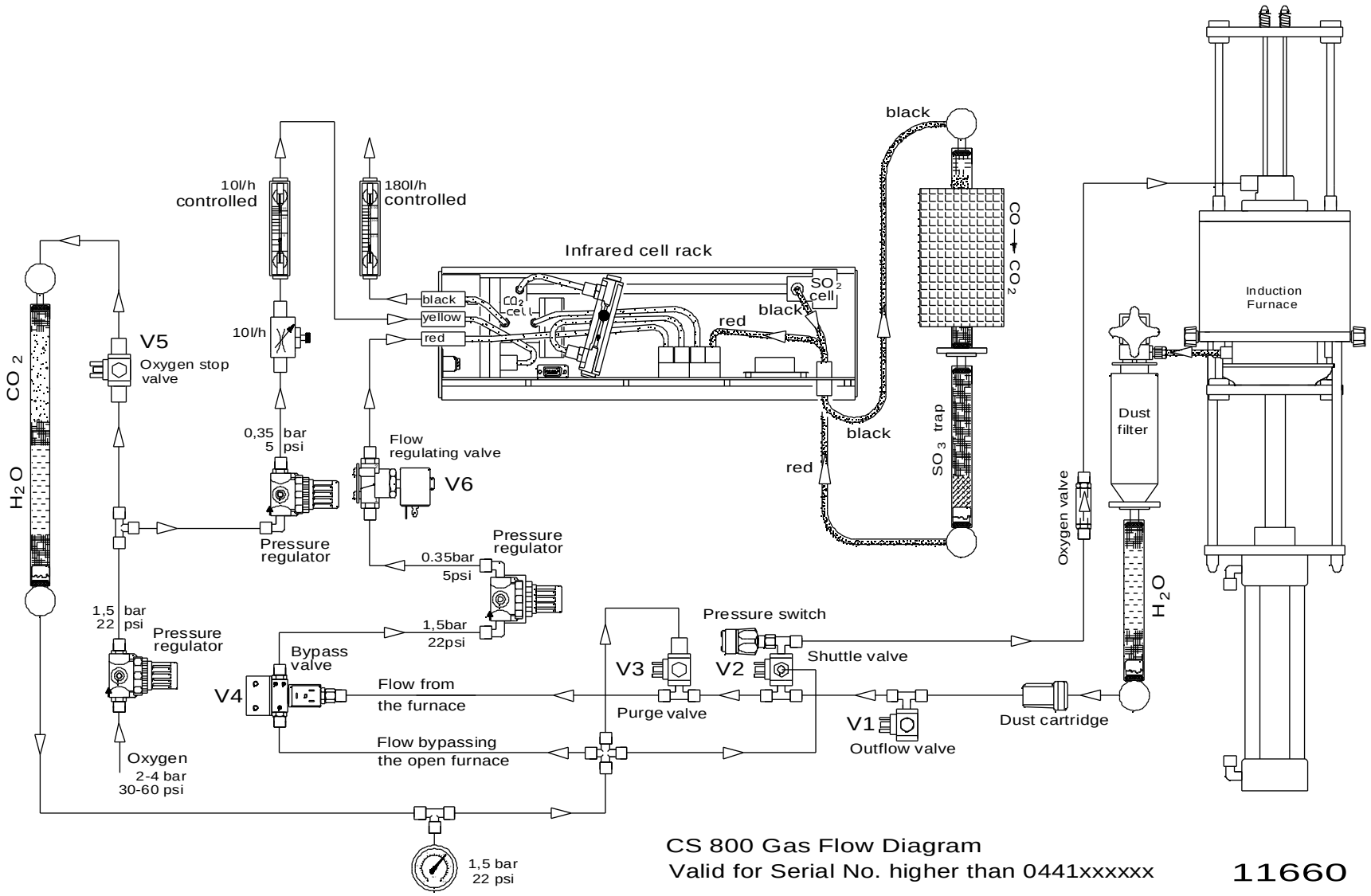
Up to S/N0766xxxxxx

The CS-800 analysers are equipped with a flow sensor with optical elements and with the corresponding board **HF-3** and **HF-4**.





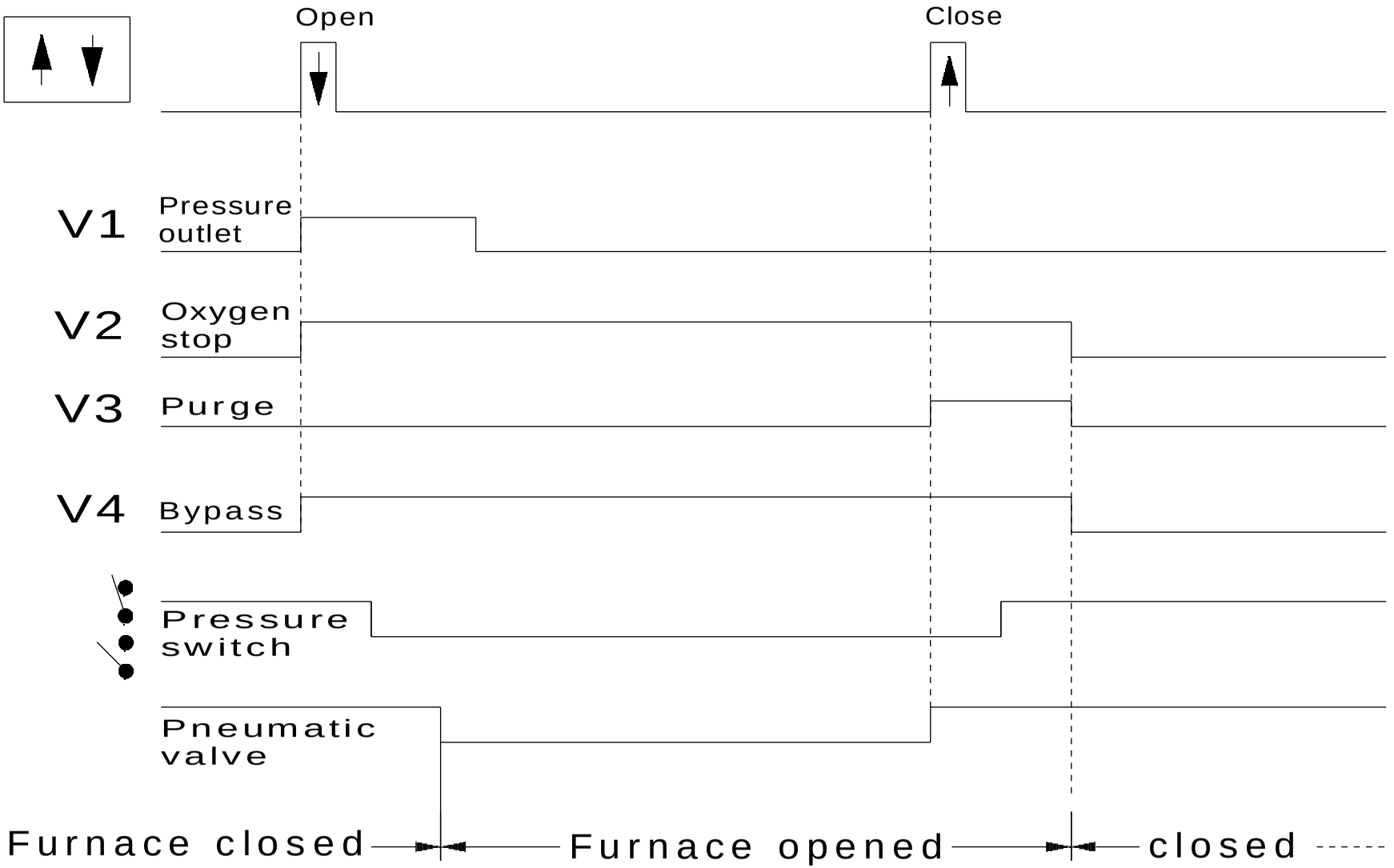
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CS 800 Gas Flow Diagram
Valid for Serial No. higher than 0441xxxxxx

11660

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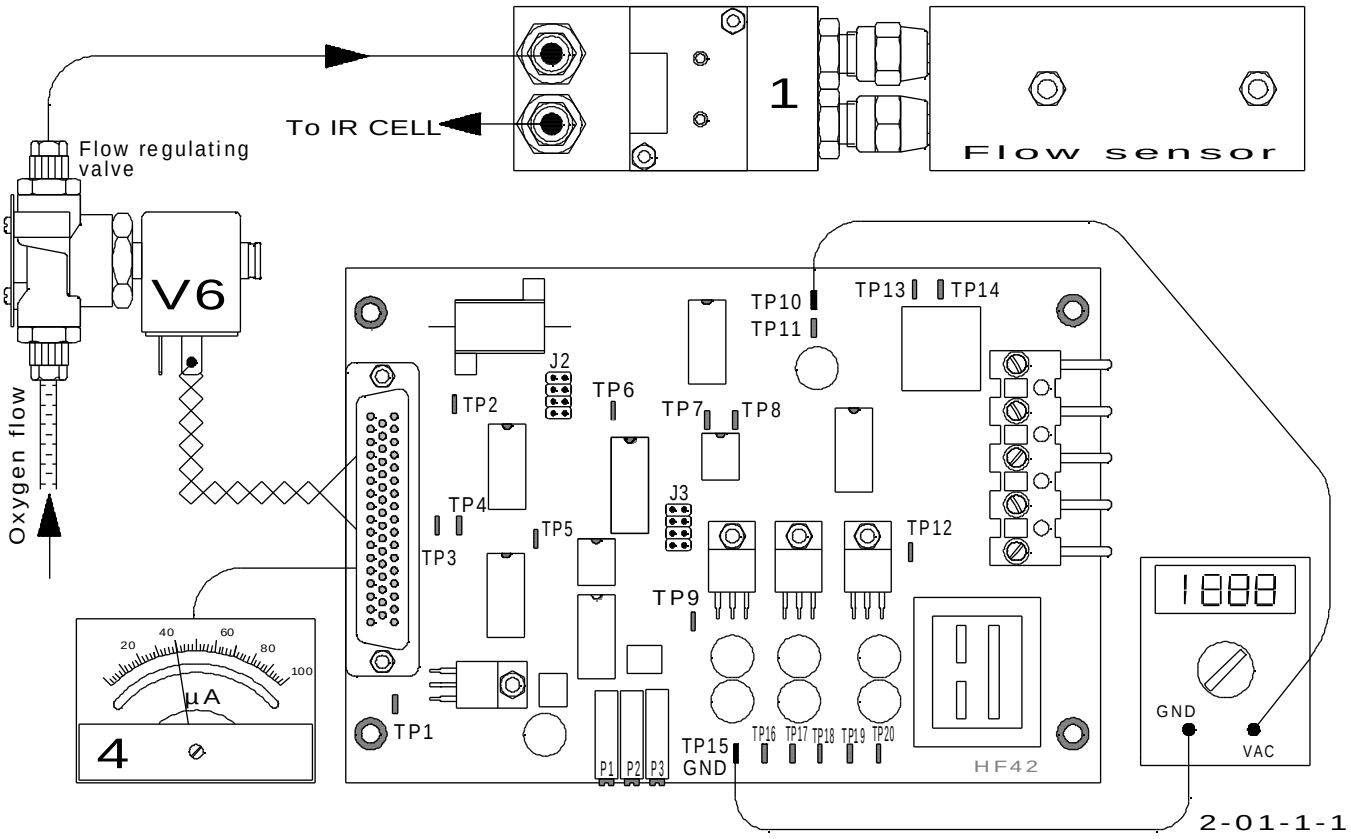


From S/N 0767xxxxxx

The CS-800 is equipped with a flow sensor employing a pressure transducer, and with the corresponding boards **HF-41** and later the **HF-42**.
These boards also offer:

- Current limit for the **induction furnace** (on board HF 41/42 adjustment)
- **Oxygen flow** only during combustion (on board jumber)
- **Gas saving mode** by controlling the oxygen flow (start / stop) by the software

This function has been included later in the software, from **SN / 1080xxxx**
Analysers from **SN / 0767 to SN / 1079** can be upgraded with this function.
For description see **"corresponding service manual"**

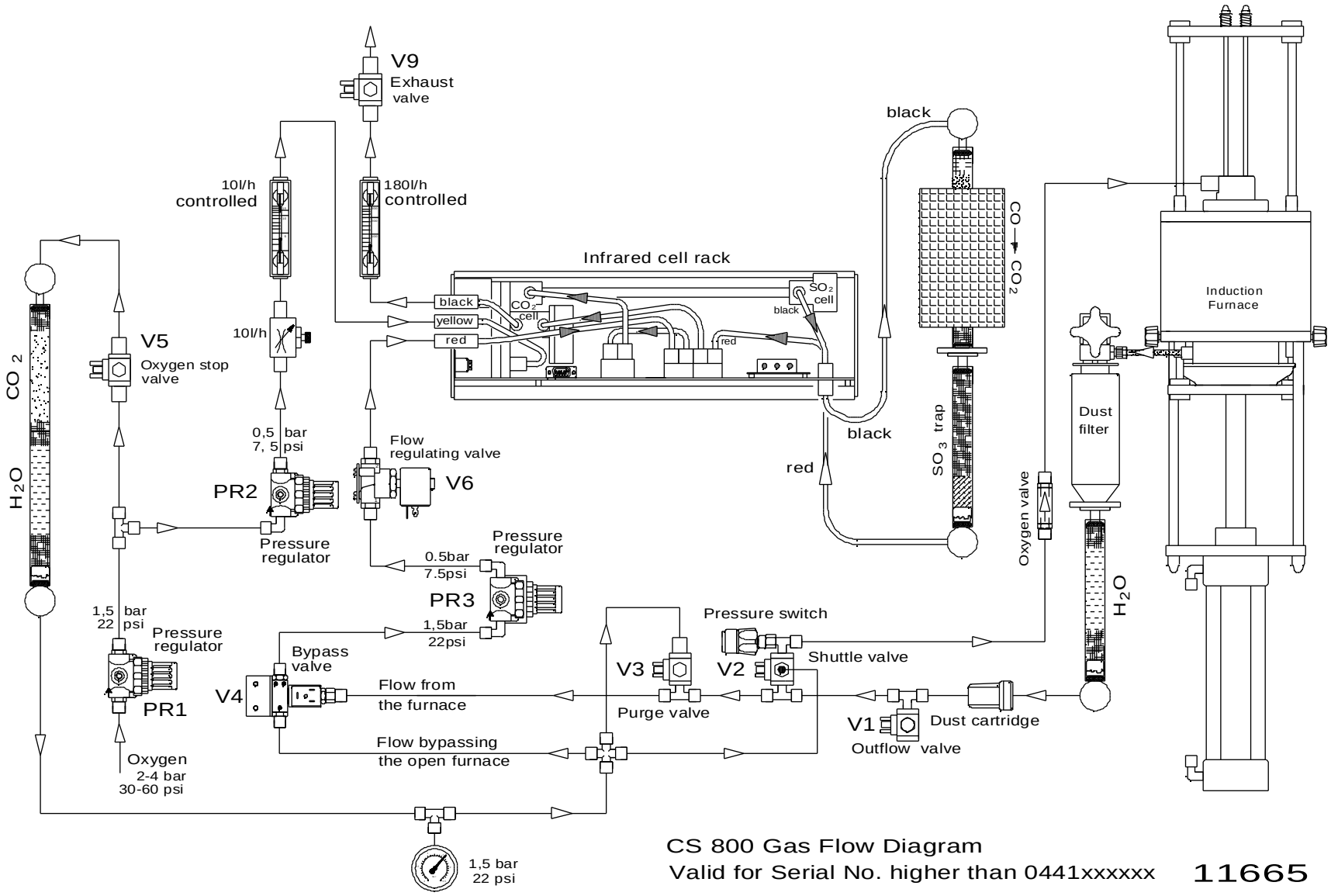


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CS 800 Signal and control

Valid for CS 800 with serial No. over 12058

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CS 800 Gas Flow Diagram

Valid for Serial No. higher than 0441xxxxxx

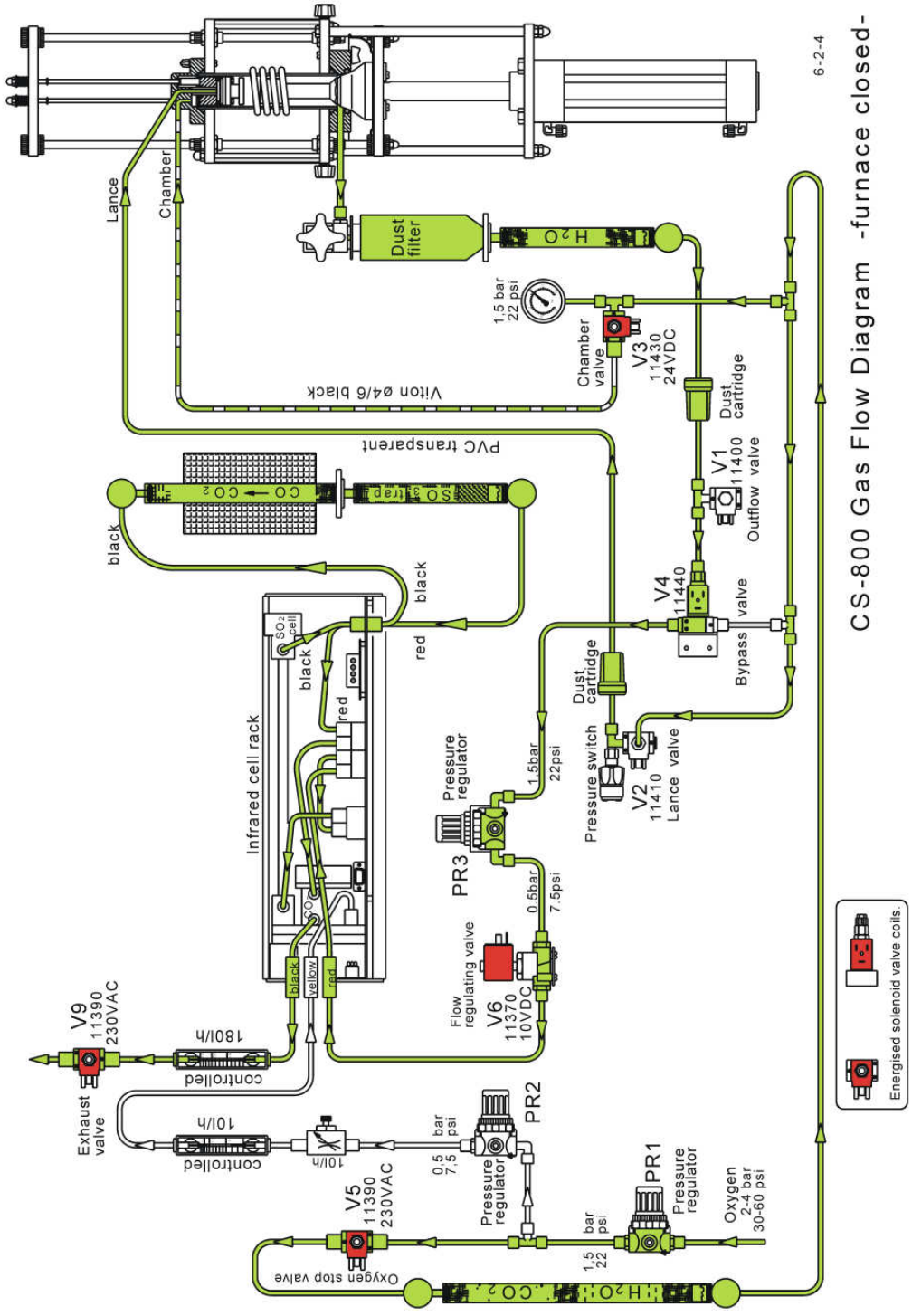
11665

From S/N 0951xxxxxx

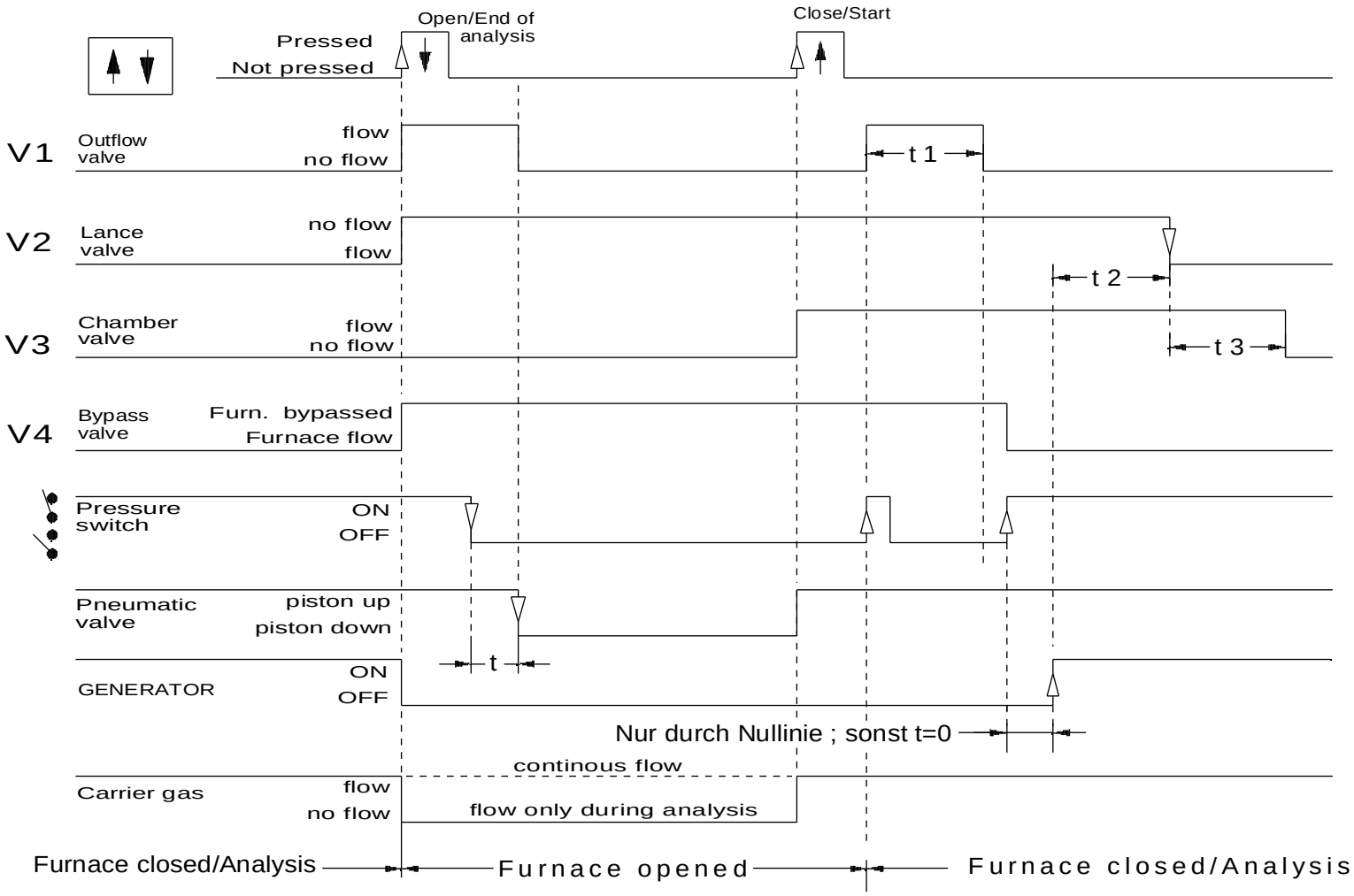
The **CS-800** has an additional purging inlet on top of the combustion chamber.

- The position of the solenoid valves is rearranged and their controlling software is modified accordingly. Therefore, a very good care has to be taken when changing the **EPROMS**.

- The wiring has also changed. It has been modified to be used with the **IR-4**, and the four **IR-cell** rack. As the **4-cell** software was not available, the **CS-800** was equipped with the still available with the **3-range IR-cell** using an adapter and the **3-cell** software up to **SN / 1079xxxx**.



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V2	V3	
H	H	Only chamber flow
H	L	No flow
L	H	Lance and chamber flow
L	L	Only lance flow

t1 : Purging befor combustion
t2 : Chamber oxygen only
t3 : Lance and chamber oxygen
Rest of combuston after t3, lance oxygen only

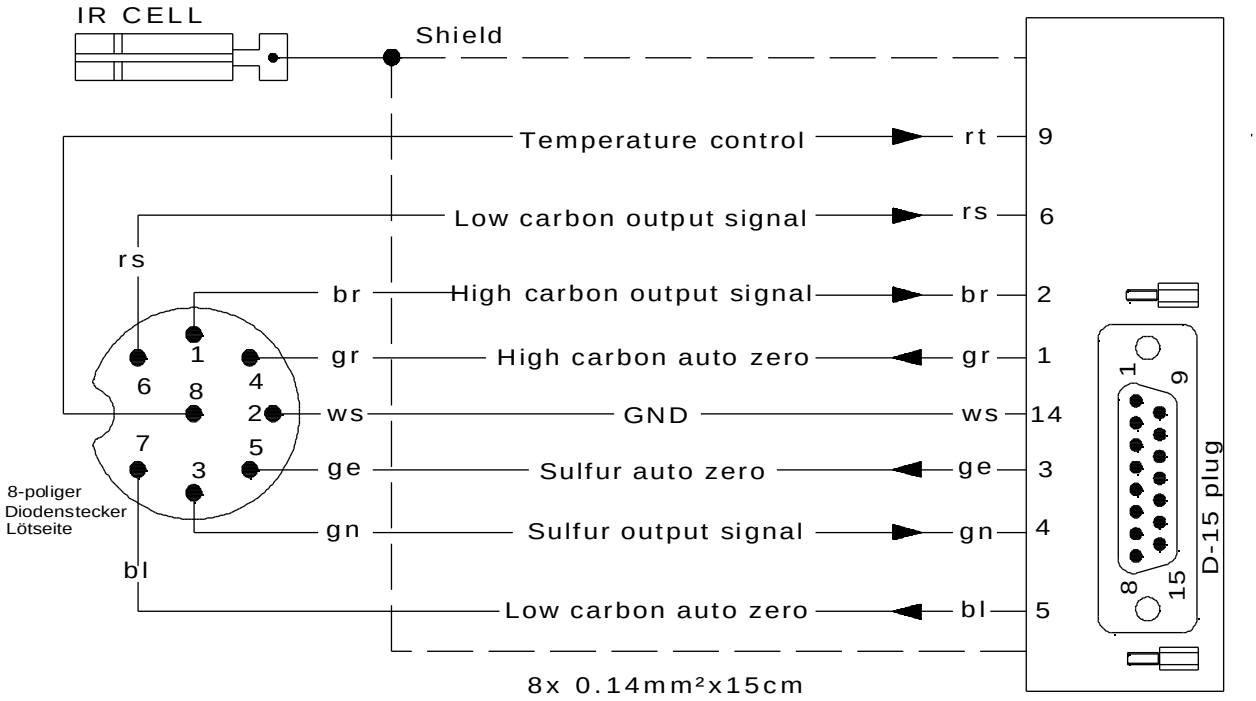
NOTE: V1 and V3 enable the oxygen flow when they are energised.
V2 stops the oxygen flow when it is energised.
Valid for all valves (V1 to V4 and for the pneumastic valve):
High means the coil is energised.
Low means the coil is not energised.

12202

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bl	blue
br	brown
ge	yellow
gr	grey
gn	green
or	orange
rs	pink
rt	red
sw	black
vi	violett
ws	white

h	24.01.2002				
g	23.01.2002				
f	30. 4. 2001		Datum	Name	Benennung: CS-800 CS-2000 Signalleitung für IR-4
e	27. 3. 2001	gez.:	14. 7. 2000	Knipp	
d	5. 3. 2001	gepr.:	14. 7. 2000	Polemitis	
c	20. 9. 2000				
b	18. 9. 2000	ELTRA			Zeichnungs-Nr.: 12059
a	29. 8. 2000	Mainstr. 85 Block 20 D-41469 Neuss			
Bez.:	geändert am:				



bl	blue
br	brown
ge	yellow
gr	grey
gn	green
or	orange
rs	pink
rt	red
sw	black
vi	violett
ws	white

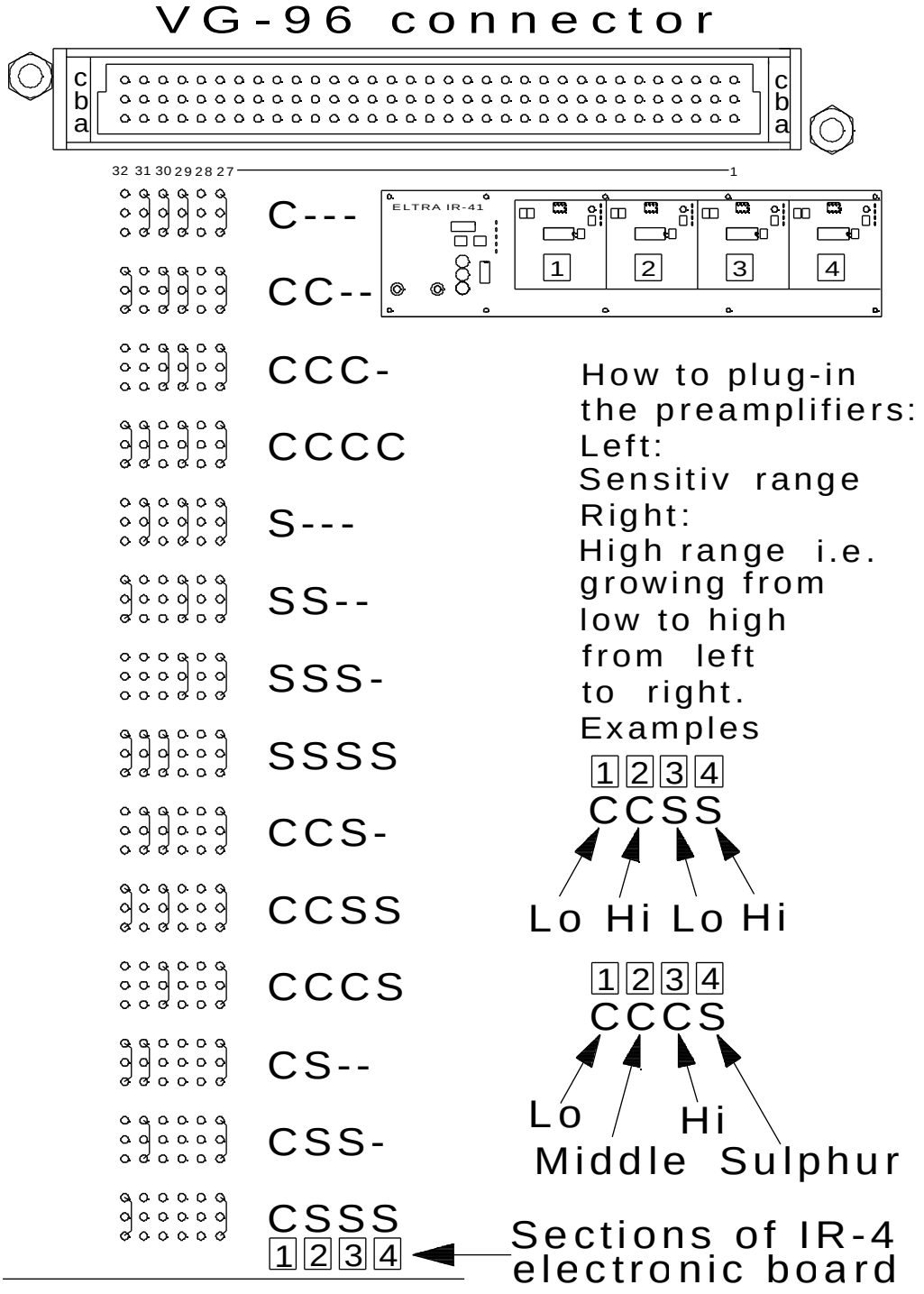
			Datum	Name	Benennung:
		gez.:	18. 9.2000	Knipp	IR Signal adapter Alte Zelle-neuer Analysator- -alte Software
		gepr.:	18. 9.2000	Polemitis	
		ELTRA Mainstr. 85 Block 20 D-41469 Neuss			Zeichnungs-Nr.: 12068
Bez.:	geändert am:				

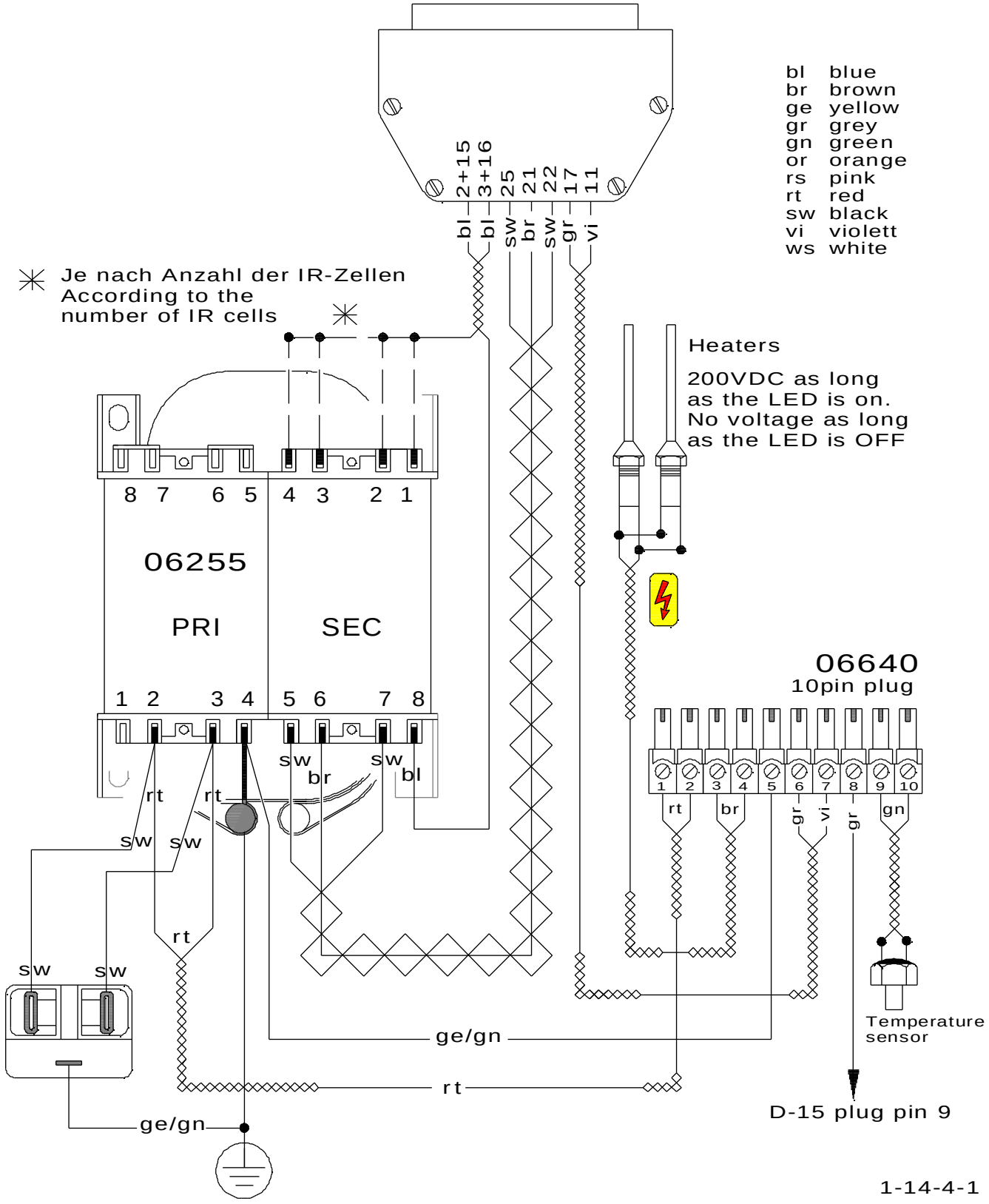
From S/N 1080xxxxxx

The **CS-800** is equipped with the **four IR-cell** rack. All electronic boards as well as the chopper motor **ARE DIFFERENT** to those of the previous **3-range IR-cell**.

The software changed to the four IR-range version !!!

The gas saving mode is available and selectable in the PC software **PLOTCS**.
When an analysis has not been carried out for a period of time, the analyser will automatically switch to **" Gas Conservation Mode "**. This effectively means the carrier gas flow rate is reduced to a minimum, only < allowing a small amount of **oxygen** to circulate through the **IR-cell** etc. The period of time before the Gas Conservation is activated, can be modified via the PC Software. It is also possible to have carrier gas flow only during combustion.

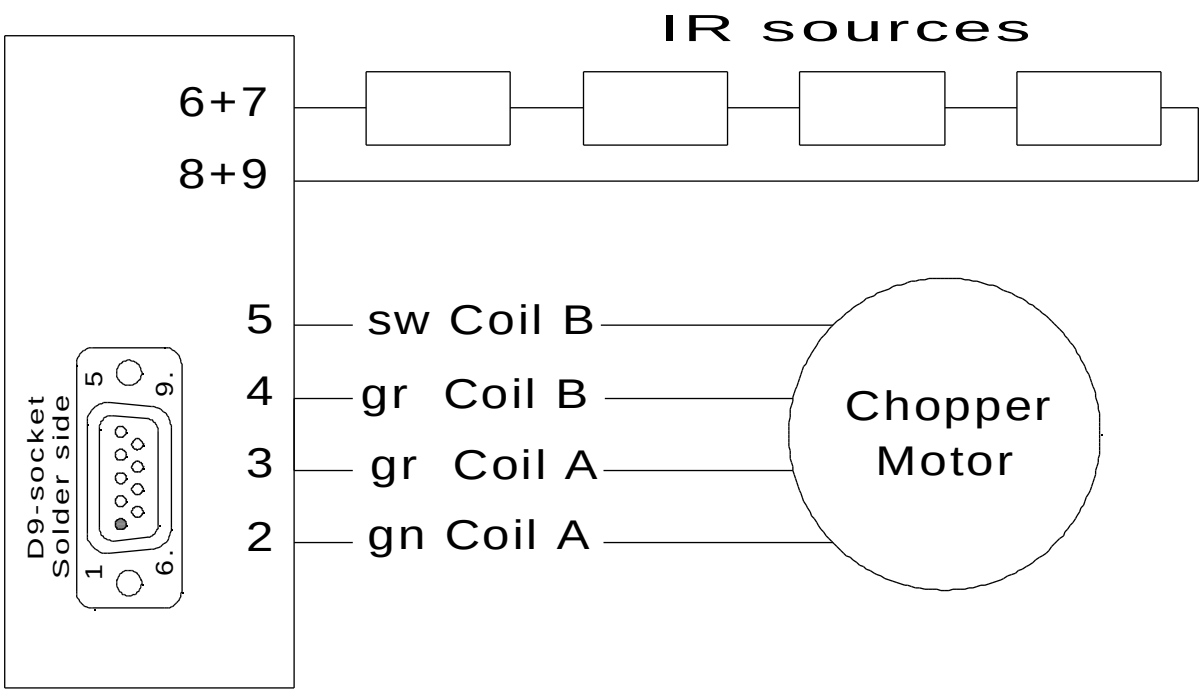



bl blue
br brown
ge yellow
gr grey
gn green
or orange
rs pink
rt red
sw black
vi violett
ws white
2+15
3+16
25
21
22
17
11
bl
bl
sw
br
sw
gr
vi
Je nach Anzahl der IR-Zellen
According to the
number of IR cells
Heaters
200VDC as long
as the LED is on.
No voltage as long
as the LED is OFF
8 7 6 5 4 3 2 1
06255
PRI
SEC
1 2 3 4 5 6 7 8
06640
10pin plug
1 2 3 4 5 6 7 8 9 10
rt
br
gr
vi
gr
gn
sw
br
bl
rt
rt
sw
sw
rt
sw
sw
ge/gn
rt
ge/gn
Temperature
sensor
D-15 plug pin 9

1-14-4-1

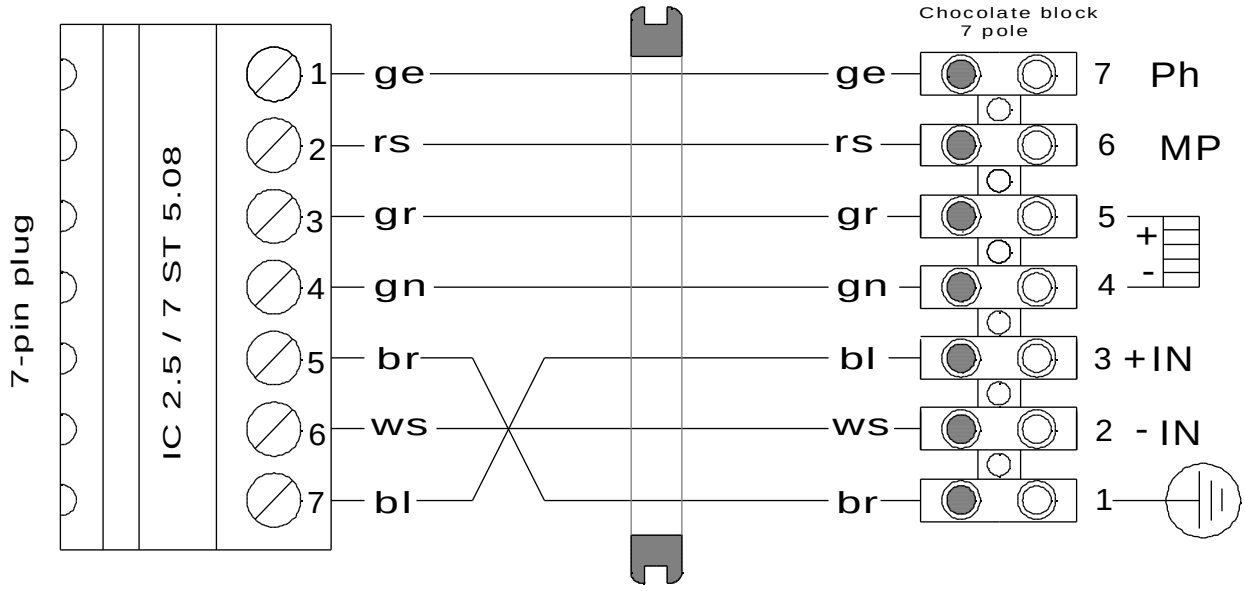
			Datum	Name	Benennung: IR - 4 rack Wiring diagram
		gez.:	10.7.2000	Knipp	
		gepr.:	10.7.2000	Polemitis	
b	22. 1. 2002	ELTRA			Zeichnungs-Nr.: 06665
a	3. 5. 2001	Mainstr. 85 Block 20			
Bez.:	geändert am:	D-41469 Neuss			

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bl blue
br brown
ge yellow
gr grey
gn green
or orange
rs pink
rt red
sw black
vi violett
ws white

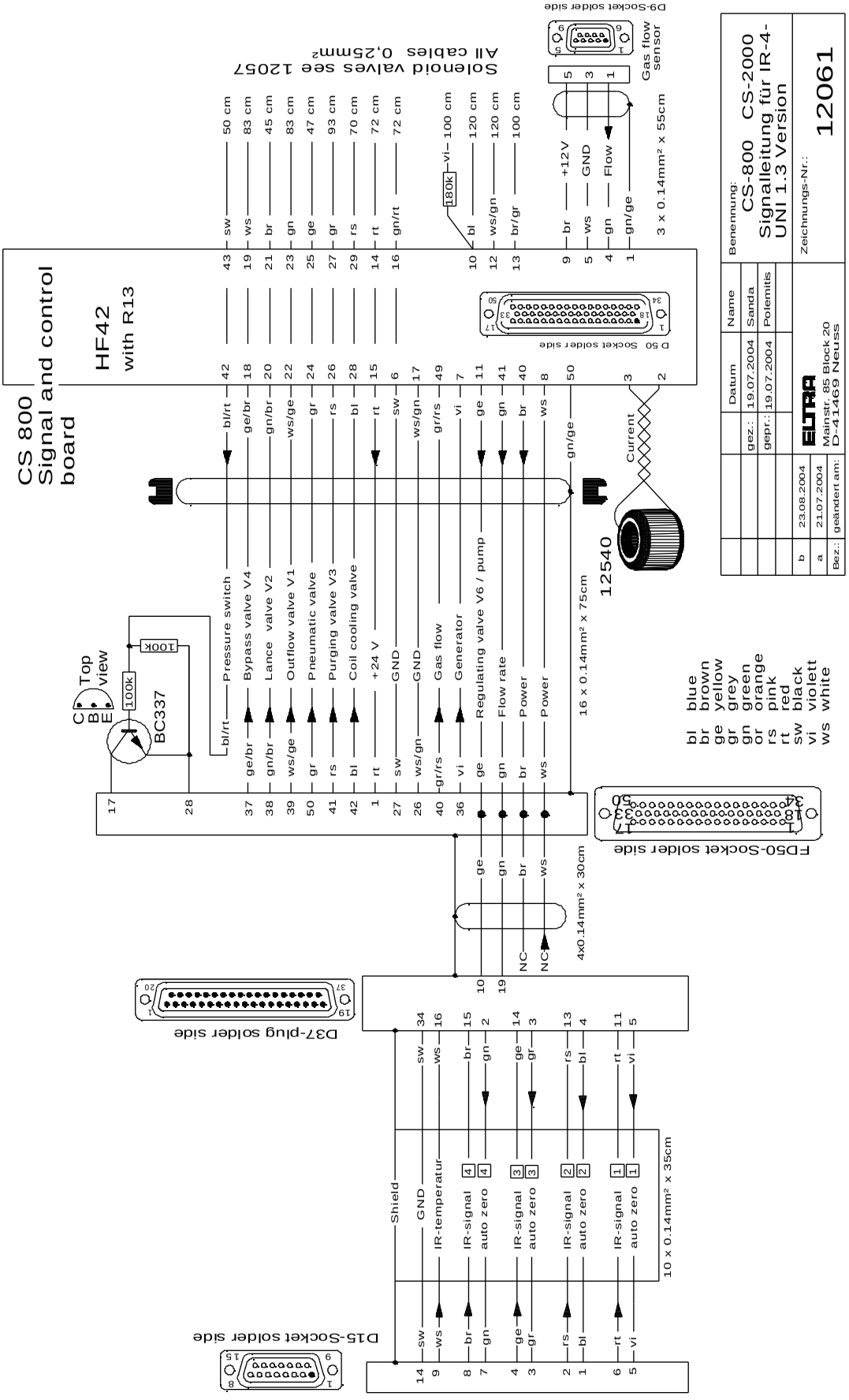
				Datum	Name	Benennung:
			gez.:	10.7.2000	Knipp	Chopper motor and IR source
			gepr.:	10.7.2000	Polemitis	
			ELTRA			Zeichnungs-Nr.:
			Mainstr. 85 Block 20			06660
Bez.:	geändert am:	gepr.:	D-41469 Neuss			



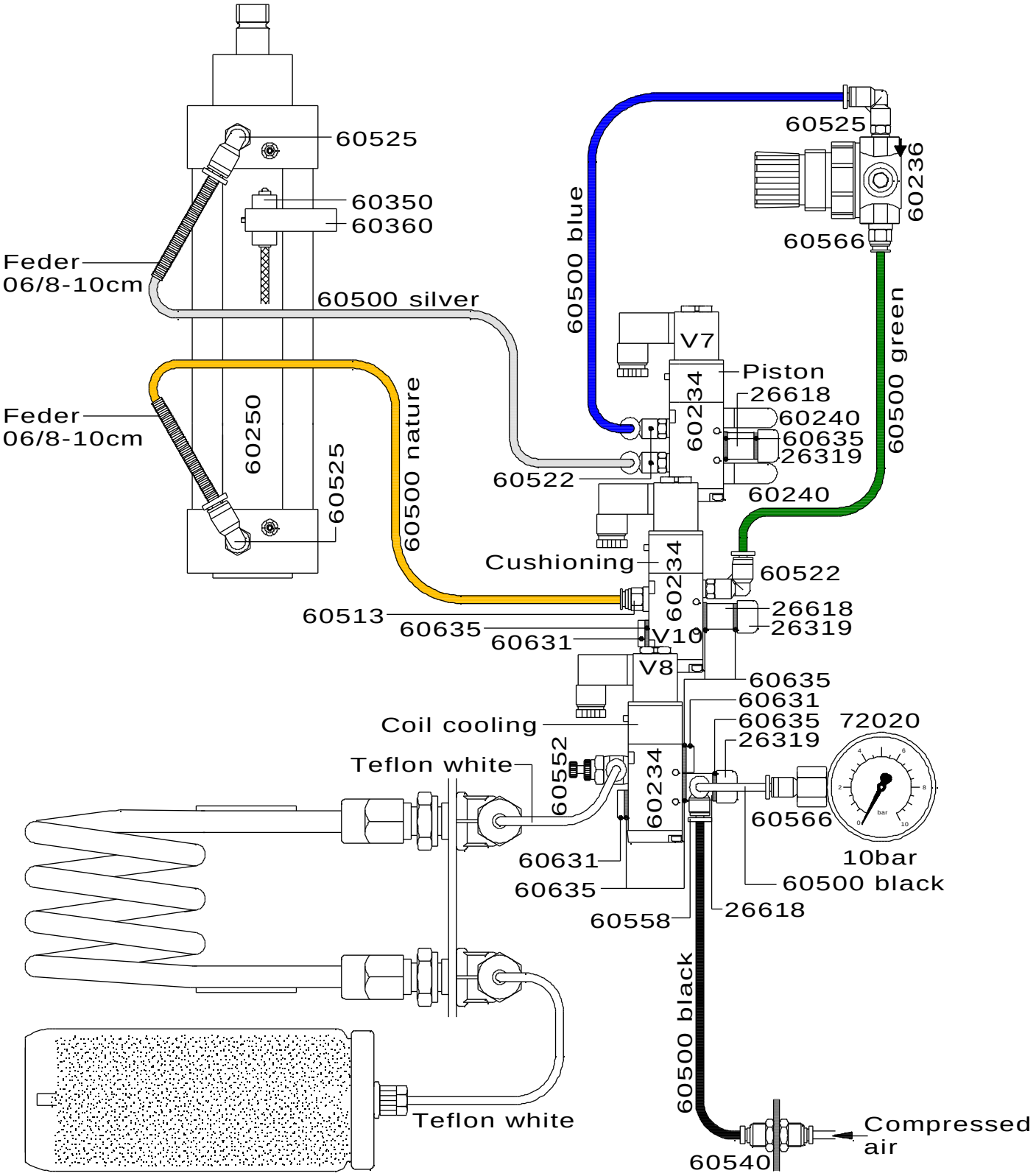
			Datum	Name	Benennung:
		gez.:	25.08.2000	Knipp	Cable conection TH 62 - NR 32 (15037)
		gepr.:	26.08.2000	Polemitis	
		ELTRA Mainstr. 85 Block 20 D-41469 Neuss			Zeichnungs-Nr.: 06645
Bez.:	geändert am:				

From S/N 1557xxxxxx

The electronic unit is replaced by the board UNI 1.3 and the electronic rack is removed.
The corresponding wiring diagram is **12061**.
The modification took place in the second half of 2004.



From end of the year 2007 the CS-800 is equipped with the new pneumatics.



1 FAULTS

1.1 IR-cell test display: ++++ see 2. 3

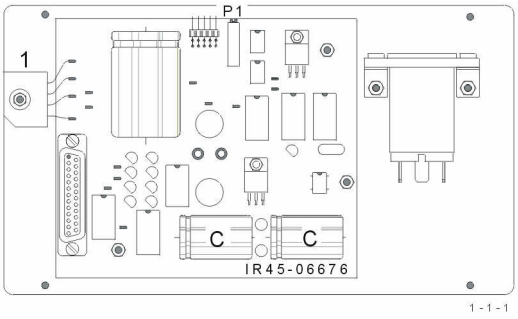
also after five minutes of oxygen flow:

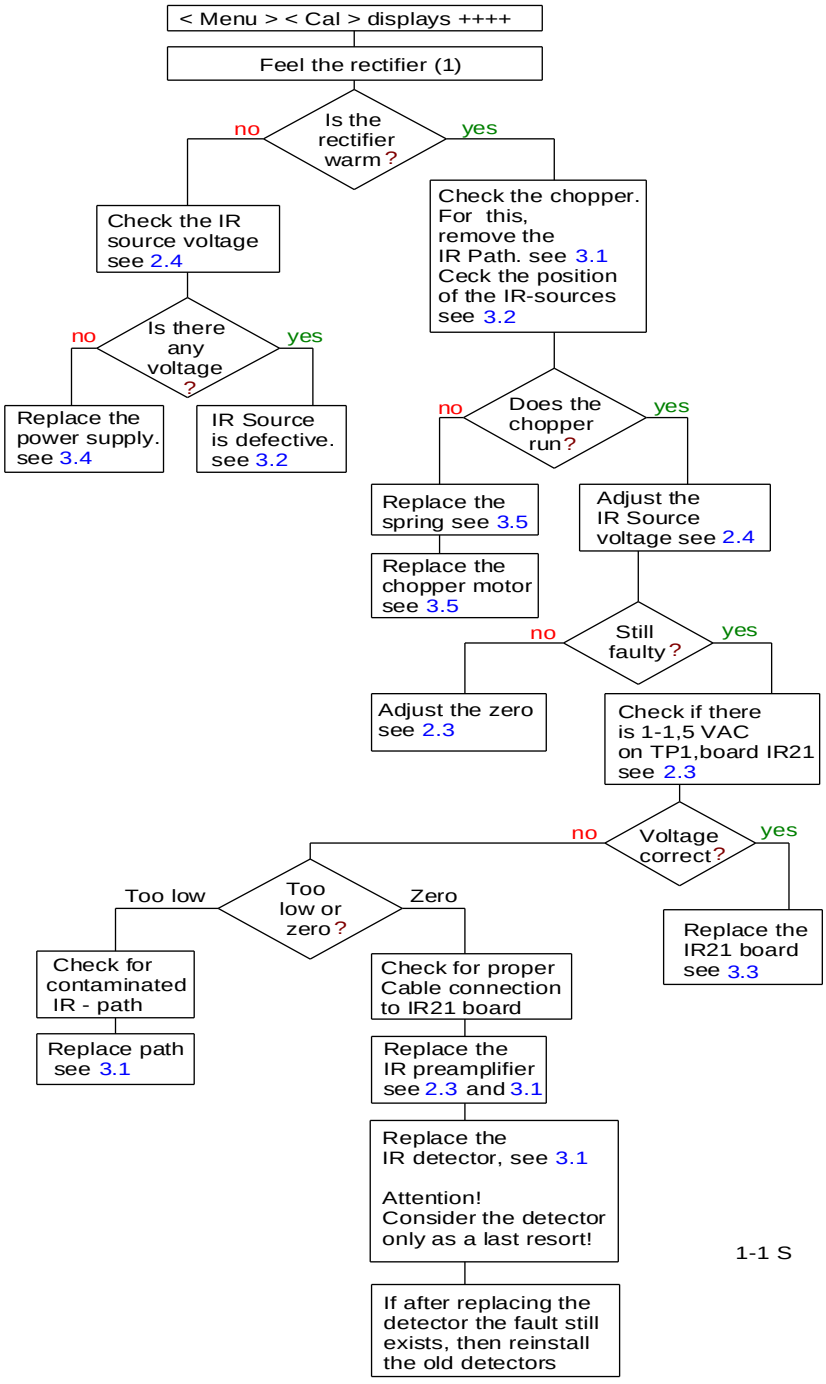
If the range is higher than **10 V, ++++** then the problems are as follows:

1). **Too much contamination of the IR-paths:**
In case the analyser has more than one cell, and if not all of them shows **++++**, then a contamination is very likely.

2). **The IR-Sources:**
The sources are bent or de-adjusted through transport. See **Remark:**

3). **Chopper:**
The chopper is not running. This is obvious when the paths are clean and the IR-sources are in place.

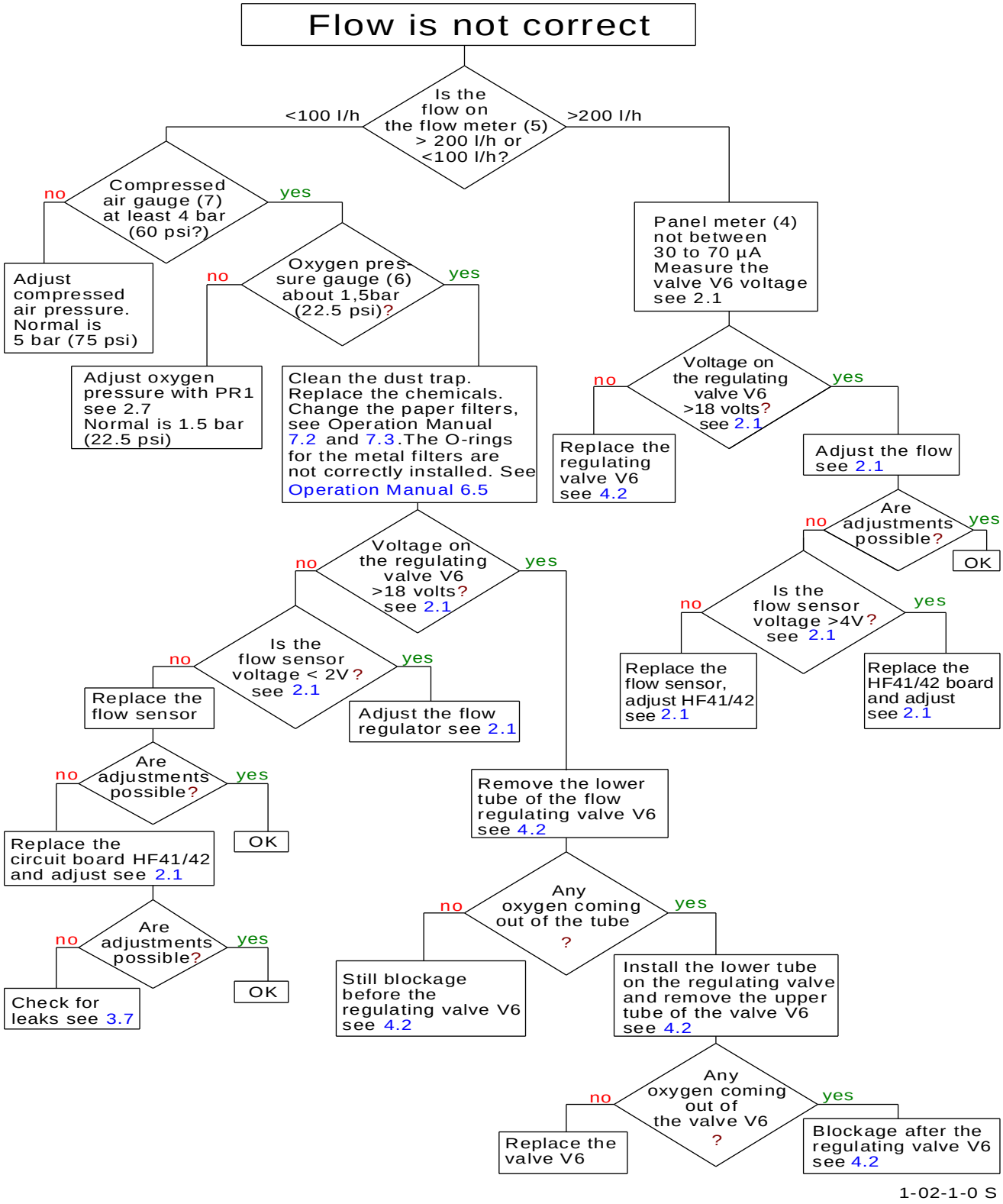




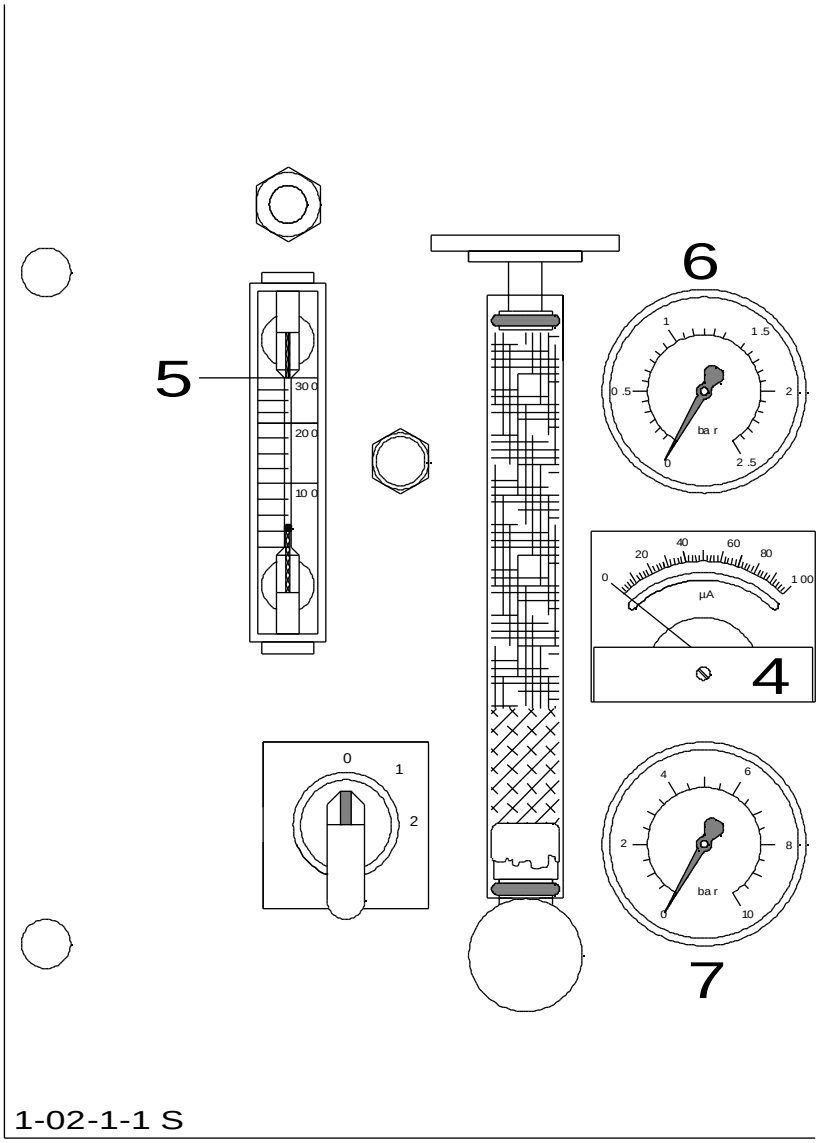
Remark:
In most cases the problem is in the IR-sources or in the power supply. During a rough transportation the IR-sources may be bent causing the problem. See 3.2. We experienced that it is very popular for the new IR-detector and preamplifiers. We can only help if you send us a copy of the flow diagram of this chapter, after drawing a line along the path you followed according to the condition you found.
Asking for detectors, preamplifiers and boards. Without following this diagram is useless.

1.2 Gas flow too high or too low:

Valid for induction furnace operation:



1-02-1-0 S



4 Panel meter indicating the control of the gas regulation valve
5 Gas flow meter 300 l/h
6 Oxygen pressure gauge
7 Compressed air pressure gauge

1.3 The gas flow rate fluctuates:

The flow rate is electronically regulated, therefore there should be no significant variation from the set value.
In case of a fault however, the automatic regulation of the flow rate is no longer possible and the gas flow fluctuates. This can be caused, for example, by an excessive obstruction of the gas flow system or by a faulty component hat needs to be replaced, see **1. 2** and **2. 1**
Most of the time, the problem lies in the saturation of the dust trap or of the chemicals.

In case the flow becomes lower and the µA-meter goes higher during combustion, it is obvious that the flow regulator is working. Therefore the problem must be a restricted oxygen supply. When the accelerators start burning they take a lot of oxygen, so that the pressure in the furnace goes down, and as a result for this the flow also goes down.

The restriction can be in:

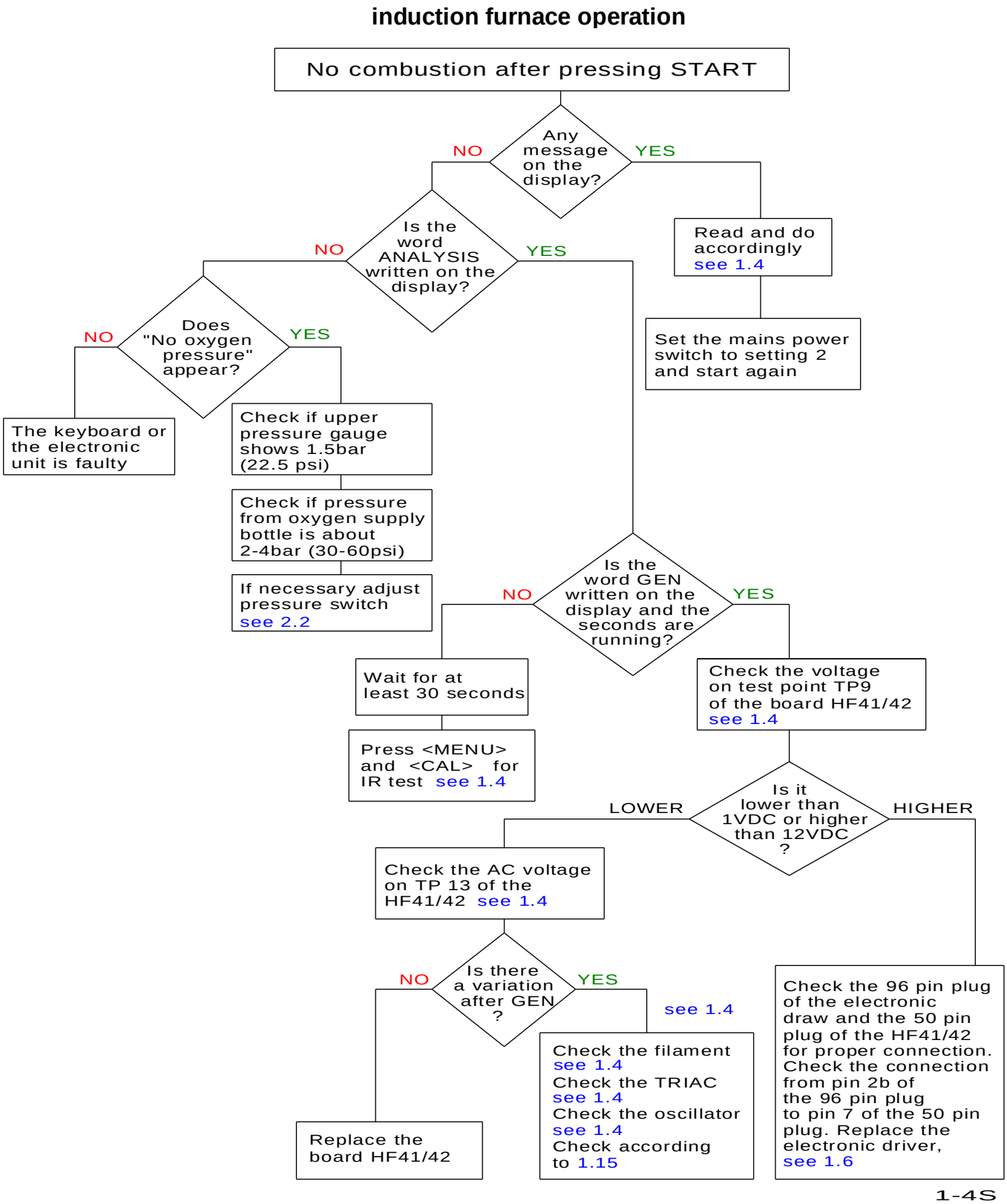
- the hole in the ceramic shield
- the furnace outlet
- the connection from the furnace outlet to the metal filter housing
- the inlet of the metal filter housing
- the metal dust filter
- the anhydrone
- the paper filter
- the filter cartridge

Please note that the restrictions can also be outside the analyser, for example a faulty pressure regulator on the oxygen bottle, a too low adjustment of the pressure on the regulator, not properly opened outlet tap of the regulator, a too long and too thin tube, or this tube is somewhere bent or pressed or, or, or.

If the problem is only a long thin tube, the problem can eventually be solved by increasing the pressure on the pressure regulator of the bottle.

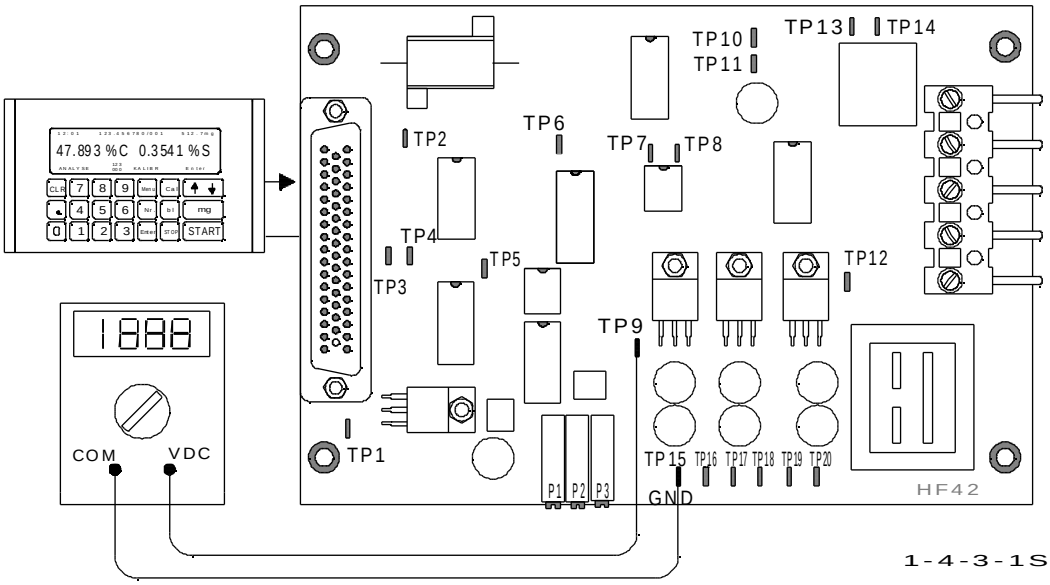
As a hint, when you open the furnace the pressure on the analyser's oxygen gauge should go from 1.5 bar down to 1.4 bar but not lower. If it goes much lower, it means that the incoming oxygen is restricted on the way from the bottle to the analyser.

1.4 No combustion:



AFTER PRESSING < START >
"ANALYSIS" AND "GEN" APPEARS,BUT COMBUSTION DOESN'T TAKE PLACE.

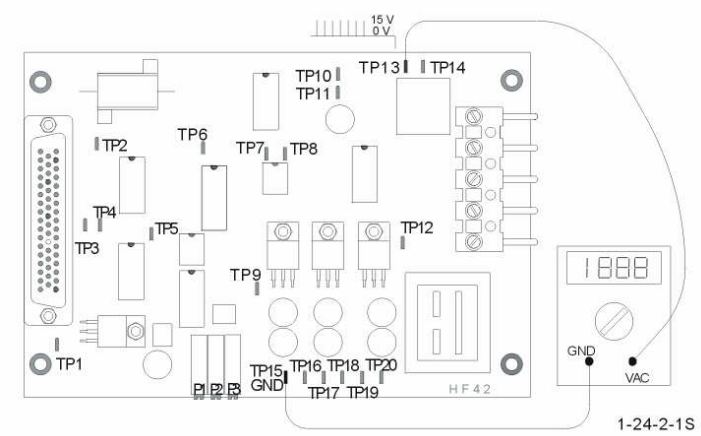
- **The command from the electronic unit to start the generator, is not received:**



Measurements on TP9:

- a signal of about **0.5 V** should turn the generator on,
- a signal of about **12 V** should turn the generator off.

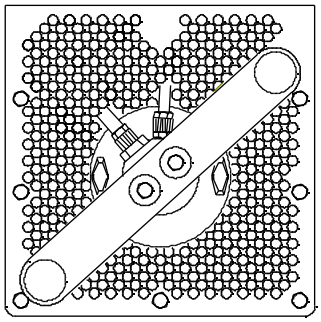
If **12 V** are measured, despite **"GEN"** appearing on the display, then the electronic is defective, see **1. 6**; or the connection from the **HF 42** circuit board, **pin 7** is loose, see **4. 2**.



When the command for the generator is received **(0.5 V DC)**, the needle pulse must appear on the **TP13** test point. If there is no oscilloscope available you can test this with a digital voltmeter.
The displayed value depends on what type of digital voltmeter you have. There must be a voltage increase on **TP13**, once the word **"GEN"** has appeared on the display, or once **0.5 V** are present on **TP9**. When no voltage increase occurs on **TP13**, despite having **0.5 V** on **TP9**; the **HF 42 circuit board** is defective.

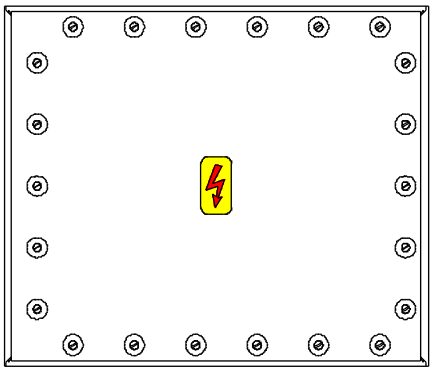
CAUTION! After replacing the **HF 42** board, **make sure that the 50 pin plug is properly inserted. It takes a lot of force to push in 50 pins at once**.
50 pin plugs that haven't been properly inserted are a frequent problem.
Tighten the screws of the plug properly, to ensure a proper connection to the board.

Checking the generator tube:

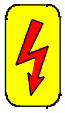


- Ensure that the power switch is at **setting 2**
- Check if the filament of the generator tube glows:
  This can be easily checked:
  through the air vent holes of the furnace,
  the reflected light of the glowing filaments
  (heater of the cathode) should be visible.

If the light from the filament is not visible, then remove the cover from the generator section, in order to see the tube.

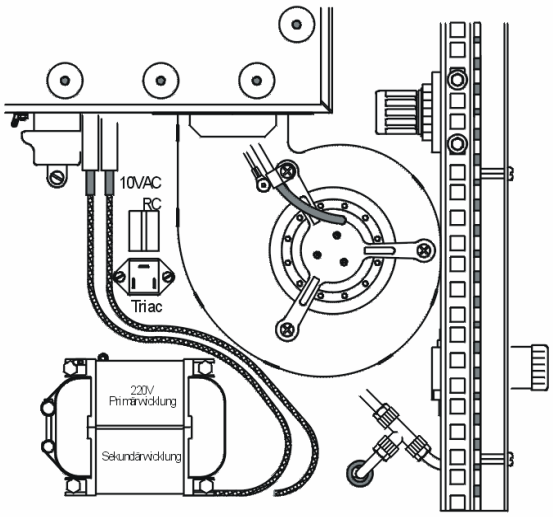


WARNING ! HIGH VOLTAGE !



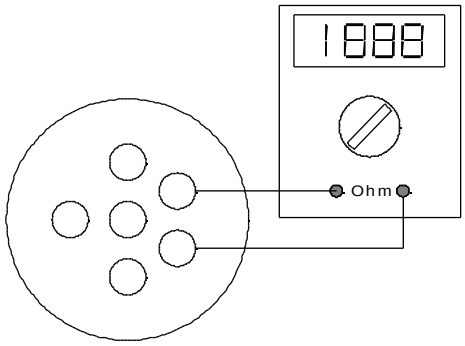
If the filament of the generator tube doesn't glow:

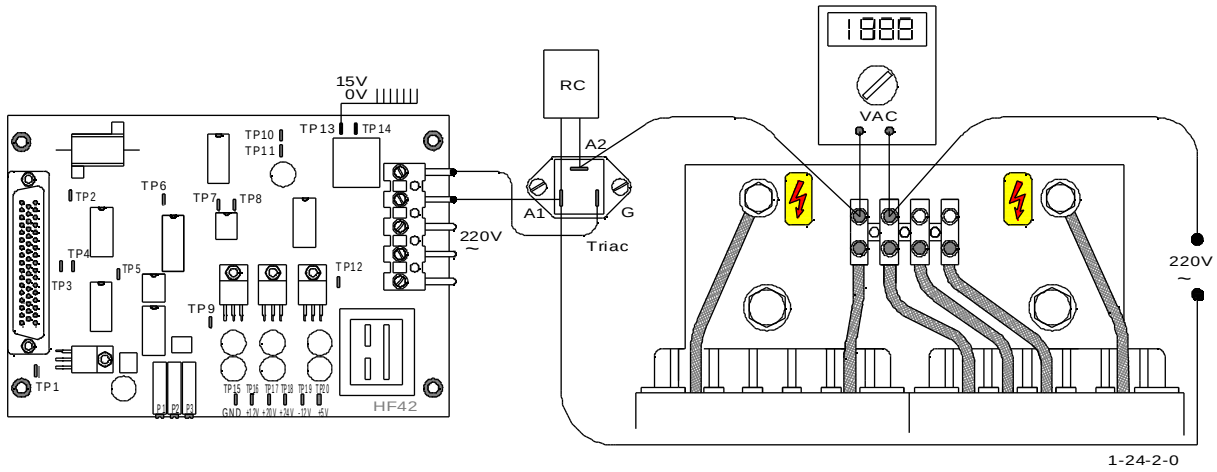
- Check the voltage for the heater,
  on the transformer, there should be **10 V AC**
  on the secondary, and **220 V AC primary voltage**.
- Check whether the filament is faulty,
  at the filament connections, only **1 Ohm**
  must be measured. A very high or
  unmeasured resistance means that the
  filament is burnt through and the tube needs
  to be replaced.



CAUTION!

- Set the power switch to **pos. 1** before removing
  the tube, although it would be best
  to completely turn off the device and unplug the power cord.





Checking the primary voltage on the high voltage transformer:

- On the primary side of the high voltage transformer, you should be able to measure **210 V AC**; if not, the **triac** is defective. (To locate the triac, see **4. 1 - 4**)
  WARNING ! HIGH VOLTAGE !

High voltage transformer: windings check up:

- In case the transformer has **210 V AC** on the **primary coil** and there is still no combustion, check the windings of the transformer as follows:
- Switch off the analyser and disconnect the main power plug.
- Measure the resistance of the primary coil.
  It must be extremely low, about **0.8 Ohms** between the screws labelled **0** and **270**.
- Measure the resistance of the secondary coil **between** the **two screws** on the **ceramic insulator** where the wires of the rectifier are connected. The resistance is approximately **322 Ohms**.

Once there is voltage on the transformer the triac must be OK. A relatively low voltage on the transformer could be a result of too high current so that the board reduces the phase angle. There is most probably a faulty component in the oscillator circuit preventing it from oscillating so that the oscillator tube takes a high DC current.

This can damage the tube. Therefore when you start for testing whether there is combustion, keep your finger on the STOP key. If the sample does not start burning about 3 seconds after the generator starts, then immediately stop the analysis.

One thing that will give further evidence is the current taken by the analyzer from the mains power.

If the current goes up to a level of about 10A, then a faulty component prevents oscillations so that the tube takes all this power causing overheating of the tube within several seconds.

If the current does not increase, it means that the generator does not take power, for example due to a broken grid resietor.

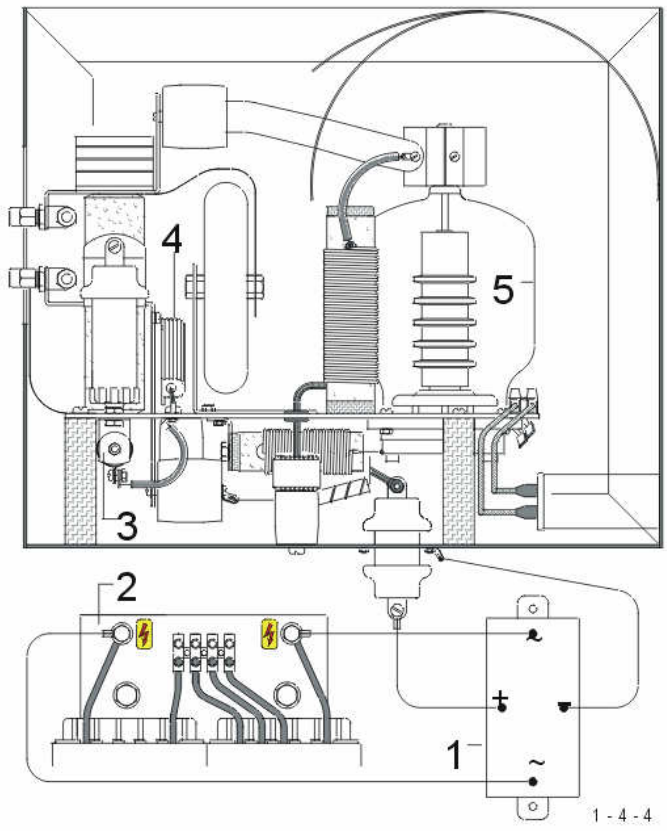
- **The rectifier (1) could also be faulty!**

CHECKING THE HIGH FREQUENCY OSCILLATOR:

Warning ! HIGH VOLTAGE !

Never try to measure the voltage here !
As there is high voltage **(5000 volts)** and high frequency **(19.2 MHz)** present, a measurement would be very difficult and, above all, **very dangerous**. Before the generator cover plate is unscrewed, the device should be turned off or, better, the power plug pulled out.

- You should check the connections in the oscillating circuit to ensure all screws are turned tightly, especially all the screw caps on the combustion coil.
- The electrical connections and resistors should be checked with an ohmmeter.
- **If the resistor 2.7 KΩ / 100 W (3) is open circuit, then there is no oscillation**.
- The parts e.g. tube and rectifier should be replaced one by one, see also **1. 15**



Loud buzzing sound when the generator turnes on.

If during integration (combustion period) the high voltage transformer is making exeptoinally loud buzzing sound when the generator turnes on. Also when running the furnace empty still the loud buzzing appears. This means that obviously for some reason , the triggering of the triac has changed.
If you are sure that the noise appears only during integration period (combustion period) then the problem could be in the generator. The unusually laud noise could be due to current limitation by phase angle control.
The oscillator tube may not be oscillating due to a tube fault so that it takes a very high DC current causing the current limit circuit to reduce the phase angle. If a capacitor is faulty most probably the fuses would blow because faulty capacitors cause sudden sparking so that the current limit doesn't have time to react.
I would suggest to replace the tube. This is also the easiest thing to try so that it can be done by the customer.

CAUTION!: The oscillator tube can be damaged due to overheating if for some other reason the new tube may not be able to oscillate. For testing after installing the new tube, put crucible with sample and accelerators into the furnace like you use to do with every normal analysis. After starting analysis watch carefully the furnace to see the light of the burning sample/accelerators. If a couple of seconds after generator start (transformer noise, base lines for peak on the PC screen) there is no combustion to see in the furnace then STOP the generator by pressing the STOP button or by clicking STOP on the screen depending on which software and hardware you use.

If the oscillator tube replacement doesn't help then either the triac or the HF board is not in proper condition any more. The best thing to doin this case is to replace both, board and triac.

CAUTION !: When looking to find out whether there is combustion or not, STOP the analysis cycle about 3 seconds after it started. If there are oscillations, after 3 seconds the sample (steel or iron chips) will have visible signs of starting burning. But if you wait up to the end of the analysis cycle in order to check whether there was combustion, it could be already too late for the tube due to overheating.

Once there is voltage on the transformer the triac must be OK. A relatively low voltage on the transformer could be a result of too high current so that the board reduces the phase angle. There is most probably a faulty component in the oscillator circuit preventing it from oscillating so that the oscillator tube takes a high DC current.

This can damage the tube. Therefore when you start for testing whether there is combustion, keep your finger on the STOP key. If the sample does not start burning about 3 seconds after the generator starts, then immediately stop the analysis.

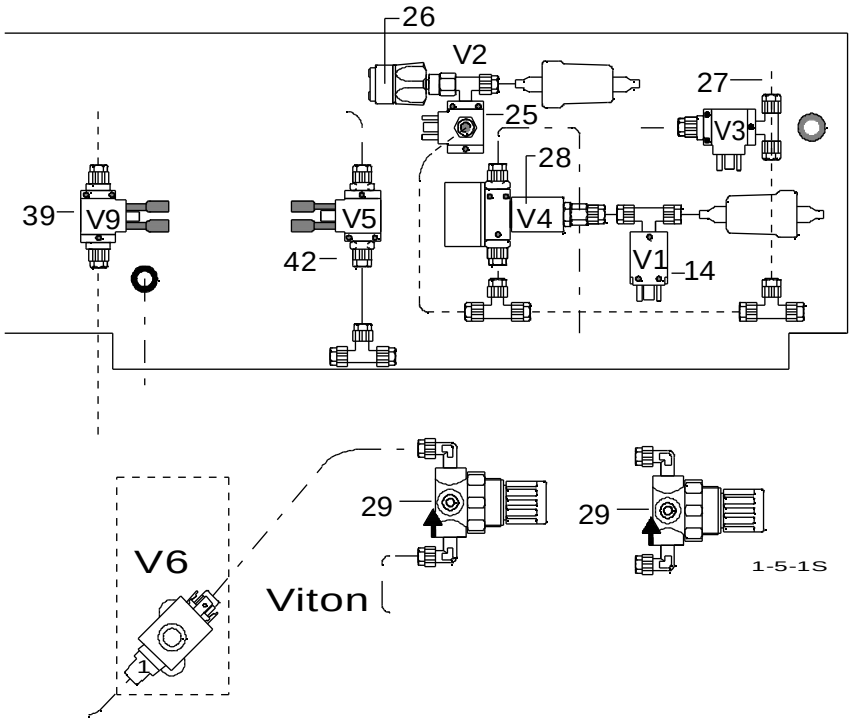
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If the current does not increase, it means that the generator does not take power, for example due to a broken grid resietor.

1.5 Bad combustion:

Insufficient flow: see 1. 3



- The bypass valve **(28)** is either falsely activated during combustion, or it is sticking. In this case, the oxygen flows through the bypass valve into the **IR-cell** and not through the furnace. The furnace remains nonetheless under oxygen pressure.

- Measure the voltage to the bypass valve **(28)**
  24 Volts DC while the furnace is open is normal.
  Zero volts when the furnace is closed is normal.
  The measurements can also be made with a digital voltmeter, as well as with a glow light probe that shows **24 V / 20 mA.**

  Other false controls from the electronics :
  Clear the memory;see **3. 9**

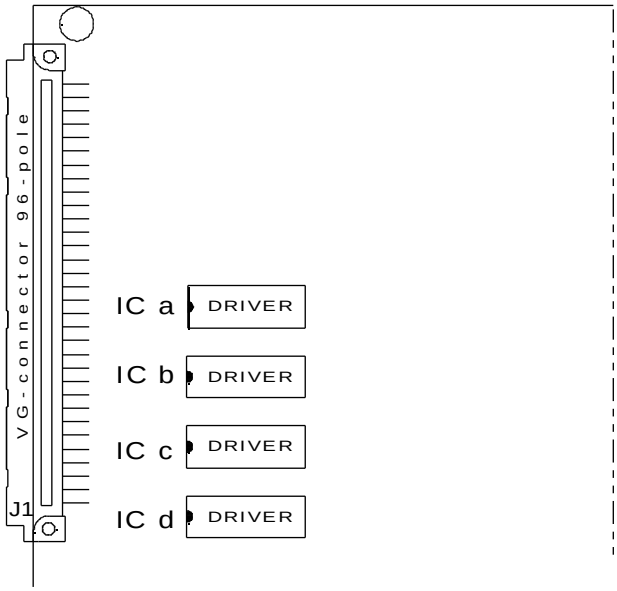
  Clean the valves; see **3.13**

  Generator tube is too old :
  This normally does not occur suddenly, it is rather a long process.
- Replace the tube

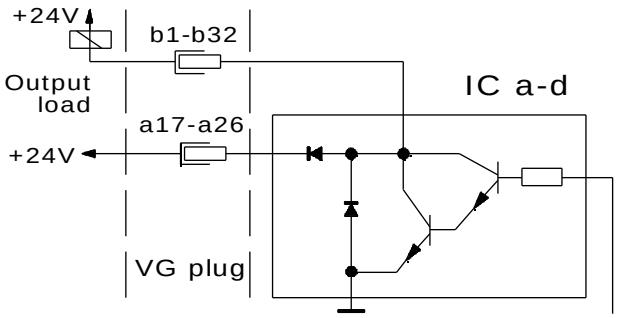
  Replace inadequate contact points in the oscillating circuit, see **1. 4**

  Replace worn power controls, see **1. 4**

1.6 Electronic- drivers malfunctioning:



IC a, b, c and **d** are electronic driver Integrated Circuits, found on the mother board inside the electronic unit.
Their Type No. is **ULN 2803** or **TD 62083**.



1-6

These **IC's** act as a power switch, in order to energise solenoid valves inside the analyser, see 2. 6, 3. 7 and 4. 2 or to send control signals, see 1. 2 1. 4 and 1.24

Operation range of IC's a, b, c, d.
Depending on the fault location, the following driver IC's need to be replaced:

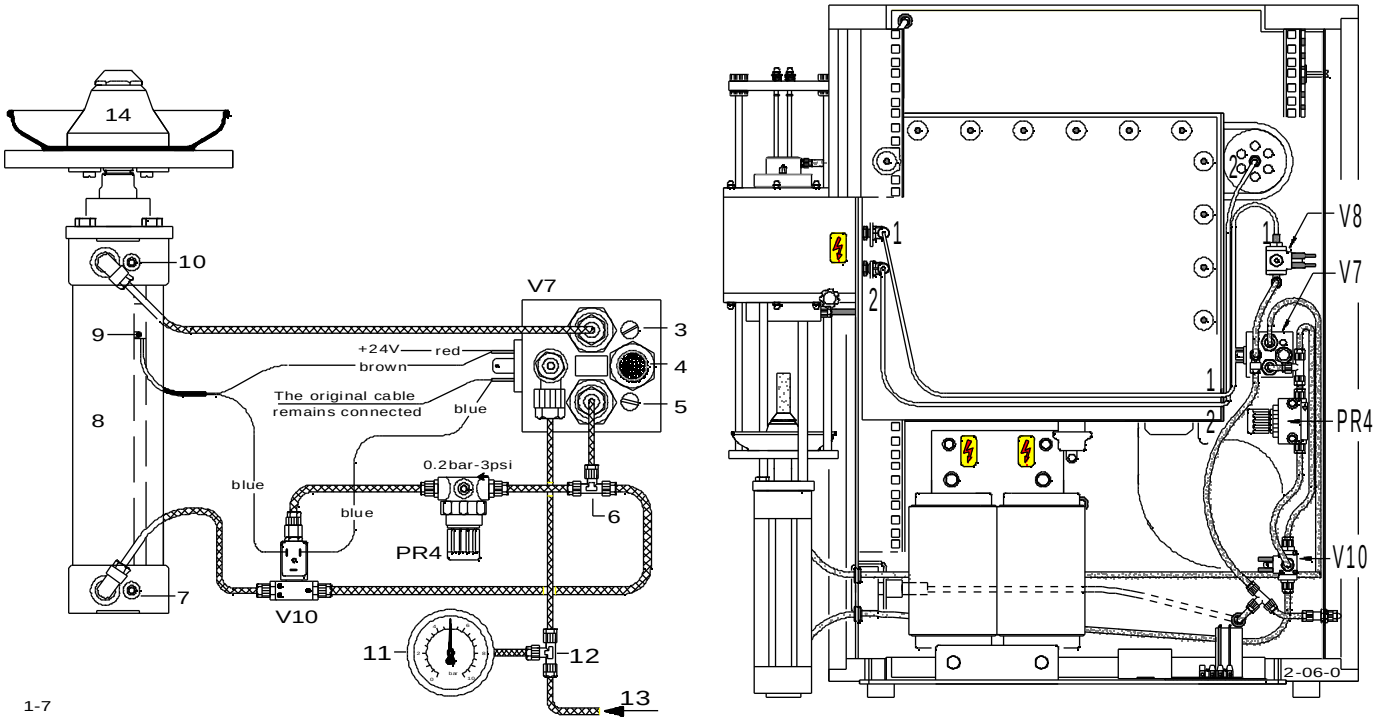
IC a: Outflow valve V1, see 3. 7 and 4. 2

IC b: Shuttle valve V2, see 3. 7 and 4. 2 ; pneumatic valve for furnace, see 2. 6

IC c: Purging valve V3, see 3. 7and 4. 2

IC d: By-pass valve V4, see 4. 2
Generator **„start"** signal, see 1. 4 and 1.24

1.7 The furnace does not close:



- Little or no compressed air pressure, the furnace cannot close.
  This pressure is shown on gauge **(11)**, on the front-side of the analyser.
  It must be between 4 to 6 bar **(60 to 90 psi)**.

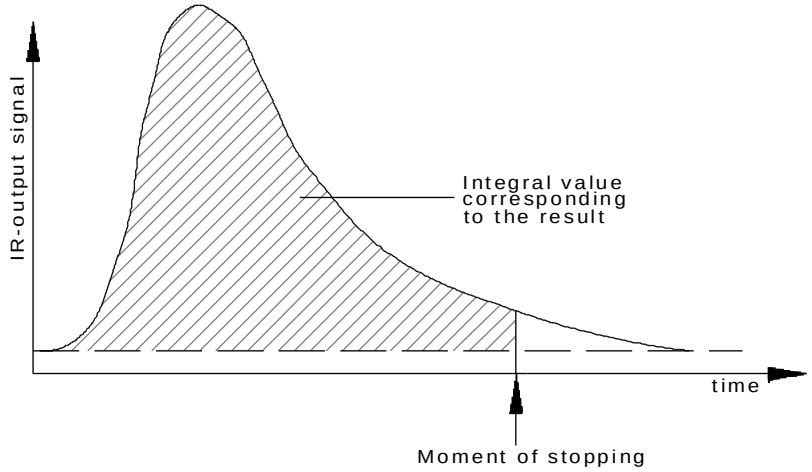
- The screws **(10)** and **(3)** must be turned counter-clockwise, as much as possible.

- Adjust regulator **(PR4)**, so that the furnace floor can rise completely, without shaking; **while a person still can stop the moving furnace floor with only one hand.**
  This is a **safety precaution**.
  Repeat above instruction, until the adjustment is completed. Now, the upward speed is fast enough, yet safe for the operator. The pressure regulator **(PR4)** is found on the inside, on the right-side section of the analyser.

- The pneumatic valve **(V7)** is malfunctioning.

- The magnetic coil of the pneumatic valve **(V7)** receives no current.
  The furnace floor goes up, when valve **(V7)** receives **24 VDC**.
  The **24 V DC** comes from the electronic unit; if not, replace the electronic drivers, see **1. 6**

1.8 The analysis takes too long:



The analysis length lasts a maximum of up to **100 seconds**, by virtue of a maximum time limit which the operator can select.
The minimum analysis time is automatically defined by the analyser and corresponds to half the maximum time.
Once the minimum time has expired, the analysis will stop automatically, if by that time no combustion has taken place.
If however the required combustion does take place, a signal from the infrared cell is then produced, causing the analysis time to be automatically lengthened.
The analysis is ended once the infrared signal has descended to the comparator threshold level, which is nearly **zero volts**.
The comparator threshold level is an artificial **zero level**.
When, however, as a result of unwanted hydrocarbons in the carrier gas, there is too much CO_2, this threshold level won't be reached.
In this case the analysis will stop only once the selected maximum time has expired.
The purpose of the maximum time is to protect the furnace from overheating.
It is important to ensure that the analysis is completed before the maximum time has expired.
This threshold level is not the same for every analysis, it is reset automatically during each analysis. The higher the maximum peaks, the higher the threshold level.
It can therefore happen that with higher peaks the analysis ends sooner than with lower peaks.
As long as the unwanted hydrocarbon concentration in the oxygen is not extremely high, the problem could only exist in the low carbon channel (if present).
You can confirm the source of this problem by deactivating the low carbon channel;
< Menu > < 5 > < 1 > .
If the analysis then ends before max. time, you can be fairly sure that the problem is with hydrocarbons.
In case that there is neither an oxygen purification furnace, nor some clean oxygen available, you can by-pass this problem by setting the threshold level higher. Press the keys;

< Menu > < 9 > < 1 > < k > < XXX > < ENTER >.

< k > can be the number **1, 2 or 3** for selecting the required **IR- detector**.
< XXX > is a three digit number for the **set point** of the threshold level, for example **250**.
If the problem remains, this number can be increased stepwise until the problem is solved. The threshold level can only be set in the low carbon channel.

Additional reasons for excessive analysis duration could be:

- Dirty dust trap, see **Operation Manual 7. 3**
- Saturated chemicals, see **Operation Manual 7. 2**
- **Cotton, glass or quartz wool** is pressed too tightly, see **Operation Manual 7. 2**
- The **oxygen** is not **pure**, or the catalyst furnace is faulty or is cold, or the copper oxide is used up, see **Operation Manual 7. 2**
- The temperature of the **infrared cell** is not yet stable. Either it is not yet operational for at least **1 to 2 hours**, or the oxygen flow has not yet been running for **10 to 15 minutes** (power switch on **setting 2**), see **Operation Manual 3. 1** and **3. 2**
- The thermostatic control of the infrared cell is defective, see **1.14** and **2. 5**
- Excessive combustion temperature, causing the crucible to emit **CO_2**.

One of the IR-sources is unstable:

- Small resistance changes of one or more **IR-sources**, can cause the current to vary, thus affecting the intensity of the **IR-radiation**.
  This problem will effect all the channels, due to the fact that the **IR-sources** are all connected in series.
  In order to establish whether this problem is present or not, an analysis cycle should be run without a sample or a crucible. The baseline of the **IR-cells** can then be monitored on the PC screen, see **Operation Manual 5. 8 PLOTCS**
  The baselines should be quite stable and should run between **0.100 V** and – **0.100 V**
  It would be **very difficult**, in case of a problem, to establish which **IR-source** is faulty and it is therefore easier to replace them all.

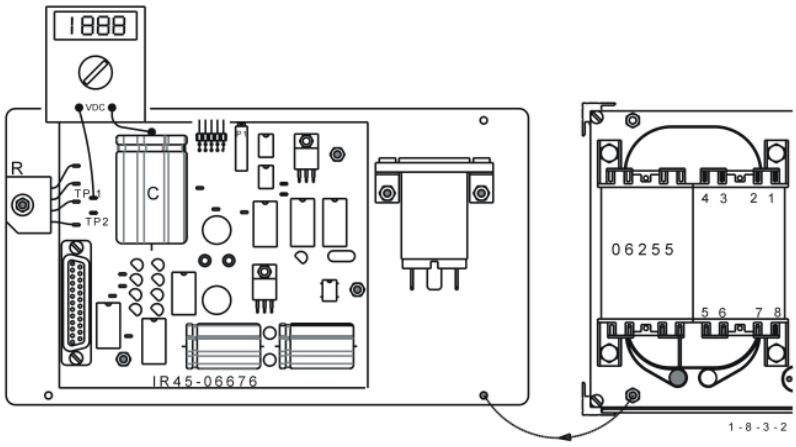
- A window of an **IR-path** is not airtight. The measuring gases pass through the leakage, either into the chopper housing or to the **IR-detector**.
  Perform a leakage test of the **IR-paths**. Replace the faulty **IR-path**. see **3. 1**

- The rectifier of the **IR-source** supply is faulty. The unstable voltage is too low, so that the voltage at the **IR-sources** cannot be regulated. see **2. 4**
  Check the base line on the PC screen, by starting analysis without sample. Zoom to get the scale of **10mV** steps. see **Operation Manual 5. 8**
  The base line should remain within **10mV, 50 seconds after START**.
  If the drift is larger and always positive, then check the **IR-source voltage**, see **2. 4**

- The infrared power supply is defective, so that the voltage stabilisation does not function.
  It is possible that the current to the **IR-source** is unstable, due to a faulty rectifier **(4)** causing only a half-wave to pass through. This can be checked rather easily, by measuring the **DC-voltage** across the outer legs of the rectifier (DC-output).
  It should be at least **4 V DC higher** than the supply voltage for the **IR-source**, measured between **TP2** and **TP1 (GND)**.

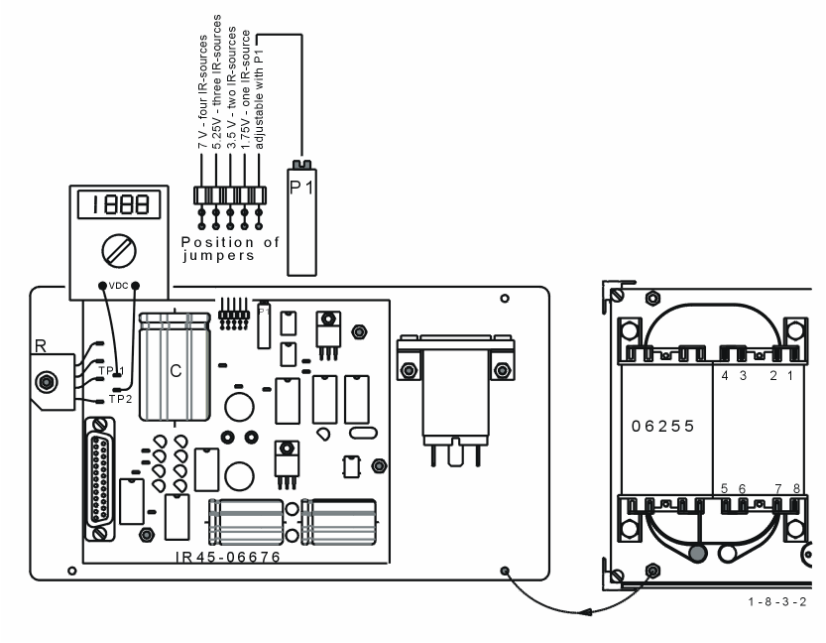
Voltage across DC-output at rectifier	**At least 10 V DC for a 3 channel device** **At least 8 V DC for a 2 channel device** **At least 6 V DC for a 1 channel device**

Voltage across DC output of the rectifier:



Voltage between TP1 (GND) and capacitor C:
(not stabilized voltage before stabilizer)

At least 6 V DC for 1 channel device
At least 7,5 V DC for 2 channel
At least 9,5 V DC for 3 channel device
At least 11 V DC for 4 channel device



IR-source voltage, is to be measured between TP1 and TP2 on IR 45 board.
(stabilized voltage of IR – sources)

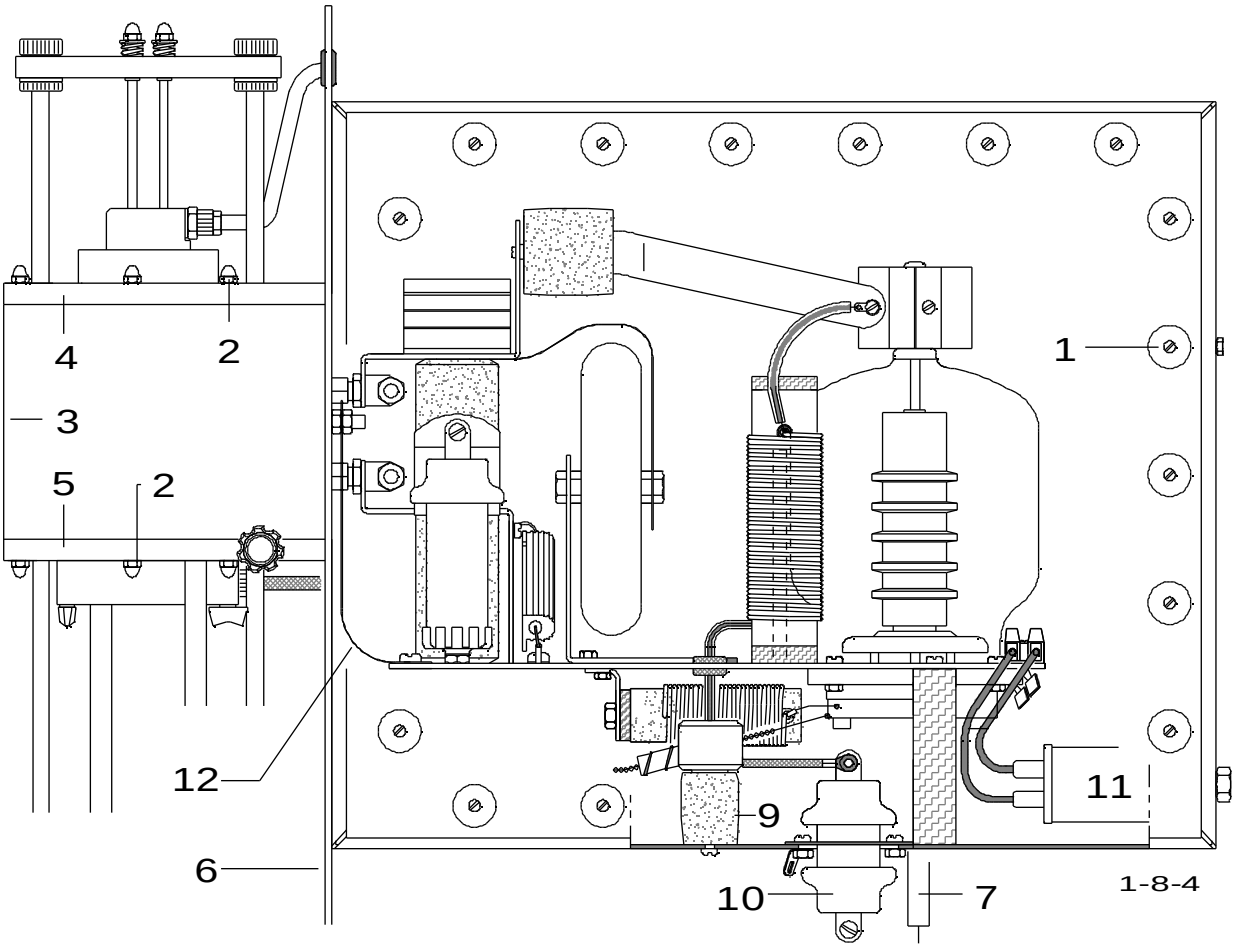
1,75 V DC for 1 channel device
3,5 V DC for 2 channel device
5,25 V DC for 3 channel device
7 V DC for 4 channel device
(1,75 Volts DC for each IR source)

Transformer connections:

Blue cables

1 Soldering location for 1 channel device
2 Soldering location for 2 channel device
3 Soldering location for 3 channel device
4 Soldering location for 4 channel device
8 Always connected (common)

- **RF-interference on the IR-cell, or on the electronic units:**
  If the generator's high frequency disrupts the electronic units or the infrared cell, then the base line on the PC monitor appears **jerky**.



CAUTION ! HIGH VOLTAGE !

The causes:

- The screws **(1)** are not tightened properly, or not all **22** of them are screwed in.
- The acorn nuts **(2)** are not tightened properly or not all **14** are in place.
- The cover **(3)** does not seal tightly with the plates **(4)** and **(5)** or with the front panel **(6)**
- The capacitor **(10)** is out of order
- The capacitor **(9)** is out of order

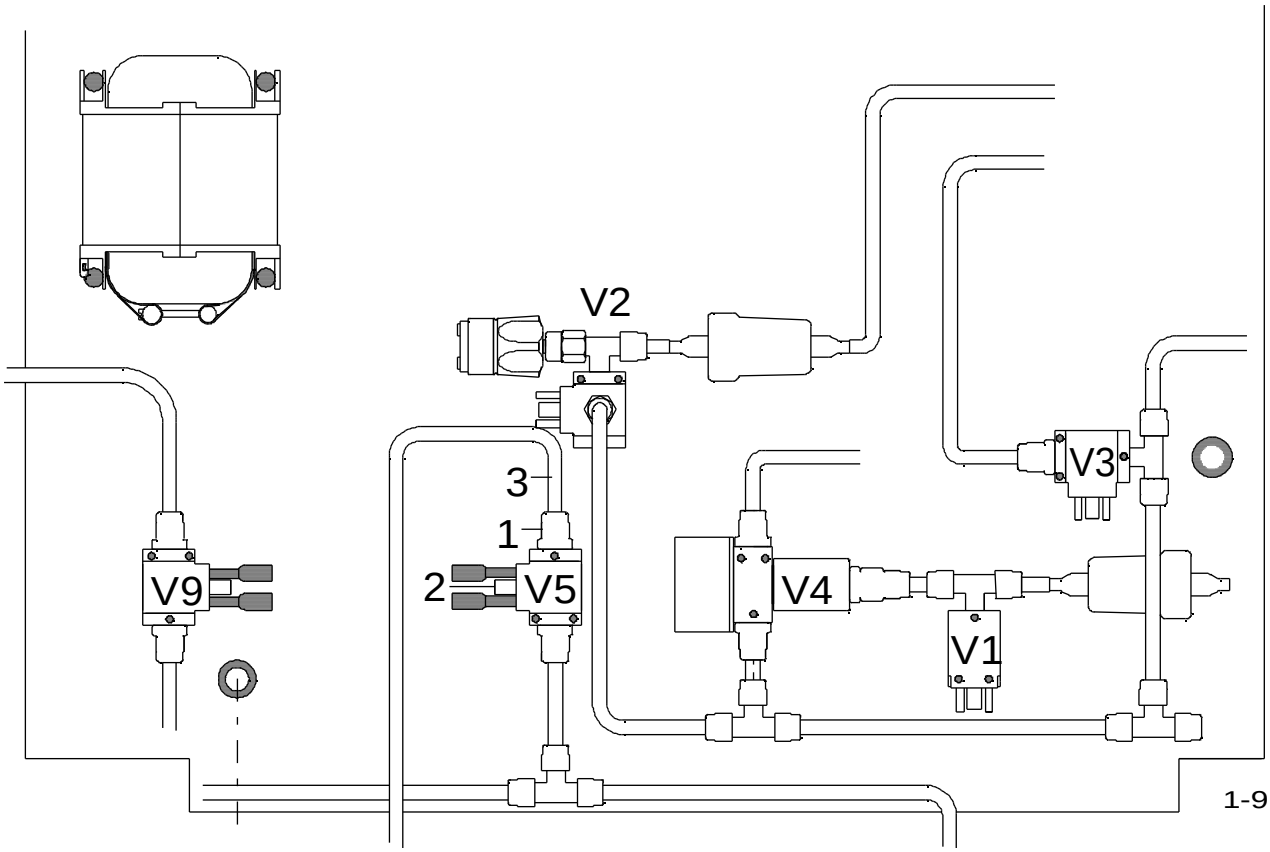
One or both filters (7) are not OK:

- The filter **(11)** can also be damaged in this way.
  When the ground strip **(12)** is not connected after removal or replacement of the oscillator the filters **(7)** will defect.

The power voltage sinks below 180 VAC:

- Even a momentary drop in the in the voltage is enough to cause problems.
  Use a voltage stabiliser. See 3.15

1.9 Development of dust when closing the furnace:



- The screw joint **(1)** from the valve **(2)** contains no nozzle, or the internal diameter of the nozzle is too large. This can easily be checked when removing the tube **(3)**. The nozzle should have an internal diameter of **1 mm**.

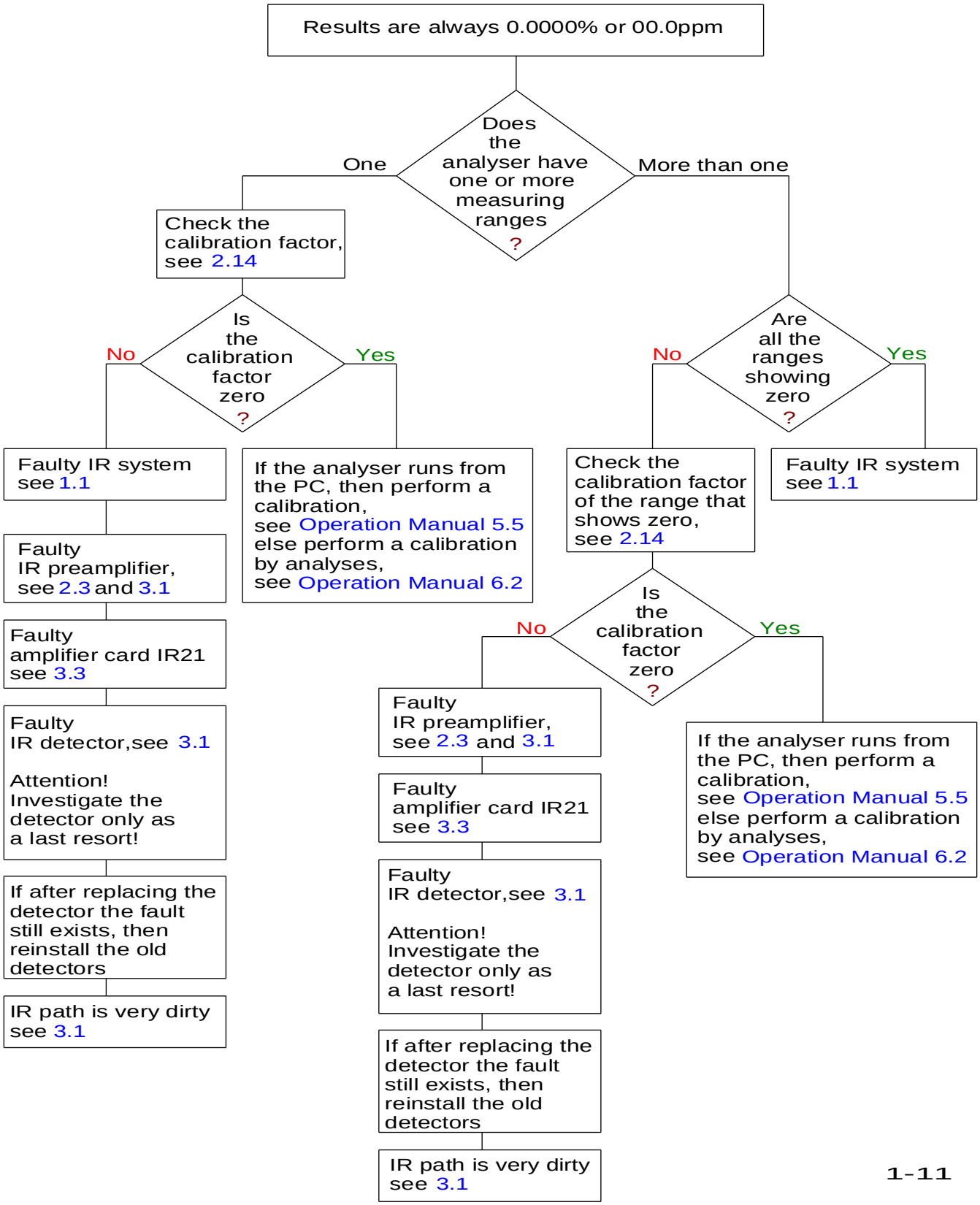
1.10 Erratic results:

There are a lot of different reasons for this:

- Saturated chemicals or clogged dust filter -
  see Operation Manual **7. 2** and **7. 3**
- Heterogeneous samples
- Leakage, see **3. 7**
- Flow problems, see **1. 2** , **1.3** and **1.18**
- The electronic noise of the infrared signal, see **1.20**

  This can happen quite often that the **combustion start** is delayed and the analysis time is too long, see **1. 8**.
  You will see that the **combustion start** is delayed, when the word **"GEN"** appears **later** than the word **"ANALYSIS"**.
- Incomplete or bad combustion, see **1. 5**.
- Too high **blank value** for the crucible and tungsten. This will be especially noticeable, mostly though, in the **low carbon channel**.
- Widely different **weights** of the sample and the **accelerator** (tungsten).
- Wrong **data** in the memory of the electronics: **Clear memory**, see **3. 9**
- The **base line** of the detector is unstable, due through insufficient main voltage (less than 200 V AC).
  Connect a stabiliser, see **3.15**

1.11 The results are always 0.0000% or 00.0 ppm:



1-11

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1.12 Beeper responding:

The built-in beeper of the analyser responds during the following reasons:

- When trying to analyse without entering the weight sample (when the analyser operates without the PC)
- No oxygen input
- 24 V supply for the solenoid valves faulty
- No balance attached (when analyser operating without PC)

At request, beeper can be made to respond every time when an analysis is complete.

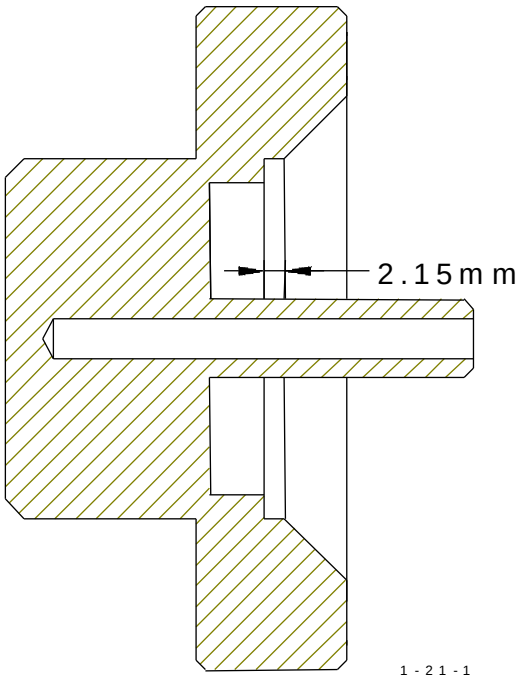
1.13 The life time of the combustion tubes is too short:

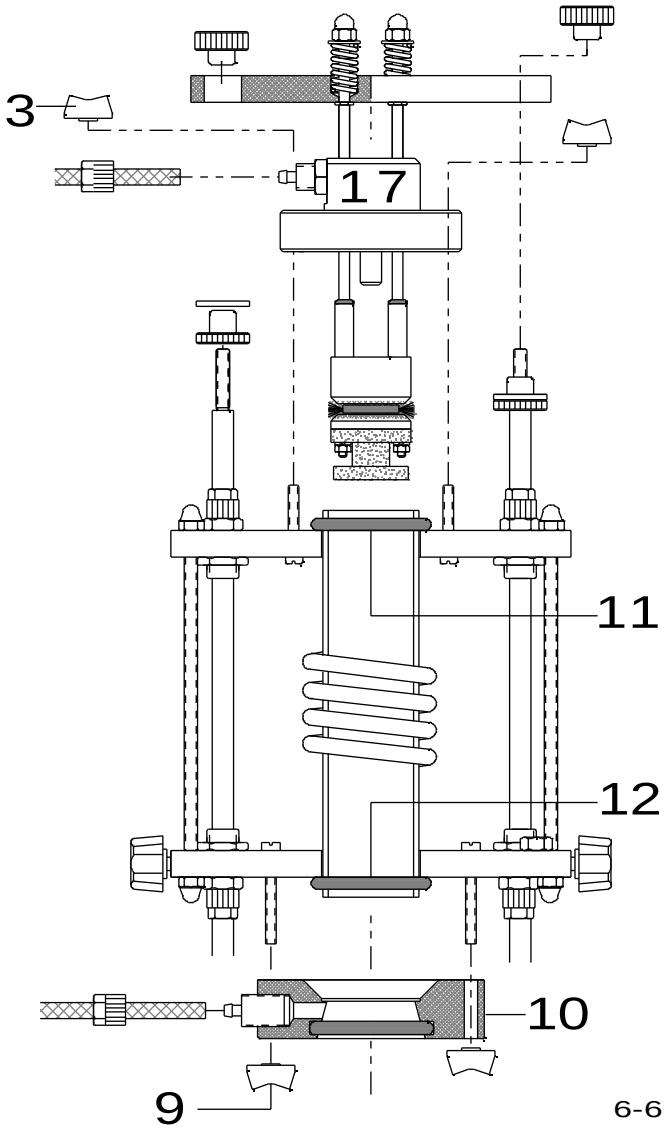
Possible reasons for that:

1. The sample weight or the weight of the accelerator is too high.
   See **Operation Manual: “applications of”**

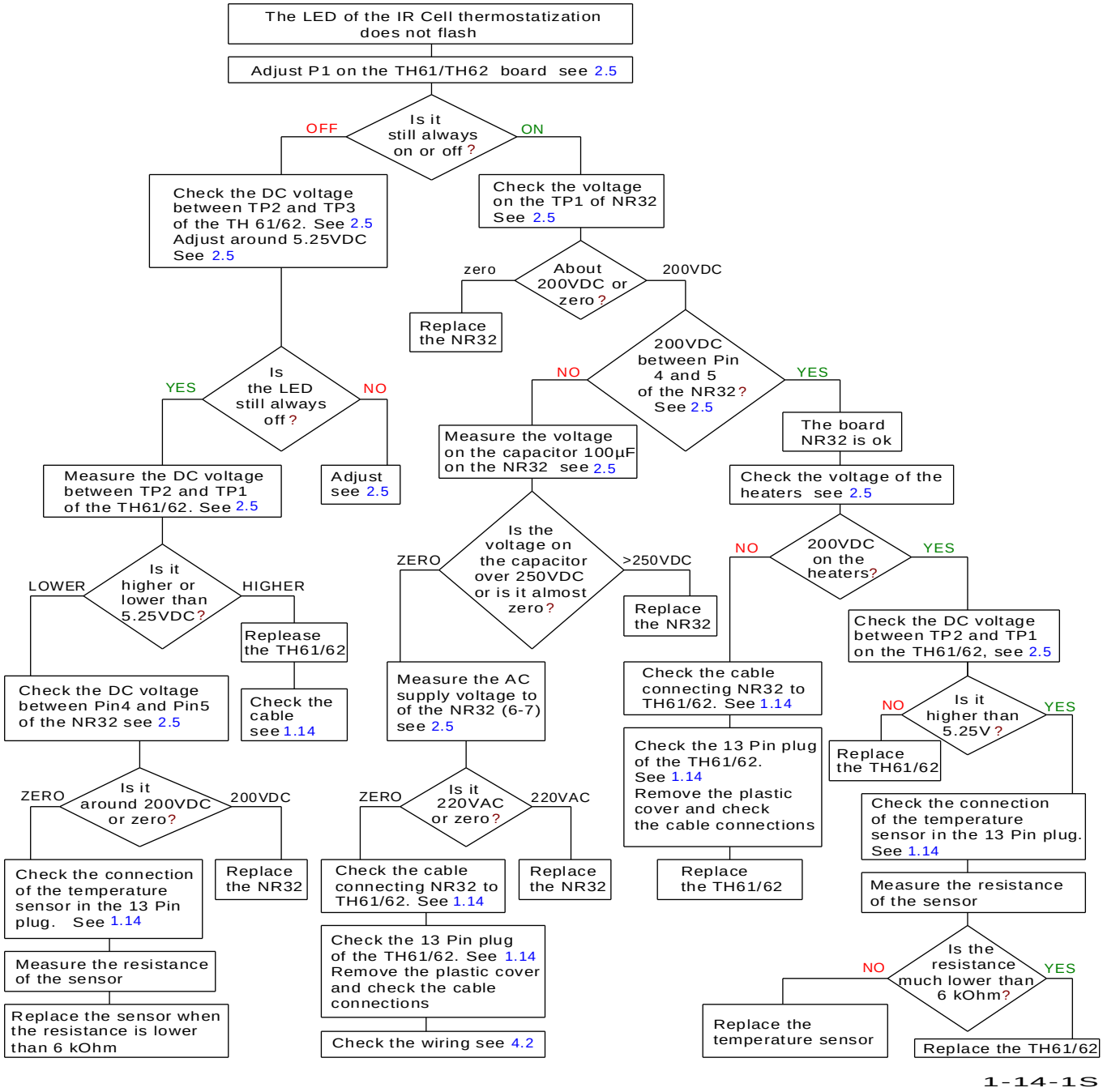
2. Don’t use copper as accelerator.

3. The combustion tube is too long, i.e. longer than **145 mm**. In this case, after fixing the four wing nuts **(3)** and **(9)**, the combustion tube is pressed between the upper furnace closing part **(17)** and the lower part **(10)**
   In this case, when the combustion tube heats up during combustion, it may break.
   Check the length of the combustion tubes to be not longer than **145 mm**.
4. The upper furnace closing part **(17)** does not provide enough space for the combustion tube. To check this, install a combustion tube as usual but without the O-rings **(11)** and **(12)**. After fixing the wing nuts **(3)** and **(9)**, move the tube up and down. If the tube does not move at least **0,5 to 1 mm**, replace the part **(17)** or make room for the combustion tube by machining the upper furnace closure on a lathe.

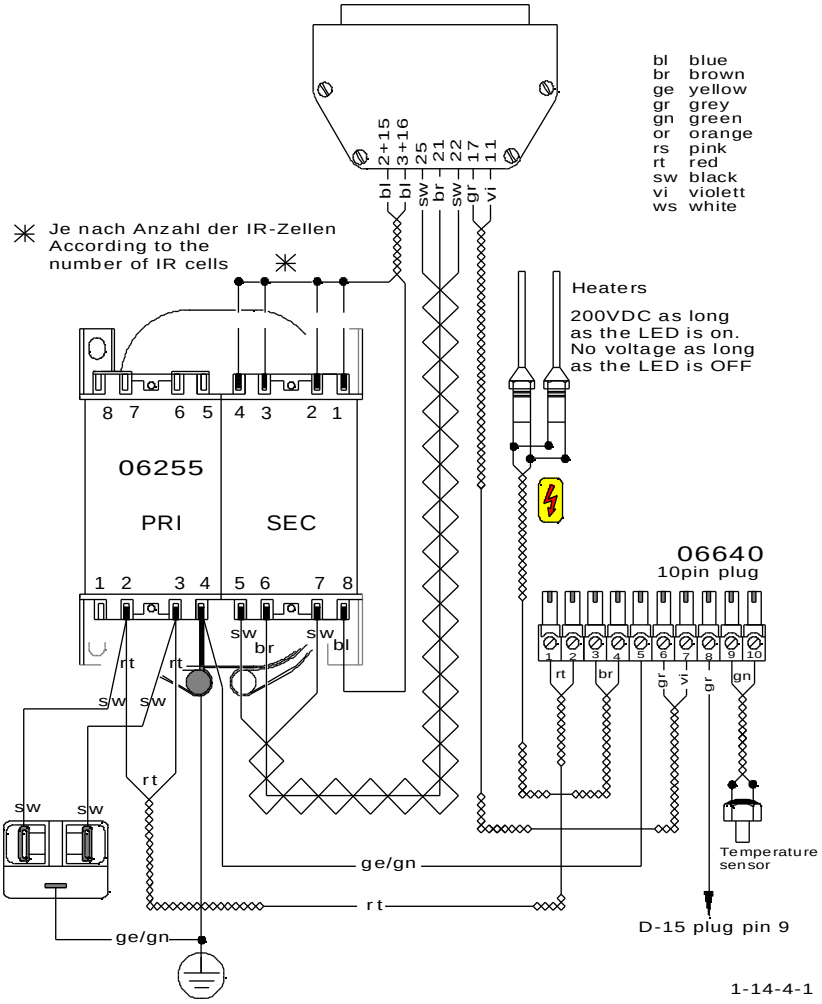




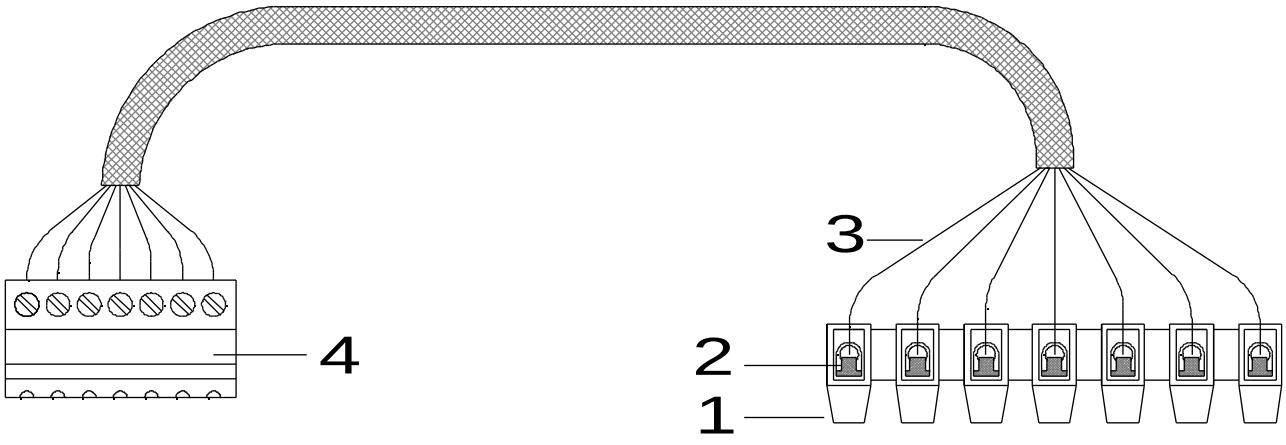
1.14 The LED for the IR-cell temperature regulation does not flash:



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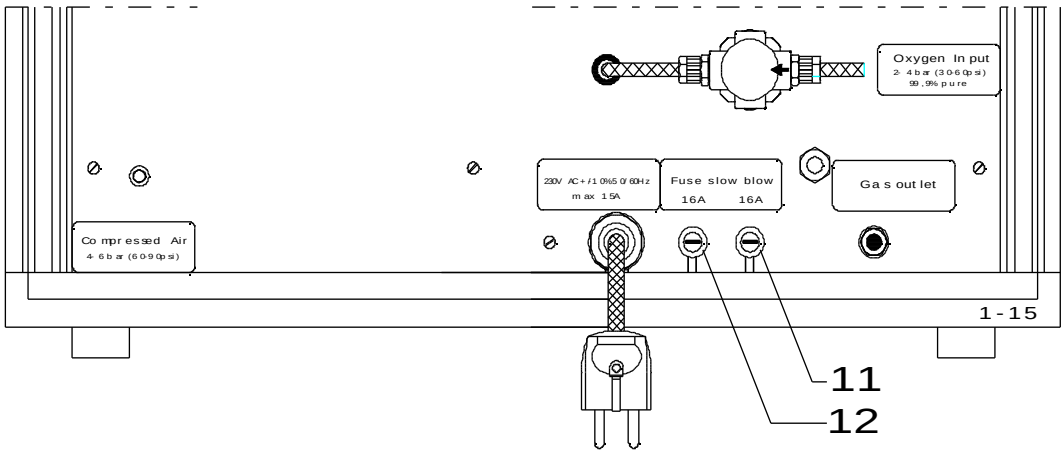


- Check that the cable is well connected to the plug, and that there are no short circuits between the contacts in the **13 pin plug**.



- Inspect the **spring contact (2)** on the connector **(1)**
- One of the contact threads **(2)** could have failed, or one of the connections **(3)** could be **disconnected**.
- A look inside the plug **(4)** is **recommended**.

1.15 The fuse burns out at the beginning of combustion:



- If the fuses **(11)** or **(12)** blow, then Unplug the main power and replace them.
- Disconnect the cables **(1)** from the primary side of the transformer **(2)** and connect the cables **(1)** to a **220 V** light bulb **(3) which is inserted to a socket**. An ordinary desk lamp can serve for this purpose. In case only **110 V** light bulbs are available, connect two of them in series.
  BE CAREFUL that no short circuit occurs !

  After the cables **(1)** have been connected plug the analyser to the main power again.
- Set the power switch to **pos. 2**
- Enter a weight manually, for example, **500 mg**
- Press **< START >**
- When **"GEN"** appears on the display, the light bulb should glow; this does not happen suddenly, but gradually.
- Within a few seconds, the light bulb will change from dark to fully bright.
  WARNING ! HIGH VOLTAGE!

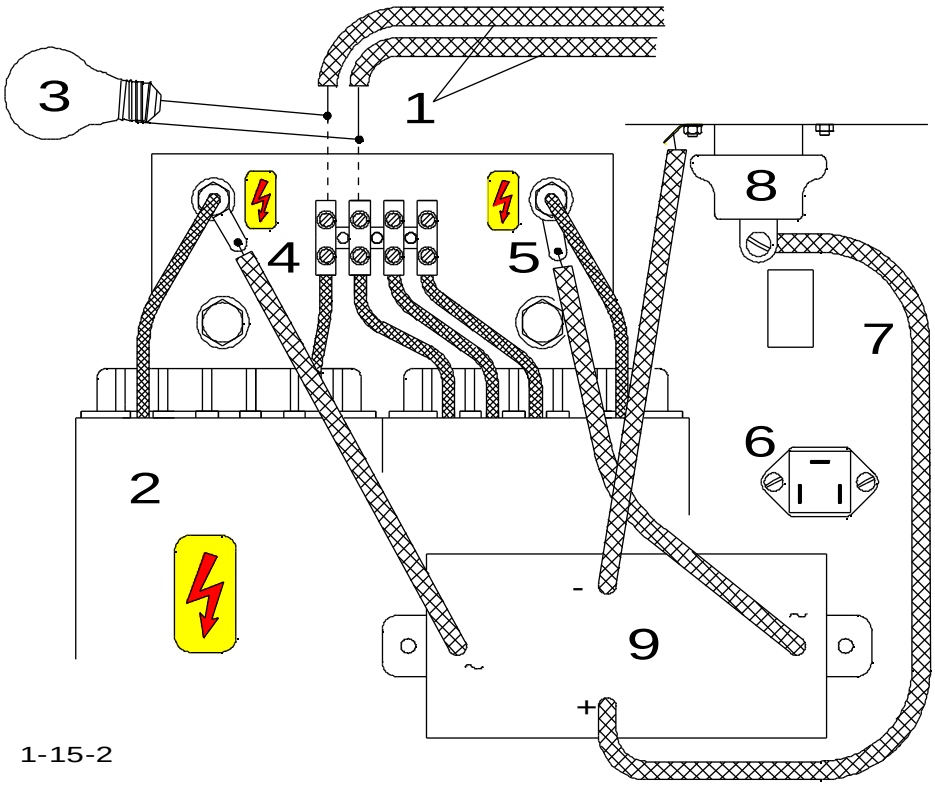
  SEE DRAWING NEXT PAGE:
- After pressing **< START >**, the message " **ANALYSIS** " appears, but **"GEN"** could appear later. The reason is, that after restarting the device and the oxygen flow, the infrared cell base-line could drift.
  For the same reason, the analysis may **stop** longer than usual.
- You should wait until **"GEN"** appears.
- Quit by pressing **< STOP >**. If the light bulb turns dim, the triac **(6)** is OK.
- Unplug the main power and reconnect the power cables **(1)** to the transformer **(2)**

  WARNING ! HIGH VOLTAGE !
  When reconnecting the power cables **(1**), do not let these wires approach the connectors for the cables **(4)** and **(5)**. Otherwise the high voltage can create sparks.
- The cables **(4)** and **(5)** should be unscrewed from the transformer and placed away from it.
- A new analysis should be started. When **"GEN"** appears and the fuse is not damaged, and the main current didn't exceed **10 A** (RMS), then the transformer is functioning properly.
- Otherwise, replace the transformer. The cables **(4)** and **(5)** are then reconnected. The cable **(7)** is unscrewed and removed from the capacitor **(8)**

WARNING ! HIGH VOLTAGE !

After the generator starts **(GEN)** the cable **(7)** carries a voltage of about 7000 Volts ! The cable **(7)** therefore should be laid so that its end is at least **10 cm** away from the nearest object !

- If, after pressing **< START >** and **GEN**, the fuse is blown, then replace the rectifier **(9)**

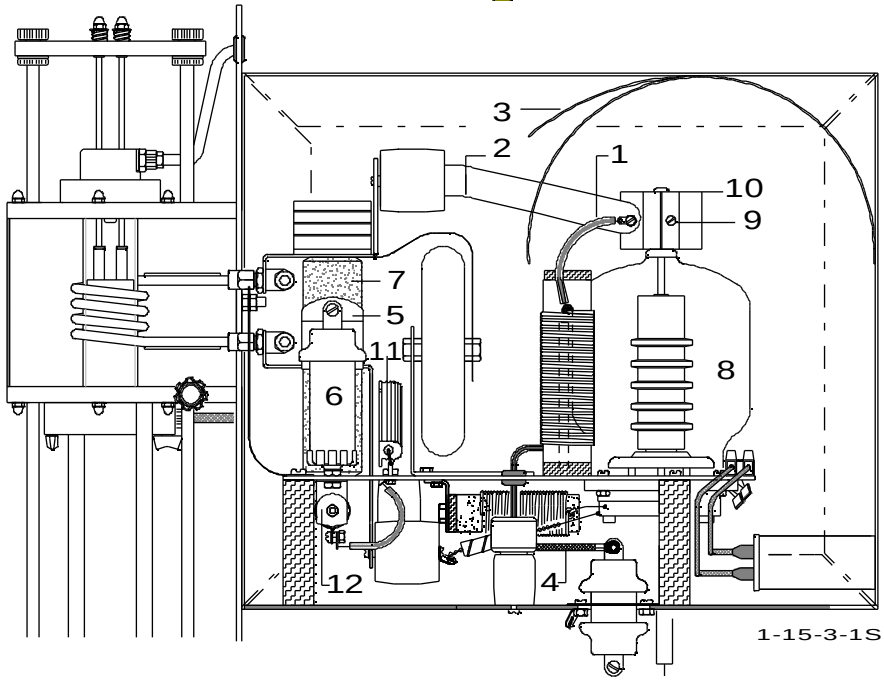


1-15-2

Further causes could be found in the oscillator circuit:

Because of the **high voltage** (7000 volts) and the **high frequency** (19.5 MHz), it is difficult to make measurements without any special measuring instruments.
Thus, the analyser needs to be turned off, and the power plug disconnected.

WARNING ! HIGH VOLTAGE !



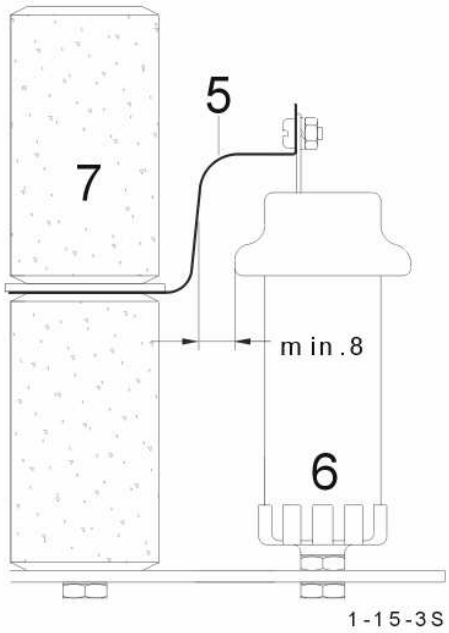
- Check that all the screws and soldering connections have a good contact.

If the resistor 100 KΩ / 50W (11) is a short circuit, then the fuse will blow when starting the combustion.

- Check that all power conductors and copper bands are placed far enough away, from any nearby objects! The wire **(1)** and the copper band **(2)**, for example, should be placed far away from the plate **(3)**.

- The power cable **(4)** should have a maximum distance from any surrounding object.

- The copper band **(5**) should be placed as far as possible away, from the capacitor **(6) !**
  This is why the copper band **(5)** should always be bent around the insulator **(7) !**



If the tube needs to be replaced (8)

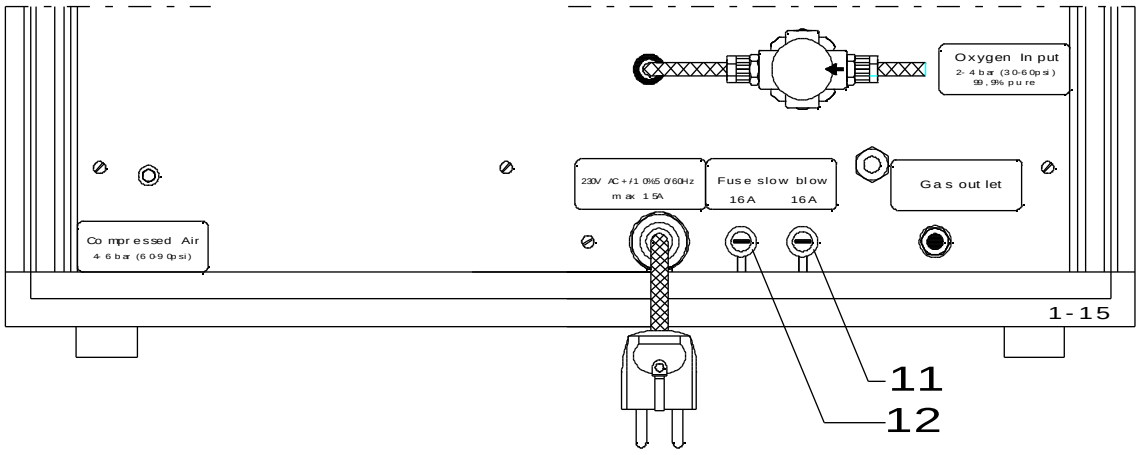
- Loosen the screw **(9)**, pull out the heat sink **(10)** upwards ! Pull out the tube **(8)** upwards!

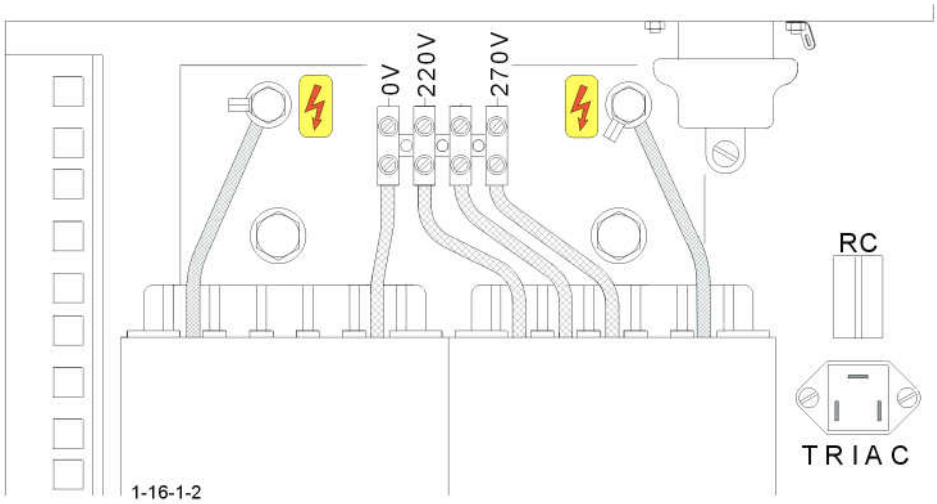
1.16 The fuse blows at the end of the analysis:

Causes :

- The triac is malfunctioning.

  The so-called **Latch-up effect** causes the undesired conduction during **one halfway** of the **triac**, once the trigger pulses to the triac have subsided. The transformer is then acting as a **short circuit** because it is fed with a **DC voltage!**

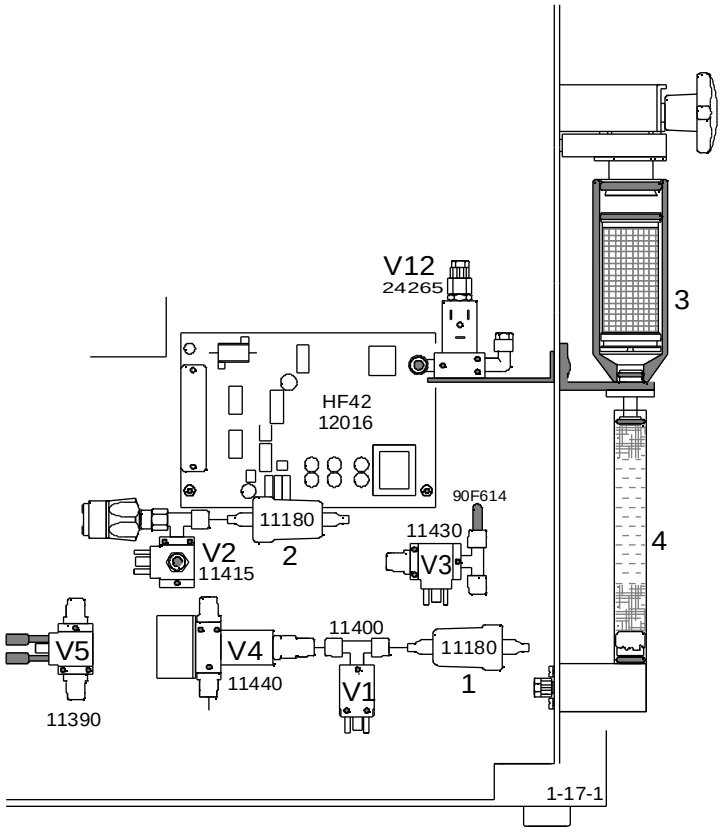




Replace the TRIAC!
(To locate the triac, see **4. 1 - 4**)

1.17 Large collection of dust when opening the furnace:

After pressing the key to open the furnace, the valves **(V1)** and **(V2)** a re-activated, this means that on the coils, **24 volts DC** coming from the electronic unit are present.
Valve **(V2)** closes the oxygen supply to the furnace.
Valve **(V1)** opens, releasing the pressure from the furnace through the dust trap **(3)**, through the moisture trap **(4)** and through the filter cartridge **(1)** into the open air **(in the direction of the arrow)**.
Following this, the pneumatic valve shuts and the furnace opens **(lift downwards)**.
When dust comes out of the furnace after this process this will cause, that the pressure in the furnace is not sufficiently eliminated.



The causes:

- Too much dust in the dust trap **(3)**, **(a few hundred analyses without cleaning)**
- Saturated moisture trap **(4)**
- Clogged paper filter in the moisture trap **(4)**, see **Operation Manual 6.1**
- Clogged filter cartridge **(1 and 2)** (this would be unlikely though)
- One of the valves **(V1)** or **(V2)** receives no power **(24 V DC)**

CAUTION !

- The valve **(V1)** will only be supplied with voltage **(24 V DC)** until the lift has reached the bottom position, then it will be switched off.
- The **24V** on the coil of this valve can be measured with a digital voltmeter, or with a light bulb of **24 V / 20 mA**.
- One of the valves **(V1)** or **(V2)** is sticking, preferable valve **(V1)**
- Clean the valves, see **3.13**

1.18 No or low oxygen pressure:

SYMPTOM: After pressing the START button, the following message appears: " no oxygen pressure "

POSSIBLE FAULTS: on the front panel of the analyser:

- Is the power switch **(1)** set on **pos. 2 ?**

- The pressure on the oxygen gauge **(2)** may be too low.
  1.5 bar is **normal** (22 psi).
  The pressure remains constant when the furnace is closed, and it sinks during the upward movement of the furnace floor.

- Check the oxygen pressure in the supply line or tank.
  4 to 6 bar (60 to 90 psi) showing on the pressure gauge is normal.

- Check if the pressure gauge for compressed air **(5)** shows **4 to 6 bar** (60 to 90 psi).

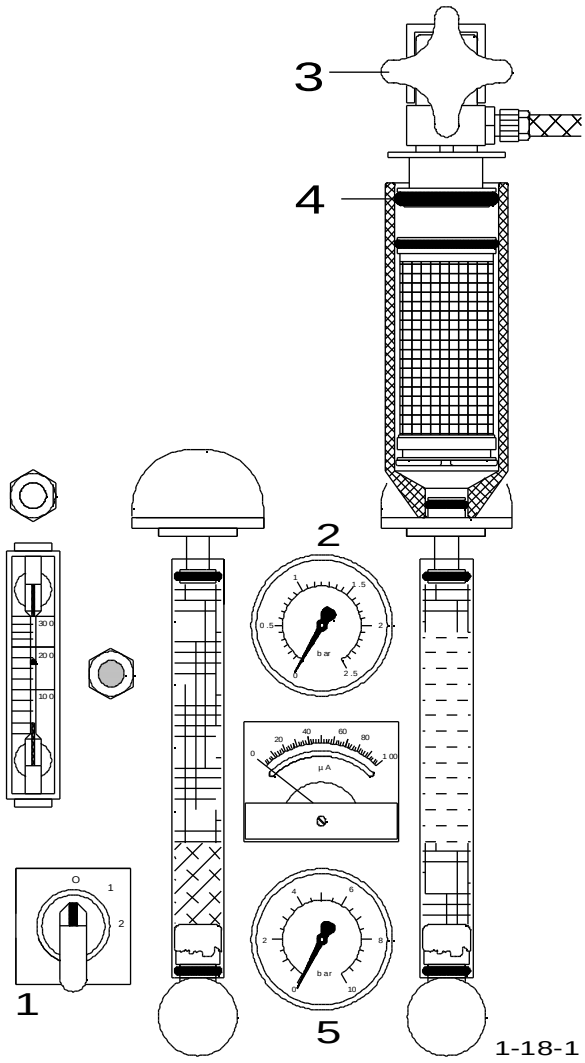
- Check if the cock **(3)** is properly shut, or else the O-ring **(4)** will not seal.
  Check if the O-ring **(4)** is in a good condition.

- Check if the combustion tube is broken or cracked.

- Check for gas leakage, see **3.7**

- Check if the chemicals are saturated and have become hard.

- The paper filter could also be the cause.
  For changing the paper filter, see **Operation Manual 7. 2**.



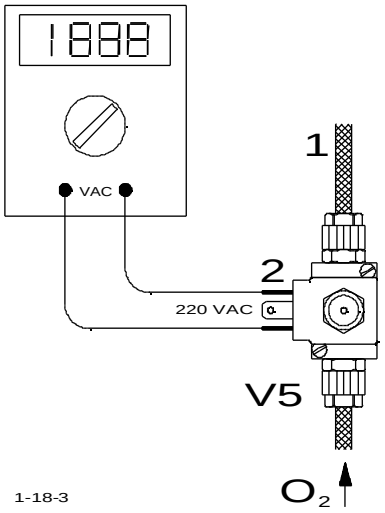
On the rear-side of the analyser:

- The contents of the gas cleaning furnace could be worn out and clogged.
  See **Operation Manual 7. 2**

Inside the analyser:

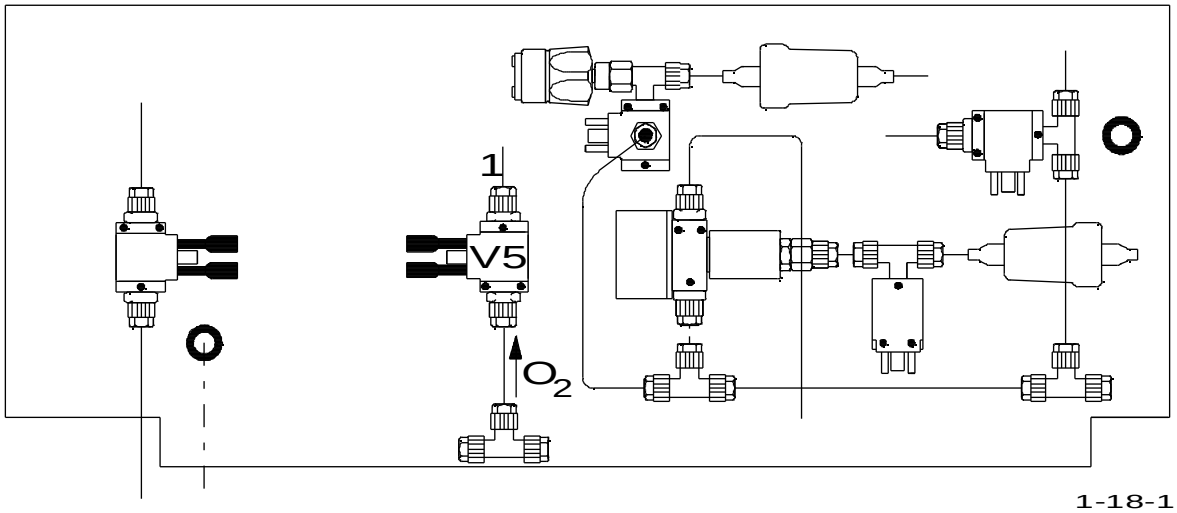
The oxygen solenoid valve (V5) may be defect.

- Open the left-side panel of the analyser.
  Unscrew the upper tube **(1)**. The oxygen should rush out when the power switch is set to **pos. 2**.
  If not :
- There may be no oxygen supplied.
- **220 V AC** is not measured on the terminal **(2)** of the solenoid coil.
- The solenoid valve is clogged.
  Clean the solenoid valve, see 3.13.
  If the fault is still present, then:
- Switch off the power, (set the power switch to position **0**)
  Pull out the socket **(2)** from the coil and measure the coil resistance. **3.3 KΩ is normal**.



1-18-3

The outflow valve does not close:



1-18-1

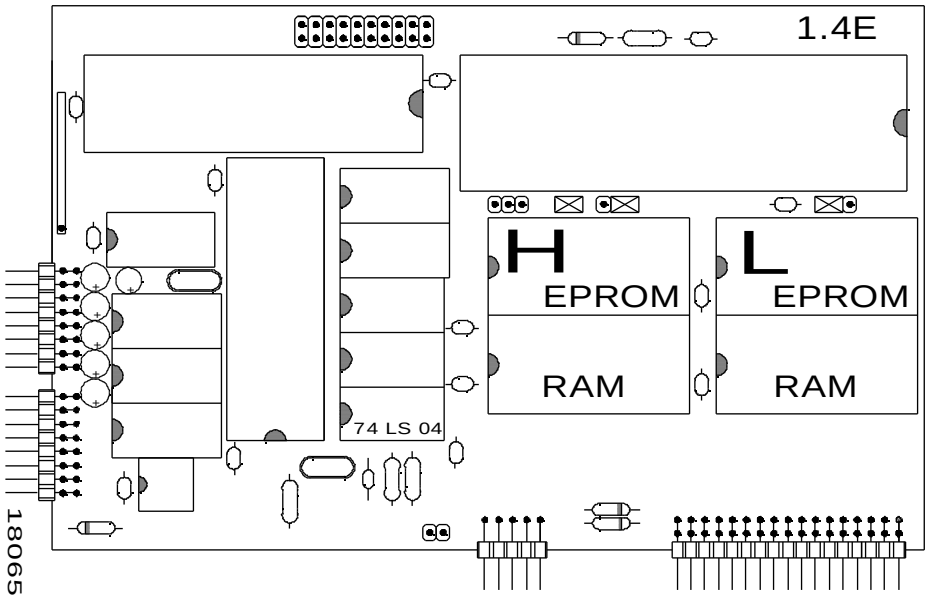
Open the left-side panel of the analyser. When the furnace is closed (the lift is up), no oxygen should be flowing out of the lower (free) opening of the valve **(1)** (in the direction of the arrow). This can be checked by putting your finger under the lower opening of the valve. If the valve does not close correctly, you will feel a strong oxygen pressure. The power supply to the valve **(1)** should be **0 Volt**. If this is the case then the outflow valve **(1)** should be cleaned, see 3.13 or replaced.

If the voltage on the outflow valve is constantly at 24 V, then:

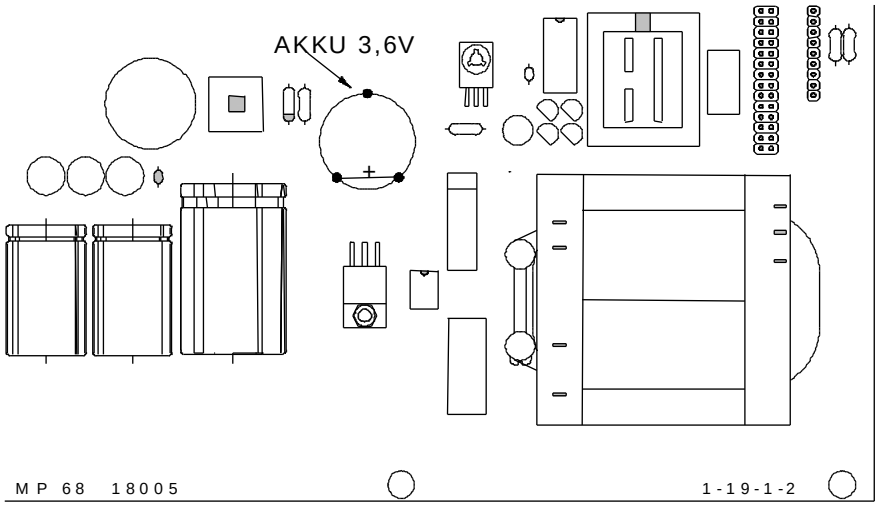
- Erase the memory, see 3. 9 .
- Replace the electronic driver, see 1.6.

OTHER FAULTS:
The screw for the upper furnace cushioning is too tight, see 2. 6
The pressure switch does not close, see 2. 2
The furnace closes too slowly, adjust according to 2. 6
The furnace does not close, see 1. 7

1.19 Saved data are lost:



- Make sure that a **74LS 04** is present.
- In this location only an **LS**-Type has to be installed.



- Replace the accumulator (accu in diagram), when the accumulator will not charge after the power had been switched on, and after installing the **74 LS 04**
  Once the analyser is switched off and the **accu** didn't charge **data will be lost !!!**

  The data that is meant here is the data that is saved in the accumulator-buffered **RAM** area. It consists mainly of the calibration factors, the **blank values**, and the **linearity factors**, which are entered through the keyboard. See **2. 9**
  The **linearity factors**, which were **programmed** in our **company** when the device was manufactured, were saved in the **EPROM**, they don't get lost.
  After turning on the power again (with an empty accumulator), those default linearity factors that are saved in the **EPROM's** are the current values. Therefore, you should note down any **linearity factors** that you enter through the keyboard, in case the accumulator becomes empty.

1.20 Noise or drift of the infrared baseline:

The **symptoms** are noticeable on the **display** and **especially** on the **monitor** attached to the **PC**, when either **rhythmic** or **sporadic** jumps of the **zero line** are present.

- The cause for a swinging rhythmic is the **chopper motor**.
  Replace the chopper motor, see **3. 5**

Causes for noise are:

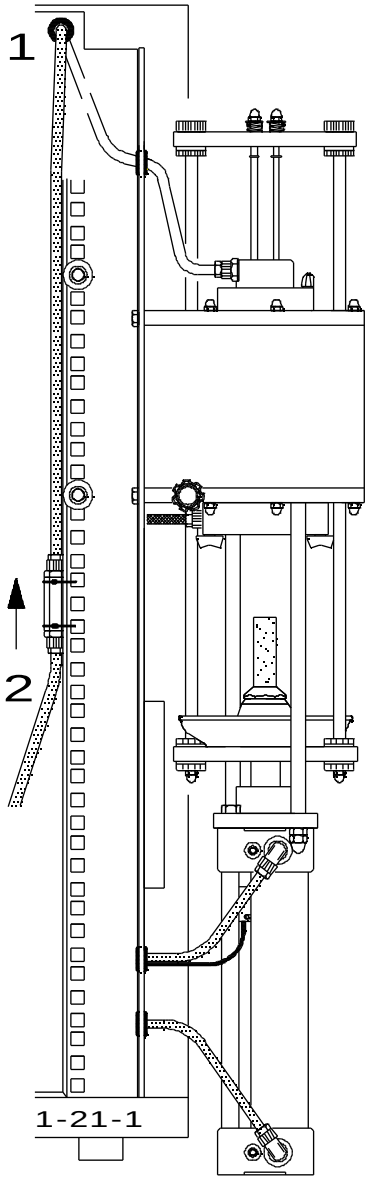
- The pre-amplifier,
  replace, see **3. 1** and **2. 3**
- The infrared detector,
  replace, see **3. 1** and **2. 3**
- A fault on the circuit board IR 21,
  replace, see **3. 3**
- The power supply fluctuates,
  see **3. 3** and **3. 4**
- The IR source is defective,
  see **3. 2** and **1. 8**.

1.21 Dust in the oxygen carrying tube when the furnace opens:

When **dust** can be **seen inside the transparent tube (1)** leading into the furnace, then the one-way valve **(2)** is **defect**.

- Replace the valve **(2)**.
  Attention: install the valve, so that the **arrow points upwards**. Because. the gas has to flow upwards.
  This is a one-way valve.

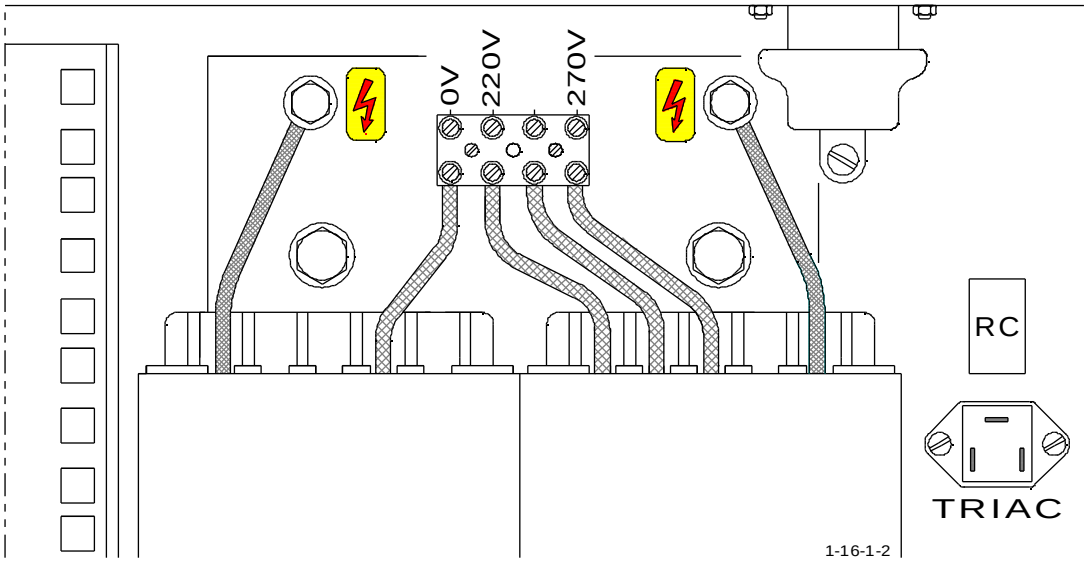
- **Before** mounting the valve, you should simply **push air** (e.g. by blowing) through the valve in order to ensure that it is properly **connected**.
  When the valve is **incorrectly mounted**, the oxygen flow will be **blocked**.



1.22 The word Eltra appears on the display:

This only happens when the power supply to the electronic is turned on.
The electronic unit can function down to a minimum main voltage of only **160 V**.
If, during the operation the word **"ELTRA"** appears on the display, then the voltage has sunken below **160 V**.

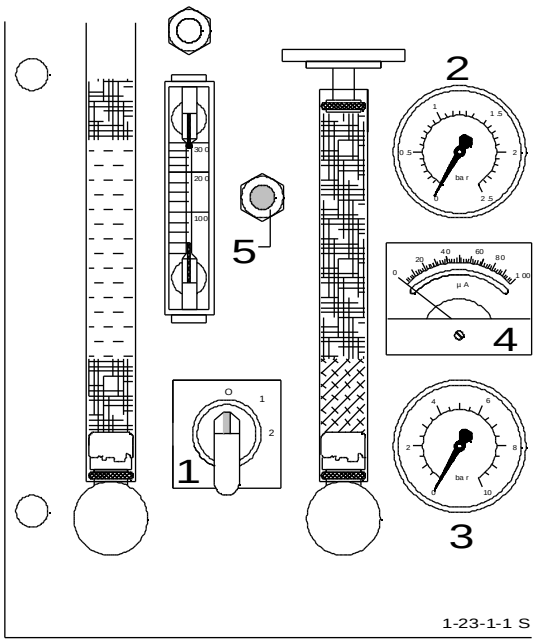
- Monitor the main voltage during an analysis.
  Should there be a short interruption detected, then the cause could lie with a poor contact.
- If the voltage drops when the generator is running, then the generator power can be reduced:



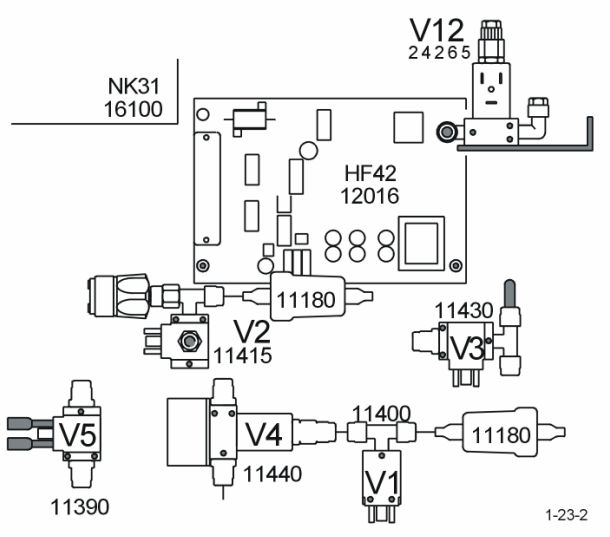
The cable that is connected on the **high voltage transformer** to the **220 V terminal**, should be then connected to the **270 V terminal**. This way, the generator draws less energy.

- Use a voltage stabiliser, see **3.15**

1.23 The oxygen pressure falls when the furnace opens



Regardless of whether the furnace is **opened** or **closed**,
the oxygen pressure shown on the pressure gauge **(2)**, must remain **1.5 bar** (22.5 psi) constant.
If, however, the **oxygen** pressure **falls** when the furnace is **open**, then:



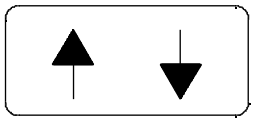
either the valve **(V2)** is defective or its control is incorrect.
When the furnace is open, the valve **(V2)** should have **23 V DC** on its magnetic coil.
When the furnace is closed, the voltage should be at **zero volts**.

- If the voltage on the valve **(V2)** remains at **23 V DC**, no matter whether the furnace is opened or closed, then the electronic unit is defect, see **1. 6**.
- If the **valve voltage** always stays at **zero**, then either the wiring to the electronic unit is broken, see **4. 2 ,** or the electronic unit is defect, see **1. 6**.
- If the voltage on the valve **(V2)** is correct, then the valve itself is defect, see **3.13**.

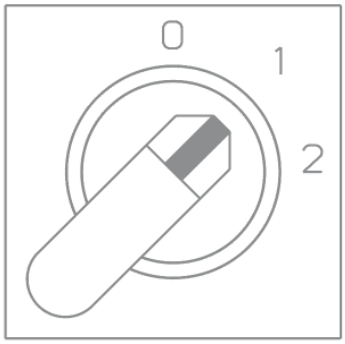
1.24 Combustion without pressing " START "

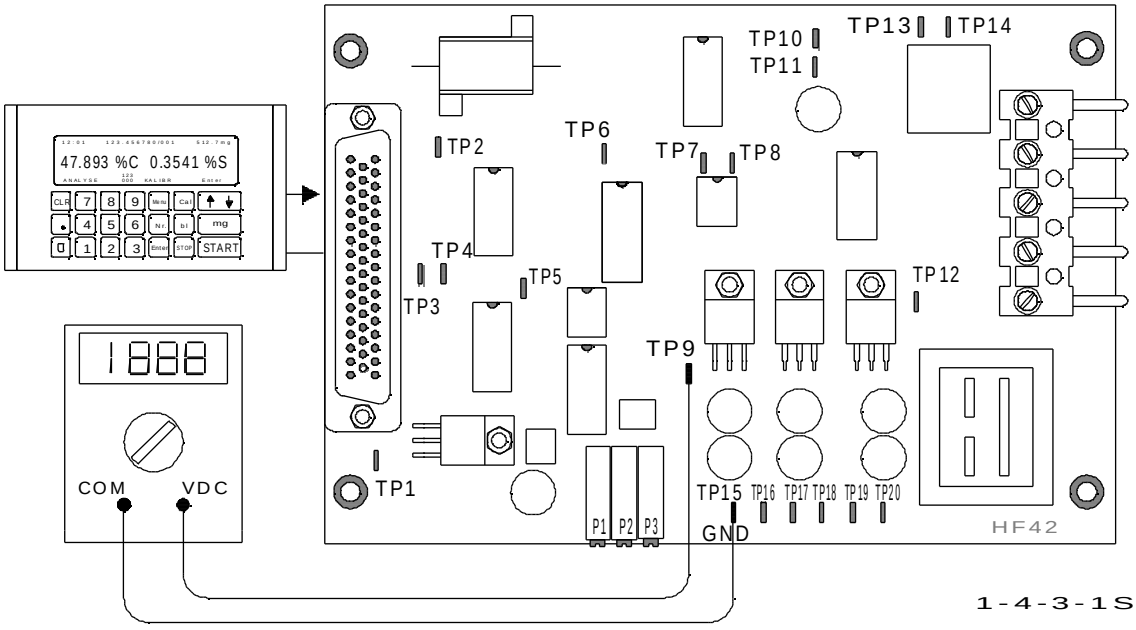
In this case, the combustion of the sample begins immediately after the sample enters the furnace, and before having pressed the **"START"** button.

Should the combustion start just,
after closing the furnace, and by pressing
then there is a serious fault !

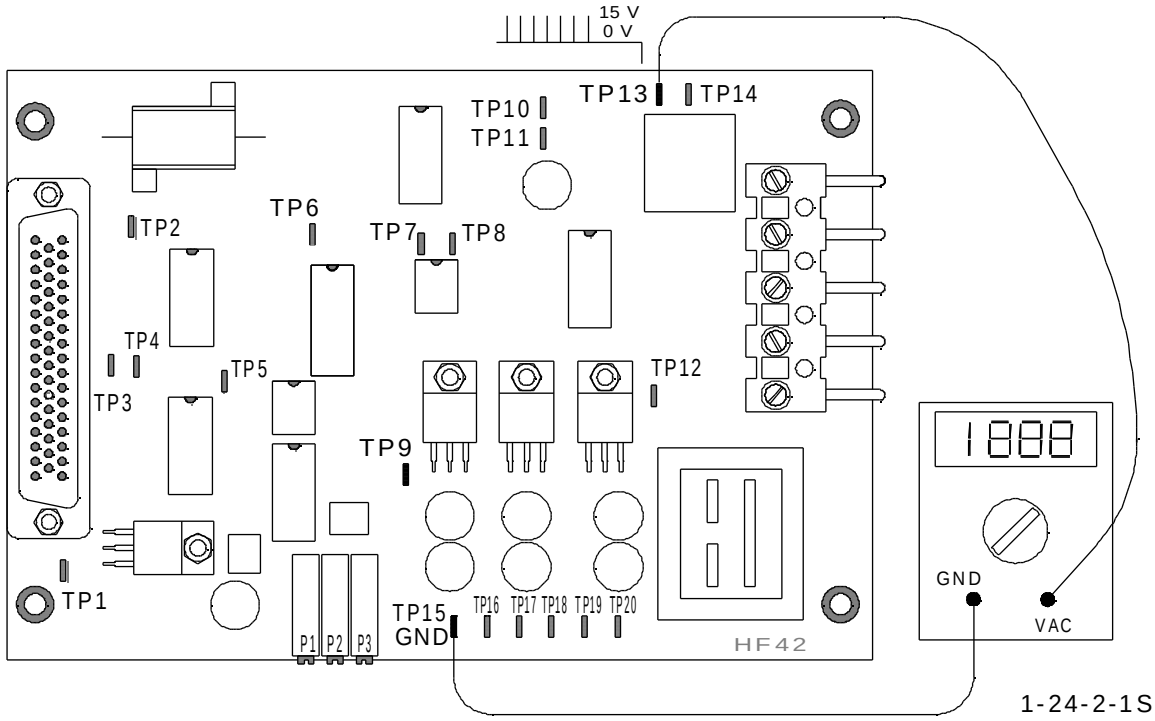


The power switch should be set **immediately** to **pos. 1**, in order to avoid any **overheating** of the generator.





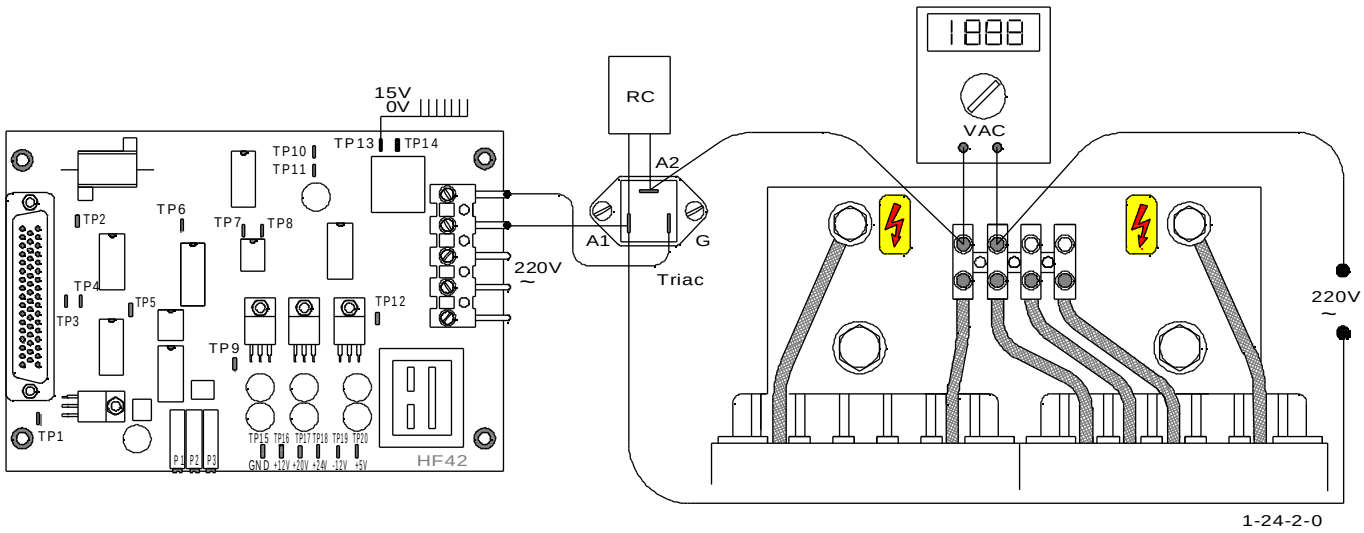
- The **electronic unit** (rack) is out of order, when the **combustion starts** without pressing **"START"** and without **"GEN"** on the display, there is only **0,5 V DC** on **TP9** (**instead of 1 2V DC**). Replace the electronic drivers, see **1. 6**.



When the pulses at **TP13** are present without pressing **"START"**
and with **15 V DC** at **TP9**, then the circuit board **HF 42** is out of order.
If no scope is available, the pulses can be detected by using a voltmeter.
Normal values are about **0 V AC** without pulses, and about **1 V AC** with pulses.
This indicated value can be different, depending on the type of the voltmeter used.

Possible reason :

- The triac is faulty (short circuit), and has to be replaced.
  (To locate the triac, see **4.1- 4**)



1.25 The crucible cracks or melts:

One reason could be that:
The quality of the crucible is bad, use a better quality.

Another reason could be that:
The furnace temperature is too high, due through:

- Excessive **main voltage**.
- Excessive **sample and / or accelerator weight**.
- The use of a **"sample or accelerator"** that requires lower generation power. In this case reduce the generator power, see **2.12**

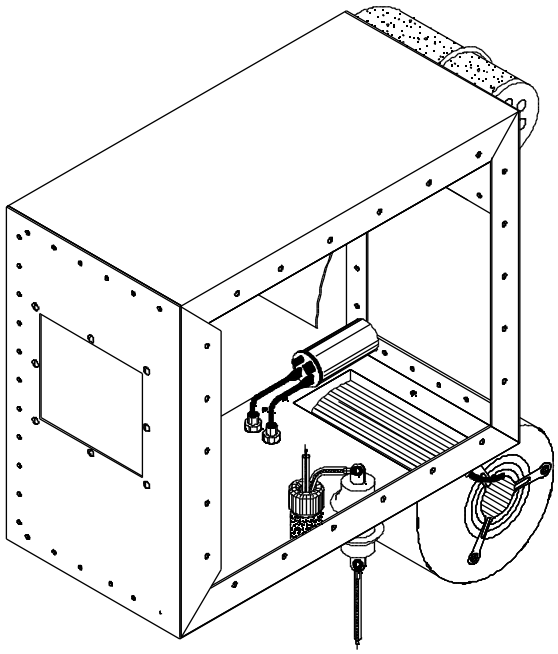
1.26 The analysis doesn't start :

There are two reasons for the above fault:

- Insufficient **oxygen pressure** (below 1 bar), see **1.18**
- The **infrared zero- baseline** deviates too much from zero, see **2.3**

1.27 Vibrations on setting 2:

The reason is dust accumulation on the blades of the oscillator's blower. The oscillation result due through distribution of dust on the blades causes an unequal rotation.



Caution:
Disconnect the power before removing the oscillators lid.

Blow the dust away with **compressed** air. Blow from the **inside** to the **outside**, otherwise the **dust** will be **blown** into the **oscillator**. Take care of the **rotary speed** of the blower to **remain** within the operation limits. When blowing compressed air, the rotary speed of the blower can exceed the limit of operation causing **damage** to the bearings and the shaft.

1.28 The analysis cycle stops only 25 seconds after start:

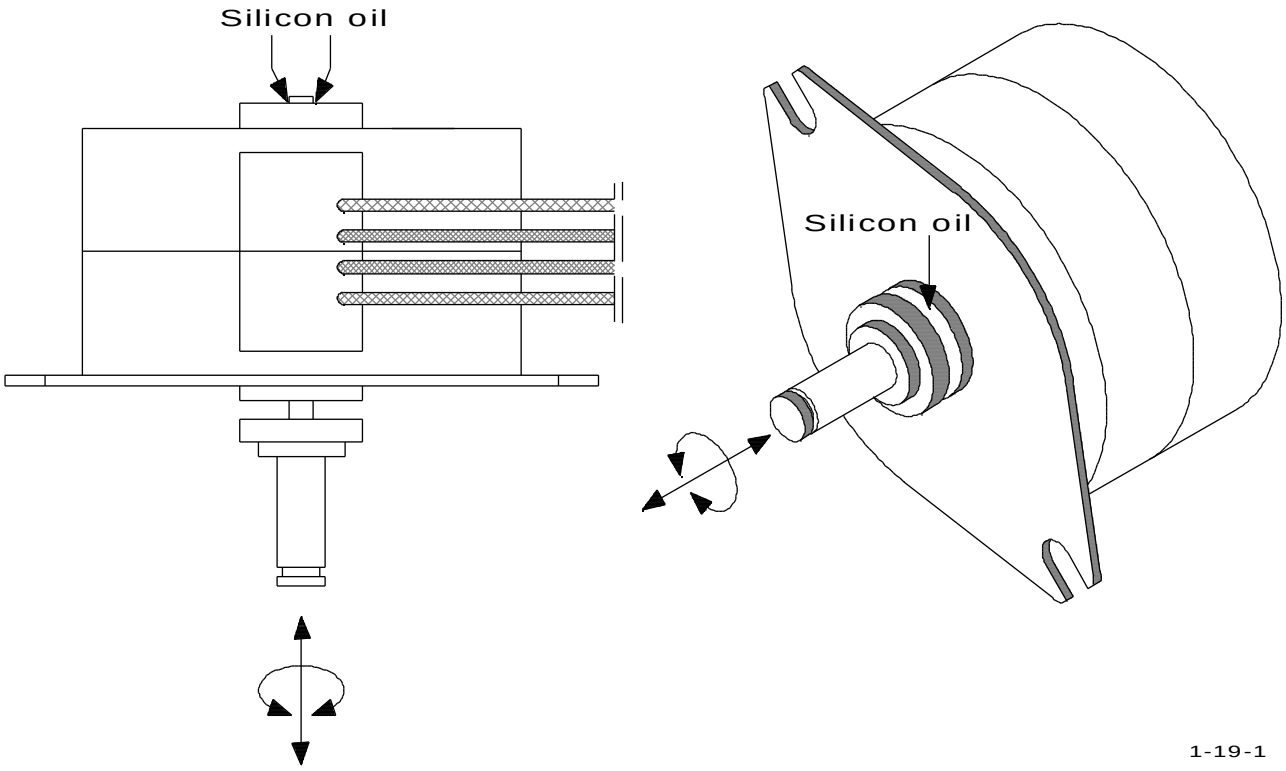
Information.
When 50 seconds as maximum analysis time is entered, this means that 50 seconds after start, the analysis, resp. the combustion will definitely stop in any case. But if there is no signal (peak) coming from the infrared cell, the analysis cycle will take at least 25 seconds i.e. half the maximum analysis time.

The problem.
It seams that there is no signal coming from the infrared detector. If the peak comes, the minimum analysis time of 25 seconds will be automatically prolonged until the signal comes bask to zero or the maximum analysis time of 50 seconds has been reached.
There are two possibilities for not having a signal:

1. There is no combustion. See **1. 4** and **1. 5**.
2. The infrared cell is damaged. Do the IR-test. See **1. 1**, **2. 3** and **2. 4**.
   Make sure that you take a sample with relatively high carbon to provide a clear visible high peak to about 3 to 8 volts.

1.29 The chopper motor doesn`t rotate:

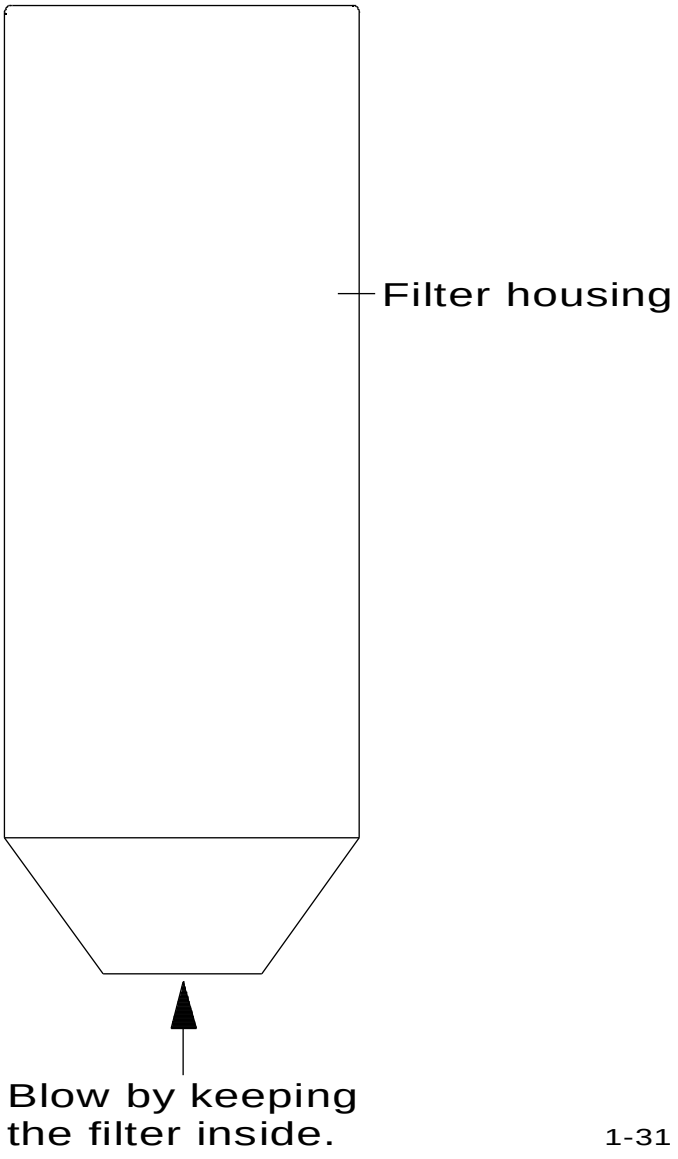
Mostly, the reason is that the grease of the bearings becomes dry.
You can feel a resistance when you try to turn the shaft by hand.
In this case the problem can be solved by lubricating using silicon oil.
Dip a piece of wire in to a flask of silicon oil and apply as shown below.



In order to spread the oil in to the space between shaft and bearings, turn the shaft and move it in axial direction at the same time. The use of mineral oil is not suggested, because mineral oils become dry and hard after long time of operation. If no silicon oil available, use silicon spray. Silicon grease is also good for this purpose and it is also available in laboratories, however it could be very difficult for grease to penetrate the space between shaft and bearings.

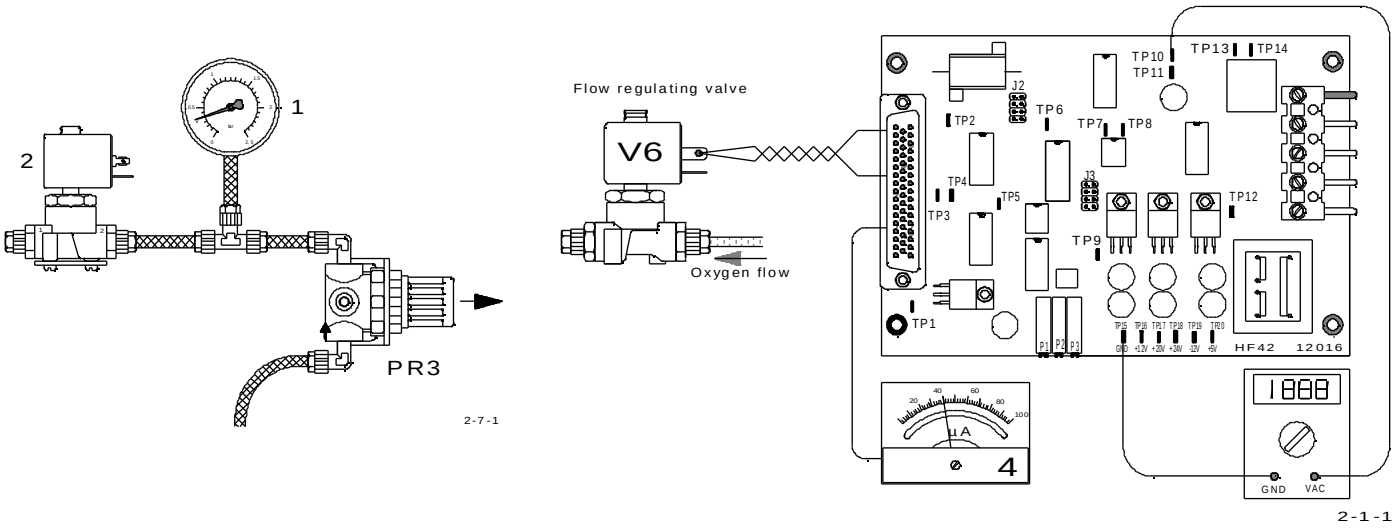
1.30 High carbon results are erratic:

If only high carbon results are erratic, while low carbon and sulfur results are repeatable, most likely the metal dust filter is blocked.
Even if the filter may be brushed and cleaned in ultrasonic cleaner, some day will not be able to be cleaned any more. The filter don't last for ever.
Check by removing the filter with the dust filter housing.
Don't remove the filter from its housing.
Turn the filter housing upside down and try to blow air through the small hole (about 16mm diameter) of the filter housing.
If you feel a remarkable restriction, replace it by a new one. With a new filter the air should pass practically free without any restriction.



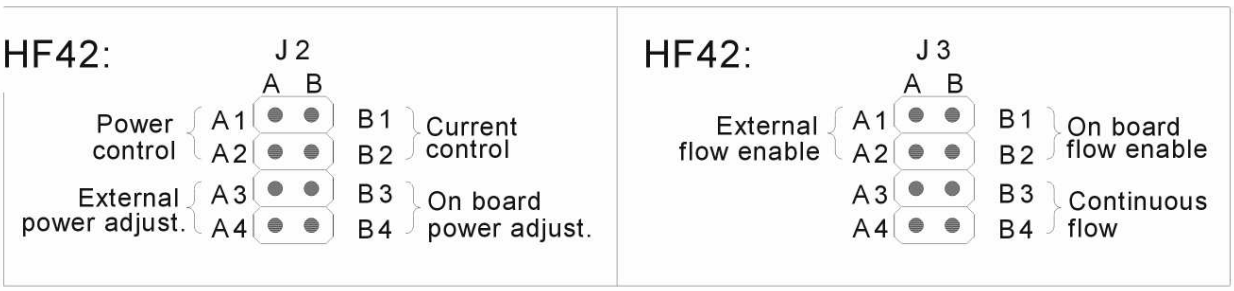
2 ADJUSTMENTS, TEST AND FUNCTION EXPLANATION

2.1 Gas flow controller adjustment and jumper settings:

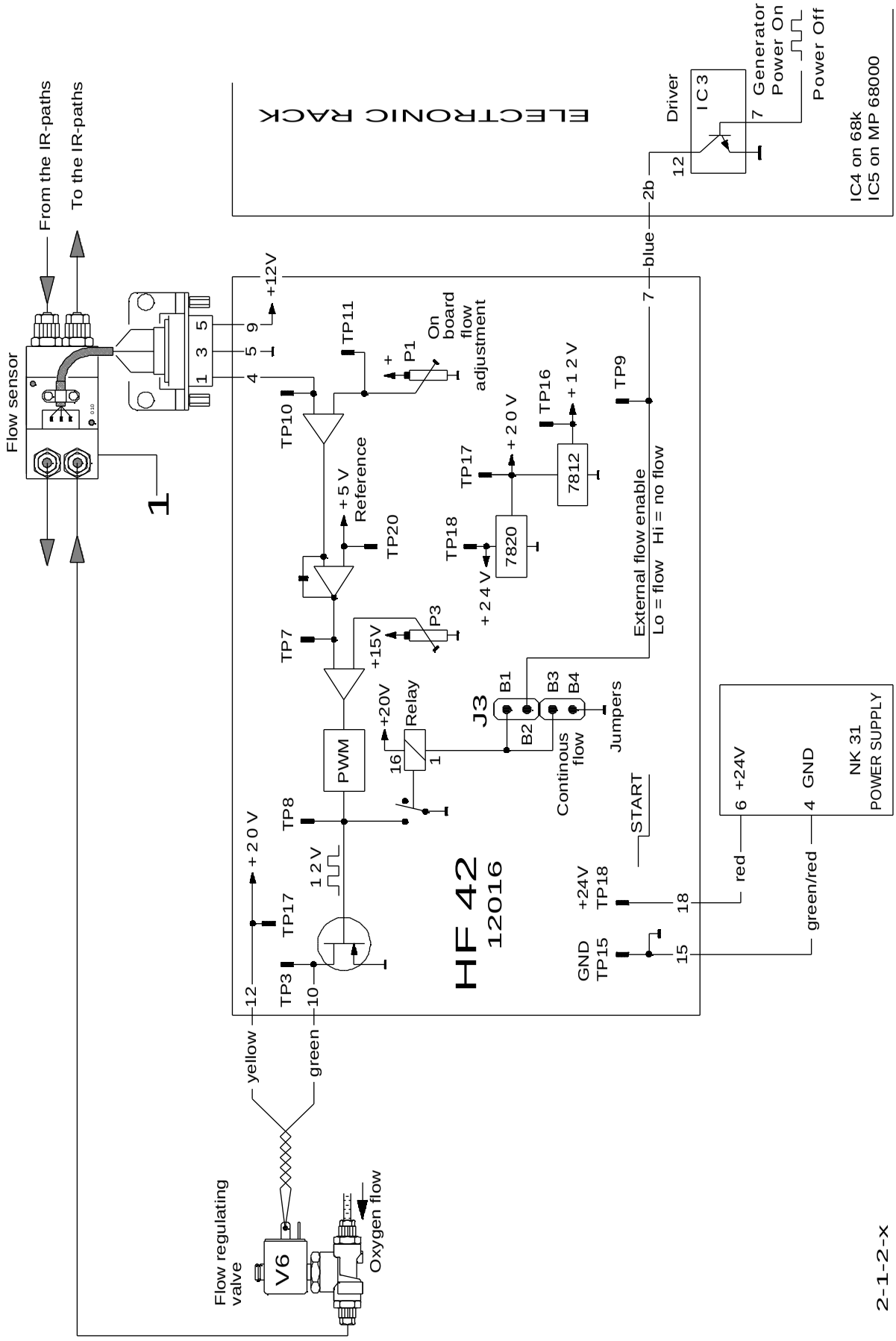


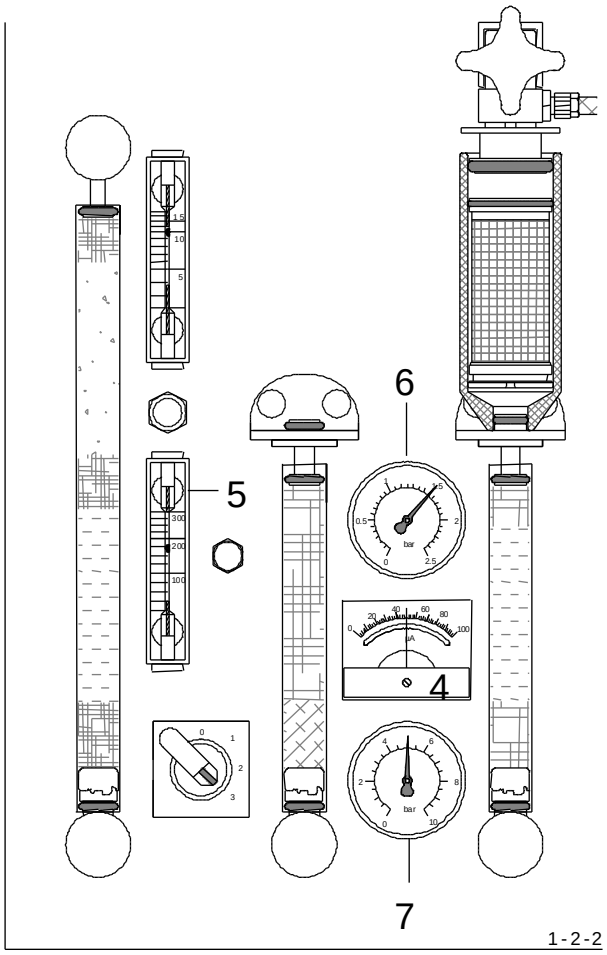
- Make sure that the **pressure regulators** are at least pre-adjusted. See 2.7 this is mainly important for the pressure regulator **(PR3)** in front of the **gas flow regulating valve**.
- Set the flow rate with **P1** of the **HF 42**, to about **180 l/h**. Observe the flow rate on the lower flow meter of the analyser, wait until the value has settled.
- The output of the flow sensor is found on **TP10** of the **HF 42 board**; **TP15 is GND**. With a flow of **180 l/h**, the voltage is about **2.5 – 3 V**.
  Please note: without flow, the output voltage of the sensor is not **0 V**, but about **0.6 V**.
- Adjust with **P3** until the voltage on **TP7** is **5 V**.
- On **TP8**, the activity of the pulse width modulator can be checked.
- The output voltage to the gas flow regulation valve can be measured on **TP3**. With a constant flow of about **180 l/h**, it should be between **5** and **15 volts**. The panel meter **(4)** must indicate between **30** and **70 µA**.
- Check and if necessary readjust the pressure regulator **(PR3)** in front of the **flow regulating valve**. See 2.7

- **Jumper settings:**



Detailed explanation of the gas flow regulation:



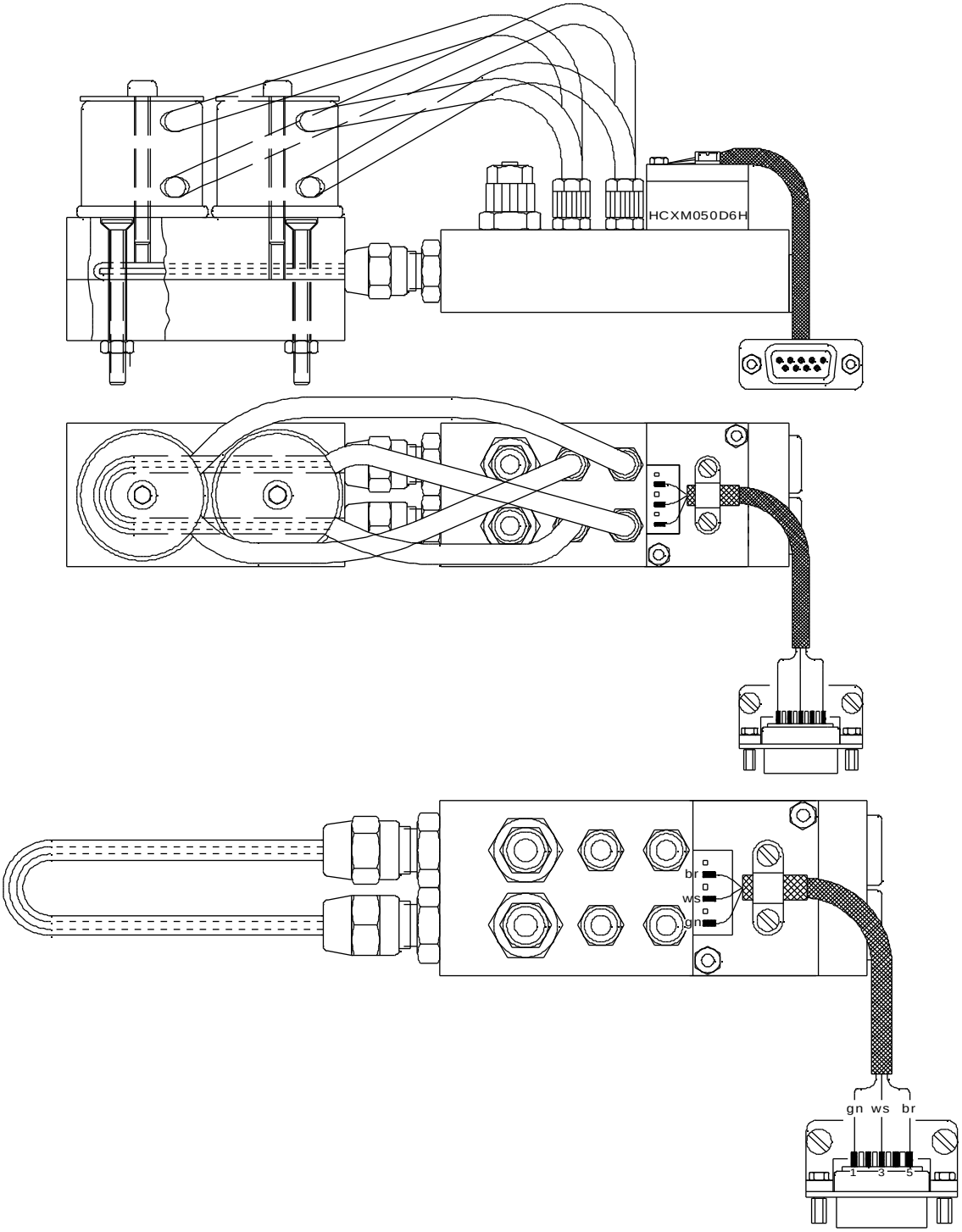


The flow controller mainly consists of the following components:

- The flow sensor **(1)**
- The flow regulating valve **(V6)**
- The flow control board **HF 42**

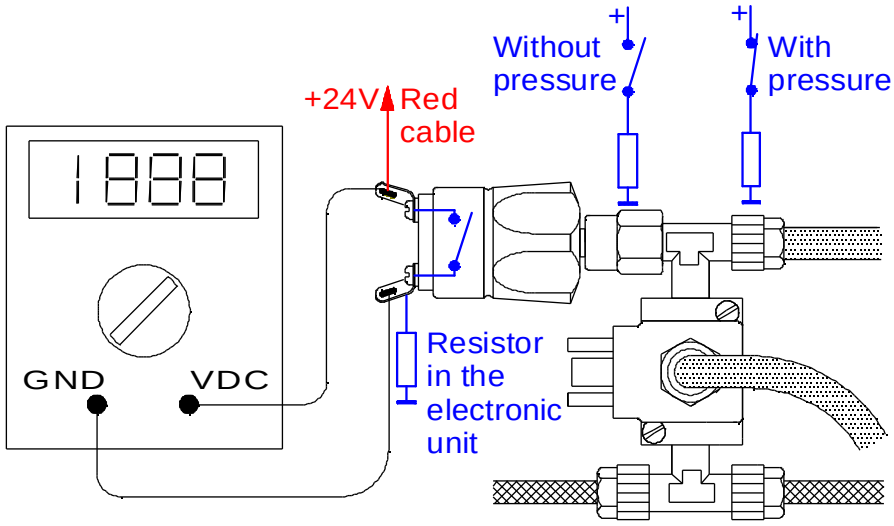
The flow sensor detects the gas flow, and converts its amount into an electrical voltage.
This voltage is then sent, as a feedback signal, to the **HF 42** board.
The **HF 42** board compares this feedback value, to the flow set point value.
The signal resulting from the comparator, runs a pulse width modulator.
Its output can be seen on **TP 8**.
The pulse width modulated signal runs a power transistor, which in turn, supplies the output signal to the flow regulating valve.
The duty cycle of the output signal determines its **DC voltage**, which, with a flow of about **180 l/h** and with clean chemicals, measures around **9 V** (on TP 3).
The **HF 42** board drives the flow regulating valve **(V6)** in such way, to provide a constant and accurate gas flow. The µA meter **(4)** shows the rate, at which the flow valve **(V6)** is driven **„open“**.

Remark:
Due to a few failures of the flow sensors, almost exclusively on the CS-800 at customers who regularly treat their samples with acid, we concluded that the reason of the failures should be of chemical nature i.e. acids and Schutze`s Reagent damage the sensor.
The solution is to prevent the analysis gases to get in contact with the sensors. Therefore the sensor ports are connected with long tubes to the gas flow system. There is no gas flow through the sensor tubes but only the pressure is sensed by the sensor.
In case of failure of a previous version sensor, it is advisable to replace it by the new version. In this case the part numbers of the complete assemblies should be used for ordering. In case the analyzer has already the new version sensor, the order should include the spare part number. See attached drawings.
The new flow sensor can not be used as a replacement for the older flow sensor consisting of a rotameter and a optical element.



2.2 Pressure switch:

■ Close the furnace.
The pressure switch should be adjusted, to about **1 bar** (15 psi); this means that under **1 bar** (15 psi), the contact is open (no contact), and over **1 bar** (15 psi), the contact is closed (turned on).

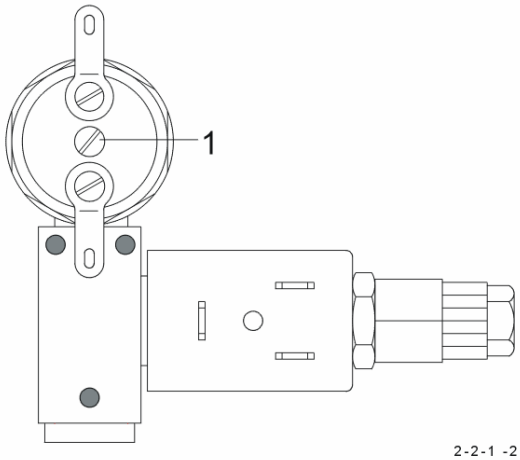


2-2-1-1 S

■ In installed condition and with the analyser turned on (Power switch set to **pos. 2**), there should be a voltage of **24 V DC** when the pressure is under **1 bar** (15 psi). If the pressure is over **1 bar** (15 psi), then the voltage should be **zero**.

ATTENTION ! Measure this with a high-impedance digital voltmeter!
Do not cause a short circuit while measuring, or else the electronic drivers will blow!

■ If necessary, the oxygen pressure can be adjusted to **1 bar** (15 psi). This can be read off the upper pressure gauge of the analyser.



2-2-1 -2

■ The switch point can be set by turning the screw **(1)**

■ If the switch is turned off **(24 V)** when the pressure is at **1 bar** (15 psi), then the screw **(1)** should be turned counter clockwise until the switch turns on, measuring the power until it reaches **zero** volt.

■ If **zero volts** are measured when the pressure is at **1 bar** (15 psi), the screw **(1)** should be turned clockwise until the voltage goes to **24 V**.

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2.3 Infrared zero- baseline, control and adjustment:

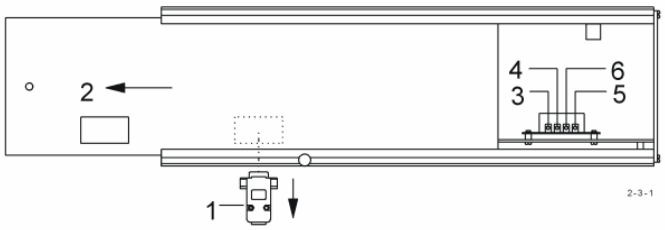
The infrared cell zero-baseline is normally controlled by the electronic and automatically set to **zero**.
The auto – zero control should be **disabled** In order to control and adjust the infrared cell zero-baseline manually, this way the electronics will have no influence. This can be done by pressing the **< Menu > and < Cal >** keys.
The voltage exiting the infrared channel should be shown as in the following example:

- 0.13
- 0.21
- 0.18
- 0,17

The displayed numbers refer to the IR-cell output voltage:

The upper number refers to the **voltage of channel 1**
The next number refers to the **voltage of channel 2**
The next number refers to the **voltage of channel 3**
The lower number refers to the **voltage of channel 4**

The channel numbers can be shown on the display by pressing: **< Menu > < 5 >**
Return by pressing **< CLR >**.
If at least one voltage exceeds +3.0 volts, then the **zero-signal** needs to be adjusted.



- To adjust the zero signal, push the left cover plate **(2)** of the infrared cell about **10 cm** towards the back.
  With a small screwdriver, adjust the trimmers **(3 / 4 / 5 / 6)** in the infrared rack, so that the numbers shown on the display are between **+ 0.20** and **- 0.20**.
  The adjustment should preferably be carried out while the **carrier gas is flowing**.

  If the zero level (between + 0.20 and - 0.20 volts) cannot be reached, and if more than two adjustments were recently carried out, then the problem could be:
- Contamination of the **IR-paths**, see **3. 1**
- bending of the **IR-source**, after rough shipment of the device, see **3. 2**
- insufficient **supply voltage** for the **Infrared**, see **2. 4**

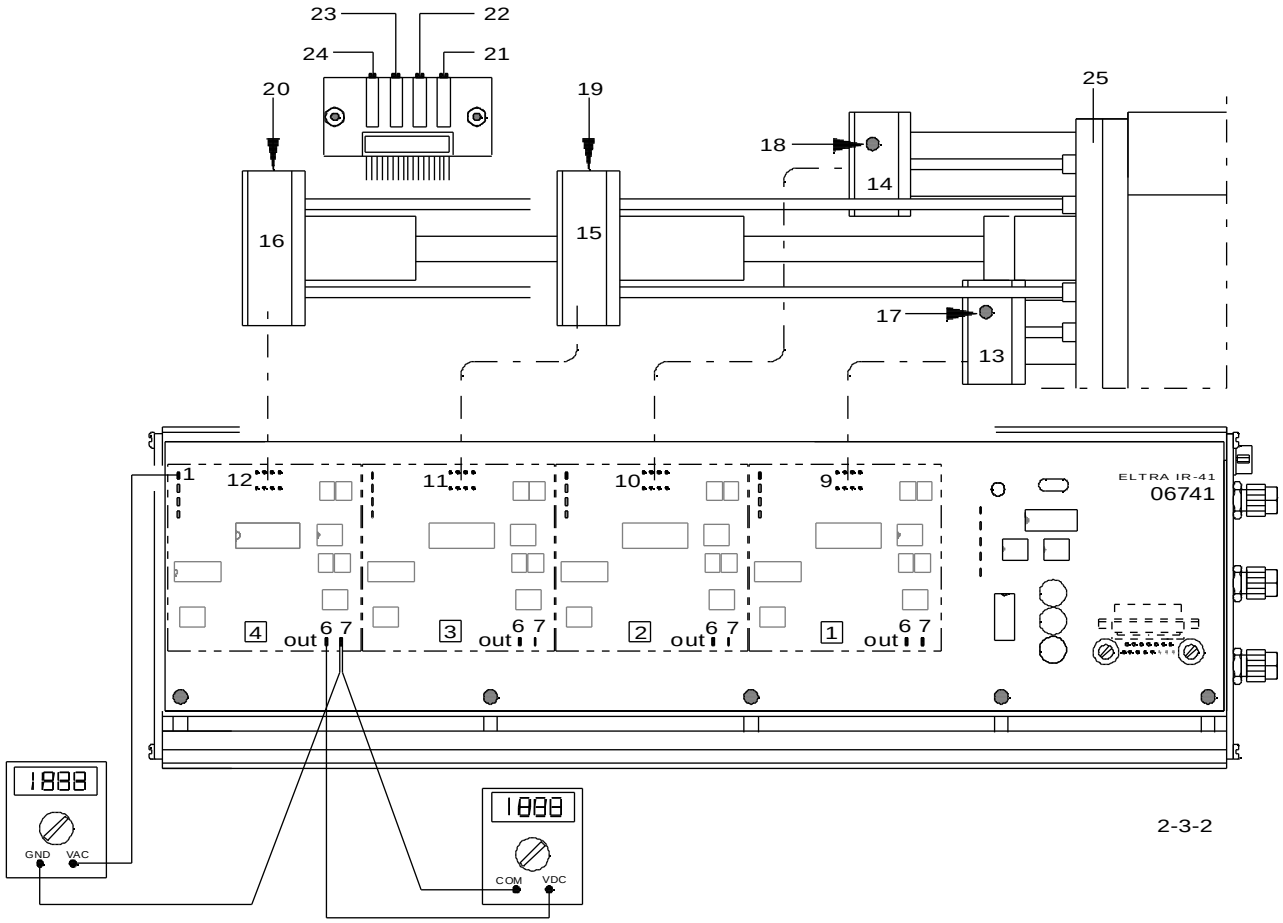
  The stability of the displayed numbers should be better than ±0.01.
  Normally, the second digit after the decimal comma does not change, or it may fluctuate up and down by only **1**, since this could be actually on the rounding point.
  If the fluctuations are larger, then there is a major degree of **noise**, see **1.20**
  The drift should also be very small. Within **10 minutes** the second digit after the decimal point should not change more than **1**.
  The drift should first be checked when the analyser has been switched on (power switch on **setting 1**) for at least **one hour**, better would be **two hours**, and the **oxygen** flowed for about **10 to 15 minutes** (Power switch on **setting 2**).

In case the drift is too large :

- Check the temperature regulation, see 2. 5
- Unstable power supply, see 2. 4
- Defective IR-source, see 3. 2
- By pressing the **< CLR >** key, you can end the test.

- **Notice :**
  If the infrared cell's **output voltage** is over **10 volts**,
  ++++ **is shown on the display**, ++++ then there is a serious defect.

Adjusting the infrared cell:



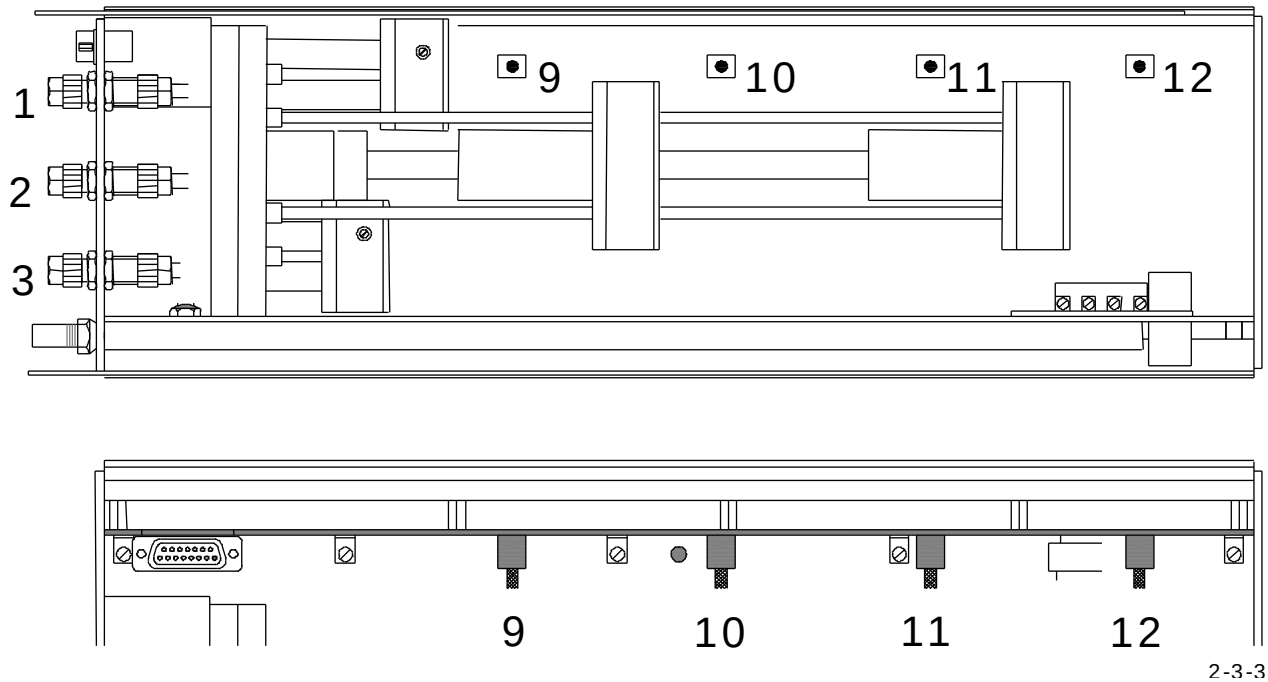
The connection sockets of the measurement channels **(9 / 10 / 11 / 12)** are predetermined on the circuit board **IR 41**.
The position of the **IR-paths** on the path plate **(25)** is irrelevant. Each **IR-path** can be changed, according to the required measuring ranges.
The connections to the **IR 41 board**, however, is very important:

9	Connection for section **(1)**
10	Connection for section **(2)**
11	Connection for section **(3)**
12	Connection for section **(4)**
	(C or S, depending on the layout of the Analyser, see 3.11)
13 / 14 / 15 / 16	Pre-amplifiers
17 / 18 / 19 / 20	Adjusters
21 / 22 / 23 / 24	Zero fine adjustment

- Each channel is adjusted separately.
- Set the trimmers **(19 / 20 / 21 / 22)** in the middle of their range.
- Connect a digital voltmeter on the **outlet 6** and the **ground 7** (measuring range **200 V DC**)
- Adjust **0 volts DC** by adjusting the preamplifiers **(13 / 14 / 15 / 16)**
- Turn the trimmer clockwise for **lower voltage**, counter clockwise for **higher voltage**. After the **zero adjustment**, the voltage on **test point 1** should be about **1 to 1.5 volts AC**(measuring range **2 V AC**)
- Install the infrared cell in the Analyser.
- Restore the oxygen flow.
- After **30 to 60 minutes**, adjust the zero by turning the trimmers **(19 / 20 / 21 /22).**
- To adjust zero, the **< Menu > and < Cal >** keys are pressed,
- Press the **< Cal >** key again to return to the analysis.
- On the temperature regulation card, check if the **LED is blinking**, see 2. 5

ATTENTION !
When the test signal fails on **test point 1**, this can be due to the **8-pin connector (9 / 10 / 11 / 12)** that connects the pre-amplifier to the **IR 41 board** not being correctly connected.

- **remove, turn 180°, and replace** , the 8-pinn connector and measure again.

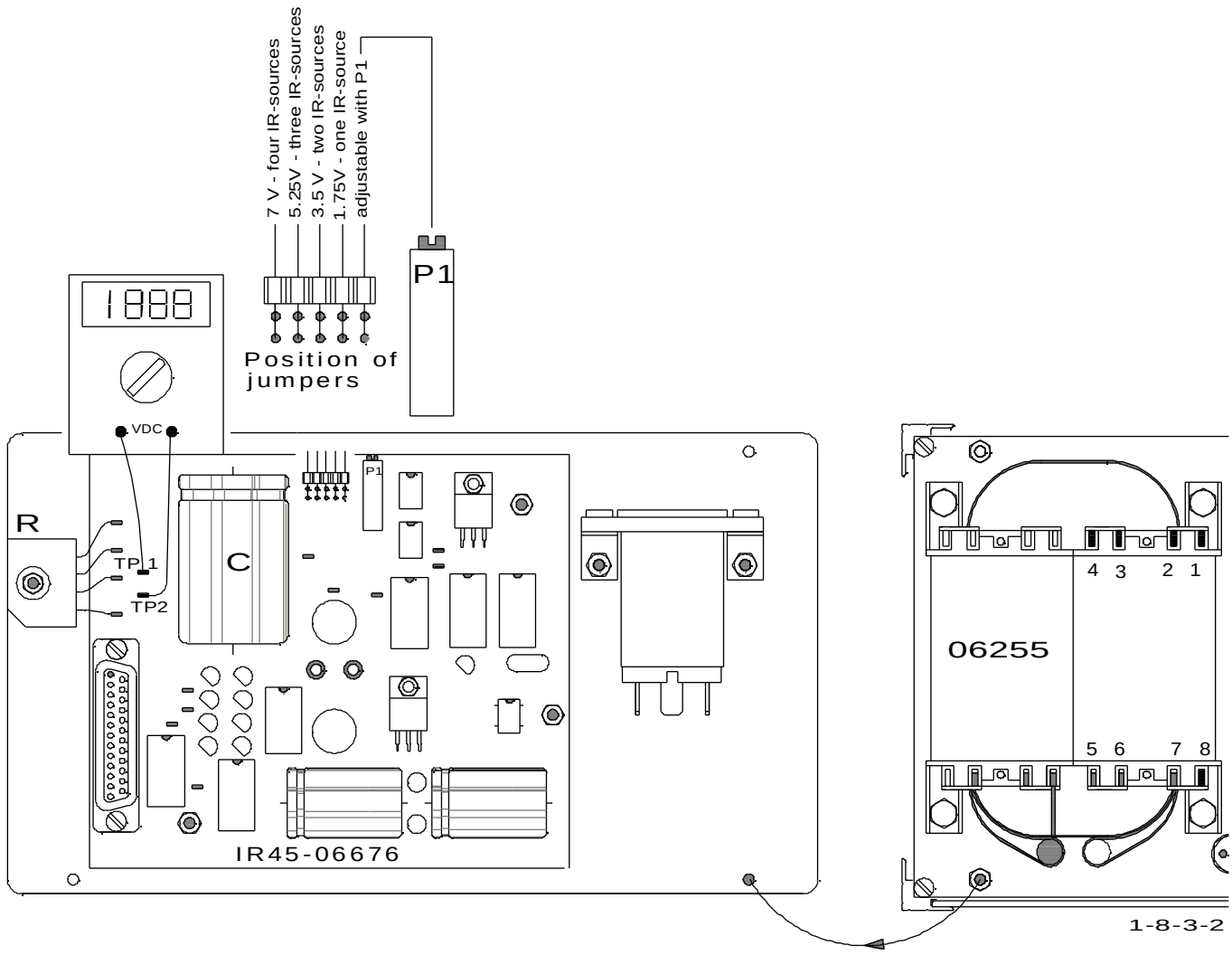


2-3-3

1 **black** marked tube connection
2 **yellow** marked tube connection
3 **red** marked tube connection

- When reinstalling the infrared cell into the analyser, you must pay **attention** to the colour markings of the tubes and their connections.

2.4 IR-source voltage setting:



IR-source voltage, is to be measured between TP1 and TP2 on IR 45 board.

1,75 V DC for 1 channel device
3,5 V DC for 2 channel device
5,25 V DC for 3 channel device
7 V DC for 4 channel device
(1,75 Volts DC for each IR source)

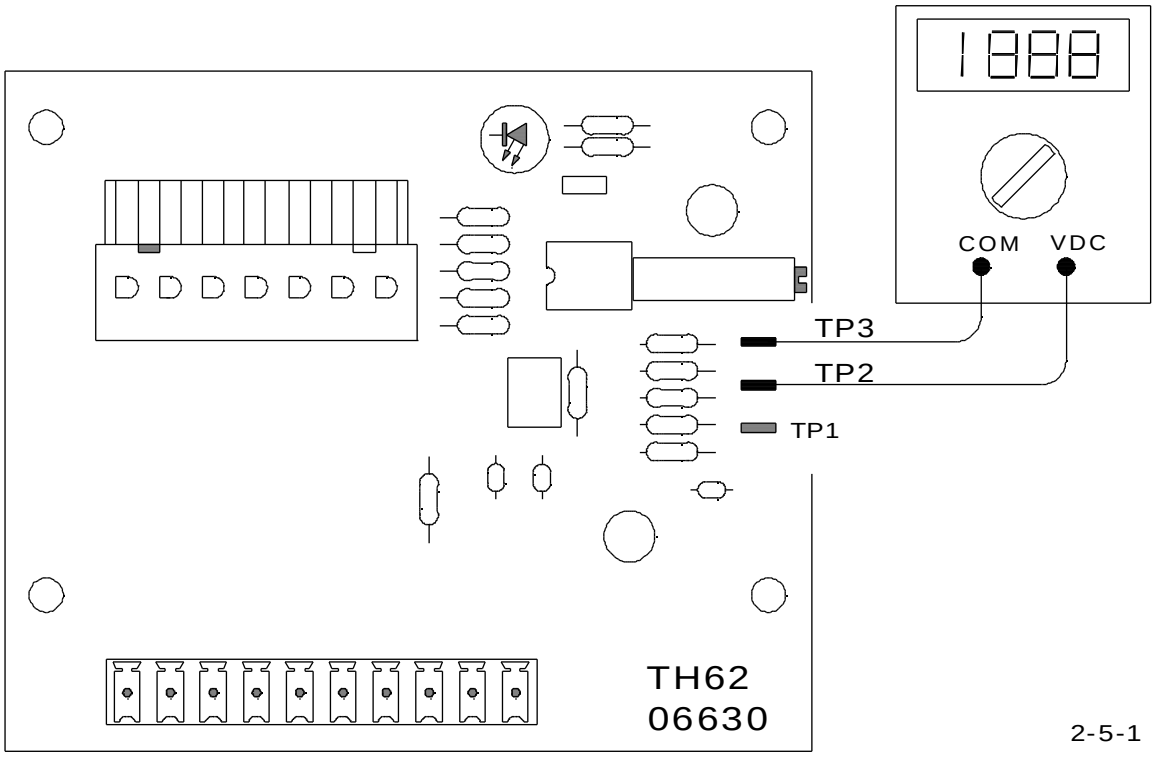
Transformer connections:

Blue cables

1 Soldering Location for 1 channel device
2 Soldering Location for 2 channel device
3 Soldering Location for 3 channel device
4 Soldering Location for 4 channel device
8 Always connected (common)

- Set above voltages through **Jumpers**
- The voltage of the capacitor **C** must be about **5 to 6V higher** than the **voltage of the IR-source** measured on the **a.m. test point**.
- If the voltage of **C is too low**, either the **transformer** is not correctly connected, or the **rectifier R** is out of order.

2.5 Temperature regulation of the IR-cell:



2-5-1

The adjustment should preferably be done only when the analyser, and the infrared cell, has been in operation for at least **one hour**.

- If the **LED** is always off, adjust **P1** on the **TH 62** board clockwise for **higher temperature set point**.

- If the **LED** is always on, adjust **P1** counter clockwise for **lower temperature set point**.

  In case the **LED** is already blinking, adjust the flash rate of the **LED** to 50% duty circle.

ATTENTION!

- The effect of the readjustment will appear in a **few minutes**, as soon as the temperature has changed to the **new setting**.

- The voltage on **TP1 (TP2 = GND)** does not correspond to the actual temperature of the **IR-cell**, but it corresponds to the power needed to keep the **IR-cell** at a constant temperature.

- When the environmental temperature goes **down**, the heaters of the **IR-cell** need **higher power** to keep the temperature of the **IR-cell** constant. In this case the **voltage** will go **higher**.

- The opposite happens when the **temperature** in the laboratory goes **higher**. The **IR-cell** heaters need **less power** to keep the temperature constant, so that the **voltage** will become **lower**.

- The adjustment of the **IR-cell** should be done, if possible, when the laboratory has the **average temperature of a year**. The set point of the **IR-temperature** should then be adjusted with **P1** so that the voltage in stable condition measures 6 volts.

- For readjusting, turn **P1** when the voltage to is too low **clockwise**, when the voltage is to high turn **counter clockwise**.

- **Caution:** After you have turned **P1**, several times the **voltage** will be **out of range**. This is normal. When turning **P1** you enter a new **set point** of the **IR-cell temperature** which is at that moment different to the **actual temperature** of the cell.

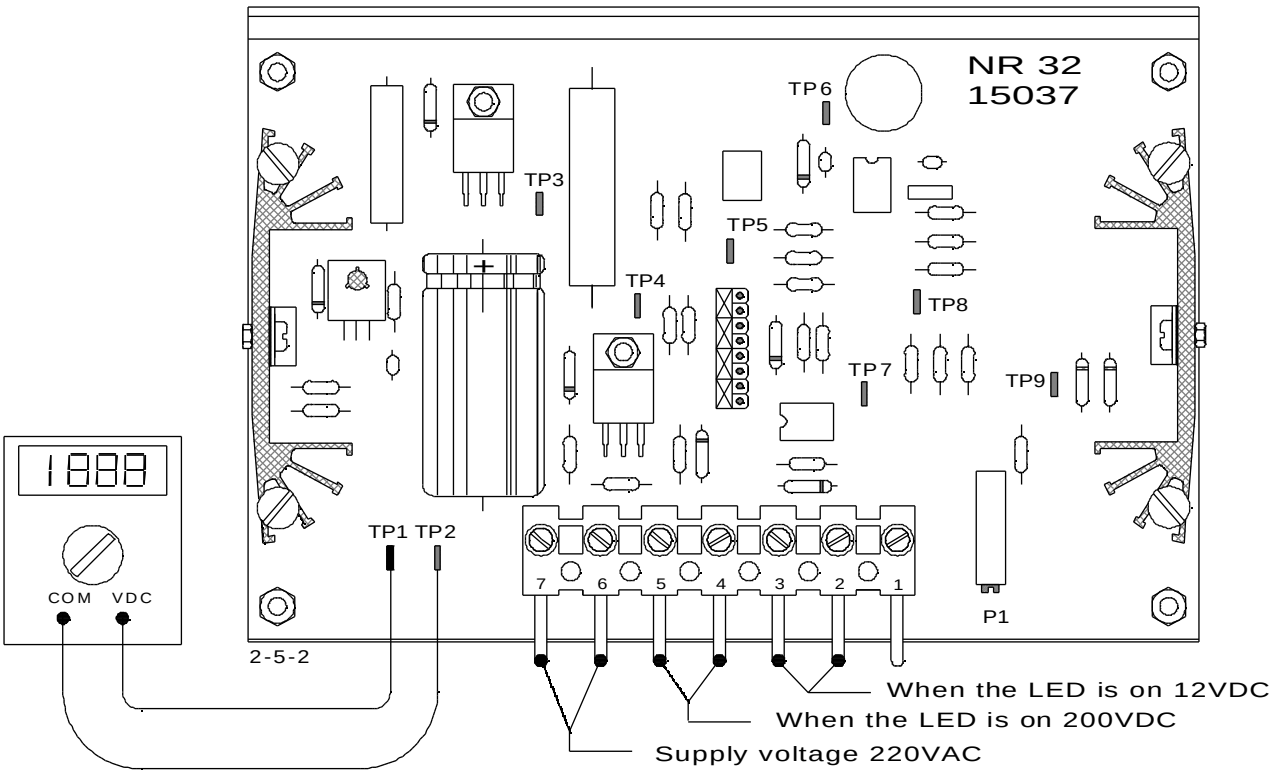
- The **temperature control circuit** will give **full power** to the **heaters** (in case you have set a higher temperature) or the circuit will **completely shut down** the **power** to the heaters, if you have adjusted a **lower temperature set point** than the actual temperature.

- After about **10 minutes** the temperature will reach the new adjusted level, and the **voltage** will come back to **remain stable at the new level**.

- This is the voltage level which corresponds to the power to keep the **IR-temperature** stable at the new level.

- If the **LED** still doesn't start blinking , adjust **P1** on the **TH 62**, until there is about **5.35 V DC** present between **TP2** an **TP3**.

- If the **fault** still remains, despite adjusting the **TH 62**, then check the board **NR 32**, according to the following instructions.



CAUTION! ELECTRICIAL HAZARD !

- You should be able to measure **200 V DC** between **TP1** and **TP2 (GND)** of the **NR 32** board; otherwise the board is faulty.
- This requires that **220 V AC** comes through the connectors **6** and **7**
- If there is no **220 V AC**, then there could be a bad contact in the plug.
- The voltage for the **infrared cell** heating elements, comes from the connections **4** and **5** of the **7 pin plug**, measure the voltage on the screws, without disconnecting the plug.
- As long as the **LED** is on, there is **200 V DC** between **4** and **5**.
- As long as the **LED** is off, there is **no voltage** between **4** and **5**.

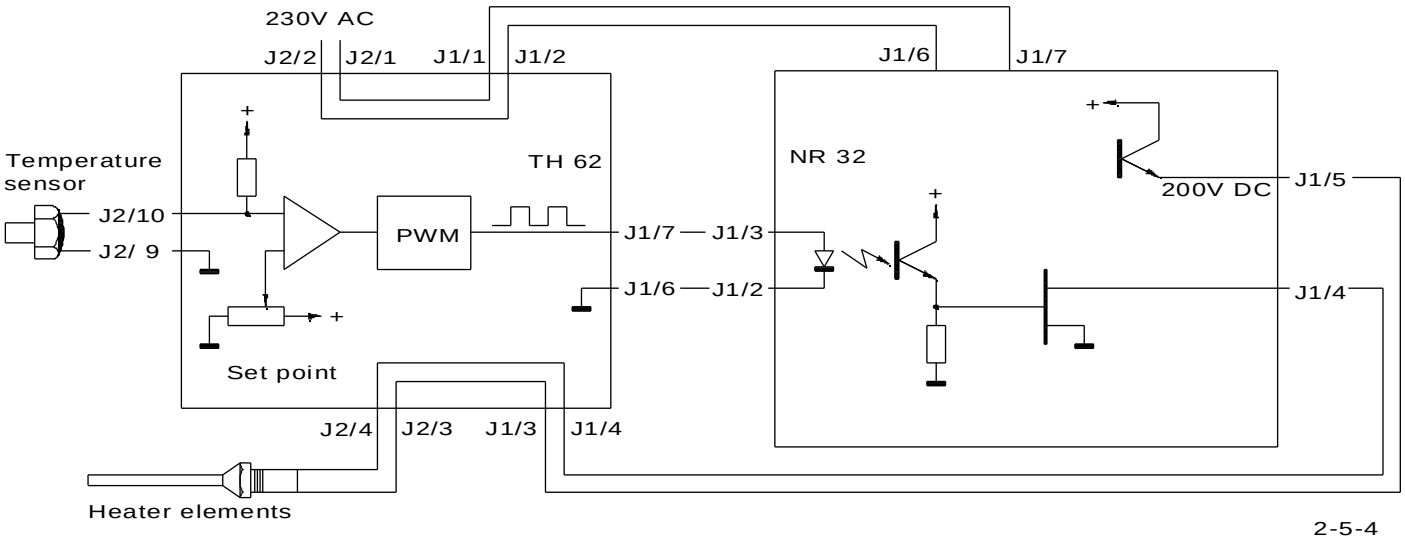
  If there is no **voltage** between **4** and **5**, then the **NR 32** is faulty. Replace it, according to **3. 6**.

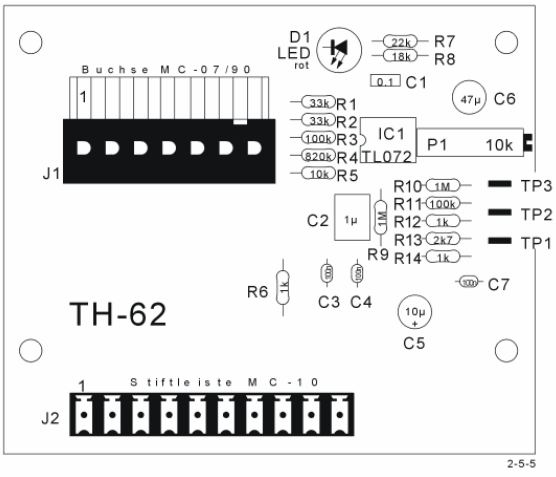
- The above sentences, extend to the board **TH 62**. From there they feed the heating elements.

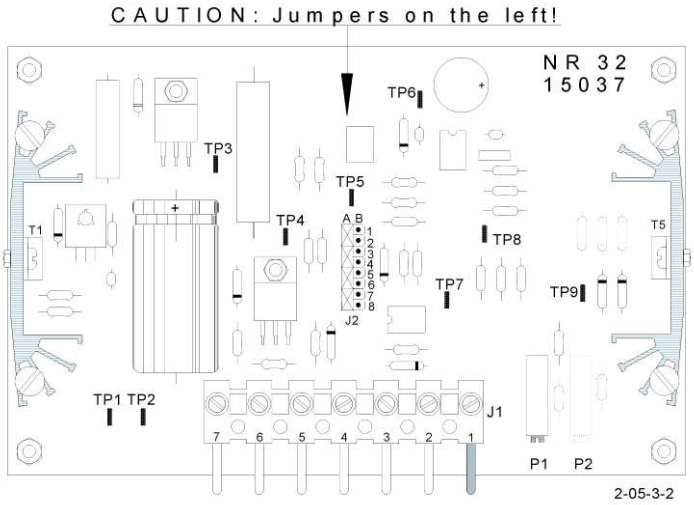
General description of the infrared cell temperature regulation:

For more details see 4.2

Simplified diagram with **TH-62**







This system consists mainly of the following components:

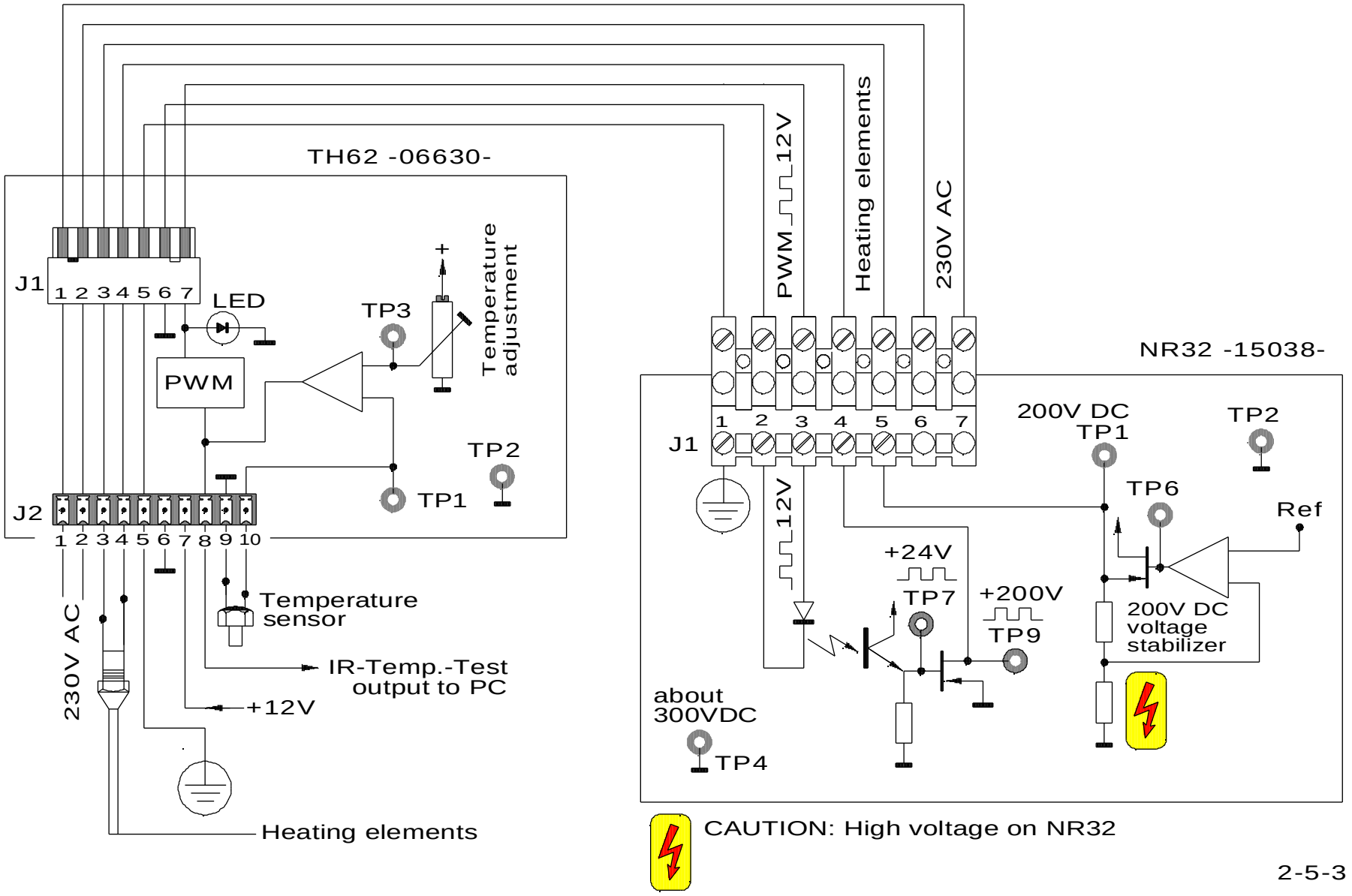
- The temperature sensor
- The temperature control board **TH 62**
- The power stage board **NR 32**
- The heater elements

The temperature sensor feels the temperature of the infrared system, and sends the signal to the temperature control board **TH 62**.

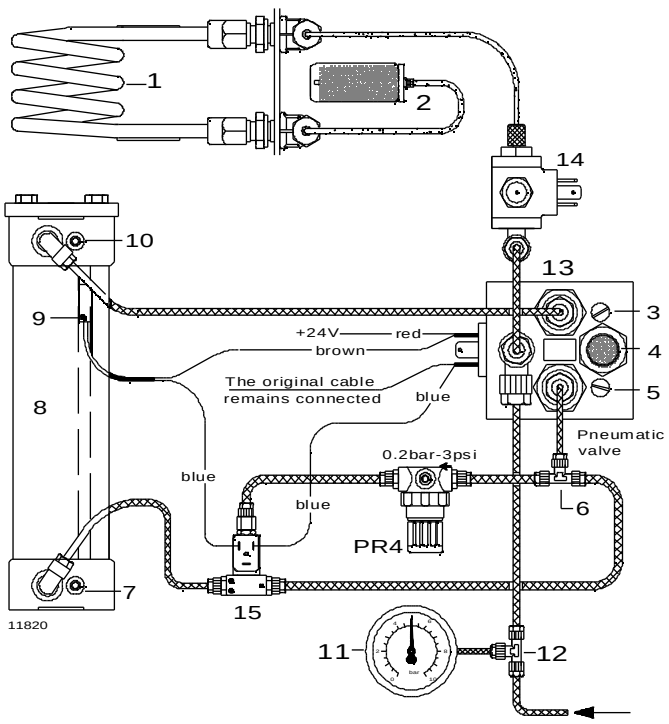
The **TH 62** compares this signal with a set point value. The resultant value drives a pulse width modulator. The **LED** of this board shows the function of the modulator.

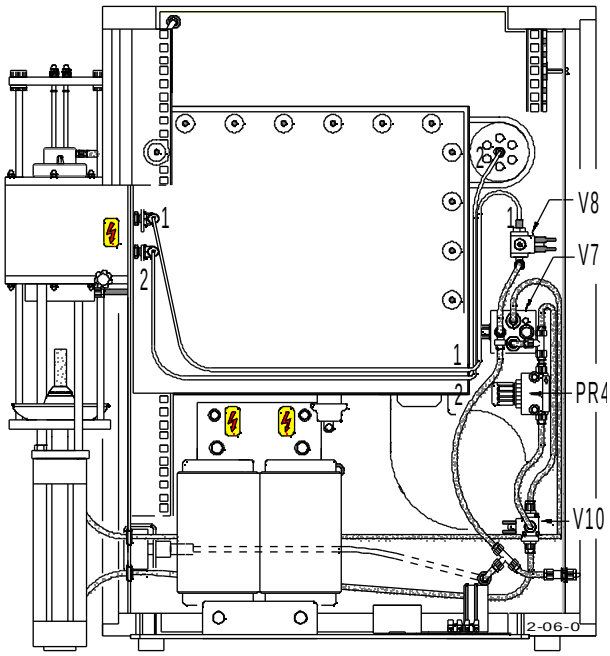
The modulated signal further drives and power stage of the **NR 32 board**; the power signal returns to the **TH 62** board, from there it finally goes to the heater elements.

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2.6 Pneumatics:





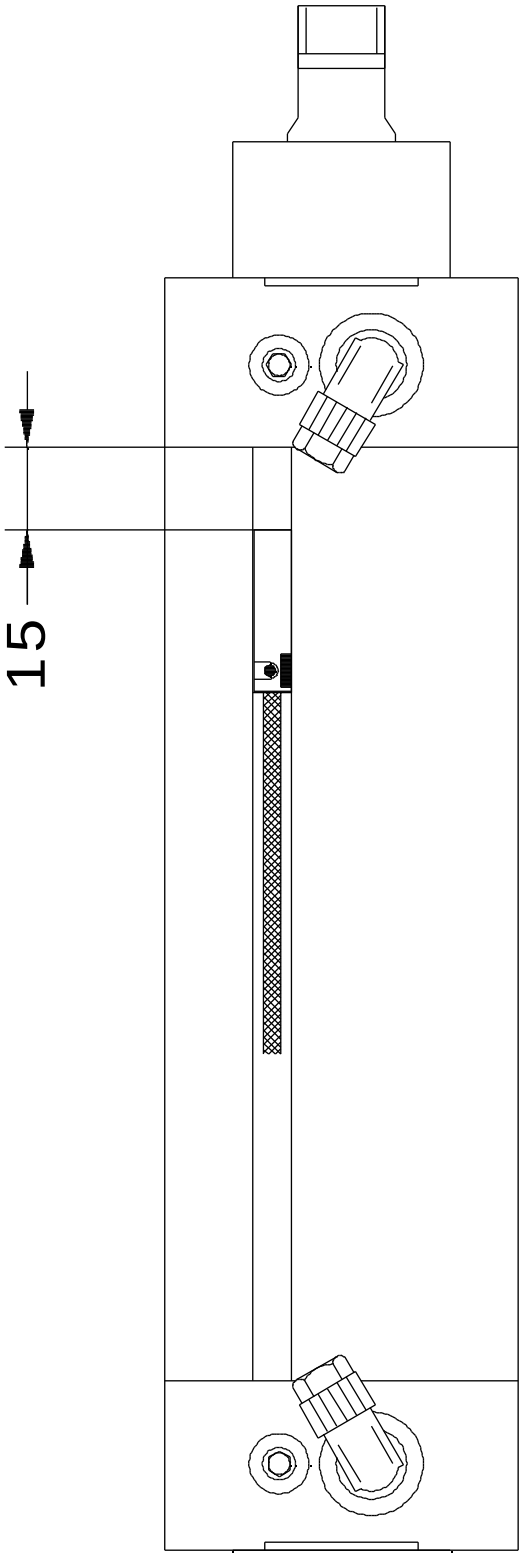
1 Combustion coil
2 Muffler
3 Upward speed regulator
4 Muffler
5 Downward speed regulator
6 T-piece
7 Lower cushioning
8 Pneumatic cylinder
9 Magnetic switch
10 Upper cushioning
11 Pressure gauge
12 T-piece
13 Pneumatic valve
14 Coil cooling valve
15 Pressure reduction valve
PR4 Pressure regulator

Adjusting the pneumatics for correct furnace movement:

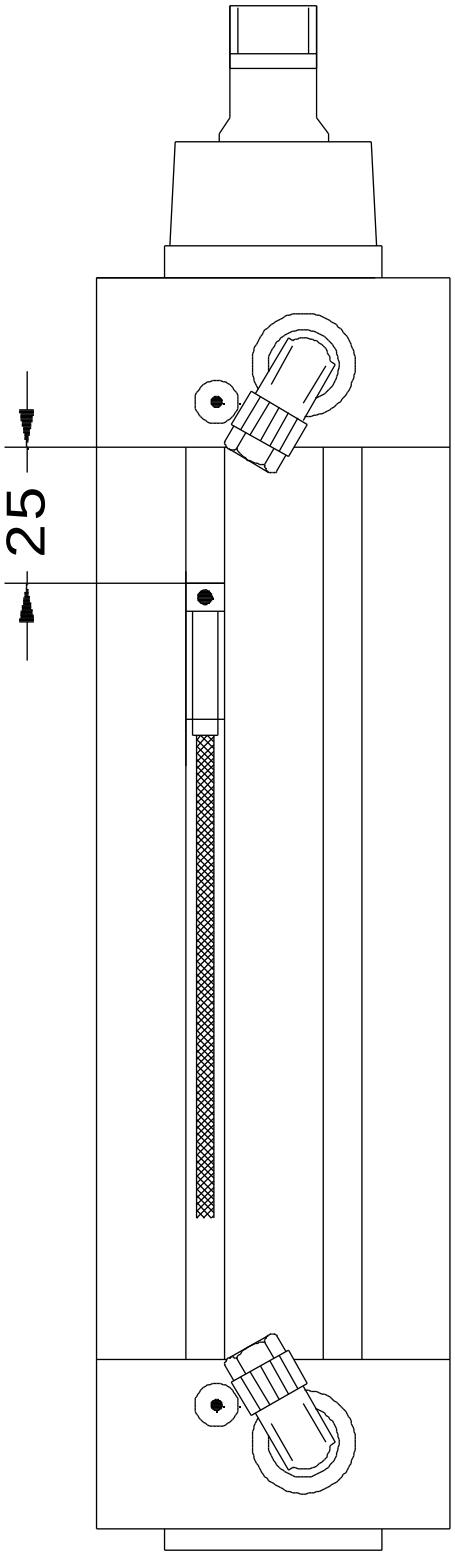
- Check if the air pressure on gauge **(11)** is between **4-6 bar**.
- Press the button ↓ ↑ to open the furnace.
- Open the right-side panel of the analyser, to find the pressure regulator **PR4** and the **pneumatic valve (13)**
- Turn the screw **(5)** counter clockwise, for minimum air restriction. Leave it in that position.
- Rotate the knob of the pressure regulator **PR4** fully counter clockwise.
- Turn the screw **(3)** clockwise, for maximum air restriction. Leave it in that position.
- Shift the magnetic switch **(9)** fully upwards.
- Press the button ↓ ↑ to close the furnace (furnace floor won't yet move).
- Adjust regulator **PR4**, until the furnace floor can rise completely, without shaking,
- **For safety precaution**, **a person still can stop moving the furnace floor with only one hand.**
- When the furnace is closed, shift the magnetic switch downwards until it switches on; Now shift down another **5 mm**.
- Open the furnace and then close it, to check if the adjustments are still correct.
- Adjust the furnace upwards speed with screw **(3)**, it must be within a reasonable limit.
- Adjust the furnace downwards speed with screw **(5)**, it must be within a reasonable limit.
- Adjust lower cushioning **(7)**, so that the furnace opens without banging at the bottom.

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Magnetic switch of the pneumatic cylinder:



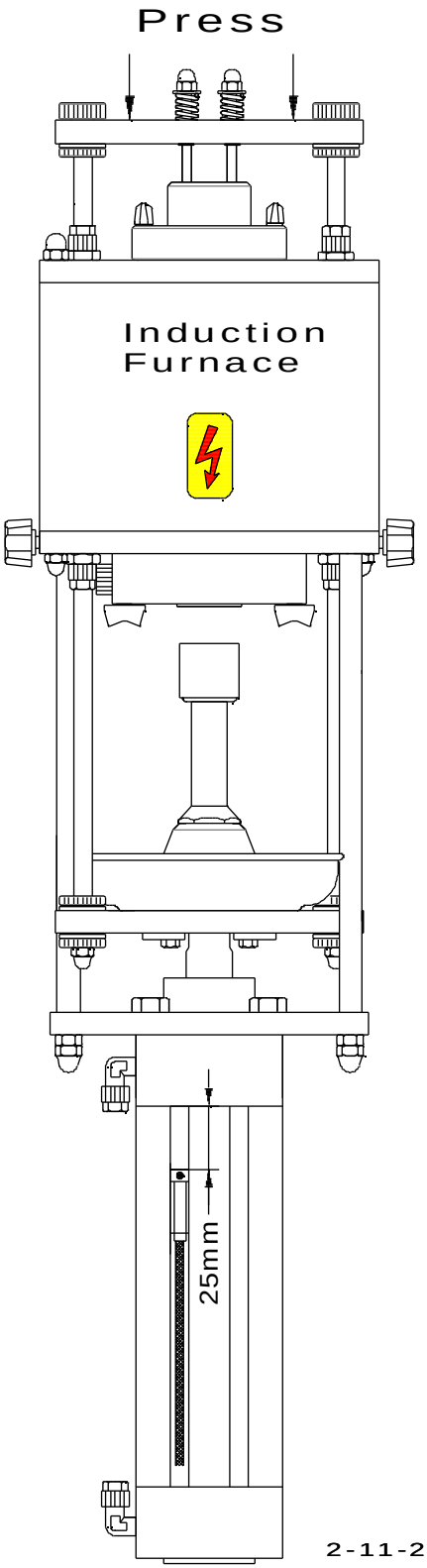
Cylinder model with one
slot pre-adjust 15 mm as above.



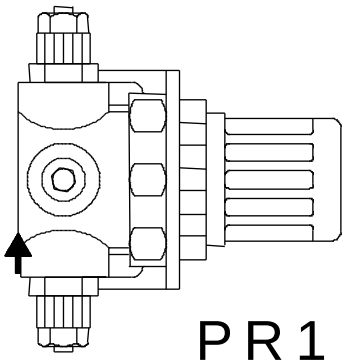
Cylinder model with two
slots pre-adjust 25 mm as above.

Check the following :

- Open the furnace **(piston down)**.
- Hold the piston down by pressing on the horizontal bar of the furnace. (with the fingers)
- Press the key to close the furnace.
- Allow the piston to go up very slowly by controlling the force of your fingers.
  If not possible do the pneumatics adjustment.
  see **pages before**.
- About **5 mm** before the piston reaches it's highest position the force will increase.
- With your fingers press down firmly to make sure that the piston can not be pushed down.
- If the piston starts vibrating by moving up and down with full force, then adjust the switch higher.
- If the piston goes down, then adjust the switch lower.

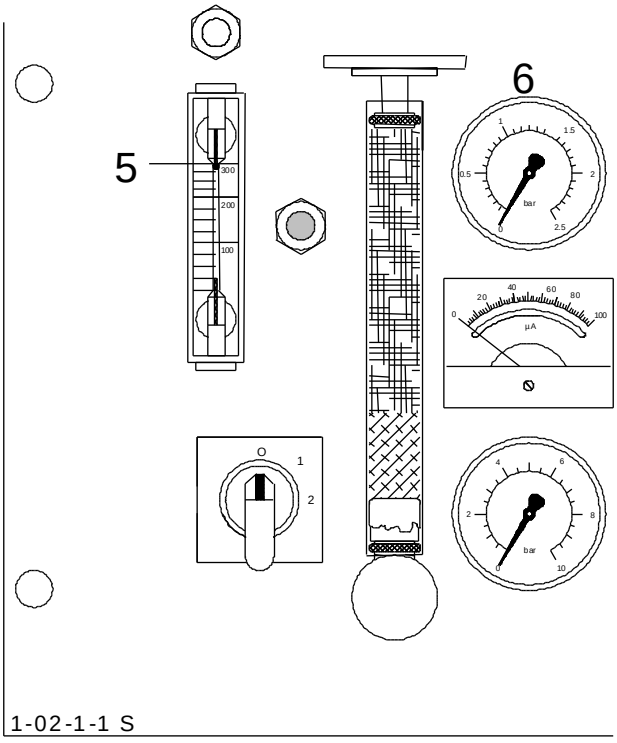


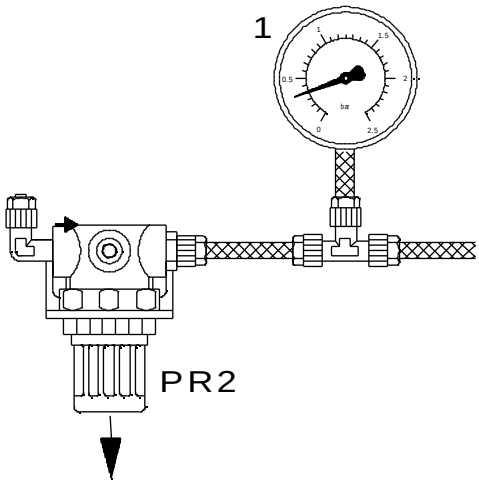
2.7 Pressure regulation:



PR1 is the inlet oxygen regulator, and is situated inside the analyser, on the rear panel. The outlet pressure needs to be set to **1.5 bar** (22.5 psi).

- Pull and rotate the knob of the regulator, until the pressure gauge **(6)** shows the correct value.
- Ensure that the flow shown on the flow meter **(5)** shows between **180 and 200 l/h**; if not, adjust according to **2. 1**.

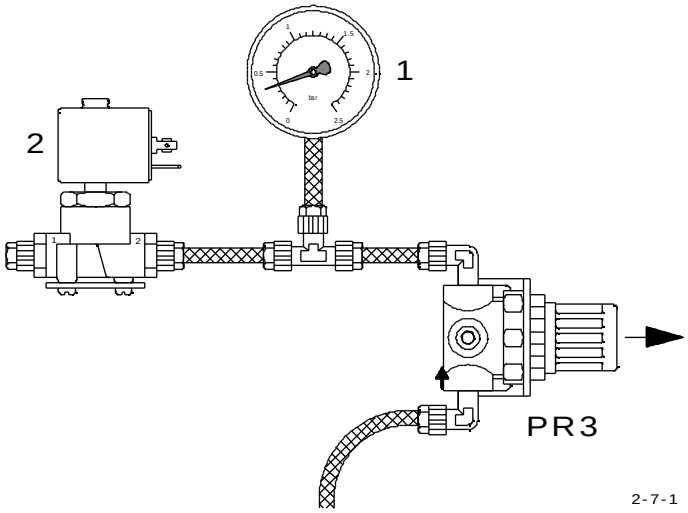




PR2 is the pressure regulator for the **purging system** of the **IR-cell** and it is situated inside the analyser, just behind the left-side of the panel. It is positioned horizontally. The oxygen pressure at the outlet of the **PR2** should be **0.35 bar** (5 psi).

- The pressure can be checked by applying a **T-piece** on the outlet of the pressure regulator, and connecting a **pressure gauge (1), as indicated above**.

- Pull and rotate the knob of the pressure regulator **(PR2)**, until the correct pressure is shown on the gauge.



Using induction furnace operation:

PR3 regulates the pressure of the **carrier gas** that circulates through the **IR-cell** and then finally out of the analyser. This pressure regulator is situated inside the analyser, just before the **flow regulation valve (2)**. The gas pressure at the outlet should be **0.7 bar** (10 psi).

- The pressure can be checked, by applying a **T-piece** on the outlet of the pressure regulator, and connecting a **pressure gauge (1)**, as indicated above.

- Pull and rotate the knob of the pressure regulator **(PR3)**, until the correct pressure is shown on the gauge.

- Ensure that the flow shown on **flow meter (5)**, see **drawing on previous page**, shows between **180 and 200 l/h**; if not, adjust according to **2. 1**.

For more accurate adjustment do this:

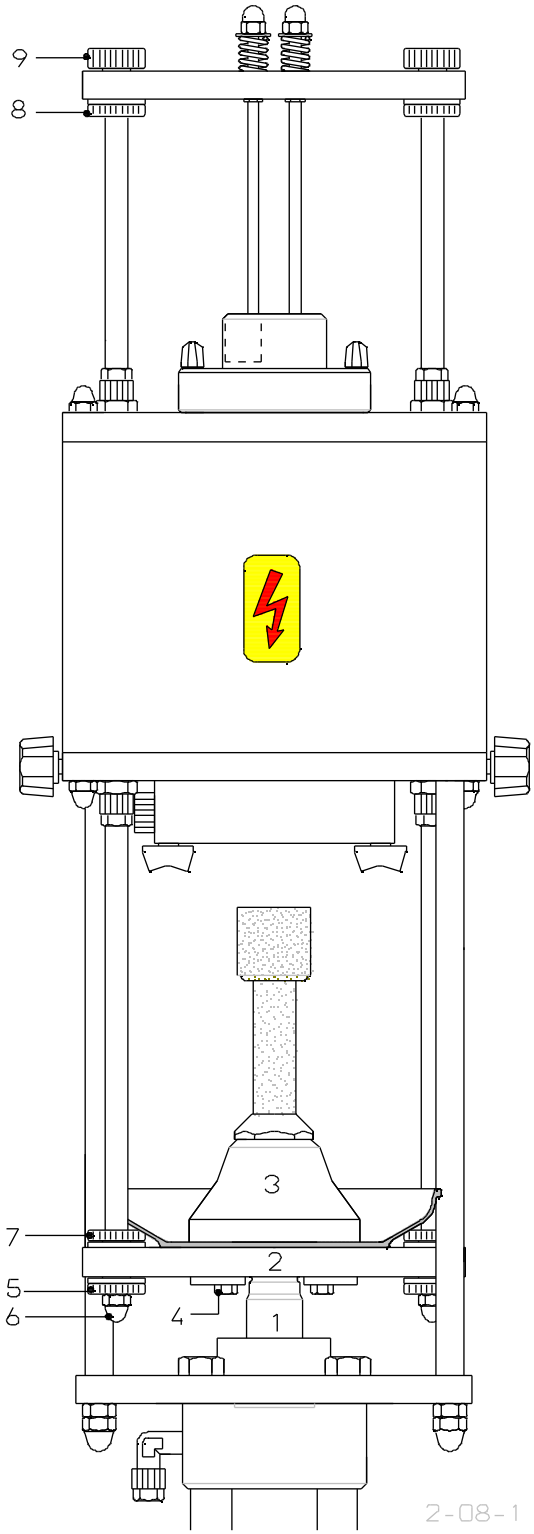
Increase the pressure slowly by turning clockwise and observe the upper pressure gauge **(6)** on the front panel. It may start vibrating. It may not vibrate even if you adjust the maximum possible pressure with **(PR3).** The maximum possible pressure is slightly lower than **1,5 bar** (22 psi), because the incoming oxygen pressure is adjusted to **1,5 bar** (22 psi). After reaching the maximum pressure or when any vibrations should start, slowly reduce the pressure by turning **PR3** counter clockwise.
Read the pressure on the gauge **(1)** when the vibration on **(6)** stops.
(In case of no vibrations read the maximum pressure you obtained). Then go on reducing the pressure with **(PR3)** and observe the volt meter **(4)**. When it starts moving towards its maximum scale **(100 µA)** stop reducing the pressure, and read it on the gauge **(1)**.
Now adjust the pressure with **(PR3)** at a level on the gauge **(1)** wich is about in the **middle between** the **lowest pressure** you **read** and **the pressure you noted** after the vibrations stopped.

For example:
The vibration **stopped** at the level of **1 bar**. The volt meter **(4)** started moving to ist maximum at **0,3 bar**.

Therefore: $\frac{\text{1 bar + 0,3 bar}}{2}$ **= 0.65 bar** on the gauge **(1)** with **PR3**

2.8 Closing cone, adjustment:

- You should ensure that the shaft **(1)** is securely fastened to the base **(2)** If not, hold the base **(2)** securely and tighten the shaft **(1)** **(engineers wrench size 17)**
- In order to adjust the cone, the screws **(4)** should be loosened so that the cone **(3)** moves horizontally on the base **(2)**
- Close the furnace (with the lift upwards)
- Tighten the screws **(4)**
- The cone is now positioned correctly
- The screws **(7)**, **(5)**, **(6)**, must now be well tightened in this order
- The screws **(8)** should be properly fastened (with a wrench)
- The screws **(9)** should only be tightened by hand



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2.9 Linearisation:

The linearisation of the Analyser is done in **our company** and does not **need** to be repeated by the customer.
Therefore it is **fatal to experiment** with the linearity.
The following description applies **only** in case the number of **channels are increased** see **3. 12** , or if the **range** of a **channel has changed**, (for example, by installing a longer or shorter IR-path).
The **infrared cell** is basically non-linear; meaning that its output voltage, is not proportional to the **CO_2** or **SO_2 concentration**. In order to obtain the correct measurements, this non-linearity must be corrected **electronically** through the software.
Once the „linearity factor“ has been entered, see **description below**.
For each measurement channel, the exact characteristic curve must be individually determined and **programmed** into memory.
After programming in a **(new)** factor, analyse a high and a low standard sample, to check the accuracy.
If, the measurement results after the test of the **low standard** sample are not correct, a new factor must be programmed and the **test repeated**.

Procedure:

1) Analyse the high standard **(7 Volts to 8 Volts peak)**
2) Note the result
3) **< Cal > < 1 > < Channel Number >**
4) **< Standard Value > < Enter >**
5) **< Result > < Enter >**
6) Analyse the low standard **(2 Volts to 3 Volts peak)**
7) If the result (from 6) is too low, then the factor should be **higher**.
8) If the result (from 6) is too high, then the factor should be **lower**.
9) **< Menu > < . > < Channel Number >**
10) **< New Factor > < Enter >**
11) **< Nr > < New Factor > < Enter >**
12) Repeat from # 1

Approximate standard samples for linearisation and calibration:
of the usual standard ranges for metal analysis.

Channel 1 : Carbon (low) linearisation factor Approximate value 23000:

0.197%C	400 mg
0.151%C	500 mg
0.100%C	500 mg
0.067%C	500 mg
0.023%C	500 mg

The standard for successive calibration is **0.151%C**

Channel 2 : Carbon **Linearisation factor** **Approximate value 23500**

3.920%C	500 mg
3.200%C	500 mg
2.080%C	500 mg
1.050%C	500 mg
0.452%C	500 mg
0.243%C	500 mg

The standard for successive calibration is, **2.080%C**

Channel 3 : Sulphur **Linearisation factor** **Approximate value 50000**

0.230%S	500 mg
0.167%S	500 mg
0.103%S	500 mg
0.050%S	500 mg
0.022%S	500 mg

The standard for successive calibration, is **0.103%S**

When the **true factor** is closely approached after using the above methods, an exact determination can be derived in the following way:
Rather than only one analysis, three separate analyses are conducted.
The arithmetic average is then taken.

1) Analyse the high standard three times.
2) Note the arithmetic average.
3) **< Cal > < 1 > < Channel Number >**
4) **< Set Value > < Enter >**
5) **< Result > < Enter >**
6) Analyse the low standard three times.
7) If the arithmetic average (from 6) is **too low**, then the factor should be **higher**.
8) If the arithmetic average (from 6) is **too high**, then the factor should be l**ower**.
9) **< Menu > < . > < Channel Number >**
10) **< New Factor > < Enter >**
11) **< Nr > < New Factor > < Enter >**
12) Repeat from # 1)

2.10 Programming the balance:

Basic settings for all types of balances:
2400 Baud
No parity
Send continuously

Please note:
We are not responsible for balances that have not been delivered through our company.

The below setting is only a general guideline. Some balance may have a different data or cable configuration and may therefore fail to communicate with the analyser. The balance supplied by **Eltra** is a Sartorius, model **CP 64**. The balance is programmed **(always with 3 Digits)** in our company, in order to establish a good communication with the analyser.

Should any problems arise, then please follow the next instructions:
At first switch the balance off by **pressing** I/⏻ and follow the steps below.

1) Switch the balance on, by **pressing** the **TARE** button by **holding** it down. Then **press** the **on/off** button. I/⏻ **Release** first the I/⏻ and then **TARE**.

2) Selecting the first programming mode, **113** (to stabilise the vibration) by **pressing** ⊙ the first digit No. will appear on the display. Change the digit No. by **pressing** CAL **Repeat step 2 until the No. 113** has been **inserted** then,
Store with a **short press** on the **TARE** button.

3) Selecting the 2nd programming mode **515** (2400 Baud)
Same usage as in step 2) and don't forget to store with TARE (short press)

4) Selecting the 3rd programming mode **614** (continuous data sending)
Same usage as in step 2) store again with TARE (short press)

5) After the programming has been done it is **IMPORTANT** to **hold** the **TARE** button again until the display shows a row of **88888888** and then release the **TARE** button and the balance is ready for operation.

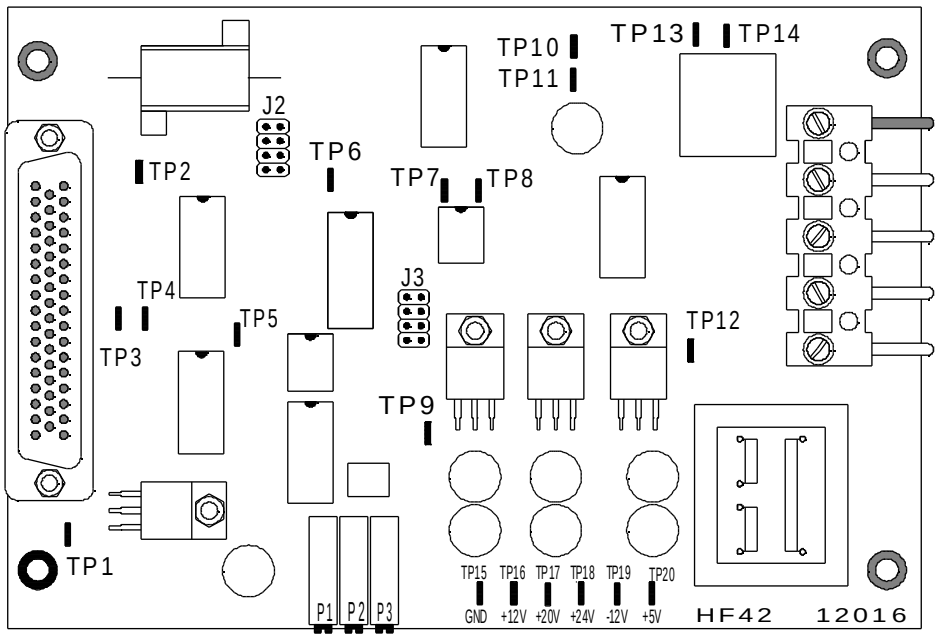
The correct settings:

113 to stabilise the vibration
515 2400 baud
614 continuous data sending

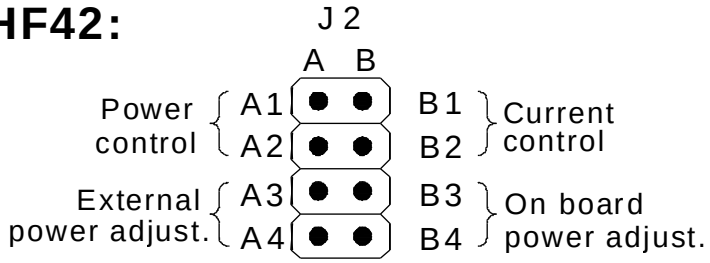
CAUTION:
The balance model **CP 64** has is a switch to **enable / disable** the programming mode. The switch, when shifted to the left, **disables** the programming mode.

2.11

2.12 Induction generator control



HF42:

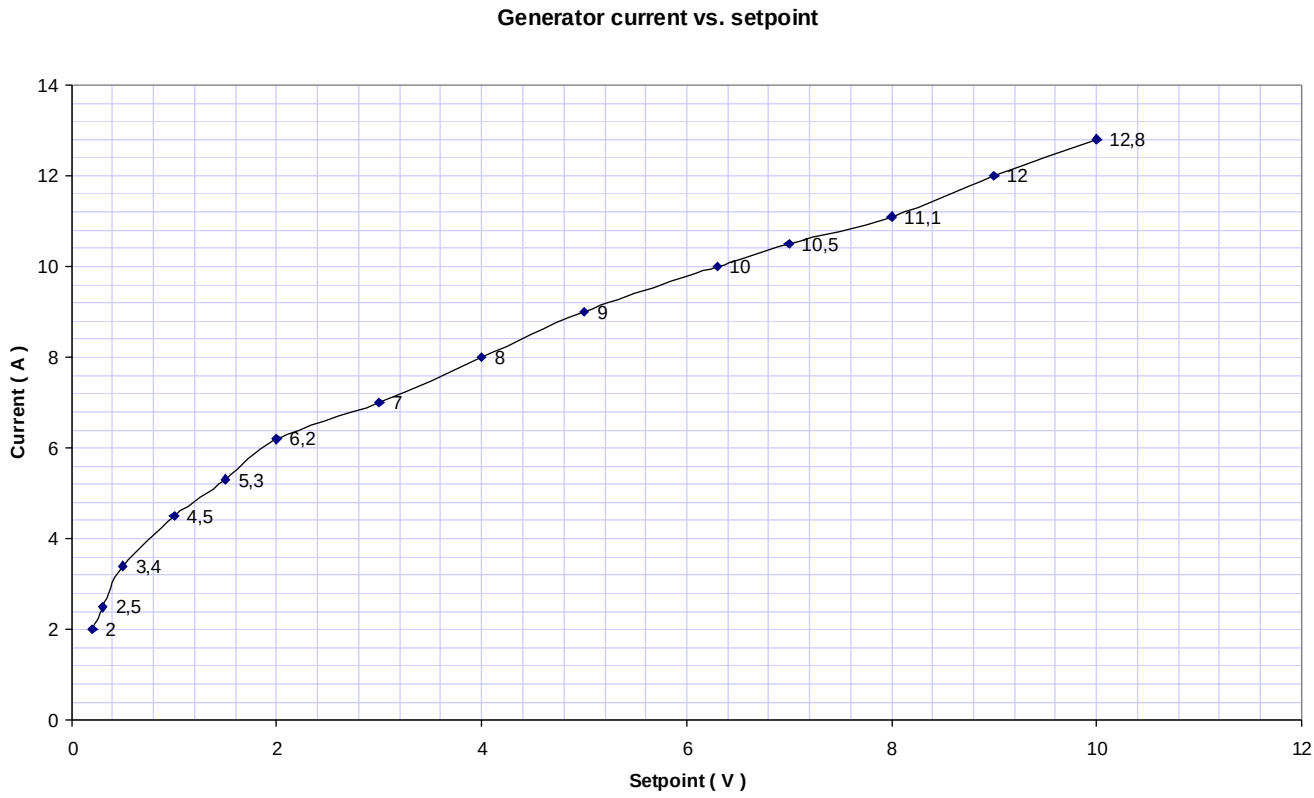


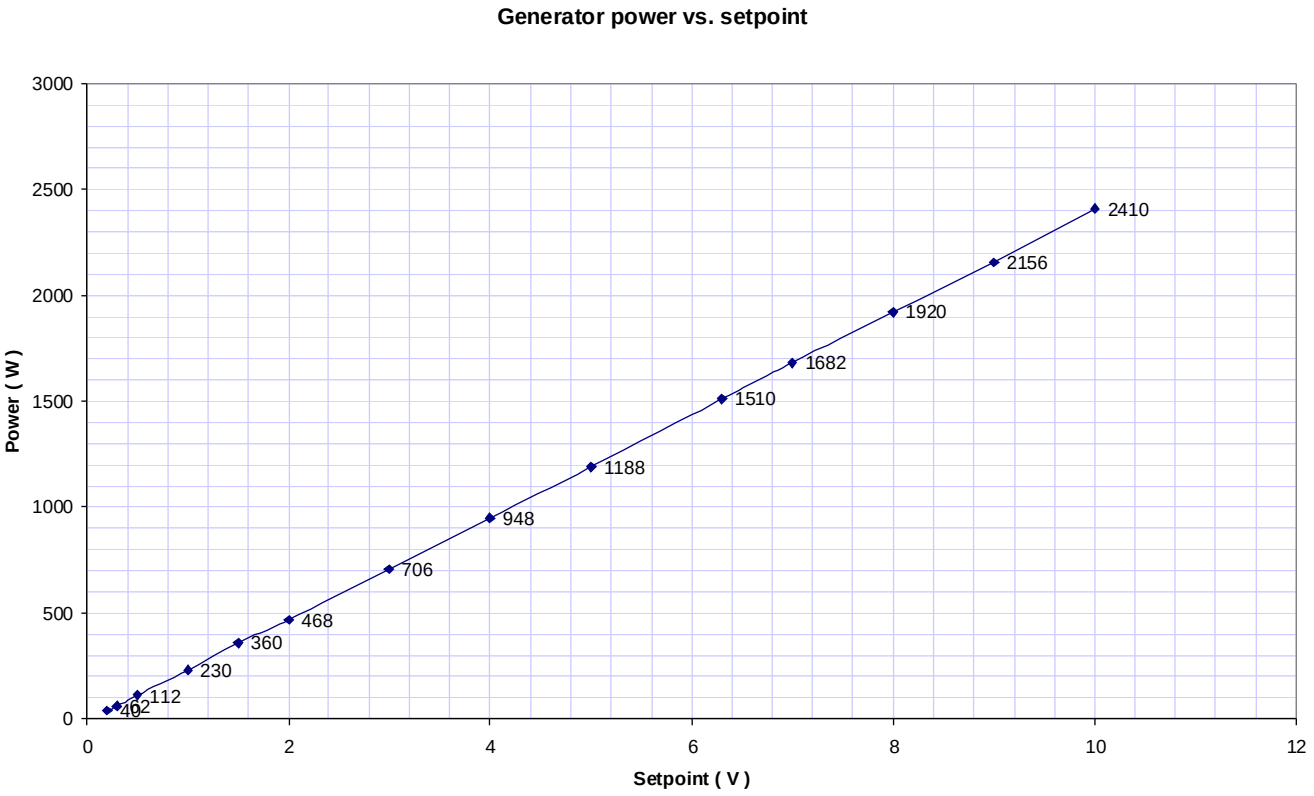
Current control:

The current control provides a safer and more accurate control of the furnace intensity.

- Set the jumper **J2** to **B1-B2**
- Connect a digital multi meter on **TP1** (TP15 is GND)
- Start the analysis, adjusting **P2** until **6.3 volts DC** are on **TP1** (for copper analysis adjust **1.2 volts DC**).
  Adjust only, while the furnace is active.

The following diagrams show the relationship between the set value (adjustment with P2 on the HF 42 board) and the generator parameters.





2.13 Diagnostic printouts:

By pressing the:

< Menu > < . > < 0 >

keys, a diagnostic report will be printed out on the printer.

Attention !

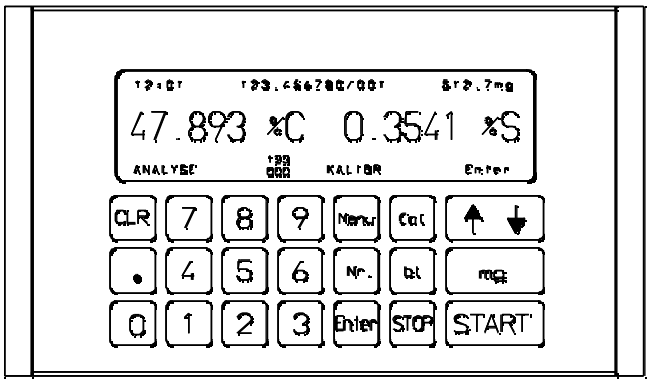
The printer port must be activated, with :

< Menu > < 3 > < 1 > < Enter >

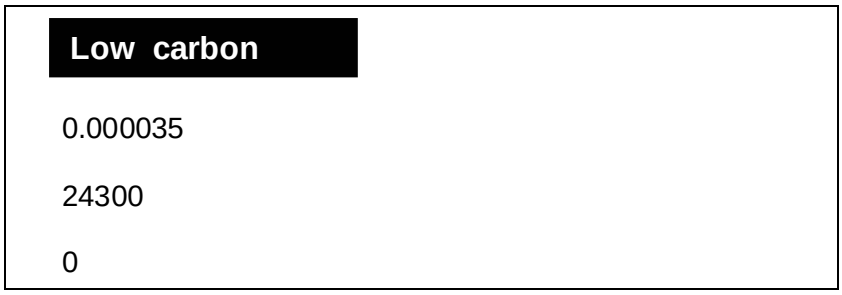
This report should be faxed to **ELTRA** if interpretation or further instructions are needed.

2.14 Setting check up:

CAUTION!
If the analyser is currently being controlled by the **PC**, disable the latter by clicking on the **disconnect** button of the main window.



- Press **Menu** , then **•**
- Ignore the error message
- Press the number of the measuring range to be examined, e.g. **1**



Now the display shows the setting as above. Starting from the top, the following information appears:

- The measuring range
- The calibration factor
- The linearisation factor
- The blank value
- Conclude this section, by pressing **Enter**

CAUTION!
Do not press any other key instead of Enter, otherwise the linearisation factor will be affected and the analyser will be totally inaccurate.

Setting print out:

When a printer is connected to the analyser, all the settings, regarding all the measuring ranges can be printed out.

- Press Menu , then 3 , then 1 , in order to **activate the printer**.

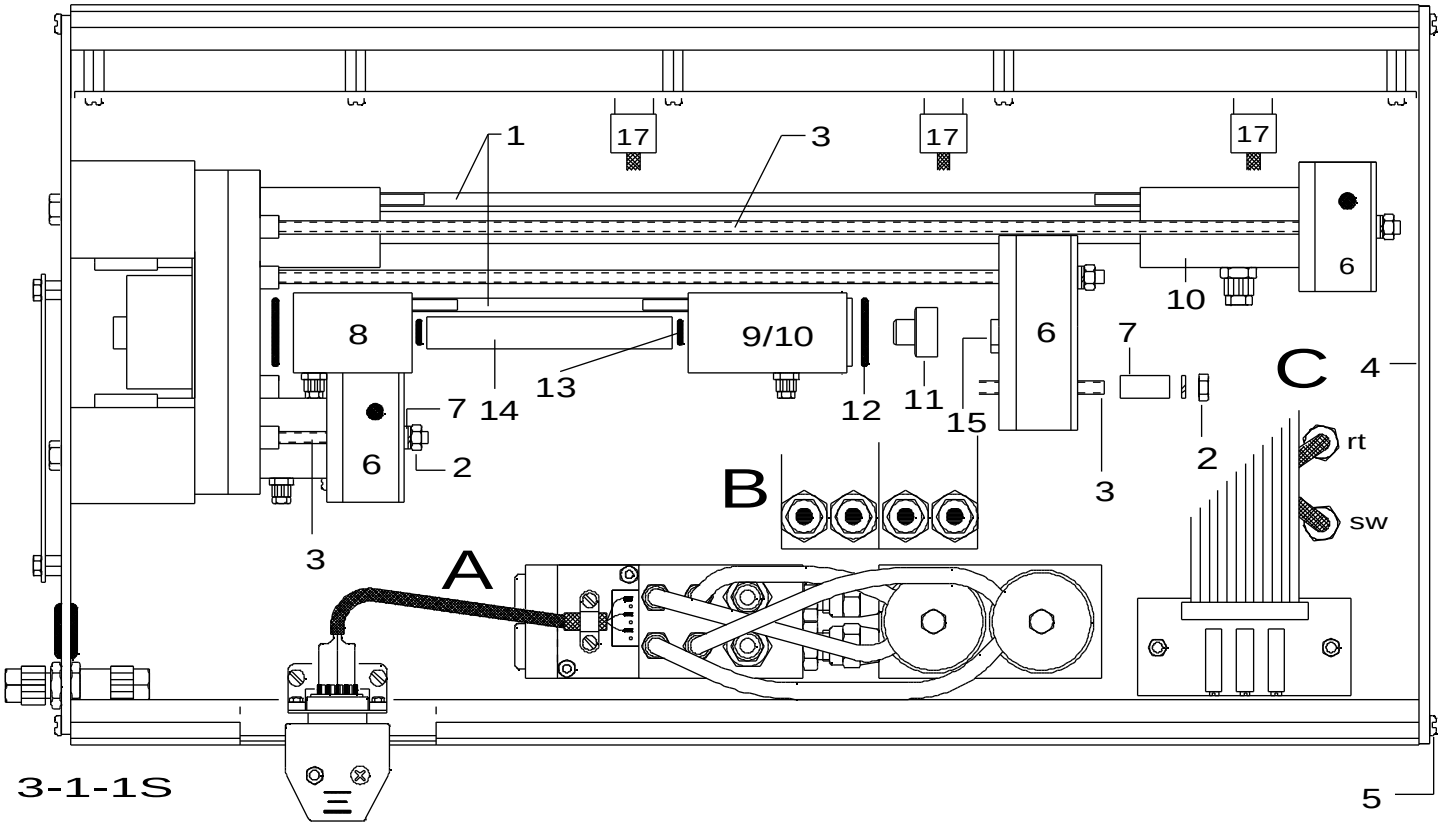
- Press Menu , then • , then 0 , in order to **print out the settings.**

The following information is printed out:

- The serial No. of the analyser
- The internal software version
- The calibration factors for each measuring range
- The linearity factor
- The blank value
- The comparator level

3 SERVICE

3.1 IR-paths, cleaning and replacing:



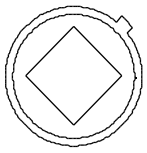
- Unscrew and remove the tubes from the **IR-paths**.
- Remove the nuts **(2) (Size 7)**; in doing this, the threaded rods **(3)** should be held tight to prevent them from turning with the nut.
  To be able to remove the nut **(2)** from the maximum length **IR-path (10)**, remove the plate **(4)** by unscrewing the four screws **(5)**.
  Take out the pre-amplifiers **(6)** together with the spacers **(7)**.
- Clean the paths with a **cleaning solvent**, e.g., **ethanol**.
- With a three part path, such as **(B)** and **(C)**, the windows can be cleaned on the inside using a **cotton swab**.
- In case of a single part path, such as **(A)**, the path is filled with **ethanol** and, after a few minutes, **oxygen** is blown in, to clean and dry out the path.

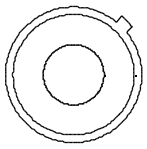
  Soiling, which can **accumulate** from the **analysis** of **materials** that contains a lot of **sulphur** and **moisture** or **hydrogen**, can be very difficult to clean. In such cases, the paths should be replaced.

- Before reassembling the paths, the threaded rods **(3)** should be screwed in by hand, in order to ensure that they are firmly installed.

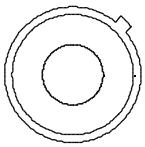
- Assembly of the paths follows in the **reverse order**.
- Reconnect the plugs **(17)** of the preamplifiers **(6)**, in case they were removed.
- After reinstallation, adjustments according to **2. 3** are **highly recommended**.

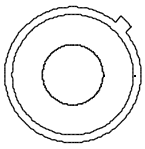
How CO_2 detectors can be recognized:

Initial option:  Square window without any type number.

Later option:  Round window with type No.: 407M36-611

How SO_2 detectors can be recognized:

Initial option:  Round window without any type number.

Later option:  Round window with type No.: 407M36-118

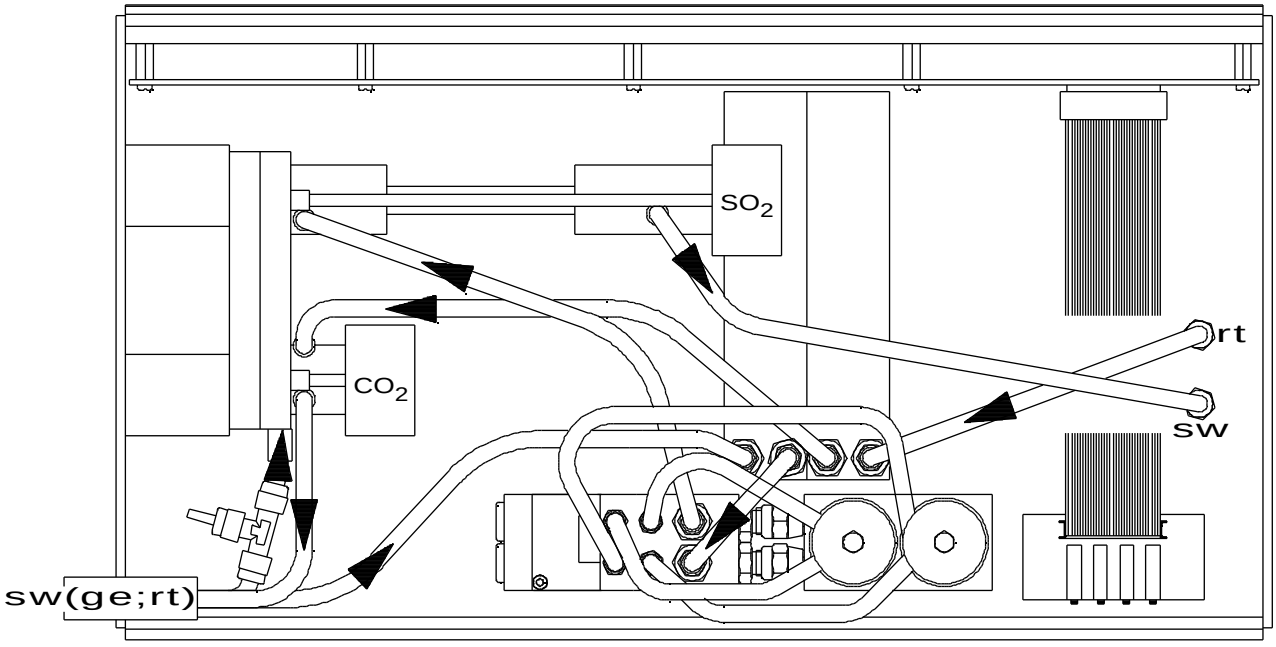
- In case the infrared detectors **(15)** are to be replaced, you can recognize them as described above.

ATTENTION!:
After replacing a specific IR-detector, it is compulsory to zero-adjust:

- see **2.3** under **„ Adjusting the IR cell “**
- **linearise**, see **Operation Manual 5.5** when operated by PC, see **2.9**

and calibrate the corresponding measuring range:

- see **Operation Manual 5.5** when operated by PC see **Operation Manual chapter 6**.



1 **black** marked tube connection
2 **yellow** marked tube connection
3 **red** marked tube connection

- by reinstalling the **infrared cell unit** in the analyser, you must pay **attention** to the **colour markings** of the tubes and their connections.

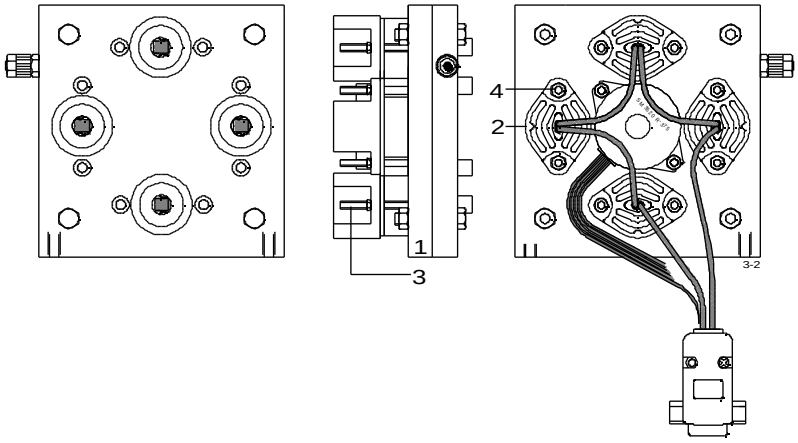
Available infrared paths for the CS-800:

Path length	% C	Material/ Sample weight	% S	Material/ Sample weight
1 mm				
3 mm	6	Metals / 500 mg		
mm				
6 mm	5	Metals / 500 mg		
10 mm			40	Non Metals / 200 mg
20 mm			20	Non Metals / 200 mg
30 mm				
40 mm				
50 mm				
100 mm			4	Non Metals / 200 mg
120 mm	0,2	Metals / 500 mg		
140 mm				
170 mm				
200 mm	0,1	Metals / 500 mg		
275 mm				
300 mm			0,3	Metals / 500 mg

Comments:

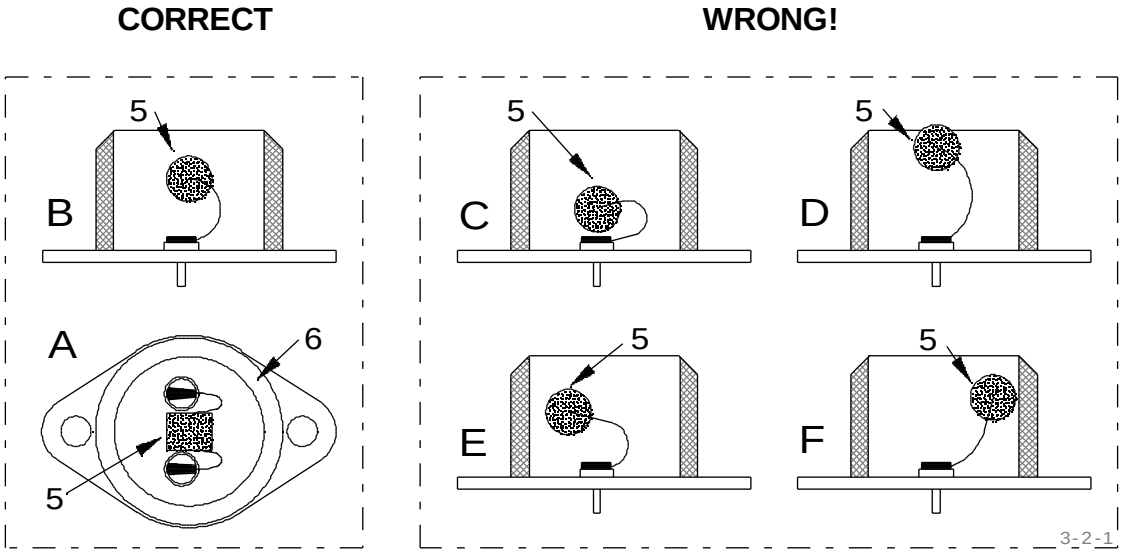
1,5 g Tungsten accelerator are needed when analysing Metals.
Above sample weights for Metals and Alloys are just guidelines. For more accurate information please turn to **Operation Manual 3.3 „Applications“**
The following materials are used as Non Metals: **cement, stone, soils, etc**.

3.2 IR-source:



- The IR sources **(2)** are fastened with the screws **(3)**
- To install or removing the IR-source **(2)**, the complete chopper motor assembly **(1)**, together with the mounted paths and pre-amplifier, should be removed from the infrared unit, see **3. 5**
  The chopper motor housing **(1)** does **not need to be unscrewed**. Either by removing or installing the IR-source.

- In order to remove the IR-source, unscrew the nuts **(4)** with a (5.5 mm wrench) and counter the screws **(3)** at the same time.

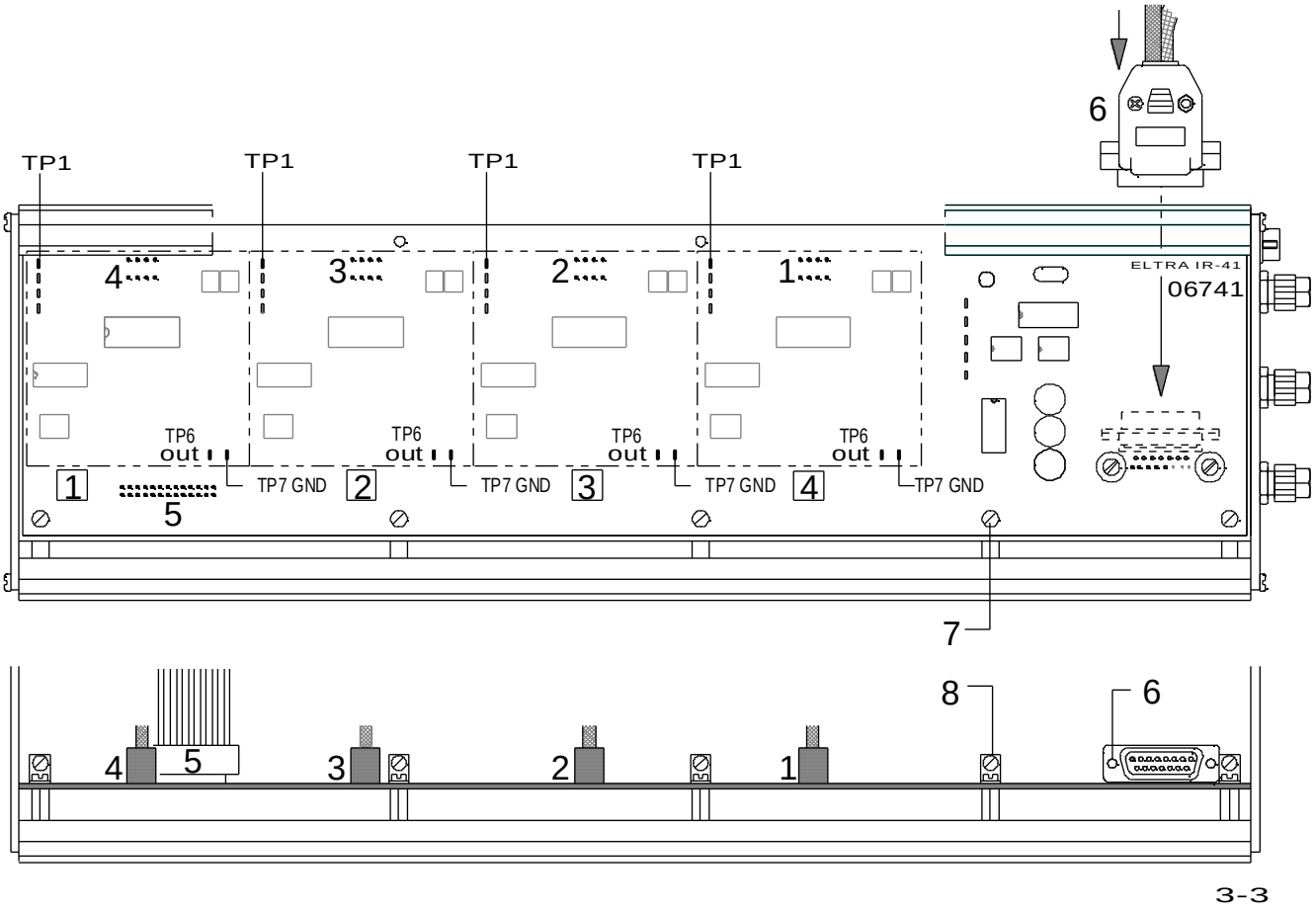


CAUTION !
The IR source **(5)** itself should be in the middle of the ring **(6)**
(this is without considering the location of the soldered connections, which are not centered).
See **above drawing**: **A** and **B** are correct, **C, D, E** and **F** are wrong.
Avoid moving the IR-source back and forth, try placing it correctly the first time.

- After re-assembling the infrared cell, adjust according to **2. 3**

3.3 Infrared electronics:

The complete signal processing for all channels is handled through the circuit board **IR 41**. In the event of a failure, the entire circuit board should be exchanged.



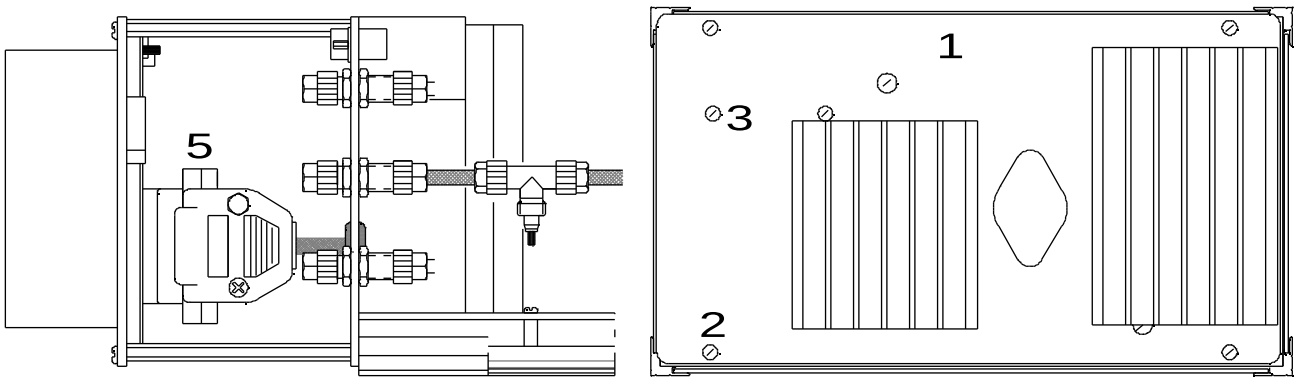
- The plugs **(1 / 2 / 3 / 4 / 5 / 6)** should be unplugged.
- The **10** screws **(7 and 8)** should be removed.
- No adjustment is needed on the **IR 41-circuit board**, You should, however, check the adjustments on the **infrared cell**, see 2. 3.
  The **IR 41-circuit board** is **malfunctioning**, when the **correct** signal can be measured at test **point 1**; while the **signal** at test **point 6** cannot be adjusted to **zero**, see 2. 3.

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3.4 Infrared power supply:

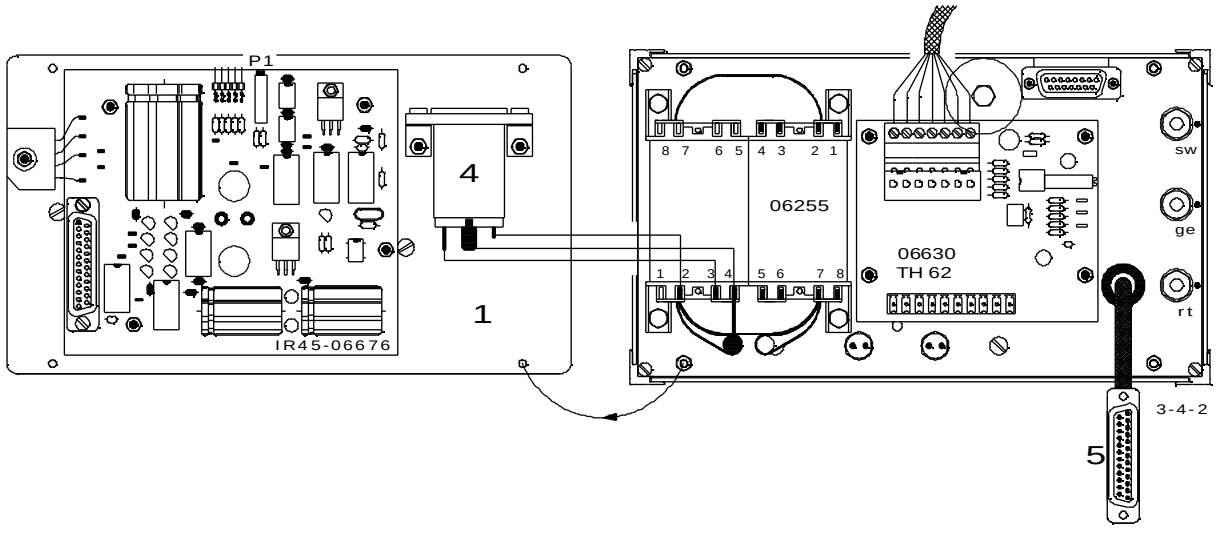
- The power supply **(1)** is a complete unit, which is regarded as a single spare part.
- If there is a failure, the entire module **(1)** is replaced.
- In order to keep costs down, are exchange of modules is offered.

Replacement:



3-4-1

- Remove the four screws **(2)** from the front panel **(1)**.
- Remove the two screws **(3)** from the front panel **(1)**, to loosen the internal plug **(4)**
- Unplug the 2nd internal plug **(5)**

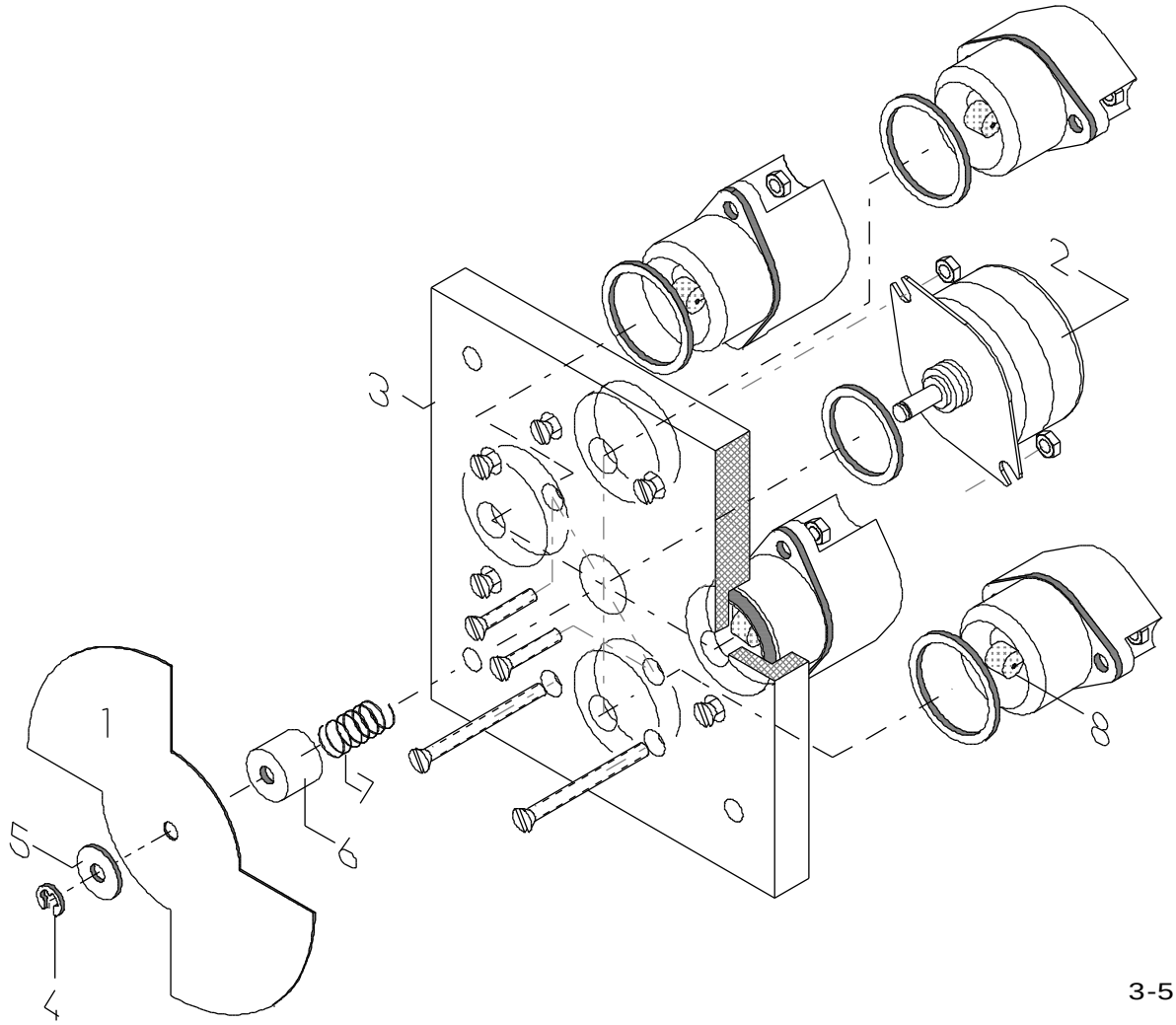


3-4-2

- The front panel is now completely loose and can be exchanged.
- The new power supply unit **(1)** is installed in the reverse order.
- It is suggested that the adjustments now be made according to 2. 4.

3.5 Chopper:

see 3. 1



3-5-1

The chopper blade **(1)** is fastened to the motor **(2)**
the chopper blade must be removed first to dismount
the motor **(2)** from the mounting plate **(3)**

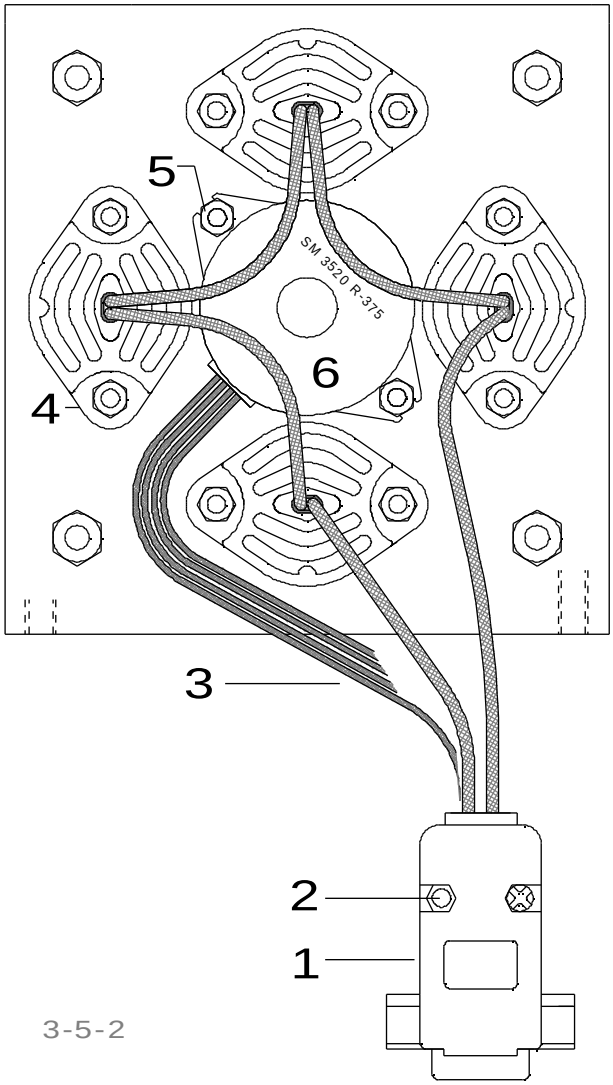
In this numeral sequence disassemble the pieces as follows:

- safety ring **(4)**
  the washer(s) **(5)** (there could be two)
  the chopper blade **(1)**
  the cylinder **(6)** and the
  spring **(7)**
- Reassemble in the reverse order.

CAUTION !

Before re-assembling, check the position of the **IR-source (8)** and, if necessary, centre its position see 3. 2. The heating wire is not very elastic, therefore do not move it back and forth, rather, you should correctly position it the first time

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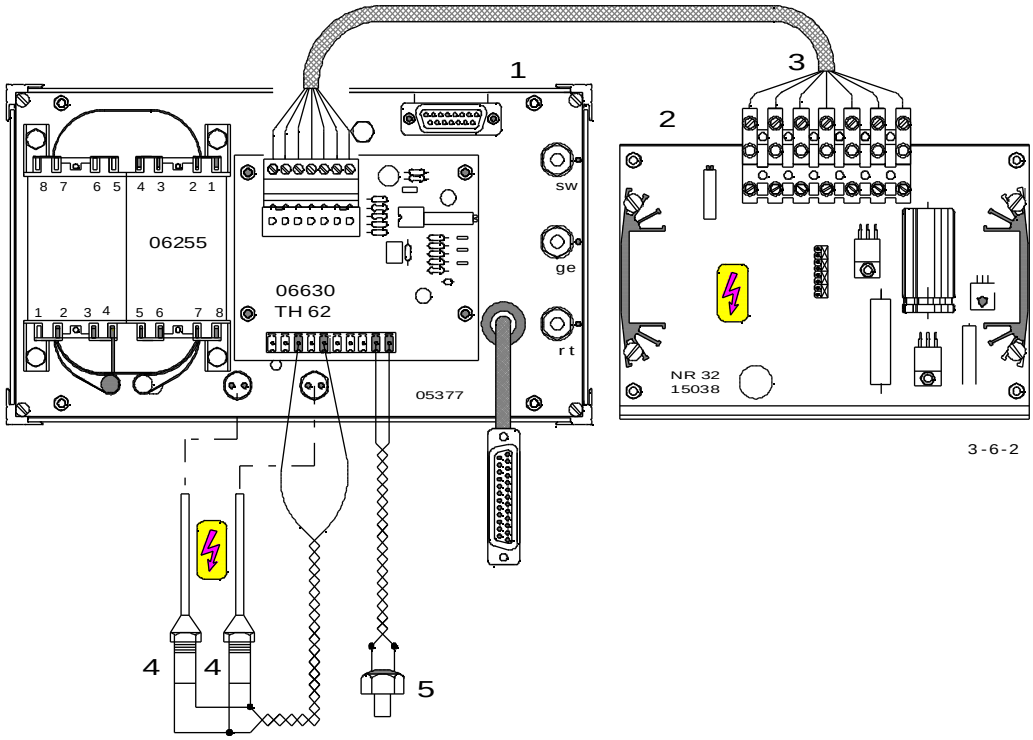


- Disassemble the plug **(1)** by removing the screws **(2).**
- The cables **(3)** of the IR source **(4)** are then unsoldered from plug **(1)**
- Unscrew the nuts **(5)**
- Install the new motor **(6)**
- The IR source cables **(3)** are then soldered to the plug **(1)**

CAUTION !
Due to the high current for the infrared cell;
it is **important** that the soldering here is done accurately, because two pins inside the plug **(1)** will be soldered together to form one group. There are two such groups in one plug.
Each end of the IR-source cables **(3)** will then be soldered to each one of these groups. Polarity is irrelevant.

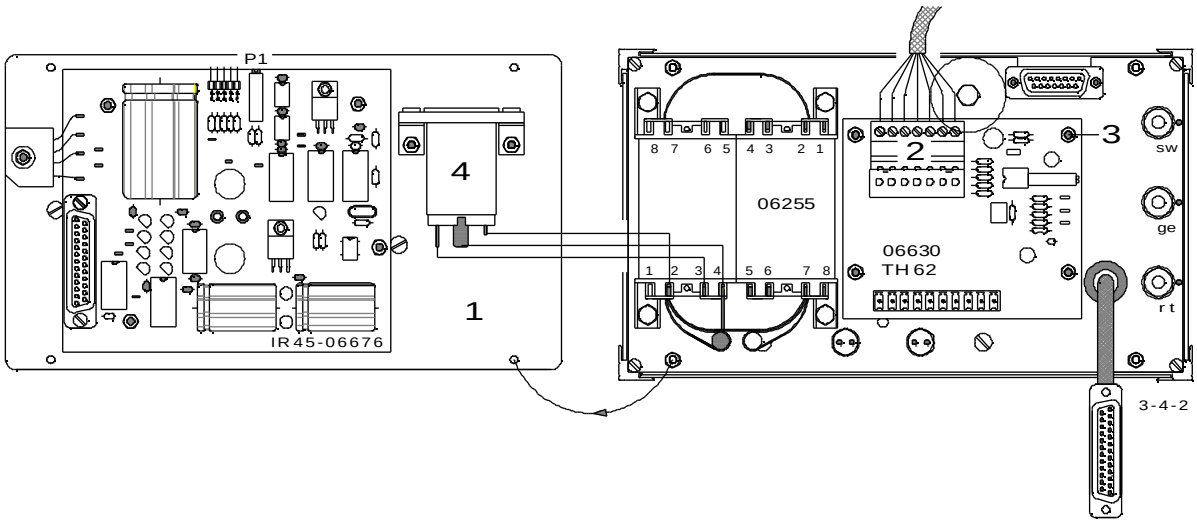
- Afterwards, the chopper blade is refastened.
- Reassemble in the reverse order.
- After installing, the infrared cell should be adjusted, see 2. 3

3.6 Infrared temperature regulation:



- The temperature regulation of the infrared cell are made up of;
  the circuit boards **TH 62 (1)** and **NR 32 (2)**
  the **connecting wires (3)**
  the **temperature sensor (5)** and the
  heaters (4).

Replacing the TH 62:

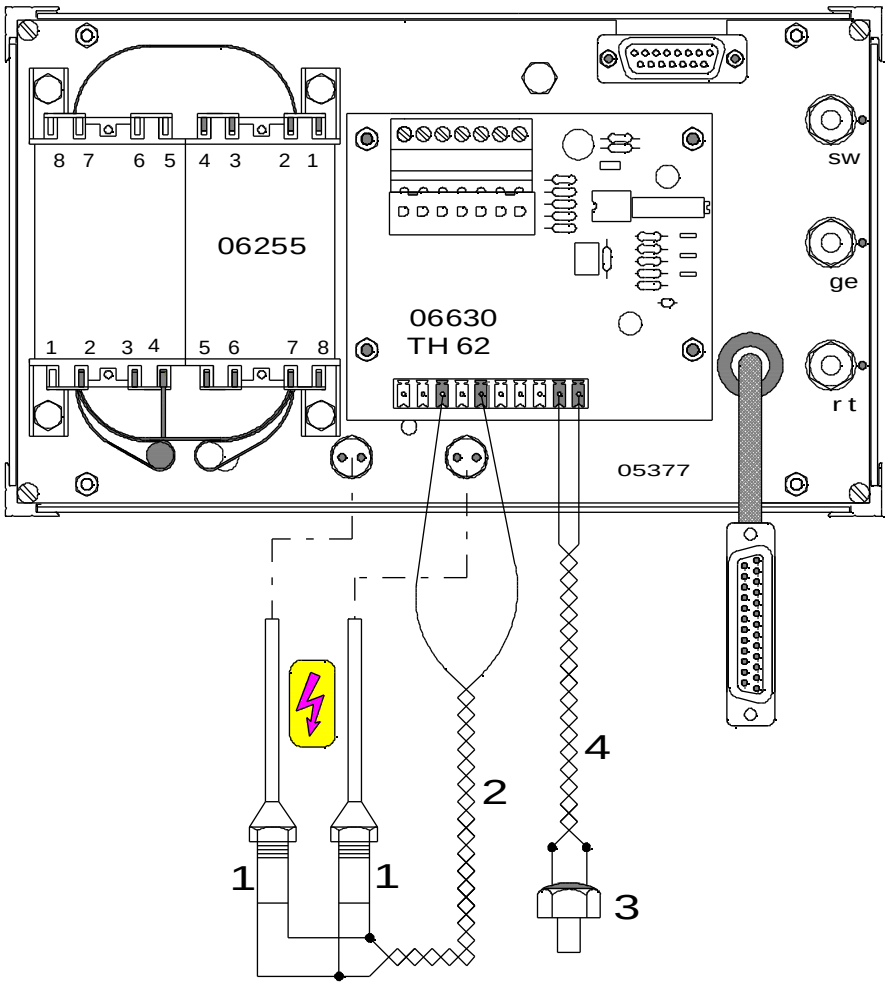


- The plug **(4)** should already have been **disconnected** during the **removal** of the **infrared cell** from the **analyser**.
- Unscrew and remove the power supply module **(1)** see 3. 4
- Disconnect plug **(2)**
- Remove the four nuts **(3)** Re-assemble in reverse order.
- Make adjusts to the unit, according to 2. 5

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Replacing the heaters:

- Unsolder the cables **(2)**
- Cut the **silicon seal** away from the heaters **(1)** and then pull them **carefully** out
- Insert the new heaters with smearing **thermal conducting paste** (in case there is none available, **silicon grease** can be used).
- Solder the cables.
- Secure the heaters against falling out with silicon sealant.



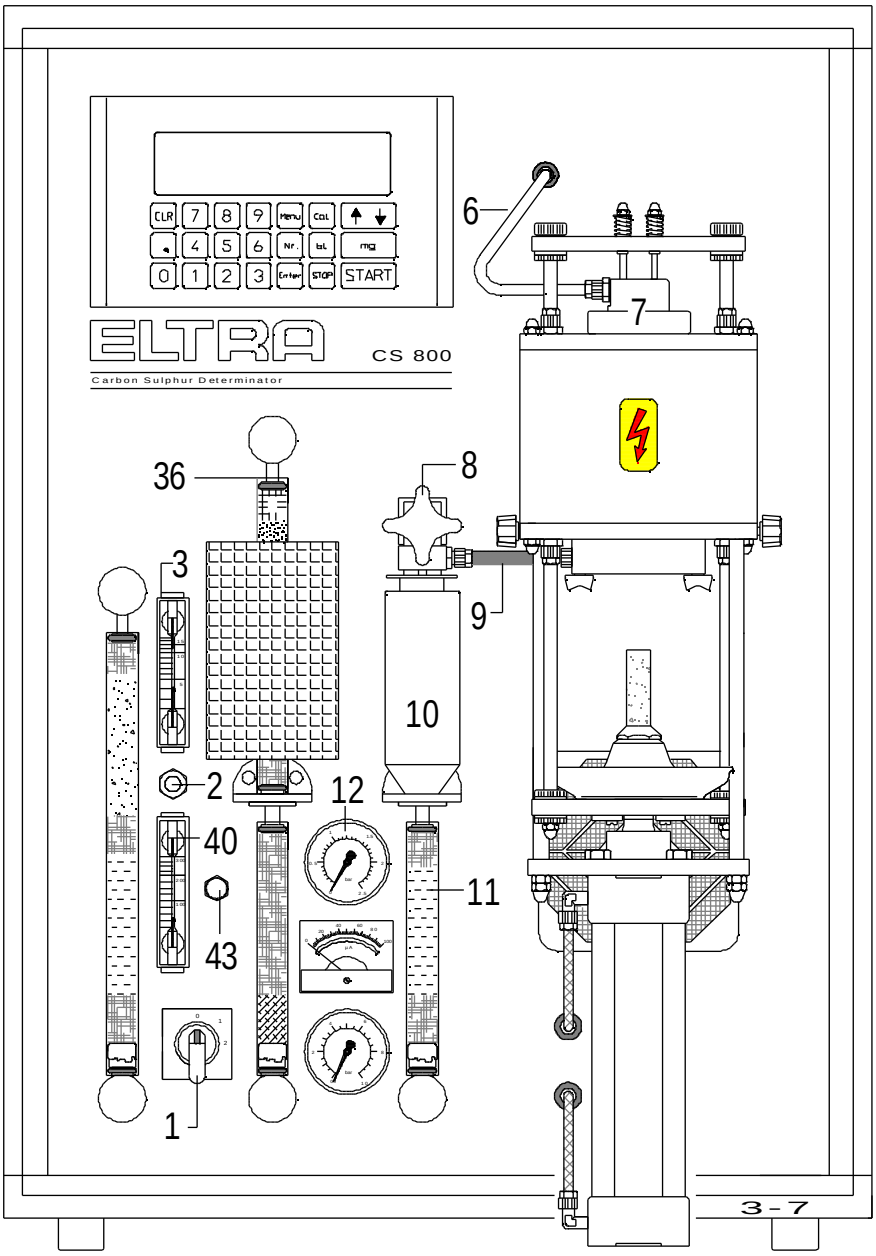
Replacing the temperature sensor:

- Unsolder the cables **(4)**
- Cut the **silicon sealant** away from the **temperature sensor (3)**
- Screw the new temperature probes in
- Solder the cables **(4)**

CAUTION !
screw the probes in **very gently,** the threads are of **aluminium**.

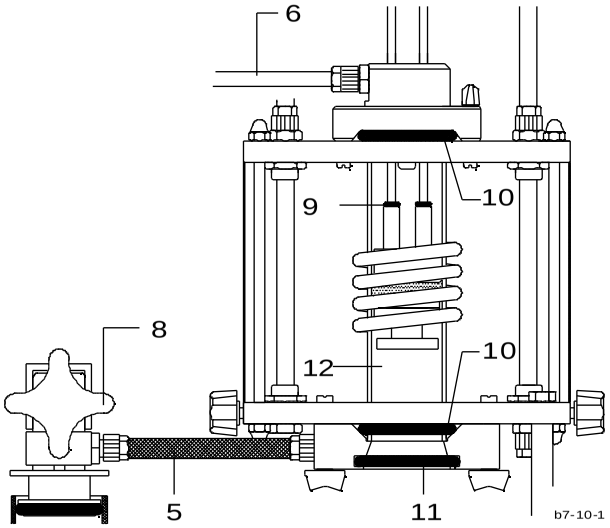
- After replacing the temperature sensor, adjust according to **2. 5**

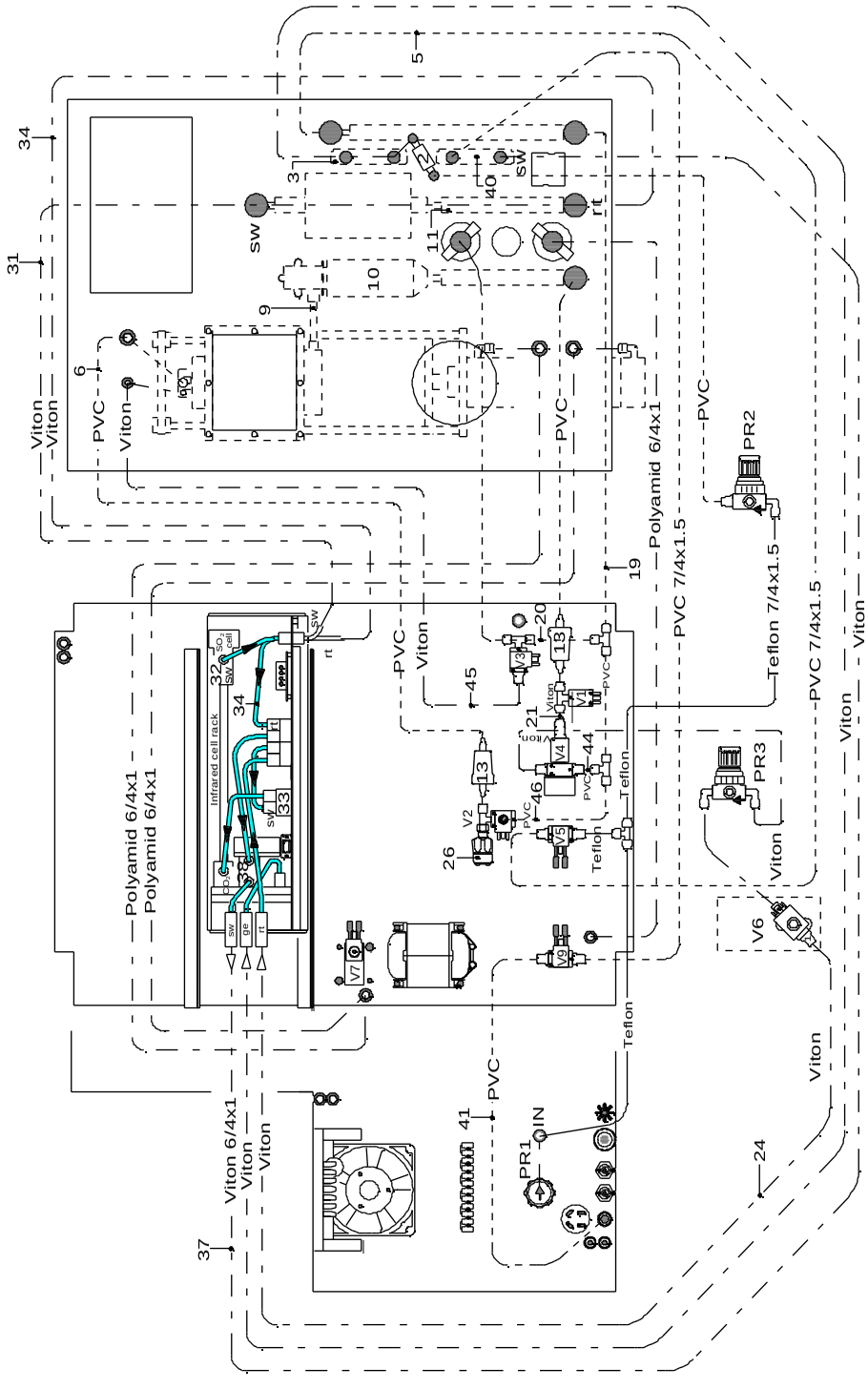
3.7 Leak checking:



- Set the power switch **(1)** to **pos. 2**
- Close the furnace
- Press and hold the button **(43)**
  The entire system will be checked for leaks.
- **The leakage test is completed when the initial pressure drops (about 5 seconds) on gauge (12) and then remains constant, the gas system is ok.**

- Should there be a continuous pressure drop, then **release** the button **(43)**, open the furnace, **press** and **hold** the button **(43)** again. If the pressure is stable then the leakage will found in the **furnace**.
- If the pressure still **decreases**, then the leakage is to found inside the **analyser**.


6
9
10
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12
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11
b7-10-1


5
34
31
3
40
SW
rt
11
10
9
6
Viton
Viton
PVC
Viton
PVC
PVC
Polyamid 6/4x1
PVC 7/4x1.5
PR2
19
Teflon 7/4x1.5
PVC 7/4x1.5
Viton
Viton
Infrared cell rack
Polyamid 6/4x1
Polyamid 6/4x1
32
34
33
36
35
20
18
45
21
44
13
46
26
V2
Teflon
PR3
Viton
V6
V7
V9
Teflon
Viton
Viton 6/4x1
Viton
Viton
37
PVC
41
PR1
IN
24

- Release the push button **(43)**, close the furnace, squeeze the tube **(6) tightly** and **press** and hold the button **(43)**.
- If the pressure on gauge **(12)** remains constant, then the furnace has to be checked for leaks.
- If the pressure shown on gauge **(12)** drops, then the leakage has to be found somewhere along the furnace inlet system.

Leaks in the furnace inlet system:

- After following the above instructions, check for gas leakage between inlet tube **(6)** and reverse valve **(V2)**.

Leaks in the furnace:

- After following the above instructions, close the furnace, squeeze tube **(9) tightly**, **press** and **hold** the button **(43)**, observe the pressure gauge **(12)**.

- If the pressure drops, then the furnace is leaking. Check whether the O-rings **(16)**, **(17)** and **(18)** are soiled or defective see **Operation Manual** 7. 4 and 7. 5
  Check whether the combustion tube **(15)** is broken or cracked.
- If the pressure remains constant, then the furnace outlet system is leaking.

Leaks in the furnace outlet system:

- After following the instructions in the section **„Leaks in the furnace“**, **check if the handle (8) is properly shut**, or else there will be a major gas leak from the **dust filter**. Check the following components for leakage, by squeezing the following tubes, while **pressing** and **holding** the button **(43)**:

Tube to squeeze:	**Leak location:**
19	Dust trap **(10)**, glass tube **(11)**, dust filter cartridge **(13)**, outflow valve **(V 1)**

Leaks inside the analyser:

- when pressing the button **(43)**, the gauge **(12)** shows a pressure drop while the furnace is open, then locate the leakage, **according to the sequence below**.
  Keep the furnace opened, squeeze the following tubes **tightly**, while **pressing** and **holding** the button **(43)**:

Tube to squeeze:	**Leak location:**
4	Exhaust valve **(V9)**
37	Flow meter **(40)**
34	CO_2-Paths **(38)**
31	SO_3-Trap **(35)** or oxidising furnace tube **(36)**
24	SO_2-Path **(32)** or flow sensor **(33)**
23	Regulator valve **(V6)**
22	Pressure regulator **(PR3)**
44	Bypass valve **(V4)**, **check for 24 VDC on input pins**
45	Purging valve **(V3)**, **check for 0 VDC on input pins**
46	Reverse valve **(V2)**, **check for 24 VDC on input pins**

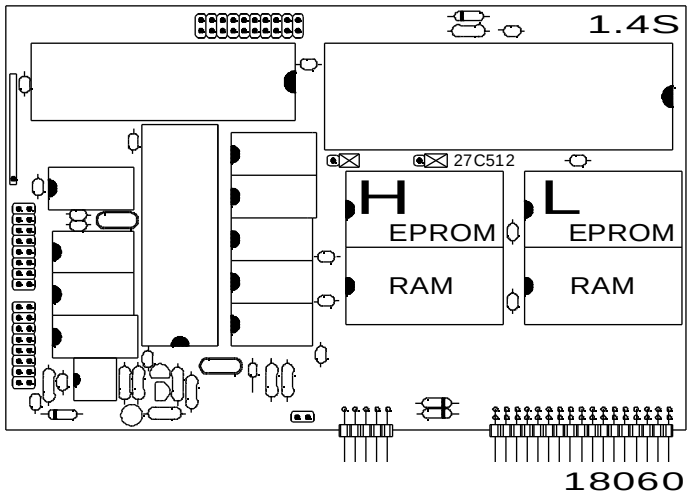
ATTENTION: **do not cause a short circuit while measuring!**

- If the voltages on **V2**, **V3**, or **V4** are wrong, then replace the electronic drivers, see 1. 6.

3.8 Replacing EPROMs:

- Set the power setting to **pos. 1**
- Open the furnace.
- Pull out **all** of the **plugs** from the electronic unit
- Open the left side of the analyser.
- Unscrew the electronic unit.
- Pull out the electronic unit.
- **Carefully**, take out the two **EPROMs H** + **L** with the aid of a screwdriver (using it as a lever), from the **CPU** board. See **drawing below**.
- Insert the new **EPROMs H** + **L**, notice the comparing marks. See **drawing below.** Be sure that they are positioned correctly.

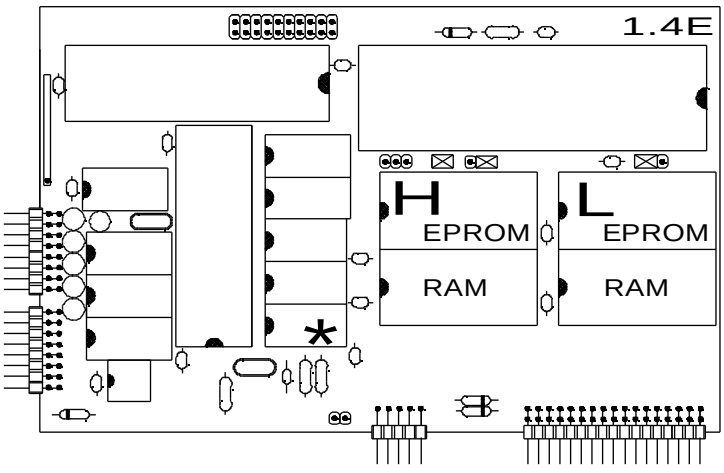
Important: When installing **27C512 EPROMs**, check that the **jumpers** are **connected** as shown in the drawings.
If the instrument has an **older** card, follow the **first** drawing; else follow the **second** drawing.



18060

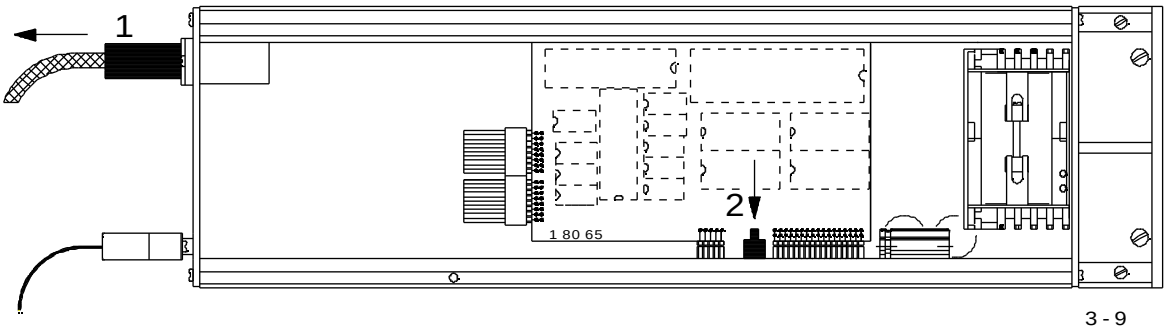
- Exchange the **RAMs** with each other to ensure that after switching on the electronic unit, any stored data during operation with the previous **EPROMs**, will be deleted.

CAUTION: The analyzer has to be recalibrated, or an application has to be recalled from the application memory.



18065

3.9 Clearing memory:



- Set the power switch to **pos. 1**
- Open the furnace
- Detach the left hand cover of the Analyser
- Detach the power plug **(1)** from the electronic unit
- Press the **reset key (2)** on the base plate of the electronic unit **for 30 seconds**
- Restore the unit to its original condition
- Recalibrate.

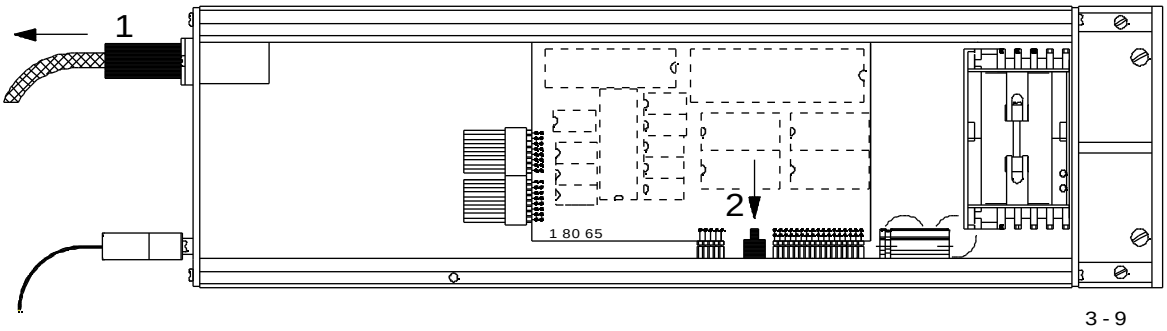
3.10 Electronic reset:

Should any problems arise with the electronic unit:

- Press **STOP**

If the problem remains:

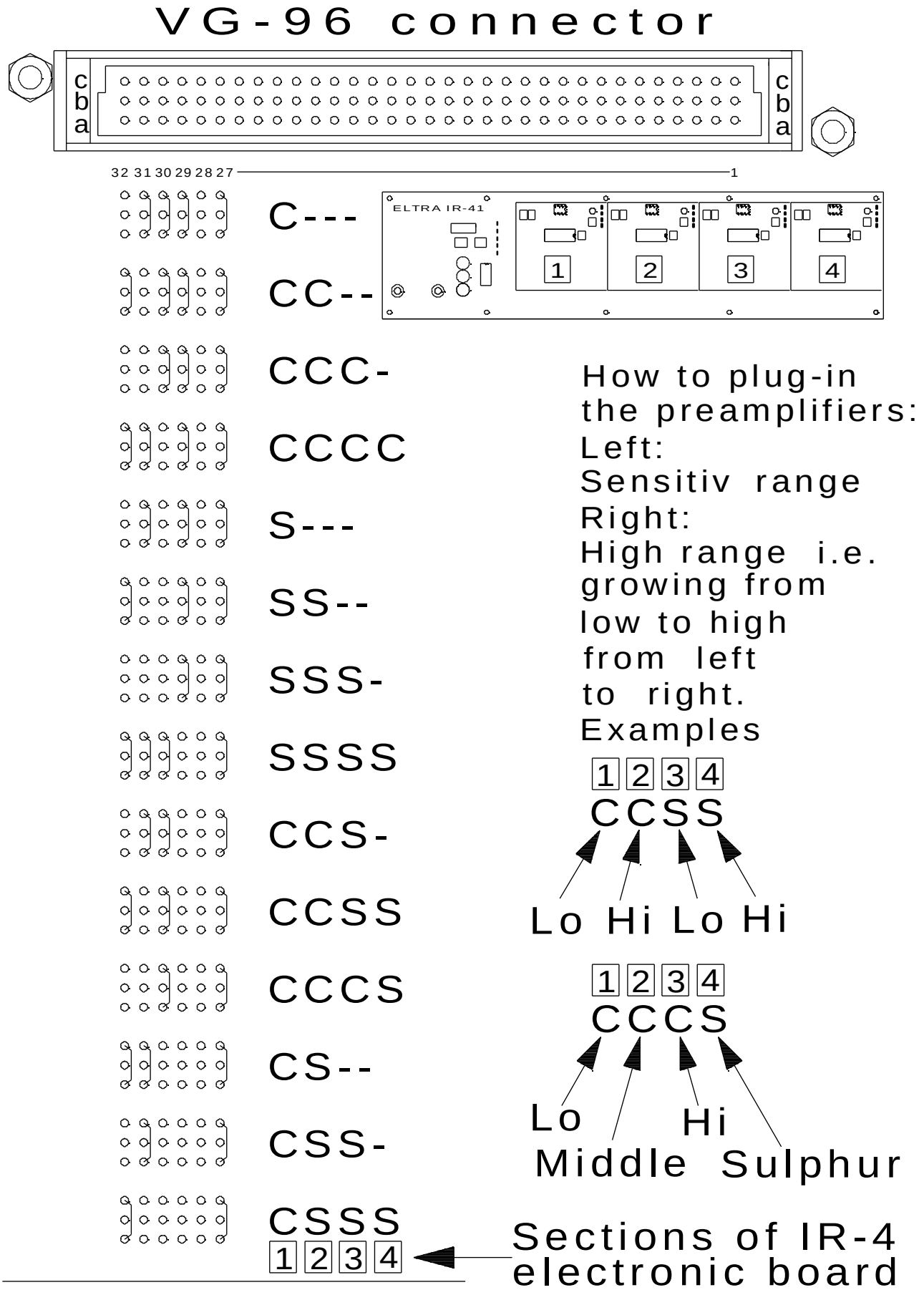
- Turn the power switch to **pos. 1**
- Open the furnace
- Disconnect the cable **(1)** from the electronic unit for **10 seconds** and plug back in.



- **Should the problem remain:**

  see 3. 9 " Clearing Memory "

3.11 Coding IR- ranges:



Example for CCSS
Plug the preamplifiers according to this drawing:

3.12 Adding new IR – ranges:

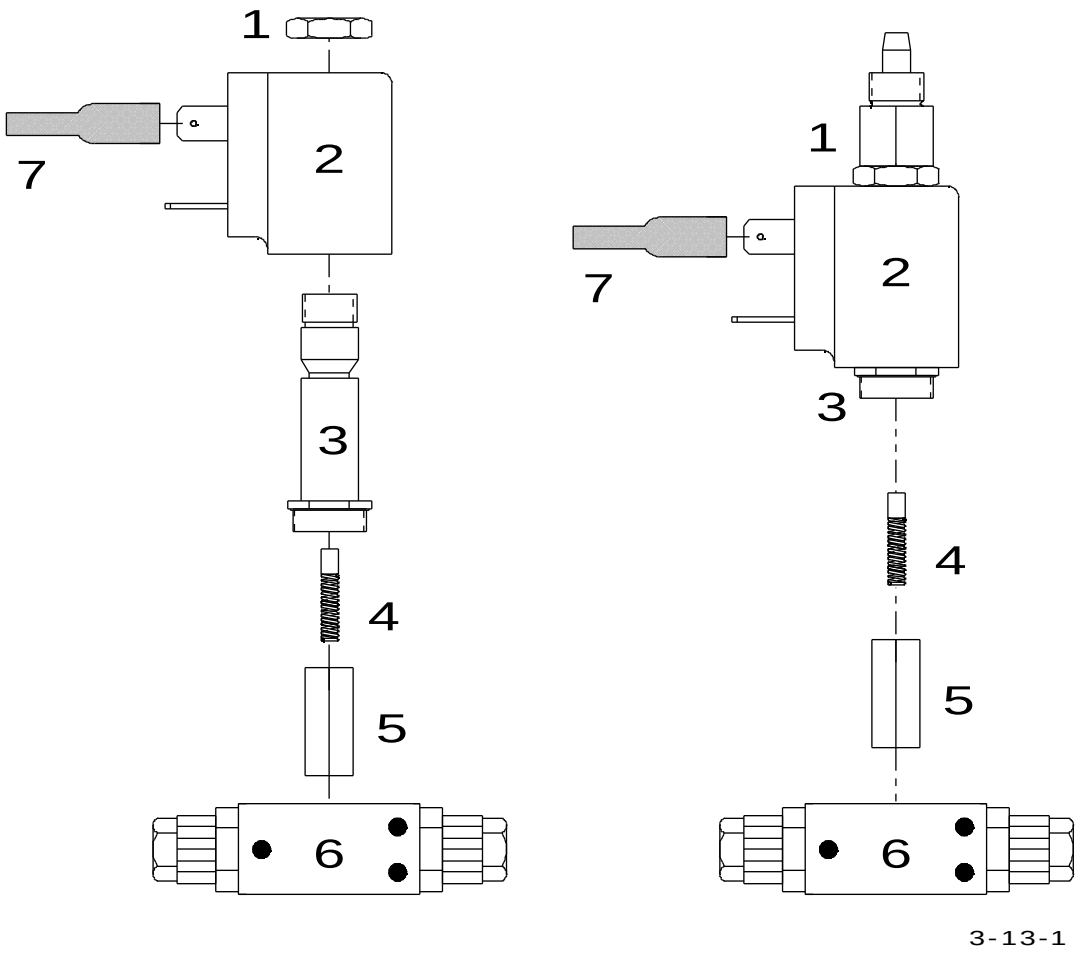
(from **1** to **2** , from **2** to **3**, from **3** to **4** or form **1** to **4** channels)

- The chopper housing with the appropriate number of **IR-sources**.
  Before installing, the **IR-source** positions should be **checked** and, if necessary, **repositioned,** see 3. 2 and 3. 5.
- **One**, **two** or **three** additional pre-amplifiers needed
- **One**, **two** or **three** additional infrared detectors with the appropriate interference filters needed
- **One**, **two** or **three** additional IR-paths of the appropriate length needed
- On the **circuit board IR-41**, cables must be rearranged **correctly**, see 3. 3
- Connection of the transformer, matching the number of channels, see 2. 4
  "Setting the IR-source voltage "
- Adjustments for the **IR-source power**, respective for each channel,
  see 2. 4 **" Setting the IR-source voltage "**
- Adjusting the **zero**,
  see 2. 3 **" Adjusting the Infrared cell "**
- Coding of the channels,
  see 3.11 **" Coding of the channels "**
- The settings for the temperature regulation,
  see 2. 5 **" Temperature regulation "**
- Afterwards, the linearisation of the Analyser,
  see 2. 9 **" Linearisation "**
- Recommended spare parts. See 4.1

The following components may be needed, when adding more IR cells:

05257	Chopper housing, with one IR-source and motor
05254	Chopper housing, with two IR-sources and motor
05251	Chopper housing, with three IR-sources and motor
05244	Chopper housing, with four IR-sources and motor
05066	IR-path: carbon low
05067	IR-path: carbon high
05068	IR-path: sulphur
06741	Printed circuit board IR-41
06032	Infrared receiver with CO_2 filter
06034	Infrared receiver with SO_2 filter

3.13 Cleaning the solenoid valves:



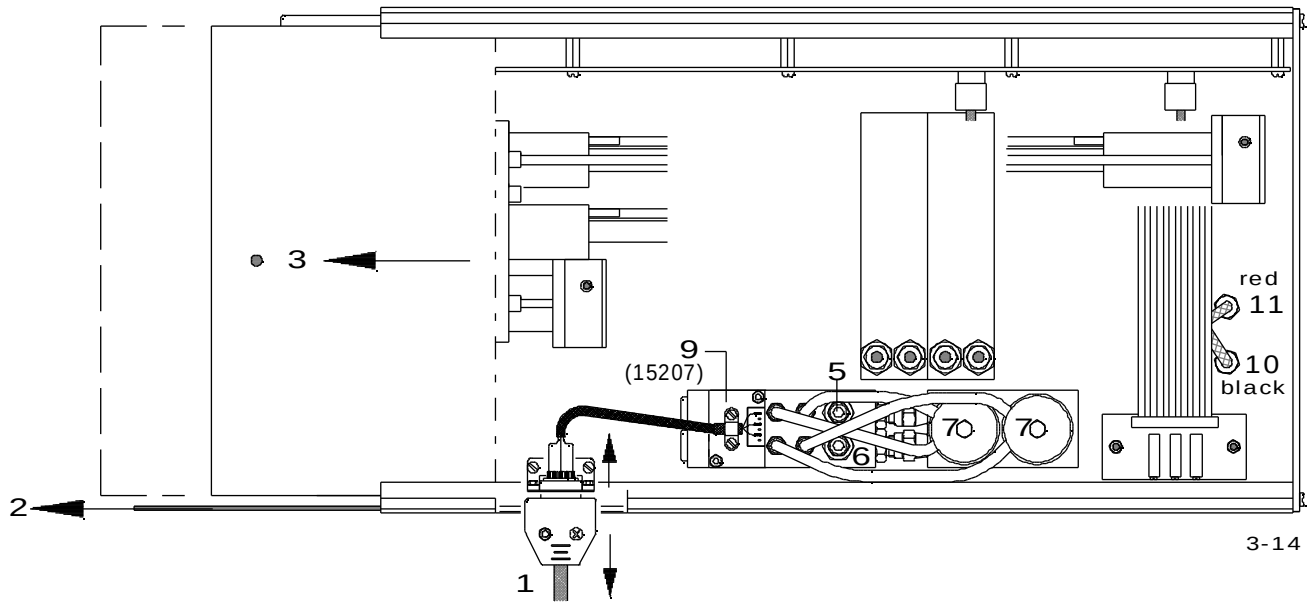
Only with the 2/2 valve

Only with the 3/2 valve

- Turn the power switch to **pos.0**
- Unplug the **main power plug** as well
- Remove the connector **(7)**
- Unscrew the nut **(1)**
- Remove the coil **(2)** (only with the 2/2 valve)
- Unscrew **counter-clockwise** the hexagon screw on the armature housing.
- Remove the armature **(5)** (only with the 2/2 valve)
  Careful ! Do not loose the spring **(4)**
- With **oxygen pressure** or **compressed air**, clean the inside of the armature housing **(3)**, as well as the armature **(5)** and re-assemble the solenoid valve.
  With the furnace **closed** and renewed **oxygen pressure**, check to ensure that the solenoid valve is **sealed**, see **3. 7**

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3.14 Replacing the flow sensor:



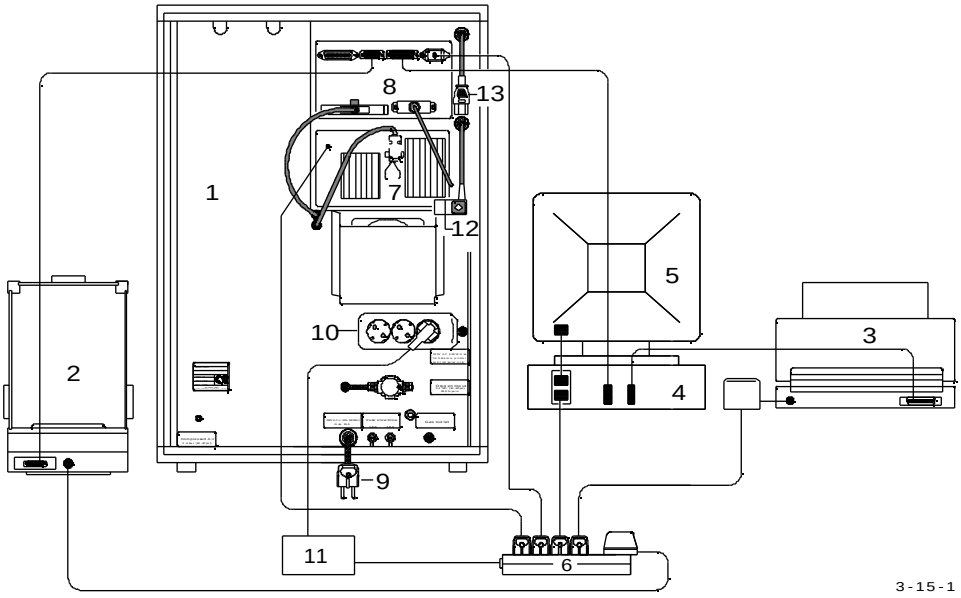
- Set the power switch to **pos. 0**
- Remove the **left** side panel of the analyser
- **Unplug** the **two** cables at the **rear-side** of the infrared rack
- Remove the tubes **(10)** and **(11)** at the **bottom-side** of the infrared rack
- Unplug the plug **(1)**
- Pull out the infrared rack from the analyser
- Remove the **left** side cover **(2)**, the **top** cover **(3)** and the **bottom** cover **(4)** of the infrared rack
- Remove the two tubes **(5)** and **(6)** from the flow sensor **(9)**
- Remove the two screws **(7) underneath** the flow sensor.
- Remove the **old** flow meter, install the **new** one.
- Reassemble the infrared rack in reverse order.
  Pay particular attention to the position of the tubes (5), (6), (10) and (11).

- Adjust according to **2. 1**

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3.15 Installing an AC power stabiliser:

When the power voltage sinks below **180 V AC** (even for a short time), a stabiliser is recommended.
The Analyser can **draw**, during combustion and according to the power setting, up to **13 A**.
The **maximum current** depends on the type and size of the sample and accelerator.
To stabilise such a **high current** is not easy and not necessary.



1 Analyser
2 Balance
3 Printer
4 Computer
5 Monitor
6 Power strip
7 Infrared cell
8 Electronic unit
9 Power plug
10 Triple plug
11 Voltage stabiliser
12 Original infrared cell power cable
13 Original electronic unit power cable

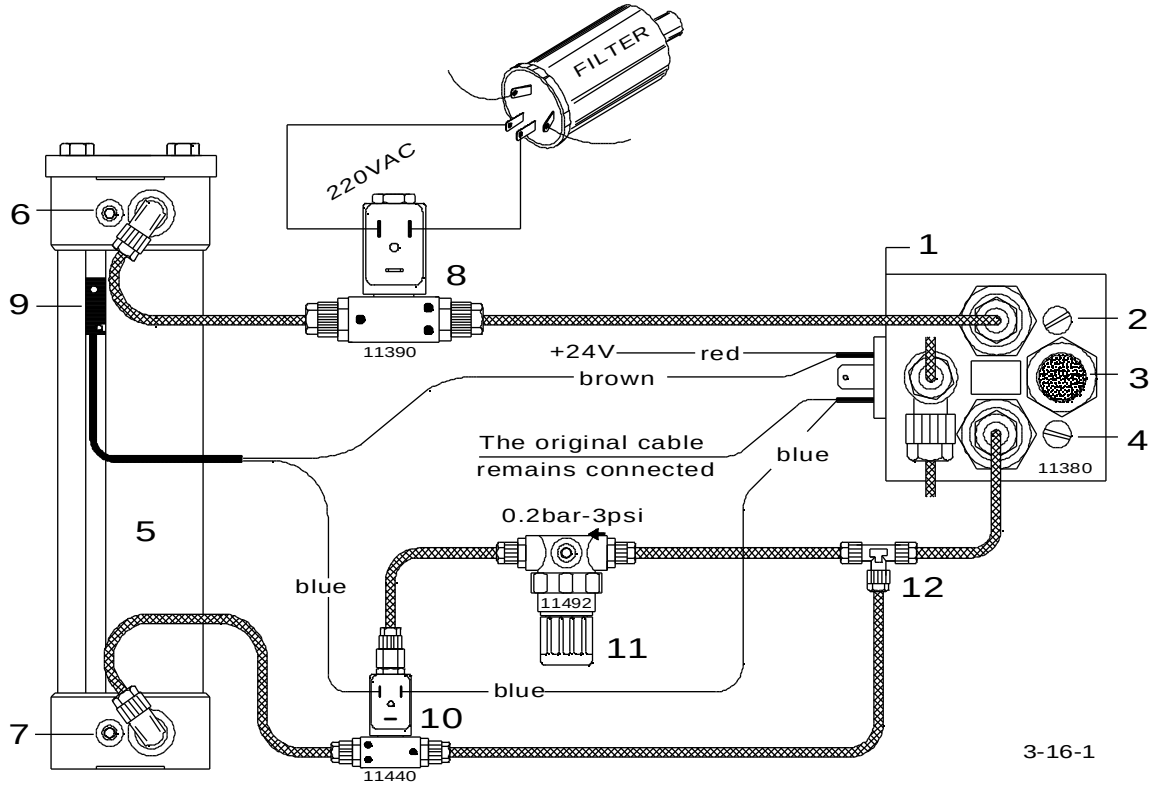
It is sufficient that the electronic unit **(8)** and the infrared cell **(7)** are protected by the stabiliser **(11)**. This can easily be done, as both units **(7 / 8)** use standard plugs.
It is then advisable to protect the balance **(2)**, the printer **(3)** and the computer **(4)** with a stabiliser **(11)**.

- The stabiliser **(11)** is plugged into the triple socket **(10)** (rear of the Analyser).
- The electronic unit **(8)** and the infrared cell **(7)** are plugged into a power strip **(6)**, using a normal power cable (the device cable).
- The original power plugs **(12 / 13)** of the units **(7 / 8)** are simply unplugged and left hanging.

A simple transformer can be used when the **voltage** of the power line is always too **low** or temporarily, lower than **200 V AC**, instead of a stabiliser.
The power of the transformer should be at least **100 VA**. The **primary** voltage should be **220 V to 240 V**. The **secondary** voltage should be about **20 V higher** than the **primary** voltage. For example **Pr 220 V / Sec 240 V or Pr 230 V / Sec 250 V**.
The power of the stabilizer should be about **250 VA**. The IR-cell and the electronic unit take less than **100 VA**, however the power drawn by the PC, monitor, balance and printer, depends on the models connected. Sometimes these devices are provided by the customer himself, so that we can not exactly define the power of the stabilizer. It is advisable to check the power of the above devices before ordering a stabilizer.

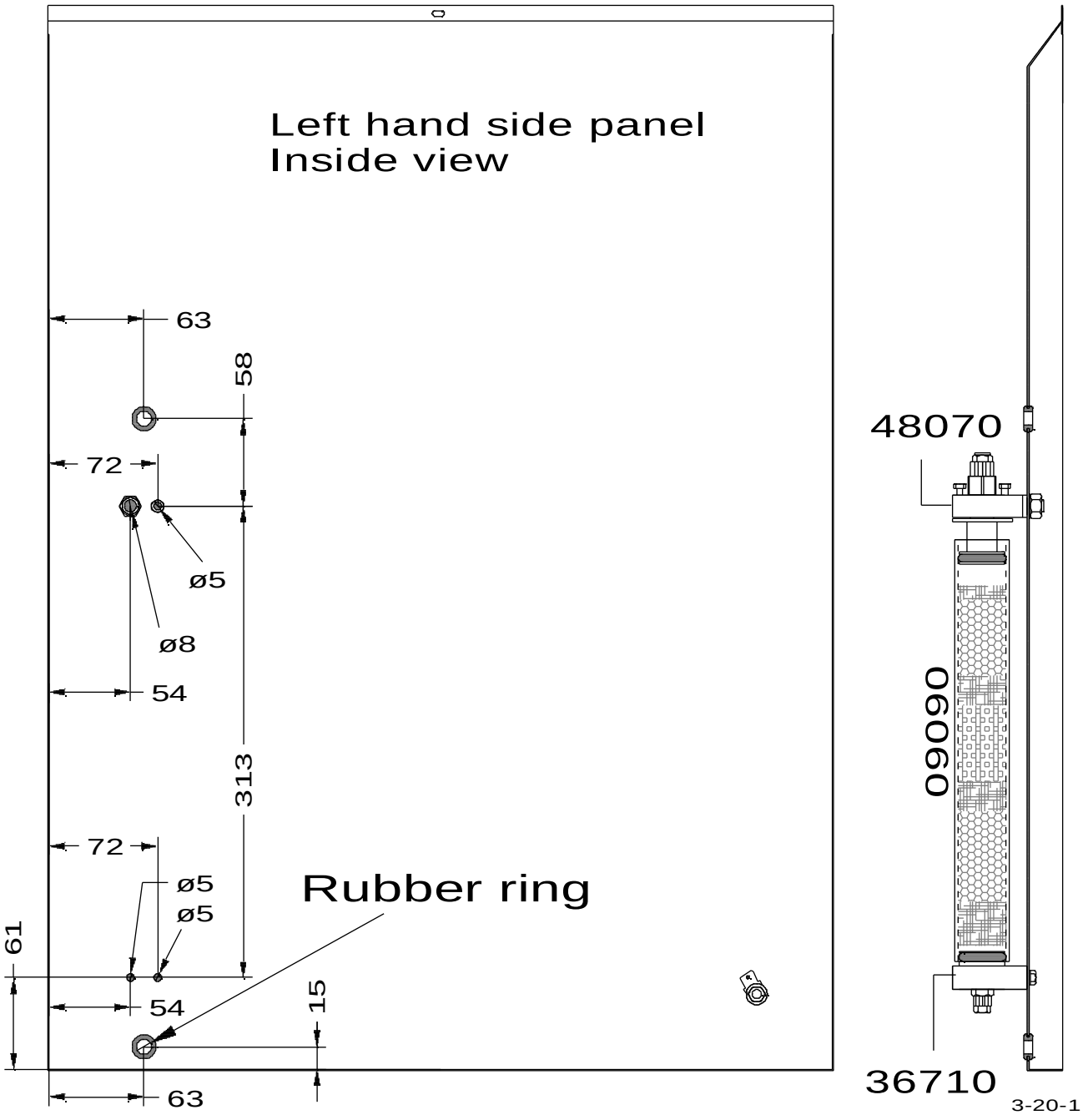
3.16 Additional safety features for furnace pneumatics (optional):

The furnace doesn't change position in case of a power failure:



By adding a **solenoid valve (8)** and connecting the **coil** directly to **220 V AC**, the piston won't change position in case of a power failure. If the piston was **down**, it will remain **down;** if it was **up,** it will remain **up**.

3.17 Installing a halogen trap:

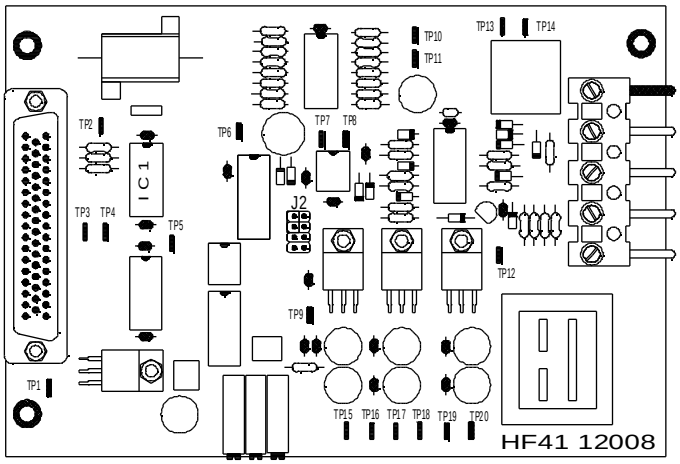


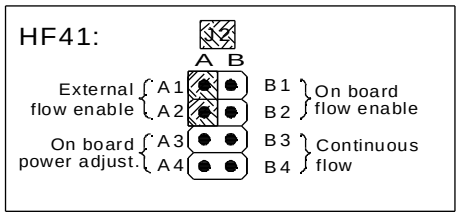
3.18 Gas saving mode:

How to set the jumpers for gas saving mode:

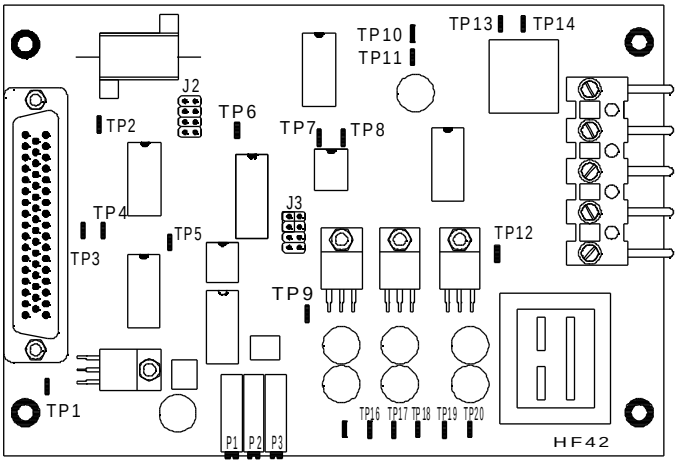
Caution:
This option is functional with EPROMS and PC software versions, later than June 2001.

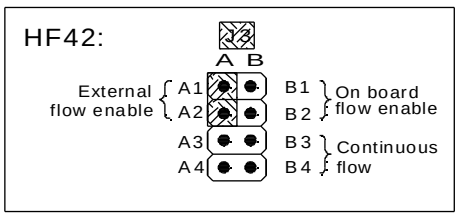
If the analyser has the HF 41 board:
Set the jumper setting to **A1** with **A2** on **J2**





If the analyser has the HF 42 board:
Set the jumper setting to connect **A1** with **A2** on **J3**





3.193.19 Upgrade for copper analysis without accelerators:

The **CS-800** (CS-2000) can analyse Copper of very high weight, without using any accelerators. Copper sample up to **20 g**, or as much Copper sample the crucible can accommodate.
If the Copper sample has the form of **grains** or **drillings**, the standard **CS-800** (CS-2000) can do the job.

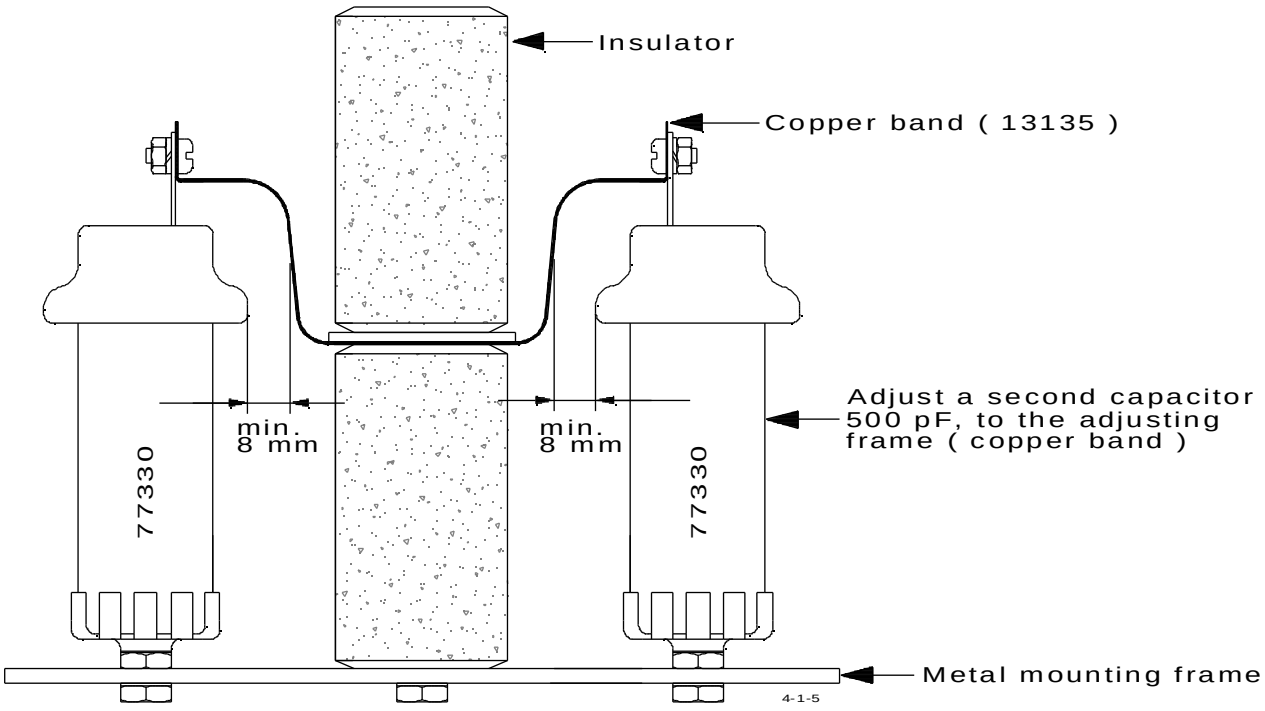
The condition is:
The furnace control board should have a **HF-42** with the corresponding jumper setting for The correct control mode. See **1.4**

If the Copper sample is a **solid piece** then the temperature may not go **high** enough to reach the **melting point**. In this case the following modifications are necessary:

WARNING ! High voltage

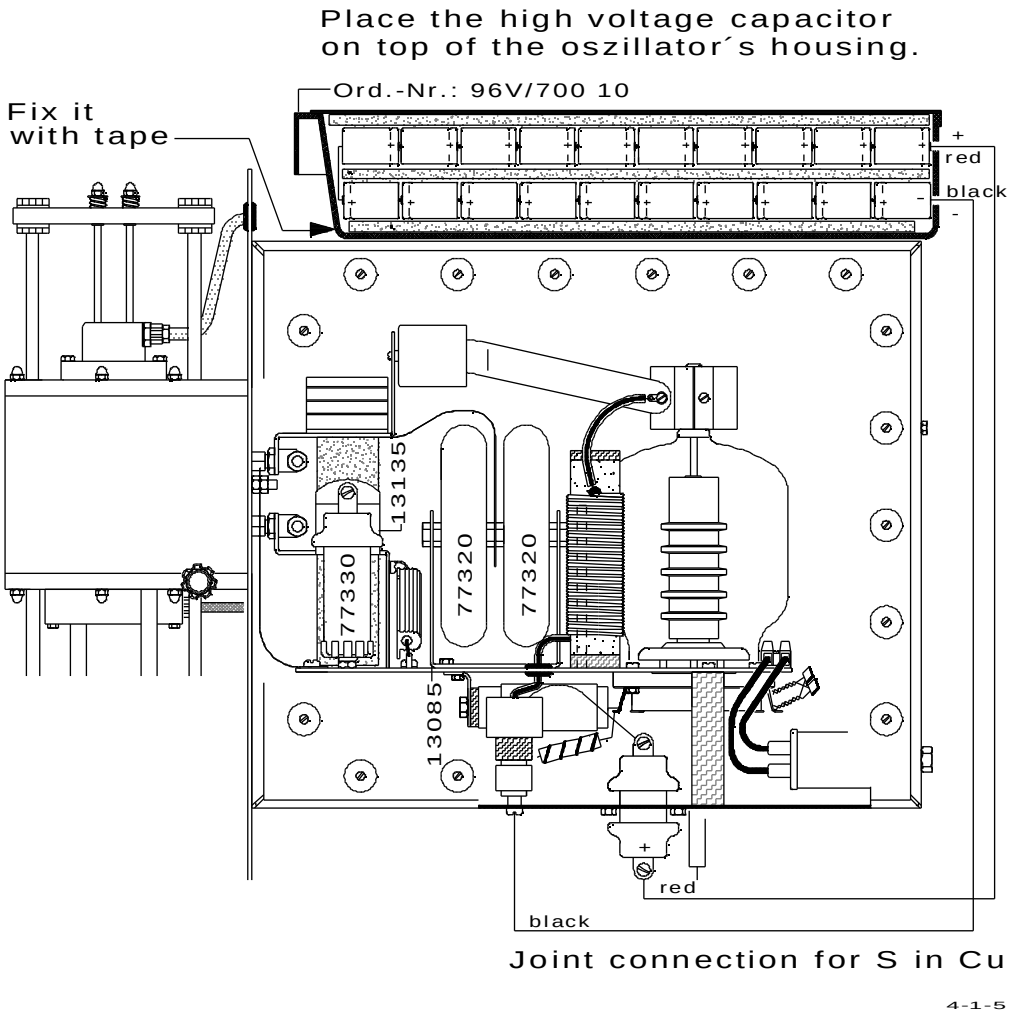
1) Switch off the analyser and unplug the main power cable.

2) A second **capacitor 500 pF** (ordering no. 77330) will be added between the adjusting frame (Copper band: ordering no. 13135) and the metal mountung frame. The distance of the capacitors to the frame, has to amount to **8 mm** min. See **drawing below** and **next page**.



3) Install a second **100 pF** capacitor (ordering no. 77320) parallel to the first one between the cooling system and the coil, mounted on a **U-form** metal frame. (ordering no. 13085)

4) Place a **high voltage capacitor** (ordering no. 96V/ 700 10) on top of the oscillator's housing, fixing it with tape. A red cable **(+)** will be joined from the high voltage capacitor to the lower capacitor that is fixed on the bottom housing.
A black cable also from the high voltage capacitor **(-)** will be jointed to the capacitor coil, also mounted on the bottom housing. See **drawing below**.



3.20 Upgrading of analysers with electronic rack for using the new Windows software:

Late analysers **(from S/N 0767xxxxxx)** equipped with the new flow sensor (pressure transducer) can easily be upgraded as follows:
+ Remove the electronic rack.
+ Install the new hardware at the same place.
+ Connect the adapters and the new cables for PC and balance.
+ Install the front frame and the rear frame.

Upgrading of older analysers equipped with the previous flow sensor (rotameter in the IR-cell) is theoretically possible but practically difficult. The new software is made for the latest versions of analysers with the electronic flow sensor and with two oxygen inlets furnaces. Therefore, older analysers can not run with the new software, unless the analyser is first modified to correspond to the later version. This means replacement of the wiring, new HF board, new upper furnace part with two oxygen inlets and modifications of the tubing and new flow sensor in the IR-cell.

3.21 Preventive Maintenance checklist

The instruments should be maintaind 1 -2 times per year and the following should be checked and if necessary replaced:

1. check of the IR-cells
a) cleaning and if necssary change of the IR paths
b) check and if necessary change of the dust filter
c), check of the flow sensor
d) check of the emitters and the chopper motor

2. check and adjustment of the flow regulator

3. check of the reagent train and if necessary cleaning

4. leackage test

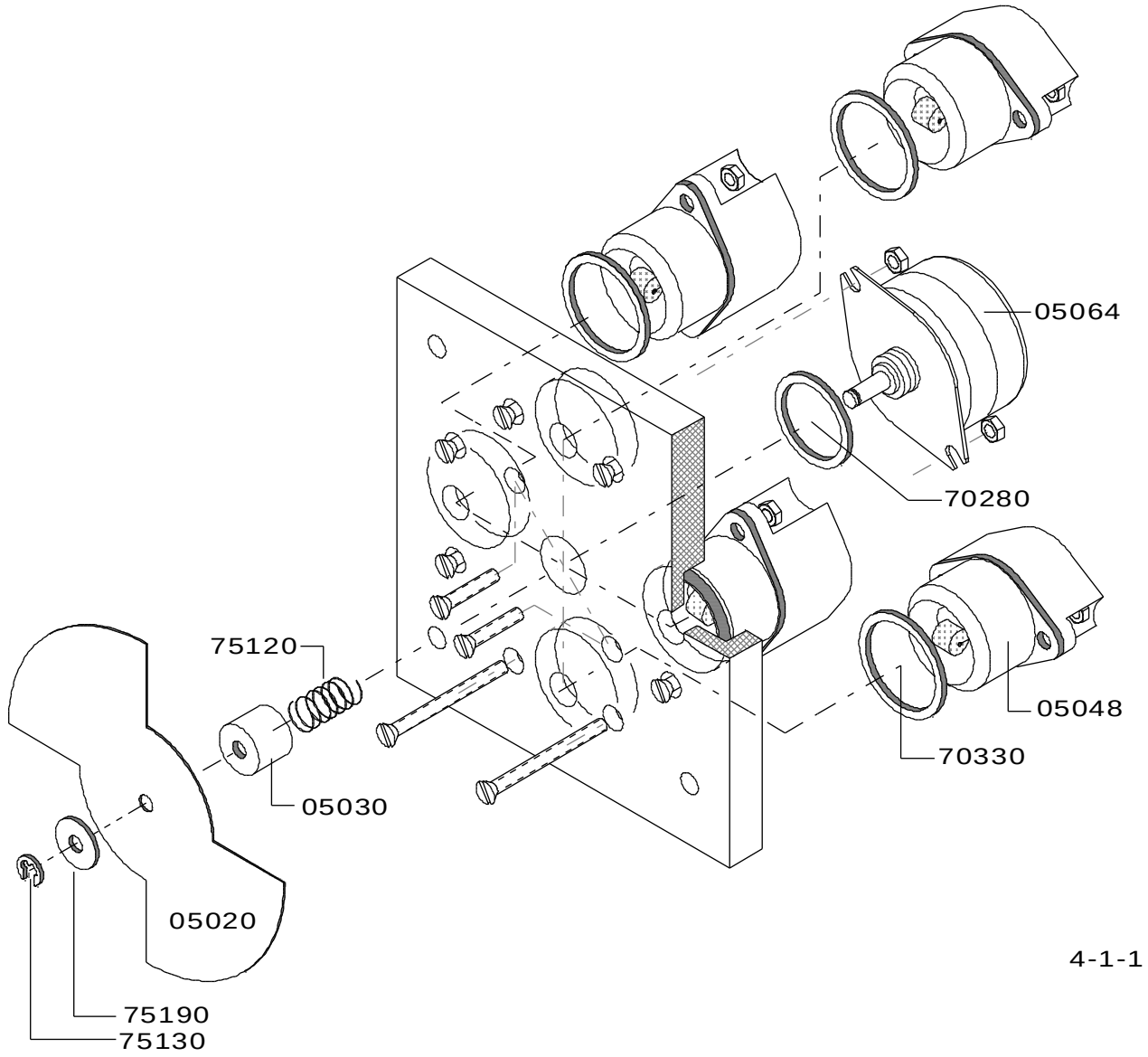
5. check of the chopper purge flow

6. check of the induction furnace
a) measurement of the power/capacity and if necessary adjust
b) check of the pneumatic and if necessary adjust.

4 MISCELLANEOUS

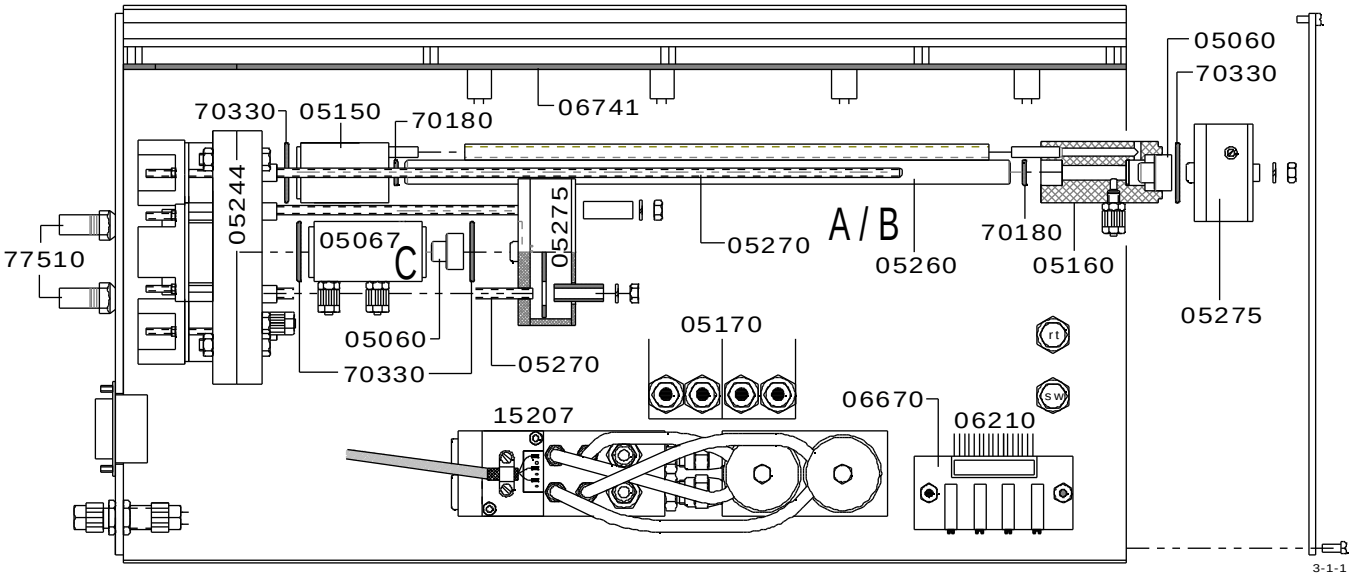
4.1 Ordering numbers:

see also **Operation Manual**, chapter **8.**



05020	Chopper blade
05030	Chopper blade holder
05064	Chopper motor
05048	Infrared source (emitter)
70280	O-ring
70330	O-ring
75120	Spring
75130	Retaining washer
75190	Washer

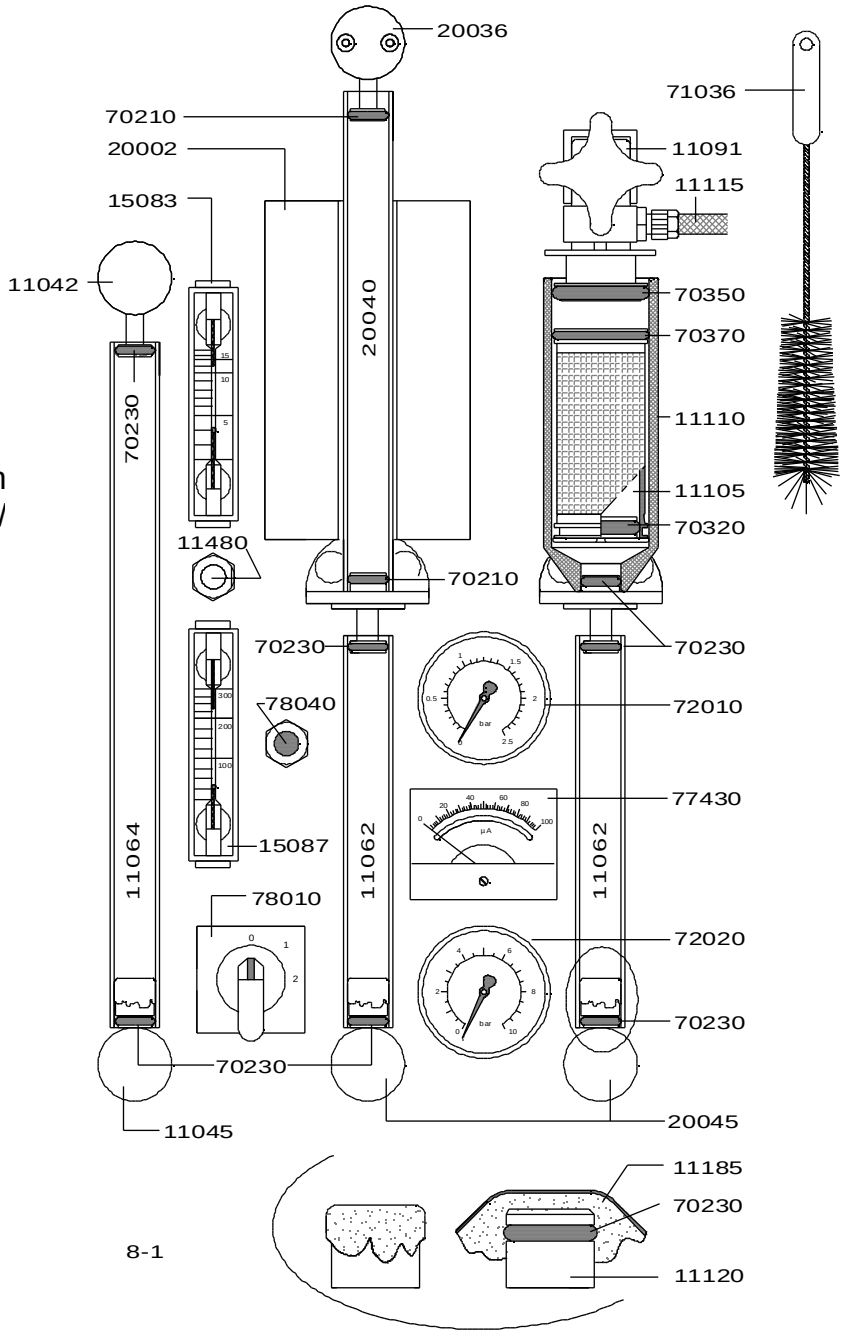
Infrared cells:



05060	Reflector
05067	IR-path for high carbon
05150	IR-path connector with window source side
05160	IR-path connector with window detector side
05170	Gas conditioner
05244	IR 4 chopper
05260	IR-path tube (advice the length)
05270	Threaded rod (advice the length)
05275	Infrared preamplifier
06210	IR-cable
06670	IR-zero adjustment board
06741	Infrared electronics board
15207	Gas flow sensor
70180	O-ring
70330	O-ring
77510	Heaters for IR-cell

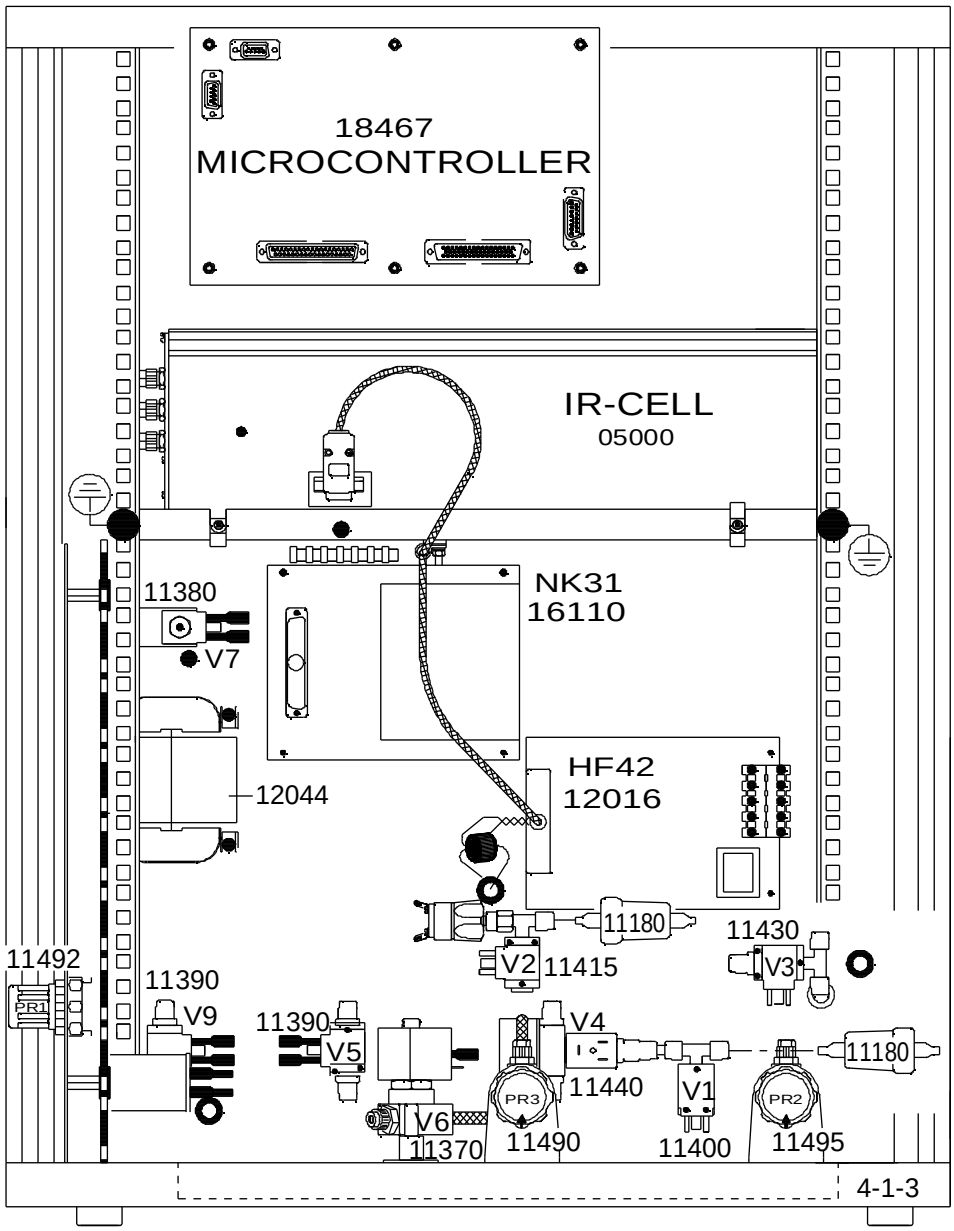
Front side

11042	Upper tube holder
11045	Lower tube holder
11062	Reagent tube
11064	Reagent tube
11091	Dust trap mechanism
11105	Metal dust filter
11110	Filter housing
11115	Furnace outlet tube
11120	Paper filter holder
11185	Paper filters
11480	Adjustable restrictor
15083	Gas flow indicator 15 l/h
15087	Gas flow indicator 300 l/
20002	Catalyst furnace
20036	Upper tube holder
20040	Catalyst tube
20045	Lower tube holder
70210	O-ring
70230	O-ring
70320	O-ring
70350	O-ring
70370	O-ring
71036	Cleaning brush for filter
72010	Pressure gauge
72020	Pressure gauge
77430	Panel meter 100 µA
78010	Main power switch
78040	Button for leakage test



Left side:

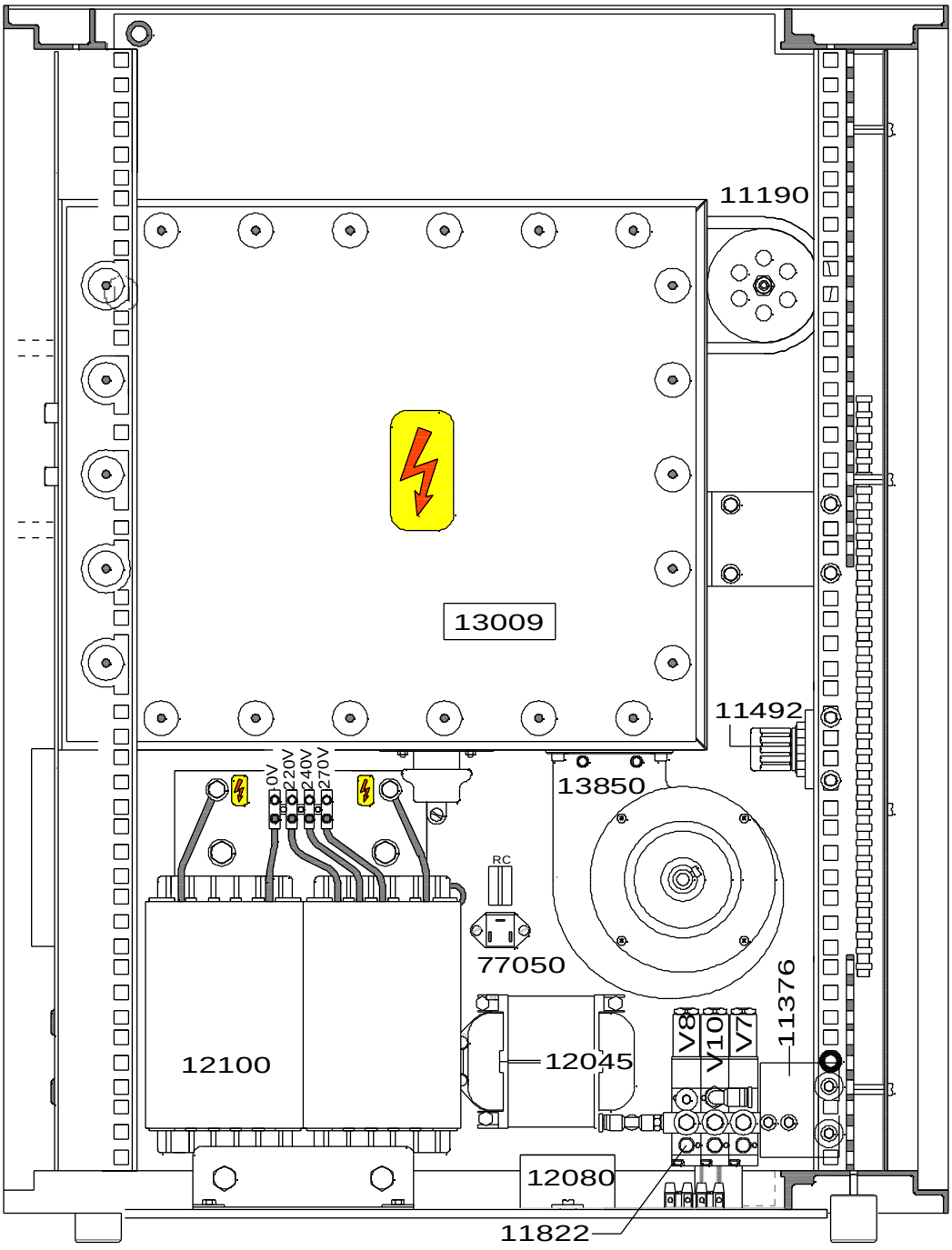
Separator plate side



05000	IR-cell
11180	Dust cartridge
11390	Oxygen solenoid valve
11400	Pressure outlet solenoid valve
11415	Oxygen stop solenoid valve
11430	Purge solenoid valve
11440	Bypass solenoid valve
11492	Pressure regulator
11492	Inlet pressure regulator
11495	Purge pressure regulator
12016	Gas flow and furnace control board HF 42
12044	Transformer
16100	Power supply board NK 31
18467	Microcontroller board UNI

Right side:

Ventilation

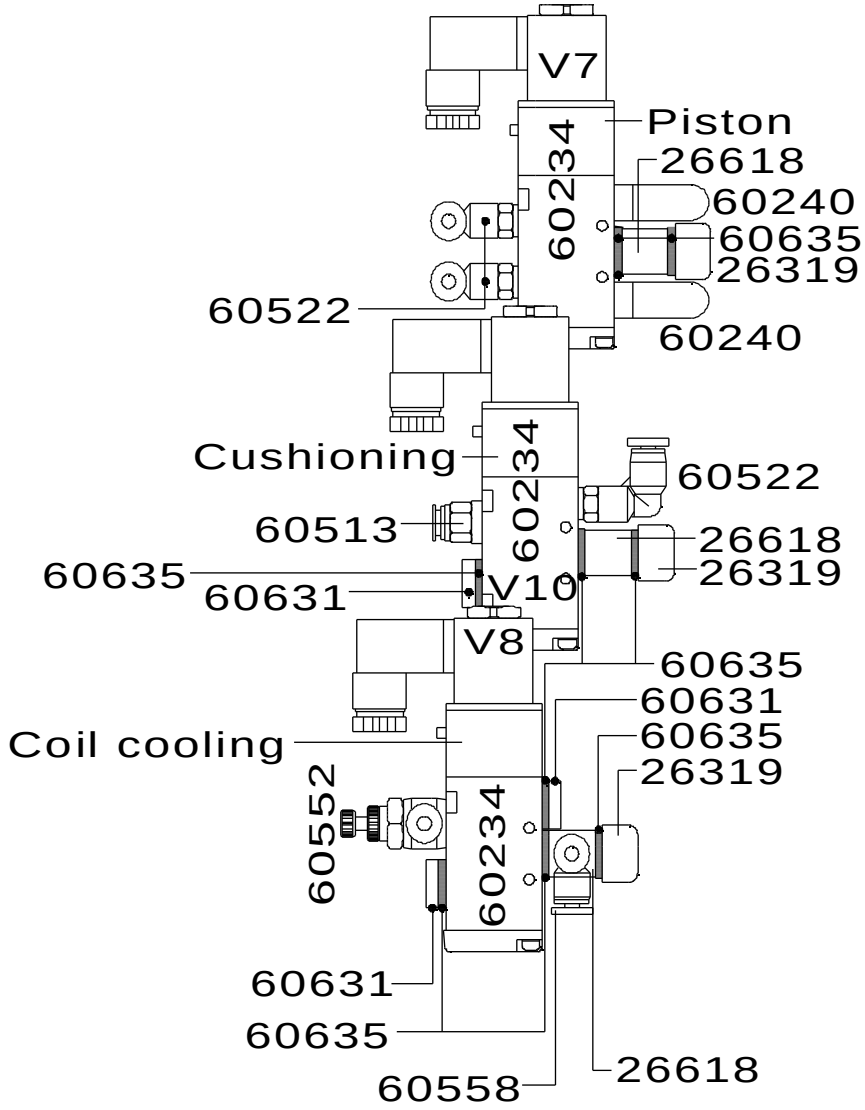


B9-1-5

11190	Exhaust muffler
11376	Fixing plate for 11822
11492	Pressure regulator
11822	Pnematic valve block
12045	Transformer
12080	Rectifier
12100	Transformer
13850	Centrifugal blower
77050	TRIAC
77135	Capacitor

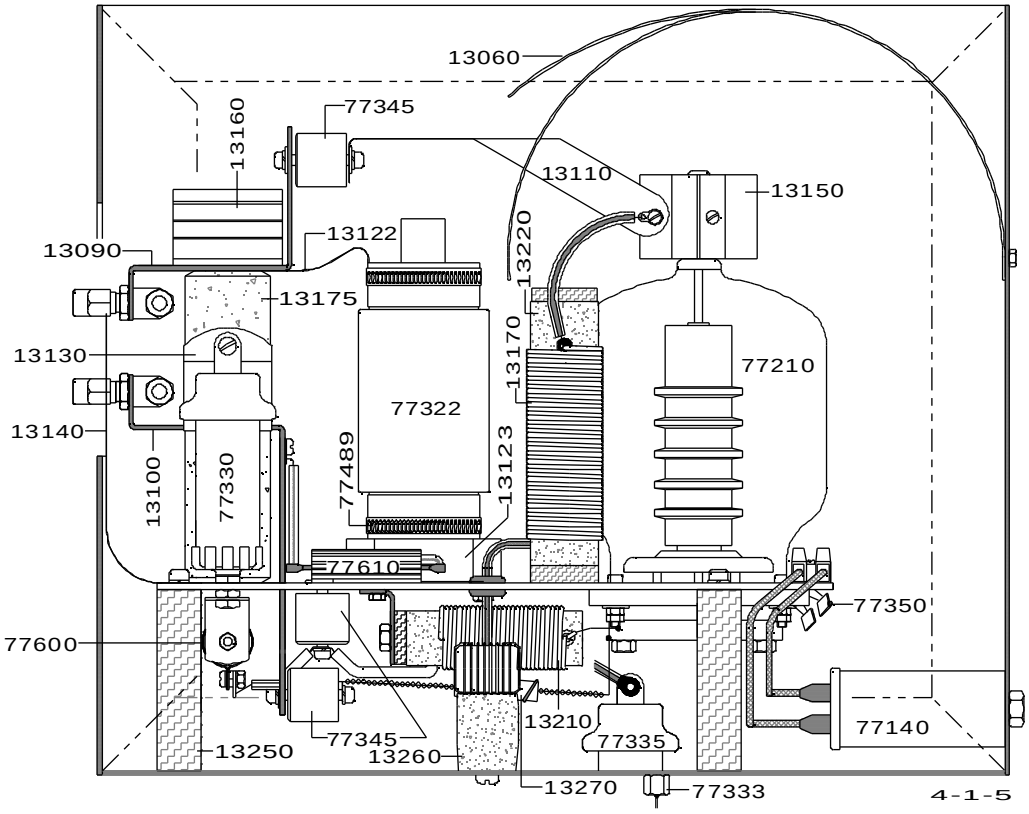
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Pneumatic valve block 11822



26319	Hollow screw
26618	Valve block
60234	Pneumatic valve
60240	Silencer
60513	Fiting
60522	Fiting
60631	Closure
60635	Seal

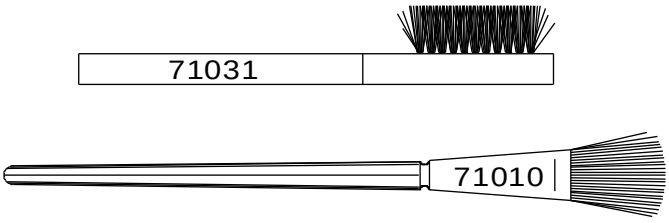
Oscillating circuit:

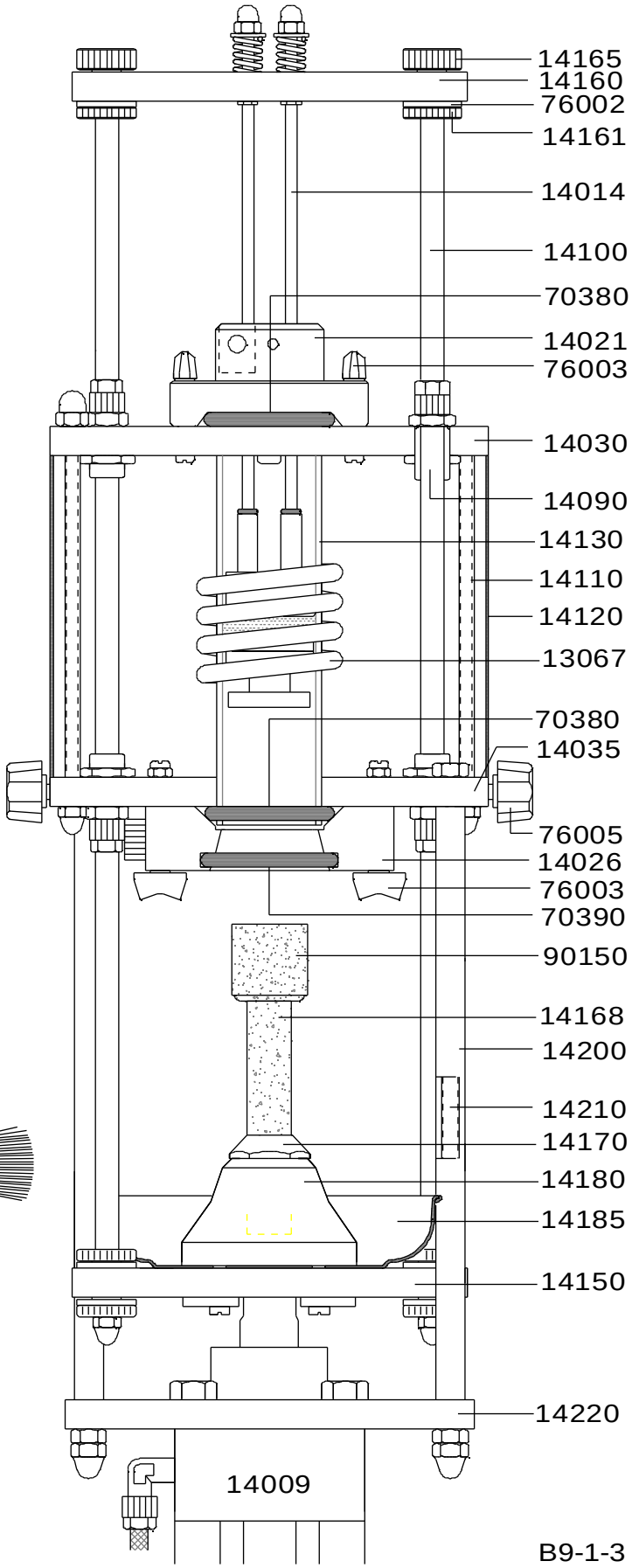


13060	Protection sheet
13081	Capacitor support
13090	Upper coil connector
13100	Lower coil connector
13110	Anode connector
13122	Capacitor connector
13130	Capacitor connector
13140	Ground connector
13150	Anode heat sink
13160	Coil heat sink
13170	Radiation shield
13175	Insulator
13210	Grid choke
13220	Anode choke
13250	Chassis support
13260	High voltage filter
13270	Resistor
77140	HF-filter
77210	Oscillator tube
77322	Capacitorr
77330	Capacitor
77335	Capacitor
77333	Filter
77345(13261; 13262; 77340; 77341; 77342)	Capacitor
77350	Capacitor 100 nF
77489	Bracket
77600	Resistor
77610	Resistor

Furnace:

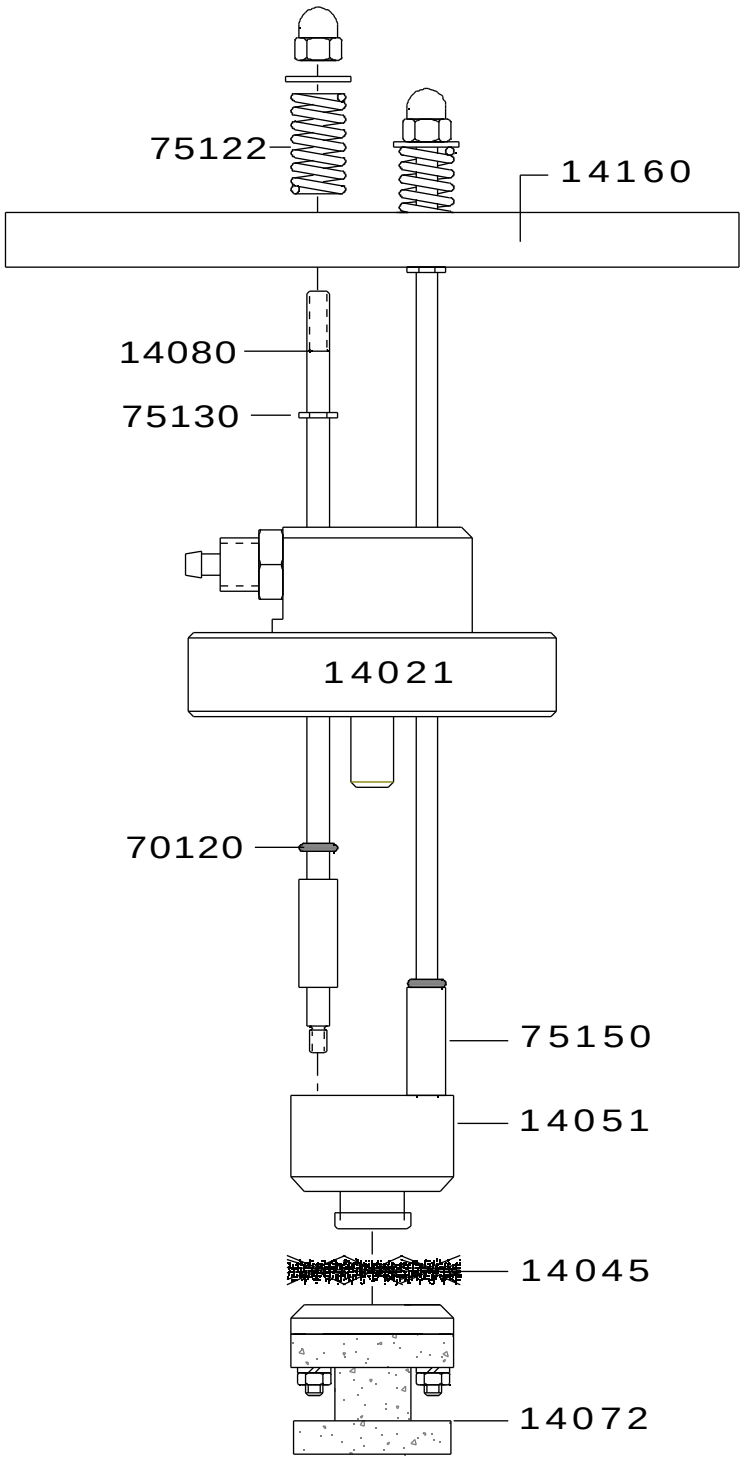
13067	Combustion coil
14009	Pneumatic cylinder for furnace lift
14021	Upper furnace lock
14026	Lower furnace lock
14030	Upper furnace plate
14035	Lower furnace plate
14090	Bearing
14100	Mounting rod
14110	Threaded rod
14120	Furnace cover
14130	Combustion tube
14150	Lower log
14160	Upper log
14161	Lower knurled nut
14165	Upper knurled nut
14168	Pedestal
14170	Pedestal mount
14180	Furnace closure
14185	Tray
14200	Metal tube
14210	Threaded rod
14220	Cylinder support
70380	O-ring
70390	O-ring
71010	Cleaning brush for pedestal
71031	Cleaning brush for radiation shield
76002	Washer
76003	Wing nut
76005	Knurled nut
90150	Crucibles



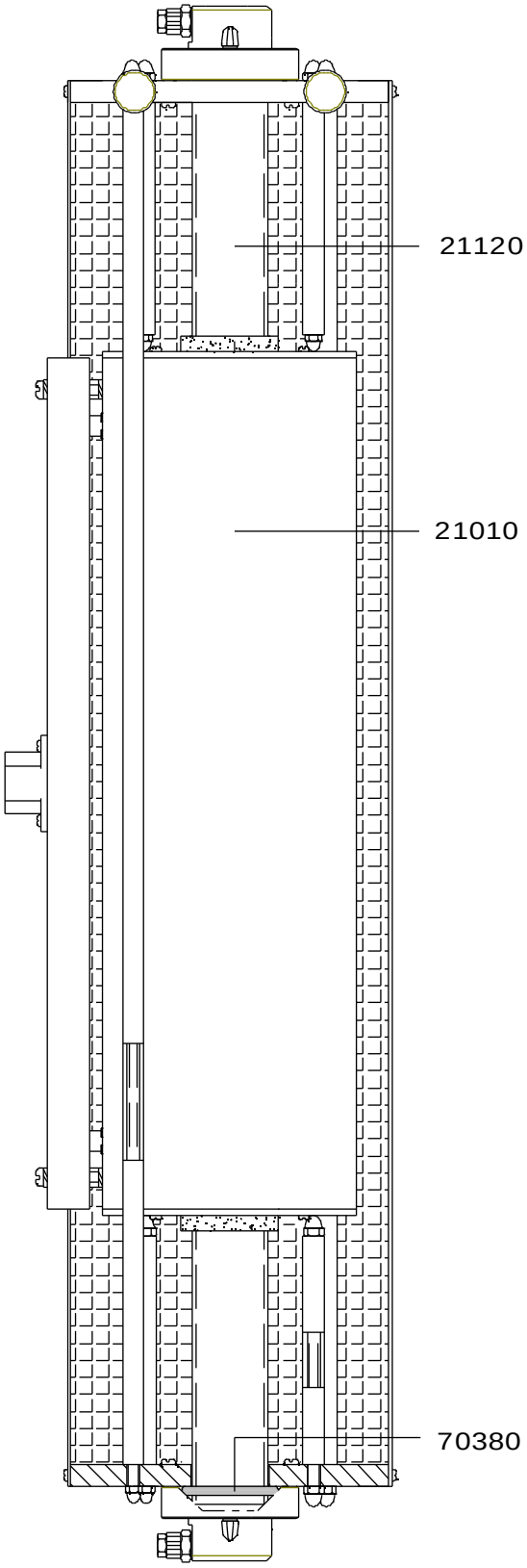


Furnace cleaning:

14014	**Complete furnace cleaning assembly unit:**
14021	Upper furnace lock
14045	Cleaning brush for combustion tube
14051	Brush holder
14072	Ceramic heat shield for brush
14080	Cleaning mechanism Rod
14160	Upper log
70120	O-ring
75122	Spring
75130	Safety spring
75150	Metal tube



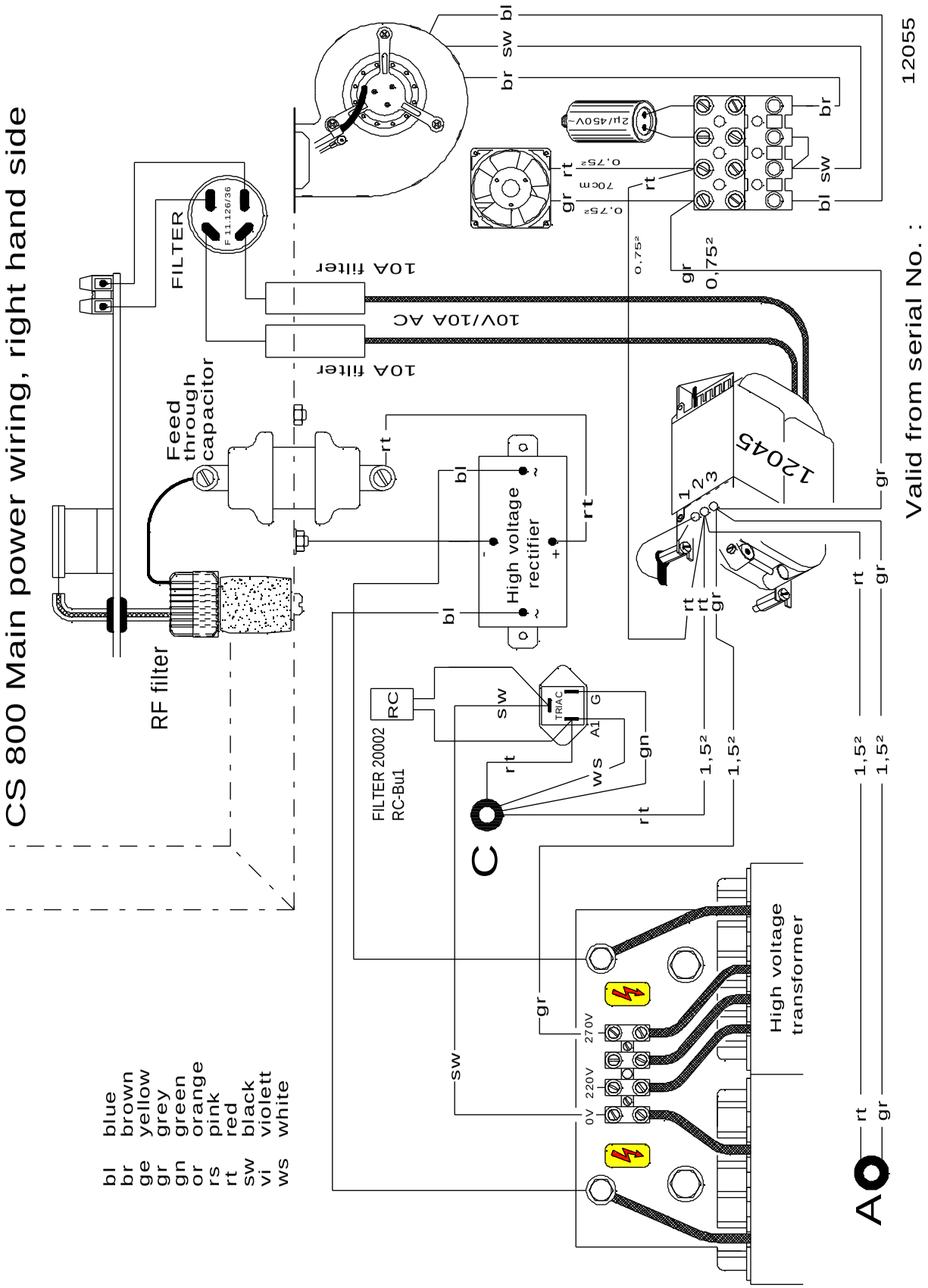
Oxygen purifying furnace:



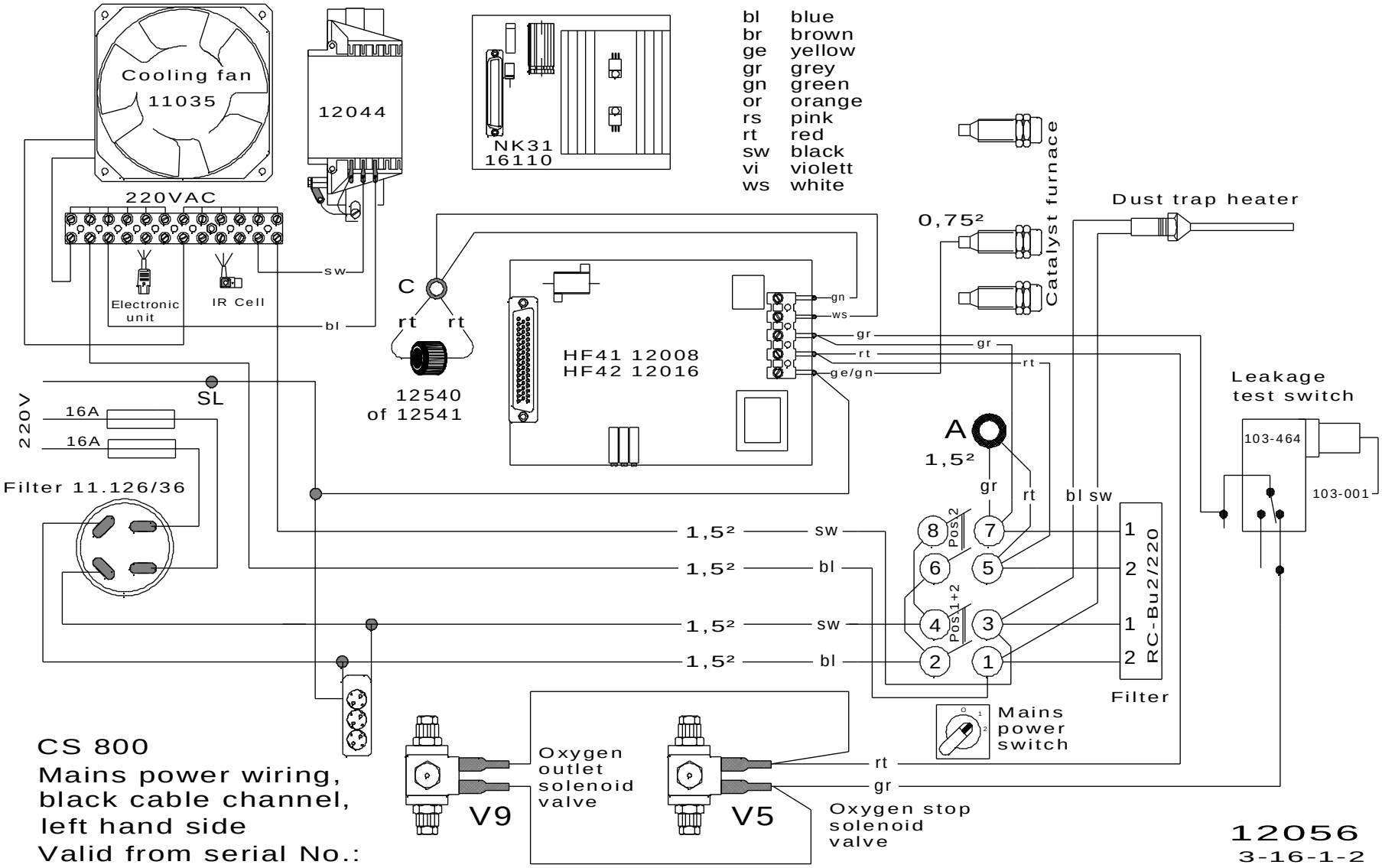
21010	Heather section
21120	Quartz tube
70380	O-Ring

4.2 Wiring and gas flow diagrams:

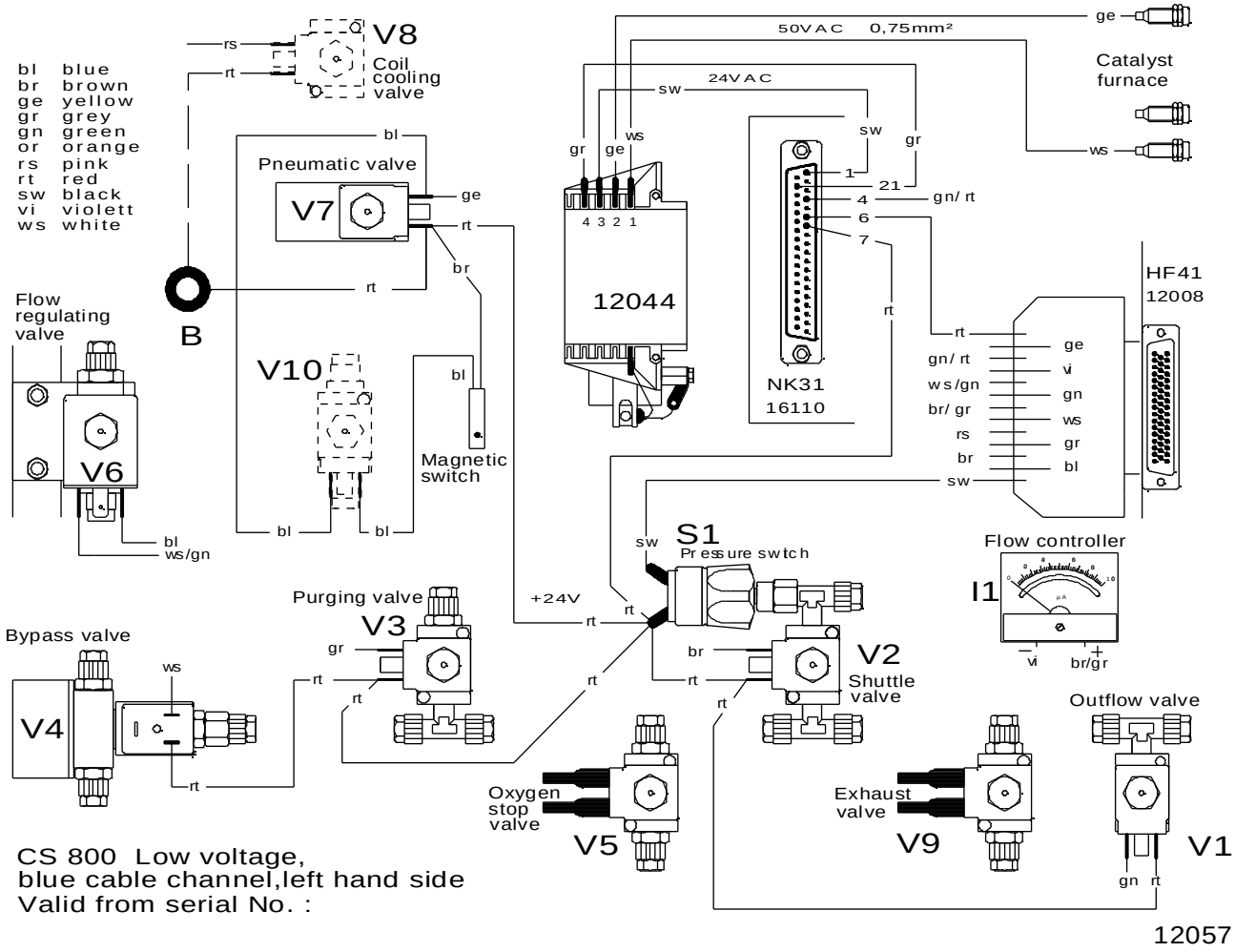
Right side:



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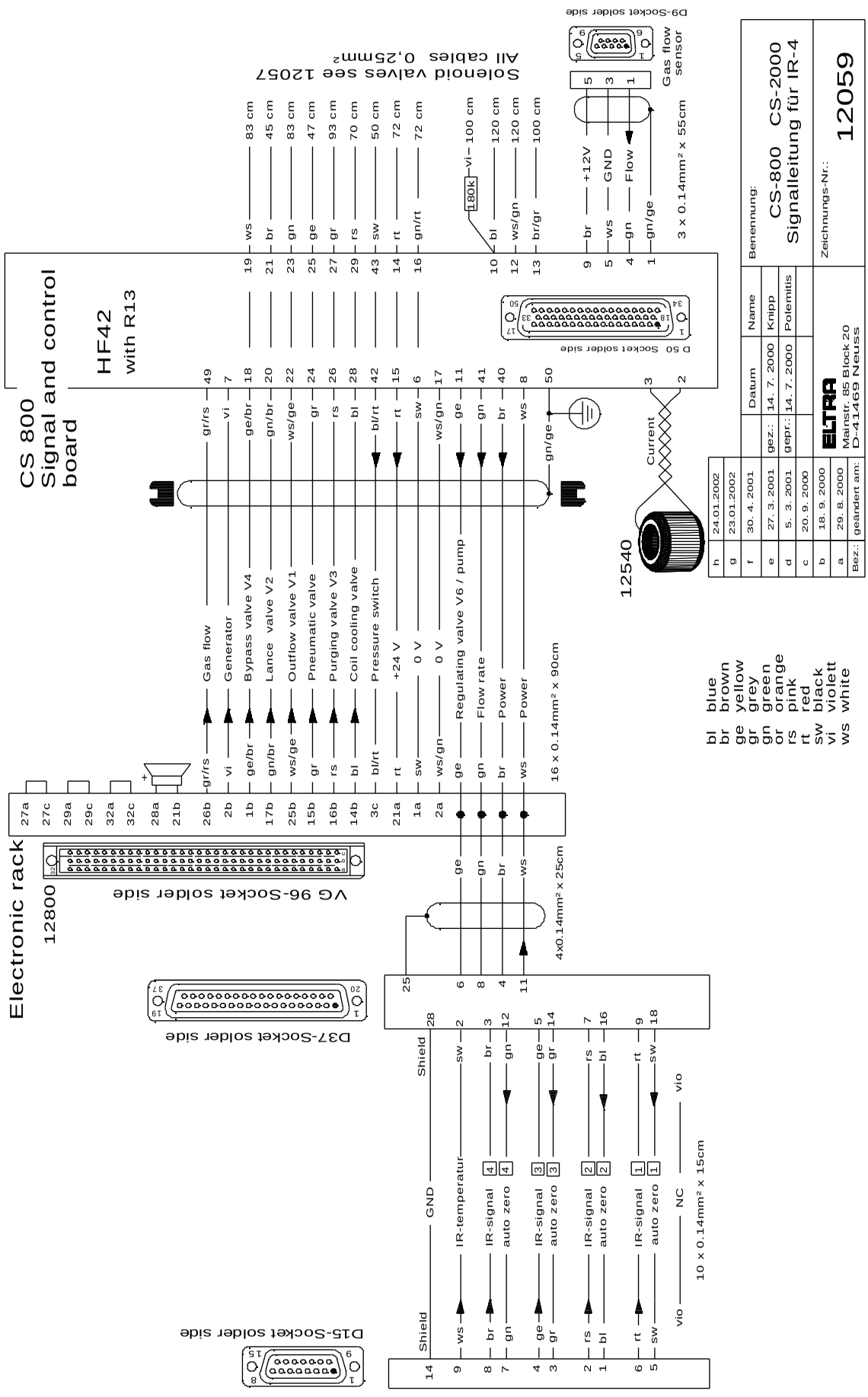


Valve wiring:



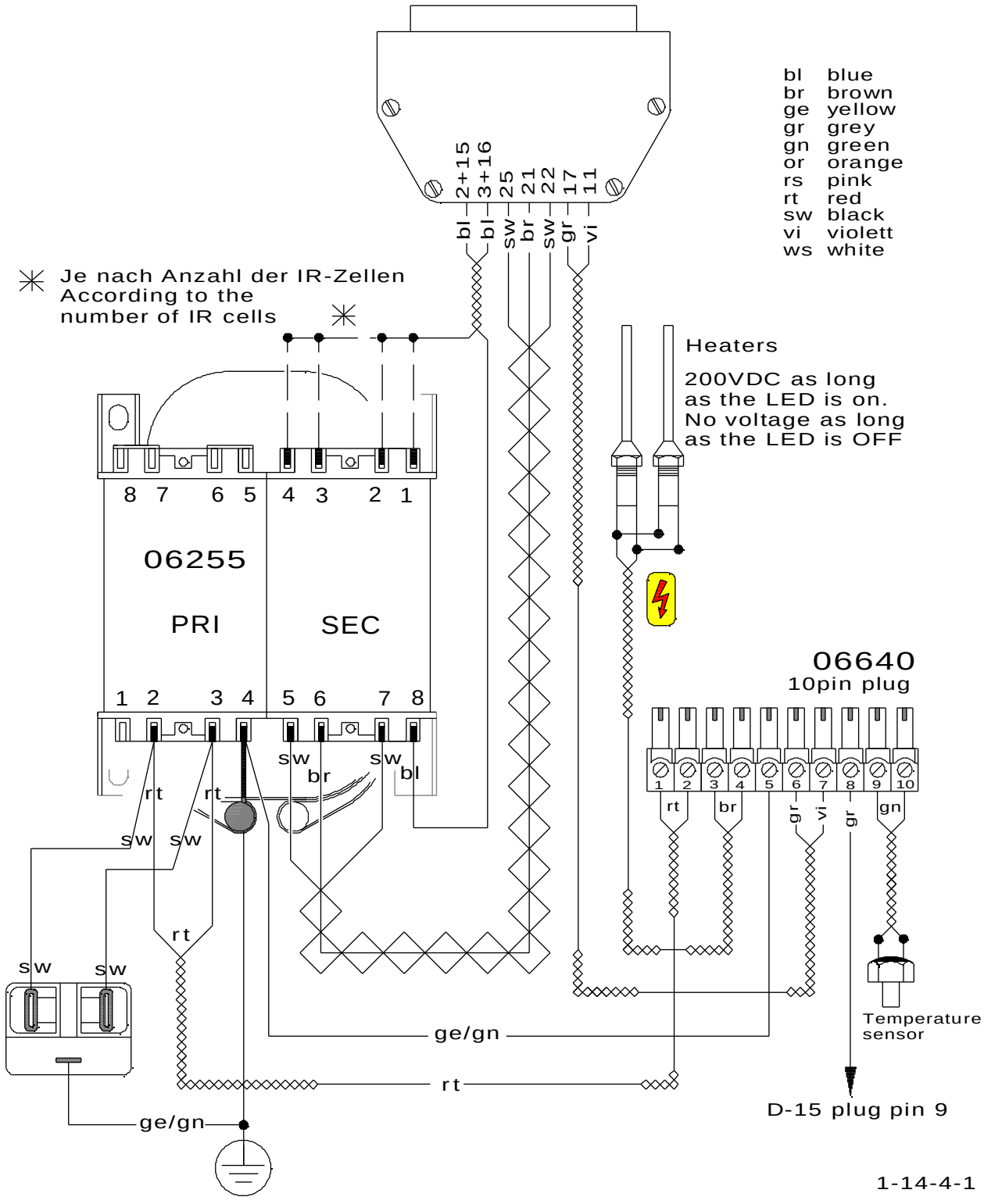
A	To rear (V8)
V1	Outflow valve
V2	Shuttle valve
V3	Purging valve
V4	Bypass valve
V5	Oxygen valve
V6	Regulating valve
V7	Pneumatic valve
V8	Coil cooling valve
V9	Outlet valve
V10	Pressure switch over valve for furnace lift
S1	Pressure switch
I1	Panel meter

Control wiring:



IR-current supply:

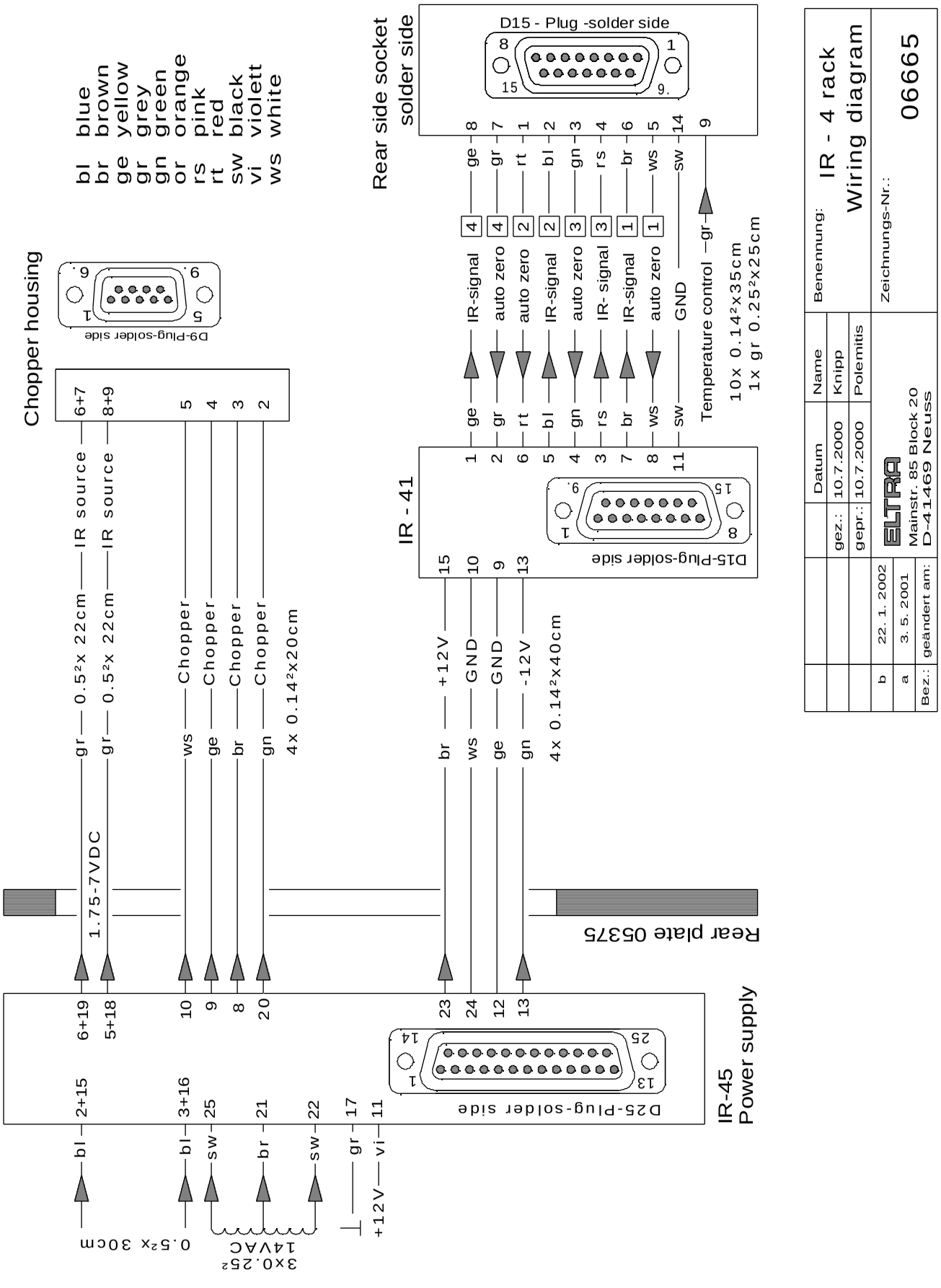
Attention:
The next four drawings consider the IR-rack with four IR-cells
The pages after, Connection between TH 62 and NR 32 are for the older Model (S/N 1080 till S/N 1079)



1-14-4-1

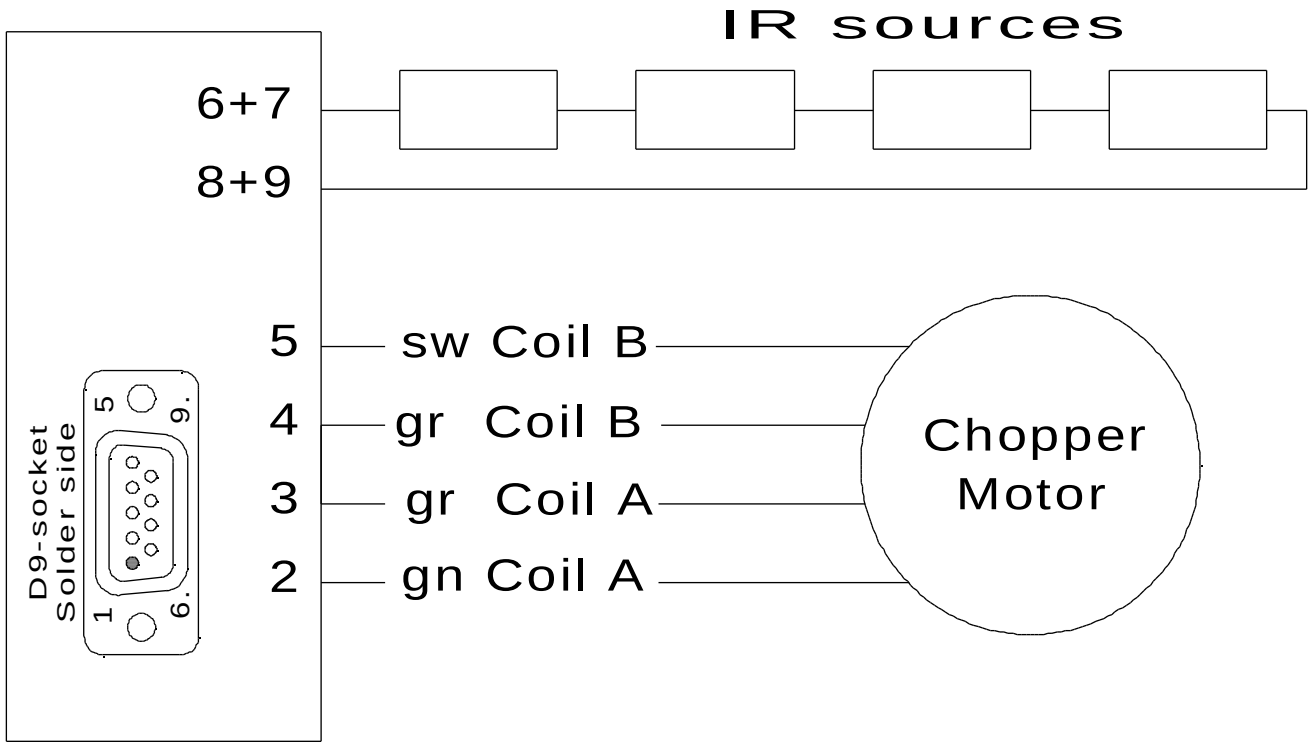
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Infrared cell:



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Chopper motor and IR-source:

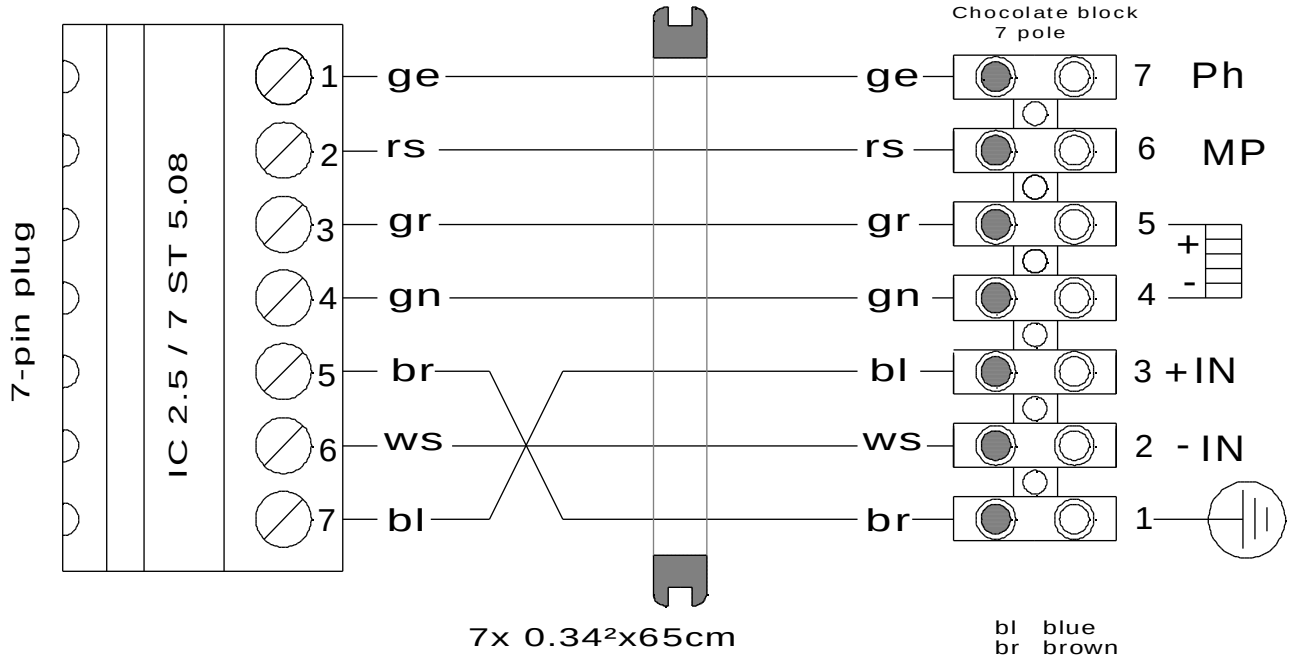


bl blue
br brown
ge yellow
gr grey
gn green
or orange
rs pink
rt red
sw black
vi violett
ws white

				Datum	Name	Benennung:
			gez.:	10.7.2000	Knipp	Chopper motor and IR source
			gepr.:	10.7.2000	Polemitis	
			ELTRA Mainstr. 85 Block 20 D-41469 Neuss			Zeichnungs-Nr.: 06660
Bez.:	geändert am:	gepr.:				

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Connections between TH62 and NR32:

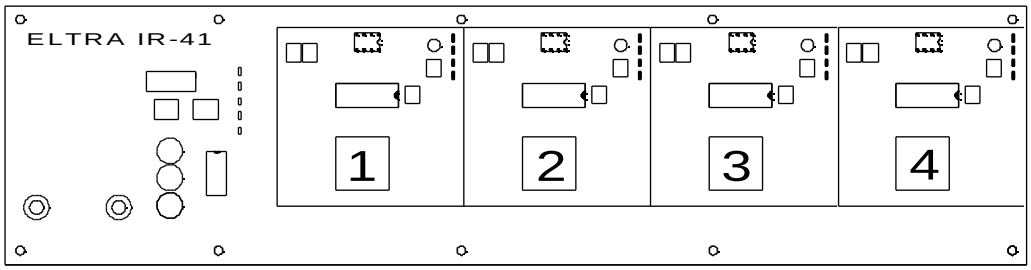


bl blue
br brown
ge yellow
gr grey
gn green
or orange
rs pink
rt red
sw black
vi violett
ws white

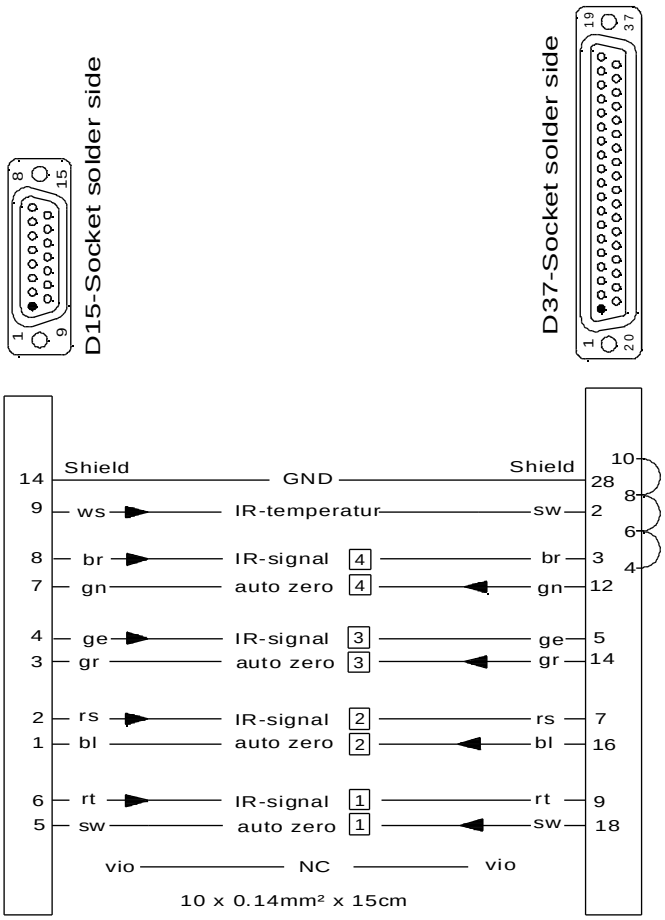
			Datum	Name	Benennung:
		gez.:	25.08.2000	Knipp	Cable conection
		gepr.:	26.08.2000	Polemitis	TH 62 - NR 32 (15037)
		ELTRA			Zeichnungs-Nr.:
		Mainstr. 85 Block 20			06645
Bez.:	geändert am:	D-41469 Neuss			

Attention:

Some **CS-800** analysers may be furnished with the previous model of **IR-rack**, which was designed for maximum three **IR-cells**. The wiring and the plugs of that rack are different to the rack **IR-4** which is described in this manual. The adapter of the drawing below is used to adapt the new **IR-rack** to the **CS-800** analyser. The drawings of the previous rack wiring can be found in the following **5 pages, these are the older models.**



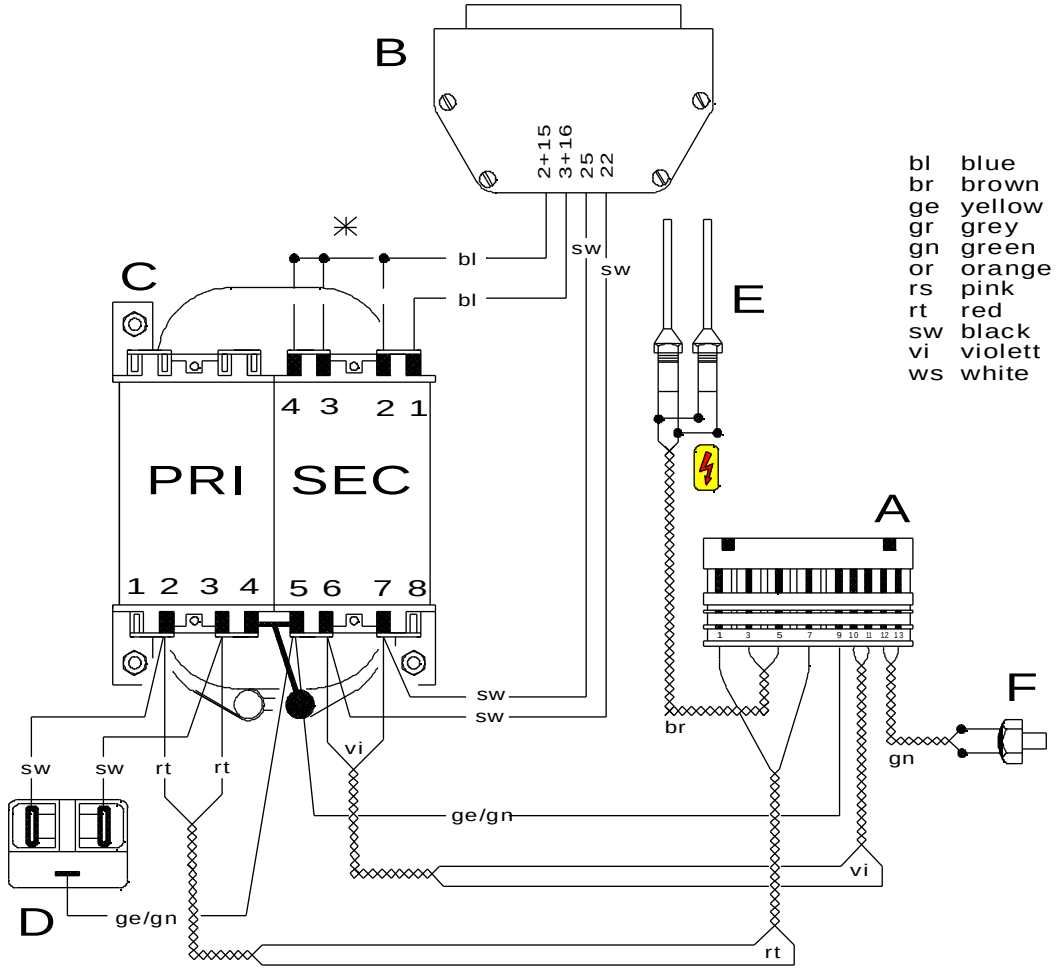
Use they adapter below to install the new IR-cell IR-4 in a previous analyzer wired for the previous IR-cell model.
The **EPROMs and the Windows** software must also correspond to the new IR-cell. Also the **coding** of the IR-ranges must match. See 3.11-1.



bl	blue
br	brown
ge	yellow
gr	grey
gn	green
or	orange
rs	pink
rt	red
sw	black
vi	violett
ws	white

			Datum	Name	Benennung:
		gez.:	07.06.2001	Sanda	IR Signal adapter
c	07.06.2002	gepr.:	07.06.2001	Polemitis	
b	24.01.2002	ELTRA Mainstr. 85 Block 20 D-41469 Neuss			Zeichnungs-Nr.: 12069
a	13.07.2001				
Bez.:	geändert am:				

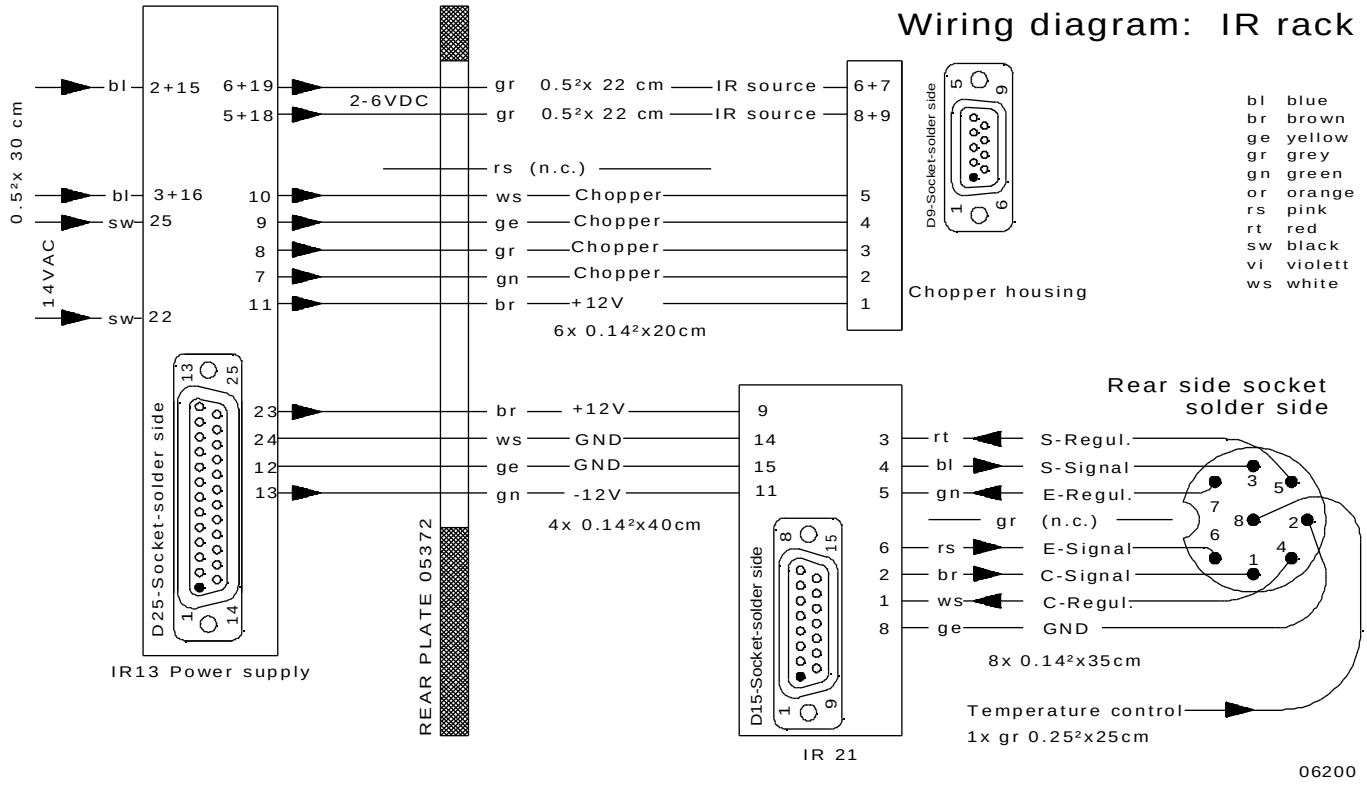
IR-current supply:



✳ According to the number of channels see 2.4

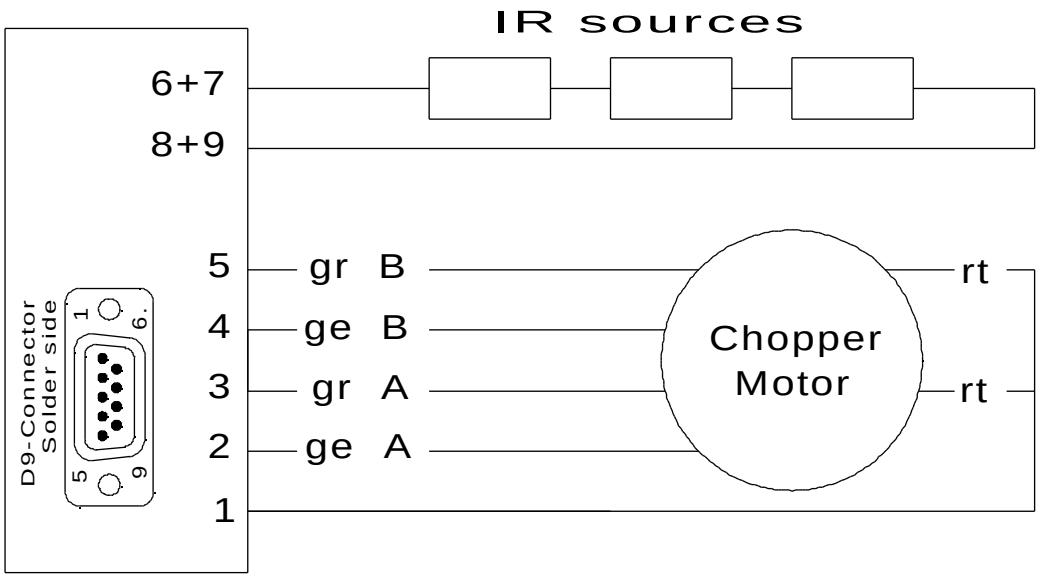
A	13-pin plug connector
B	25-pin plug
C	Transformer
D	Energy filter
E	Heating elements
F	Temperature sensor
*	**According to the number of channels**, see **2.4**

Infrared cell:



1 C-signal
2 GND
3 S-signal
4 Control voltage
5 Control voltage
6 Control signal for low channel
7 Regulating voltage for low channel

Chopper motor and IR-source:

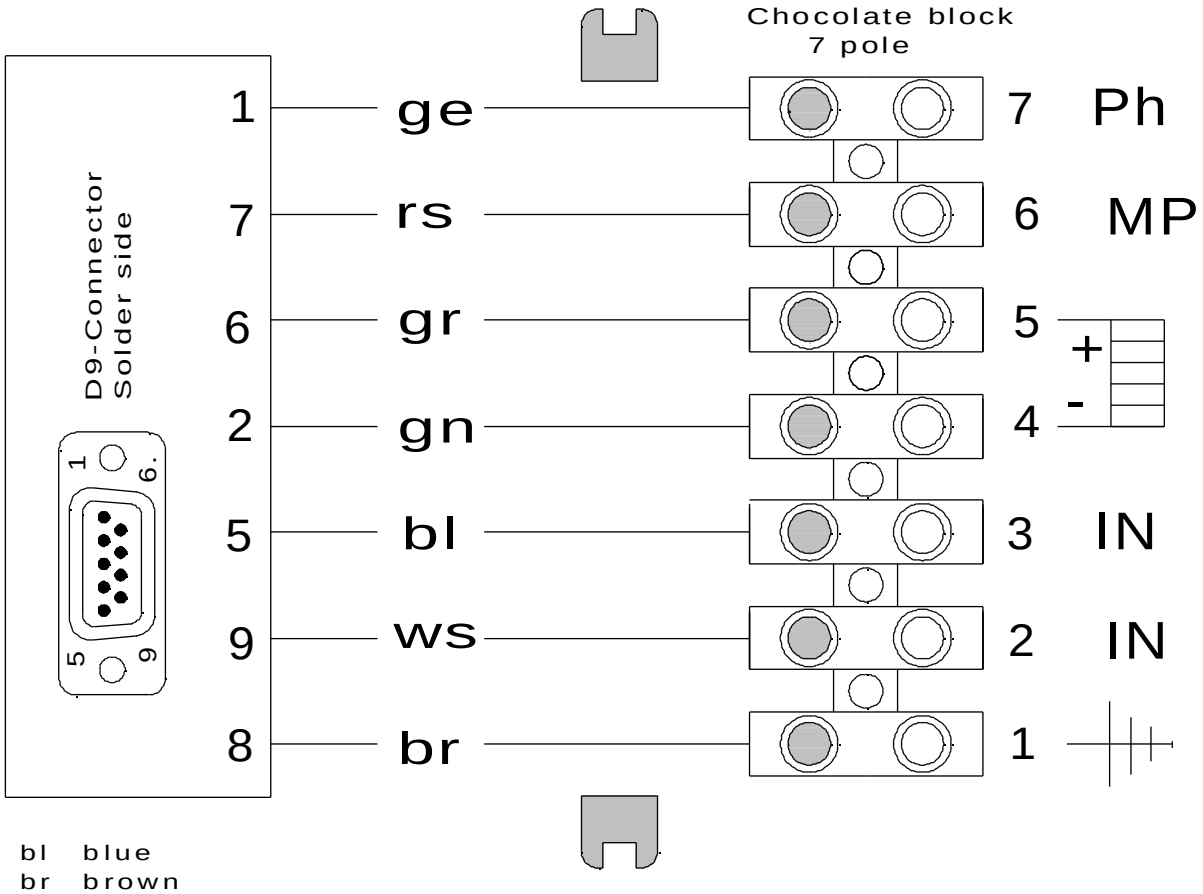


bl blue
br brown
ge yellow
gr grey
gn green
or orange
rs pink
rt red
sw black
vi violett
ws white

Chopper motor and IR source

06190

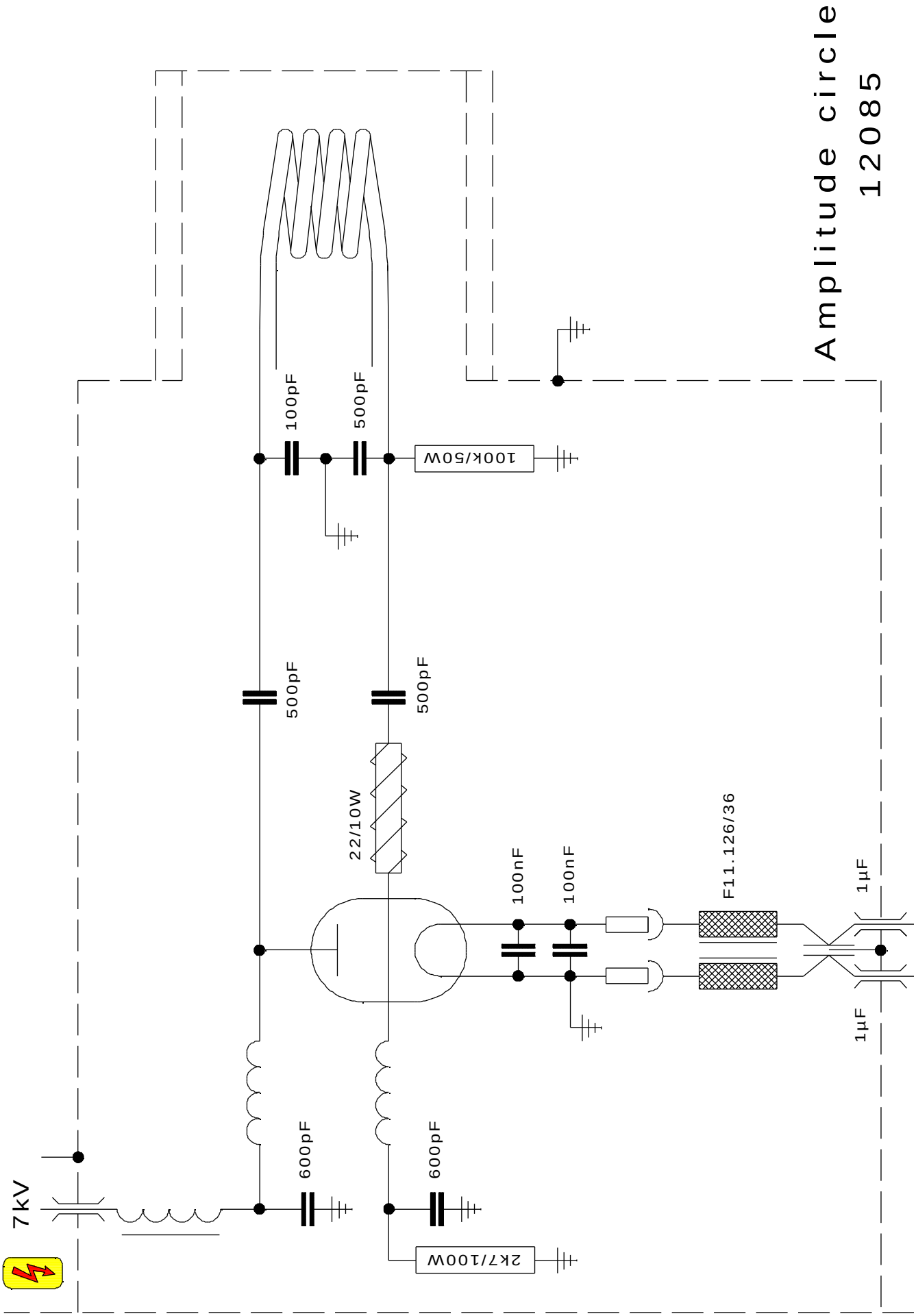
Connection between TH 61 and NR 32:



bl blue
br brown
ge yellow
gr grey
gn green
or orange
rs pink
rt red
sw black
vi violett
ws white

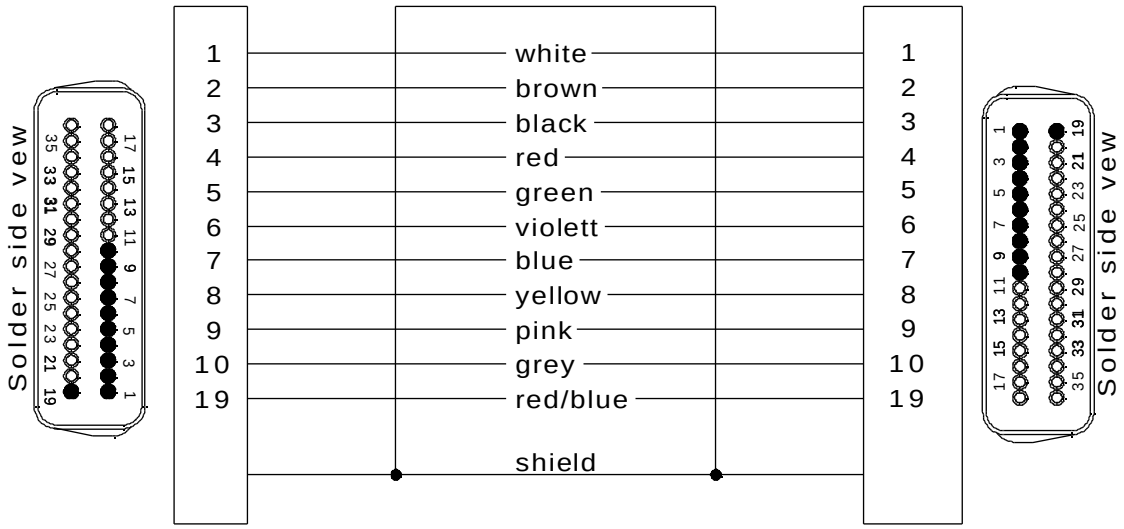
7x 0.34²x65cm

Cable connection
TH 61 - NR 32 (15037) 06090

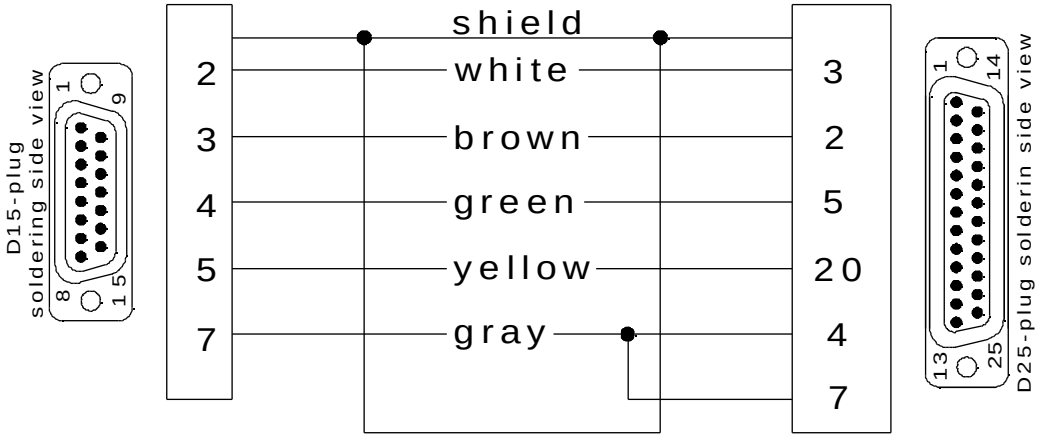

Amplitude circle
12085
100pF
500pF
100k/50W
500pF
500pF
22/10W
100nF
100nF
F11.126/36
1µF
1µF
600pF
600pF
7kV
2k7/100W

Connecting cables:

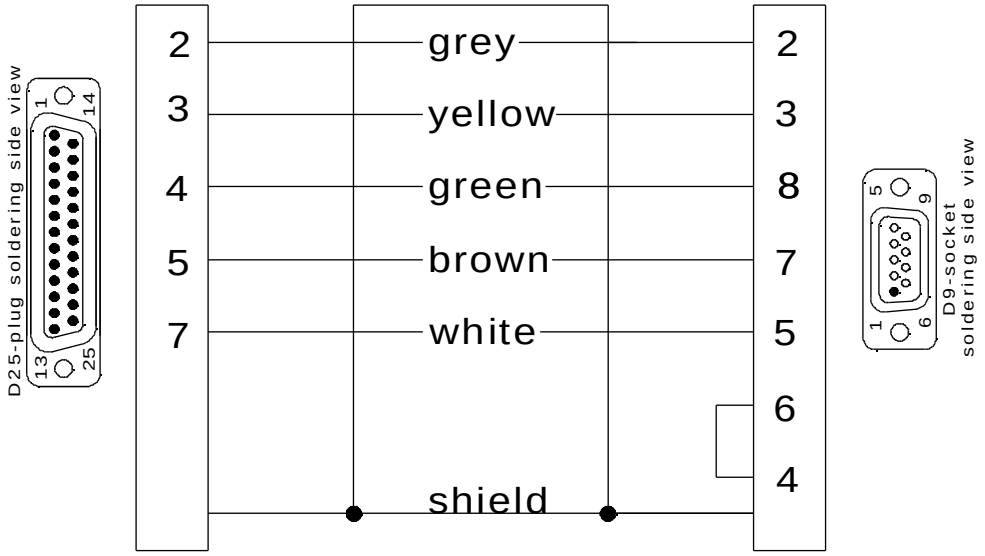
Analyzer-Parallel printer



Analyzer-Sartorius balance

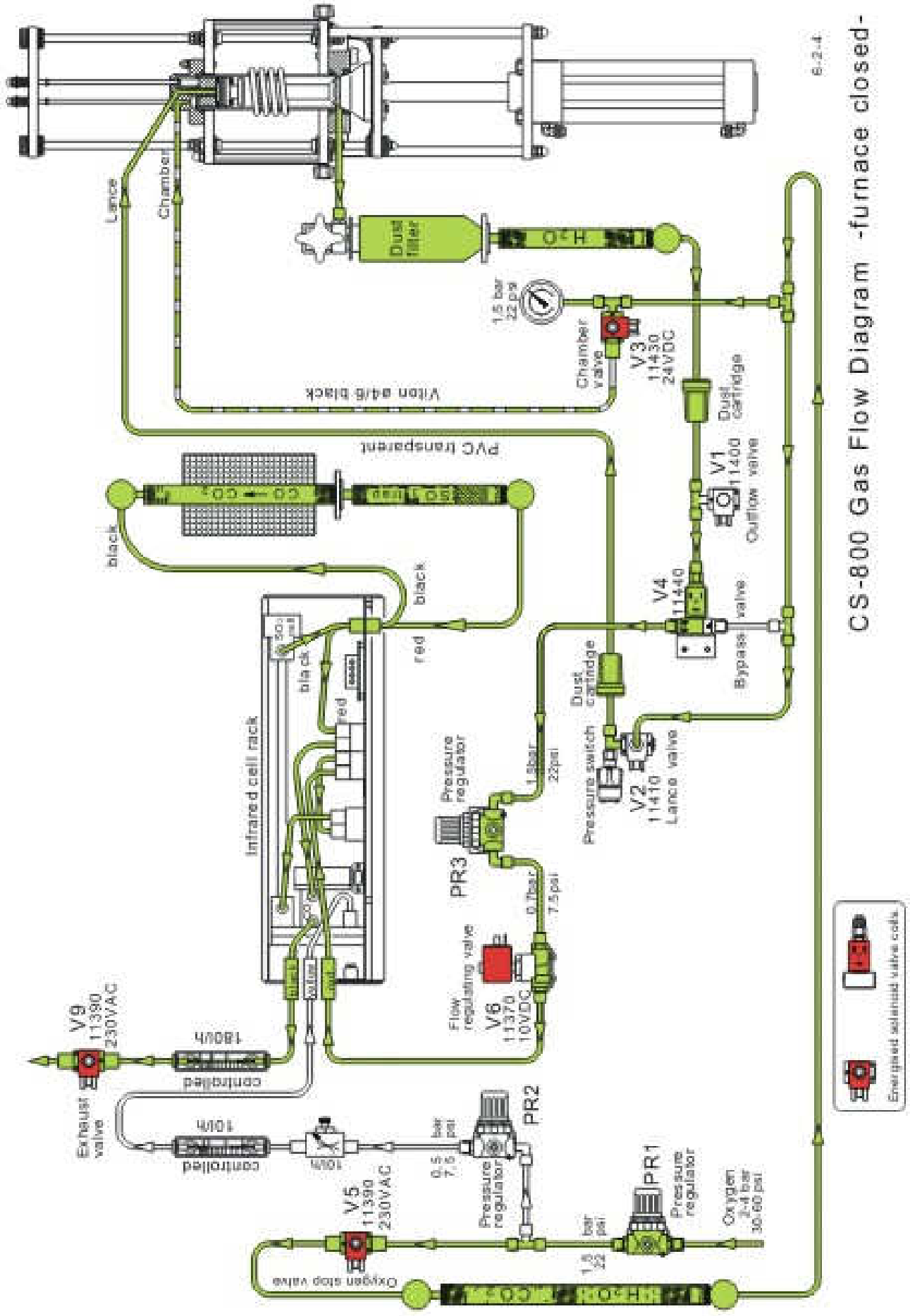


Analyzer-PC

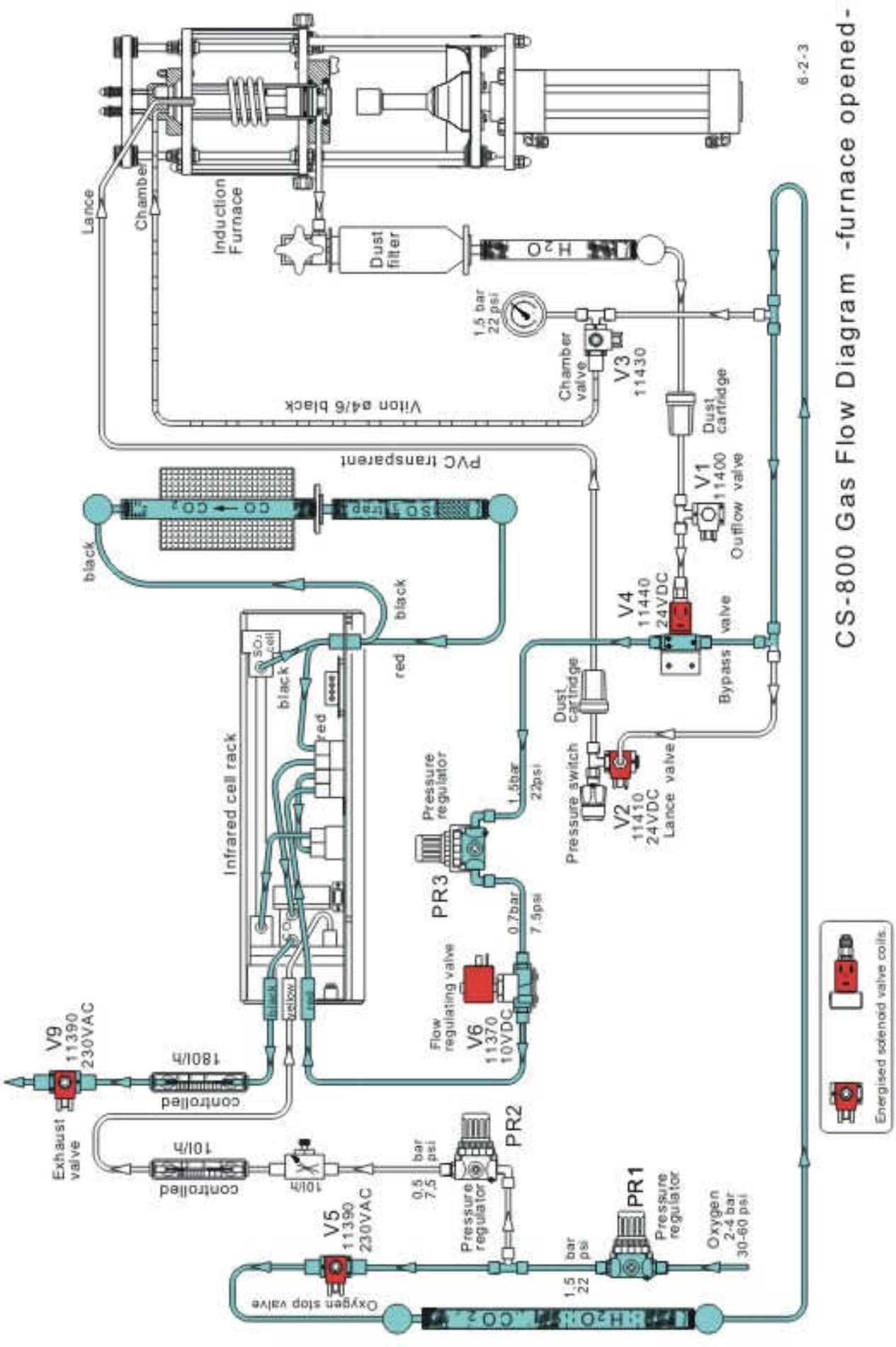


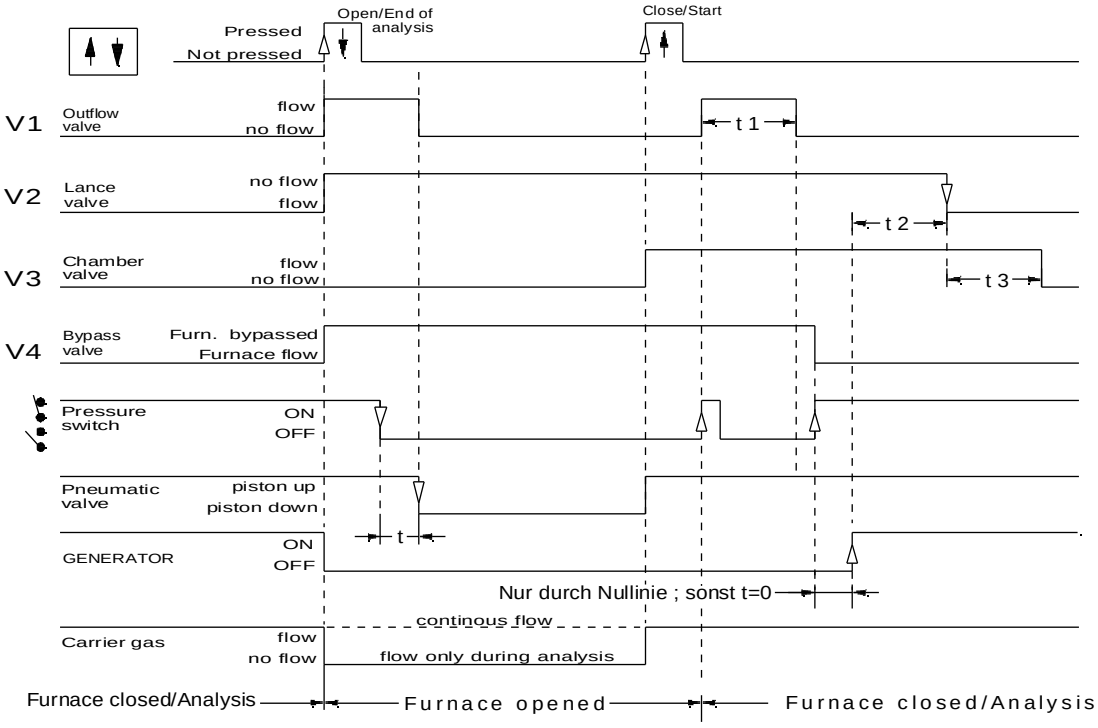
CAUTION! Connect the shield on both connector frames.

Gas flow diagram:



Gas flow diagram:





V2	V3	
H	H	Only chamber flow
H	L	No flow
L	H	Lance and chamber flow
L	L	Only lance flow

t1 : Purging befor combustion
t2 : Chamber oxygen only
t3 : Lance and chamber oxygen
Rest of combuston after t3, lance oxygen only

NOTE: V1 and V3 enable the oxygen flow when they are energised.
V2 stops the oxygen flow when it is energised.
Valid for all valves (V1 to V4 and for the pneumastic valve):
High means the coil is energised.
Low means the coil is not energised.

12202

Low = de-energised (Zero volts on the coil)
High = energised (24 V DC on the coil)

Opening and closing of the furnace, sequence:

(Please refer to above drawing)

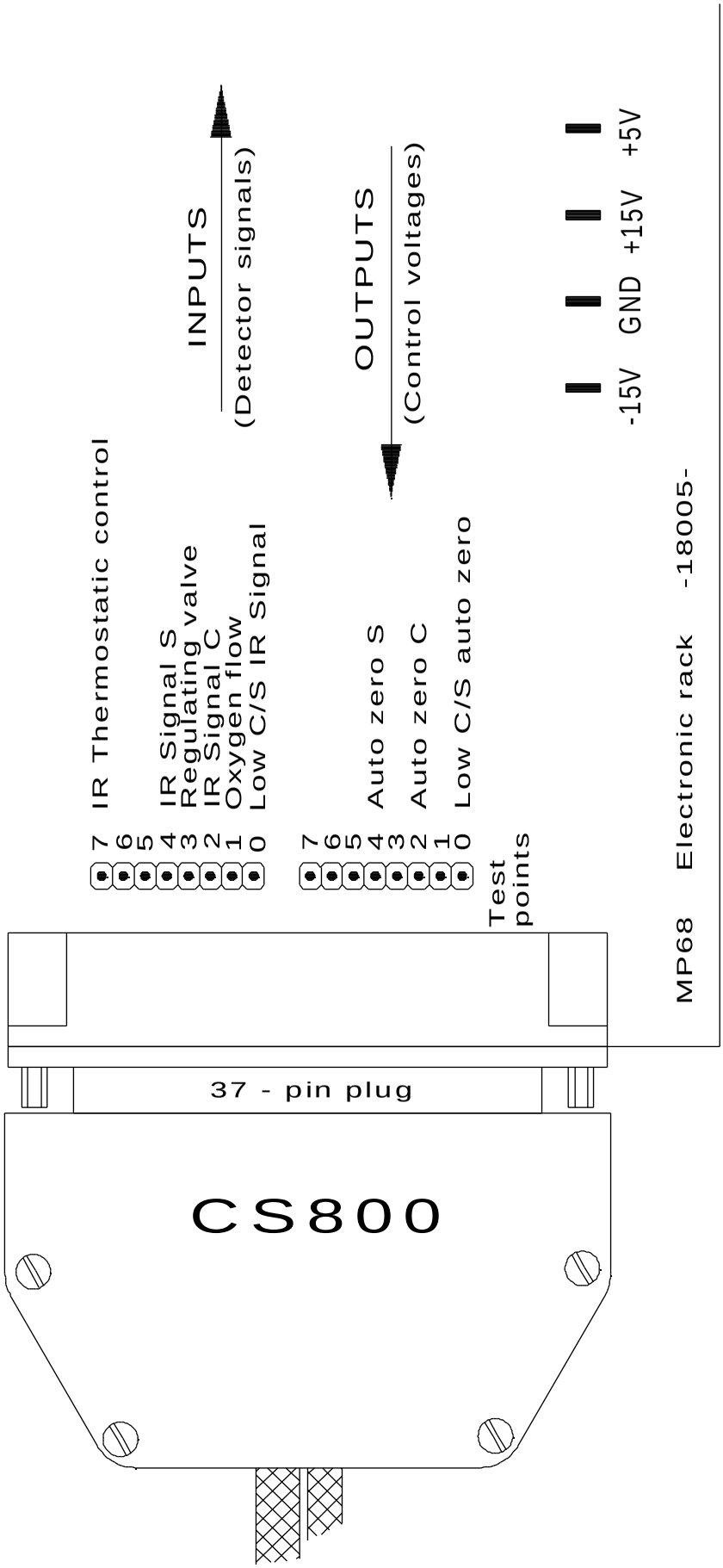
Opening the furnace:

At the moment when the key is pressed to open the furnace,
V1, V2 and **V4** are energised.
V1 releases the oxygen out of the furnace.
V2 stops the oxygen supply to the furnace.
V4 keeps the oxygen flow to the **IR-cell**, bypassing the furnace.
About **one second** later, the pressure in the furnace drops lower than **one bar** (15 psi) so that the pressure switch opens (no contact any more)
resp. **24V DC** between its two leads.
After a short delay produced by the software, thus allowing sufficient time for the oxygen pressure in the furnace to fall practically to **zero**, the pneumatic valve is de-energised, causing the piston to move down, opening the furnace.

Closing the furnace:

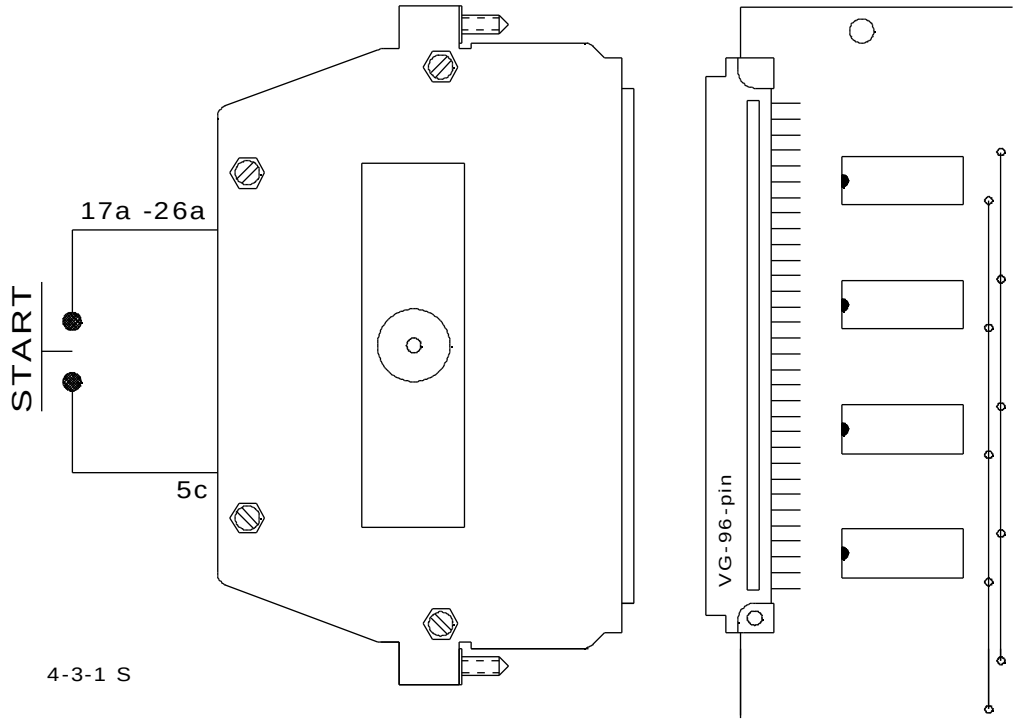
By pressing the key to close the furnace, the pneumatic valve is energised and the piston moves up. At the same time **V3** is also energised, letting oxygen into the furnace area from the top and from the bottom (through the dust filter).
Before the furnace closing cone reaches the **O-ring** to **seal**, the oxygen which enters the furnace area escapes, purging the air out of the furnace. After the cone seals the furnace, the incoming oxygen leads to a growing pressure in the furnace.
When this pressure reaches approx. **one bar** (15 psi) the pressure switch will close **(zero volts between its two leads)**.
After a short delay by the software, **V2, V3** and **V4** will be de-energised.
The closed furnace condition is now reached.

Analogue I/0 signals of the electronic unit:



4.3 Starting through external key:

The analysis can be started by means of an external connected key, if desired.

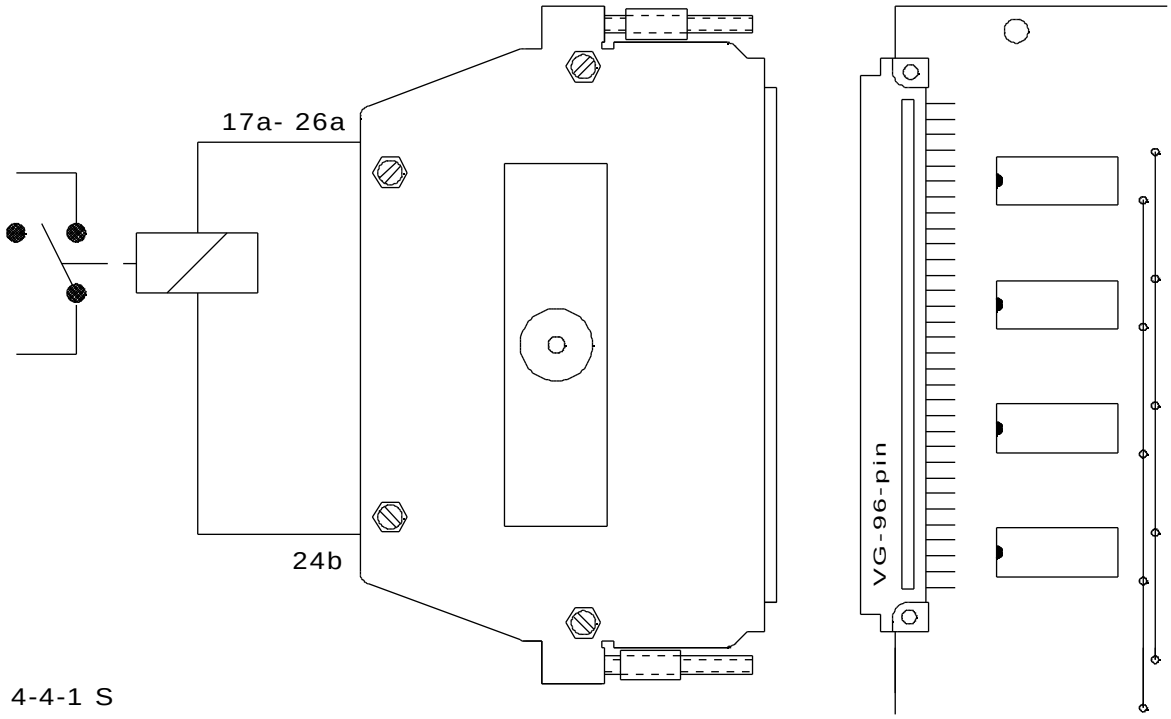


- The key is connected to a **96-pin** connector on the rear-side of the electronic unit. For this purpose, remove the **case** of the **96-pin** plug and connect a wire to the key **(pins 17a to 26a). (All carry +24 volts)**

- The second wire is connected to pin **5C**.

4.4 External report of analysis conditions:

The analysis is running; while the word **"ANALYSIS"** stands on the display; the **pin 24B** on the **96-pin connector** on the rear-side of the electronic is switched to **zero**.



One could, for example, attach a **24 V relay** in order to receive a potential-free contact message that an analysis is underway.

- The relay is attached to the **96 - pin connector**, on the rear-side of the electronic unit. To do this, remove the cover of the **96-pin connector** and attach a **relay wire** to **17a to 26a** (all carry +24 volts).
- The second wire is attached to **pin 24B**.

4.5 Spare parts kits:

Common spare parts kit for all analysers

92610	Tube of grease	1
11064	Reagent tubes 280mm x 16mm	2
11480	Adjustable flow restrictor	1
15087	Gasflow meter 300 l/h	1
15095	Gasflow meter 600 l/h	1
18175	Electronic unit	1
72010	Pressure gauge 2,5 bar (37.5 psi)	1
11035	Cooling fan	1
11492	Inlet pressure regulator	1
11390	Oxygen solenoid valve	1
35310	Pressure switch	1
05067	IR path for high carbon	1
05068	IR path for sulphur	1
05150	IR path connector with window source side	1
05160	IR path connector with window detector side	1
05260	IR path tube (80 to 320 mm)	1
05275	Infrared preamplifier	1
06005	Infrared electronics board IR 21	1
06741	Infrared electronics board IR 41	1
06032	Infrared detector with CO_2 filter	1
06034	Infrared detector with SO_2 filter	1
06421	Infrared power supply assembly IR13	1
06675	Infrared power supply assembly IR45	1
06058	IR Temperature control board TH61	1
06630	IR Temperature control board TH62	1
15037	IR Temperature regulation board NR32	1
11408	Pressure switch	1
15063	Gasflow sensor 300 l/h	1
05042	Chopper motor	1
05065	Chopper motor	1
05048	Infrared source (emitter)	1
05060	Reflector	1
75120	Spring	1
75130	Retaining washer	1
75190	Washer	1
18150	Printer interface-cable	1
18160	Balance interface-cable	1
18171	PC-cable	1
73020	Tube transparent	5m
73030	Tube black id = 4 od = 5	5m
73040	Tube black id = 6 od = 9	1m
90290	Copper oxide	100g
11062	Reagent tubes 160 x 16mm	2
21120	Quartz tube for purification furnace	1
15083	Gasflow meter 15 l/h	1

72020	Gauge 10 bar/140 psi	1
78010	Mains power switch	1
11380	Pneumatic valve	1
16110	Power supply board NK 32	1
77140	HF-filter 250 V	1
15098	Gas flow control board FC 21	1
71004	PLOTON Windows software (for OH/ON 900)	1
71006	PLOTCS Windows software (for CS 500/800)	1
70280	O-ring 18 x 2 VT for chopper motor	2
70330	O-ring 21 x 2 VT for infrared source	6
70120	O-ring 3.4 x 1.9 VT furnace cleaning rods (CS 800)and for furnace platform	1
70150	O-ring 6 x 2.5 VT	1
70210	O-ring 8 x 3.5 VT for catalyst tube (CS 800)and for reagent tube (OH/ON 900)	1
70230	O-ring 9 x 3 VT for reagent tubes and dust filter	1
70320	O-ring 20 x 5 VT for dust filter(CS 800) and for furnace glass tube (CS 500)	1
70350	O-ring 29 x 5 VT for dust filter (CS 800)	1
70370	O ring 34 x 3 VT for dust filter (CS 800)	1
70380	O-ring 35 x 5 VT for combustion tube (CS 800) and for furnace internal (CS 500)	1
70390	O-ring 38 x 5 VT for furnace (CS 800)	1
70285	O-ring 19 x 3 VT for furnace ON/OH 900 (top)	1
70405	O-ring 47.2x 5.7 VT for furnace closure ON/OH	1
70410	O-ring 48 x 3 VT for furnace internal (CS 500)	1
70415	O-ring 62 x 3 VT for furnace ON/OH 900 (centre)	1
70425	O-ring 90 x 2.5 VT for furnace ON/OH (bottom)	1

Spare parts kit for CS-800

90220	Tungsten	2500g
90260	Iron chips	908g
91300	Steel standards (advice %C and %S)	100g
91600	Cast iron standards (advice %C and %S)	100g
92200	Alloy steel standards (advice %C and %S)	100g
11105	Metal dust filter	1
11180	Dust filter cartridge	2
11185	Paper filters	10
13067	Combustion coil	1
14045	Cleaning brush for combustion tube	1
14130	Combustion tube l=145 id=32 od=36 mm	2
77210	Oscillator tube	1
14072	Ceramic heat shield for brush	1
14168	Pedestal	1
20040	Catalyst tube 200 x 16mm	1
80925	Sets of fuses	3
11115	Plastic tube	75mm
11120	Paper filter holder	1
11370	Gasflow regulating valve	1
11400	Pressure outlet solenoid valve	1

11410	Oxygen stop solenoid valve	1
11430	Purge solenoid valve	1
11440	Bypass solenoid valve	1
11470	One way valve	1
12005	Gasflow and furnace control board HF3	1
12016	Gasflow and furnace control board HF42	1
12080	Rectifier	1
77050	Triac	1
77135	Capacitor 2µF for blower (at the generator unit)	1
13175	Insulator	1
13260	High voltage filter	1
77337....	10V/10A filter	2
13270	Resistor	1
77320	Capacitor 100 pF/30KVA	1
13262	Capacitor 700 pF/40KV	1
77350	Capacitor 1µF/50V	2
77600	Grid resistor	1
77610	Resistor	1
14080	Cleaning mechanism rod	1
75122	Spring	1
75130	Safety ring	1
20000	Catalyst furnace	1
11490	Pressure regulator	1
15116	Gas flow sensor	1

4.6 Maintenance CS 800:

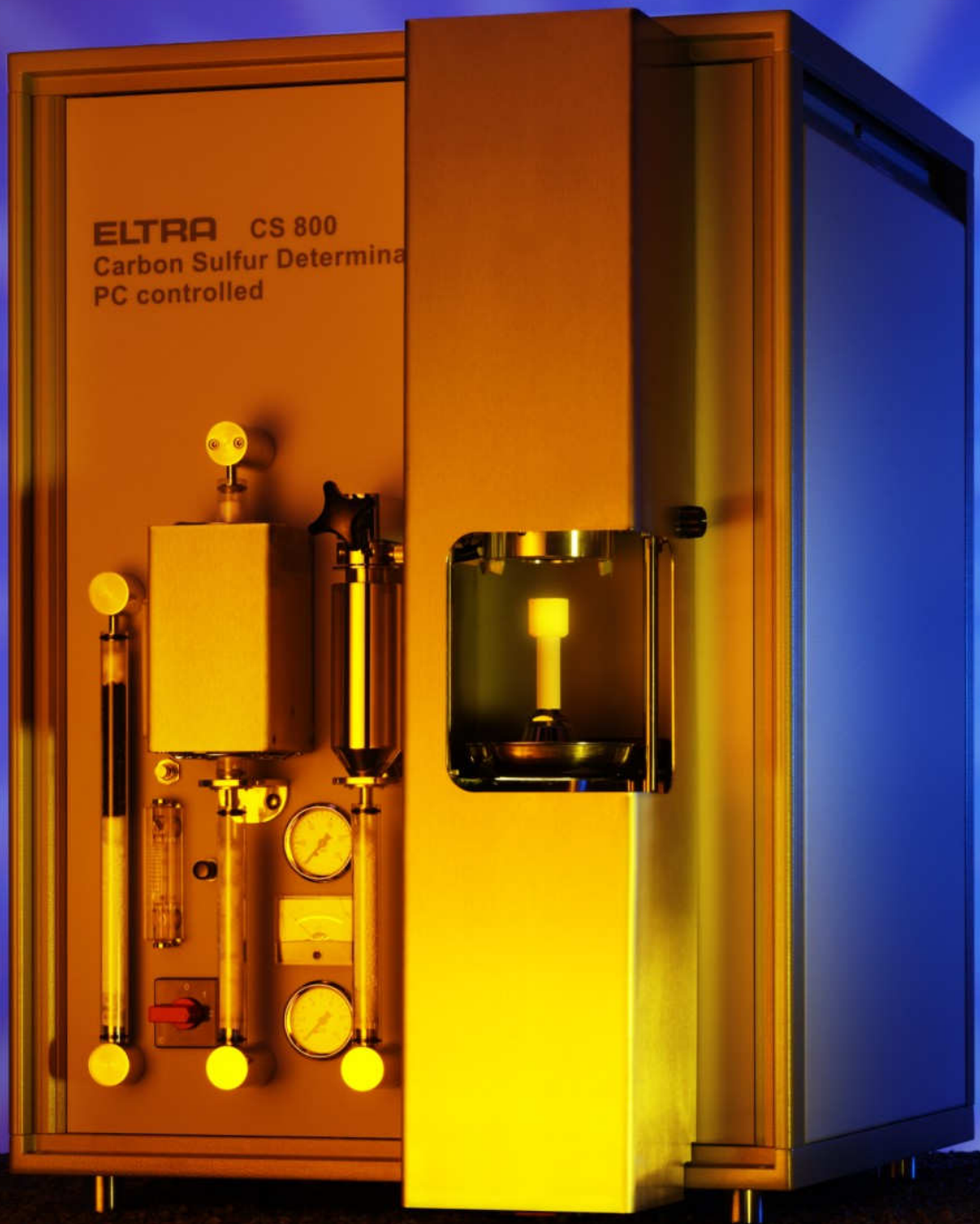
- ☐ Is the furnace closure cone still firm? See **2.8**
- ☐ Check whether the imprint of all the O-rings exceeds 2 mm.
- ☐ Is the inlet pressure regulator set on 1,5 bar (22.5 psi)?
- ☐ Are the other two pressure regulators set on 0,35 bar (5 psi)? See **2.7**
- ☐ Check for leaks. See **3.7**
- ☐ Is the gas flow rate correct? See **2.1**
- ☐ Pressure switch: change over at_____ bar. See **2.2**
- ☐ Does the thermostabilisation work correctly? See **2.5**
- ☐ Check the infrared baseline. See **2.3**
- ☐ Check if all the screws of the generator housing are tightened.
- ☐ Check whether all four „high voltage“ stickers are still in place.
- ☐ Check if the 96-pole plug at the back of the CS 800 is firmly plugged in.
- ☐ Check if all the warning labels are still attached to the side-panels.
- ☐ Calibration of all measuring ranges.

CS - 800 Double Dual Range

Carbon / Sulfur
Determinator

ELTRA
Analysers made in Germany

SERVICE MANUAL



ELTRA GmbH Mainstr. 85 Block 20

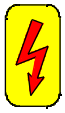
D - 41469 Neuss
Germany
☎ : +49 2137 - 12822
Fax: +49 2137 - 12513
analysers@eltragmbh.com
www.eltragmbh.com

NOTE :

In this Service Manual, no information is repeated from the Operation Manual, as it may be appreciated.

Service should only be done by persons who have mastered the servicing and maintenance of this device, as well as having further qualifications, especially in the areas of electronics and physics.

We ask the users of this Service Manual bring to our attention any possible mistakes. We would also appreciate any suggestions for supplements and improvements to this Service Manual.

CAUTION ! 

Before opening this device, always unplug the main power !

Service Manual CS-800

as from Serial No. 0951000xxx

0.1 Overview of the CS-800 modifications....0.1-5

1 FAULTS

1.1 IR-cell test display ++++ see 2. 3 ....1.1-1
1.2 Gas flow too high or too low....1.2-1
1.3 The gas flow rate fluctuates....1.3-1
1.4 No combustion....1.4-1
1.5 Bad combustion....1.5-1
1.6 Electronic drivers malfunctioning....1.6-1
1.7 The furnace does not close....1.7-1
1.8 The analysis takes too long....1.8-1
1.9 Development of dust when closing the furnace....1.9-1
1.10 Erratic results....1.10-1
1.11 The results are always 0.0000% or 00.0 ppm....1.11-1
1.12 Beeper responding....1.12-1
1.13 The life time of the combustion tube is too short....1.13-1
1.14 The LED for the infrared cell temperature regulation does not flash....1.14-1
1.15 The fuse burns out at the beginning of combustion....1.15-1
1.16 The fuse blows at the end of the analysis....1.16-1
1.17 Large collection of dust when opening the furnace....1.17-1
1.18 No or low oxygen pressure....1.18-1
1.19 Saved data are lost....1.19-1
1.20 Noise or drift of the infrared baseline....1.20-1
1.21 Dust in the oxygen carrying tube when the furnace opens....1.21-1
1.22 The word Eltra appears on the display....1.22-1
1.23 The oxygen pressure falls when the furnace opens....1.23-1
1.24 Combustion without pressing " START "....1.24-1
1.25 The crucible cracks or melts....1.25-1
1.26 The analysis doesn´t start....1.26-1
1.27 Vibrations on setting 2....1.27-1
1.28 The analysis cycle stops only 25 seconds after start....1.28-1
1.29 The chopper motor doesn`t rotate....1.29-1
1.30 High carbon results are erretic....1.30-1

2 ADJUSTMENT, TEST AND FUNCTION EXPLANATIONS

2.1 Gas flow controller adjustment and jumper setting....2.1-1
2.2 Pressure switch....2.2-1
2.3 Infrared zero-baseline, control and adjustment....2.3-1
2.4 IR-source voltage setting....2.4-1
2.5 Temperature regulation of the IR-cell....2.5-1
2.6 Pneumatics....2.6-1
2.7 Pressure regulation....2.7-1
2.8 Closing cone, adjustment....2.8-1
2.9 Linearisation....2.9-1
2.10 Programming the balance....2.10-1
2.11 ....2.11-1
2.12 Induction generator control....2.12-1
2.13 Diagnostic printous....2.13-1
2.14 Setting check up....2.14-1

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3 SERVICE

3.1 IR-paths, cleaning and replacing 3.1-1
3.2 IR-source 3.2-1
3.3 Infrared electronics 3.3-1
3.4 Infrared power supply 3.4-1
3.5 Chopper ++++ see **3. 2** 3.5-1
3.6 Infrared temperature regulation 3.6-1
3.7 Leak checking 3.7-1
3.8 Replacing EPROMs 3.8-1
3.9 Clearing memory 3.9-1
3.10 Electronic reset 3.10-1
3.11 Coding IR-ranges 3.11-1
3.12 Adding new channels 3.12-1
3.13 Cleaning the solenoid valves 3.13-1
3.14 Replacing the flow sensor 3.14-1
3.15 Installing an AC-power stabiliser 3.15-1
3.16 Additional safety features for furnace pneumatics (optional) 3.16-1
3.17 Installing a halogen trap 3.17-1
3.18 Gas saving mode 3.18-1
3.19 Upgrade for copper analysis without accelerators 3.19-1
3.20 Upgrading of analysers with electronic rack for using the new Windows software 3.20-1
3.21 Preventive Maintenance checklist 3.21-1

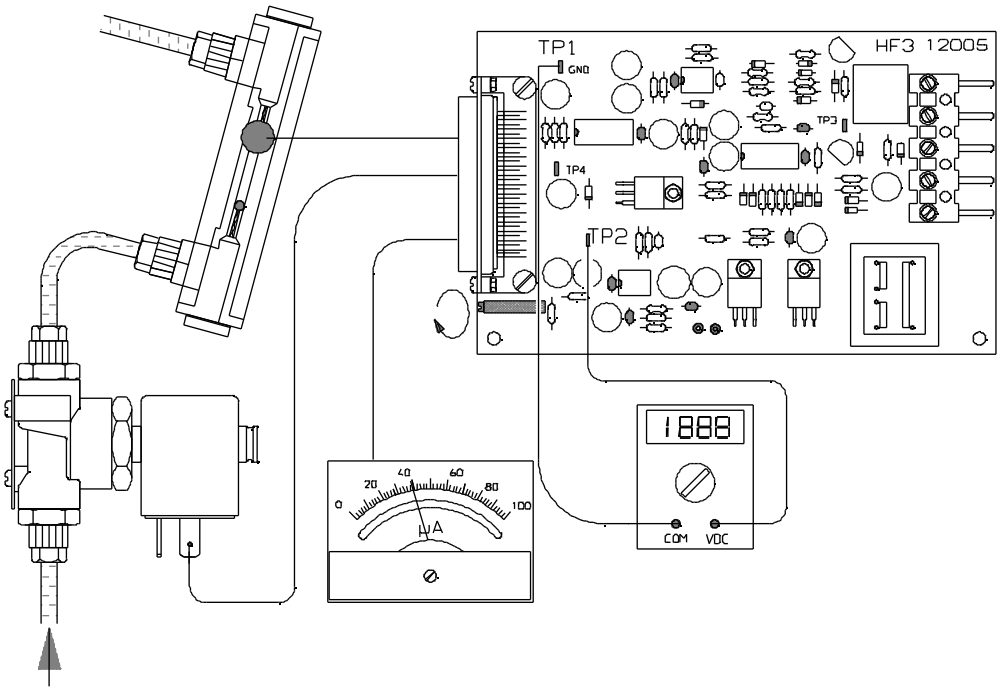
4 MISCELLANEOUS

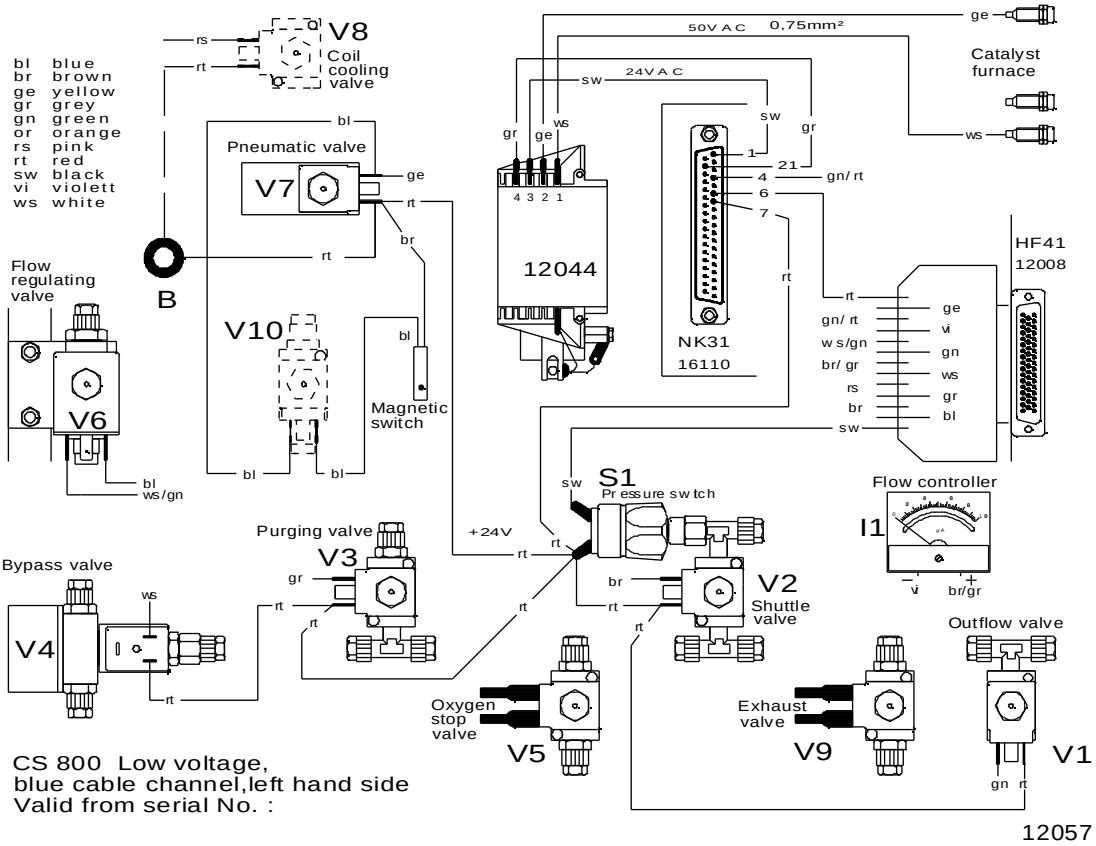
4.1 Ordering numbers 4.1-1
4.2 Wiring and gas flow diagrams 4.2-1
4.3 Starting through external key 4.3-1
4.4 External report of analysis condition 4.4-1
4.5 Spare parts kits 4.5-1
4.6 Maintenance CS-800 ..... 4.5-1

0.1 Overview of the CS-800 modifications:

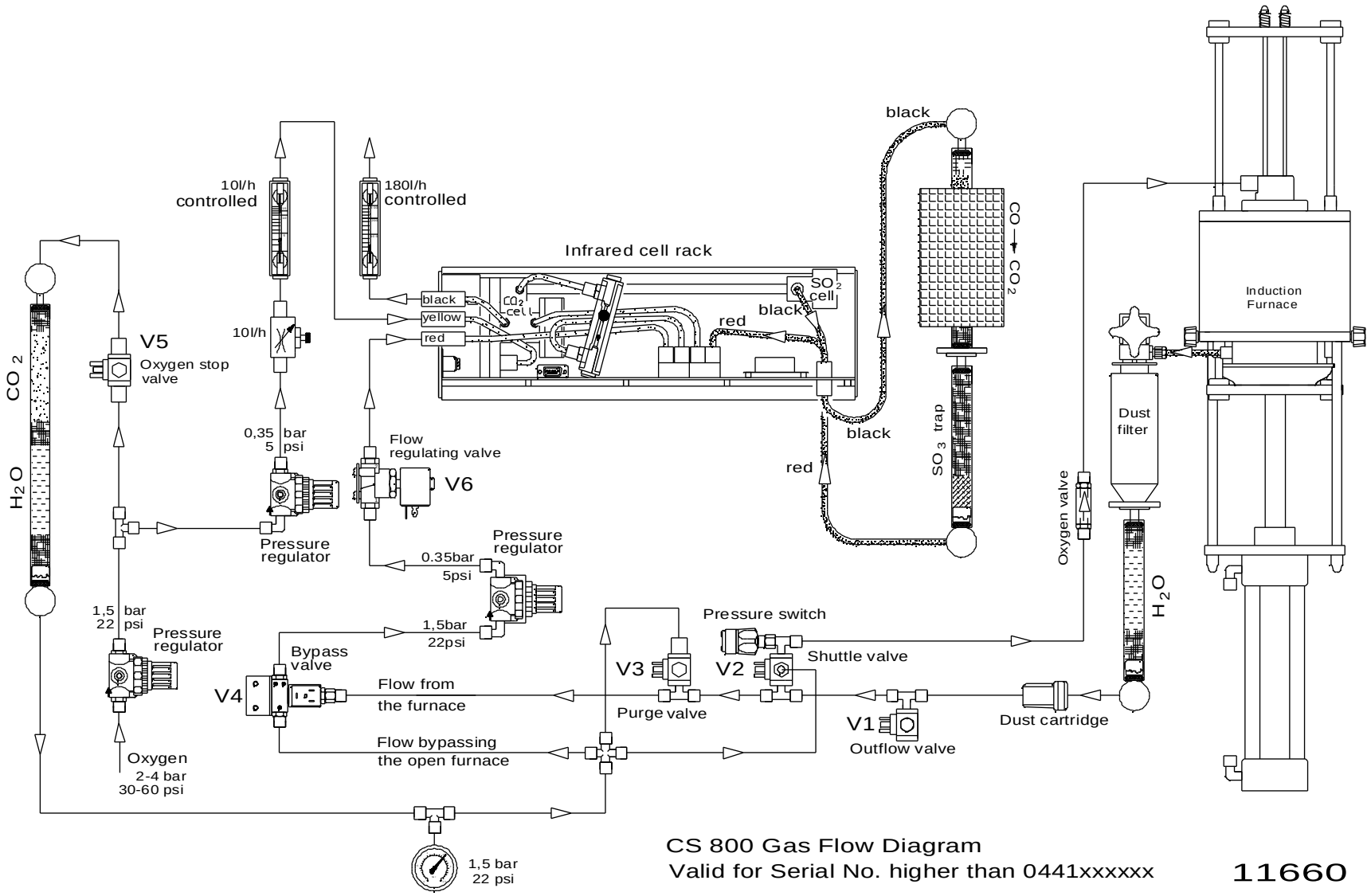
Up to S/N0766xxxxxx

The CS-800 analysers are equipped with a flow sensor with optical elements and with the corresponding board **HF-3** and **HF-4**.





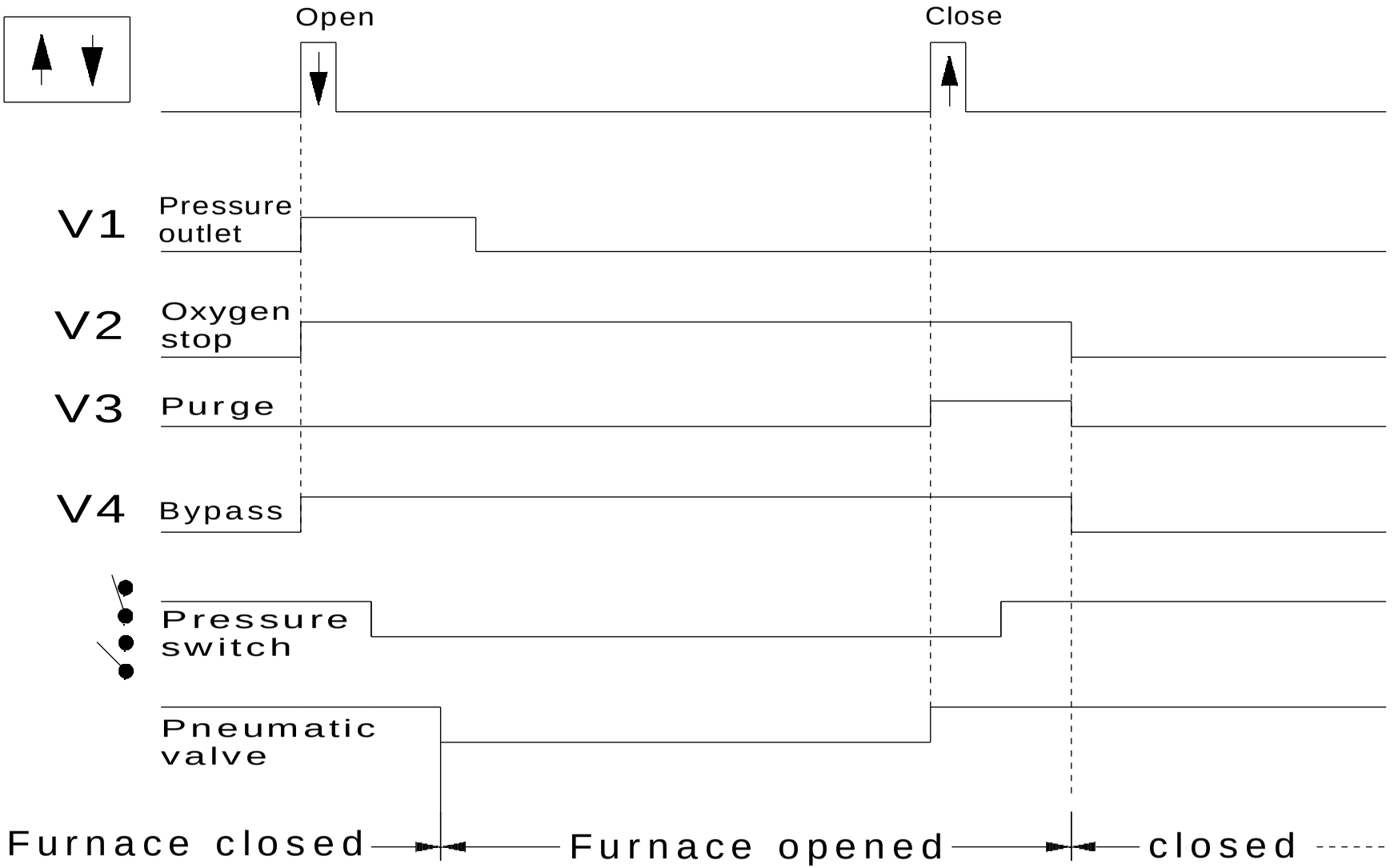
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CS 800 Gas Flow Diagram
Valid for Serial No. higher than 0441xxxxxx

11660

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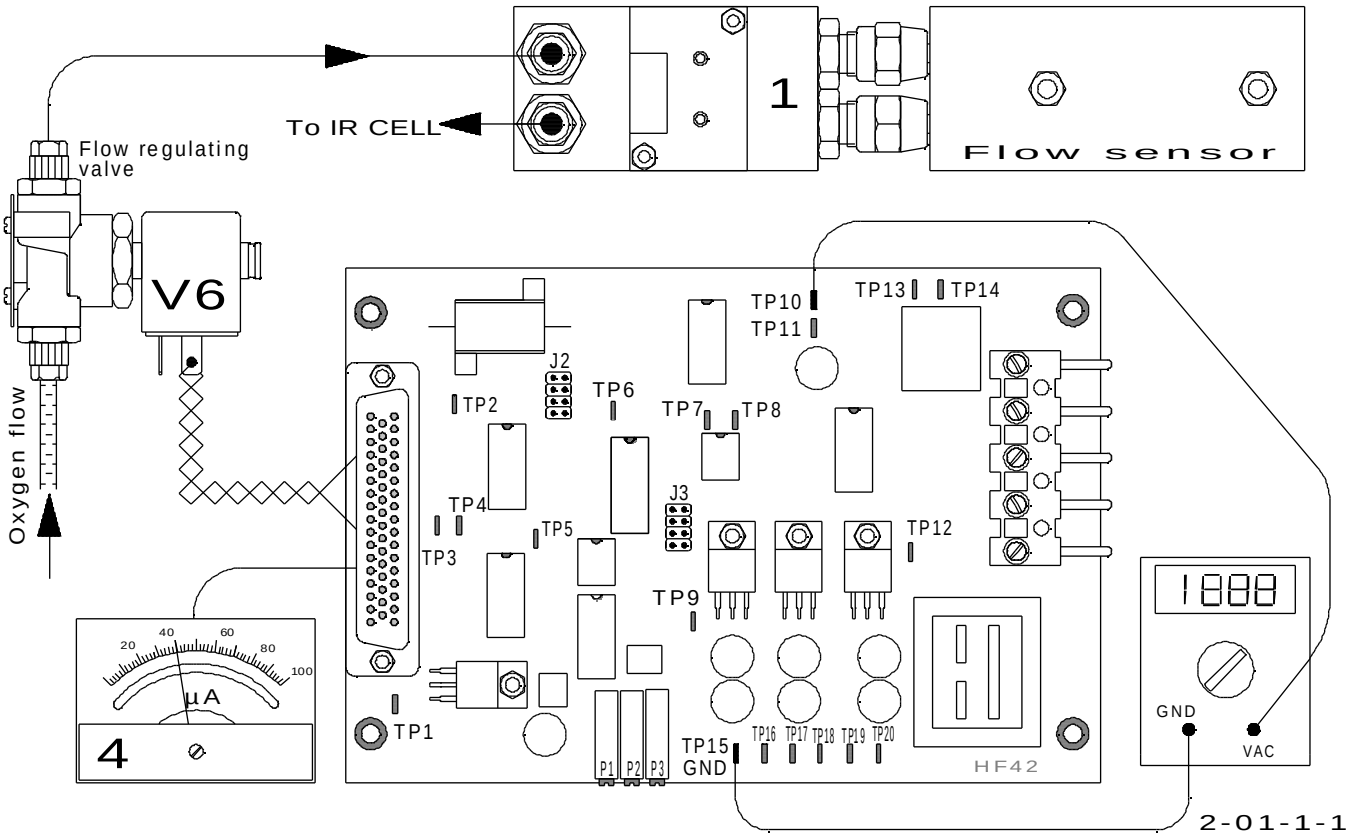


From S/N 0767xxxxxx

The CS-800 is equipped with a flow sensor employing a pressure transducer, and with the corresponding boards **HF-41** and later the **HF-42**.
These boards also offer:

- Current limit for the **induction furnace** (on board HF 41/42 adjustment)
- **Oxygen flow** only during combustion (on board jumber)
- **Gas saving mode** by controlling the oxygen flow (start / stop) by the software

This function has been included later in the software, from **SN / 1080xxxx**
Analysers from **SN / 0767 to SN / 1079** can be upgraded with this function.
For description see **"corresponding service manual"**

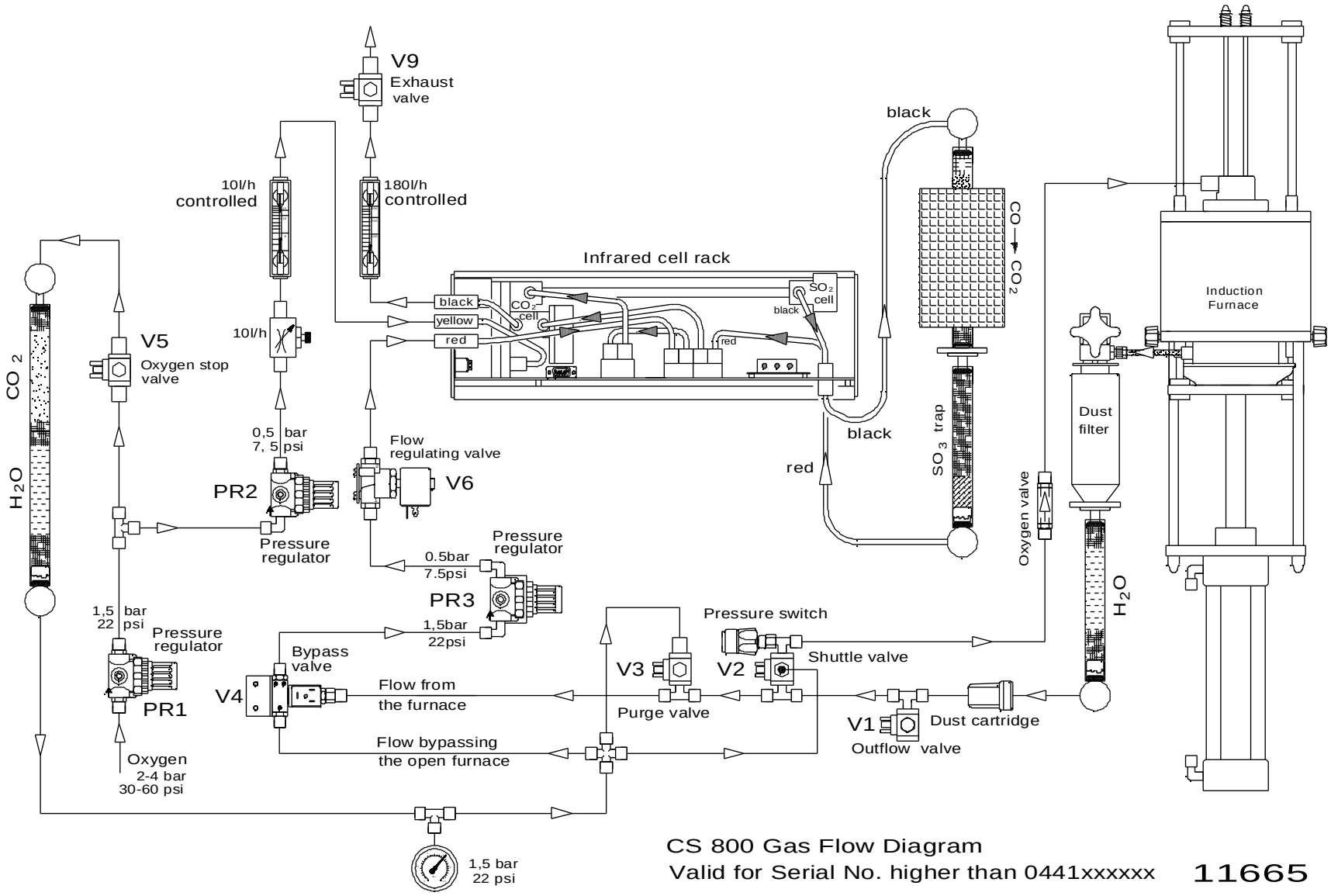


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CS 800 Signal and control

Valid for CS 800 with serial No. over 12058

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CS 800 Gas Flow Diagram

Valid for Serial No. higher than 0441xxxxxx

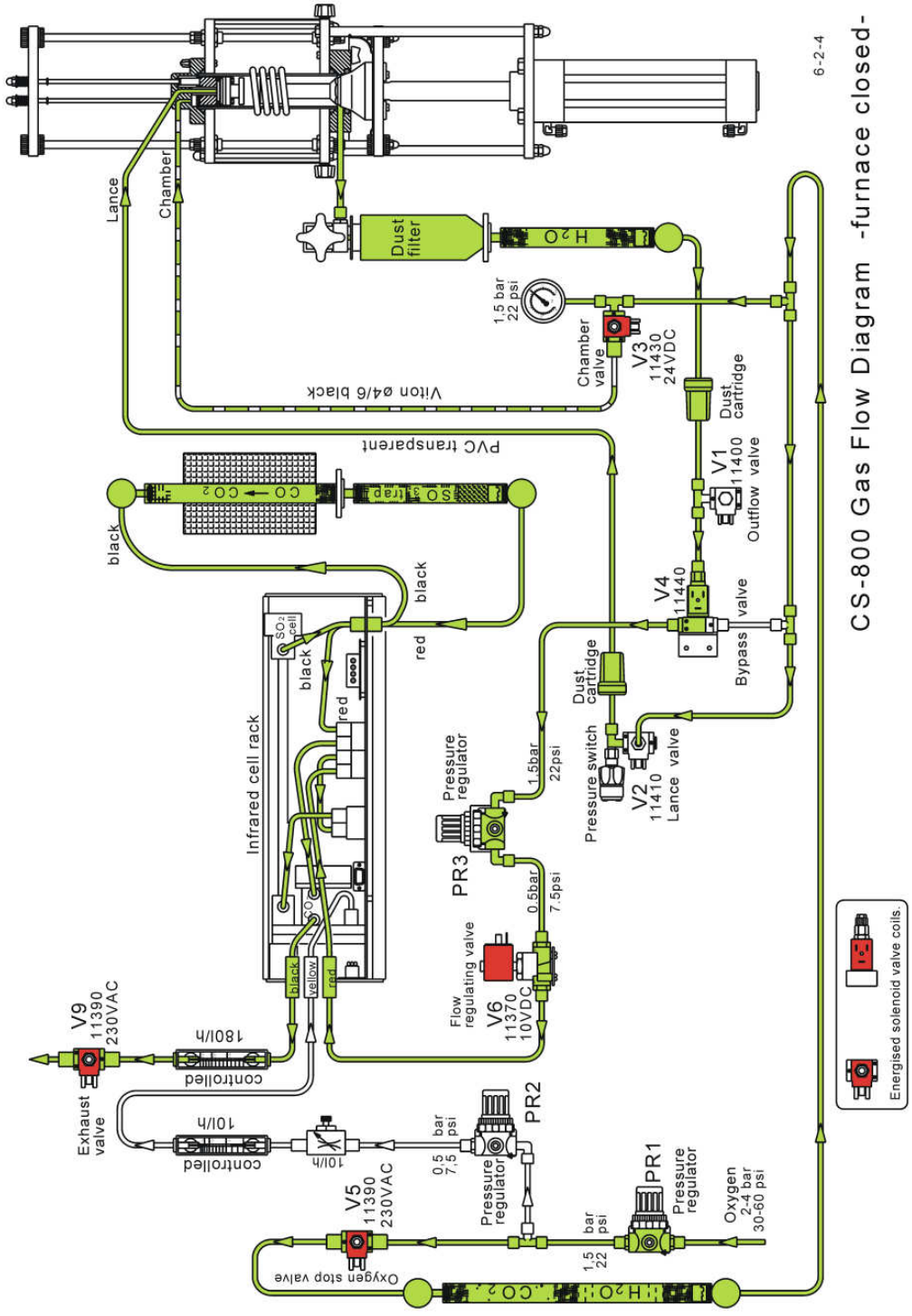
11665

From S/N 0951xxxxxx

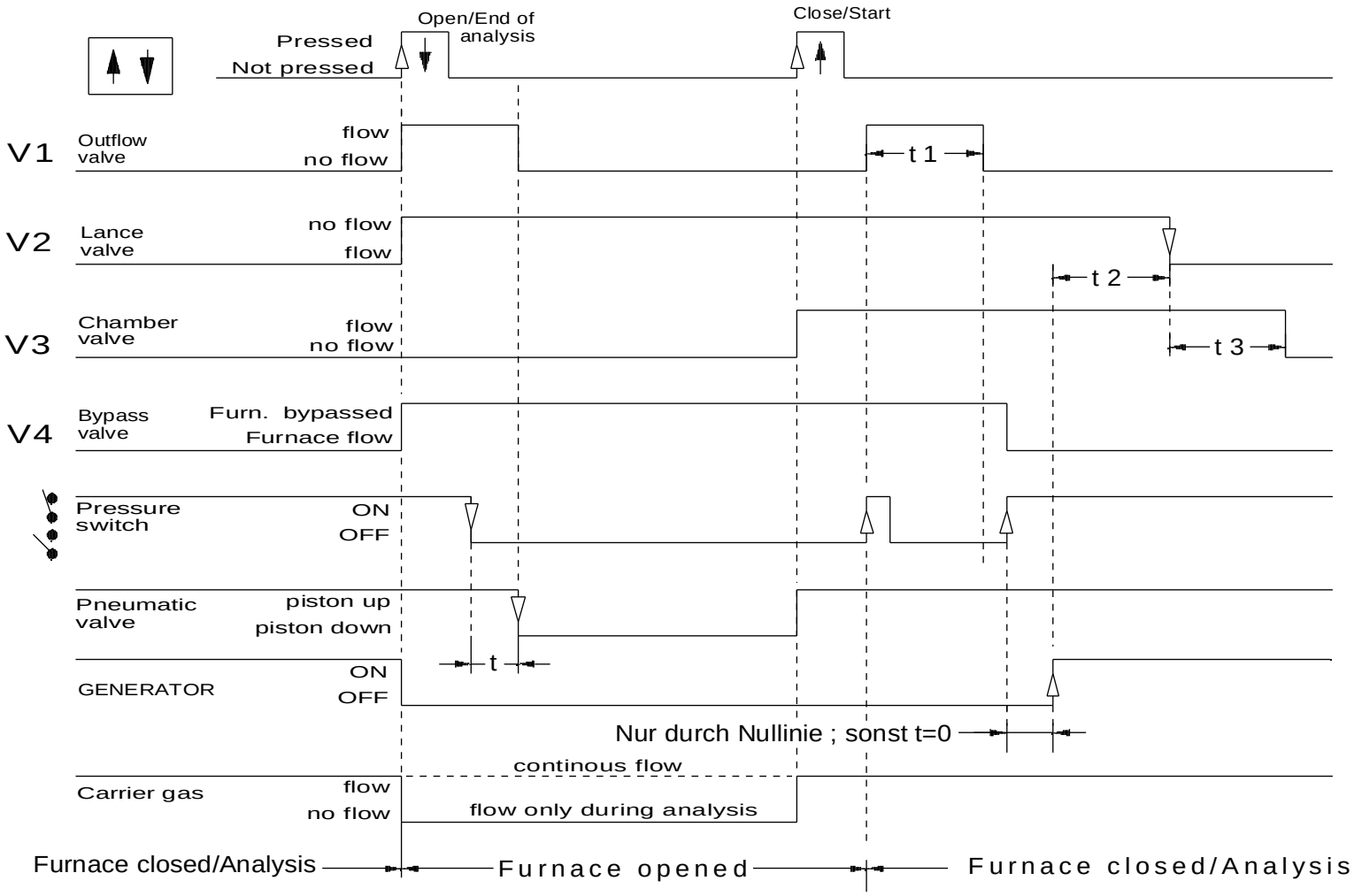
The **CS-800** has an additional purging inlet on top of the combustion chamber.

- The position of the solenoid valves is rearranged and their controlling software is modified accordingly. Therefore, a very good care has to be taken when changing the **EPROMS**.

- The wiring has also changed. It has been modified to be used with the **IR-4**, and the four **IR-cell** rack. As the **4-cell** software was not available, the **CS-800** was equipped with the still available with the **3-range IR-cell** using an adapter and the **3-cell** software up to **SN / 1079xxxx**.



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V2	V3	
H	H	Only chamber flow
H	L	No flow
L	H	Lance and chamber flow
L	L	Only lance flow

t1 : Purging befor combustion
t2 : Chamber oxygen only
t3 : Lance and chamber oxygen
Rest of combuston after t3, lance oxygen only

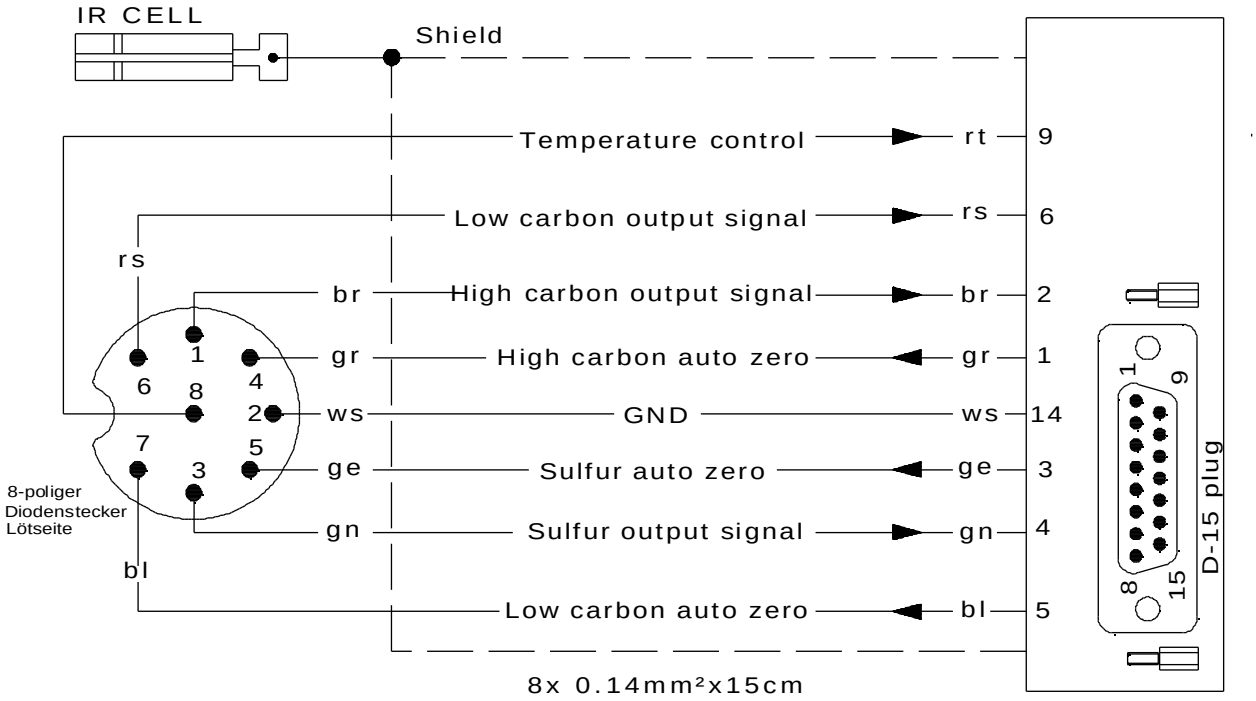
NOTE: V1 and V3 enable the oxygen flow when they are energised.
V2 stops the oxygen flow when it is energised.
Valid for all valves (V1 to V4 and for the pneumastic valve):
High means the coil is energised.
Low means the coil is not energised.

12202

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bl	blue
br	brown
ge	yellow
gr	grey
gn	green
or	orange
rs	pink
rt	red
sw	black
vi	violett
ws	white

h	24.01.2002				
g	23.01.2002				
f	30. 4. 2001		Datum	Name	Benennung: CS-800 CS-2000 Signalleitung für IR-4
e	27. 3. 2001	gez.:	14. 7. 2000	Knipp	
d	5. 3. 2001	gepr.:	14. 7. 2000	Polemitis	
c	20. 9. 2000				
b	18. 9. 2000	ELTRA			Zeichnungs-Nr.: 12059
a	29. 8. 2000	Mainstr. 85 Block 20 D-41469 Neuss			
Bez.:	geändert am:				



bl	blue
br	brown
ge	yellow
gr	grey
gn	green
or	orange
rs	pink
rt	red
sw	black
vi	violett
ws	white

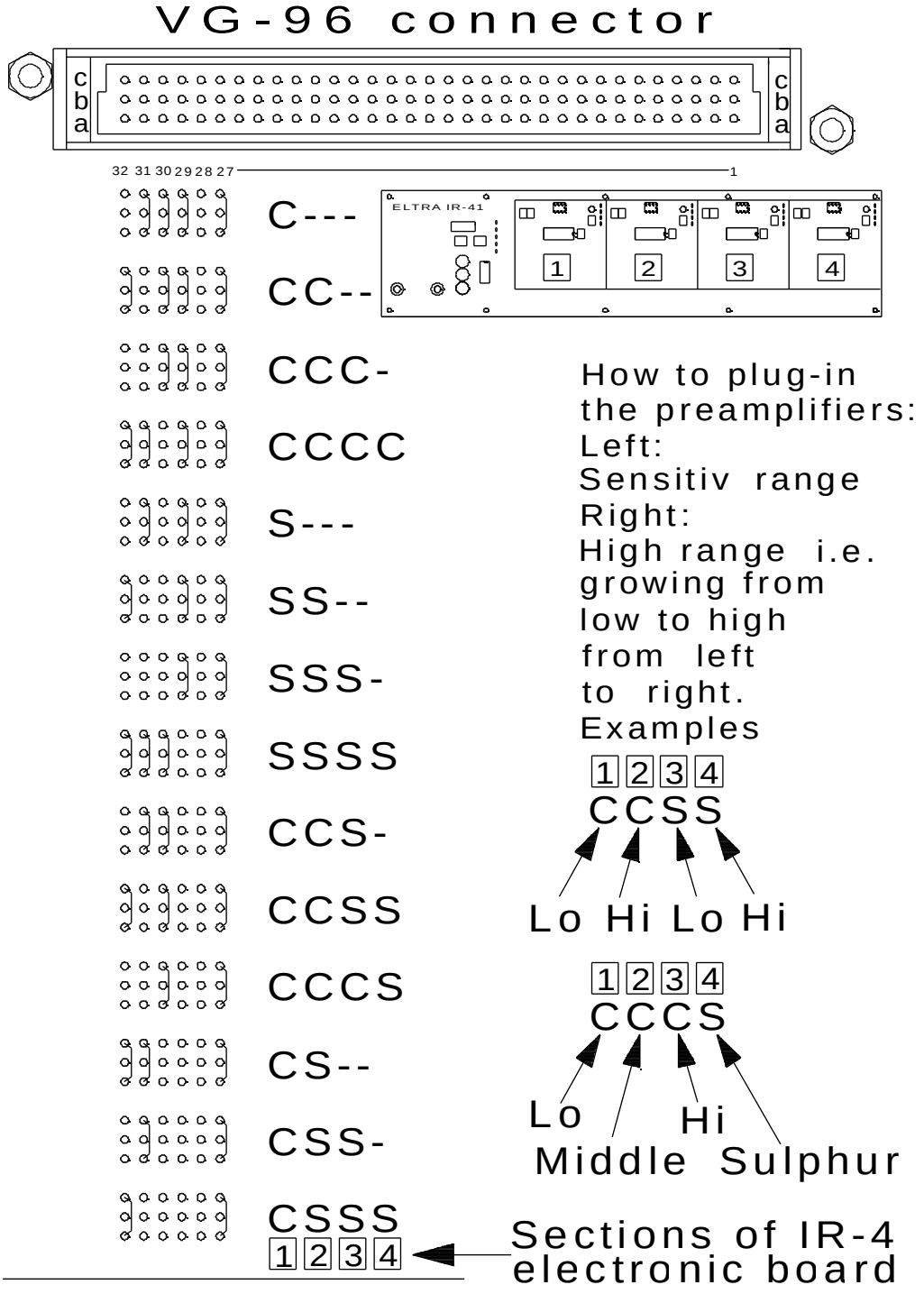
			Datum	Name	Benennung:
		gez.:	18. 9.2000	Knipp	IR Signal adapter Alte Zelle-neuer Analysator- -alte Software
		gepr.:	18. 9.2000	Polemitis	
		ELTRA Mainstr. 85 Block 20 D-41469 Neuss			Zeichnungs-Nr.: 12068
Bez.:	geändert am:				

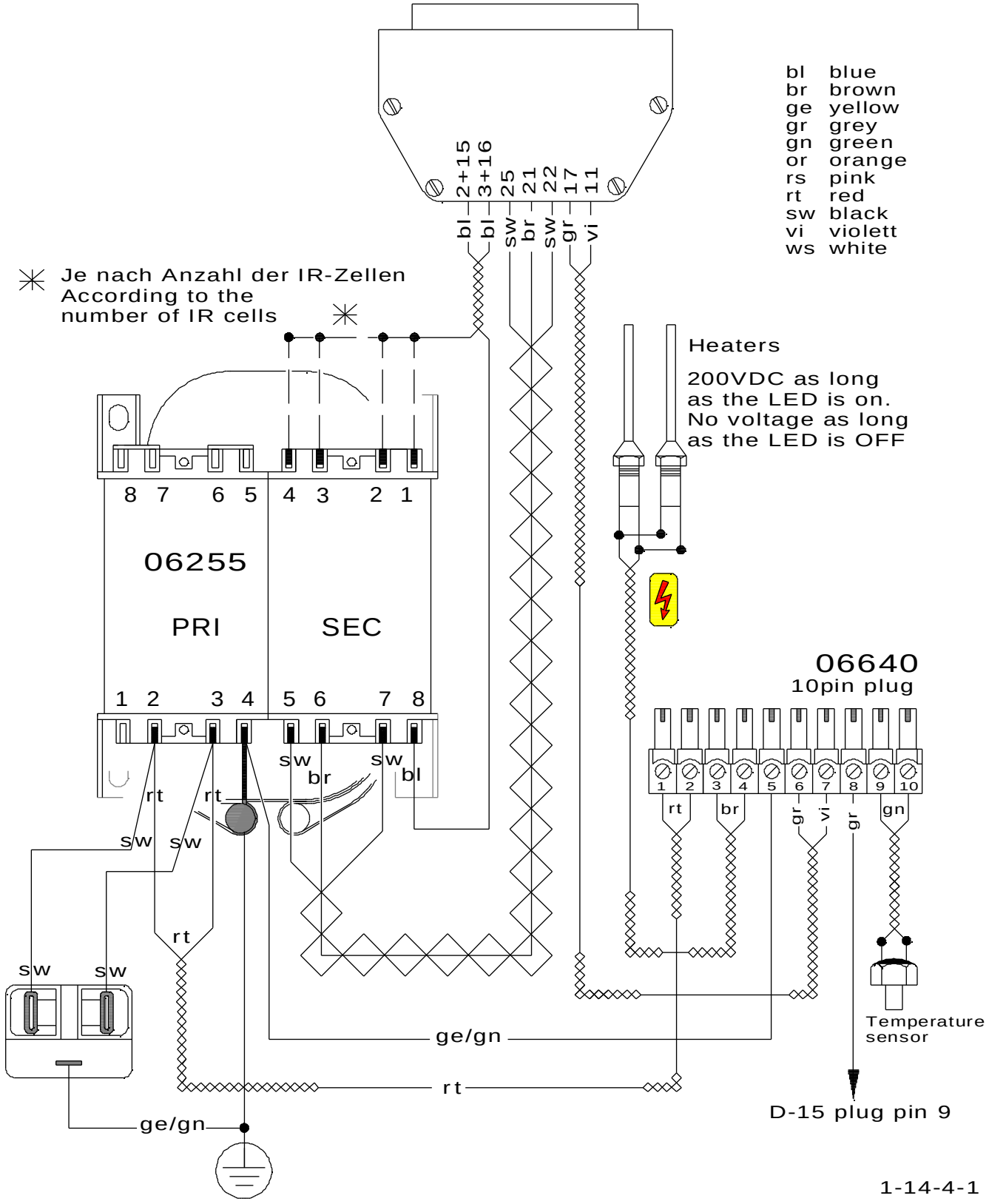
From S/N 1080xxxxxx

The **CS-800** is equipped with the **four IR-cell** rack. All electronic boards as well as the chopper motor **ARE DIFFERENT** to those of the previous **3-range IR-cell**.

The software changed to the four IR-range version !!!

The gas saving mode is available and selectable in the PC software **PLOTCS**.
When an analysis has not been carried out for a period of time, the analyser will automatically switch to **" Gas Conservation Mode "**. This effectively means the carrier gas flow rate is reduced to a minimum, only < allowing a small amount of **oxygen** to circulate through the **IR-cell** etc. The period of time before the Gas Conservation is activated, can be modified via the PC Software. It is also possible to have carrier gas flow only during combustion.

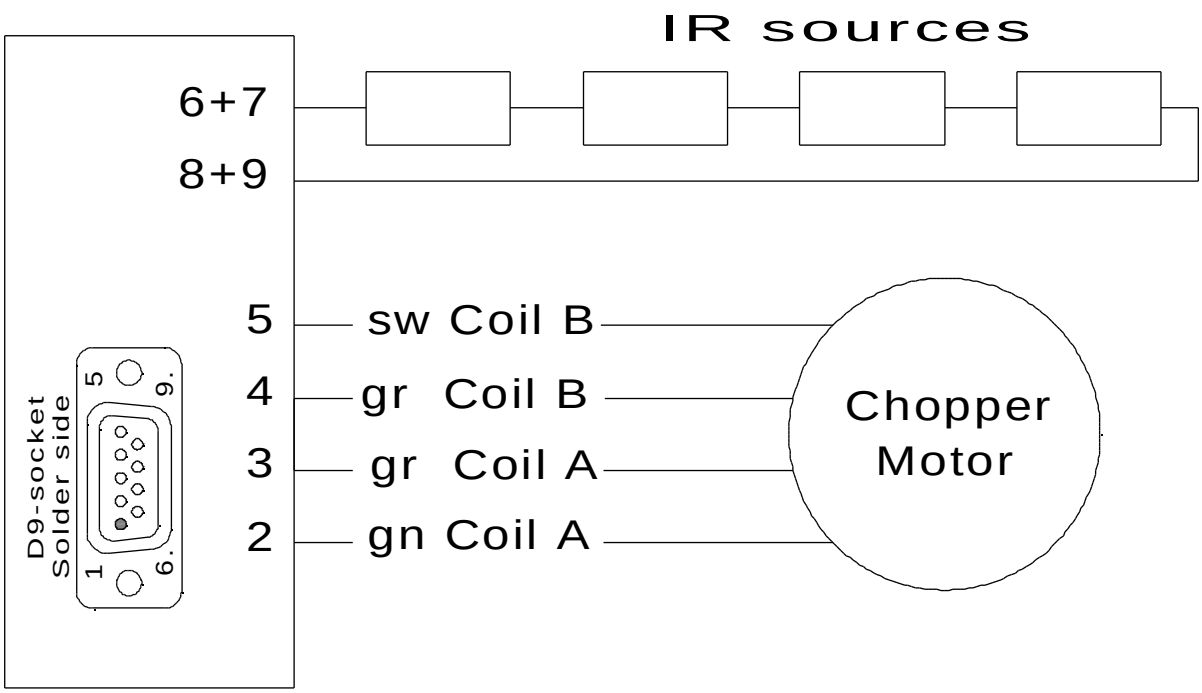



bl blue
br brown
ge yellow
gr grey
gn green
or orange
rs pink
rt red
sw black
vi violett
ws white
2+15
3+16
25
21
22
17
11
bl
bl
sw
br
sw
gr
vi
Je nach Anzahl der IR-Zellen
According to the
number of IR cells
Heaters
200VDC as long
as the LED is on.
No voltage as long
as the LED is OFF
8 7 6 5 4 3 2 1
06255
PRI
SEC
1 2 3 4 5 6 7 8
06640
10pin plug
1 2 3 4 5 6 7 8 9 10
rt
br
gr
vi
gr
gn
sw
br
bl
rt
rt
sw
sw
rt
sw
sw
ge/gn
rt
ge/gn
Temperature
sensor
D-15 plug pin 9

1-14-4-1

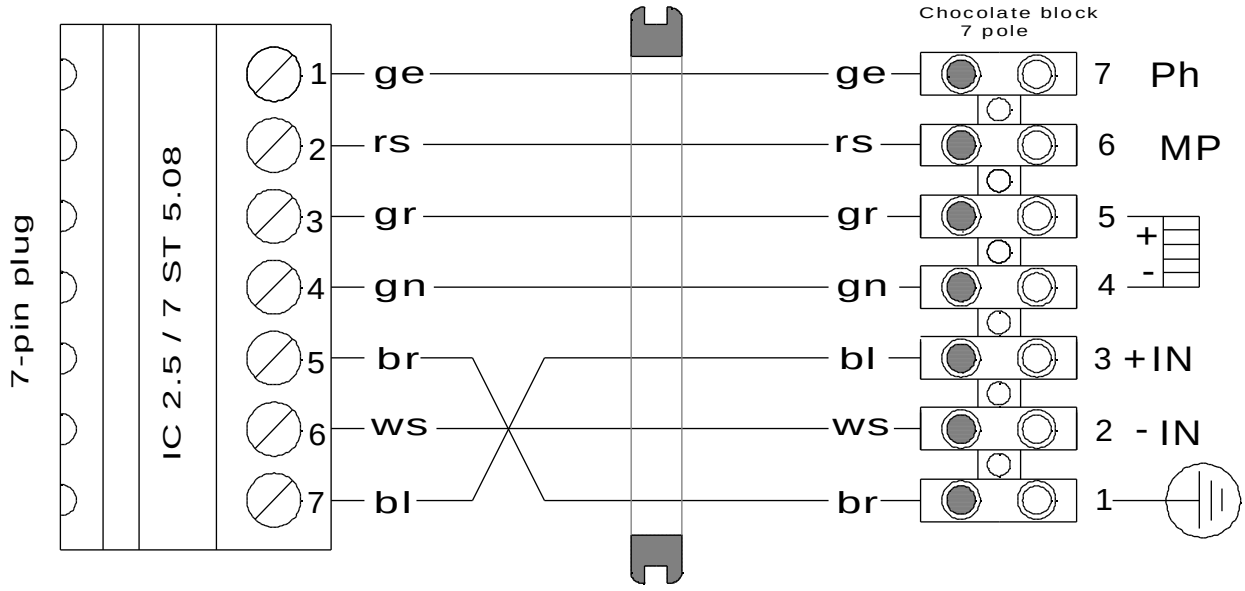
			Datum	Name	Benennung: IR - 4 rack Wiring diagram
		gez.:	10.7.2000	Knipp	
		gepr.:	10.7.2000	Polemitis	
b	22. 1. 2002	ELTRA			Zeichnungs-Nr.: 06665
a	3. 5. 2001	Mainstr. 85 Block 20			
Bez.:	geändert am:	D-41469 Neuss			

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bl blue
br brown
ge yellow
gr grey
gn green
or orange
rs pink
rt red
sw black
vi violett
ws white

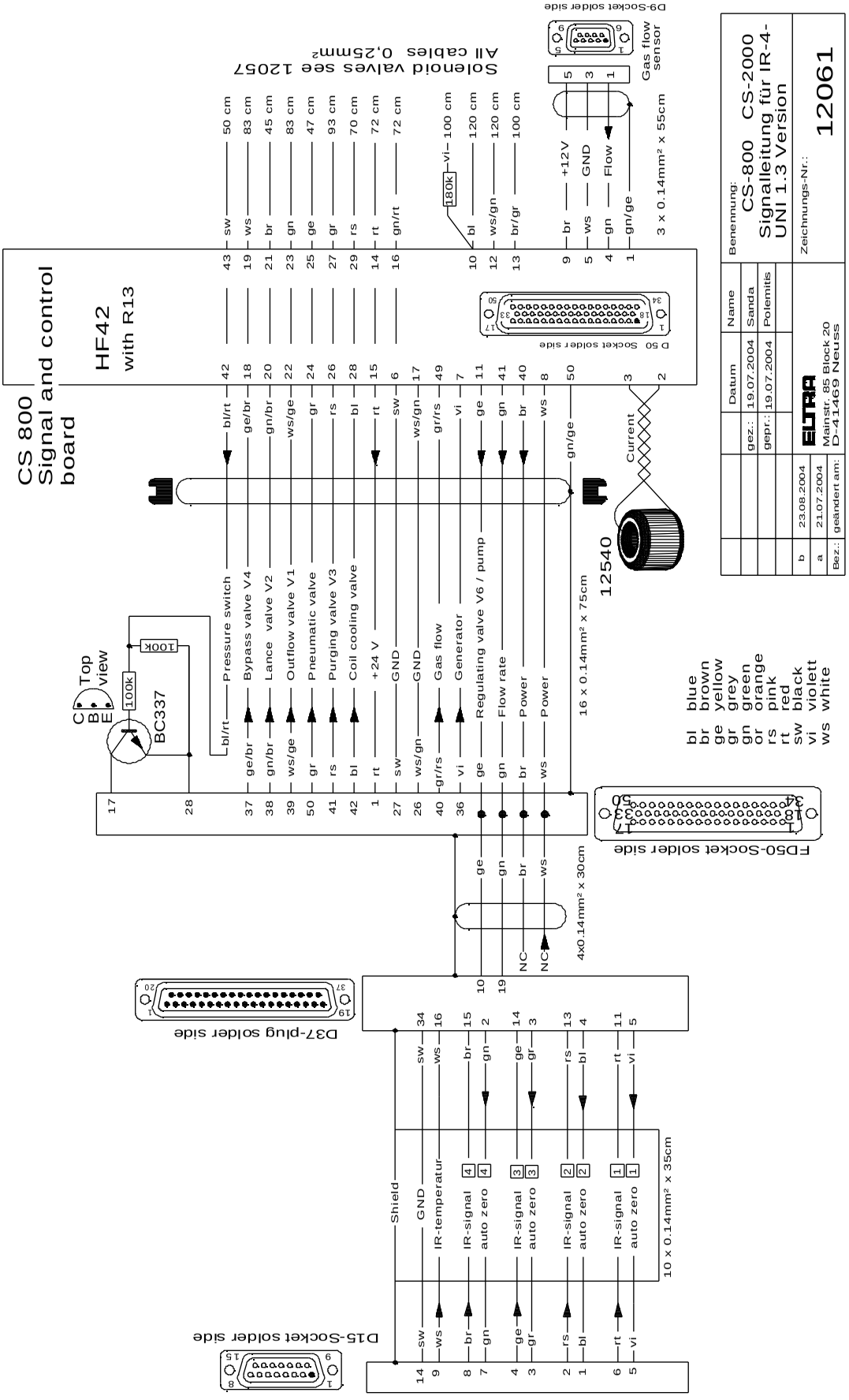
				Datum	Name	Benennung:
			gez.:	10.7.2000	Knipp	Chopper motor and IR source
			gepr.:	10.7.2000	Polemitis	
			ELTRA			Zeichnungs-Nr.:
			Mainstr. 85 Block 20			06660
Bez.:	geändert am:	gepr.:	D-41469 Neuss			



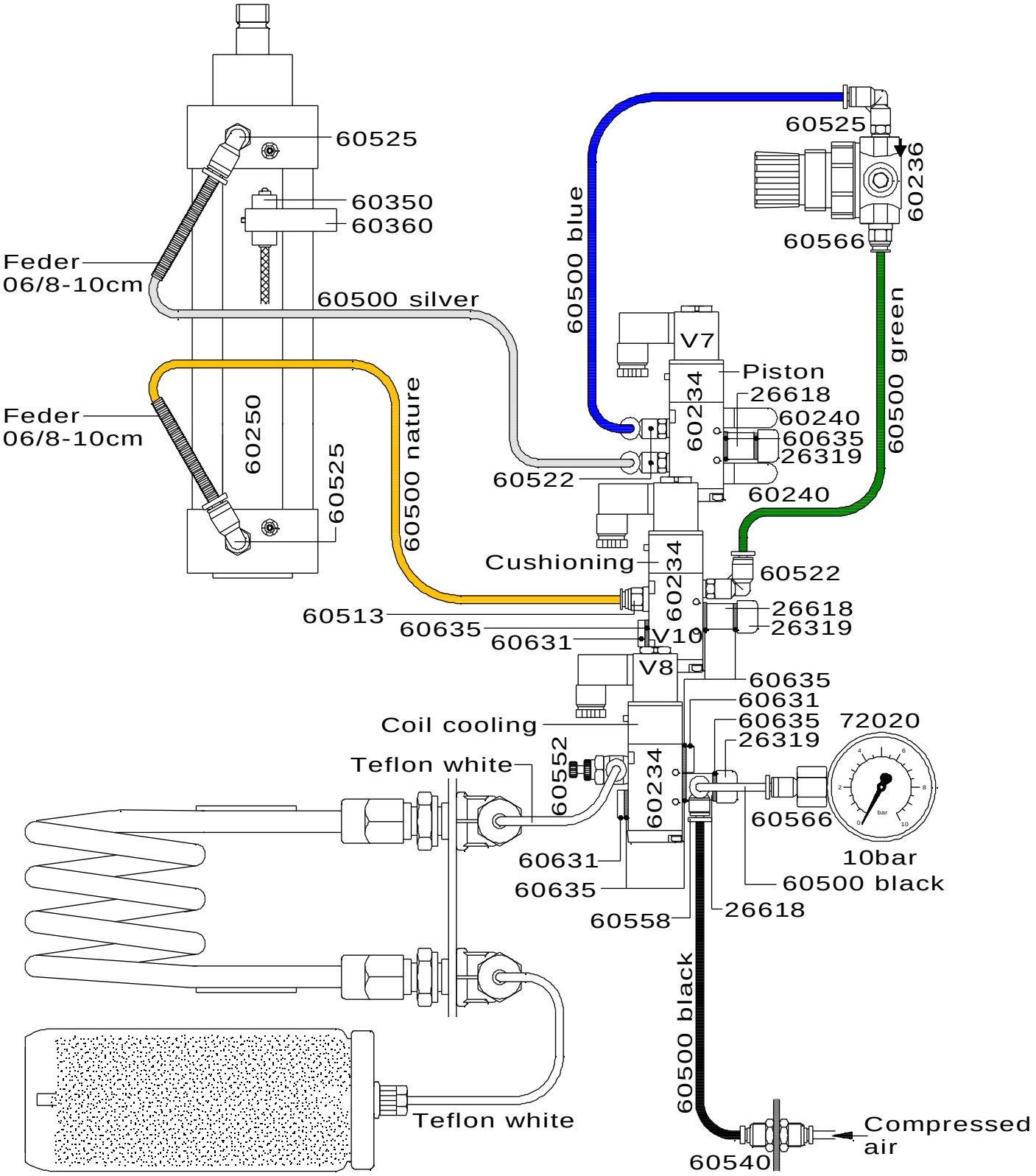
			Datum	Name	Benennung:
		gez.:	25.08.2000	Knipp	Cable conection TH 62 - NR 32 (15037)
		gepr.:	26.08.2000	Polemitis	
		ELTRA Mainstr. 85 Block 20 D-41469 Neuss			Zeichnungs-Nr.: 06645
Bez.:	geändert am:				

From S/N 1557xxxxxx

The electronic unit is replaced by the board UNI 1.3 and the electronic rack is removed.
The corresponding wiring diagram is **12061**.
The modification took place in the second half of 2004.



From end of the year 2007 the CS-800 is equipped with the new pneumatics.



1 FAULTS

1.1 IR-cell test display: ++++ see 2. 3

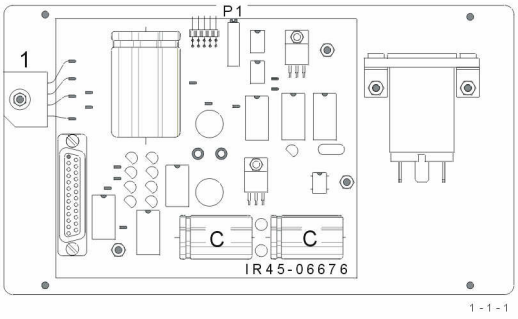
also after five minutes of oxygen flow:

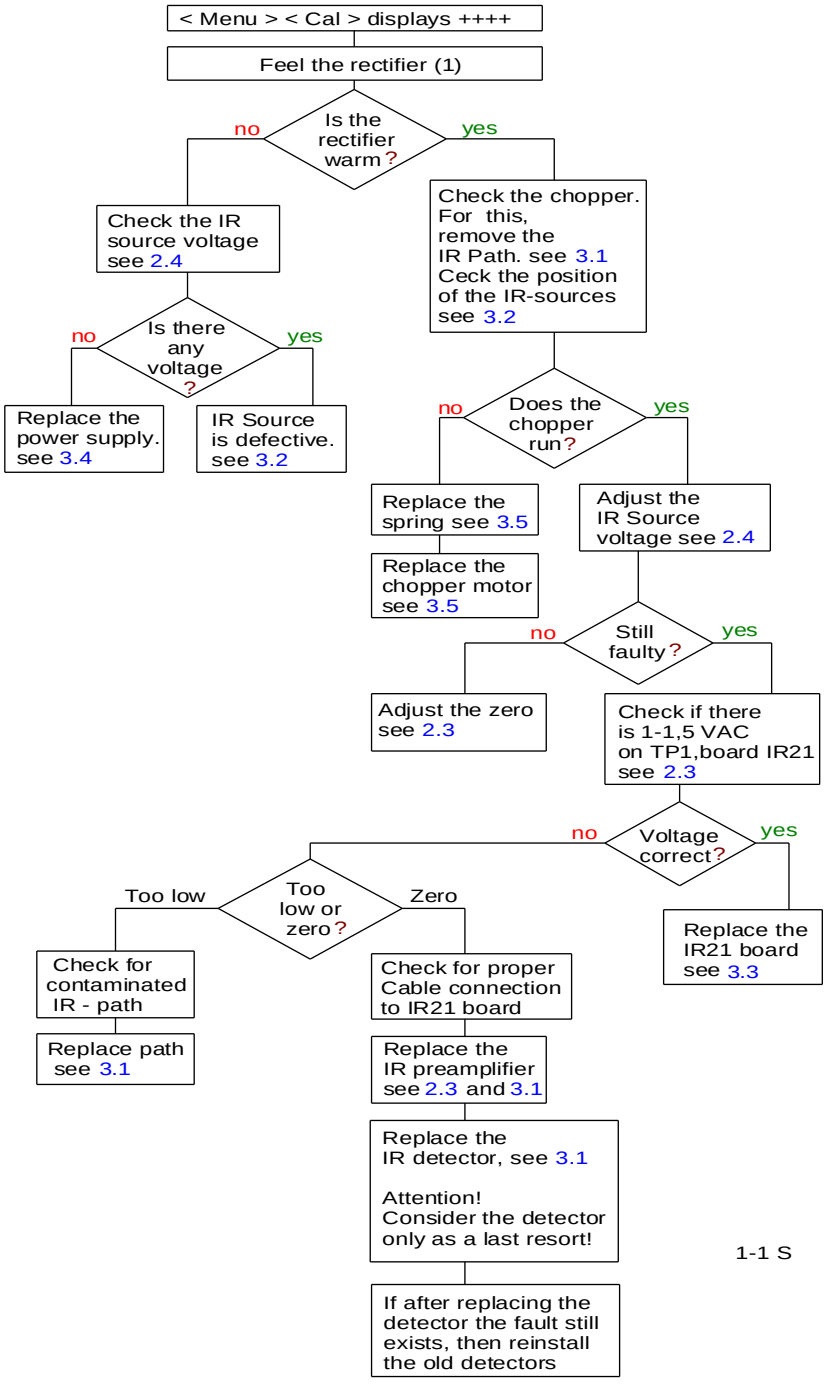
If the range is higher than **10 V, ++++** then the problems are as follows:

1). **Too much contamination of the IR-paths:**
In case the analyser has more than one cell, and if not all of them shows **++++**, then a contamination is very likely.

2). **The IR-Sources:**
The sources are bent or de-adjusted through transport. See **Remark:**

3). **Chopper:**
The chopper is not running. This is obvious when the paths are clean and the IR-sources are in place.

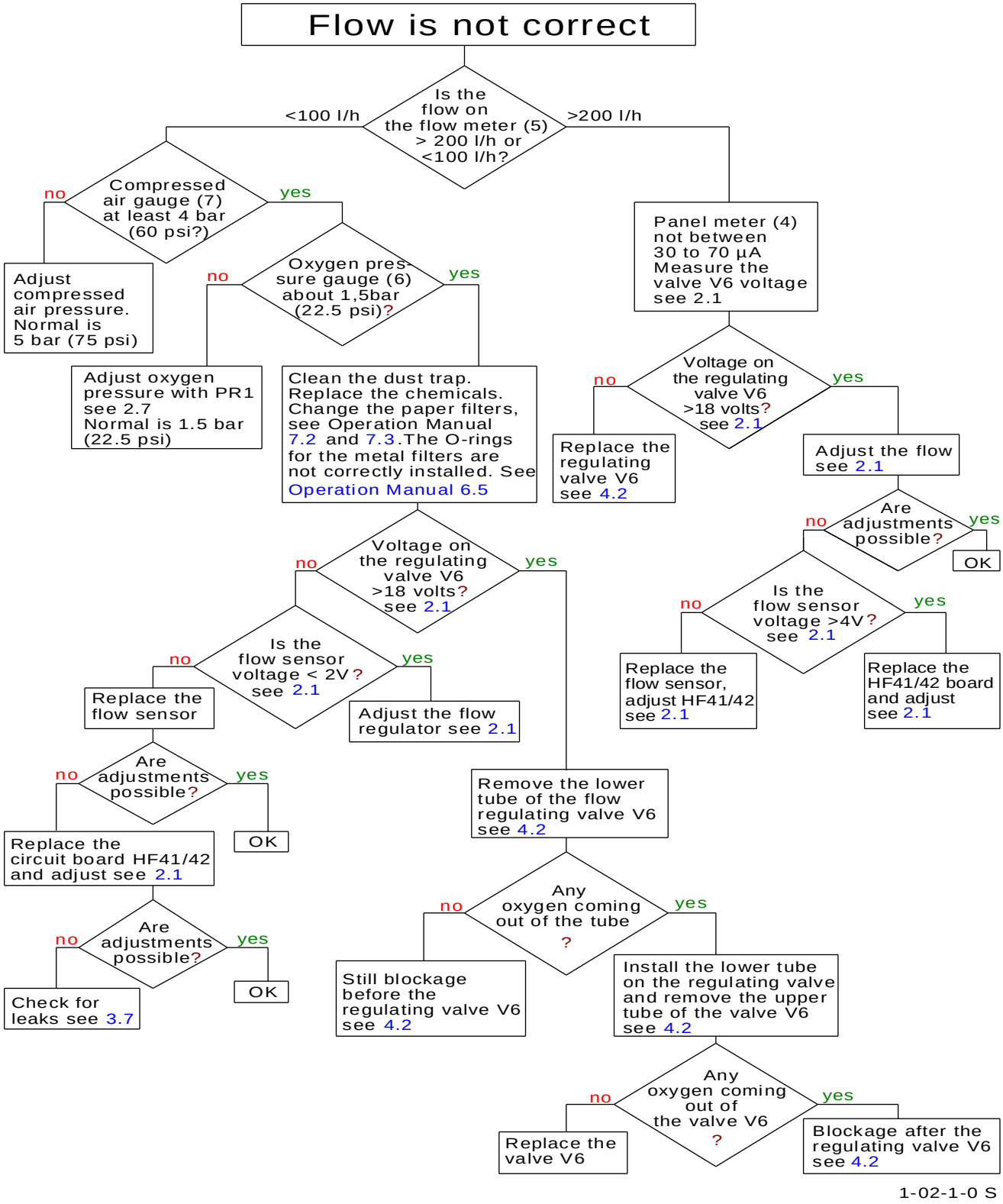




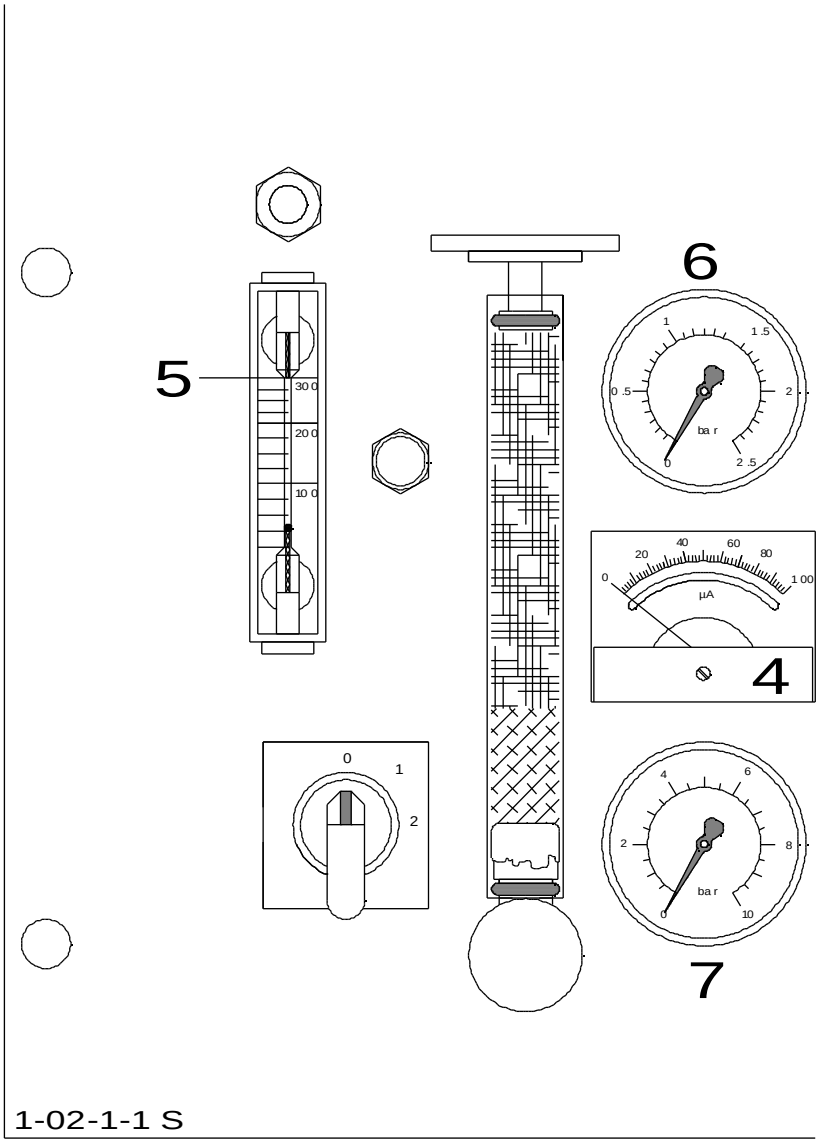
Remark:
In most cases the problem is in the IR-sources or in the power supply. During a rough transportation the IR-sources may be bent causing the problem. See 3.2. We experienced that it is very popular for the new IR-detector and preamplifiers. We can only help if you send us a copy of the flow diagram of this chapter, after drawing a line along the path you followed according to the condition you found.
Asking for detectors, preamplifiers and boards. Without following this diagram is useless.

1.2 Gas flow too high or too low:

Valid for induction furnace operation:



1-02-1-0 S



4 Panel meter indicating the control of the gas regulation valve
5 Gas flow meter 300 l/h
6 Oxygen pressure gauge
7 Compressed air pressure gauge

1.3 The gas flow rate fluctuates:

The flow rate is electronically regulated, therefore there should be no significant variation from the set value.
In case of a fault however, the automatic regulation of the flow rate is no longer possible and the gas flow fluctuates. This can be caused, for example, by an excessive obstruction of the gas flow system or by a faulty component hat needs to be replaced, see **1. 2** and **2. 1**
Most of the time, the problem lies in the saturation of the dust trap or of the chemicals.

In case the flow becomes lower and the µA-meter goes higher during combustion, it is obvious that the flow regulator is working. Therefore the problem must be a restricted oxygen supply. When the accelerators start burning they take a lot of oxygen, so that the pressure in the furnace goes down, and as a result for this the flow also goes down.

The restriction can be in:

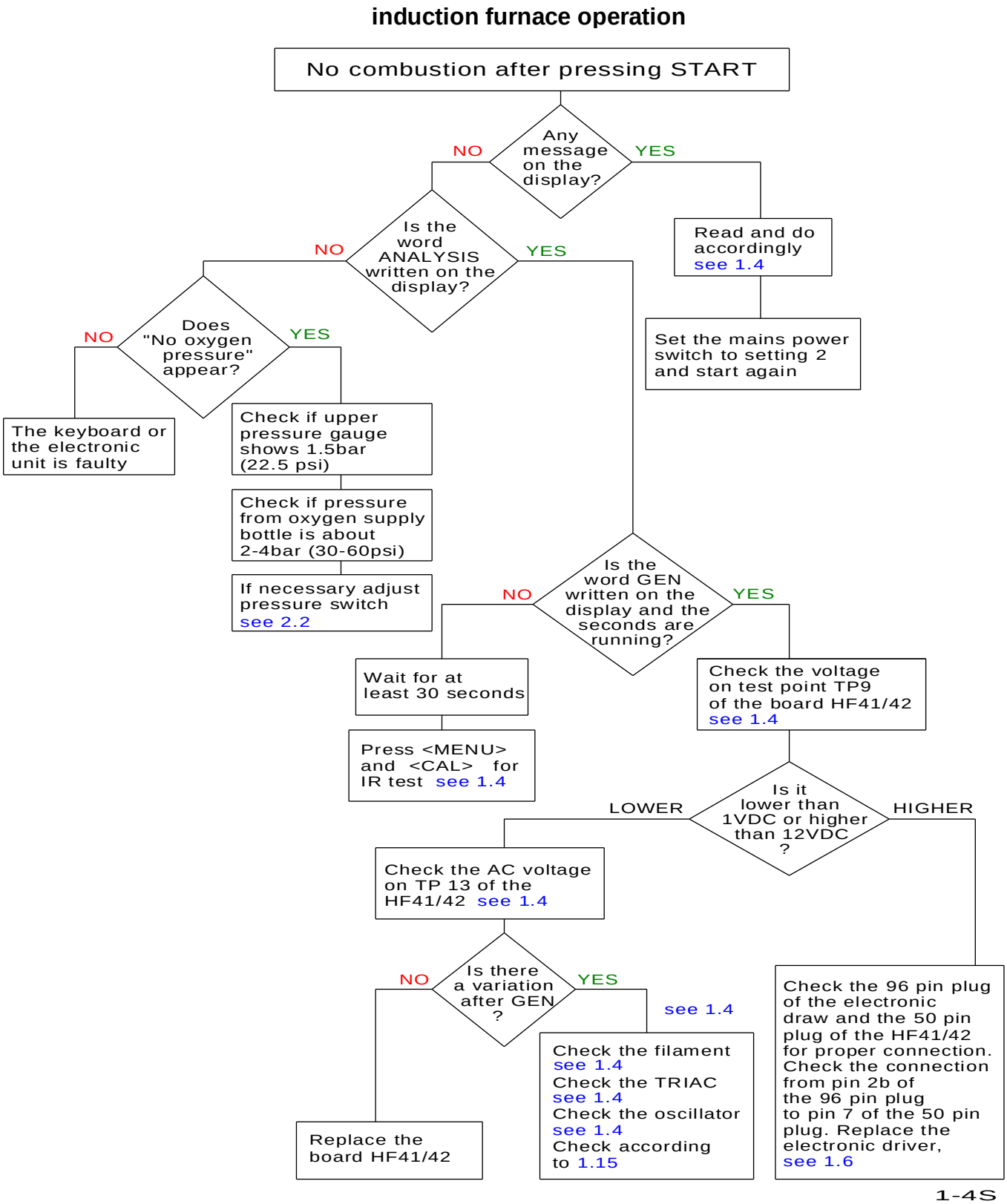
- the hole in the ceramic shield
- the furnace outlet
- the connection from the furnace outlet to the metal filter housing
- the inlet of the metal filter housing
- the metal dust filter
- the anhydrone
- the paper filter
- the filter cartridge

Please note that the restrictions can also be outside the analyser, for example a faulty pressure regulator on the oxygen bottle, a too low adjustment of the pressure on the regulator, not properly opened outlet tap of the regulator, a too long and too thin tube, or this tube is somewhere bent or pressed or, or, or.

If the problem is only a long thin tube, the problem can eventually be solved by increasing the pressure on the pressure regulator of the bottle.

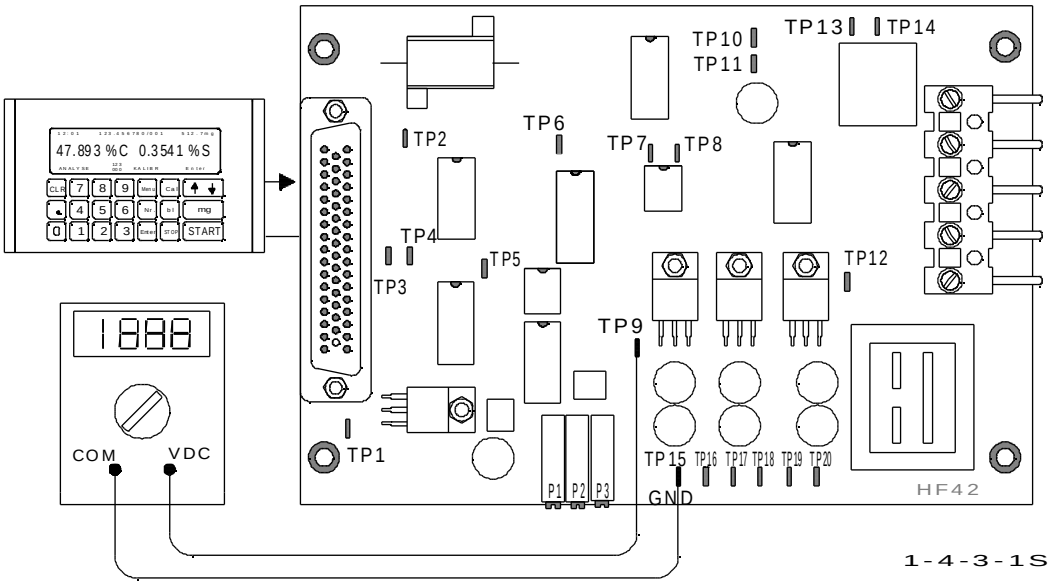
As a hint, when you open the furnace the pressure on the analyser's oxygen gauge should go from 1.5 bar down to 1.4 bar but not lower. If it goes much lower, it means that the incoming oxygen is restricted on the way from the bottle to the analyser.

1.4 No combustion:



AFTER PRESSING < START >
"ANALYSIS" AND "GEN" APPEARS,BUT COMBUSTION DOESN'T TAKE PLACE.

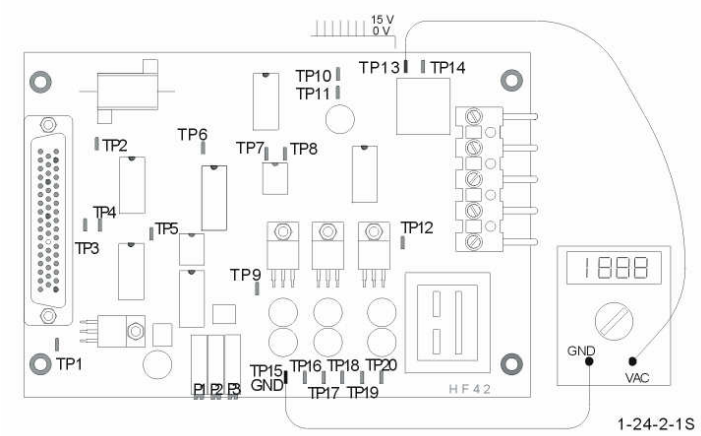
- **The command from the electronic unit to start the generator, is not received:**



Measurements on TP9:

- a signal of about **0.5 V** should turn the generator on,
- a signal of about **12 V** should turn the generator off.

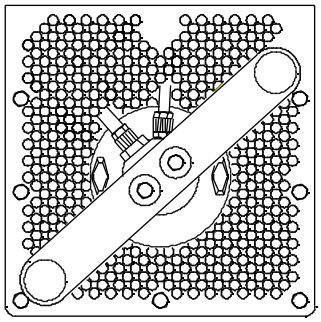
If **12 V** are measured, despite **"GEN"** appearing on the display, then the electronic is defective, see **1. 6**; or the connection from the **HF 42** circuit board, **pin 7** is loose, see **4. 2**.



When the command for the generator is received **(0.5 V DC)**, the needle pulse must appear on the **TP13** test point. If there is no oscilloscope available you can test this with a digital voltmeter.
The displayed value depends on what type of digital voltmeter you have. There must be a voltage increase on **TP13**, once the word **"GEN"** has appeared on the display, or once **0.5 V** are present on **TP9**. When no voltage increase occurs on **TP13**, despite having **0.5 V** on **TP9**; the **HF 42 circuit board** is defective.

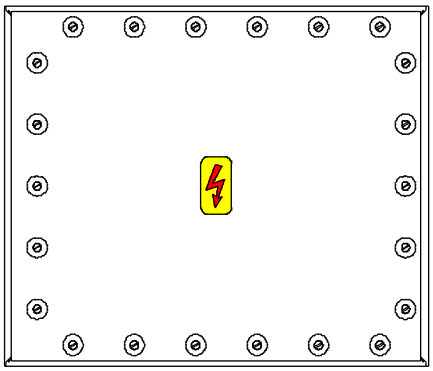
CAUTION! After replacing the **HF 42** board, **make sure that the 50 pin plug is properly inserted. It takes a lot of force to push in 50 pins at once**.
50 pin plugs that haven't been properly inserted are a frequent problem.
Tighten the screws of the plug properly, to ensure a proper connection to the board.

Checking the generator tube:

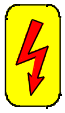


- Ensure that the power switch is at **setting 2**
- Check if the filament of the generator tube glows:
  This can be easily checked:
  through the air vent holes of the furnace,
  the reflected light of the glowing filaments
  (heater of the cathode) should be visible.

If the light from the filament is not visible, then remove the cover from the generator section, in order to see the tube.

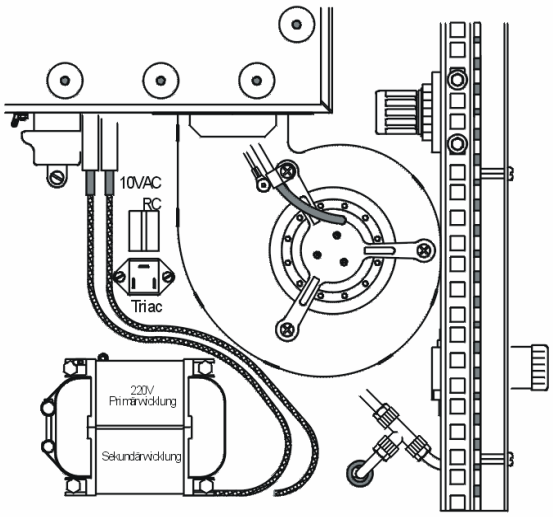


WARNING ! HIGH VOLTAGE !



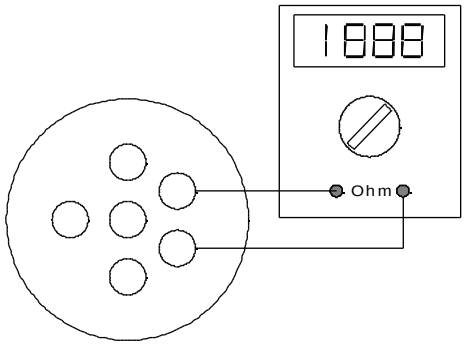
If the filament of the generator tube doesn't glow:

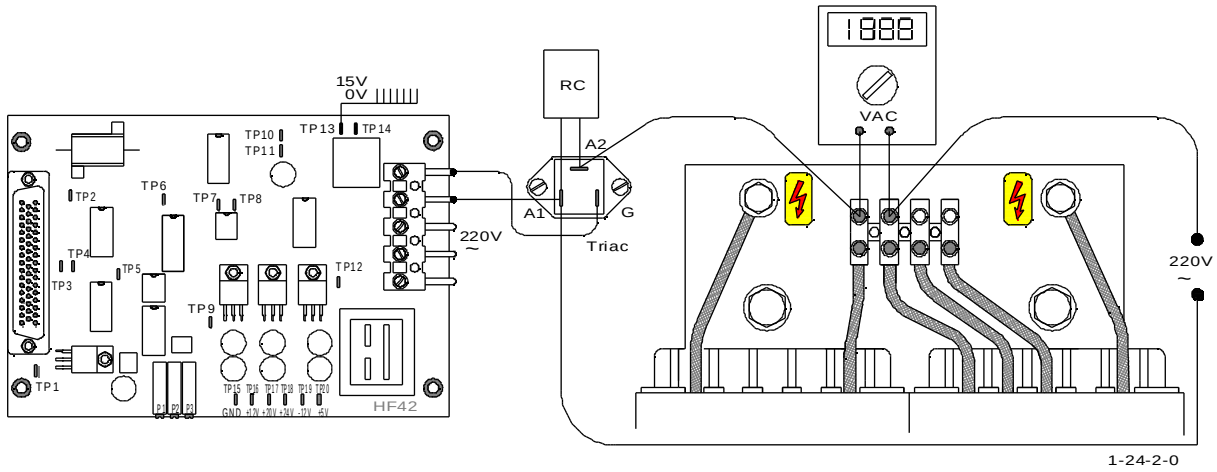
- Check the voltage for the heater,
  on the transformer, there should be **10 V AC**
  on the secondary, and **220 V AC primary voltage**.
- Check whether the filament is faulty,
  at the filament connections, only **1 Ohm**
  must be measured. A very high or
  unmeasured resistance means that the
  filament is burnt through and the tube needs
  to be replaced.



CAUTION!

- Set the power switch to **pos. 1** before removing
  the tube, although it would be best
  to completely turn off the device and unplug the power cord.





Checking the primary voltage on the high voltage transformer:

- On the primary side of the high voltage transformer, you should be able to measure **210 V AC**; if not, the **triac** is defective. (To locate the triac, see **4. 1 - 4**)
  WARNING ! HIGH VOLTAGE !

High voltage transformer: windings check up:

- In case the transformer has **210 V AC** on the **primary coil** and there is still no combustion, check the windings of the transformer as follows:
- Switch off the analyser and disconnect the main power plug.
- Measure the resistance of the primary coil.
  It must be extremely low, about **0.8 Ohms** between the screws labelled **0** and **270**.
- Measure the resistance of the secondary coil **between** the **two screws** on the **ceramic insulator** where the wires of the rectifier are connected. The resistance is approximately **322 Ohms**.

Once there is voltage on the transformer the triac must be OK. A relatively low voltage on the transformer could be a result of too high current so that the board reduces the phase angle. There is most probably a faulty component in the oscillator circuit preventing it from oscillating so that the oscillator tube takes a high DC current.

This can damage the tube. Therefore when you start for testing whether there is combustion, keep your finger on the STOP key. If the sample does not start burning about 3 seconds after the generator starts, then immediately stop the analysis.

One thing that will give further evidence is the current taken by the analyzer from the mains power.

If the current goes up to a level of about 10A, then a faulty component prevents oscillations so that the tube takes all this power causing overheating of the tube within several seconds.

If the current does not increase, it means that the generator does not take power, for example due to a broken grid resietor.

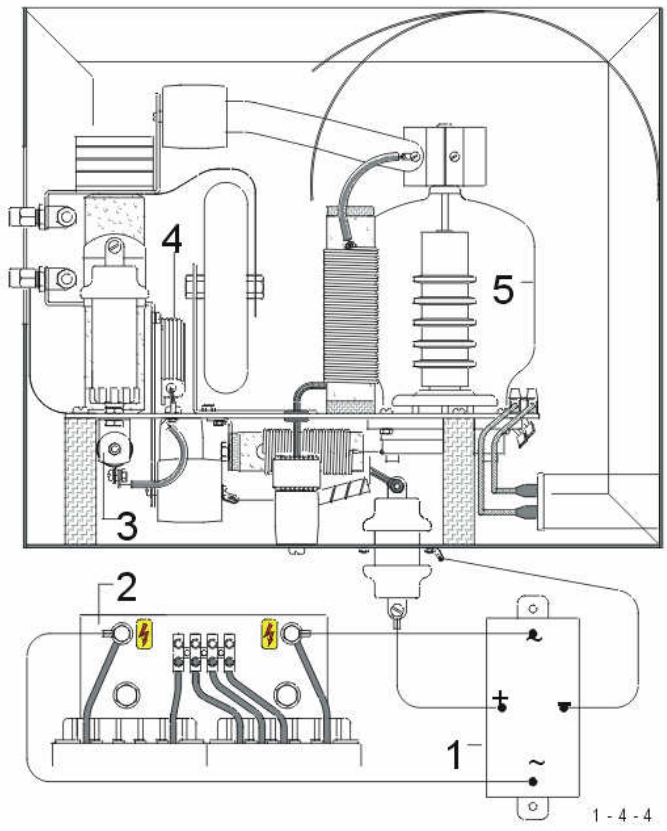
- **The rectifier (1) could also be faulty!**

CHECKING THE HIGH FREQUENCY OSCILLATOR:

Warning ! HIGH VOLTAGE !

Never try to measure the voltage here !
As there is high voltage **(5000 volts)** and high frequency **(19.2 MHz)** present, a measurement would be very difficult and, above all, **very dangerous**. Before the generator cover plate is unscrewed, the device should be turned off or, better, the power plug pulled out.

- You should check the connections in the oscillating circuit to ensure all screws are turned tightly, especially all the screw caps on the combustion coil.
- The electrical connections and resistors should be checked with an ohmmeter.
- **If the resistor 2.7 KΩ / 100 W (3) is open circuit, then there is no oscillation**.
- The parts e.g. tube and rectifier should be replaced one by one, see also **1. 15**



Loud buzzing sound when the generator turnes on.

If during integration (combustion period) the high voltage transformer is making exeptoinally loud buzzing sound when the generator turnes on. Also when running the furnace empty still the loud buzzing appears. This means that obviously for some reason , the triggering of the triac has changed.
If you are sure that the noise appears only during integration period (combustion period) then the problem could be in the generator. The unusually laud noise could be due to current limitation by phase angle control.
The oscillator tube may not be oscillating due to a tube fault so that it takes a very high DC current causing the current limit circuit to reduce the phase angle. If a capacitor is faulty most probably the fuses would blow because faulty capacitors cause sudden sparking so that the current limit doesn't have time to react.
I would suggest to replace the tube. This is also the easiest thing to try so that it can be done by the customer.

CAUTION!: The oscillator tube can be damaged due to overheating if for some other reason the new tube may not be able to oscillate. For testing after installing the new tube, put crucible with sample and accelerators into the furnace like you use to do with every normal analysis. After starting analysis watch carefully the furnace to see the light of the burning sample/accelerators. If a couple of seconds after generator start (transformer noise, base lines for peak on the PC screen) there is no combustion to see in the furnace then STOP the generator by pressing the STOP button or by clicking STOP on the screen depending on which software and hardware you use.

If the oscillator tube replacement doesn't help then either the triac or the HF board is not in proper condition any more. The best thing to doin this case is to replace both, board and triac.

CAUTION !: When looking to find out whether there is combustion or not, STOP the analysis cycle about 3 seconds after it started. If there are oscillations, after 3 seconds the sample (steel or iron chips) will have visible signs of starting burning. But if you wait up to the end of the analysis cycle in order to check whether there was combustion, it could be already too late for the tube due to overheating.

Once there is voltage on the transformer the triac must be OK. A relatively low voltage on the transformer could be a result of too high current so that the board reduces the phase angle. There is most probably a faulty component in the oscillator circuit preventing it from oscillating so that the oscillator tube takes a high DC current.

This can damage the tube. Therefore when you start for testing whether there is combustion, keep your finger on the STOP key. If the sample does not start burning about 3 seconds after the generator starts, then immediately stop the analysis.

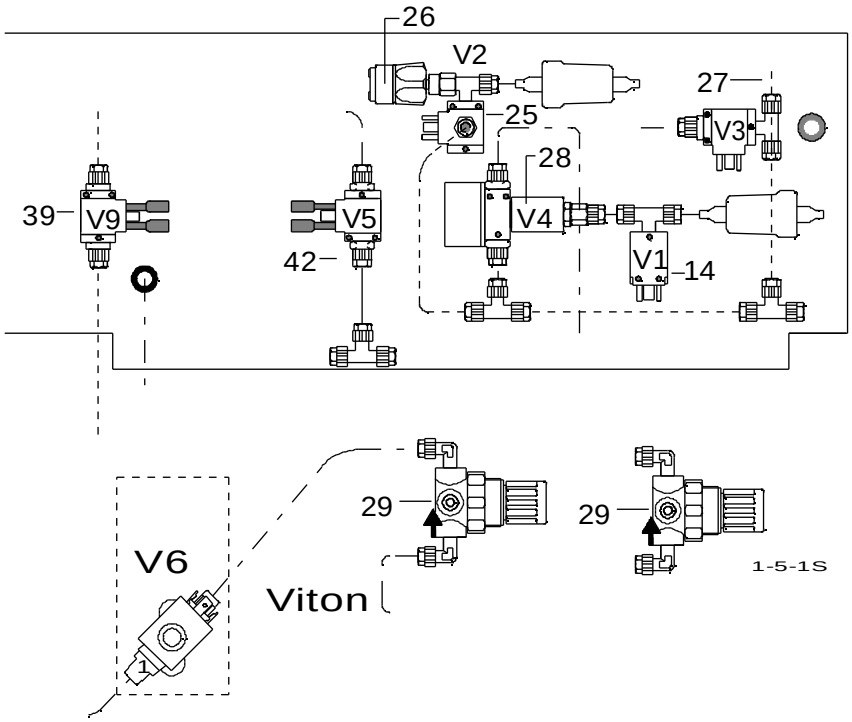
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If the current does not increase, it means that the generator does not take power, for example due to a broken grid resietor.

1.5 Bad combustion:

Insufficient flow: see 1. 3



- The bypass valve **(28)** is either falsely activated during combustion, or it is sticking. In this case, the oxygen flows through the bypass valve into the **IR-cell** and not through the furnace. The furnace remains nonetheless under oxygen pressure.

- Measure the voltage to the bypass valve **(28)**
  24 Volts DC while the furnace is open is normal.
  Zero volts when the furnace is closed is normal.
  The measurements can also be made with a digital voltmeter, as well as with a glow light probe that shows **24 V / 20 mA.**

  Other false controls from the electronics :
  Clear the memory;see **3. 9**

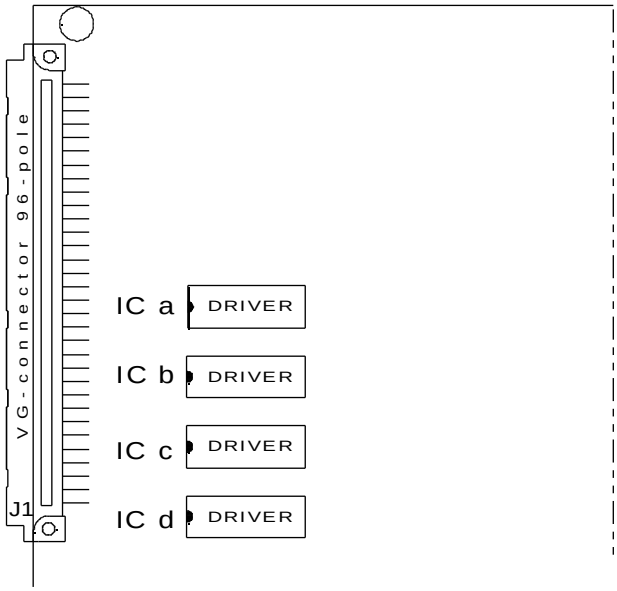
  Clean the valves; see **3.13**

  Generator tube is too old :
  This normally does not occur suddenly, it is rather a long process.
- Replace the tube

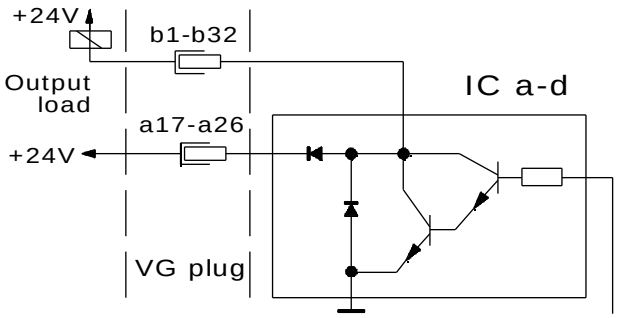
  Replace inadequate contact points in the oscillating circuit, see **1. 4**

  Replace worn power controls, see **1. 4**

1.6 Electronic- drivers malfunctioning:



IC a, b, c and **d** are electronic driver Integrated Circuits, found on the mother board inside the electronic unit.
Their Type No. is **ULN 2803** or **TD 62083**.



1-6

These **IC's** act as a power switch, in order to energise solenoid valves inside the analyser, see 2. 6, 3. 7 and 4. 2 or to send control signals, see 1. 2 1. 4 and 1.24

Operation range of IC's a, b, c, d.
Depending on the fault location, the following driver IC's need to be replaced:

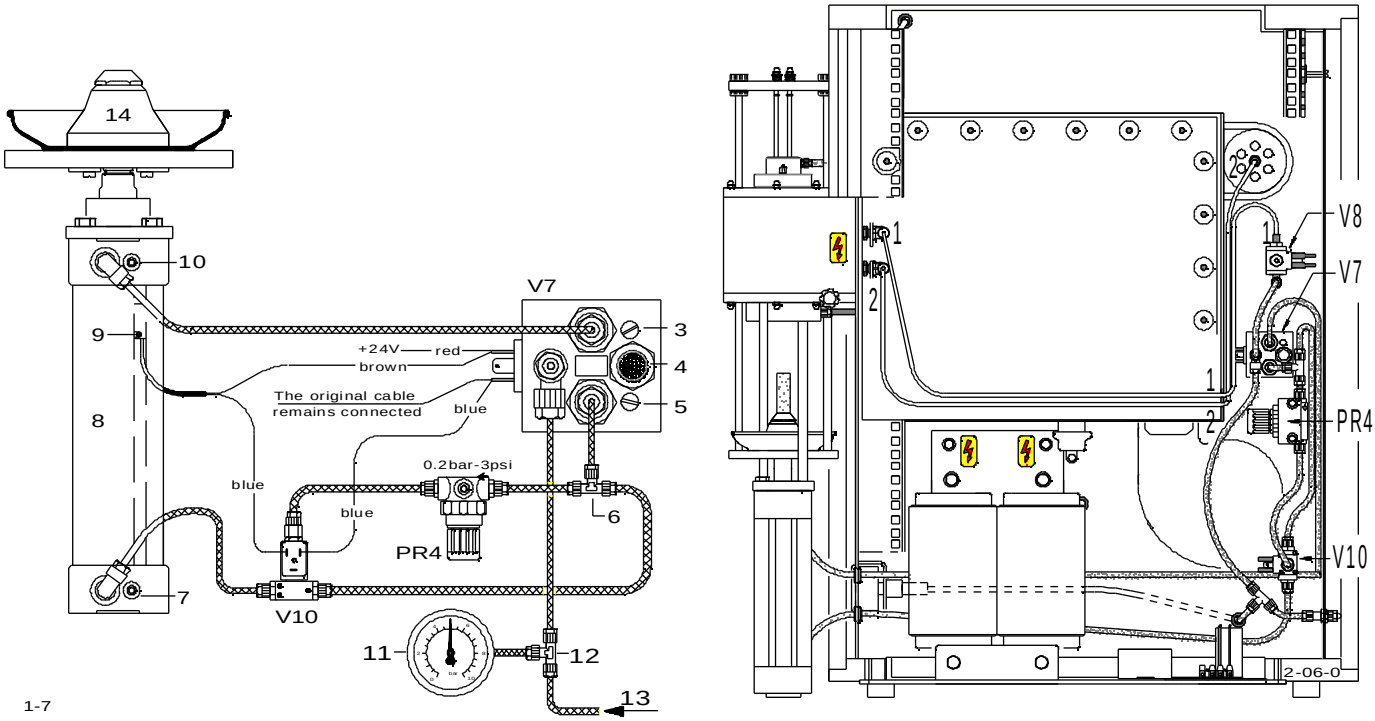
IC a: Outflow valve V1, see 3. 7 and 4. 2

IC b: Shuttle valve V2, see 3. 7 and 4. 2 ; pneumatic valve for furnace, see 2. 6

IC c: Purging valve V3, see 3. 7and 4. 2

IC d: By-pass valve V4, see 4. 2
Generator **„start"** signal, see 1. 4 and 1.24

1.7 The furnace does not close:



- Little or no compressed air pressure, the furnace cannot close.
  This pressure is shown on gauge **(11)**, on the front-side of the analyser.
  It must be between 4 to 6 bar **(60 to 90 psi)**.

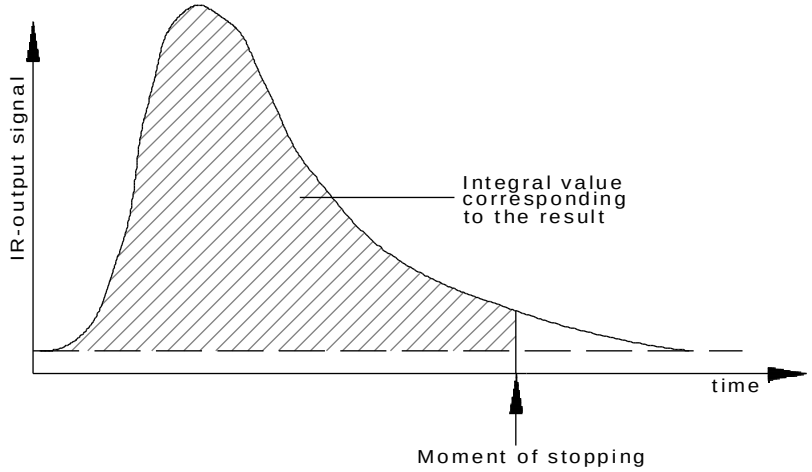
- The screws **(10)** and **(3)** must be turned counter-clockwise, as much as possible.

- Adjust regulator **(PR4)**, so that the furnace floor can rise completely, without shaking; **while a person still can stop the moving furnace floor with only one hand.**
  This is a **safety precaution**.
  Repeat above instruction, until the adjustment is completed. Now, the upward speed is fast enough, yet safe for the operator. The pressure regulator **(PR4)** is found on the inside, on the right-side section of the analyser.

- The pneumatic valve **(V7)** is malfunctioning.

- The magnetic coil of the pneumatic valve **(V7)** receives no current.
  The furnace floor goes up, when valve **(V7)** receives **24 VDC**.
  The **24 V DC** comes from the electronic unit; if not, replace the electronic drivers, see **1. 6**

1.8 The analysis takes too long:



The analysis length lasts a maximum of up to **100 seconds**, by virtue of a maximum time limit which the operator can select.
The minimum analysis time is automatically defined by the analyser and corresponds to half the maximum time.
Once the minimum time has expired, the analysis will stop automatically, if by that time no combustion has taken place.
If however the required combustion does take place, a signal from the infrared cell is then produced, causing the analysis time to be automatically lengthened.
The analysis is ended once the infrared signal has descended to the comparator threshold level, which is nearly **zero volts**.
The comparator threshold level is an artificial **zero level**.
When, however, as a result of unwanted hydrocarbons in the carrier gas, there is too much CO_2, this threshold level won't be reached.
In this case the analysis will stop only once the selected maximum time has expired.
The purpose of the maximum time is to protect the furnace from overheating.
It is important to ensure that the analysis is completed before the maximum time has expired.
This threshold level is not the same for every analysis, it is reset automatically during each analysis. The higher the maximum peaks, the higher the threshold level.
It can therefore happen that with higher peaks the analysis ends sooner than with lower peaks.
As long as the unwanted hydrocarbon concentration in the oxygen is not extremely high, the problem could only exist in the low carbon channel (if present).
You can confirm the source of this problem by deactivating the low carbon channel;
< Menu > < 5 > < 1 > .
If the analysis then ends before max. time, you can be fairly sure that the problem is with hydrocarbons.
In case that there is neither an oxygen purification furnace, nor some clean oxygen available, you can by-pass this problem by setting the threshold level higher. Press the keys;

< Menu > < 9 > < 1 > < k > < XXX > < ENTER >.

< k > can be the number **1, 2 or 3** for selecting the required **IR- detector**.
< XXX > is a three digit number for the **set point** of the threshold level, for example **250**.
If the problem remains, this number can be increased stepwise until the problem is solved. The threshold level can only be set in the low carbon channel.

Additional reasons for excessive analysis duration could be:

- Dirty dust trap, see **Operation Manual 7. 3**
- Saturated chemicals, see **Operation Manual 7. 2**
- **Cotton, glass or quartz wool** is pressed too tightly, see **Operation Manual 7. 2**
- The **oxygen** is not **pure**, or the catalyst furnace is faulty or is cold, or the copper oxide is used up, see **Operation Manual 7. 2**
- The temperature of the **infrared cell** is not yet stable. Either it is not yet operational for at least **1 to 2 hours**, or the oxygen flow has not yet been running for **10 to 15 minutes** (power switch on **setting 2**), see **Operation Manual 3. 1** and **3. 2**
- The thermostatic control of the infrared cell is defective, see **1.14** and **2. 5**
- Excessive combustion temperature, causing the crucible to emit **CO_2**.

One of the IR-sources is unstable:

- Small resistance changes of one or more **IR-sources**, can cause the current to vary, thus affecting the intensity of the **IR-radiation**.
  This problem will effect all the channels, due to the fact that the **IR-sources** are all connected in series.
  In order to establish whether this problem is present or not, an analysis cycle should be run without a sample or a crucible. The baseline of the **IR-cells** can then be monitored on the PC screen, see **Operation Manual 5. 8 PLOTCS**
  The baselines should be quite stable and should run between **0.100 V** and – **0.100 V**
  It would be **very difficult**, in case of a problem, to establish which **IR-source** is faulty and it is therefore easier to replace them all.

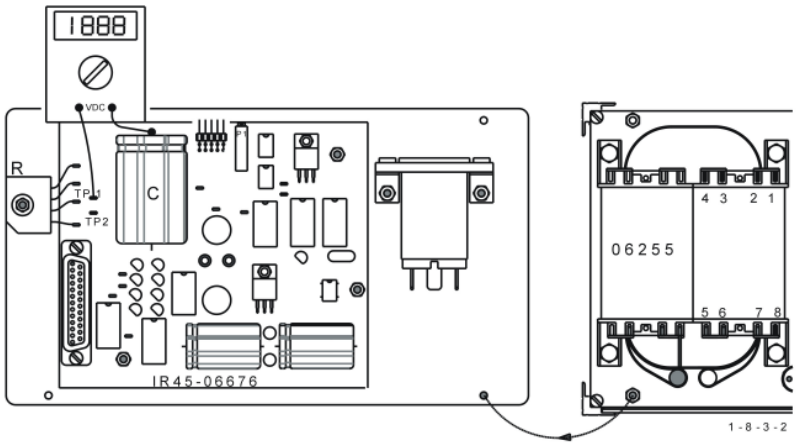
- A window of an **IR-path** is not airtight. The measuring gases pass through the leakage, either into the chopper housing or to the **IR-detector**.
  Perform a leakage test of the **IR-paths**. Replace the faulty **IR-path**. see **3. 1**

- The rectifier of the **IR-source** supply is faulty. The unstable voltage is too low, so that the voltage at the **IR-sources** cannot be regulated. see **2. 4**
  Check the base line on the PC screen, by starting analysis without sample. Zoom to get the scale of **10mV** steps. see **Operation Manual 5. 8**
  The base line should remain within **10mV, 50 seconds after START**.
  If the drift is larger and always positive, then check the **IR-source voltage**, see **2. 4**

- The infrared power supply is defective, so that the voltage stabilisation does not function.
  It is possible that the current to the **IR-source** is unstable, due to a faulty rectifier **(4)** causing only a half-wave to pass through. This can be checked rather easily, by measuring the **DC-voltage** across the outer legs of the rectifier (DC-output).
  It should be at least **4 V DC higher** than the supply voltage for the **IR-source**, measured between **TP2** and **TP1 (GND)**.

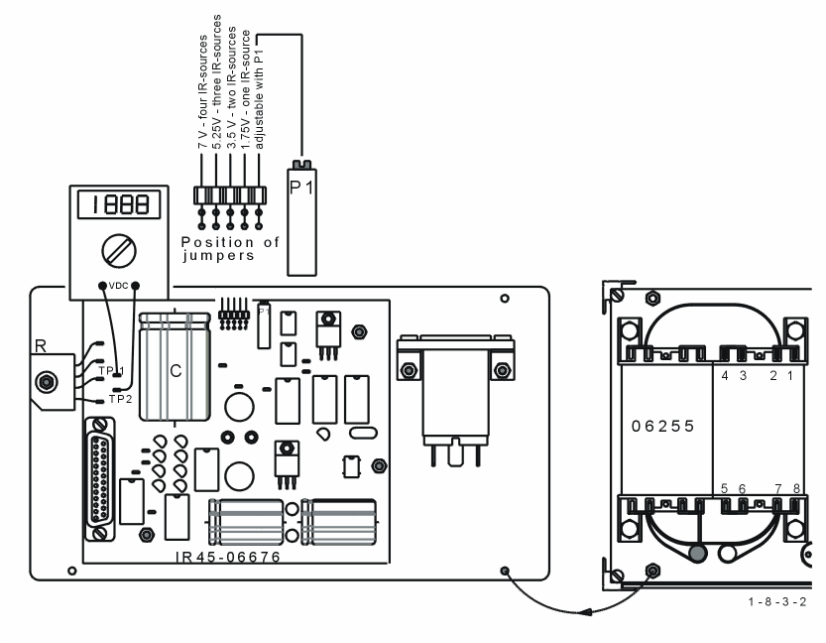
Voltage across DC-output at rectifier	**At least 10 V DC for a 3 channel device** **At least 8 V DC for a 2 channel device** **At least 6 V DC for a 1 channel device**

Voltage across DC output of the rectifier:



Voltage between TP1 (GND) and capacitor C:
(not stabilized voltage before stabilizer)

At least 6 V DC for 1 channel device
At least 7,5 V DC for 2 channel
At least 9,5 V DC for 3 channel device
At least 11 V DC for 4 channel device



IR-source voltage, is to be measured between TP1 and TP2 on IR 45 board.
(stabilized voltage of IR – sources)

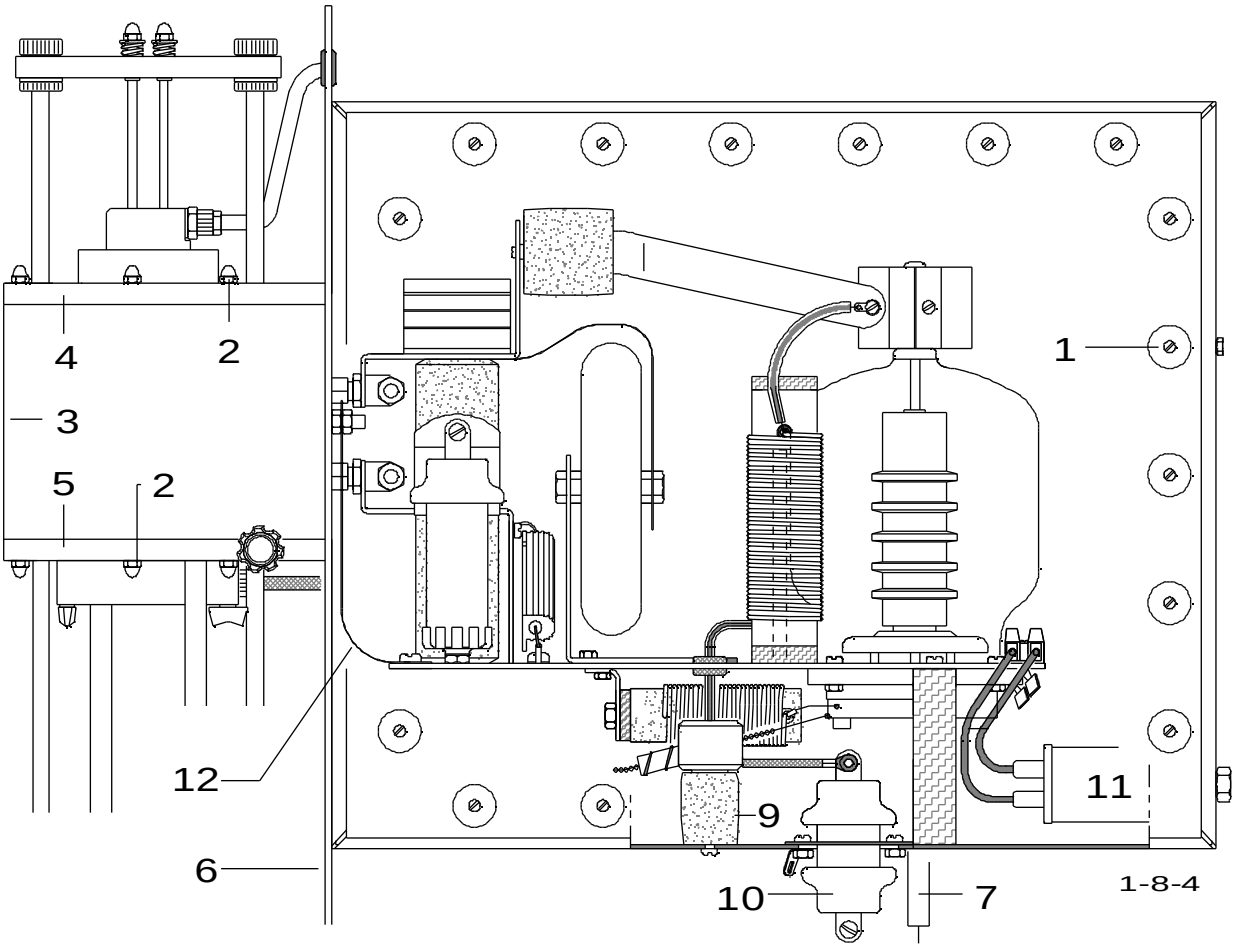
1,75 V DC for 1 channel device
3,5 V DC for 2 channel device
5,25 V DC for 3 channel device
7 V DC for 4 channel device
(1,75 Volts DC for each IR source)

Transformer connections:

Blue cables

1 Soldering location for 1 channel device
2 Soldering location for 2 channel device
3 Soldering location for 3 channel device
4 Soldering location for 4 channel device
8 Always connected (common)

- **RF-interference on the IR-cell, or on the electronic units:**
  If the generator's high frequency disrupts the electronic units or the infrared cell, then the base line on the PC monitor appears **jerky**.



CAUTION ! HIGH VOLTAGE !

The causes:

- The screws **(1)** are not tightened properly, or not all **22** of them are screwed in.
- The acorn nuts **(2)** are not tightened properly or not all **14** are in place.
- The cover **(3)** does not seal tightly with the plates **(4)** and **(5)** or with the front panel **(6)**
- The capacitor **(10)** is out of order
- The capacitor **(9)** is out of order

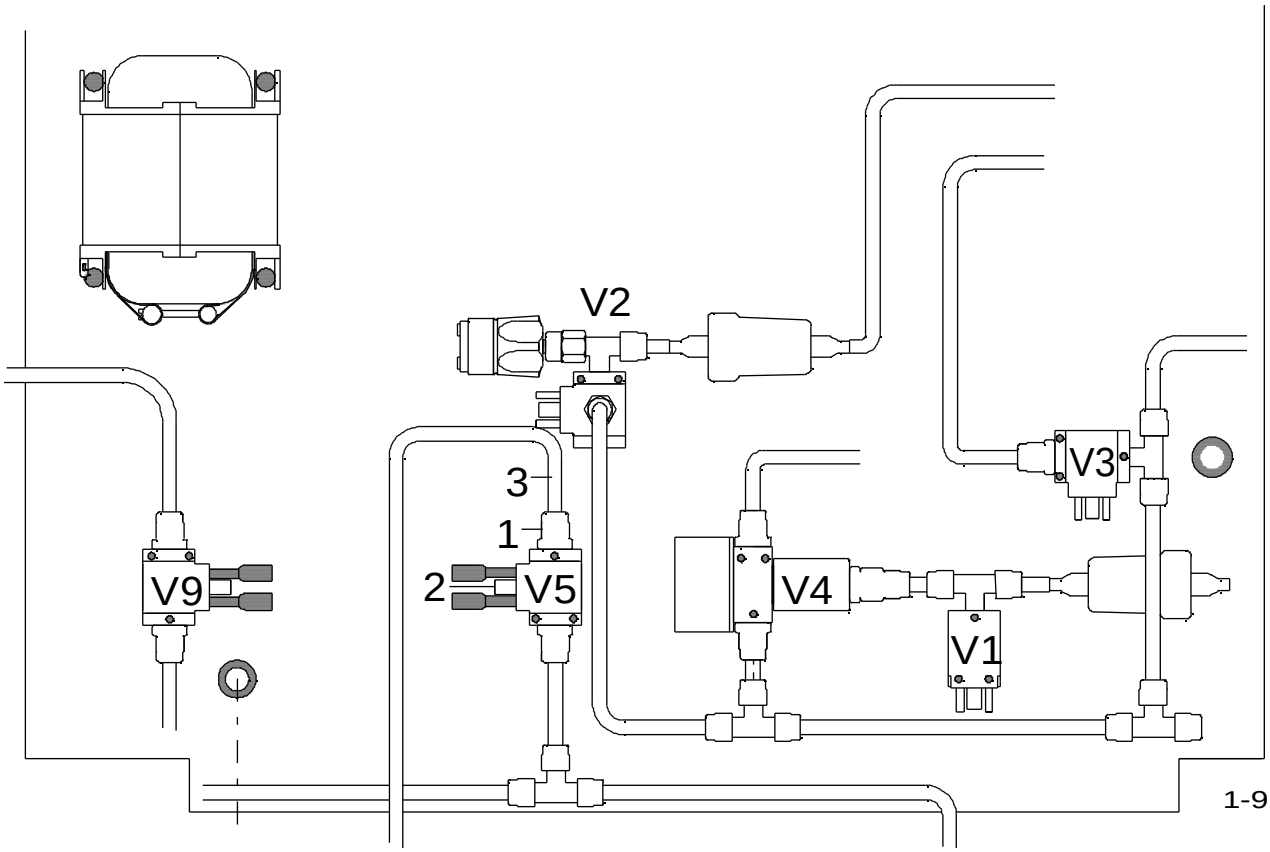
One or both filters (7) are not OK:

- The filter **(11)** can also be damaged in this way.
  When the ground strip **(12)** is not connected after removal or replacement of the oscillator the filters **(7)** will defect.

The power voltage sinks below 180 VAC:

- Even a momentary drop in the in the voltage is enough to cause problems.
  Use a voltage stabiliser. See 3.15

1.9 Development of dust when closing the furnace:



- The screw joint **(1)** from the valve **(2)** contains no nozzle, or the internal diameter of the nozzle is too large. This can easily be checked when removing the tube **(3)**. The nozzle should have an internal diameter of **1 mm**.

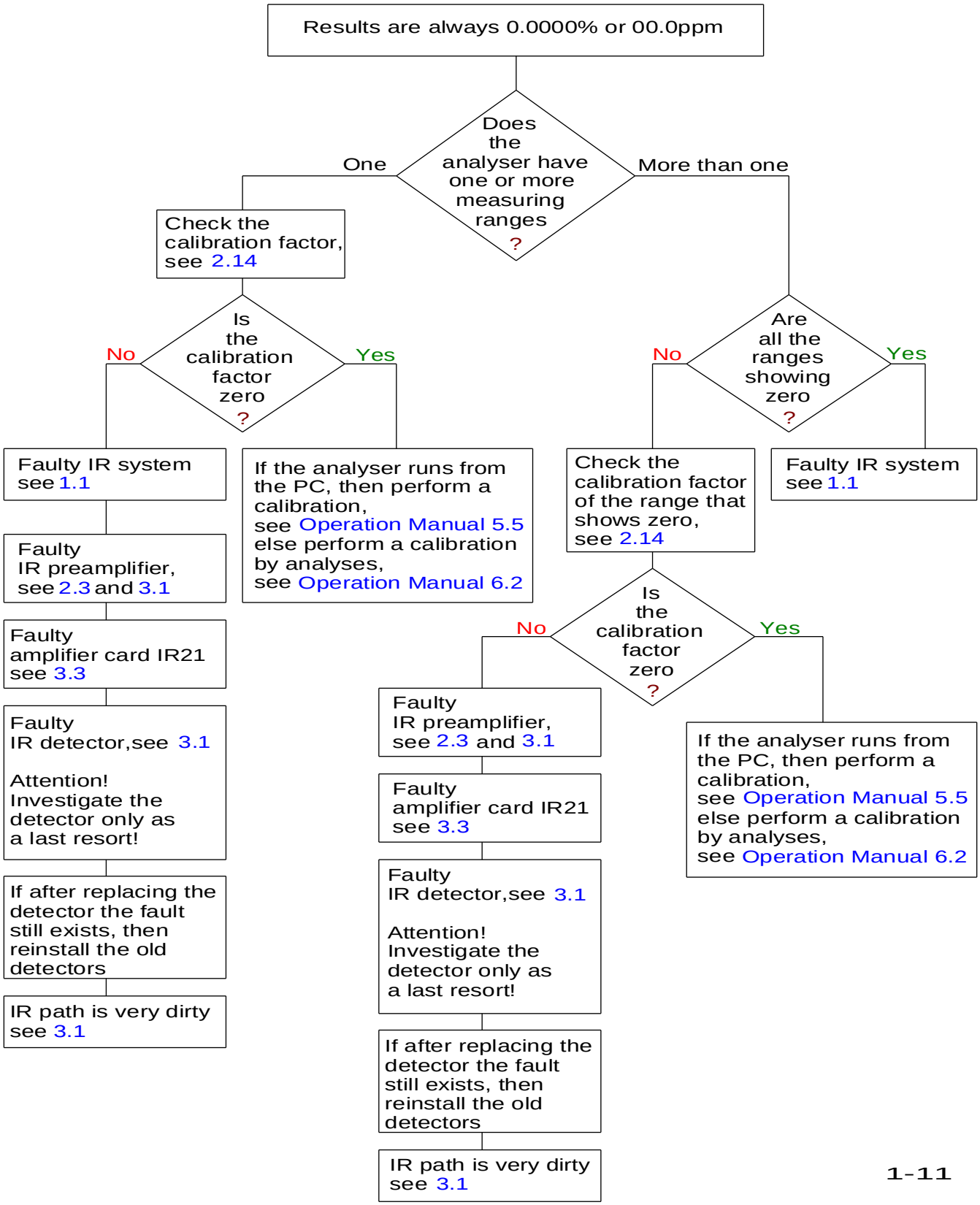
1.10 Erratic results:

There are a lot of different reasons for this:

- Saturated chemicals or clogged dust filter -
  see Operation Manual **7. 2** and **7. 3**
- Heterogeneous samples
- Leakage, see **3. 7**
- Flow problems, see **1. 2** , **1.3** and **1.18**
- The electronic noise of the infrared signal, see **1.20**

  This can happen quite often that the **combustion start** is delayed and the analysis time is too long, see **1. 8**.
  You will see that the **combustion start** is delayed, when the word **"GEN"** appears **later** than the word **"ANALYSIS"**.
- Incomplete or bad combustion, see **1. 5**.
- Too high **blank value** for the crucible and tungsten. This will be especially noticeable, mostly though, in the **low carbon channel**.
- Widely different **weights** of the sample and the **accelerator** (tungsten).
- Wrong **data** in the memory of the electronics: **Clear memory**, see **3. 9**
- The **base line** of the detector is unstable, due through insufficient main voltage (less than 200 V AC).
  Connect a stabiliser, see **3.15**

1.11 The results are always 0.0000% or 00.0 ppm:



1-11

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1.12 Beeper responding:

The built-in beeper of the analyser responds during the following reasons:

- When trying to analyse without entering the weight sample (when the analyser operates without the PC)
- No oxygen input
- 24 V supply for the solenoid valves faulty
- No balance attached (when analyser operating without PC)

At request, beeper can be made to respond every time when an analysis is complete.

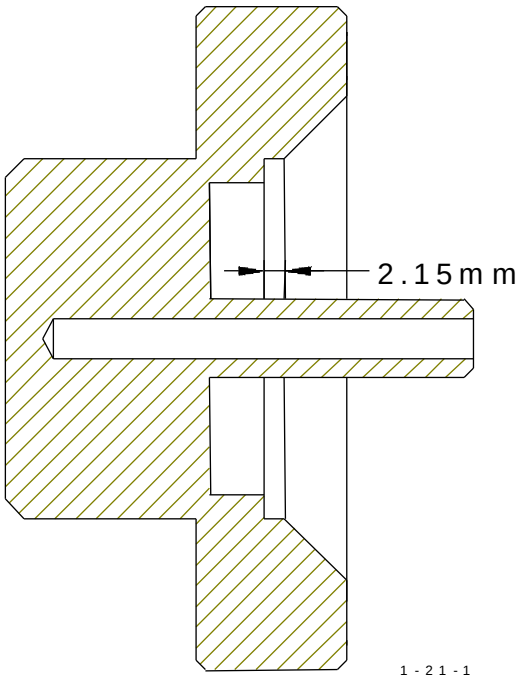
1.13 The life time of the combustion tubes is too short:

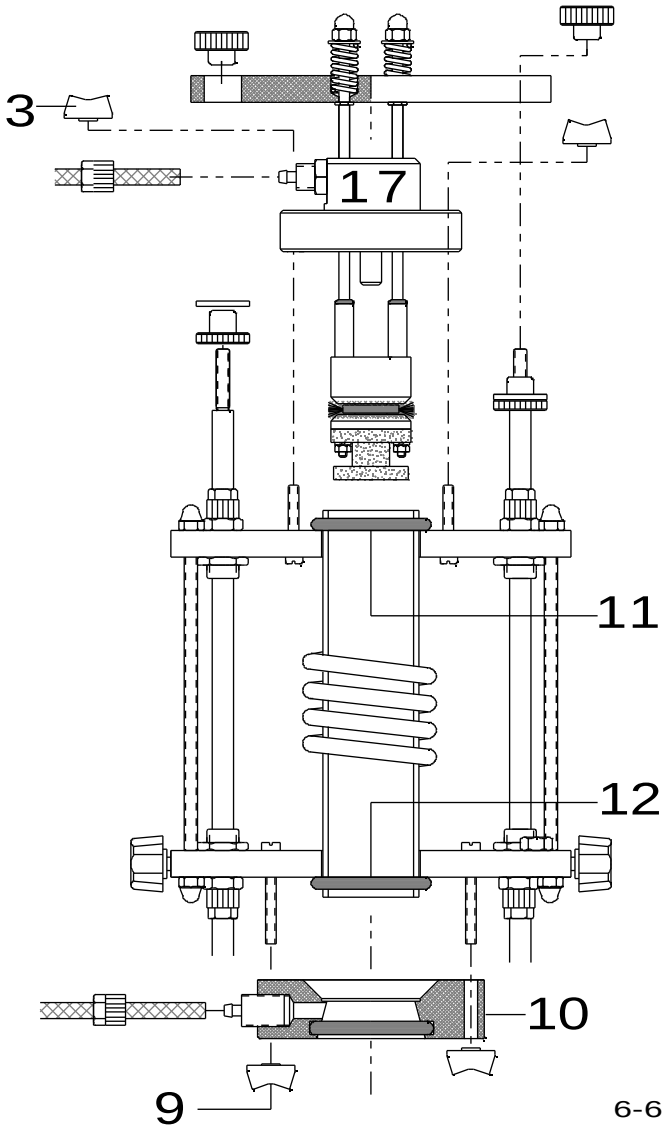
Possible reasons for that:

1. The sample weight or the weight of the accelerator is too high.
   See **Operation Manual: “applications of”**

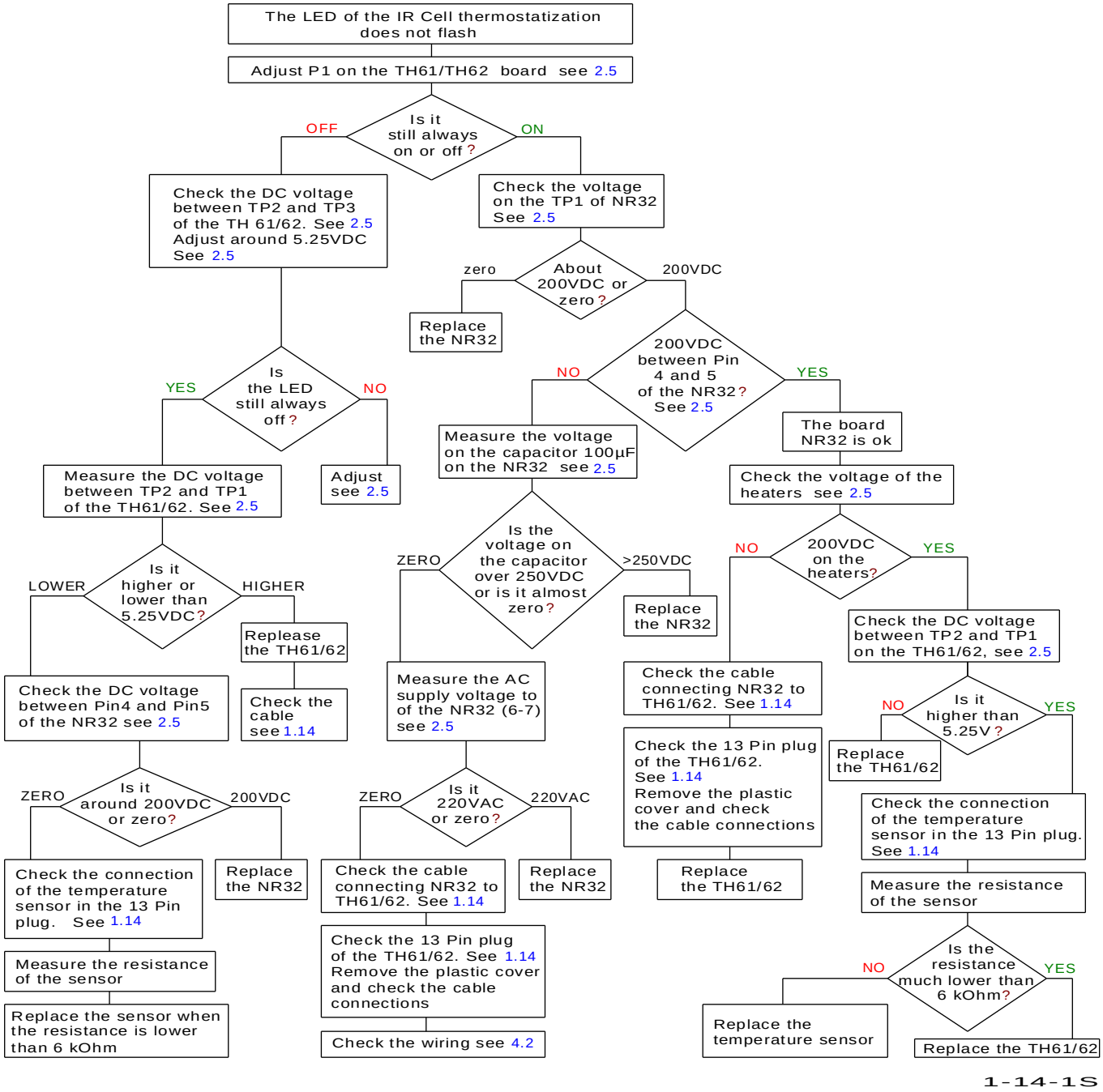
2. Don’t use copper as accelerator.

3. The combustion tube is too long, i.e. longer than **145 mm**. In this case, after fixing the four wing nuts **(3)** and **(9)**, the combustion tube is pressed between the upper furnace closing part **(17)** and the lower part **(10)**
   In this case, when the combustion tube heats up during combustion, it may break.
   Check the length of the combustion tubes to be not longer than **145 mm**.
4. The upper furnace closing part **(17)** does not provide enough space for the combustion tube. To check this, install a combustion tube as usual but without the O-rings **(11)** and **(12)**. After fixing the wing nuts **(3)** and **(9)**, move the tube up and down. If the tube does not move at least **0,5 to 1 mm**, replace the part **(17)** or make room for the combustion tube by machining the upper furnace closure on a lathe.

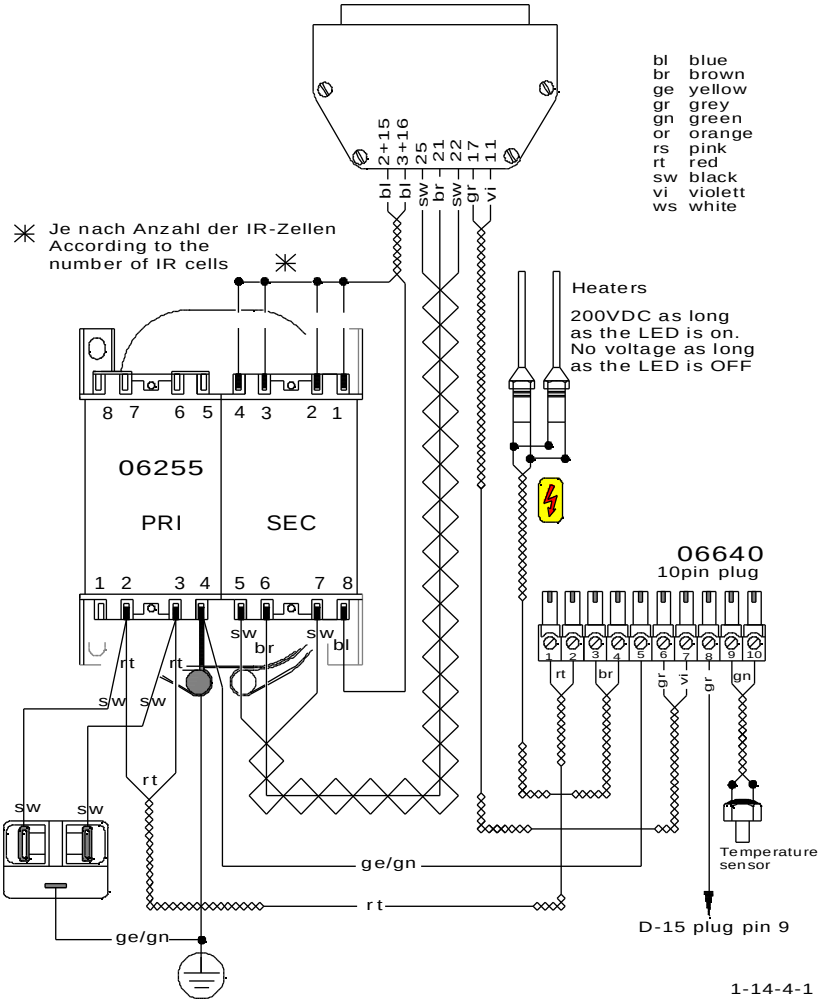




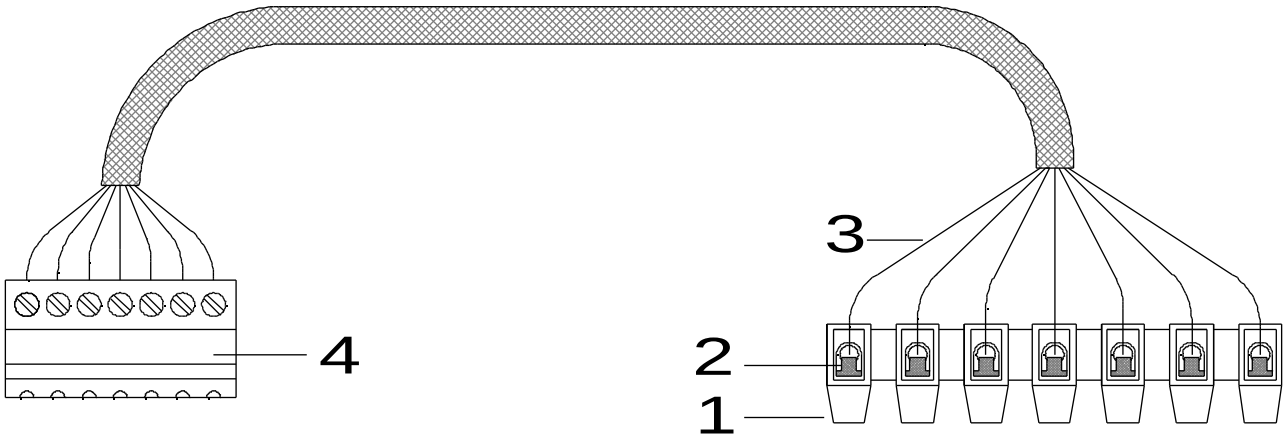
1.14 The LED for the IR-cell temperature regulation does not flash:



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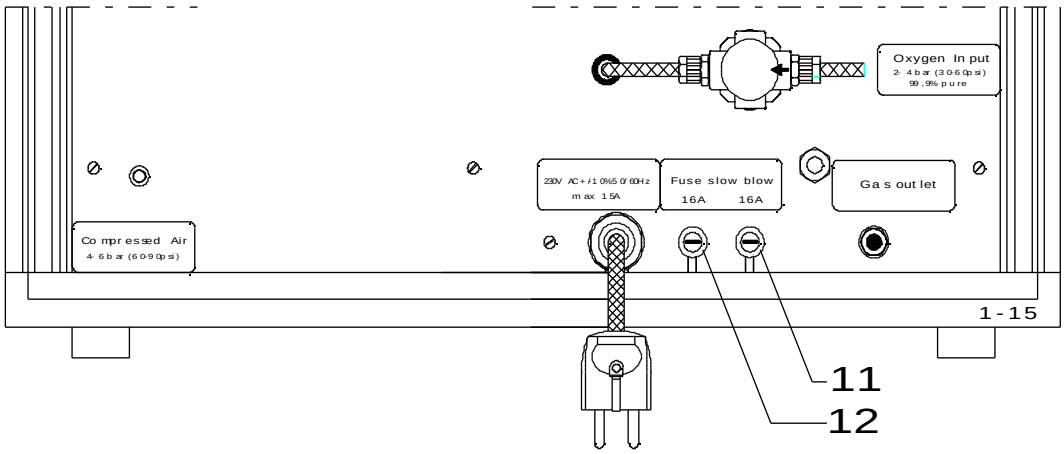


- Check that the cable is well connected to the plug, and that there are no short circuits between the contacts in the **13 pin plug**.



- Inspect the **spring contact (2)** on the connector **(1)**
- One of the contact threads **(2)** could have failed, or one of the connections **(3)** could be **disconnected**.
- A look inside the plug **(4)** is **recommended**.

1.15 The fuse burns out at the beginning of combustion:



- If the fuses **(11)** or **(12)** blow, then Unplug the main power and replace them.
- Disconnect the cables **(1)** from the primary side of the transformer **(2)** and connect the cables **(1)** to a **220 V** light bulb **(3) which is inserted to a socket**. An ordinary desk lamp can serve for this purpose. In case only **110 V** light bulbs are available, connect two of them in series.
  BE CAREFUL that no short circuit occurs !

  After the cables **(1)** have been connected plug the analyser to the main power again.
- Set the power switch to **pos. 2**
- Enter a weight manually, for example, **500 mg**
- Press **< START >**
- When **"GEN"** appears on the display, the light bulb should glow; this does not happen suddenly, but gradually.
- Within a few seconds, the light bulb will change from dark to fully bright.
  WARNING ! HIGH VOLTAGE!

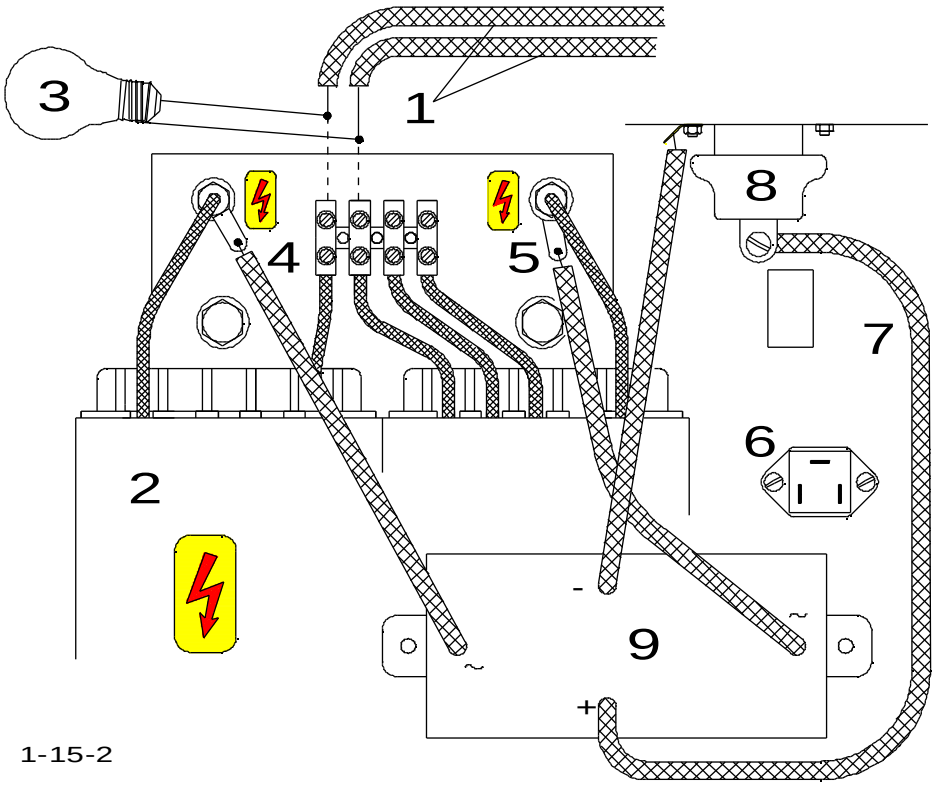
  SEE DRAWING NEXT PAGE:
- After pressing **< START >**, the message " **ANALYSIS** " appears, but **"GEN"** could appear later. The reason is, that after restarting the device and the oxygen flow, the infrared cell base-line could drift.
  For the same reason, the analysis may **stop** longer than usual.
- You should wait until **"GEN"** appears.
- Quit by pressing **< STOP >**. If the light bulb turns dim, the triac **(6)** is OK.
- Unplug the main power and reconnect the power cables **(1)** to the transformer **(2)**

  WARNING ! HIGH VOLTAGE !
  When reconnecting the power cables **(1**), do not let these wires approach the connectors for the cables **(4)** and **(5)**. Otherwise the high voltage can create sparks.
- The cables **(4)** and **(5)** should be unscrewed from the transformer and placed away from it.
- A new analysis should be started. When **"GEN"** appears and the fuse is not damaged, and the main current didn't exceed **10 A** (RMS), then the transformer is functioning properly.
- Otherwise, replace the transformer. The cables **(4)** and **(5)** are then reconnected. The cable **(7)** is unscrewed and removed from the capacitor **(8)**

WARNING ! HIGH VOLTAGE !

After the generator starts **(GEN)** the cable **(7)** carries a voltage of about 7000 Volts ! The cable **(7)** therefore should be laid so that its end is at least **10 cm** away from the nearest object !

- If, after pressing **< START >** and **GEN**, the fuse is blown, then replace the rectifier **(9)**

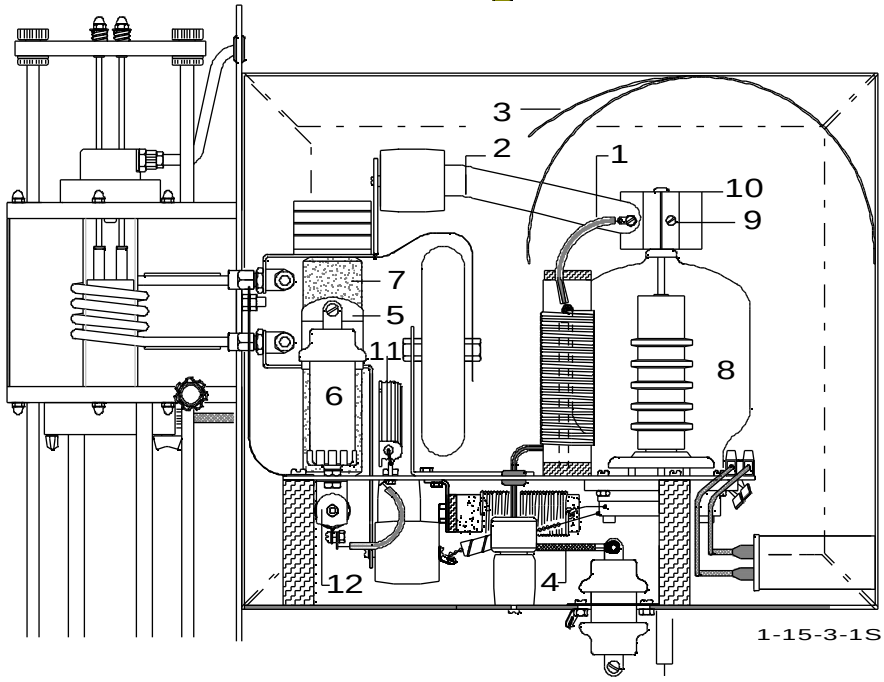


1-15-2

Further causes could be found in the oscillator circuit:

Because of the **high voltage** (7000 volts) and the **high frequency** (19.5 MHz), it is difficult to make measurements without any special measuring instruments.
Thus, the analyser needs to be turned off, and the power plug disconnected.

WARNING ! HIGH VOLTAGE !



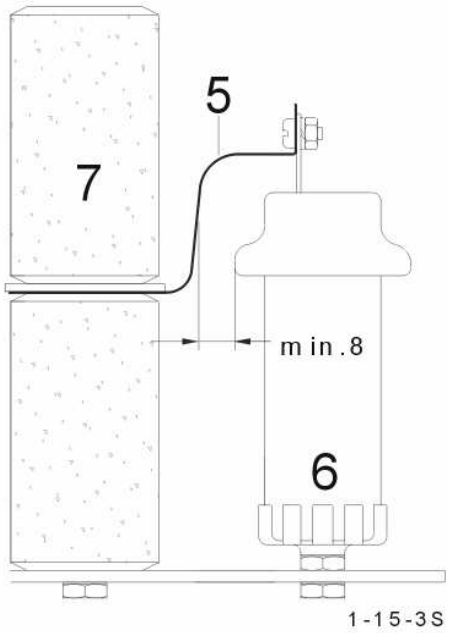
- Check that all the screws and soldering connections have a good contact.

If the resistor 100 KΩ / 50W (11) is a short circuit, then the fuse will blow when starting the combustion.

- Check that all power conductors and copper bands are placed far enough away, from any nearby objects! The wire **(1)** and the copper band **(2)**, for example, should be placed far away from the plate **(3)**.

- The power cable **(4)** should have a maximum distance from any surrounding object.

- The copper band **(5**) should be placed as far as possible away, from the capacitor **(6) !**
  This is why the copper band **(5)** should always be bent around the insulator **(7) !**



If the tube needs to be replaced (8)

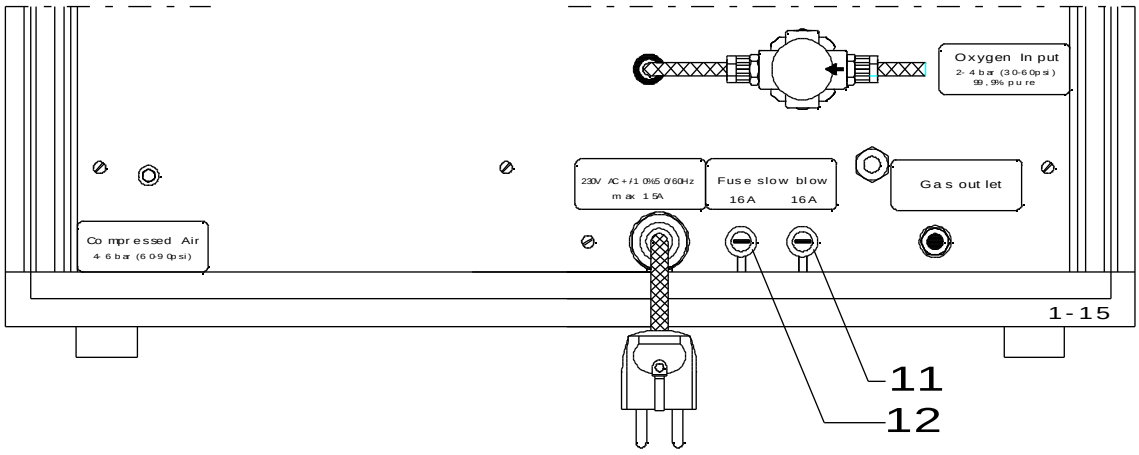
- Loosen the screw **(9)**, pull out the heat sink **(10)** upwards ! Pull out the tube **(8)** upwards!

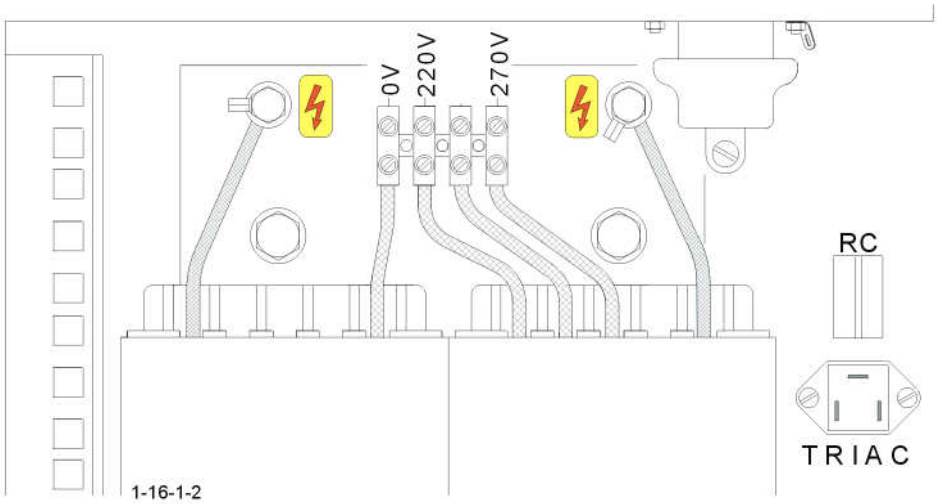
1.16 The fuse blows at the end of the analysis:

Causes :

- The triac is malfunctioning.

  The so-called **Latch-up effect** causes the undesired conduction during **one halfway** of the **triac**, once the trigger pulses to the triac have subsided. The transformer is then acting as a **short circuit** because it is fed with a **DC voltage!**

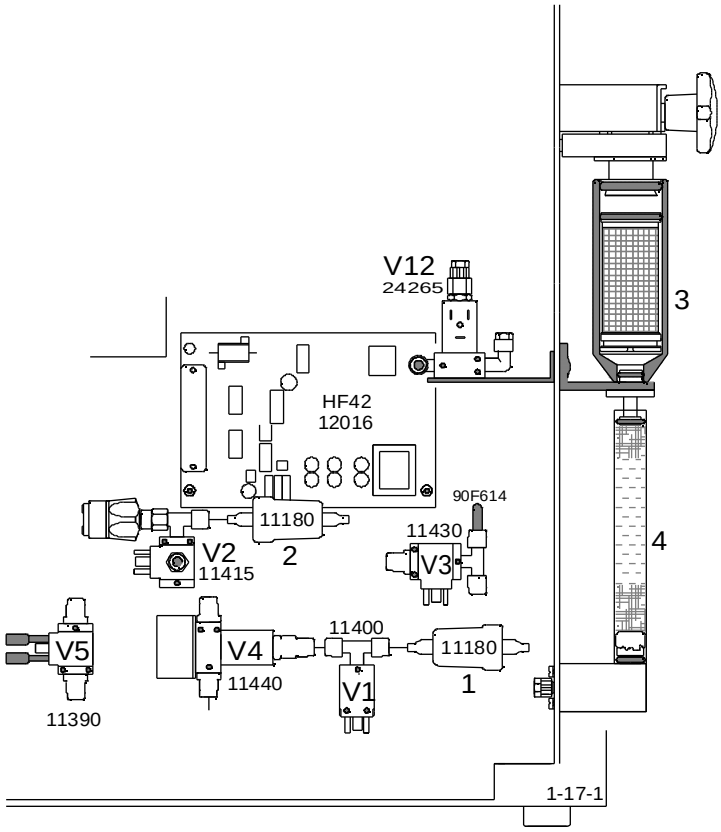




Replace the TRIAC!
(To locate the triac, see **4. 1 - 4**)

1.17 Large collection of dust when opening the furnace:

After pressing the key to open the furnace, the valves **(V1)** and **(V2)** a re-activated, this means that on the coils, **24 volts DC** coming from the electronic unit are present.
Valve **(V2)** closes the oxygen supply to the furnace.
Valve **(V1)** opens, releasing the pressure from the furnace through the dust trap **(3)**, through the moisture trap **(4)** and through the filter cartridge **(1)** into the open air **(in the direction of the arrow)**.
Following this, the pneumatic valve shuts and the furnace opens **(lift downwards)**.
When dust comes out of the furnace after this process this will cause, that the pressure in the furnace is not sufficiently eliminated.



The causes:

- Too much dust in the dust trap **(3)**, **(a few hundred analyses without cleaning)**
- Saturated moisture trap **(4)**
- Clogged paper filter in the moisture trap **(4)**, see **Operation Manual 6.1**
- Clogged filter cartridge **(1 and 2)** (this would be unlikely though)
- One of the valves **(V1)** or **(V2)** receives no power **(24 V DC)**

CAUTION !

- The valve **(V1)** will only be supplied with voltage **(24 V DC)** until the lift has reached the bottom position, then it will be switched off.
- The **24V** on the coil of this valve can be measured with a digital voltmeter, or with a light bulb of **24 V / 20 mA**.
- One of the valves **(V1)** or **(V2)** is sticking, preferable valve **(V1)**
- Clean the valves, see **3.13**

1.18 No or low oxygen pressure:

SYMPTOM: After pressing the START button, the following message appears: " no oxygen pressure "

POSSIBLE FAULTS: on the front panel of the analyser:

- Is the power switch **(1)** set on **pos. 2 ?**

- The pressure on the oxygen gauge **(2)** may be too low.
  1.5 bar is **normal** (22 psi).
  The pressure remains constant when the furnace is closed, and it sinks during the upward movement of the furnace floor.

- Check the oxygen pressure in the supply line or tank.
  4 to 6 bar (60 to 90 psi) showing on the pressure gauge is normal.

- Check if the pressure gauge for compressed air **(5)** shows **4 to 6 bar** (60 to 90 psi).

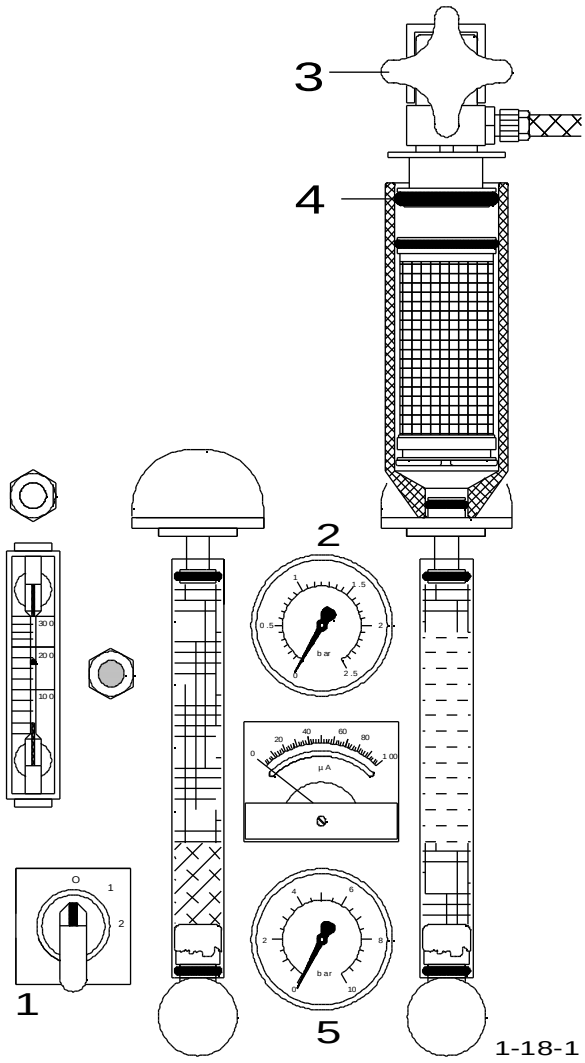
- Check if the cock **(3)** is properly shut, or else the O-ring **(4)** will not seal.
  Check if the O-ring **(4)** is in a good condition.

- Check if the combustion tube is broken or cracked.

- Check for gas leakage, see **3.7**

- Check if the chemicals are saturated and have become hard.

- The paper filter could also be the cause.
  For changing the paper filter, see **Operation Manual 7. 2**.



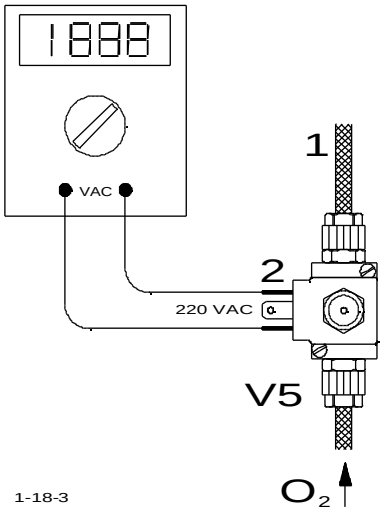
On the rear-side of the analyser:

- The contents of the gas cleaning furnace could be worn out and clogged.
  See **Operation Manual 7. 2**

Inside the analyser:

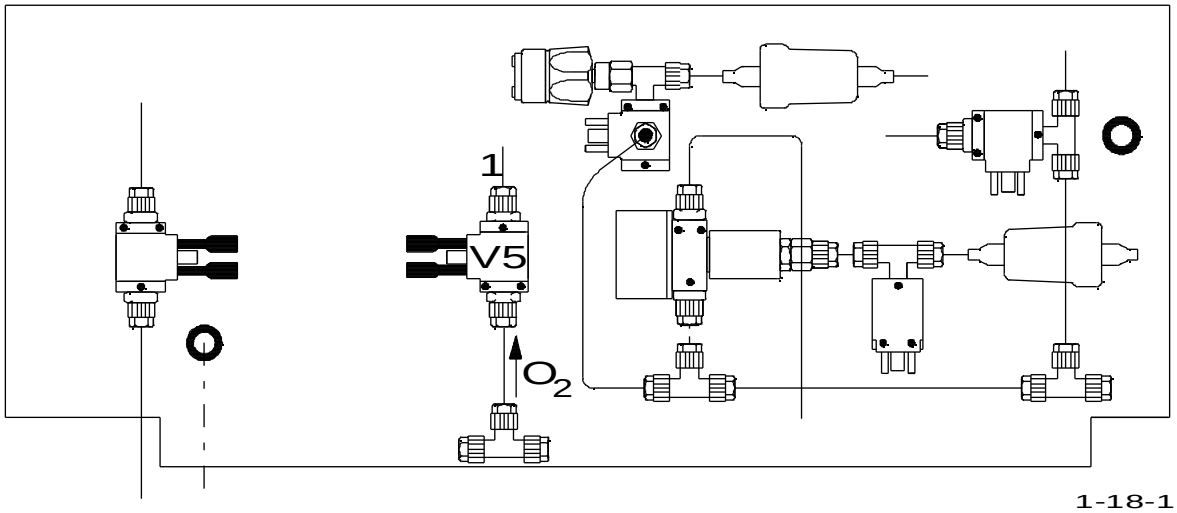
The oxygen solenoid valve (V5) may be defect.

- Open the left-side panel of the analyser.
  Unscrew the upper tube **(1)**. The oxygen should rush out when the power switch is set to **pos. 2**.
  If not :
- There may be no oxygen supplied.
- **220 V AC** is not measured on the terminal **(2)** of the solenoid coil.
- The solenoid valve is clogged.
  Clean the solenoid valve, see 3.13.
  If the fault is still present, then:
- Switch off the power, (set the power switch to position **0**)
  Pull out the socket **(2)** from the coil and measure the coil resistance. **3.3 KΩ is normal**.



1-18-3

The outflow valve does not close:



1-18-1

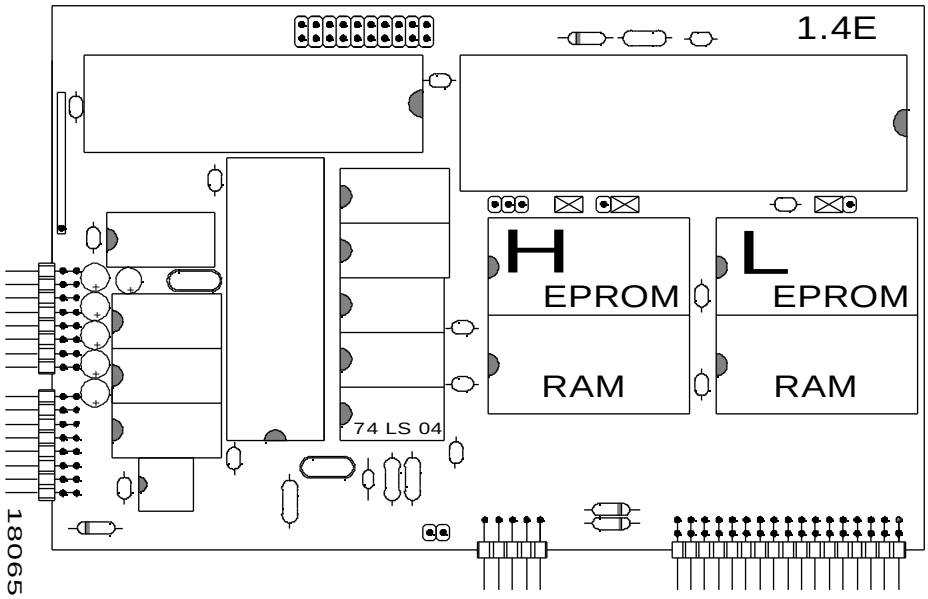
Open the left-side panel of the analyser. When the furnace is closed (the lift is up), no oxygen should be flowing out of the lower (free) opening of the valve **(1)** (in the direction of the arrow). This can be checked by putting your finger under the lower opening of the valve. If the valve does not close correctly, you will feel a strong oxygen pressure. The power supply to the valve **(1)** should be **0 Volt**. If this is the case then the outflow valve **(1)** should be cleaned, see 3.13 or replaced.

If the voltage on the outflow valve is constantly at 24 V, then:

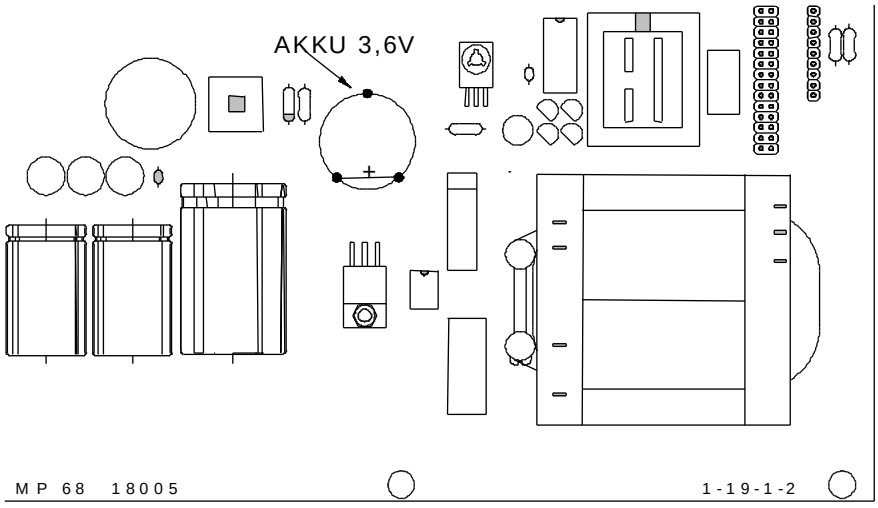
- Erase the memory, see 3. 9 .
- Replace the electronic driver, see 1.6.

OTHER FAULTS:
The screw for the upper furnace cushioning is too tight, see 2. 6
The pressure switch does not close, see 2. 2
The furnace closes too slowly, adjust according to 2. 6
The furnace does not close, see 1. 7

1.19 Saved data are lost:



- Make sure that a **74LS 04** is present.
- In this location only an **LS**-Type has to be installed.



- Replace the accumulator (accu in diagram), when the accumulator will not charge after the power had been switched on, and after installing the **74 LS 04**
  Once the analyser is switched off and the **accu** didn't charge **data will be lost !!!**

  The data that is meant here is the data that is saved in the accumulator-buffered **RAM** area. It consists mainly of the calibration factors, the **blank values**, and the **linearity factors**, which are entered through the keyboard. See **2. 9**
  The **linearity factors**, which were **programmed** in our **company** when the device was manufactured, were saved in the **EPROM**, they don't get lost.
  After turning on the power again (with an empty accumulator), those default linearity factors that are saved in the **EPROM's** are the current values. Therefore, you should note down any **linearity factors** that you enter through the keyboard, in case the accumulator becomes empty.

1.20 Noise or drift of the infrared baseline:

The **symptoms** are noticeable on the **display** and **especially** on the **monitor** attached to the **PC**, when either **rhythmic** or **sporadic** jumps of the **zero line** are present.

- The cause for a swinging rhythmic is the **chopper motor**.
  Replace the chopper motor, see **3. 5**

Causes for noise are:

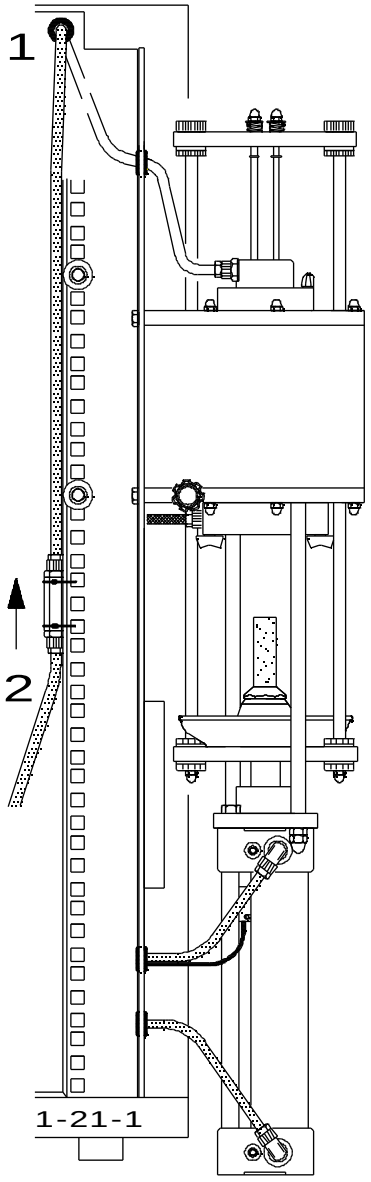
- The pre-amplifier,
  replace, see **3. 1** and **2. 3**
- The infrared detector,
  replace, see **3. 1** and **2. 3**
- A fault on the circuit board IR 21,
  replace, see **3. 3**
- The power supply fluctuates,
  see **3. 3** and **3. 4**
- The IR source is defective,
  see **3. 2** and **1. 8**.

1.21 Dust in the oxygen carrying tube when the furnace opens:

When **dust** can be **seen inside the transparent tube (1)** leading into the furnace, then the one-way valve **(2)** is **defect**.

- Replace the valve **(2)**.
  Attention: install the valve, so that the **arrow points upwards**. Because. the gas has to flow upwards.
  This is a one-way valve.

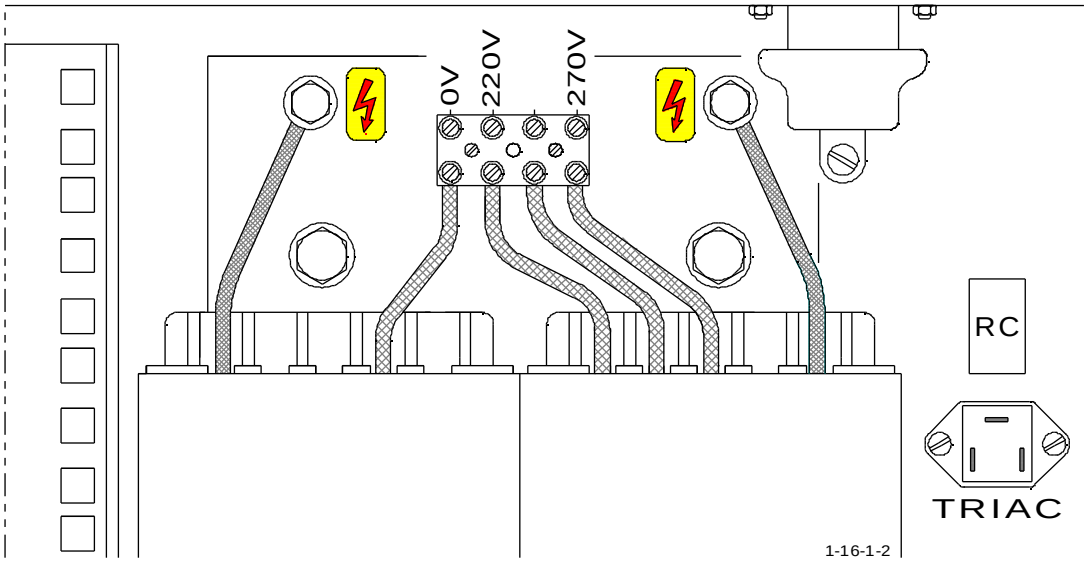
- **Before** mounting the valve, you should simply **push air** (e.g. by blowing) through the valve in order to ensure that it is properly **connected**.
  When the valve is **incorrectly mounted**, the oxygen flow will be **blocked**.



1.22 The word Eltra appears on the display:

This only happens when the power supply to the electronic is turned on.
The electronic unit can function down to a minimum main voltage of only **160 V**.
If, during the operation the word **"ELTRA"** appears on the display, then the voltage has sunken below **160 V**.

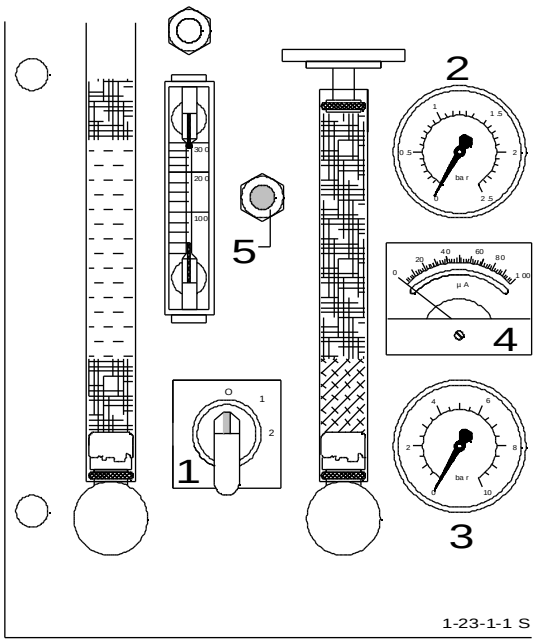
- Monitor the main voltage during an analysis.
  Should there be a short interruption detected, then the cause could lie with a poor contact.
- If the voltage drops when the generator is running, then the generator power can be reduced:



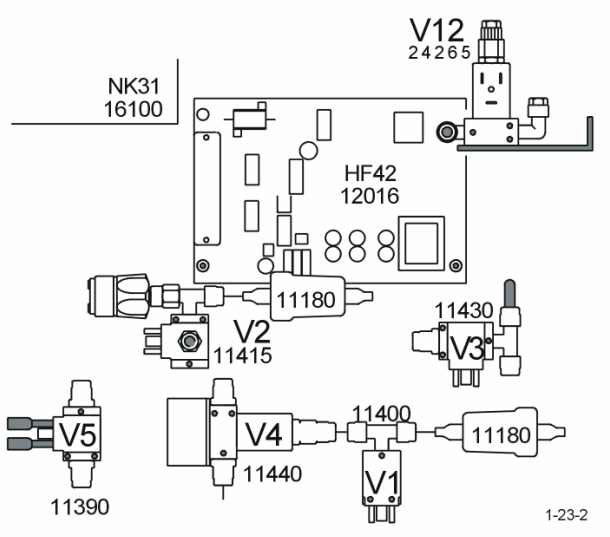
The cable that is connected on the **high voltage transformer** to the **220 V terminal**, should be then connected to the **270 V terminal**. This way, the generator draws less energy.

- Use a voltage stabiliser, see **3.15**

1.23 The oxygen pressure falls when the furnace opens



Regardless of whether the furnace is **opened** or **closed**,
the oxygen pressure shown on the pressure gauge **(2)**, must remain **1.5 bar** (22.5 psi) constant.
If, however, the **oxygen** pressure **falls** when the furnace is **open**, then:



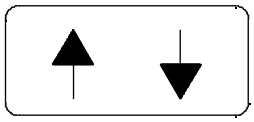
either the valve **(V2)** is defective or its control is incorrect.
When the furnace is open, the valve **(V2)** should have **23 V DC** on its magnetic coil.
When the furnace is closed, the voltage should be at **zero volts**.

- If the voltage on the valve **(V2)** remains at **23 V DC**, no matter whether the furnace is opened or closed, then the electronic unit is defect, see **1. 6**.
- If the **valve voltage** always stays at **zero**, then either the wiring to the electronic unit is broken, see **4. 2 ,** or the electronic unit is defect, see **1. 6**.
- If the voltage on the valve **(V2)** is correct, then the valve itself is defect, see **3.13**.

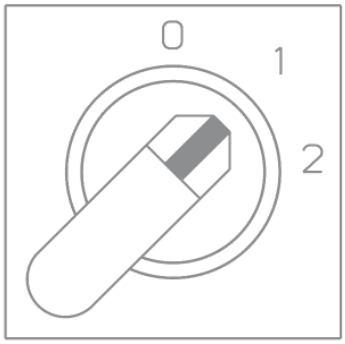
1.24 Combustion without pressing " START "

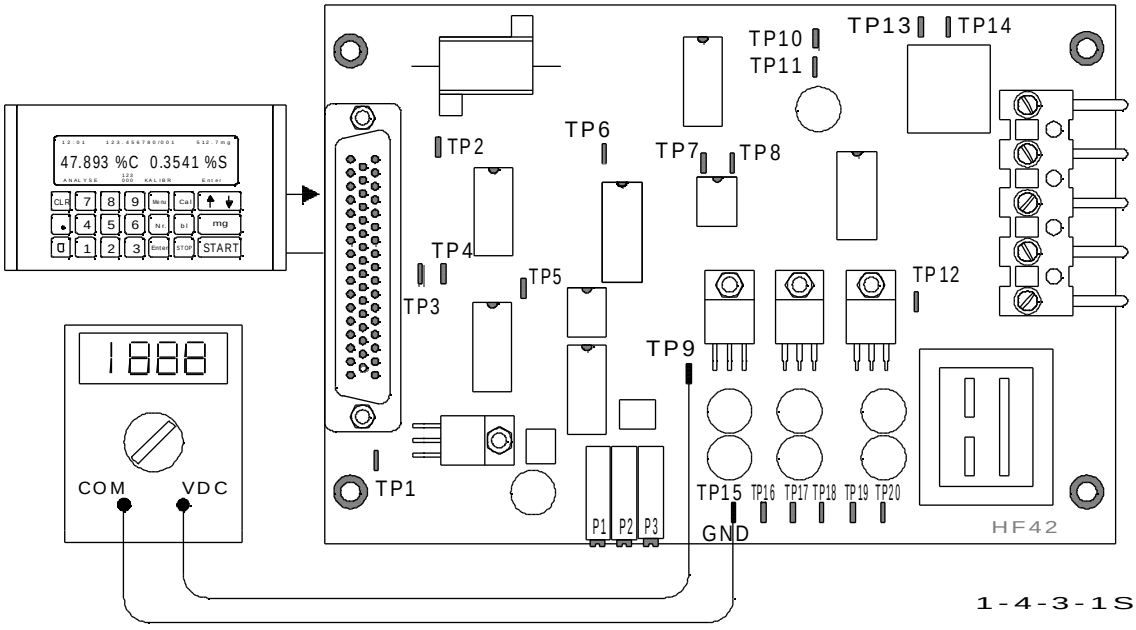
In this case, the combustion of the sample begins immediately after the sample enters the furnace, and before having pressed the **"START"** button.

Should the combustion start just,
after closing the furnace, and by pressing
then there is a serious fault !

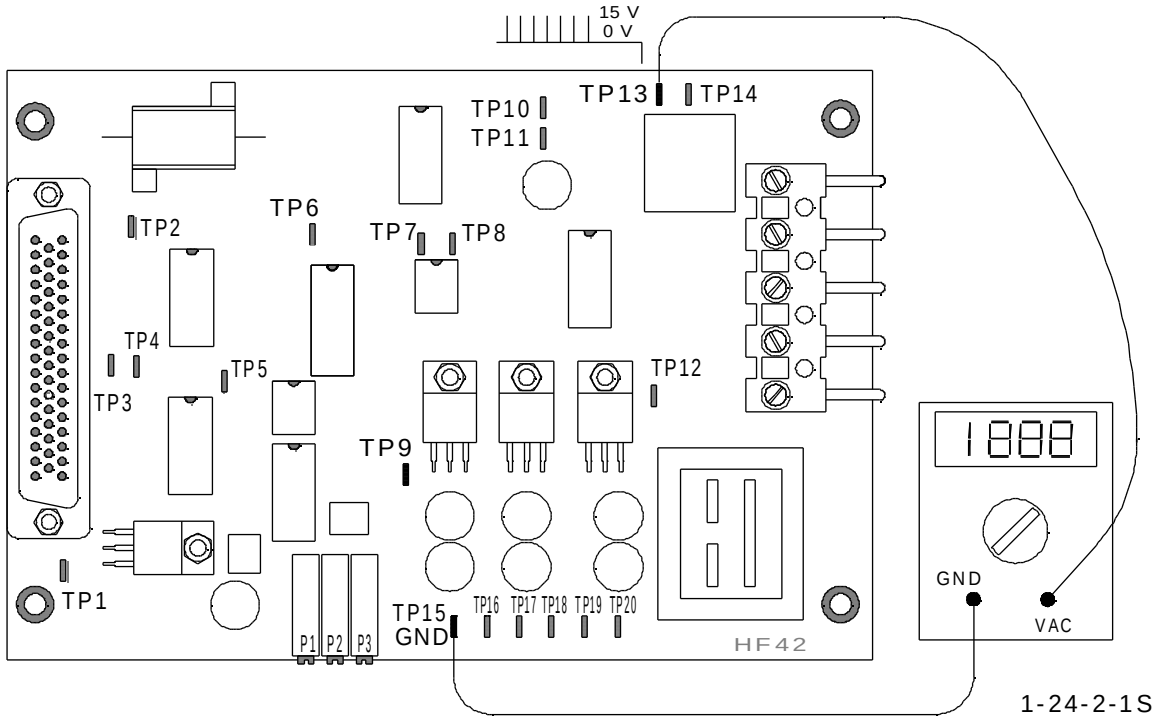


The power switch should be set **immediately** to **pos. 1**, in order to avoid any **overheating** of the generator.





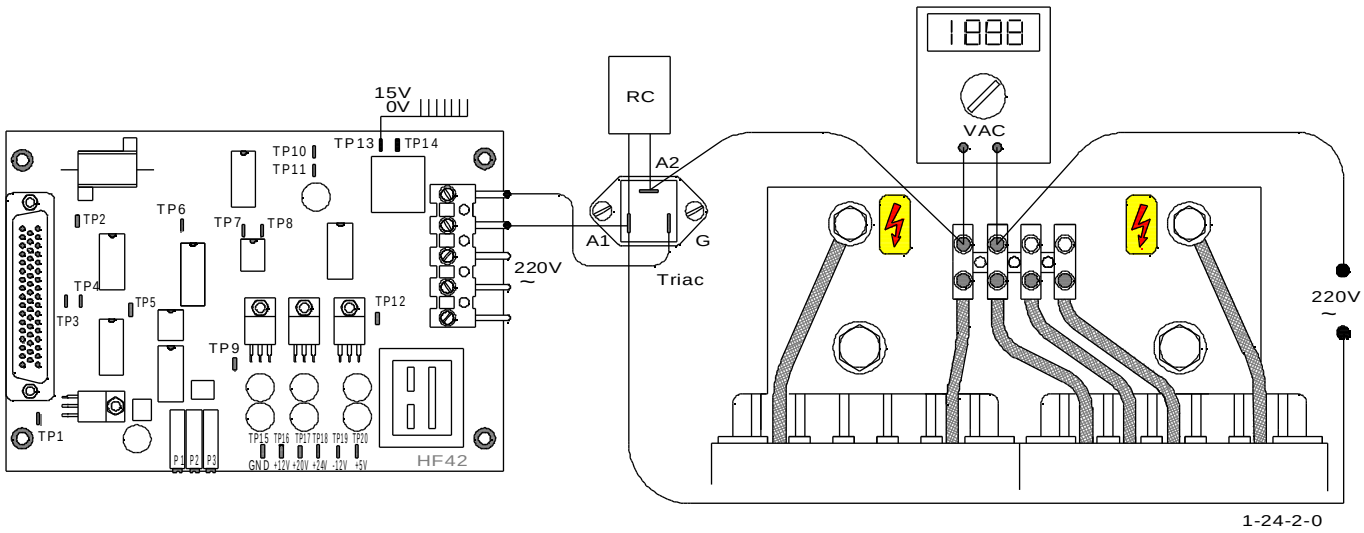
- The **electronic unit** (rack) is out of order, when the **combustion starts** without pressing **"START"** and without **"GEN"** on the display, there is only **0,5 V DC** on **TP9** (**instead of 1 2V DC**). Replace the electronic drivers, see **1. 6**.



When the pulses at **TP13** are present without pressing **"START"**
and with **15 V DC** at **TP9**, then the circuit board **HF 42** is out of order.
If no scope is available, the pulses can be detected by using a voltmeter.
Normal values are about **0 V AC** without pulses, and about **1 V AC** with pulses.
This indicated value can be different, depending on the type of the voltmeter used.

Possible reason :

- The triac is faulty (short circuit), and has to be replaced.
  (To locate the triac, see **4.1- 4**)



1.25 The crucible cracks or melts:

One reason could be that:
The quality of the crucible is bad, use a better quality.

Another reason could be that:
The furnace temperature is too high, due through:

- Excessive **main voltage**.
- Excessive **sample and / or accelerator weight**.
- The use of a **"sample or accelerator"** that requires lower generation power. In this case reduce the generator power, see **2.12**

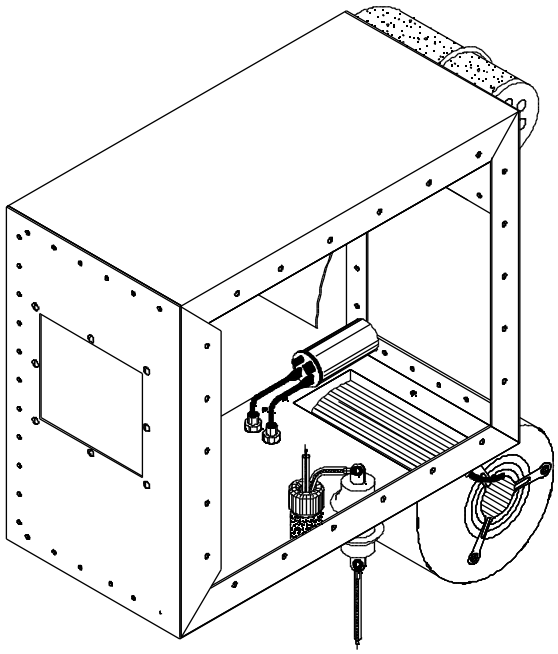
1.26 The analysis doesn't start :

There are two reasons for the above fault:

- Insufficient **oxygen pressure** (below 1 bar), see **1.18**
- The **infrared zero- baseline** deviates too much from zero, see **2.3**

1.27 Vibrations on setting 2:

The reason is dust accumulation on the blades of the oscillator's blower. The oscillation result due through distribution of dust on the blades causes an unequal rotation.



Caution:
Disconnect the power before removing the oscillators lid.

Blow the dust away with **compressed** air. Blow from the **inside** to the **outside**, otherwise the **dust** will be **blown** into the **oscillator**. Take care of the **rotary speed** of the blower to **remain** within the operation limits. When blowing compressed air, the rotary speed of the blower can exceed the limit of operation causing **damage** to the bearings and the shaft.

1.28 The analysis cycle stops only 25 seconds after start:

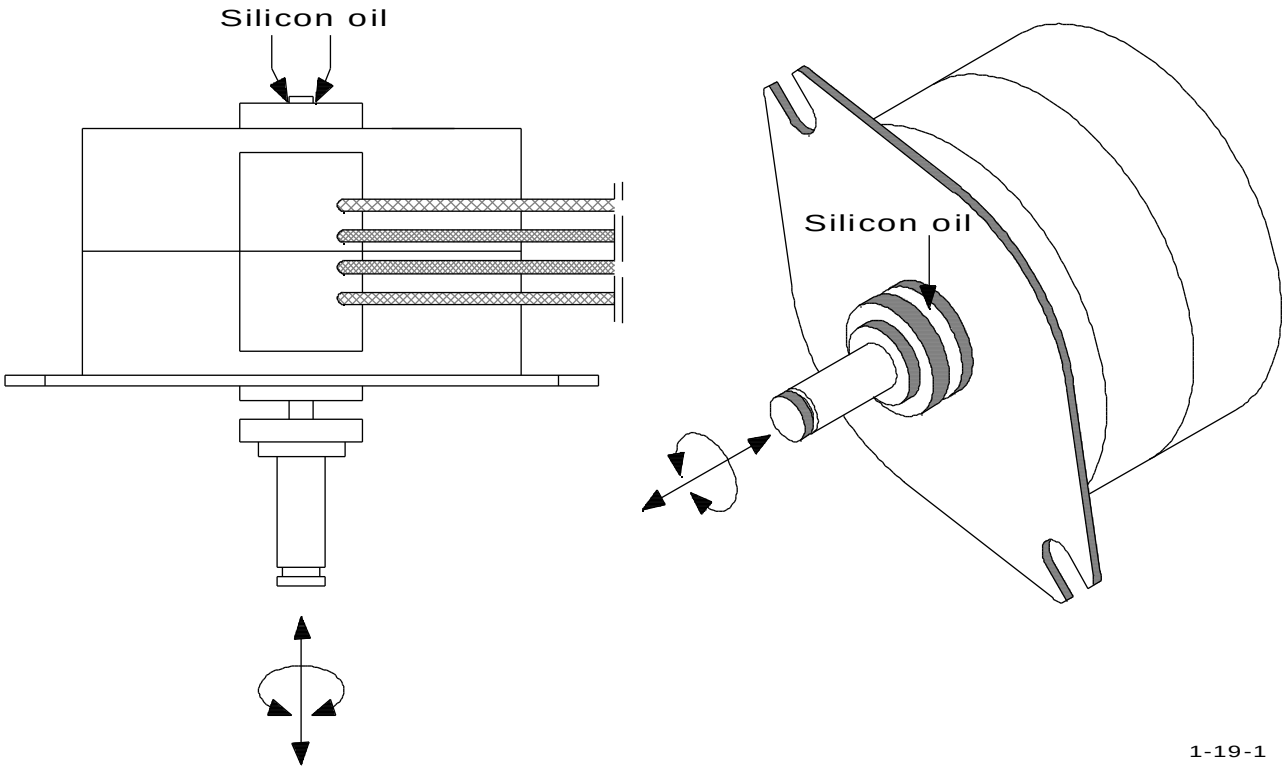
Information.
When 50 seconds as maximum analysis time is entered, this means that 50 seconds after start, the analysis, resp. the combustion will definitely stop in any case. But if there is no signal (peak) coming from the infrared cell, the analysis cycle will take at least 25 seconds i.e. half the maximum analysis time.

The problem.
It seams that there is no signal coming from the infrared detector. If the peak comes, the minimum analysis time of 25 seconds will be automatically prolonged until the signal comes bask to zero or the maximum analysis time of 50 seconds has been reached.
There are two possibilities for not having a signal:

1. There is no combustion. See **1. 4** and **1. 5**.
2. The infrared cell is damaged. Do the IR-test. See **1. 1**, **2. 3** and **2. 4**.
   Make sure that you take a sample with relatively high carbon to provide a clear visible high peak to about 3 to 8 volts.

1.29 The chopper motor doesn`t rotate:

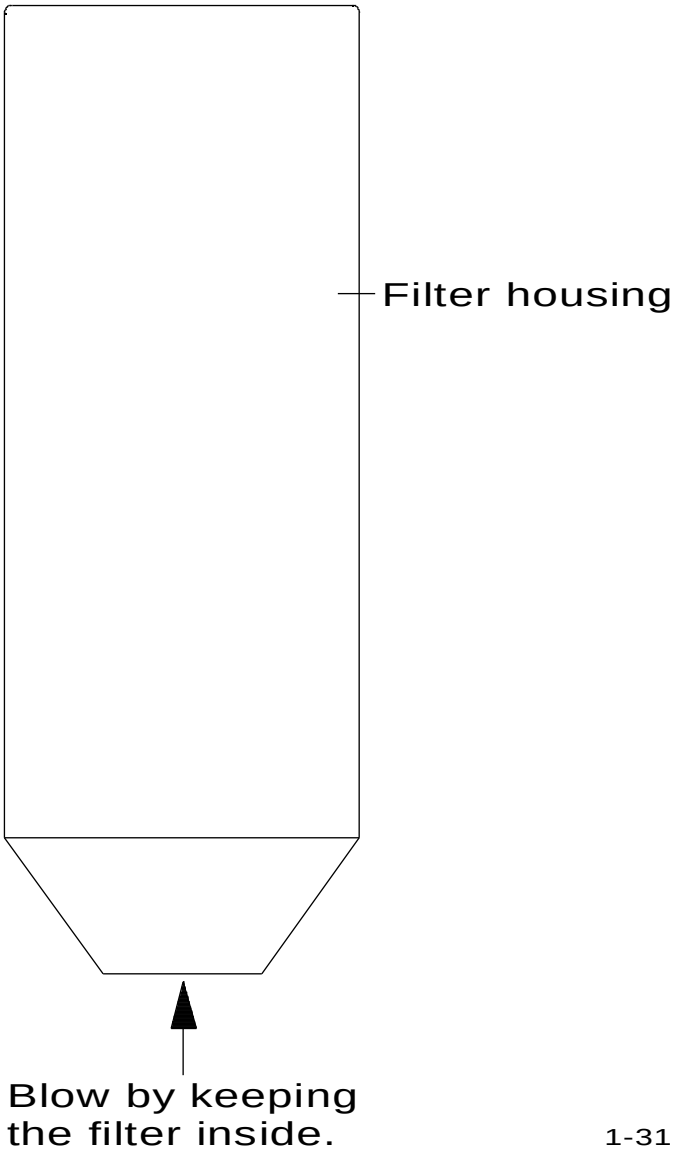
Mostly, the reason is that the grease of the bearings becomes dry.
You can feel a resistance when you try to turn the shaft by hand.
In this case the problem can be solved by lubricating using silicon oil.
Dip a piece of wire in to a flask of silicon oil and apply as shown below.



In order to spread the oil in to the space between shaft and bearings, turn the shaft and move it in axial direction at the same time. The use of mineral oil is not suggested, because mineral oils become dry and hard after long time of operation. If no silicon oil available, use silicon spray. Silicon grease is also good for this purpose and it is also available in laboratories, however it could be very difficult for grease to penetrate the space between shaft and bearings.

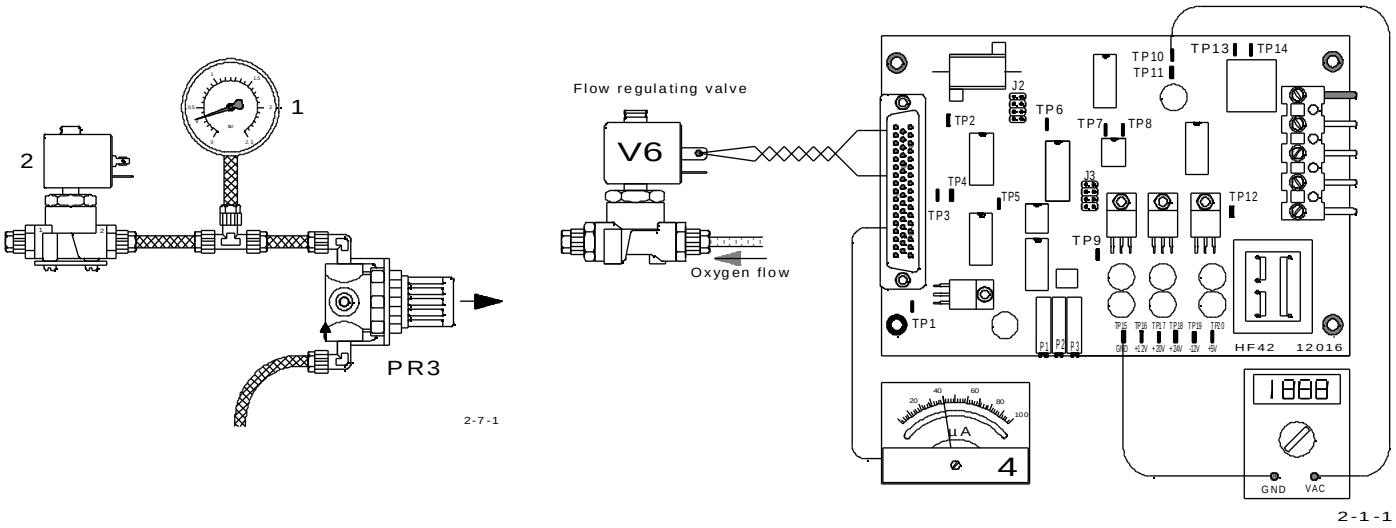
1.30 High carbon results are erratic:

If only high carbon results are erratic, while low carbon and sulfur results are repeatable, most likely the metal dust filter is blocked.
Even if the filter may be brushed and cleaned in ultrasonic cleaner, some day will not be able to be cleaned any more. The filter don't last for ever.
Check by removing the filter with the dust filter housing.
Don't remove the filter from its housing.
Turn the filter housing upside down and try to blow air through the small hole (about 16mm diameter) of the filter housing.
If you feel a remarkable restriction, replace it by a new one. With a new filter the air should pass practically free without any restriction.



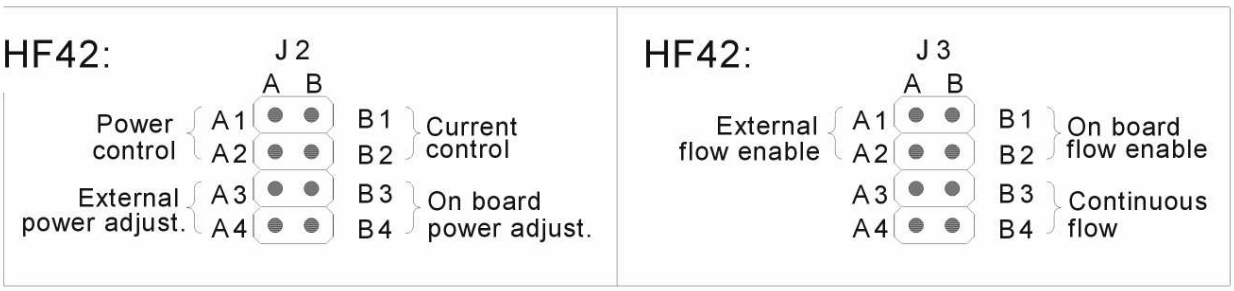
2 ADJUSTMENTS, TEST AND FUNCTION EXPLANATION

2.1 Gas flow controller adjustment and jumper settings:

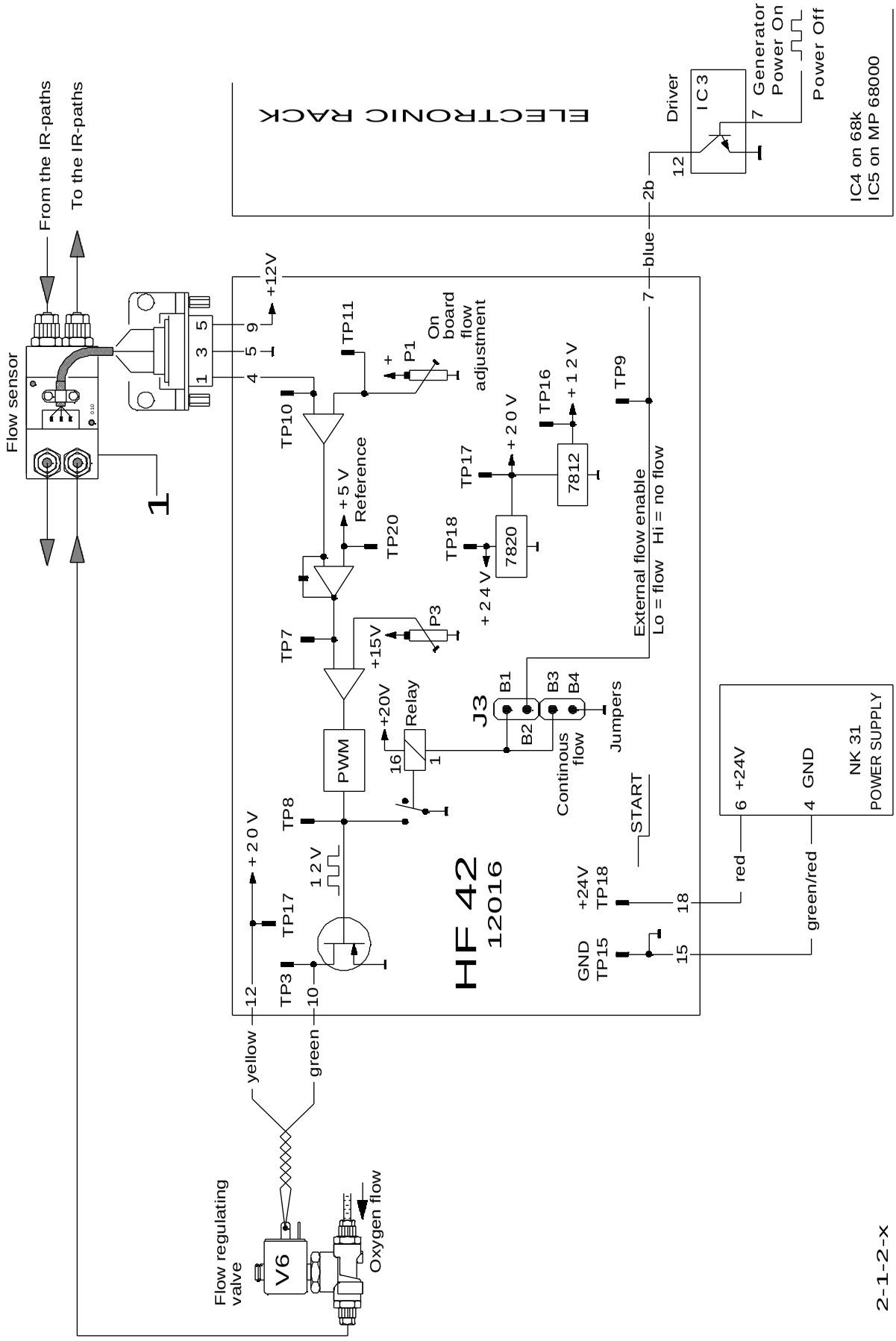


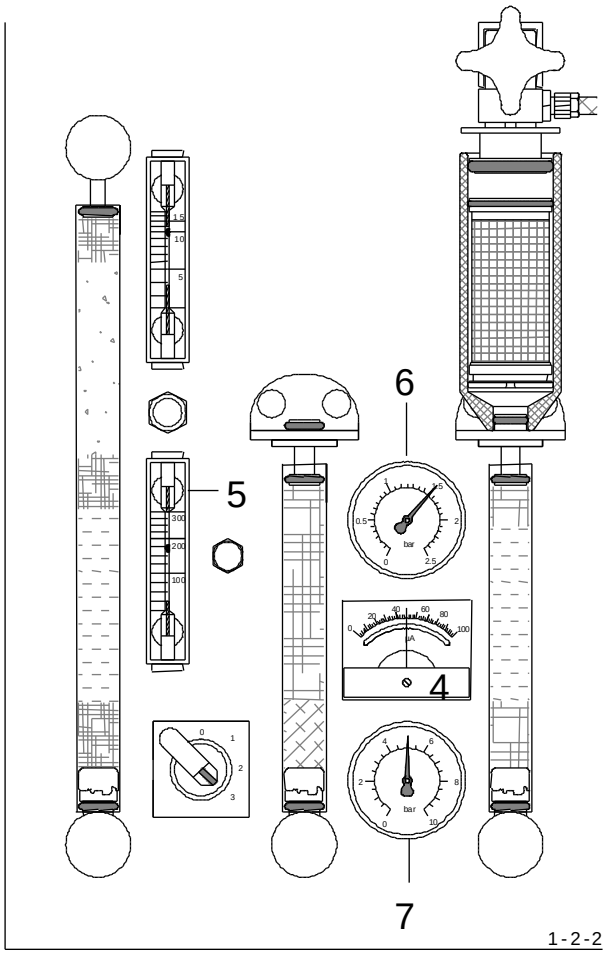
- Make sure that the **pressure regulators** are at least pre-adjusted. See 2.7 this is mainly important for the pressure regulator **(PR3)** in front of the **gas flow regulating valve**.
- Set the flow rate with **P1** of the **HF 42**, to about **180 l/h**. Observe the flow rate on the lower flow meter of the analyser, wait until the value has settled.
- The output of the flow sensor is found on **TP10** of the **HF 42 board**; **TP15 is GND**. With a flow of **180 l/h**, the voltage is about **2.5 – 3 V**.
  Please note: without flow, the output voltage of the sensor is not **0 V**, but about **0.6 V**.
- Adjust with **P3** until the voltage on **TP7** is **5 V**.
- On **TP8**, the activity of the pulse width modulator can be checked.
- The output voltage to the gas flow regulation valve can be measured on **TP3**. With a constant flow of about **180 l/h**, it should be between **5** and **15 volts**. The panel meter **(4)** must indicate between **30** and **70 µA**.
- Check and if necessary readjust the pressure regulator **(PR3)** in front of the **flow regulating valve**. See 2.7

- **Jumper settings:**



Detailed explanation of the gas flow regulation:



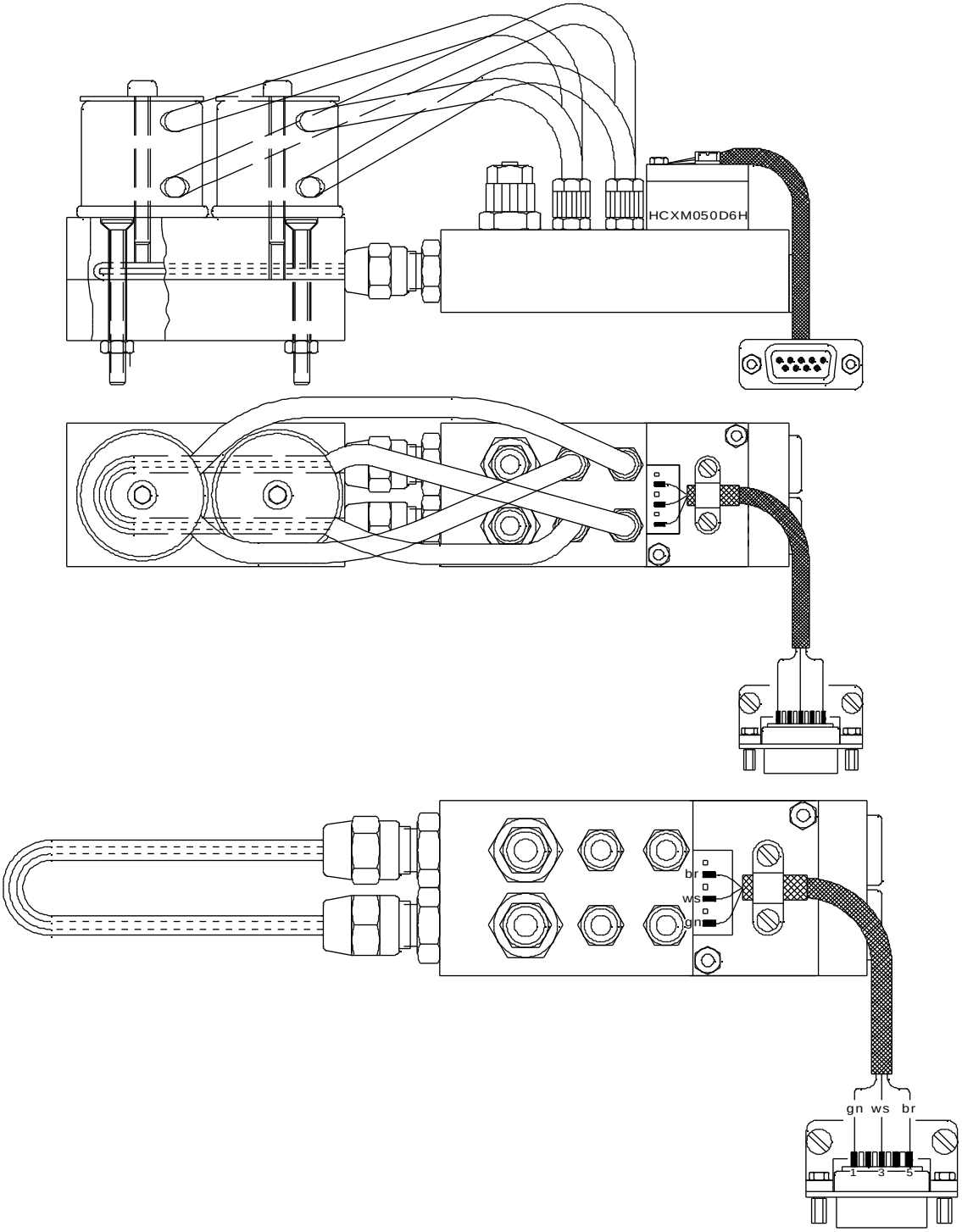


The flow controller mainly consists of the following components:

- The flow sensor **(1)**
- The flow regulating valve **(V6)**
- The flow control board **HF 42**

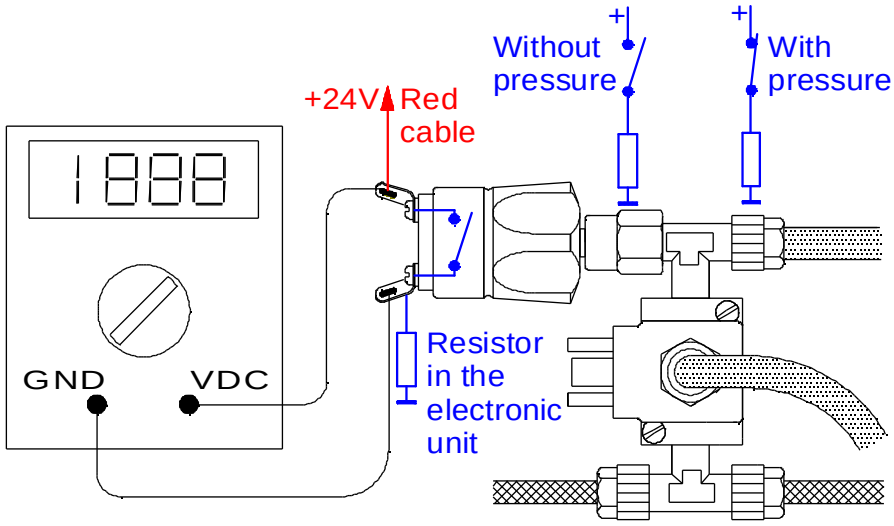
The flow sensor detects the gas flow, and converts its amount into an electrical voltage.
This voltage is then sent, as a feedback signal, to the **HF 42** board.
The **HF 42** board compares this feedback value, to the flow set point value.
The signal resulting from the comparator, runs a pulse width modulator.
Its output can be seen on **TP 8**.
The pulse width modulated signal runs a power transistor, which in turn, supplies the output signal to the flow regulating valve.
The duty cycle of the output signal determines its **DC voltage**, which, with a flow of about **180 l/h** and with clean chemicals, measures around **9 V** (on TP 3).
The **HF 42** board drives the flow regulating valve **(V6)** in such way, to provide a constant and accurate gas flow. The µA meter **(4)** shows the rate, at which the flow valve **(V6)** is driven **„open“**.

Remark:
Due to a few failures of the flow sensors, almost exclusively on the CS-800 at customers who regularly treat their samples with acid, we concluded that the reason of the failures should be of chemical nature i.e. acids and Schutze`s Reagent damage the sensor.
The solution is to prevent the analysis gases to get in contact with the sensors. Therefore the sensor ports are connected with long tubes to the gas flow system. There is no gas flow through the sensor tubes but only the pressure is sensed by the sensor.
In case of failure of a previous version sensor, it is advisable to replace it by the new version. In this case the part numbers of the complete assemblies should be used for ordering. In case the analyzer has already the new version sensor, the order should include the spare part number. See attached drawings.
The new flow sensor can not be used as a replacement for the older flow sensor consisting of a rotameter and a optical element.



2.2 Pressure switch:

■ Close the furnace.
The pressure switch should be adjusted, to about **1 bar** (15 psi); this means that under **1 bar** (15 psi), the contact is open (no contact), and over **1 bar** (15 psi), the contact is closed (turned on).

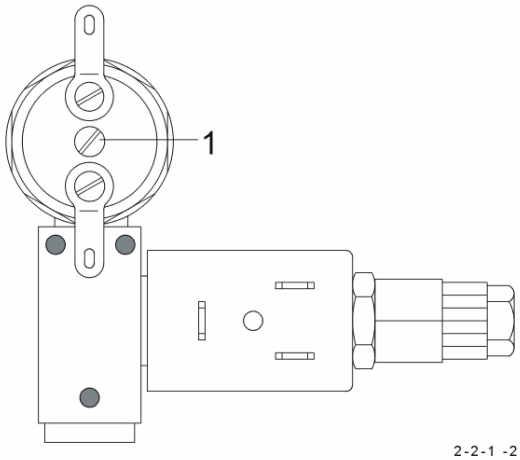


2-2-1-1 S

■ In installed condition and with the analyser turned on (Power switch set to **pos. 2**), there should be a voltage of **24 V DC** when the pressure is under **1 bar** (15 psi). If the pressure is over **1 bar** (15 psi), then the voltage should be **zero**.

ATTENTION ! Measure this with a high-impedance digital voltmeter!
Do not cause a short circuit while measuring, or else the electronic drivers will blow!

■ If necessary, the oxygen pressure can be adjusted to **1 bar** (15 psi). This can be read off the upper pressure gauge of the analyser.



2-2-1 -2

■ The switch point can be set by turning the screw **(1)**

■ If the switch is turned off **(24 V)** when the pressure is at **1 bar** (15 psi), then the screw **(1)** should be turned counter clockwise until the switch turns on, measuring the power until it reaches **zero** volt.

■ If **zero volts** are measured when the pressure is at **1 bar** (15 psi), the screw **(1)** should be turned clockwise until the voltage goes to **24 V**.

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2.3 Infrared zero- baseline, control and adjustment:

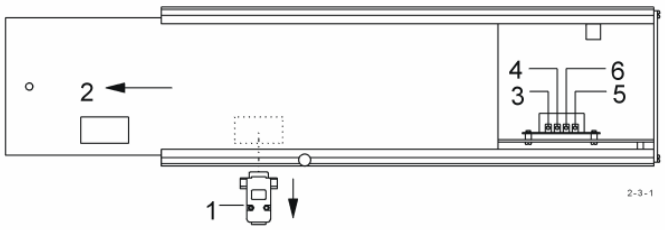
The infrared cell zero-baseline is normally controlled by the electronic and automatically set to **zero**.
The auto – zero control should be **disabled** In order to control and adjust the infrared cell zero-baseline manually, this way the electronics will have no influence. This can be done by pressing the **< Menu > and < Cal >** keys.
The voltage exiting the infrared channel should be shown as in the following example:

- 0.13
- 0.21
- 0.18
- 0,17

The displayed numbers refer to the IR-cell output voltage:

The upper number refers to the **voltage of channel 1**
The next number refers to the **voltage of channel 2**
The next number refers to the **voltage of channel 3**
The lower number refers to the **voltage of channel 4**

The channel numbers can be shown on the display by pressing: **< Menu > < 5 >**
Return by pressing **< CLR >**.
If at least one voltage exceeds +3.0 volts, then the **zero-signal** needs to be adjusted.



- To adjust the zero signal, push the left cover plate **(2)** of the infrared cell about **10 cm** towards the back.
  With a small screwdriver, adjust the trimmers **(3 / 4 / 5 / 6)** in the infrared rack, so that the numbers shown on the display are between **+ 0.20** and **- 0.20**.
  The adjustment should preferably be carried out while the **carrier gas is flowing**.

  If the zero level (between + 0.20 and - 0.20 volts) cannot be reached, and if more than two adjustments were recently carried out, then the problem could be:
- Contamination of the **IR-paths**, see **3. 1**
- bending of the **IR-source**, after rough shipment of the device, see **3. 2**
- insufficient **supply voltage** for the **Infrared**, see **2. 4**

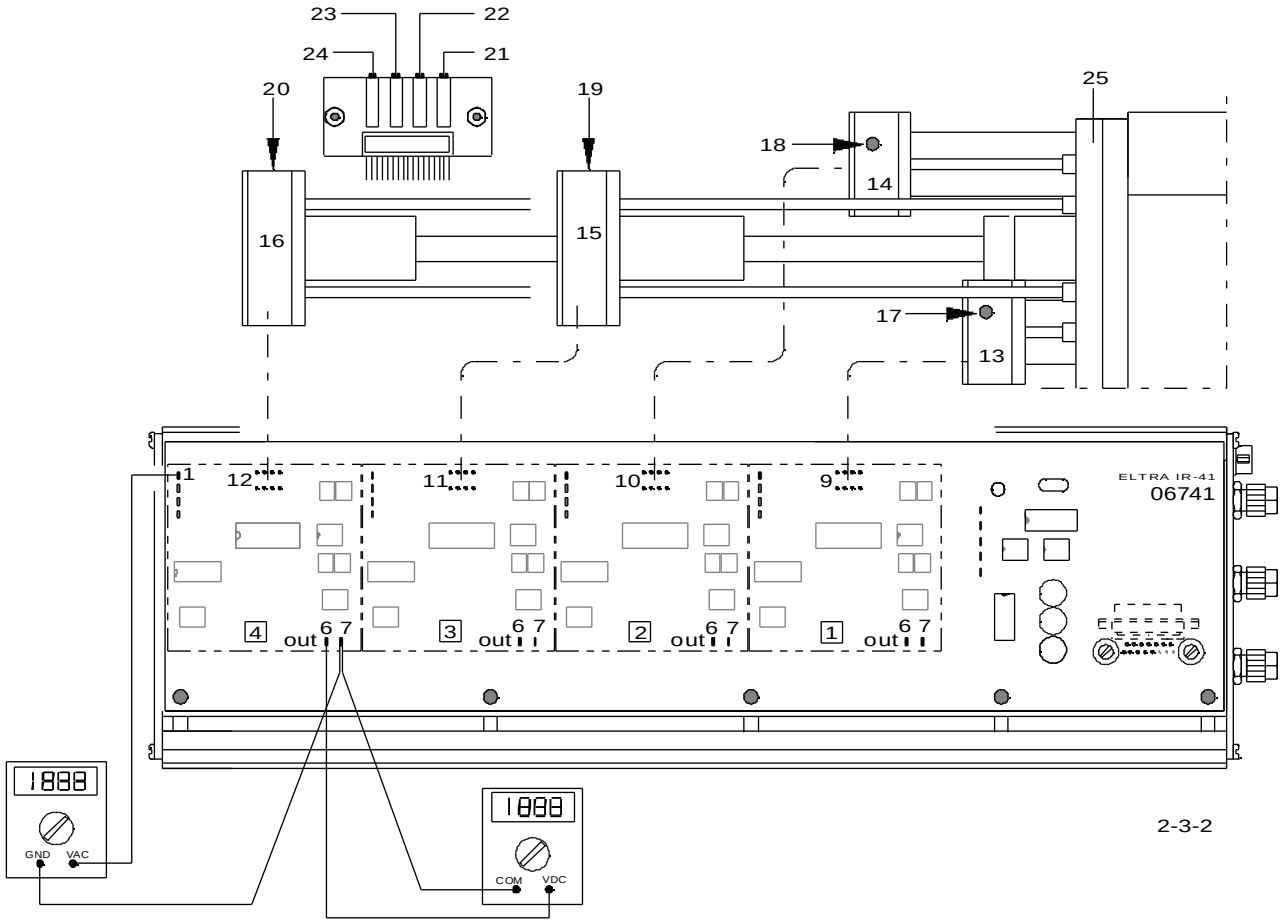
  The stability of the displayed numbers should be better than ±0.01.
  Normally, the second digit after the decimal comma does not change, or it may fluctuate up and down by only **1**, since this could be actually on the rounding point.
  If the fluctuations are larger, then there is a major degree of **noise**, see **1.20**
  The drift should also be very small. Within **10 minutes** the second digit after the decimal point should not change more than **1**.
  The drift should first be checked when the analyser has been switched on (power switch on **setting 1**) for at least **one hour**, better would be **two hours**, and the **oxygen** flowed for about **10 to 15 minutes** (Power switch on **setting 2**).

In case the drift is too large :

- Check the temperature regulation, see 2. 5
- Unstable power supply, see 2. 4
- Defective IR-source, see 3. 2
- By pressing the **< CLR >** key, you can end the test.

- **Notice :**
  If the infrared cell's **output voltage** is over **10 volts**,
  ++++ **is shown on the display**, ++++ then there is a serious defect.

Adjusting the infrared cell:



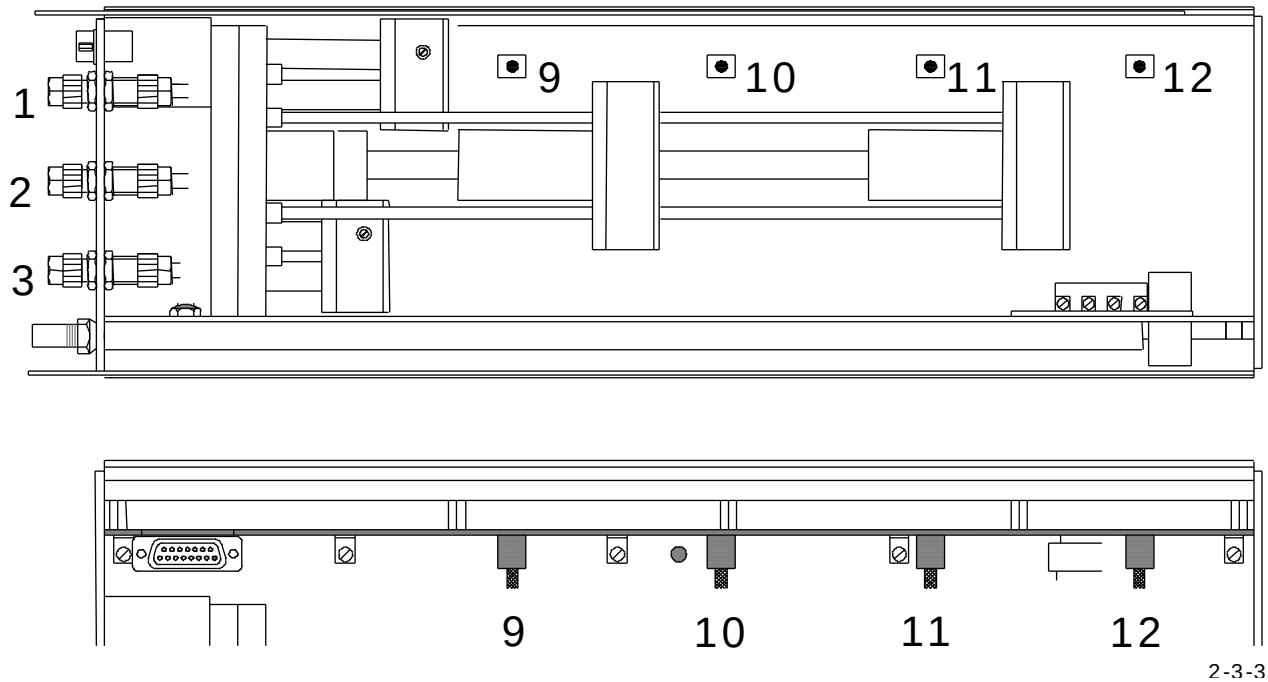
The connection sockets of the measurement channels **(9 / 10 / 11 / 12)** are predetermined on the circuit board **IR 41**.
The position of the **IR-paths** on the path plate **(25)** is irrelevant. Each **IR-path** can be changed, according to the required measuring ranges.
The connections to the **IR 41 board**, however, is very important:

9	Connection for section **(1)**
10	Connection for section **(2)**
11	Connection for section **(3)**
12	Connection for section **(4)**
	(C or S, depending on the layout of the Analyser, see 3.11)
13 / 14 / 15 / 16	Pre-amplifiers
17 / 18 / 19 / 20	Adjusters
21 / 22 / 23 / 24	Zero fine adjustment

- Each channel is adjusted separately.
- Set the trimmers **(19 / 20 / 21 / 22)** in the middle of their range.
- Connect a digital voltmeter on the **outlet 6** and the **ground 7** (measuring range **200 V DC**)
- Adjust **0 volts DC** by adjusting the preamplifiers **(13 / 14 / 15 / 16)**
- Turn the trimmer clockwise for **lower voltage**, counter clockwise for **higher voltage**. After the **zero adjustment**, the voltage on **test point 1** should be about **1 to 1.5 volts AC**(measuring range **2 V AC**)
- Install the infrared cell in the Analyser.
- Restore the oxygen flow.
- After **30 to 60 minutes**, adjust the zero by turning the trimmers **(19 / 20 / 21 /22).**
- To adjust zero, the **< Menu > and < Cal >** keys are pressed,
- Press the **< Cal >** key again to return to the analysis.
- On the temperature regulation card, check if the **LED is blinking**, see 2. 5

ATTENTION !
When the test signal fails on **test point 1**, this can be due to the **8-pin connector (9 / 10 / 11 / 12)** that connects the pre-amplifier to the **IR 41 board** not being correctly connected.

- **remove, turn 180°, and replace** , the 8-pinn connector and measure again.

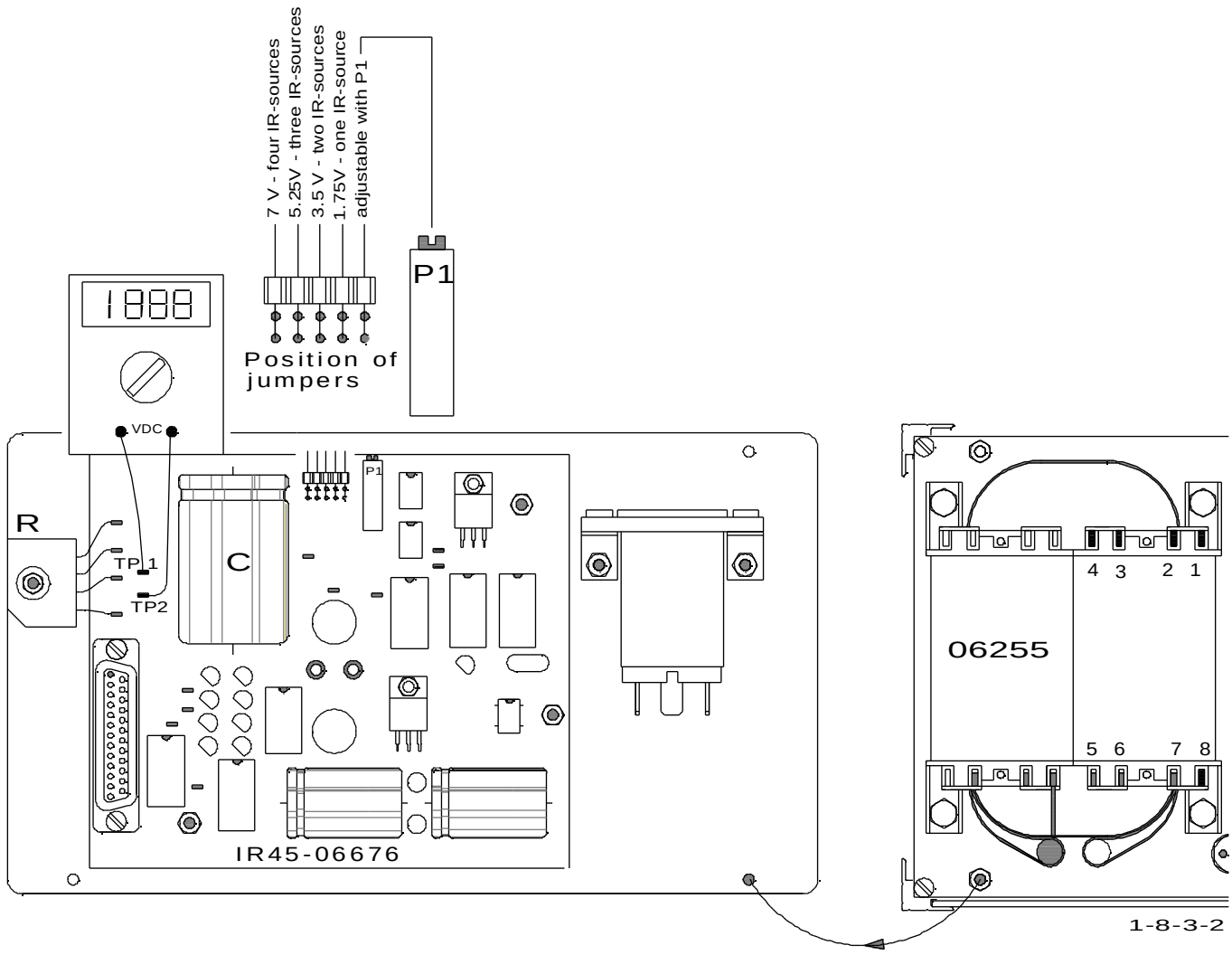


2-3-3

1 **black** marked tube connection
2 **yellow** marked tube connection
3 **red** marked tube connection

- When reinstalling the infrared cell into the analyser, you must pay **attention** to the colour markings of the tubes and their connections.

2.4 IR-source voltage setting:



IR-source voltage, is to be measured between TP1 and TP2 on IR 45 board.

1,75 V DC for 1 channel device
3,5 V DC for 2 channel device
5,25 V DC for 3 channel device
7 V DC for 4 channel device
(1,75 Volts DC for each IR source)

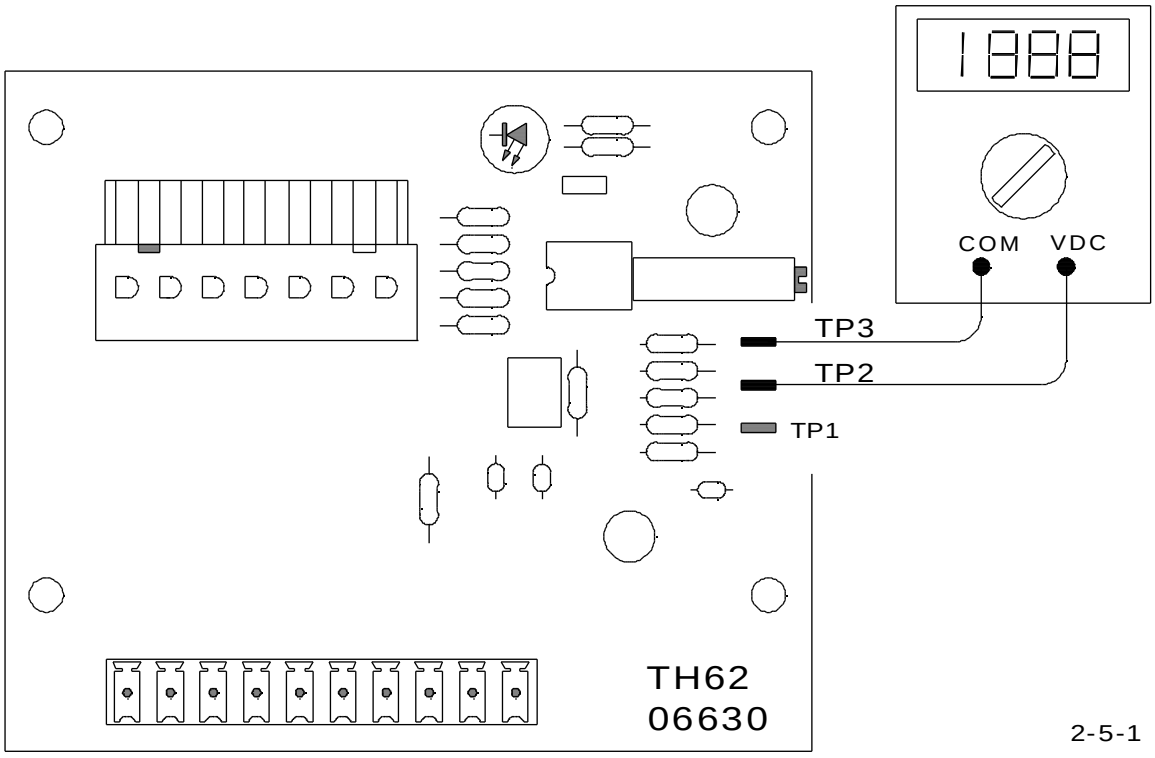
Transformer connections:

Blue cables

1 Soldering Location for 1 channel device
2 Soldering Location for 2 channel device
3 Soldering Location for 3 channel device
4 Soldering Location for 4 channel device
8 Always connected (common)

- Set above voltages through **Jumpers**
- The voltage of the capacitor **C** must be about **5 to 6V higher** than the **voltage of the IR-source** measured on the **a.m. test point**.
- If the voltage of **C is too low**, either the **transformer** is not correctly connected, or the **rectifier R** is out of order.

2.5 Temperature regulation of the IR-cell:



2-5-1

The adjustment should preferably be done only when the analyser, and the infrared cell, has been in operation for at least **one hour**.

- If the **LED** is always off, adjust **P1** on the **TH 62** board clockwise for **higher temperature set point**.

- If the **LED** is always on, adjust **P1** counter clockwise for **lower temperature set point**.

  In case the **LED** is already blinking, adjust the flash rate of the **LED** to 50% duty circle.

ATTENTION!

- The effect of the readjustment will appear in a **few minutes**, as soon as the temperature has changed to the **new setting**.

- The voltage on **TP1 (TP2 = GND)** does not correspond to the actual temperature of the **IR-cell**, but it corresponds to the power needed to keep the **IR-cell** at a constant temperature.

- When the environmental temperature goes **down**, the heaters of the **IR-cell** need **higher power** to keep the temperature of the **IR-cell** constant. In this case the **voltage** will go **higher**.

- The opposite happens when the **temperature** in the laboratory goes **higher**. The **IR-cell** heaters need **less power** to keep the temperature constant, so that the **voltage** will become **lower**.

- The adjustment of the **IR-cell** should be done, if possible, when the laboratory has the **average temperature of a year**. The set point of the **IR-temperature** should then be adjusted with **P1** so that the voltage in stable condition measures 6 volts.

- For readjusting, turn **P1** when the voltage to is too low **clockwise**, when the voltage is to high turn **counter clockwise**.

- **Caution:** After you have turned **P1**, several times the **voltage** will be **out of range**. This is normal. When turning **P1** you enter a new **set point** of the **IR-cell temperature** which is at that moment different to the **actual temperature** of the cell.

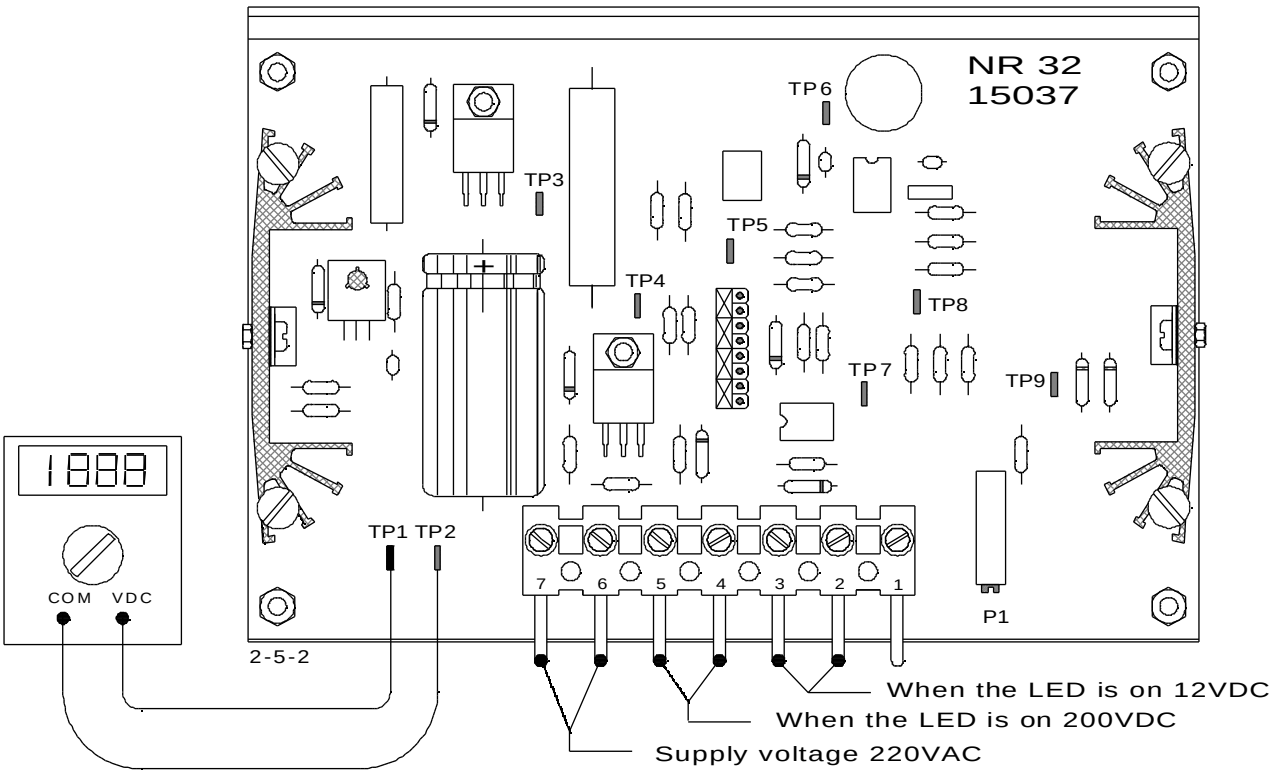
- The **temperature control circuit** will give **full power** to the **heaters** (in case you have set a higher temperature) or the circuit will **completely shut down** the **power** to the heaters, if you have adjusted a **lower temperature set point** than the actual temperature.

- After about **10 minutes** the temperature will reach the new adjusted level, and the **voltage** will come back to **remain stable at the new level**.

- This is the voltage level which corresponds to the power to keep the **IR-temperature** stable at the new level.

- If the **LED** still doesn't start blinking , adjust **P1** on the **TH 62**, until there is about **5.35 V DC** present between **TP2** an **TP3**.

- If the **fault** still remains, despite adjusting the **TH 62**, then check the board **NR 32**, according to the following instructions.



CAUTION! ELECTRICIAL HAZARD !

- You should be able to measure **200 V DC** between **TP1** and **TP2 (GND)** of the **NR 32** board; otherwise the board is faulty.
- This requires that **220 V AC** comes through the connectors **6** and **7**
- If there is no **220 V AC**, then there could be a bad contact in the plug.
- The voltage for the **infrared cell** heating elements, comes from the connections **4** and **5** of the **7 pin plug**, measure the voltage on the screws, without disconnecting the plug.
- As long as the **LED** is on, there is **200 V DC** between **4** and **5**.
- As long as the **LED** is off, there is **no voltage** between **4** and **5**.

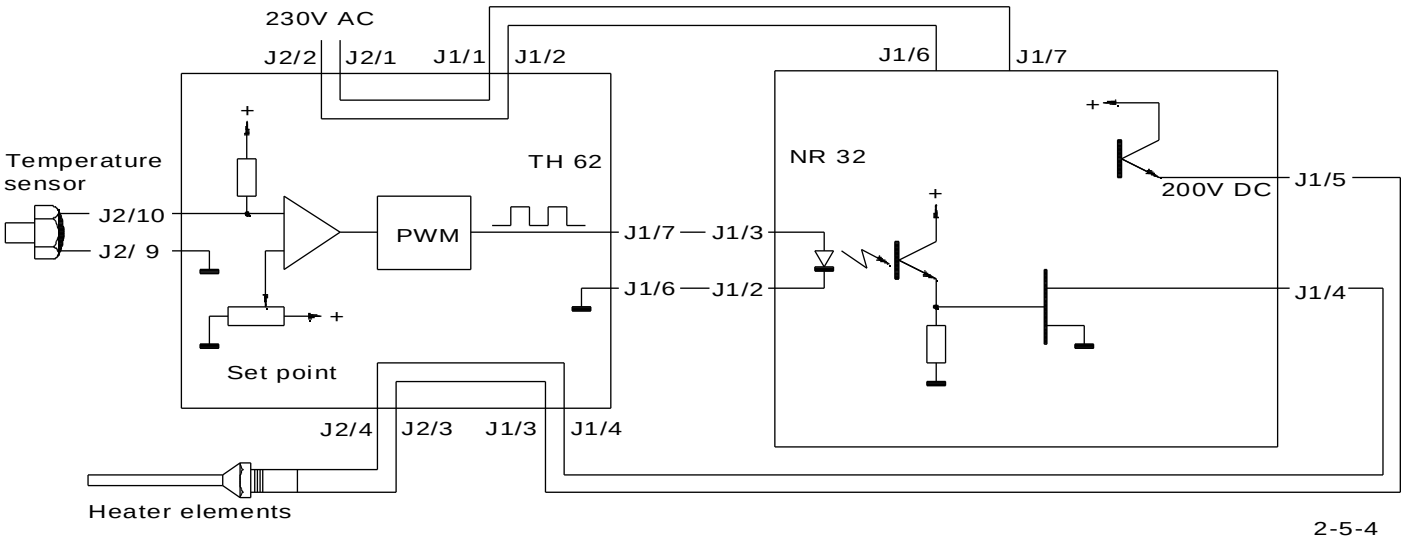
  If there is no **voltage** between **4** and **5**, then the **NR 32** is faulty. Replace it, according to **3. 6**.

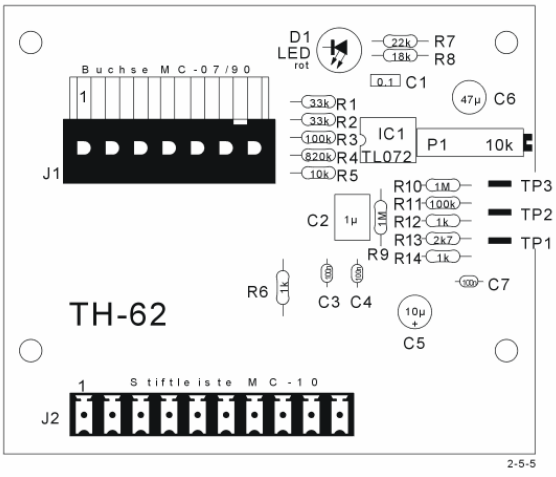
- The above sentences, extend to the board **TH 62**. From there they feed the heating elements.

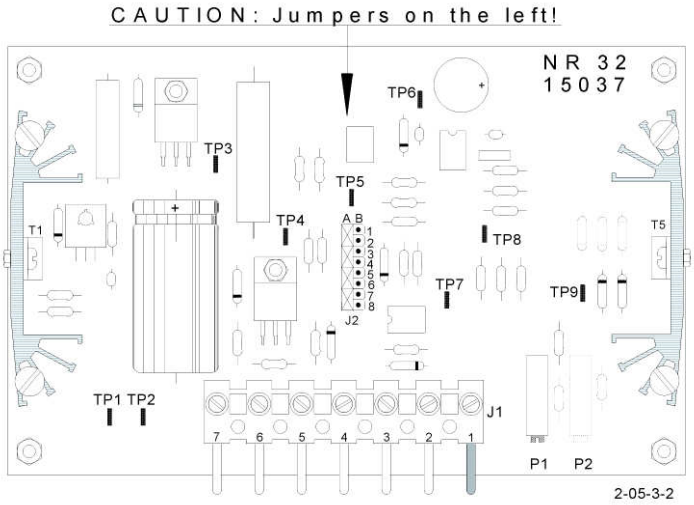
General description of the infrared cell temperature regulation:

For more details see 4.2

Simplified diagram with **TH-62**







This system consists mainly of the following components:

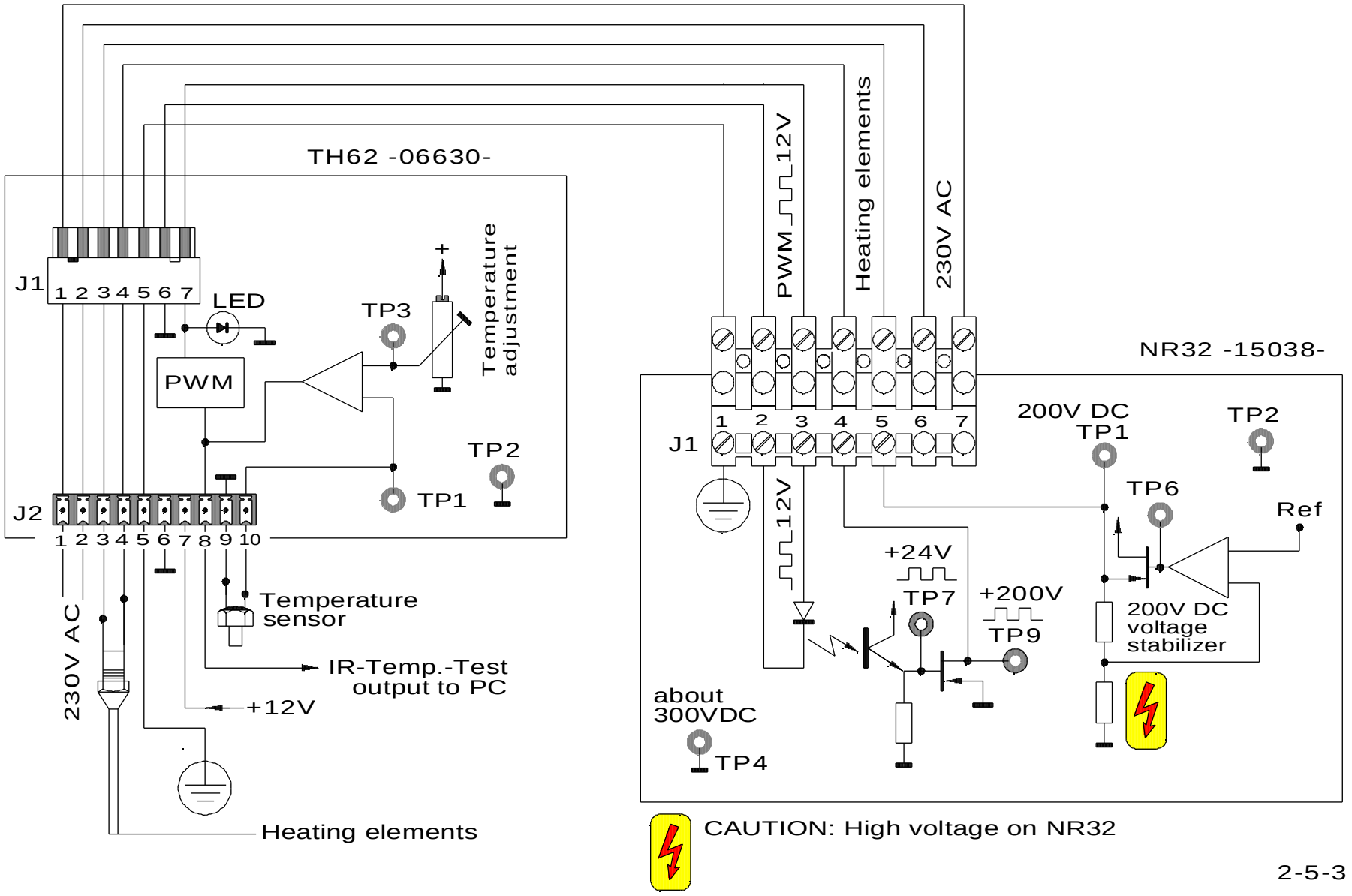
- The temperature sensor
- The temperature control board **TH 62**
- The power stage board **NR 32**
- The heater elements

The temperature sensor feels the temperature of the infrared system, and sends the signal to the temperature control board **TH 62**.

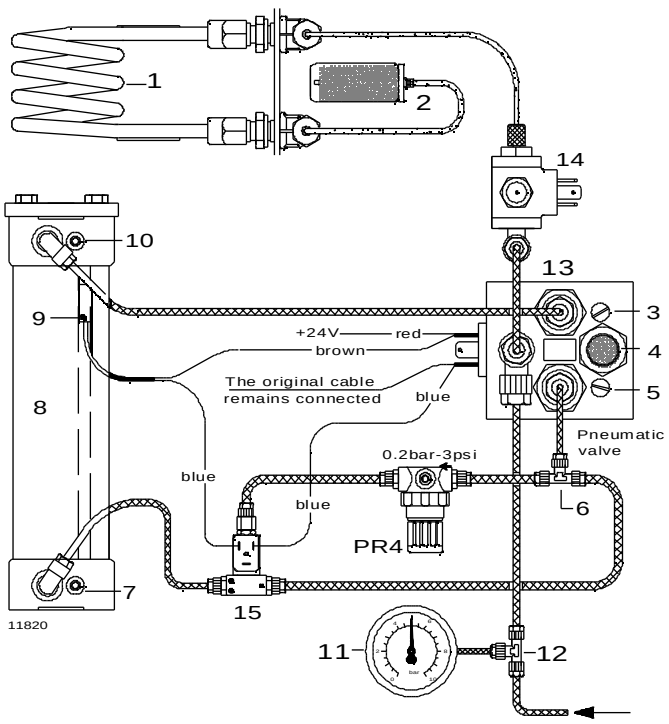
The **TH 62** compares this signal with a set point value. The resultant value drives a pulse width modulator. The **LED** of this board shows the function of the modulator.

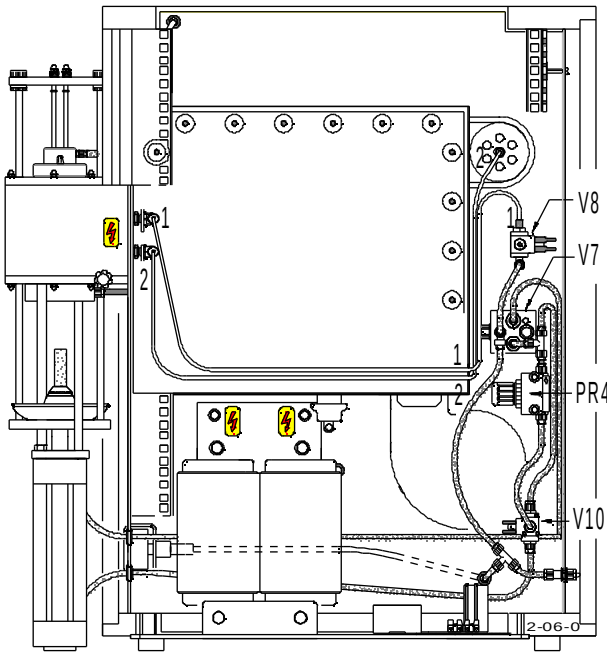
The modulated signal further drives and power stage of the **NR 32 board**; the power signal returns to the **TH 62** board, from there it finally goes to the heater elements.

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2.6 Pneumatics:





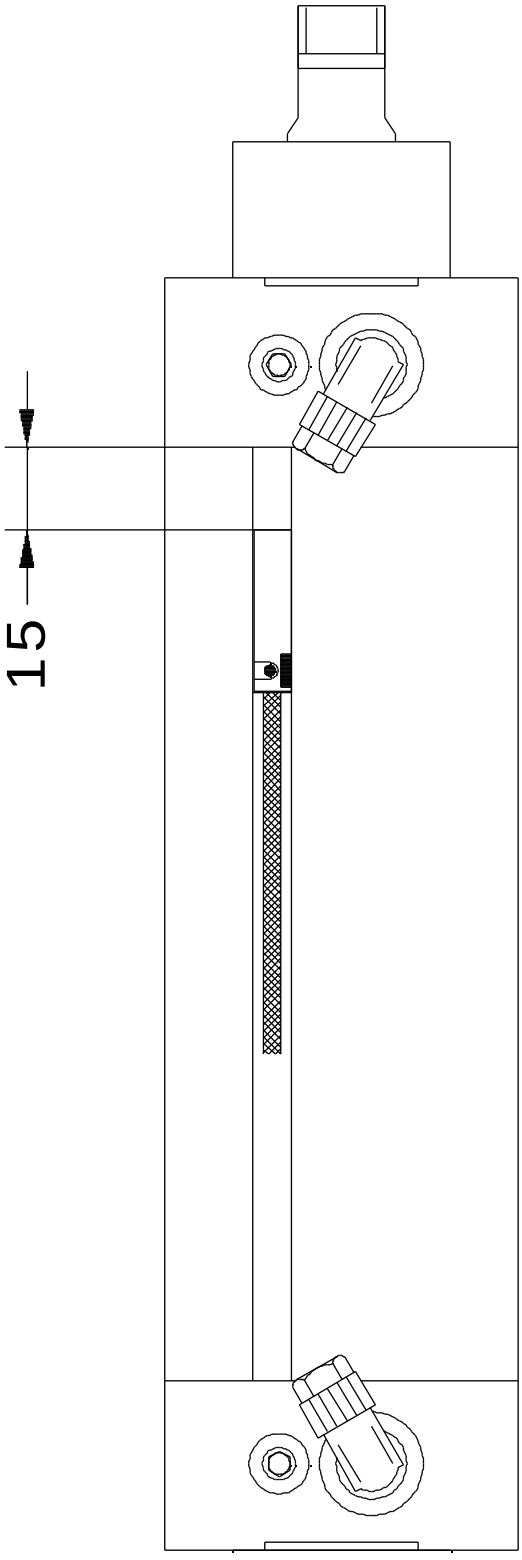
1 Combustion coil
2 Muffler
3 Upward speed regulator
4 Muffler
5 Downward speed regulator
6 T-piece
7 Lower cushioning
8 Pneumatic cylinder
9 Magnetic switch
10 Upper cushioning
11 Pressure gauge
12 T-piece
13 Pneumatic valve
14 Coil cooling valve
15 Pressure reduction valve
PR4 Pressure regulator

Adjusting the pneumatics for correct furnace movement:

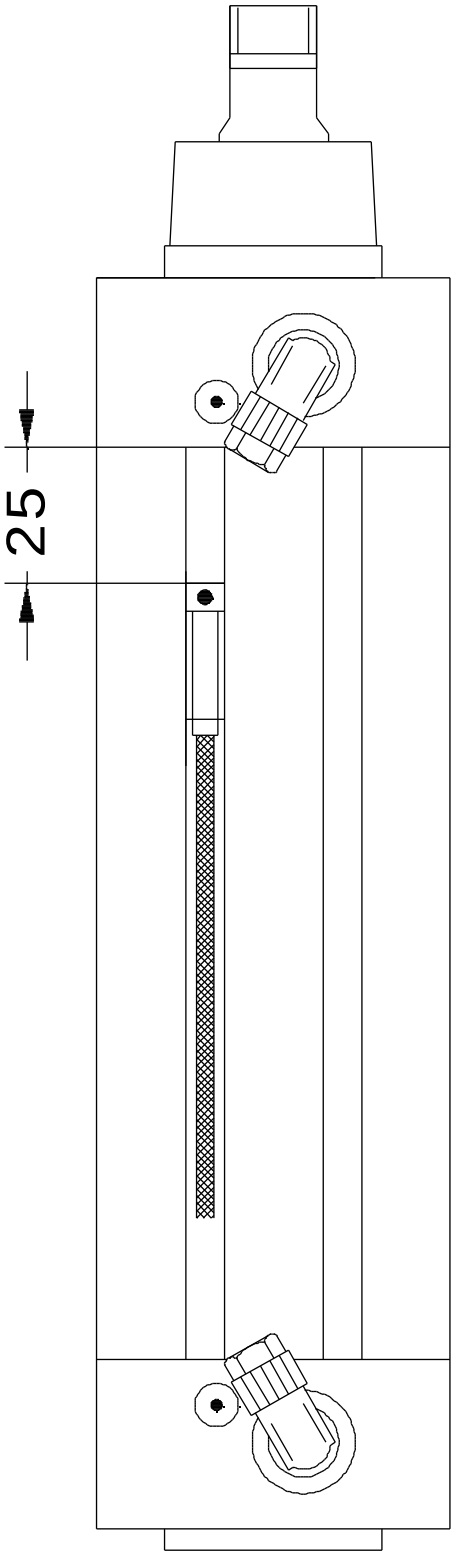
- Check if the air pressure on gauge **(11)** is between **4-6 bar**.
- Press the button ↓ ↑ to open the furnace.
- Open the right-side panel of the analyser, to find the pressure regulator **PR4** and the **pneumatic valve (13)**
- Turn the screw **(5)** counter clockwise, for minimum air restriction. Leave it in that position.
- Rotate the knob of the pressure regulator **PR4** fully counter clockwise.
- Turn the screw **(3)** clockwise, for maximum air restriction. Leave it in that position.
- Shift the magnetic switch **(9)** fully upwards.
- Press the button ↓ ↑ to close the furnace (furnace floor won't yet move).
- Adjust regulator **PR4**, until the furnace floor can rise completely, without shaking,
- **For safety precaution**, **a person still can stop moving the furnace floor with only one hand.**
- When the furnace is closed, shift the magnetic switch downwards until it switches on; Now shift down another **5 mm**.
- Open the furnace and then close it, to check if the adjustments are still correct.
- Adjust the furnace upwards speed with screw **(3)**, it must be within a reasonable limit.
- Adjust the furnace downwards speed with screw **(5)**, it must be within a reasonable limit.
- Adjust lower cushioning **(7)**, so that the furnace opens without banging at the bottom.

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Magnetic switch of the pneumatic cylinder:



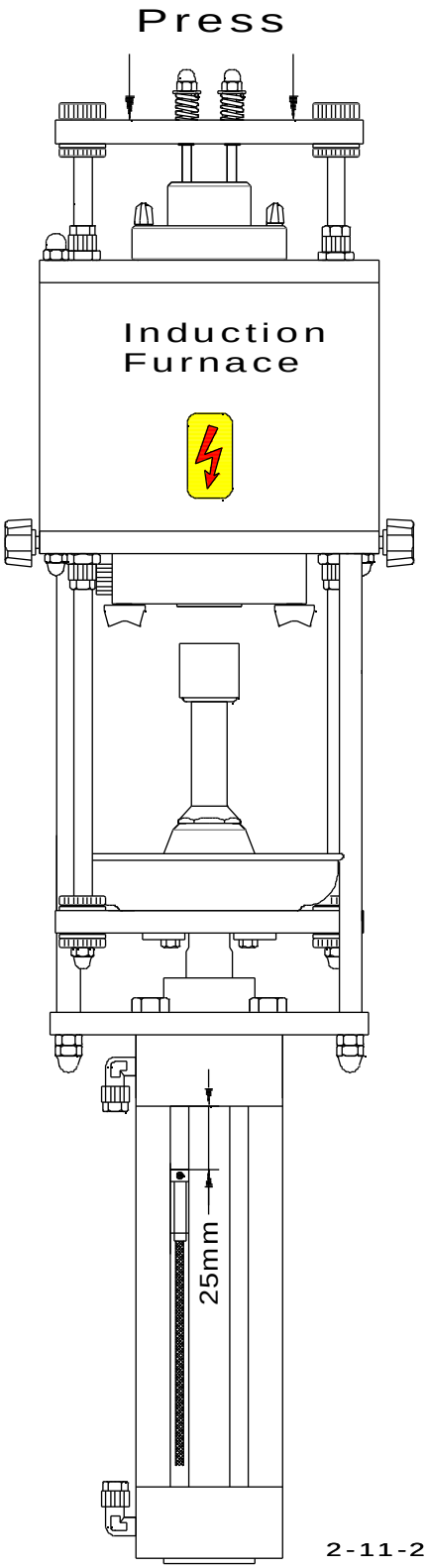
Cylinder model with one
slot pre-adjust 15 mm as above.



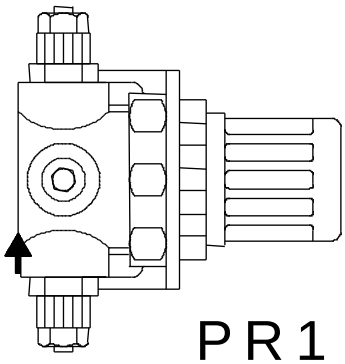
Cylinder model with two
slots pre-adjust 25 mm as above.

Check the following :

- Open the furnace **(piston down)**.
- Hold the piston down by pressing on the horizontal bar of the furnace. (with the fingers)
- Press the key to close the furnace.
- Allow the piston to go up very slowly by controlling the force of your fingers.
  If not possible do the pneumatics adjustment.
  see **pages before**.
- About **5 mm** before the piston reaches it's highest position the force will increase.
- With your fingers press down firmly to make sure that the piston can not be pushed down.
- If the piston starts vibrating by moving up and down with full force, then adjust the switch higher.
- If the piston goes down, then adjust the switch lower.

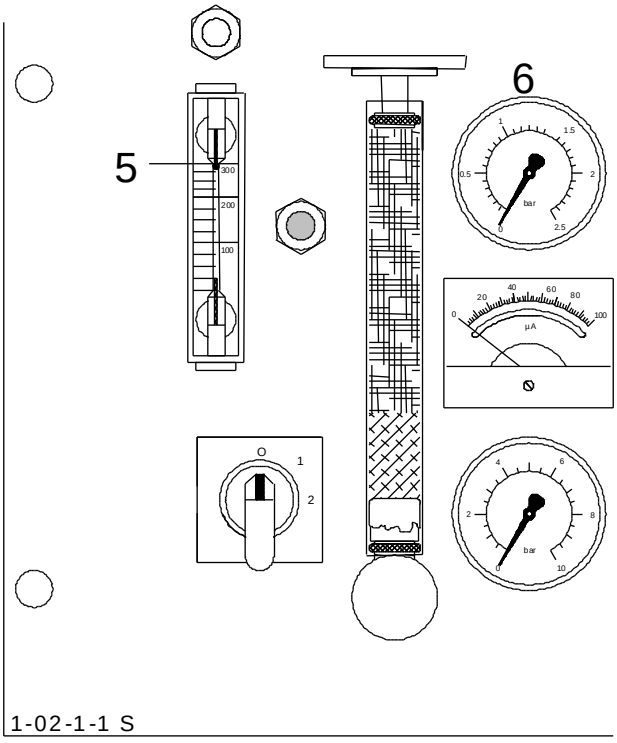


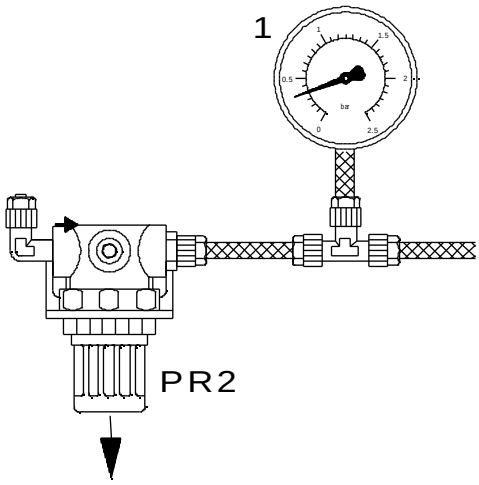
2.7 Pressure regulation:



PR1 is the inlet oxygen regulator, and is situated inside the analyser, on the rear panel. The outlet pressure needs to be set to **1.5 bar** (22.5 psi).

- Pull and rotate the knob of the regulator, until the pressure gauge **(6)** shows the correct value.
- Ensure that the flow shown on the flow meter **(5)** shows between **180 and 200 l/h**; if not, adjust according to **2. 1**.

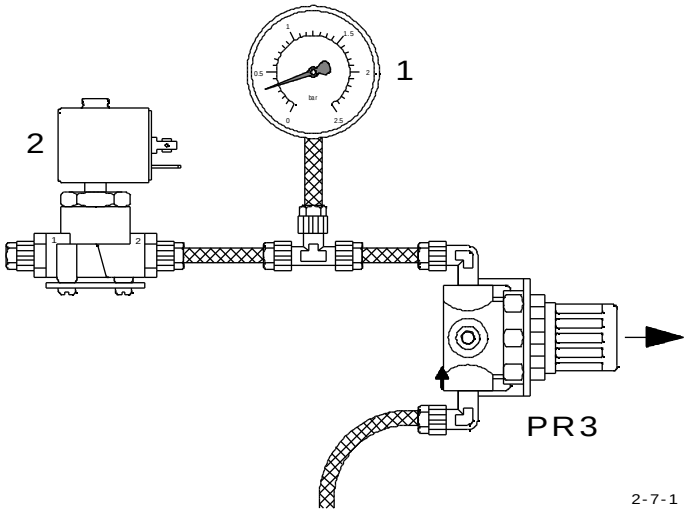




PR2 is the pressure regulator for the **purging system** of the **IR-cell** and it is situated inside the analyser, just behind the left-side of the panel. It is positioned horizontally. The oxygen pressure at the outlet of the **PR2** should be **0.35 bar** (5 psi).

- The pressure can be checked by applying a **T-piece** on the outlet of the pressure regulator, and connecting a **pressure gauge (1), as indicated above**.

- Pull and rotate the knob of the pressure regulator **(PR2)**, until the correct pressure is shown on the gauge.



Using induction furnace operation:

PR3 regulates the pressure of the **carrier gas** that circulates through the **IR-cell** and then finally out of the analyser. This pressure regulator is situated inside the analyser, just before the **flow regulation valve (2)**. The gas pressure at the outlet should be **0.7 bar** (10 psi).

- The pressure can be checked, by applying a **T-piece** on the outlet of the pressure regulator, and connecting a **pressure gauge (1)**, as indicated above.

- Pull and rotate the knob of the pressure regulator **(PR3)**, until the correct pressure is shown on the gauge.

- Ensure that the flow shown on **flow meter (5)**, see **drawing on previous page**, shows between **180 and 200 l/h**; if not, adjust according to **2. 1**.

For more accurate adjustment do this:

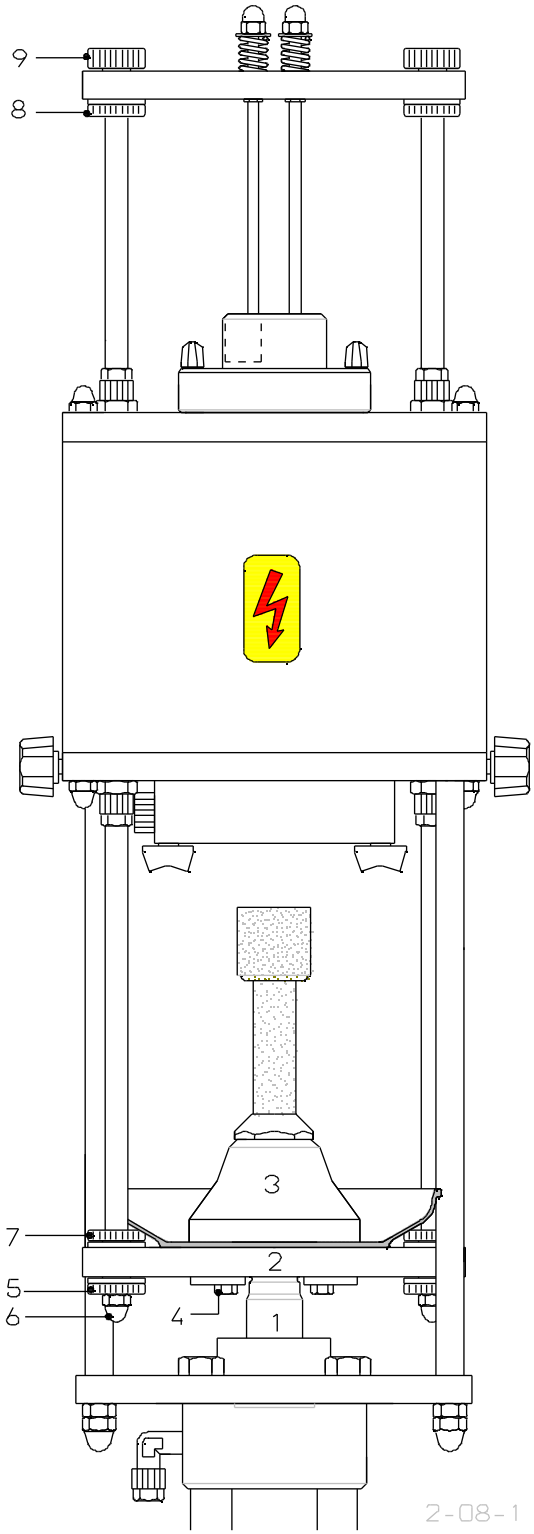
Increase the pressure slowly by turning clockwise and observe the upper pressure gauge **(6)** on the front panel. It may start vibrating. It may not vibrate even if you adjust the maximum possible pressure with **(PR3).** The maximum possible pressure is slightly lower than **1,5 bar** (22 psi), because the incoming oxygen pressure is adjusted to **1,5 bar** (22 psi). After reaching the maximum pressure or when any vibrations should start, slowly reduce the pressure by turning **PR3** counter clockwise.
Read the pressure on the gauge **(1)** when the vibration on **(6)** stops.
(In case of no vibrations read the maximum pressure you obtained). Then go on reducing the pressure with **(PR3)** and observe the volt meter **(4)**. When it starts moving towards its maximum scale **(100 µA)** stop reducing the pressure, and read it on the gauge **(1)**.
Now adjust the pressure with **(PR3)** at a level on the gauge **(1)** wich is about in the **middle between** the **lowest pressure** you **read** and **the pressure you noted** after the vibrations stopped.

For example:
The vibration **stopped** at the level of **1 bar**. The volt meter **(4)** started moving to ist maximum at **0,3 bar**.

Therefore: $\frac{\text{1 bar + 0,3 bar}}{2}$ **= 0.65 bar** on the gauge **(1)** with **PR3**

2.8 Closing cone, adjustment:

- You should ensure that the shaft **(1)** is securely fastened to the base **(2)** If not, hold the base **(2)** securely and tighten the shaft **(1)** **(engineers wrench size 17)**
- In order to adjust the cone, the screws **(4)** should be loosened so that the cone **(3)** moves horizontally on the base **(2)**
- Close the furnace (with the lift upwards)
- Tighten the screws **(4)**
- The cone is now positioned correctly
- The screws **(7)**, **(5)**, **(6)**, must now be well tightened in this order
- The screws **(8)** should be properly fastened (with a wrench)
- The screws **(9)** should only be tightened by hand



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2.9 Linearisation:

The linearisation of the Analyser is done in **our company** and does not **need** to be repeated by the customer.
Therefore it is **fatal to experiment** with the linearity.
The following description applies **only** in case the number of **channels are increased** see **3. 12** , or if the **range** of a **channel has changed**, (for example, by installing a longer or shorter IR-path).
The **infrared cell** is basically non-linear; meaning that its output voltage, is not proportional to the **CO_2** or **SO_2 concentration**. In order to obtain the correct measurements, this non-linearity must be corrected **electronically** through the software.
Once the „linearity factor“ has been entered, see **description below**.
For each measurement channel, the exact characteristic curve must be individually determined and **programmed** into memory.
After programming in a **(new)** factor, analyse a high and a low standard sample, to check the accuracy.
If, the measurement results after the test of the **low standard** sample are not correct, a new factor must be programmed and the **test repeated**.

Procedure:

1) Analyse the high standard **(7 Volts to 8 Volts peak)**
2) Note the result
3) **< Cal > < 1 > < Channel Number >**
4) **< Standard Value > < Enter >**
5) **< Result > < Enter >**
6) Analyse the low standard **(2 Volts to 3 Volts peak)**
7) If the result (from 6) is too low, then the factor should be **higher**.
8) If the result (from 6) is too high, then the factor should be **lower**.
9) **< Menu > < . > < Channel Number >**
10) **< New Factor > < Enter >**
11) **< Nr > < New Factor > < Enter >**
12) Repeat from # 1

Approximate standard samples for linearisation and calibration:
of the usual standard ranges for metal analysis.

Channel 1 : Carbon (low) linearisation factor Approximate value 23000:

0.197%C	400 mg
0.151%C	500 mg
0.100%C	500 mg
0.067%C	500 mg
0.023%C	500 mg

The standard for successive calibration is **0.151%C**

Channel 2 : Carbon **Linearisation factor** **Approximate value 23500**

3.920%C	500 mg
3.200%C	500 mg
2.080%C	500 mg
1.050%C	500 mg
0.452%C	500 mg
0.243%C	500 mg

The standard for successive calibration is, **2.080%C**

Channel 3 : Sulphur **Linearisation factor** **Approximate value 50000**

0.230%S	500 mg
0.167%S	500 mg
0.103%S	500 mg
0.050%S	500 mg
0.022%S	500 mg

The standard for successive calibration, is **0.103%S**

When the **true factor** is closely approached after using the above methods, an exact determination can be derived in the following way:
Rather than only one analysis, three separate analyses are conducted.
The arithmetic average is then taken.

1) Analyse the high standard three times.
2) Note the arithmetic average.
3) **< Cal > < 1 > < Channel Number >**
4) **< Set Value > < Enter >**
5) **< Result > < Enter >**
6) Analyse the low standard three times.
7) If the arithmetic average (from 6) is **too low**, then the factor should be **higher**.
8) If the arithmetic average (from 6) is **too high**, then the factor should be l**ower**.
9) **< Menu > < . > < Channel Number >**
10) **< New Factor > < Enter >**
11) **< Nr > < New Factor > < Enter >**
12) Repeat from # 1)

2.10 Programming the balance:

Basic settings for all types of balances:
2400 Baud
No parity
Send continuously

Please note:
We are not responsible for balances that have not been delivered through our company.

The below setting is only a general guideline. Some balance may have a different data or cable configuration and may therefore fail to communicate with the analyser. The balance supplied by **Eltra** is a Sartorius, model **CP 64**. The balance is programmed **(always with 3 Digits)** in our company, in order to establish a good communication with the analyser.

Should any problems arise, then please follow the next instructions:
At first switch the balance off by **pressing** I/⏻ and follow the steps below.

1) Switch the balance on, by **pressing** the **TARE** button by **holding** it down. Then **press** the **on/off** button. I/⏻ **Release** first the I/⏻ and then **TARE**.

2) Selecting the first programming mode, **113** (to stabilise the vibration) by **pressing** ⊙ the first digit No. will appear on the display. Change the digit No. by **pressing** CAL **Repeat step 2 until the No. 113** has been **inserted** then,
Store with a **short press** on the **TARE** button.

3) Selecting the 2nd programming mode **515** (2400 Baud)
Same usage as in step 2) and don't forget to store with TARE (short press)

4) Selecting the 3rd programming mode **614** (continuous data sending)
Same usage as in step 2) store again with TARE (short press)

5) After the programming has been done it is **IMPORTANT** to **hold** the **TARE** button again until the display shows a row of **88888888** and then release the **TARE** button and the balance is ready for operation.

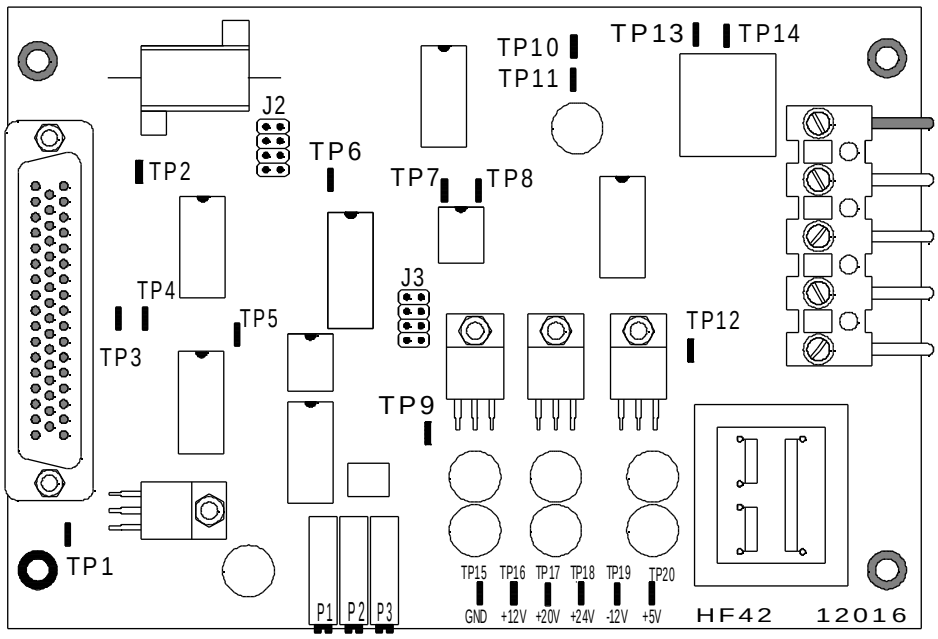
The correct settings:

113 to stabilise the vibration
515 2400 baud
614 continuous data sending

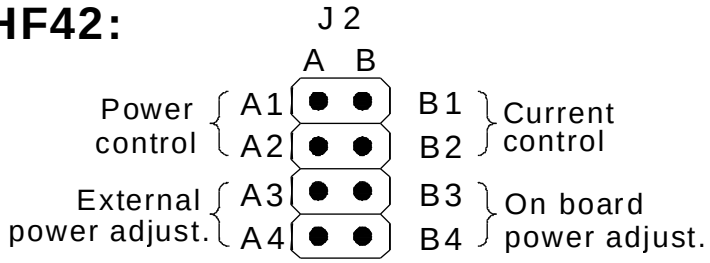
CAUTION:
The balance model **CP 64** has is a switch to **enable / disable** the programming mode. The switch, when shifted to the left, **disables** the programming mode.

2.11

2.12 Induction generator control



HF42:

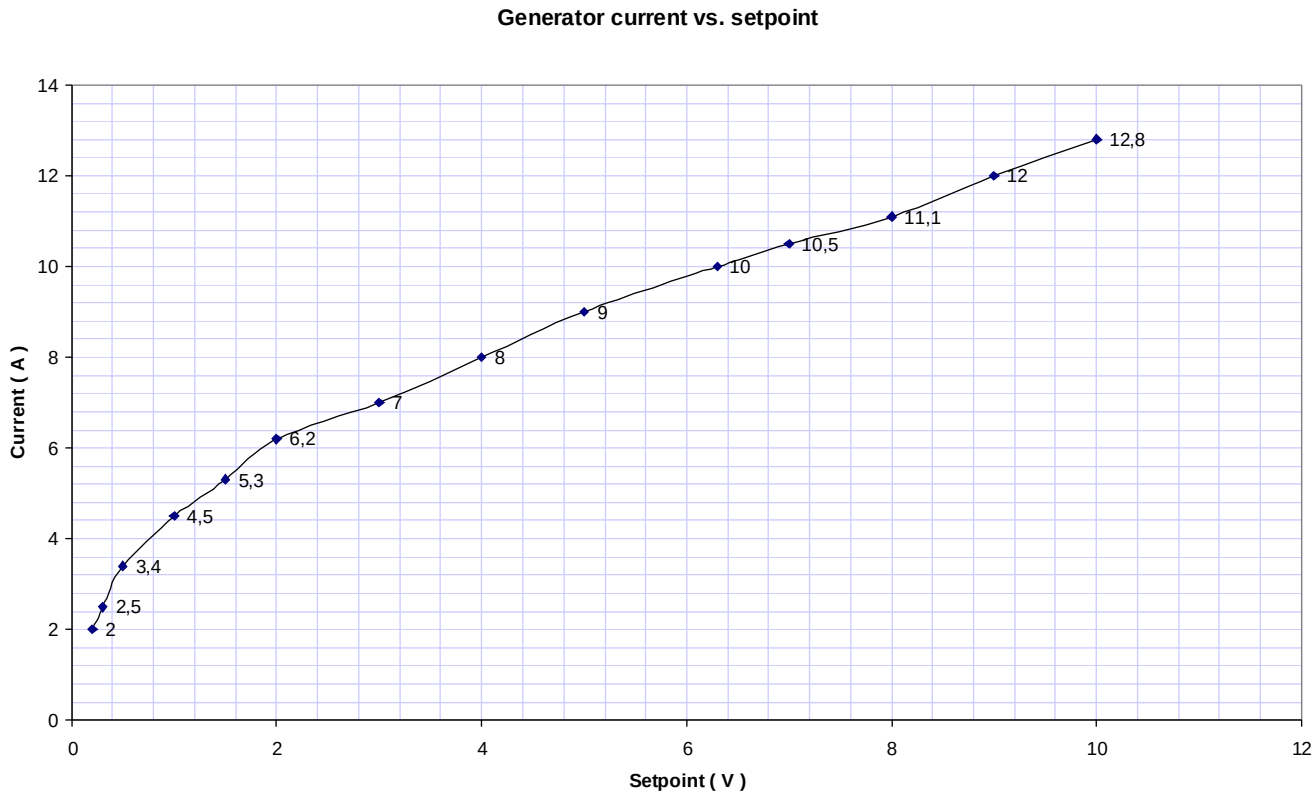


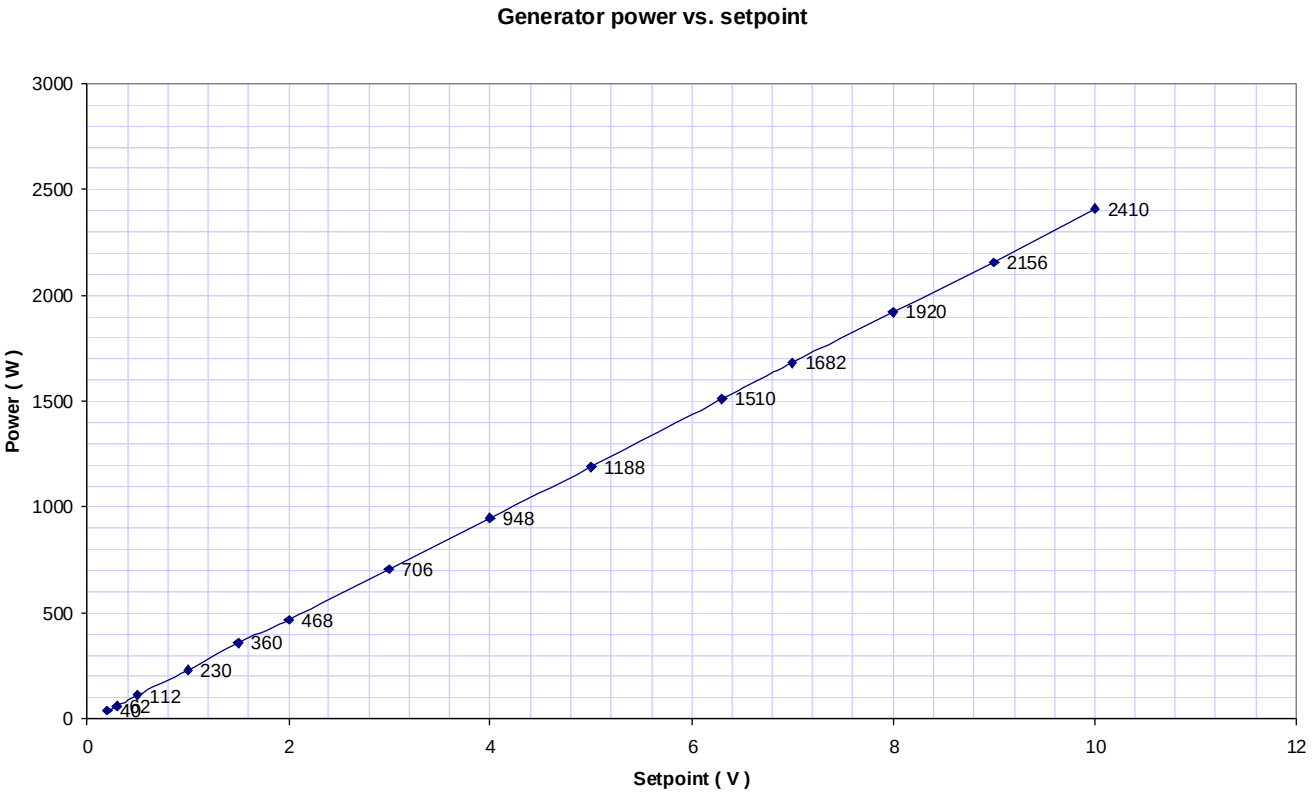
Current control:

The current control provides a safer and more accurate control of the furnace intensity.

- Set the jumper **J2** to **B1-B2**
- Connect a digital multi meter on **TP1** (TP15 is GND)
- Start the analysis, adjusting **P2** until **6.3 volts DC** are on **TP1** (for copper analysis adjust **1.2 volts DC**).
  Adjust only, while the furnace is active.

The following diagrams show the relationship between the set value (adjustment with P2 on the HF 42 board) and the generator parameters.





2.13 Diagnostic printouts:

By pressing the:

< Menu > < . > < 0 >

keys, a diagnostic report will be printed out on the printer.

Attention !

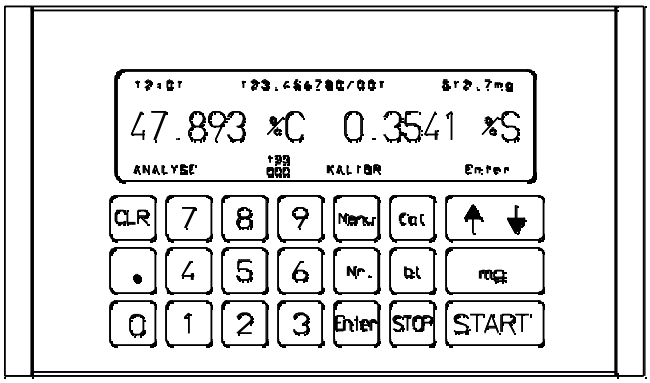
The printer port must be activated, with :

< Menu > < 3 > < 1 > < Enter >

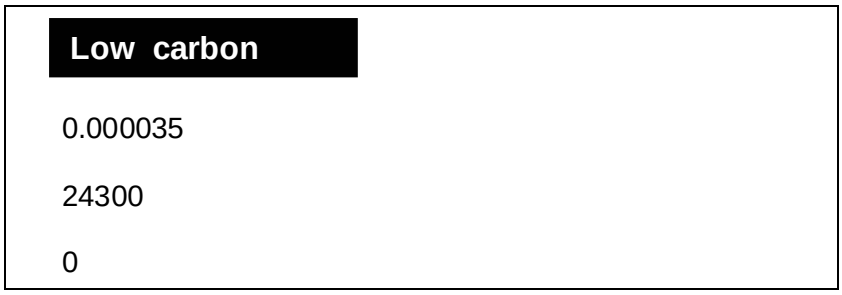
This report should be faxed to **ELTRA** if interpretation or further instructions are needed.

2.14 Setting check up:

CAUTION!
If the analyser is currently being controlled by the **PC**, disable the latter by clicking on the **disconnect** button of the main window.



- Press **Menu** , then **•**
- Ignore the error message
- Press the number of the measuring range to be examined, e.g. **1**



Now the display shows the setting as above. Starting from the top, the following information appears:

- The measuring range
- The calibration factor
- The linearisation factor
- The blank value
- Conclude this section, by pressing **Enter**

CAUTION!
Do not press any other key instead of Enter, otherwise the linearisation factor will be affected and the analyser will be totally inaccurate.

Setting print out:

When a printer is connected to the analyser, all the settings, regarding all the measuring ranges can be printed out.

- Press Menu , then 3 , then 1 , in order to **activate the printer**.

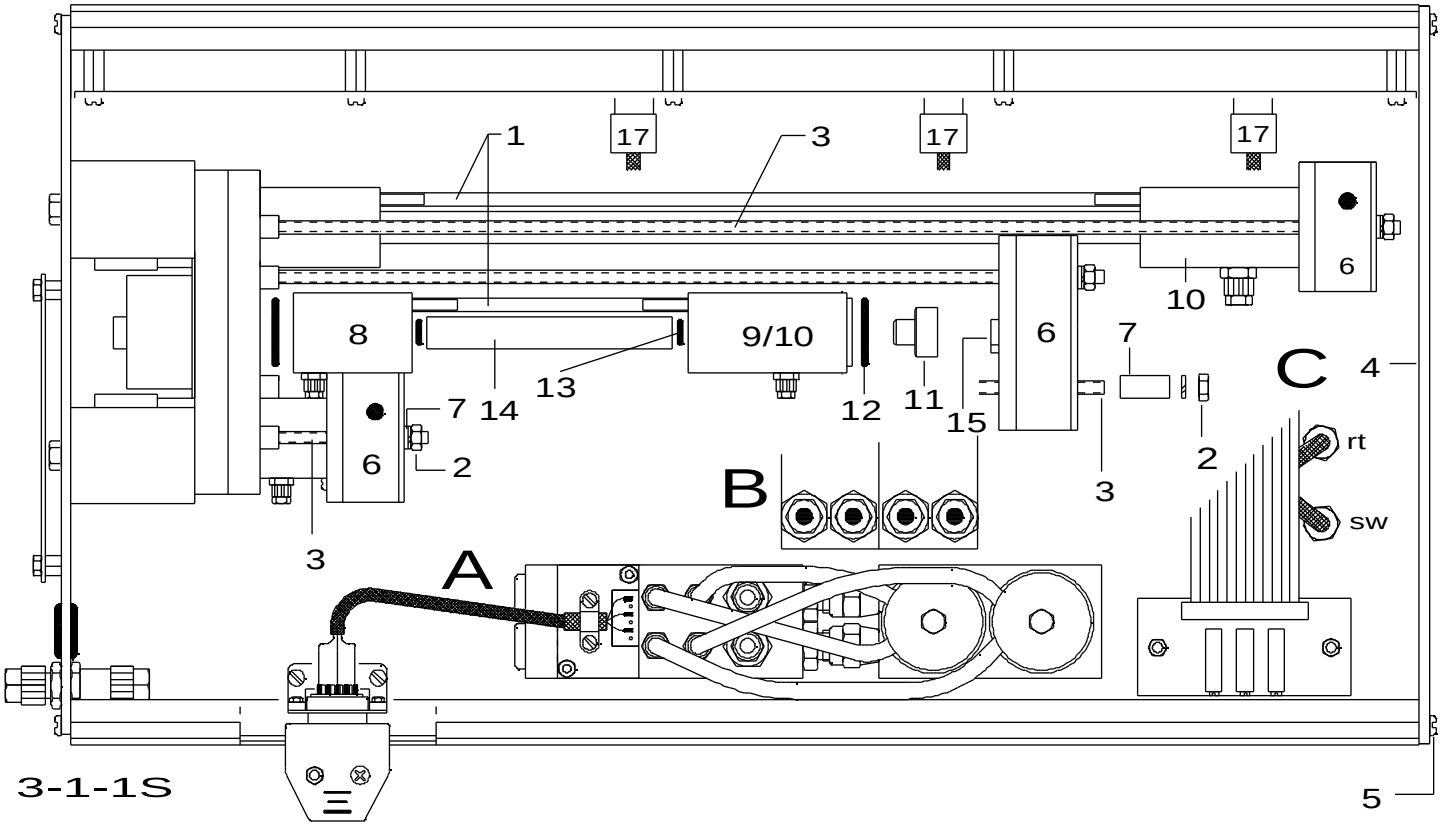
- Press Menu , then • , then 0 , in order to **print out the settings.**

The following information is printed out:

- The serial No. of the analyser
- The internal software version
- The calibration factors for each measuring range
- The linearity factor
- The blank value
- The comparator level

3 SERVICE

3.1 IR-paths, cleaning and replacing:



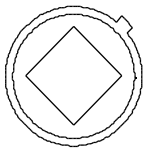
- Unscrew and remove the tubes from the **IR-paths**.
- Remove the nuts **(2) (Size 7)**; in doing this, the threaded rods **(3)** should be held tight to prevent them from turning with the nut.
  To be able to remove the nut **(2)** from the maximum length **IR-path (10)**, remove the plate **(4)** by unscrewing the four screws **(5)**.
  Take out the pre-amplifiers **(6)** together with the spacers **(7)**.
- Clean the paths with a **cleaning solvent**, e.g., **ethanol**.
- With a three part path, such as **(B)** and **(C)**, the windows can be cleaned on the inside using a **cotton swab**.
- In case of a single part path, such as **(A)**, the path is filled with **ethanol** and, after a few minutes, **oxygen** is blown in, to clean and dry out the path.

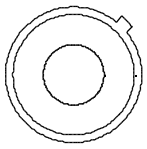
  Soiling, which can **accumulate** from the **analysis** of **materials** that contains a lot of **sulphur** and **moisture** or **hydrogen**, can be very difficult to clean. In such cases, the paths should be replaced.

- Before reassembling the paths, the threaded rods **(3)** should be screwed in by hand, in order to ensure that they are firmly installed.

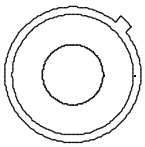
- Assembly of the paths follows in the **reverse order**.
- Reconnect the plugs **(17)** of the preamplifiers **(6)**, in case they were removed.
- After reinstallation, adjustments according to **2. 3** are **highly recommended**.

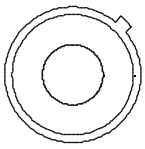
How CO_2 detectors can be recognized:

Initial option:  Square window without any type number.

Later option:  Round window with type No.: 407M36-611

How SO_2 detectors can be recognized:

Initial option:  Round window without any type number.

Later option:  Round window with type No.: 407M36-118

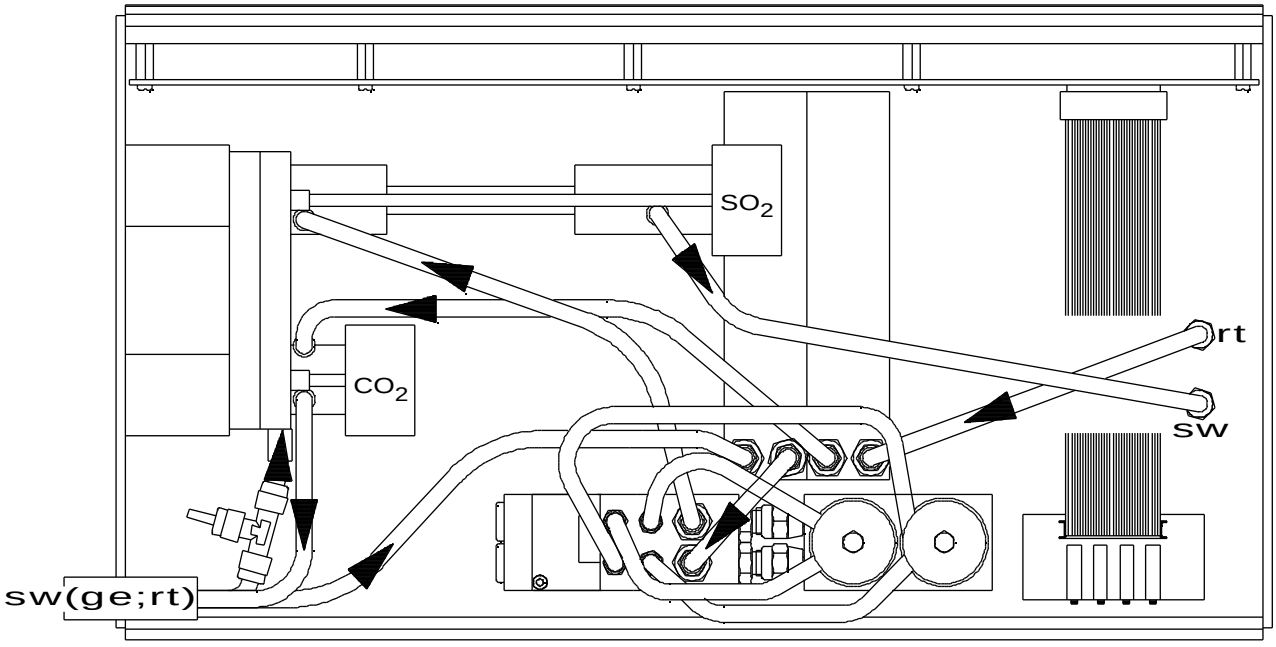
- In case the infrared detectors **(15)** are to be replaced, you can recognize them as described above.

ATTENTION!:
After replacing a specific IR-detector, it is compulsory to zero-adjust:

- see **2.3** under **„ Adjusting the IR cell “**
- **linearise**, see **Operation Manual 5.5** when operated by PC, see **2.9**

and calibrate the corresponding measuring range:

- see **Operation Manual 5.5** when operated by PC see **Operation Manual chapter 6**.



1 **black** marked tube connection
2 **yellow** marked tube connection
3 **red** marked tube connection

- by reinstalling the **infrared cell unit** in the analyser, you must pay **attention** to the **colour markings** of the tubes and their connections.

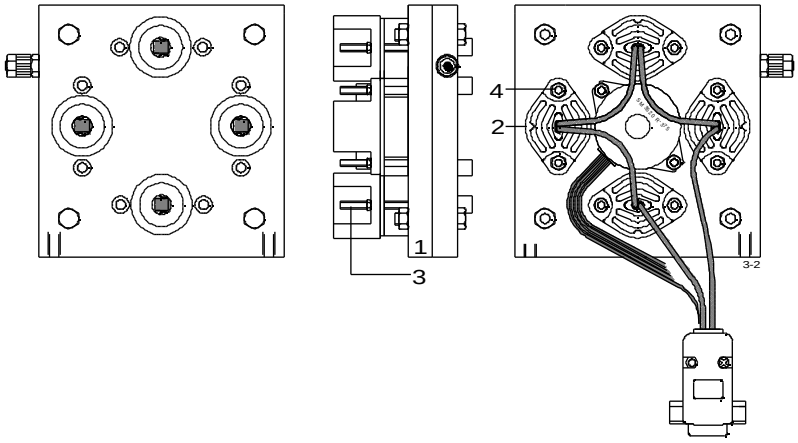
Available infrared paths for the CS-800:

Path length	% C	Material/ Sample weight	% S	Material/ Sample weight
1 mm				
3 mm	6	Metals / 500 mg		
mm				
6 mm	5	Metals / 500 mg		
10 mm			40	Non Metals / 200 mg
20 mm			20	Non Metals / 200 mg
30 mm				
40 mm				
50 mm				
100 mm			4	Non Metals / 200 mg
120 mm	0,2	Metals / 500 mg		
140 mm				
170 mm				
200 mm	0,1	Metals / 500 mg		
275 mm				
300 mm			0,3	Metals / 500 mg

Comments:

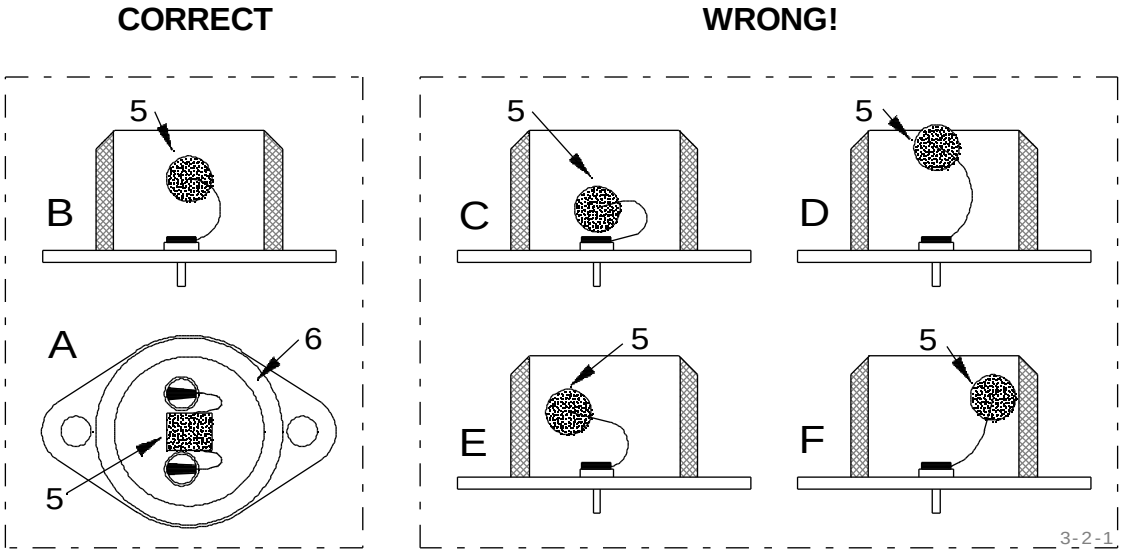
1,5 g Tungsten accelerator are needed when analysing Metals.
Above sample weights for Metals and Alloys are just guidelines. For more accurate information please turn to **Operation Manual 3.3 „Applications“**
The following materials are used as Non Metals: **cement, stone, soils, etc**.

3.2 IR-source:



- The IR sources **(2)** are fastened with the screws **(3)**
- To install or removing the IR-source **(2)**, the complete chopper motor assembly **(1)**, together with the mounted paths and pre-amplifier, should be removed from the infrared unit, see **3. 5**
  The chopper motor housing **(1)** does **not need to be unscrewed**. Either by removing or installing the IR-source.

- In order to remove the IR-source, unscrew the nuts **(4)** with a (5.5 mm wrench) and counter the screws **(3)** at the same time.

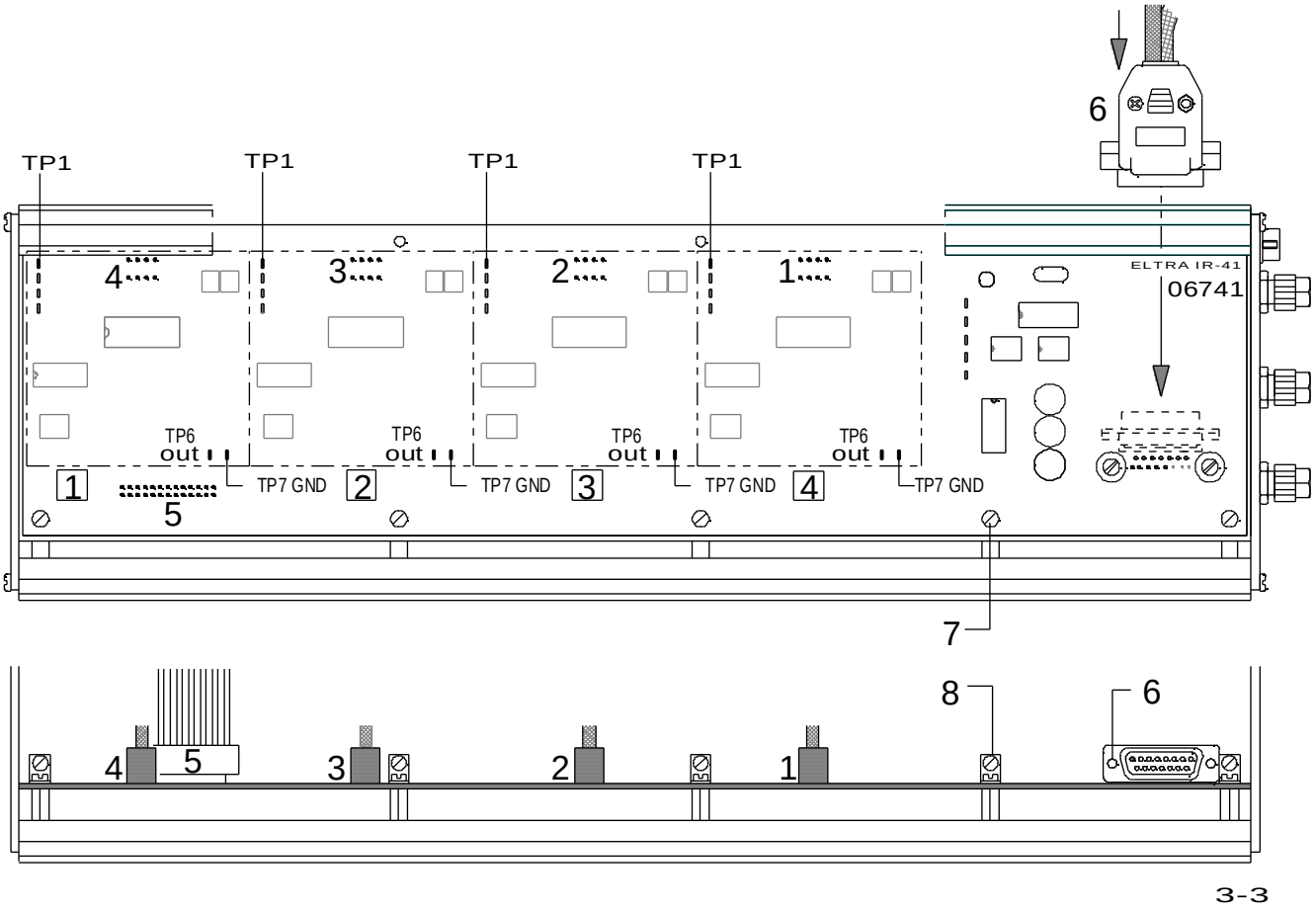


CAUTION !
The IR source **(5)** itself should be in the middle of the ring **(6)**
(this is without considering the location of the soldered connections, which are not centered).
See **above drawing**: **A** and **B** are correct, **C, D, E** and **F** are wrong.
Avoid moving the IR-source back and forth, try placing it correctly the first time.

- After re-assembling the infrared cell, adjust according to **2. 3**

3.3 Infrared electronics:

The complete signal processing for all channels is handled through the circuit board **IR 41**. In the event of a failure, the entire circuit board should be exchanged.



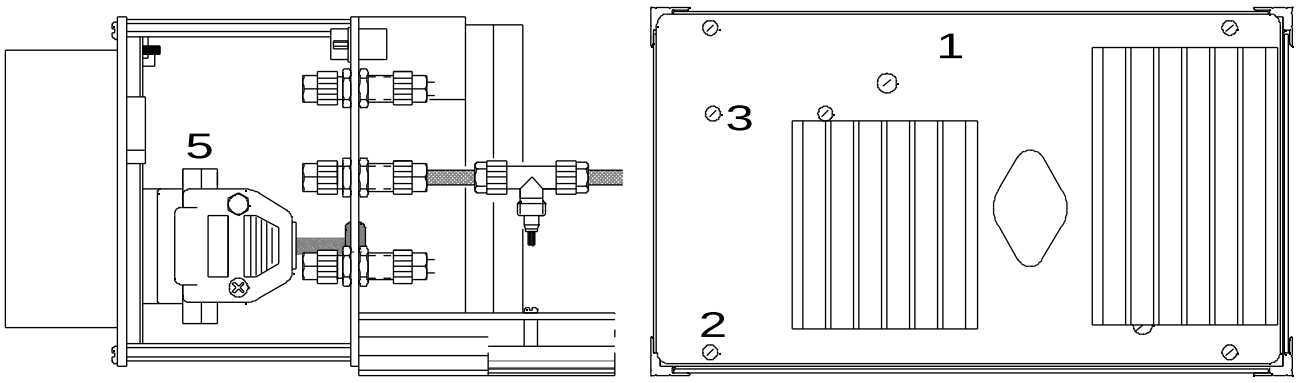
- The plugs **(1 / 2 / 3 / 4 / 5 / 6)** should be unplugged.
- The **10** screws **(7 and 8)** should be removed.
- No adjustment is needed on the **IR 41-circuit board**, You should, however, check the adjustments on the **infrared cell**, see 2. 3.
  The **IR 41-circuit board** is **malfunctioning**, when the **correct** signal can be measured at test **point 1**; while the **signal** at test **point 6** cannot be adjusted to **zero**, see 2. 3.

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3.4 Infrared power supply:

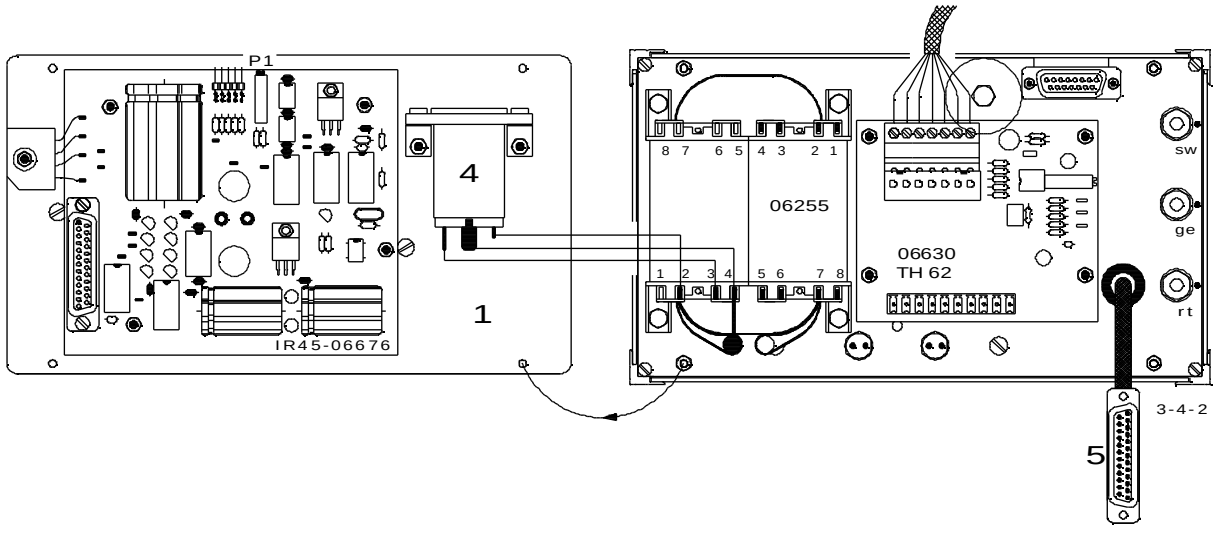
- The power supply **(1)** is a complete unit, which is regarded as a single spare part.
- If there is a failure, the entire module **(1)** is replaced.
- In order to keep costs down, are exchange of modules is offered.

Replacement:



3-4-1

- Remove the four screws **(2)** from the front panel **(1)**.
- Remove the two screws **(3)** from the front panel **(1)**, to loosen the internal plug **(4)**
- Unplug the 2nd internal plug **(5)**

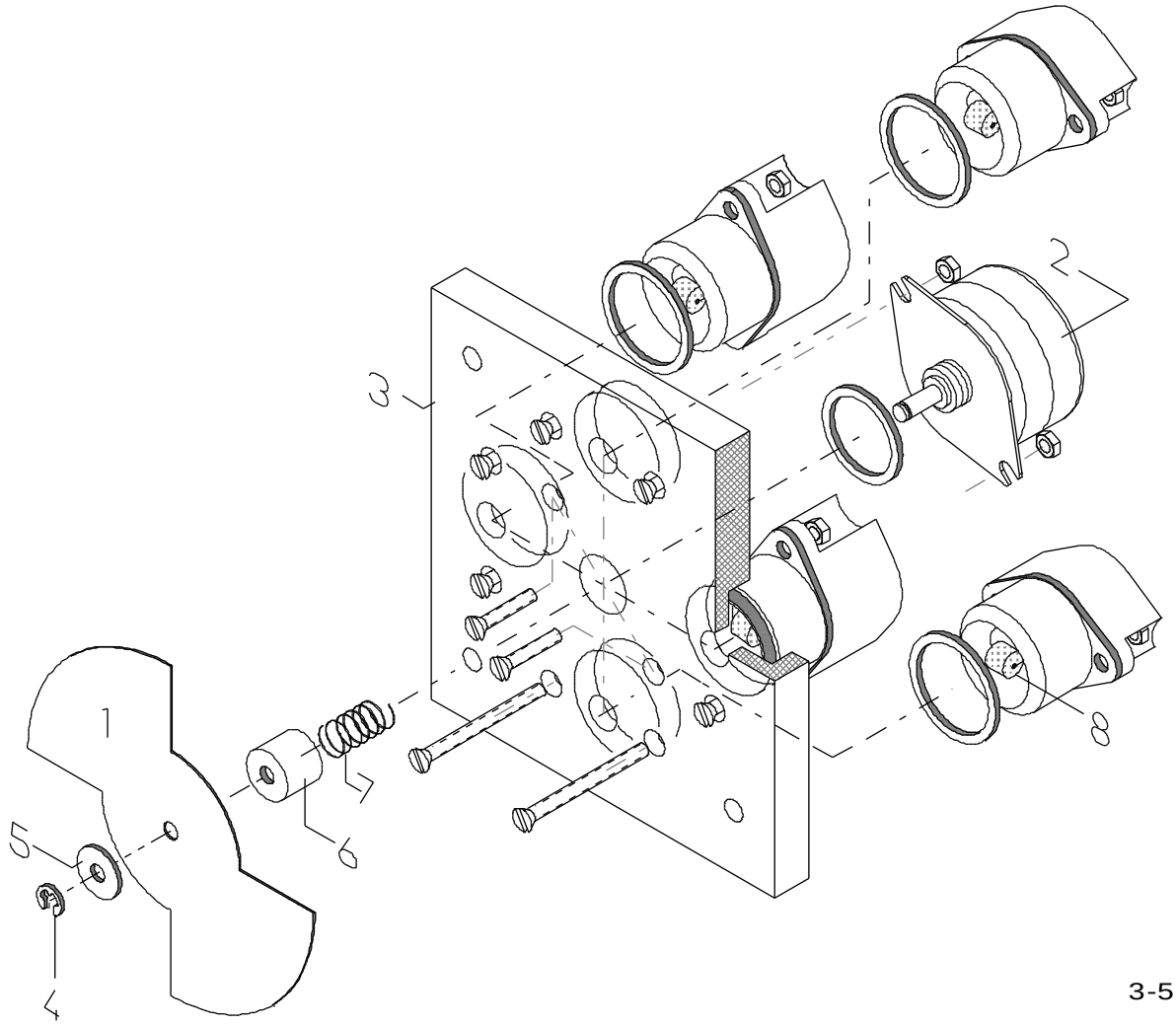


3-4-2

- The front panel is now completely loose and can be exchanged.
- The new power supply unit **(1)** is installed in the reverse order.
- It is suggested that the adjustments now be made according to 2. 4.

3.5 Chopper:

see 3. 1



3-5-1

The chopper blade **(1)** is fastened to the motor **(2)**
the chopper blade must be removed first to dismount
the motor **(2)** from the mounting plate **(3)**

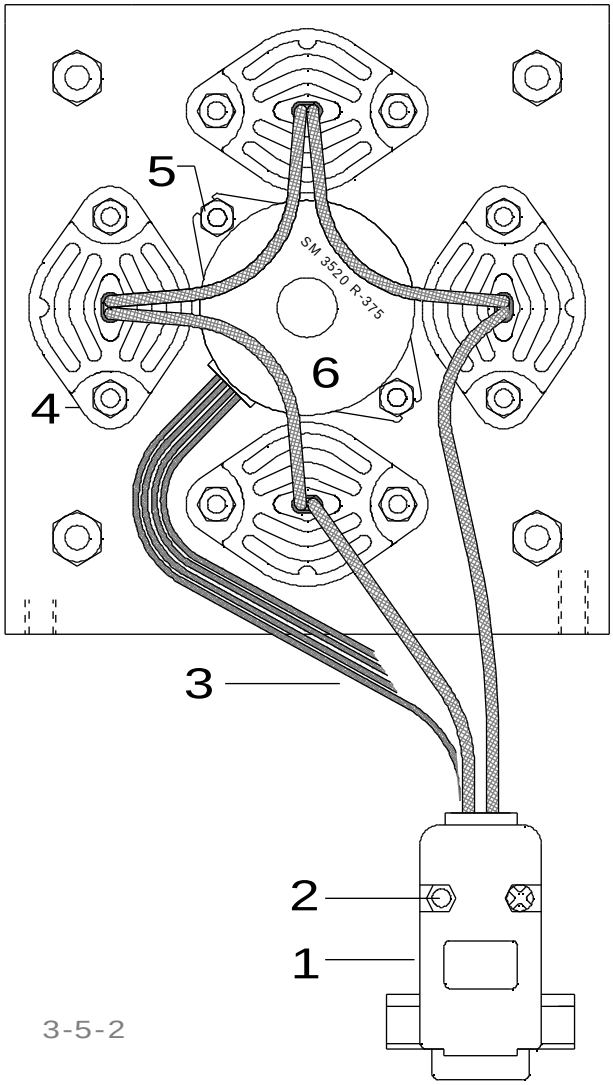
In this numeral sequence disassemble the pieces as follows:

- safety ring **(4)**
  the washer(s) **(5)** (there could be two)
  the chopper blade **(1)**
  the cylinder **(6)** and the
  spring **(7)**
- Reassemble in the reverse order.

CAUTION !

Before re-assembling, check the position of the **IR-source (8)** and, if necessary, centre its position see 3. 2. The heating wire is not very elastic, therefore do not move it back and forth, rather, you should correctly position it the first time

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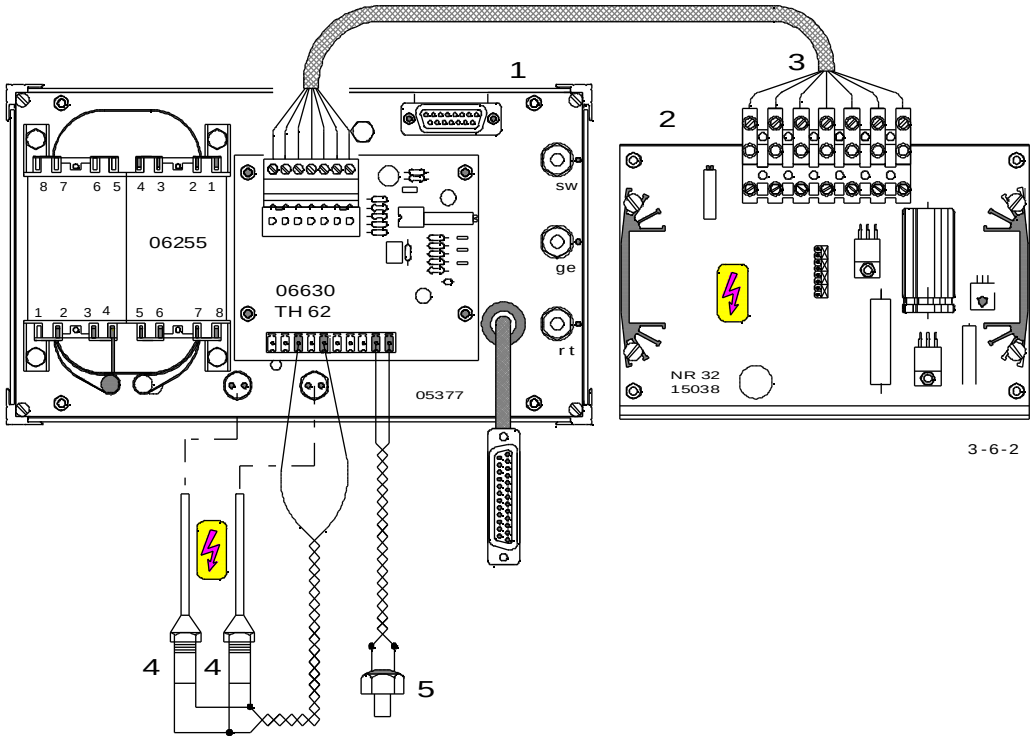


- Disassemble the plug **(1)** by removing the screws **(2).**
- The cables **(3)** of the IR source **(4)** are then unsoldered from plug **(1)**
- Unscrew the nuts **(5)**
- Install the new motor **(6)**
- The IR source cables **(3)** are then soldered to the plug **(1)**

CAUTION !
Due to the high current for the infrared cell;
it is **important** that the soldering here is done accurately, because two pins inside the plug **(1)** will be soldered together to form one group. There are two such groups in one plug.
Each end of the IR-source cables **(3)** will then be soldered to each one of these groups. Polarity is irrelevant.

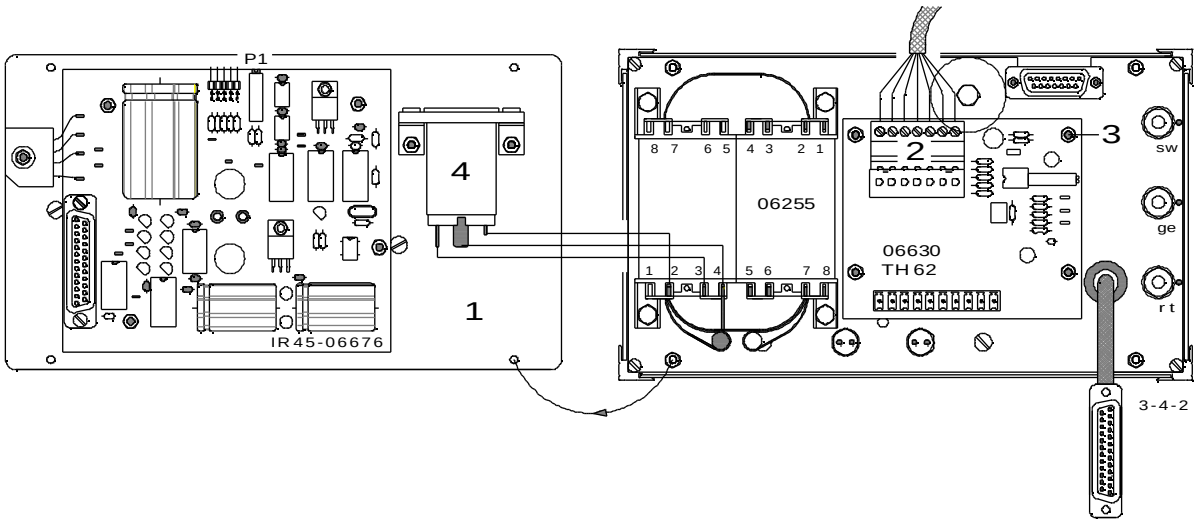
- Afterwards, the chopper blade is refastened.
- Reassemble in the reverse order.
- After installing, the infrared cell should be adjusted, see 2. 3

3.6 Infrared temperature regulation:



- The temperature regulation of the infrared cell are made up of;
  the circuit boards **TH 62 (1)** and **NR 32 (2)**
  the **connecting wires (3)**
  the **temperature sensor (5)** and the
  heaters (4).

Replacing the TH 62:

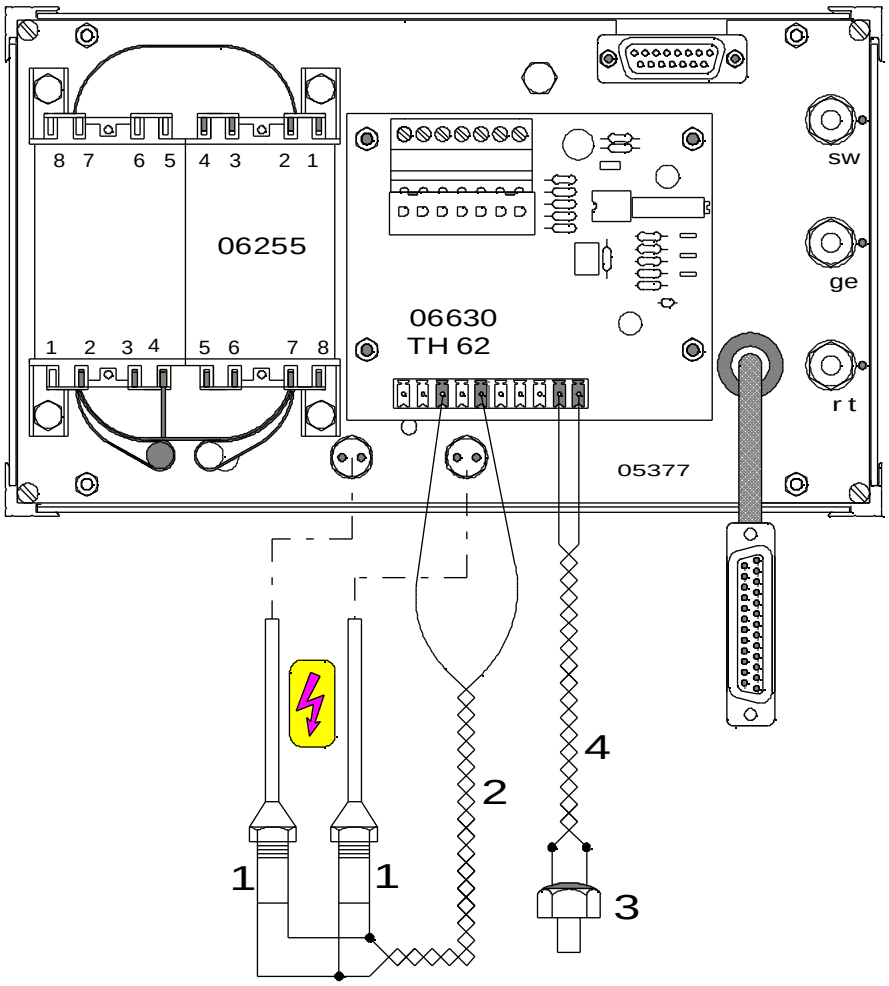


- The plug **(4)** should already have been **disconnected** during the **removal** of the **infrared cell** from the **analyser**.
- Unscrew and remove the power supply module **(1)** see 3. 4
- Disconnect plug **(2)**
- Remove the four nuts **(3)** Re-assemble in reverse order.
- Make adjusts to the unit, according to 2. 5

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Replacing the heaters:

- Unsolder the cables **(2)**
- Cut the **silicon seal** away from the heaters **(1)** and then pull them **carefully** out
- Insert the new heaters with smearing **thermal conducting paste** (in case there is none available, **silicon grease** can be used).
- Solder the cables.
- Secure the heaters against falling out with silicon sealant.



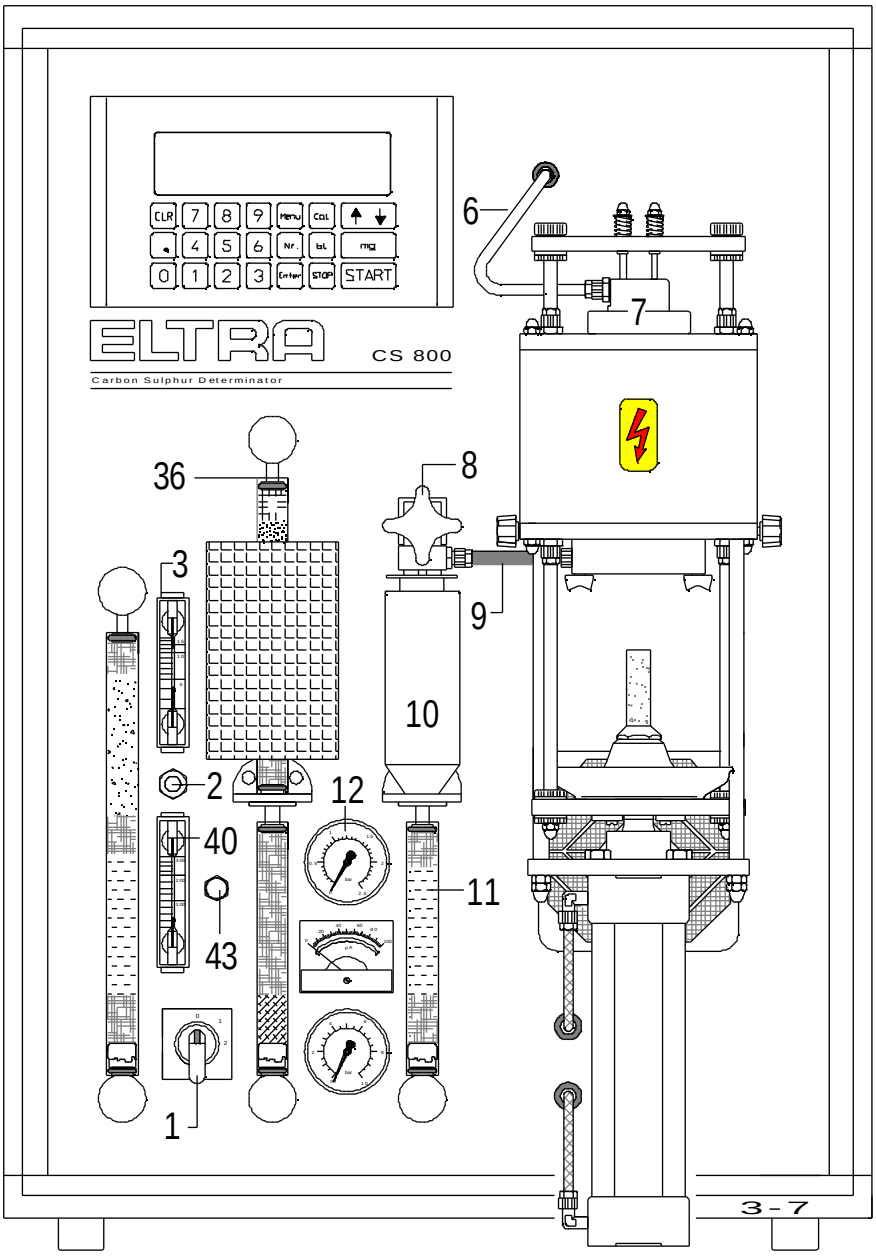
Replacing the temperature sensor:

- Unsolder the cables **(4)**
- Cut the **silicon sealant** away from the **temperature sensor (3)**
- Screw the new temperature probes in
- Solder the cables **(4)**

CAUTION !
screw the probes in **very gently,** the threads are of **aluminium**.

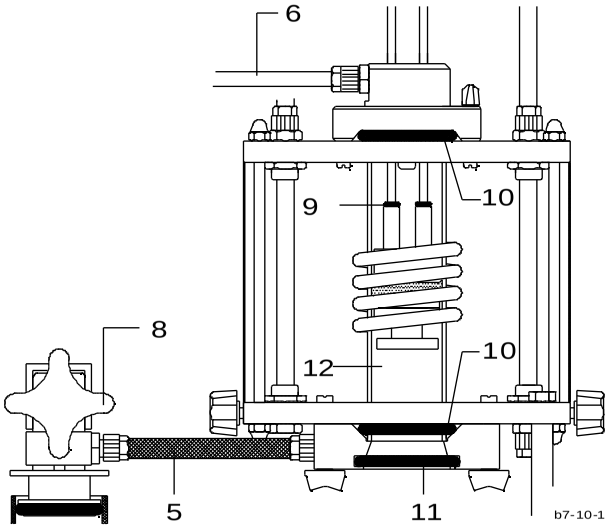
- After replacing the temperature sensor, adjust according to **2. 5**

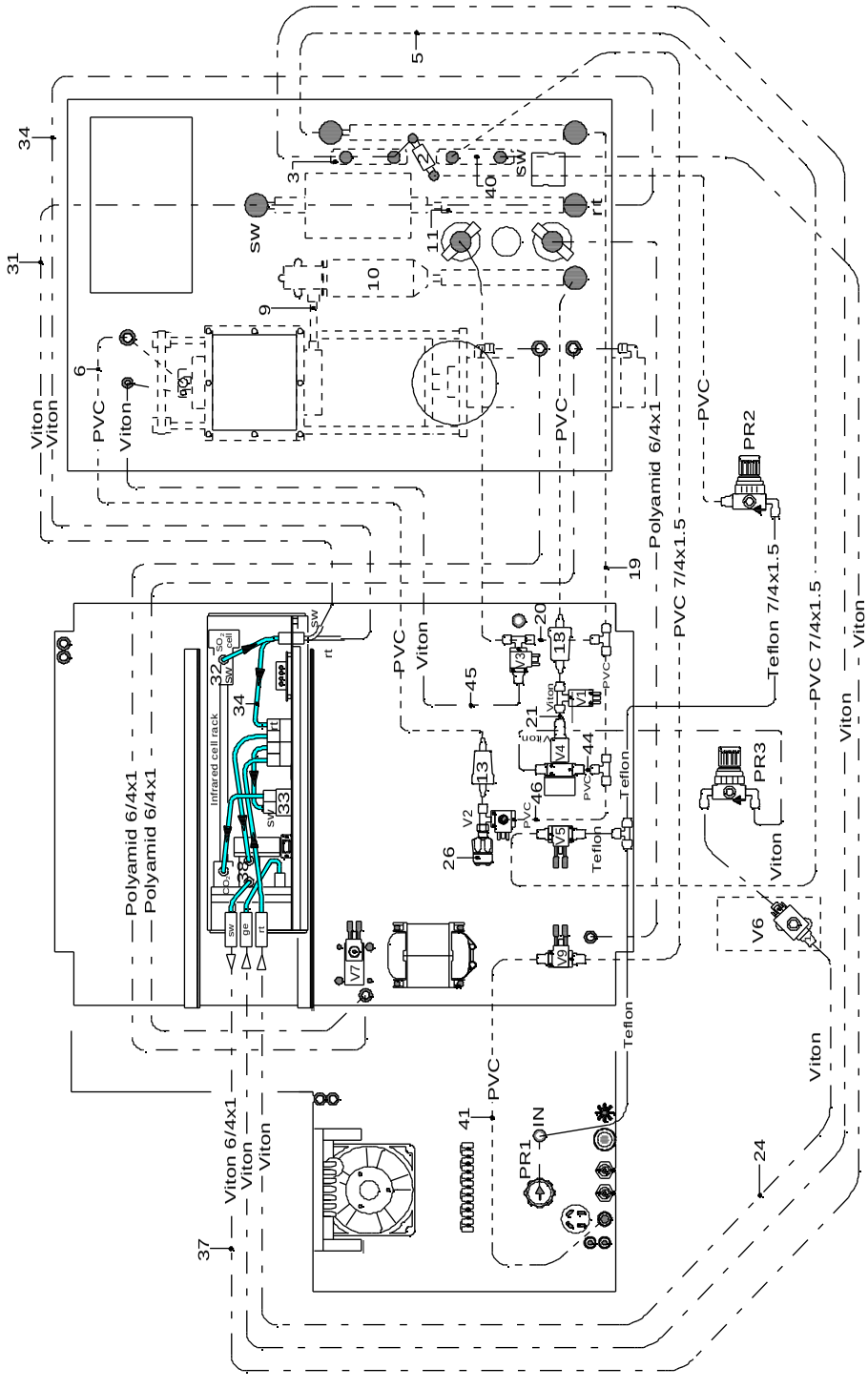
3.7 Leak checking:



- Set the power switch **(1)** to **pos. 2**
- Close the furnace
- Press and hold the button **(43)**
  The entire system will be checked for leaks.
- **The leakage test is completed when the initial pressure drops (about 5 seconds) on gauge (12) and then remains constant, the gas system is ok.**

- Should there be a continuous pressure drop, then **release** the button **(43)**, open the furnace, **press** and **hold** the button **(43)** again. If the pressure is stable then the leakage will found in the **furnace**.
- If the pressure still **decreases**, then the leakage is to found inside the **analyser**.


6
9
10
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12
10
5
11
b7-10-1


5
34
31
3
40
SW
rt
11
10
9
6
Viton
Viton
PVC
Viton
PVC
PVC
Polyamid 6/4x1
PVC 7/4x1.5
PR2
19
Teflon 7/4x1.5
PVC 7/4x1.5
Viton
Viton
Infrared cell rack
Polyamid 6/4x1
Polyamid 6/4x1
32
34
33
36
35
20
18
45
21
44
13
46
26
V2
Teflon
PR3
Viton
V6
V7
V9
Teflon
Viton
Viton 6/4x1
Viton
Viton
37
PVC
41
PR1
IN
24

- Release the push button **(43)**, close the furnace, squeeze the tube **(6) tightly** and **press** and hold the button **(43)**.
- If the pressure on gauge **(12)** remains constant, then the furnace has to be checked for leaks.
- If the pressure shown on gauge **(12)** drops, then the leakage has to be found somewhere along the furnace inlet system.

Leaks in the furnace inlet system:

- After following the above instructions, check for gas leakage between inlet tube **(6)** and reverse valve **(V2)**.

Leaks in the furnace:

- After following the above instructions, close the furnace, squeeze tube **(9) tightly**, **press** and **hold** the button **(43)**, observe the pressure gauge **(12)**.

- If the pressure drops, then the furnace is leaking. Check whether the O-rings **(16)**, **(17)** and **(18)** are soiled or defective see **Operation Manual** 7. 4 and 7. 5
  Check whether the combustion tube **(15)** is broken or cracked.
- If the pressure remains constant, then the furnace outlet system is leaking.

Leaks in the furnace outlet system:

- After following the instructions in the section **„Leaks in the furnace“**, **check if the handle (8) is properly shut**, or else there will be a major gas leak from the **dust filter**. Check the following components for leakage, by squeezing the following tubes, while **pressing** and **holding** the button **(43)**:

Tube to squeeze:	**Leak location:**
19	Dust trap **(10)**, glass tube **(11)**, dust filter cartridge **(13)**, outflow valve **(V 1)**

Leaks inside the analyser:

- when pressing the button **(43)**, the gauge **(12)** shows a pressure drop while the furnace is open, then locate the leakage, **according to the sequence below**.
  Keep the furnace opened, squeeze the following tubes **tightly**, while **pressing** and **holding** the button **(43)**:

Tube to squeeze:	**Leak location:**
4	Exhaust valve **(V9)**
37	Flow meter **(40)**
34	CO_2-Paths **(38)**
31	SO_3-Trap **(35)** or oxidising furnace tube **(36)**
24	SO_2-Path **(32)** or flow sensor **(33)**
23	Regulator valve **(V6)**
22	Pressure regulator **(PR3)**
44	Bypass valve **(V4)**, **check for 24 VDC on input pins**
45	Purging valve **(V3)**, **check for 0 VDC on input pins**
46	Reverse valve **(V2)**, **check for 24 VDC on input pins**

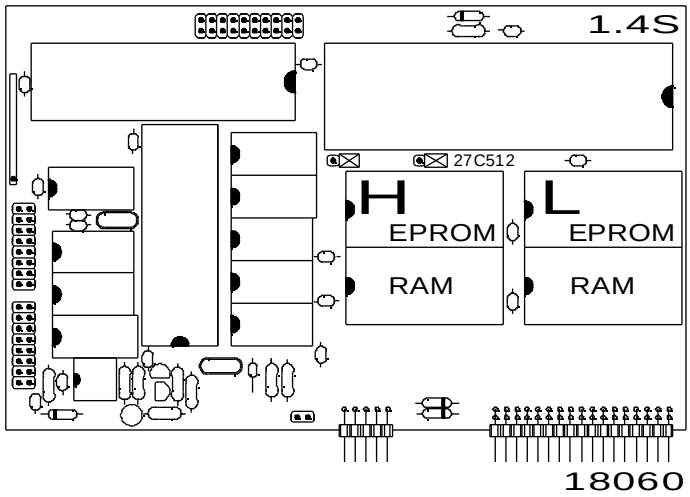
ATTENTION: **do not cause a short circuit while measuring!**

- If the voltages on **V2**, **V3**, or **V4** are wrong, then replace the electronic drivers, see 1. 6.

3.8 Replacing EPROMs:

- Set the power setting to **pos. 1**
- Open the furnace.
- Pull out **all** of the **plugs** from the electronic unit
- Open the left side of the analyser.
- Unscrew the electronic unit.
- Pull out the electronic unit.
- **Carefully**, take out the two **EPROMs H** + **L** with the aid of a screwdriver (using it as a lever), from the **CPU** board. See **drawing below**.
- Insert the new **EPROMs H** + **L**, notice the comparing marks. See **drawing below.** Be sure that they are positioned correctly.

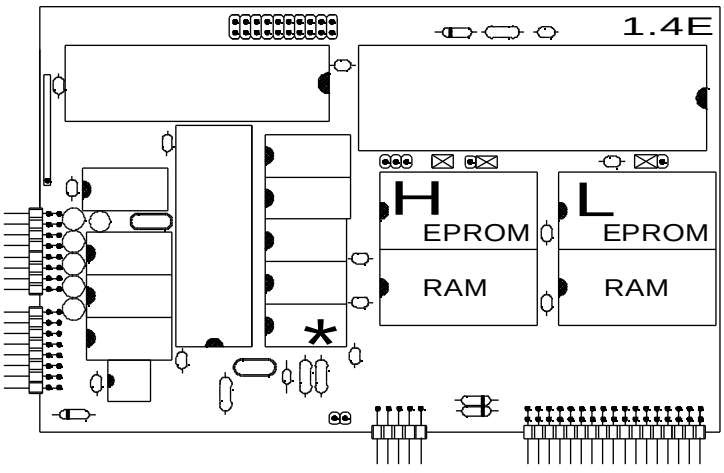
Important: When installing **27C512 EPROMs**, check that the **jumpers** are **connected** as shown in the drawings.
If the instrument has an **older** card, follow the **first** drawing; else follow the **second** drawing.



18060

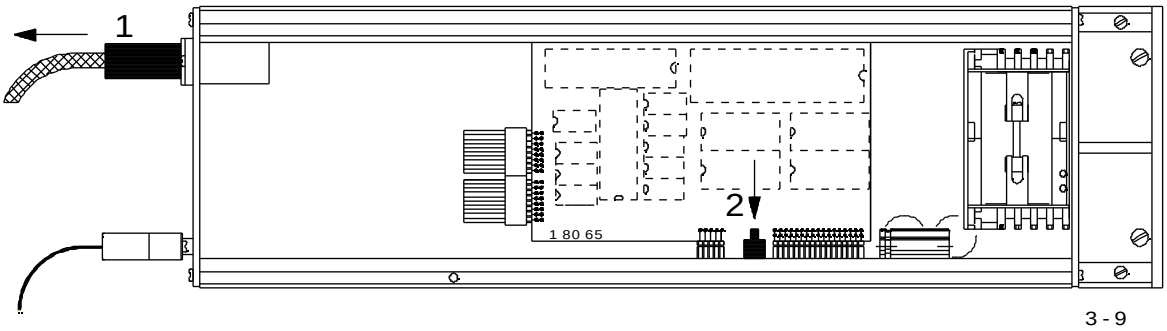
- Exchange the **RAMs** with each other to ensure that after switching on the electronic unit, any stored data during operation with the previous **EPROMs**, will be deleted.

CAUTION: The analyzer has to be recalibrated, or an application has to be recalled from the application memory.



18065

3.9 Clearing memory:



- Set the power switch to **pos. 1**
- Open the furnace
- Detach the left hand cover of the Analyser
- Detach the power plug **(1)** from the electronic unit
- Press the **reset key (2)** on the base plate of the electronic unit **for 30 seconds**
- Restore the unit to its original condition
- Recalibrate.

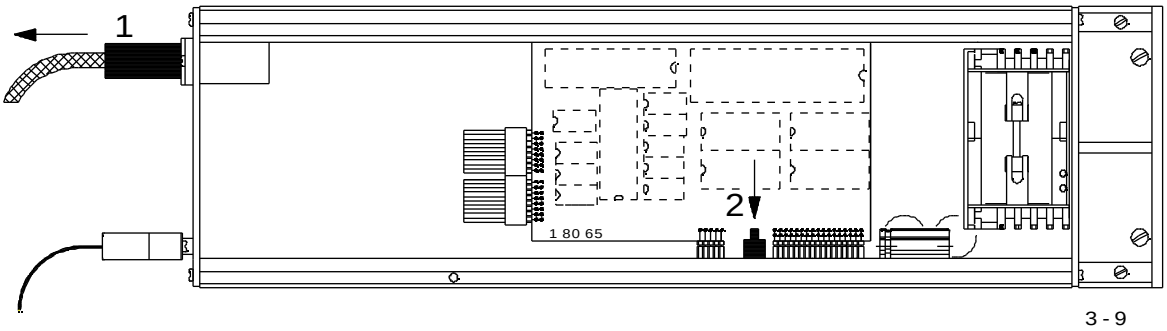
3.10 Electronic reset:

Should any problems arise with the electronic unit:

- Press **STOP**

If the problem remains:

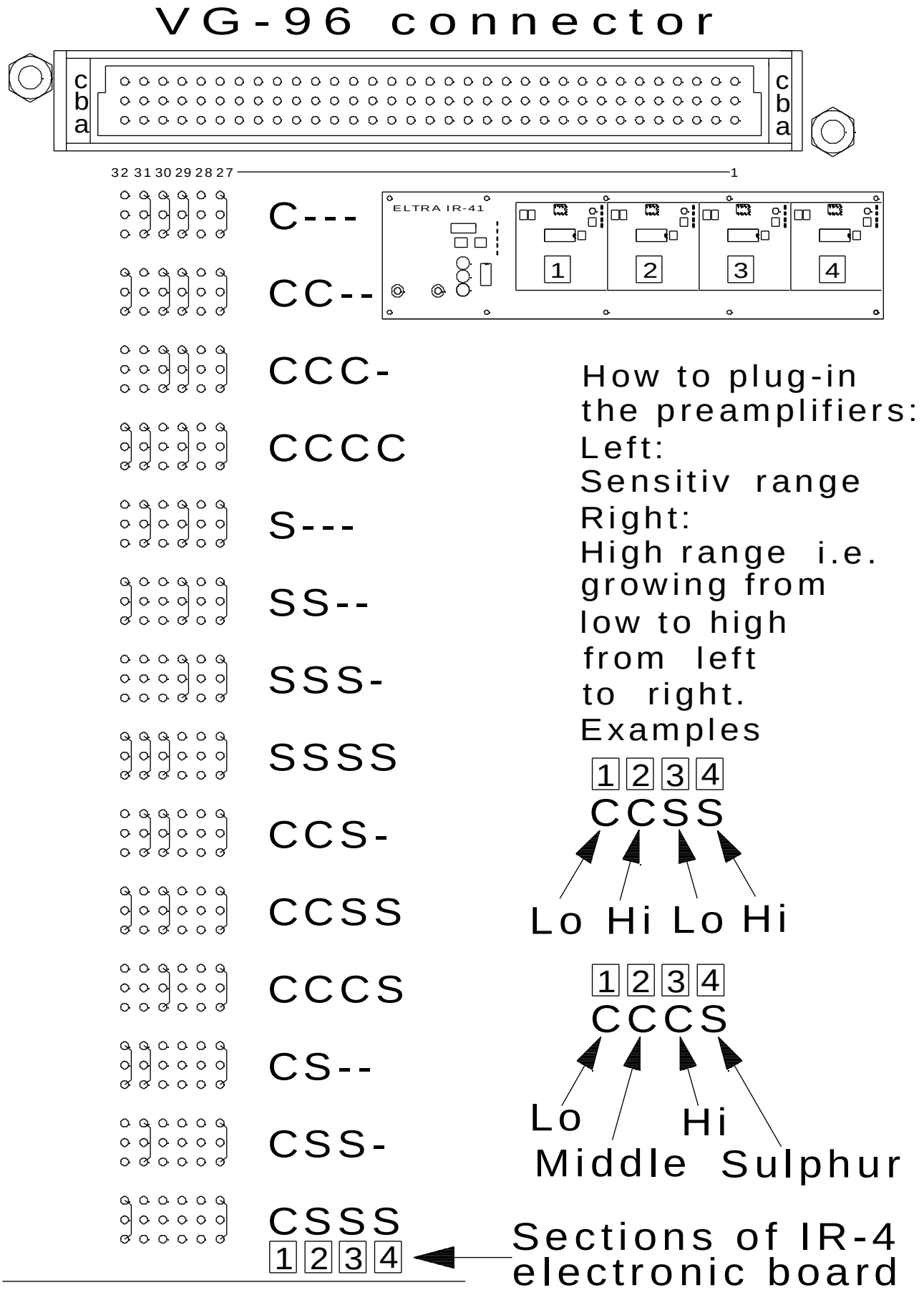
- Turn the power switch to **pos. 1**
- Open the furnace
- Disconnect the cable **(1)** from the electronic unit for **10 seconds** and plug back in.



- **Should the problem remain:**

  see 3. 9 " Clearing Memory "

3.11 Coding IR- ranges:



Example for CCSS
Plug the preamplifiers according to this drawing:

3.12 Adding new IR – ranges:

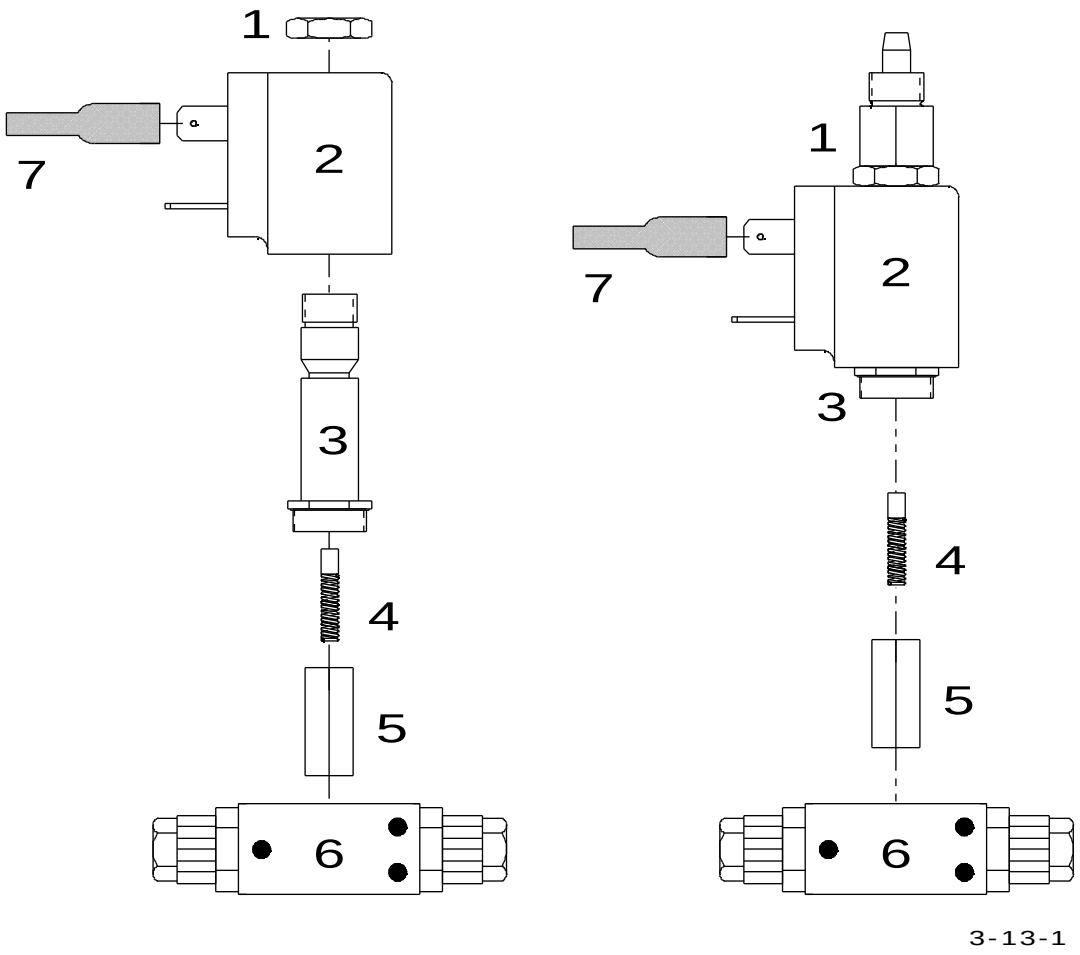
(from **1** to **2** , from **2** to **3**, from **3** to **4** or form **1** to **4** channels)

- The chopper housing with the appropriate number of **IR-sources**.
  Before installing, the **IR-source** positions should be **checked** and, if necessary, **repositioned,** see 3. 2 and 3. 5.
- **One**, **two** or **three** additional pre-amplifiers needed
- **One**, **two** or **three** additional infrared detectors with the appropriate interference filters needed
- **One**, **two** or **three** additional IR-paths of the appropriate length needed
- On the **circuit board IR-41**, cables must be rearranged **correctly**, see 3. 3
- Connection of the transformer, matching the number of channels, see 2. 4
  "Setting the IR-source voltage "
- Adjustments for the **IR-source power**, respective for each channel,
  see 2. 4 **" Setting the IR-source voltage "**
- Adjusting the **zero**,
  see 2. 3 **" Adjusting the Infrared cell "**
- Coding of the channels,
  see 3.11 **" Coding of the channels "**
- The settings for the temperature regulation,
  see 2. 5 **" Temperature regulation "**
- Afterwards, the linearisation of the Analyser,
  see 2. 9 **" Linearisation "**
- Recommended spare parts. See 4.1

The following components may be needed, when adding more IR cells:

05257	Chopper housing, with one IR-source and motor
05254	Chopper housing, with two IR-sources and motor
05251	Chopper housing, with three IR-sources and motor
05244	Chopper housing, with four IR-sources and motor
05066	IR-path: carbon low
05067	IR-path: carbon high
05068	IR-path: sulphur
06741	Printed circuit board IR-41
06032	Infrared receiver with CO_2 filter
06034	Infrared receiver with SO_2 filter

3.13 Cleaning the solenoid valves:



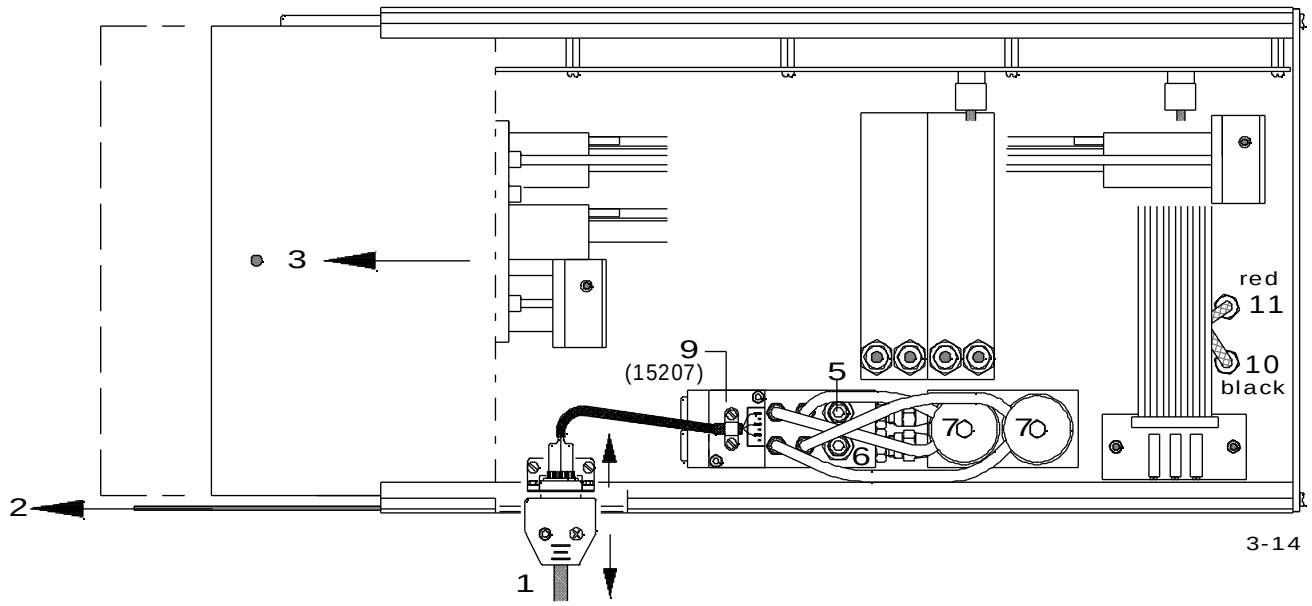
Only with the 2/2 valve

Only with the 3/2 valve

- Turn the power switch to **pos.0**
- Unplug the **main power plug** as well
- Remove the connector **(7)**
- Unscrew the nut **(1)**
- Remove the coil **(2)** (only with the 2/2 valve)
- Unscrew **counter-clockwise** the hexagon screw on the armature housing.
- Remove the armature **(5)** (only with the 2/2 valve)
  Careful ! Do not loose the spring **(4)**
- With **oxygen pressure** or **compressed air**, clean the inside of the armature housing **(3)**, as well as the armature **(5)** and re-assemble the solenoid valve.
  With the furnace **closed** and renewed **oxygen pressure**, check to ensure that the solenoid valve is **sealed**, see **3. 7**

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3.14 Replacing the flow sensor:



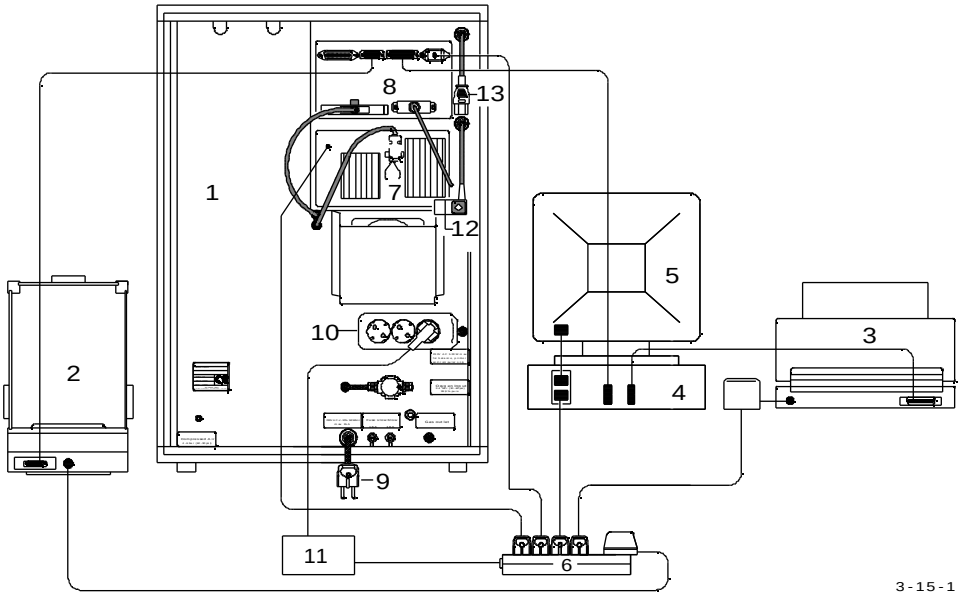
- Set the power switch to **pos. 0**
- Remove the **left** side panel of the analyser
- **Unplug** the **two** cables at the **rear-side** of the infrared rack
- Remove the tubes **(10)** and **(11)** at the **bottom-side** of the infrared rack
- Unplug the plug **(1)**
- Pull out the infrared rack from the analyser
- Remove the **left** side cover **(2)**, the **top** cover **(3)** and the **bottom** cover **(4)** of the infrared rack
- Remove the two tubes **(5)** and **(6)** from the flow sensor **(9)**
- Remove the two screws **(7) underneath** the flow sensor.
- Remove the **old** flow meter, install the **new** one.
- Reassemble the infrared rack in reverse order.
  Pay particular attention to the position of the tubes (5), (6), (10) and (11).

- Adjust according to **2. 1**

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3.15 Installing an AC power stabiliser:

When the power voltage sinks below **180 V AC** (even for a short time), a stabiliser is recommended.
The Analyser can **draw**, during combustion and according to the power setting, up to **13 A**.
The **maximum current** depends on the type and size of the sample and accelerator.
To stabilise such a **high current** is not easy and not necessary.



1 Analyser
2 Balance
3 Printer
4 Computer
5 Monitor
6 Power strip
7 Infrared cell
8 Electronic unit
9 Power plug
10 Triple plug
11 Voltage stabiliser
12 Original infrared cell power cable
13 Original electronic unit power cable

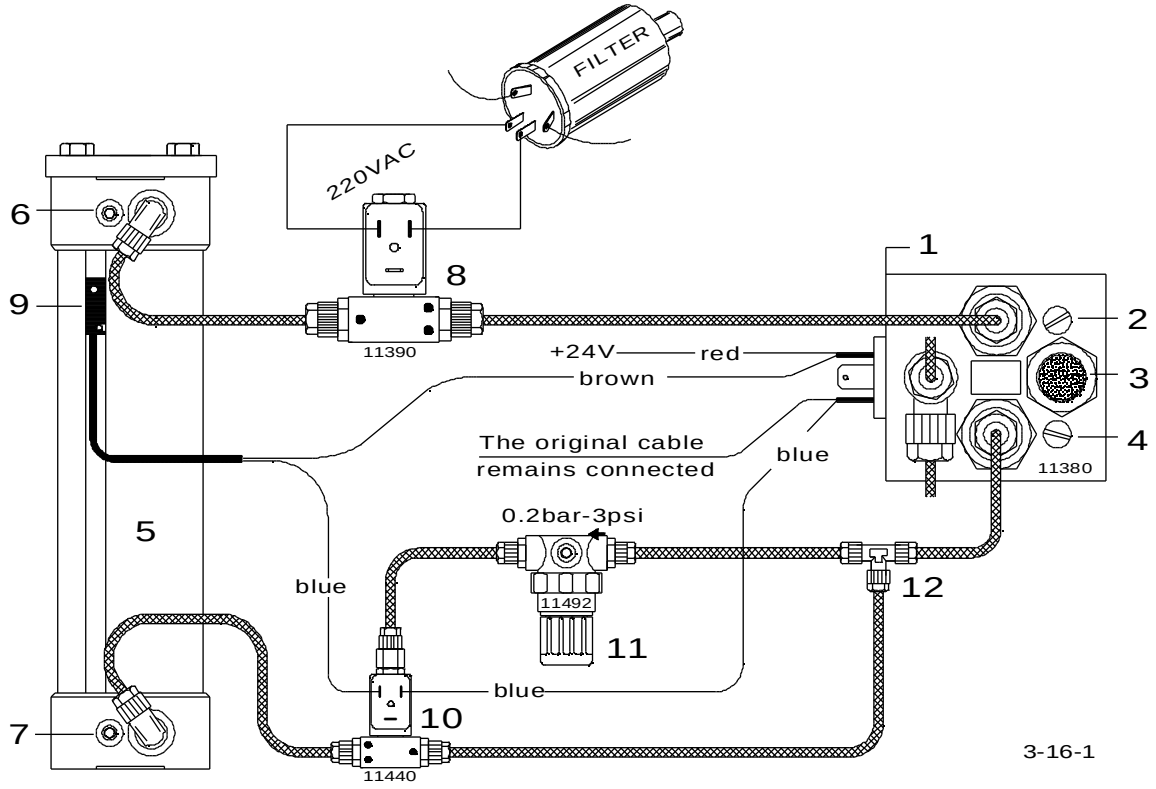
It is sufficient that the electronic unit **(8)** and the infrared cell **(7)** are protected by the stabiliser **(11)**. This can easily be done, as both units **(7 / 8)** use standard plugs.
It is then advisable to protect the balance **(2)**, the printer **(3)** and the computer **(4)** with a stabiliser **(11)**.

- The stabiliser **(11)** is plugged into the triple socket **(10)** (rear of the Analyser).
- The electronic unit **(8)** and the infrared cell **(7)** are plugged into a power strip **(6)**, using a normal power cable (the device cable).
- The original power plugs **(12 / 13)** of the units **(7 / 8)** are simply unplugged and left hanging.

A simple transformer can be used when the **voltage** of the power line is always too **low** or temporarily, lower than **200 V AC**, instead of a stabiliser.
The power of the transformer should be at least **100 VA**. The **primary** voltage should be **220 V to 240 V**. The **secondary** voltage should be about **20 V higher** than the **primary** voltage. For example **Pr 220 V / Sec 240 V or Pr 230 V / Sec 250 V**.
The power of the stabilizer should be about **250 VA**. The IR-cell and the electronic unit take less than **100 VA**, however the power drawn by the PC, monitor, balance and printer, depends on the models connected. Sometimes these devices are provided by the customer himself, so that we can not exactly define the power of the stabilizer. It is advisable to check the power of the above devices before ordering a stabilizer.

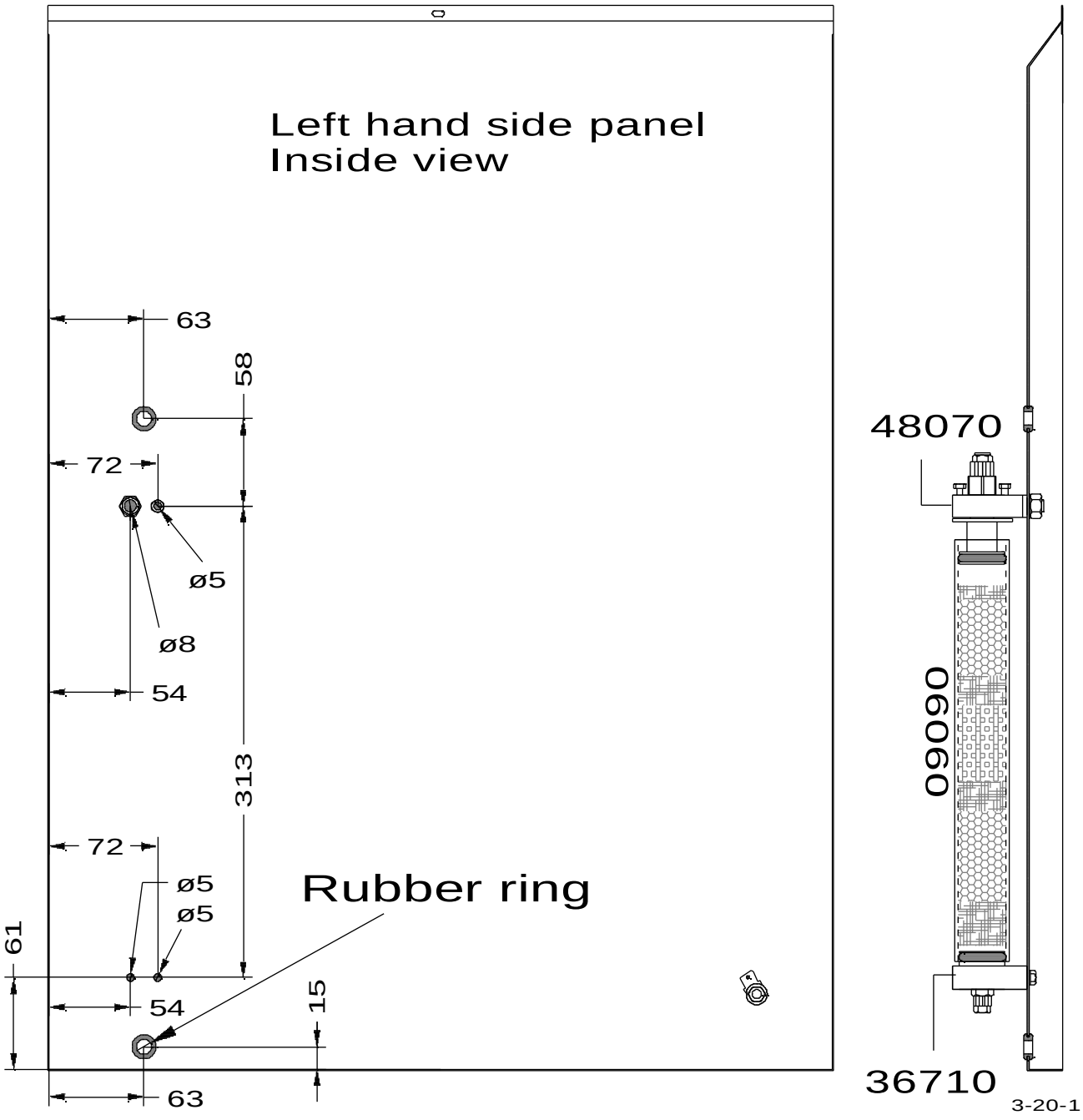
3.16 Additional safety features for furnace pneumatics (optional):

The furnace doesn't change position in case of a power failure:



By adding a **solenoid valve (8)** and connecting the **coil** directly to **220 V AC**, the piston won't change position in case of a power failure. If the piston was **down**, it will remain **down;** if it was **up,** it will remain **up**.

3.17 Installing a halogen trap:

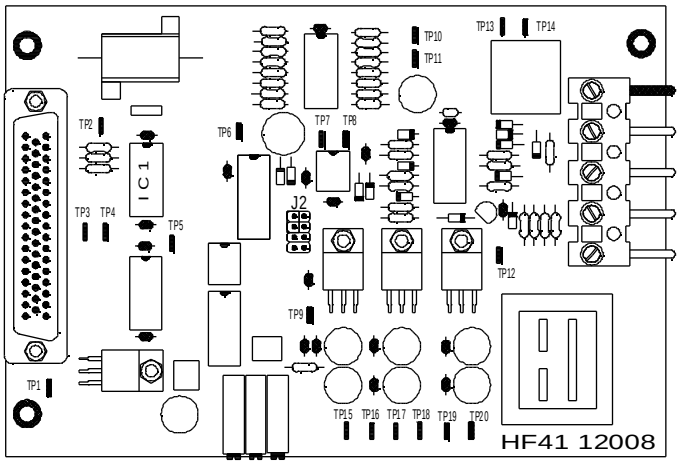


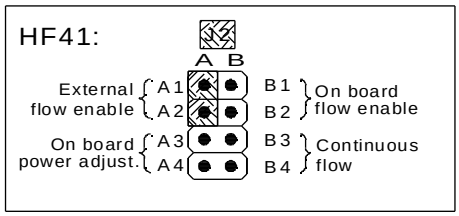
3.18 Gas saving mode:

How to set the jumpers for gas saving mode:

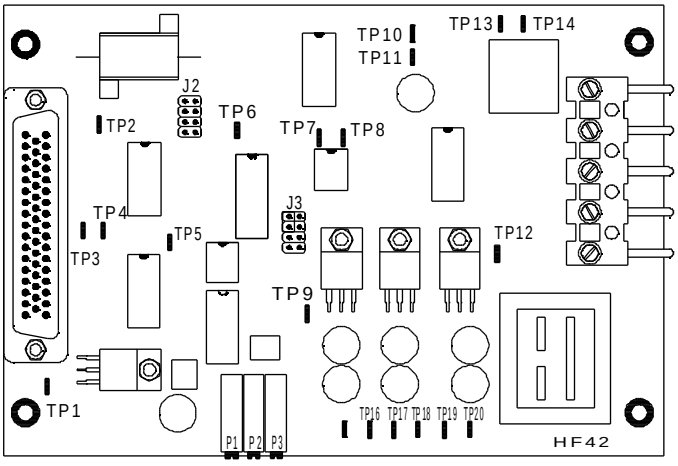
Caution:
This option is functional with EPROMS and PC software versions, later than June 2001.

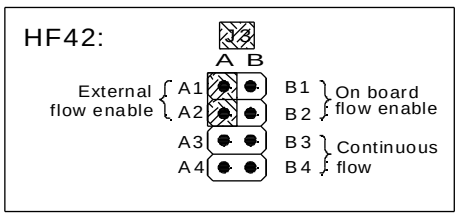
If the analyser has the HF 41 board:
Set the jumper setting to **A1** with **A2** on **J2**





If the analyser has the HF 42 board:
Set the jumper setting to connect **A1** with **A2** on **J3**





3.193.19 Upgrade for copper analysis without accelerators:

The **CS-800** (CS-2000) can analyse Copper of very high weight, without using any accelerators. Copper sample up to **20 g**, or as much Copper sample the crucible can accommodate.
If the Copper sample has the form of **grains** or **drillings**, the standard **CS-800** (CS-2000) can do the job.

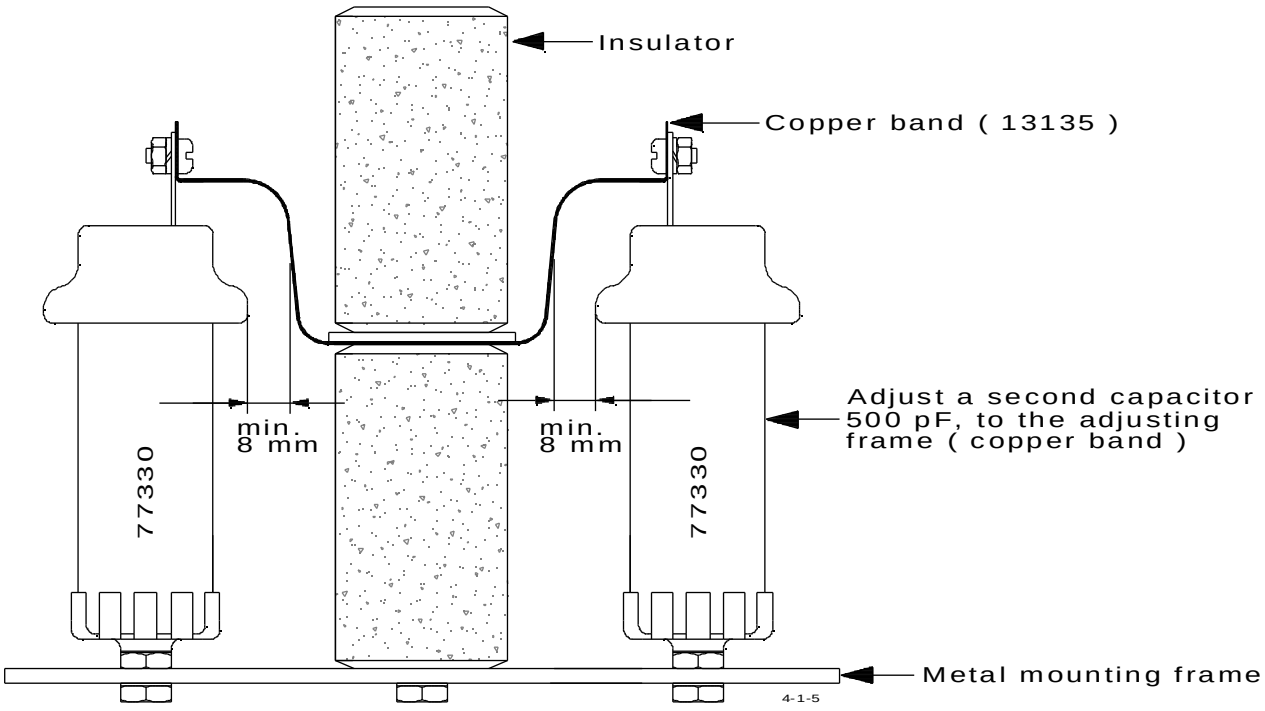
The condition is:
The furnace control board should have a **HF-42** with the corresponding jumper setting for The correct control mode. See **1.4**

If the Copper sample is a **solid piece** then the temperature may not go **high** enough to reach the **melting point**. In this case the following modifications are necessary:

WARNING ! High voltage

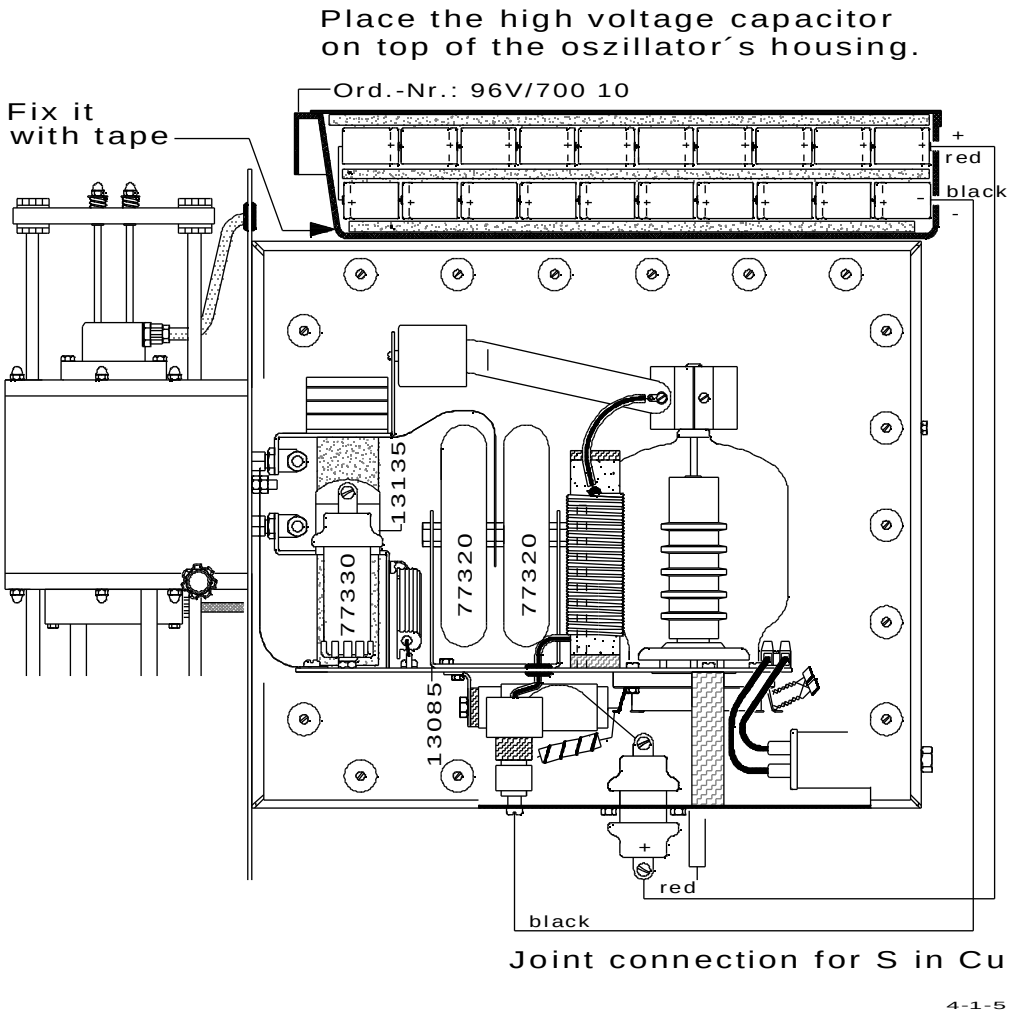
1) Switch off the analyser and unplug the main power cable.

2) A second **capacitor 500 pF** (ordering no. 77330) will be added between the adjusting frame (Copper band: ordering no. 13135) and the metal mountung frame. The distance of the capacitors to the frame, has to amount to **8 mm** min. See **drawing below** and **next page**.



3) Install a second **100 pF** capacitor (ordering no. 77320) parallel to the first one between the cooling system and the coil, mounted on a **U-form** metal frame. (ordering no. 13085)

4) Place a **high voltage capacitor** (ordering no. 96V/ 700 10) on top of the oscillator's housing, fixing it with tape. A red cable **(+)** will be joined from the high voltage capacitor to the lower capacitor that is fixed on the bottom housing.
A black cable also from the high voltage capacitor **(-)** will be jointed to the capacitor coil, also mounted on the bottom housing. See **drawing below**.



3.20 Upgrading of analysers with electronic rack for using the new Windows software:

Late analysers **(from S/N 0767xxxxxx)** equipped with the new flow sensor (pressure transducer) can easily be upgraded as follows:
+ Remove the electronic rack.
+ Install the new hardware at the same place.
+ Connect the adapters and the new cables for PC and balance.
+ Install the front frame and the rear frame.

Upgrading of older analysers equipped with the previous flow sensor (rotameter in the IR-cell) is theoretically possible but practically difficult. The new software is made for the latest versions of analysers with the electronic flow sensor and with two oxygen inlets furnaces. Therefore, older analysers can not run with the new software, unless the analyser is first modified to correspond to the later version. This means replacement of the wiring, new HF board, new upper furnace part with two oxygen inlets and modifications of the tubing and new flow sensor in the IR-cell.

3.21 Preventive Maintenance checklist

The instruments should be maintaind 1 -2 times per year and the following should be checked and if necessary replaced:

1. check of the IR-cells
a) cleaning and if necssary change of the IR paths
b) check and if necessary change of the dust filter
c), check of the flow sensor
d) check of the emitters and the chopper motor

2. check and adjustment of the flow regulator

3. check of the reagent train and if necessary cleaning

4. leackage test

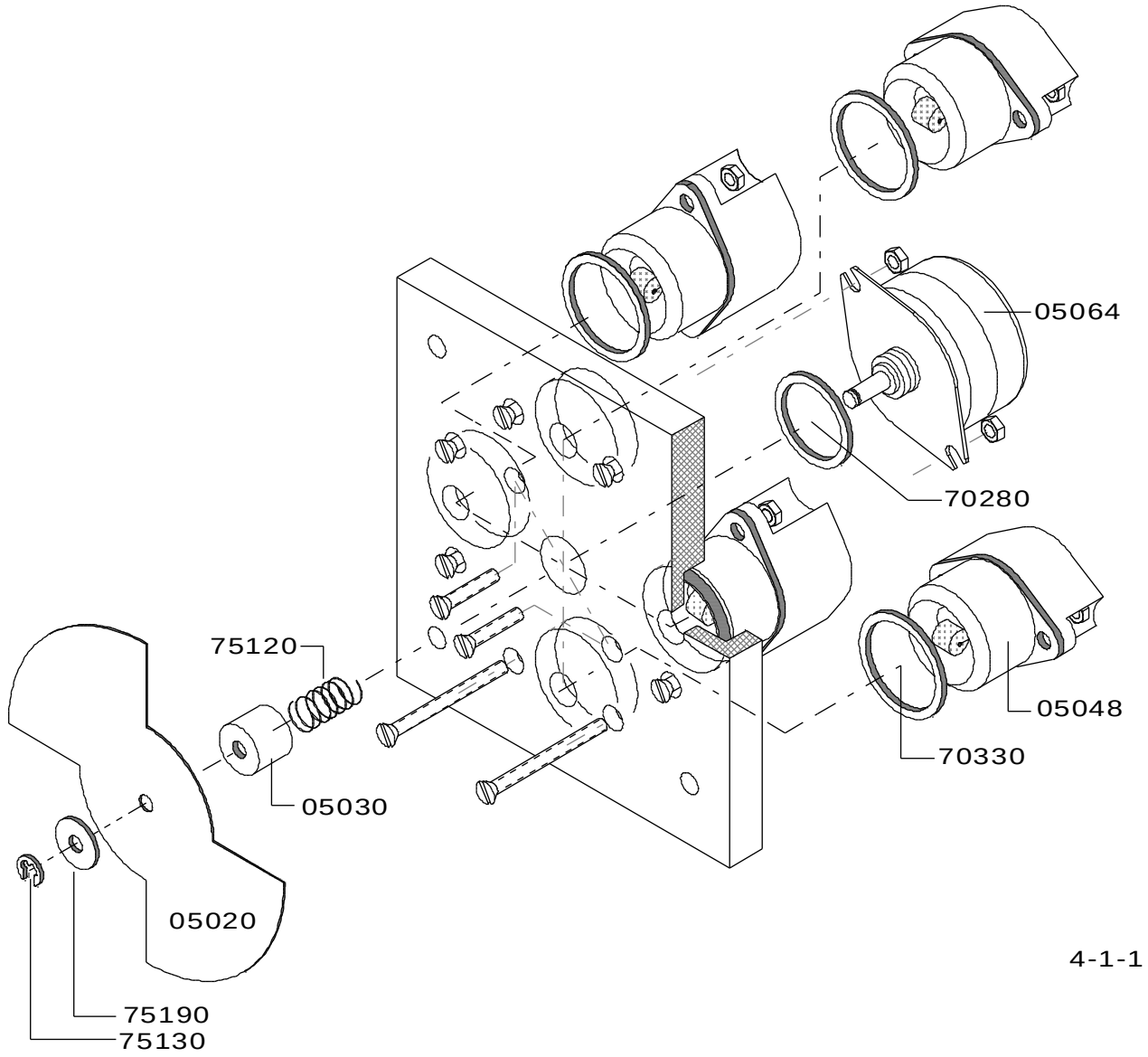
5. check of the chopper purge flow

6. check of the induction furnace
a) measurement of the power/capacity and if necessary adjust
b) check of the pneumatic and if necessary adjust.

4 MISCELLANEOUS

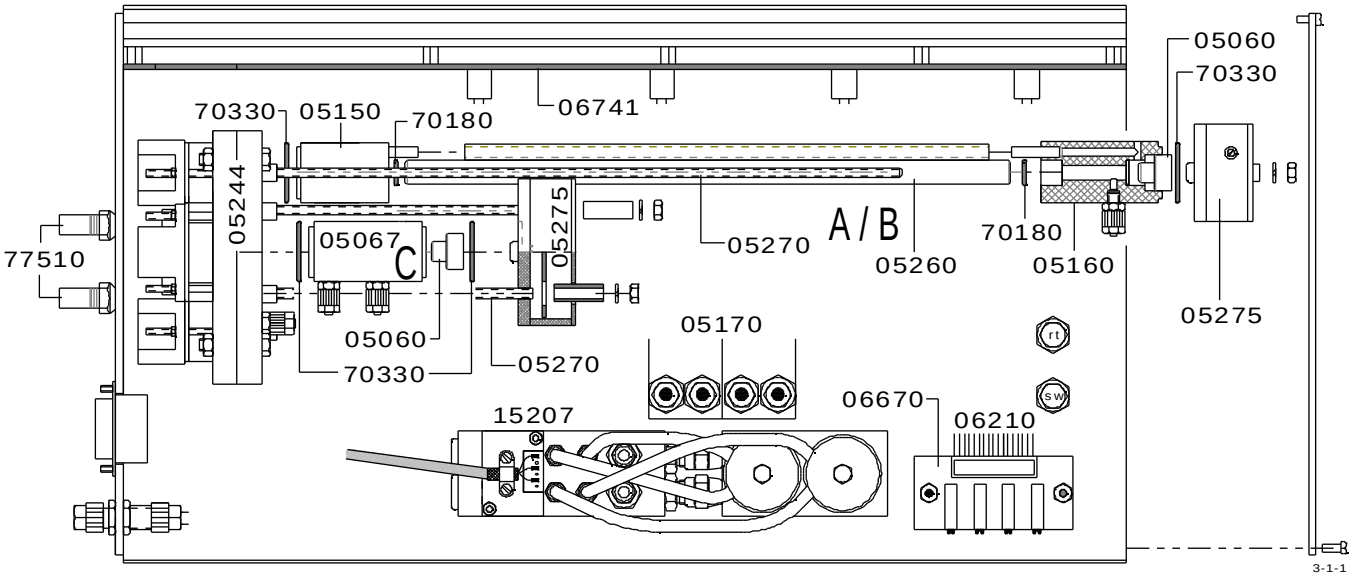
4.1 Ordering numbers:

see also **Operation Manual**, chapter **8.**



05020	Chopper blade
05030	Chopper blade holder
05064	Chopper motor
05048	Infrared source (emitter)
70280	O-ring
70330	O-ring
75120	Spring
75130	Retaining washer
75190	Washer

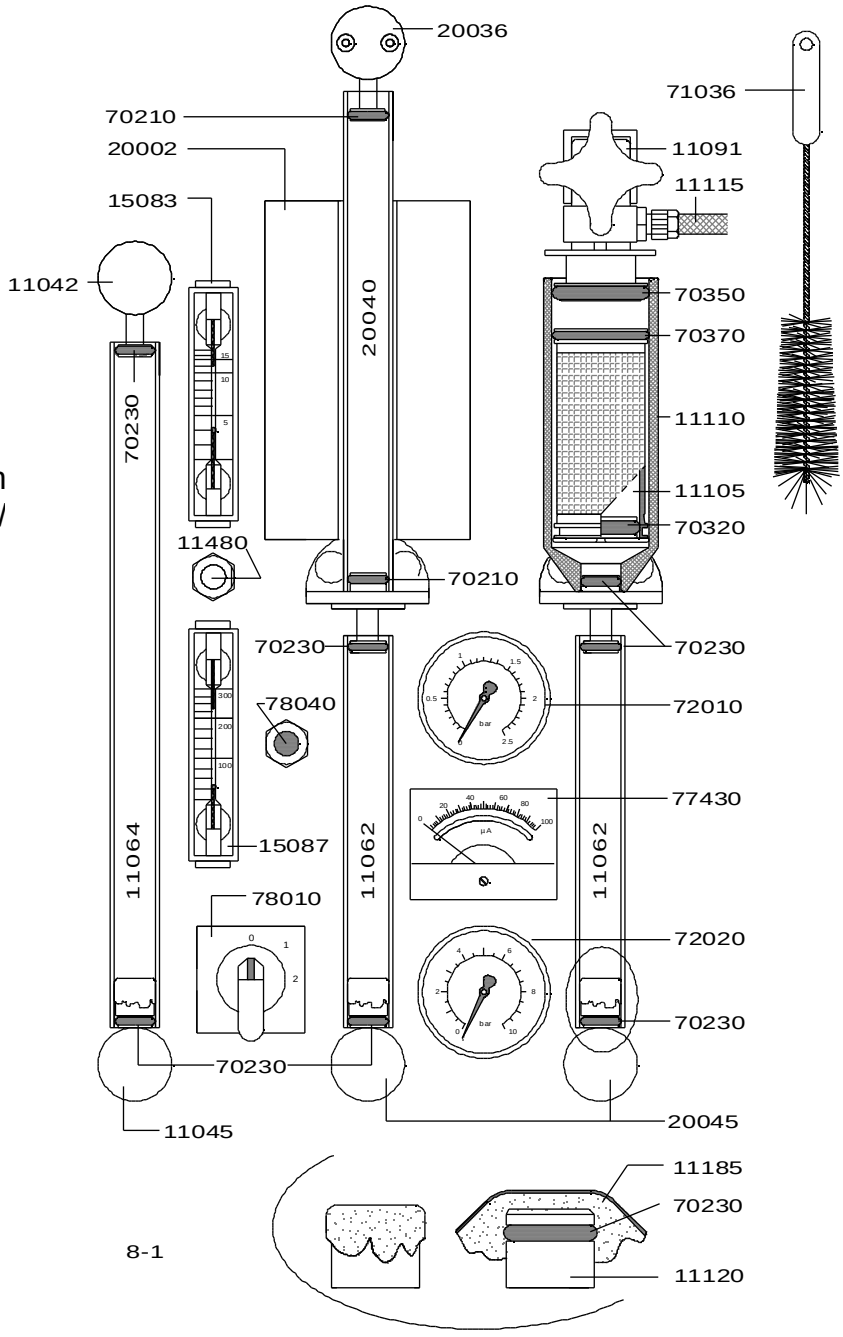
Infrared cells:



05060	Reflector
05067	IR-path for high carbon
05150	IR-path connector with window source side
05160	IR-path connector with window detector side
05170	Gas conditioner
05244	IR 4 chopper
05260	IR-path tube (advice the length)
05270	Threaded rod (advice the length)
05275	Infrared preamplifier
06210	IR-cable
06670	IR-zero adjustment board
06741	Infrared electronics board
15207	Gas flow sensor
70180	O-ring
70330	O-ring
77510	Heaters for IR-cell

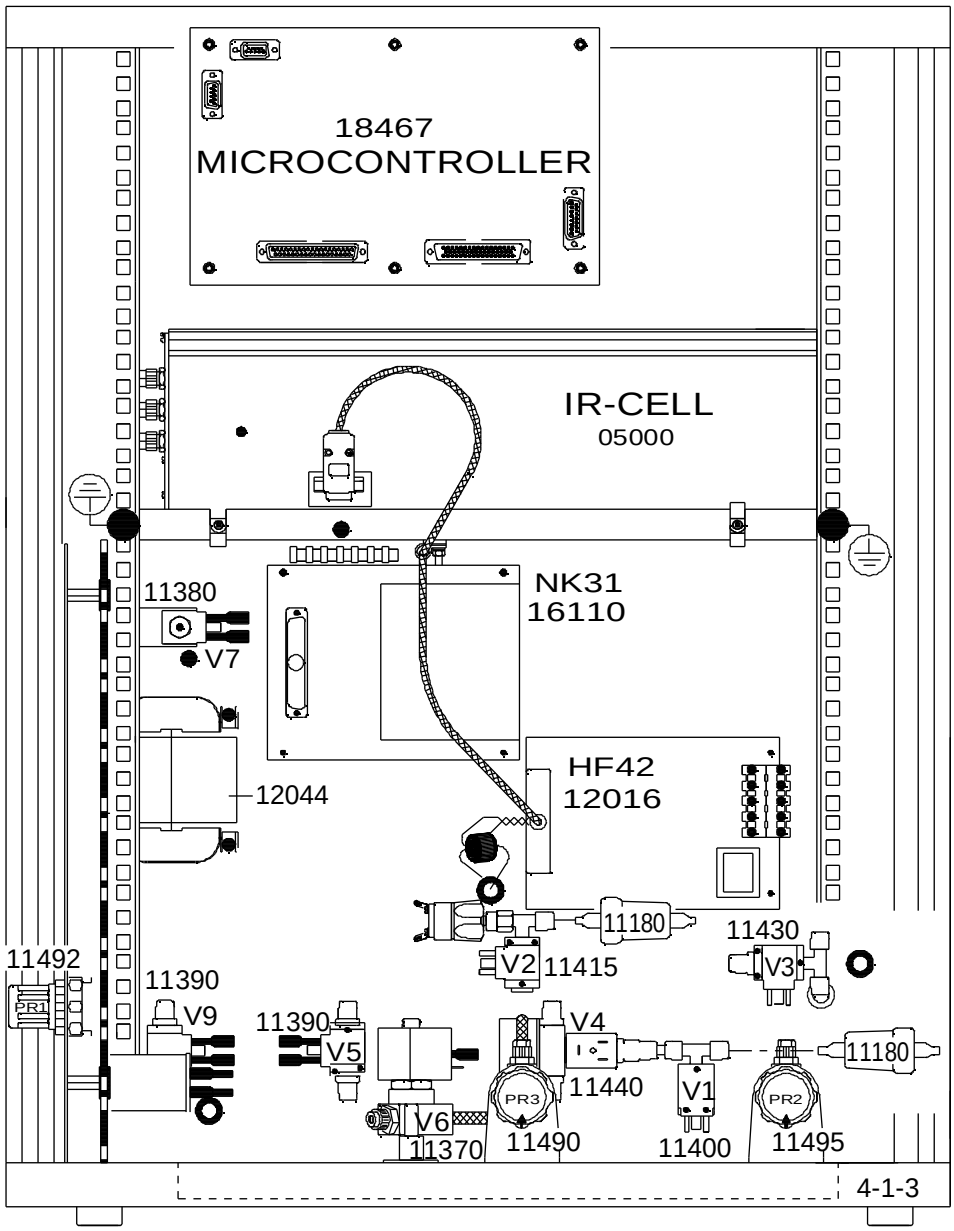
Front side

11042	Upper tube holder
11045	Lower tube holder
11062	Reagent tube
11064	Reagent tube
11091	Dust trap mechanism
11105	Metal dust filter
11110	Filter housing
11115	Furnace outlet tube
11120	Paper filter holder
11185	Paper filters
11480	Adjustable restrictor
15083	Gas flow indicator 15 l/h
15087	Gas flow indicator 300 l/
20002	Catalyst furnace
20036	Upper tube holder
20040	Catalyst tube
20045	Lower tube holder
70210	O-ring
70230	O-ring
70320	O-ring
70350	O-ring
70370	O-ring
71036	Cleaning brush for filter
72010	Pressure gauge
72020	Pressure gauge
77430	Panel meter 100 µA
78010	Main power switch
78040	Button for leakage test



Left side:

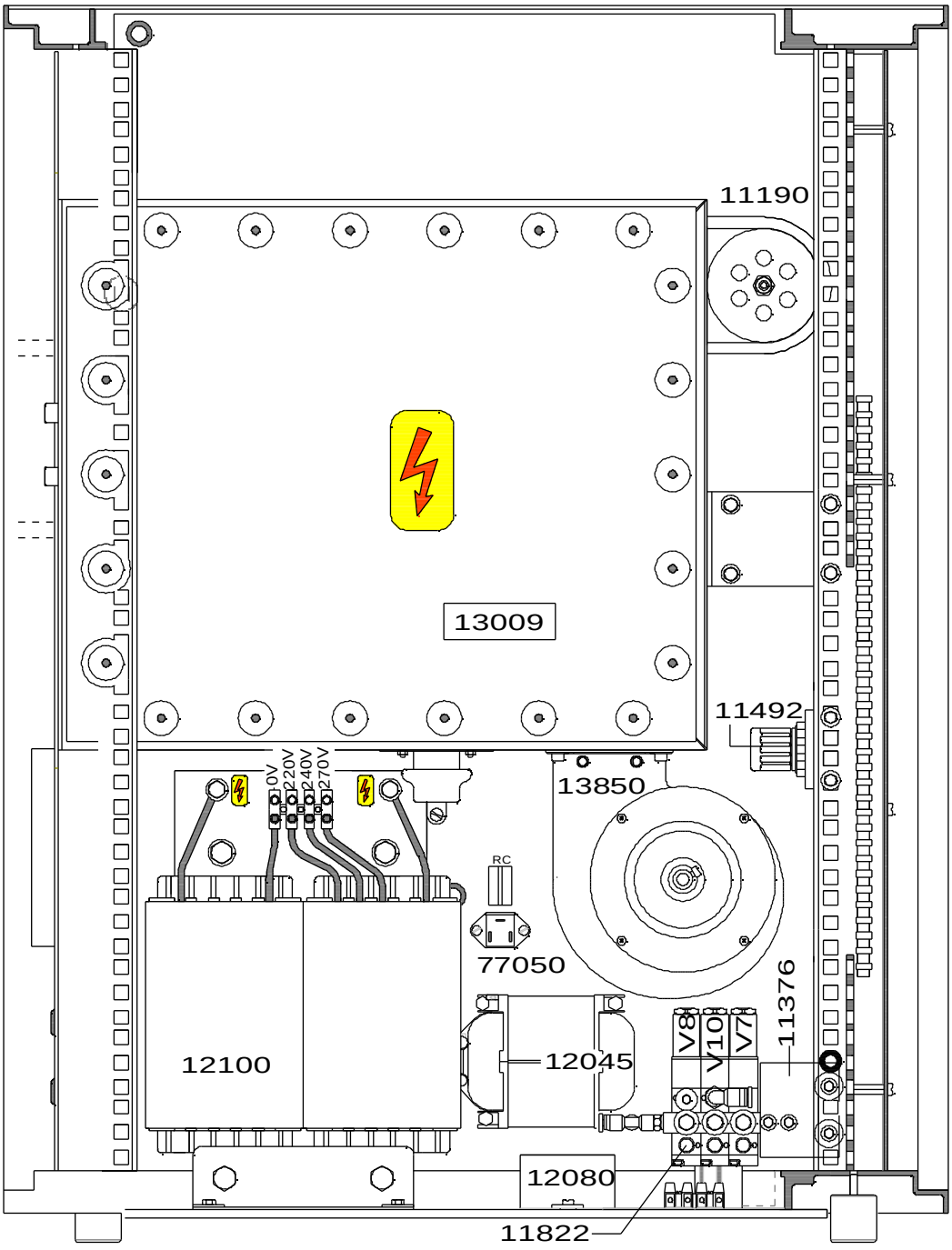
Separator plate side



05000	IR-cell
11180	Dust cartridge
11390	Oxygen solenoid valve
11400	Pressure outlet solenoid valve
11415	Oxygen stop solenoid valve
11430	Purge solenoid valve
11440	Bypass solenoid valve
11492	Pressure regulator
11492	Inlet pressure regulator
11495	Purge pressure regulator
12016	Gas flow and furnace control board HF 42
12044	Transformer
16100	Power supply board NK 31
18467	Microcontroller board UNI

Right side:

Ventilation

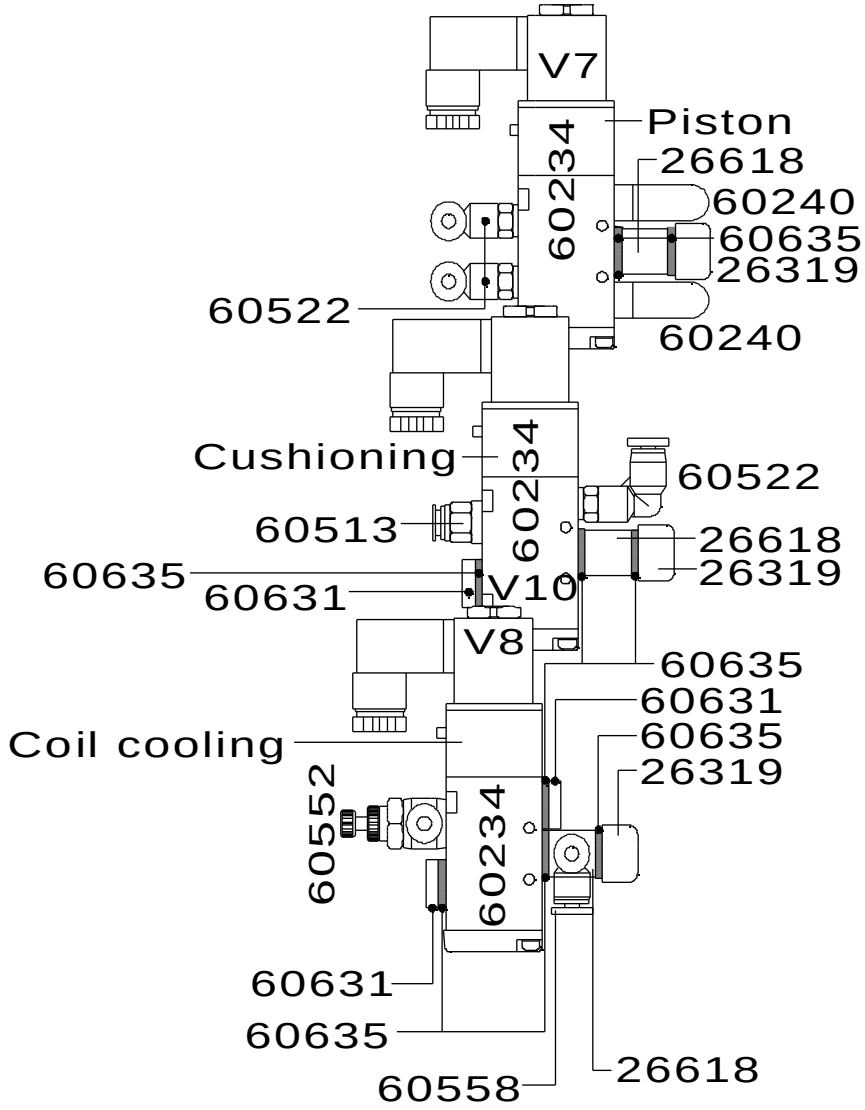


B9-1-5

11190	Exhaust muffler
11376	Fixing plate for 11822
11492	Pressure regulator
11822	Pnematic valve block
12045	Transformer
12080	Rectifier
12100	Transformer
13850	Centrifugal blower
77050	TRIAC
77135	Capacitor

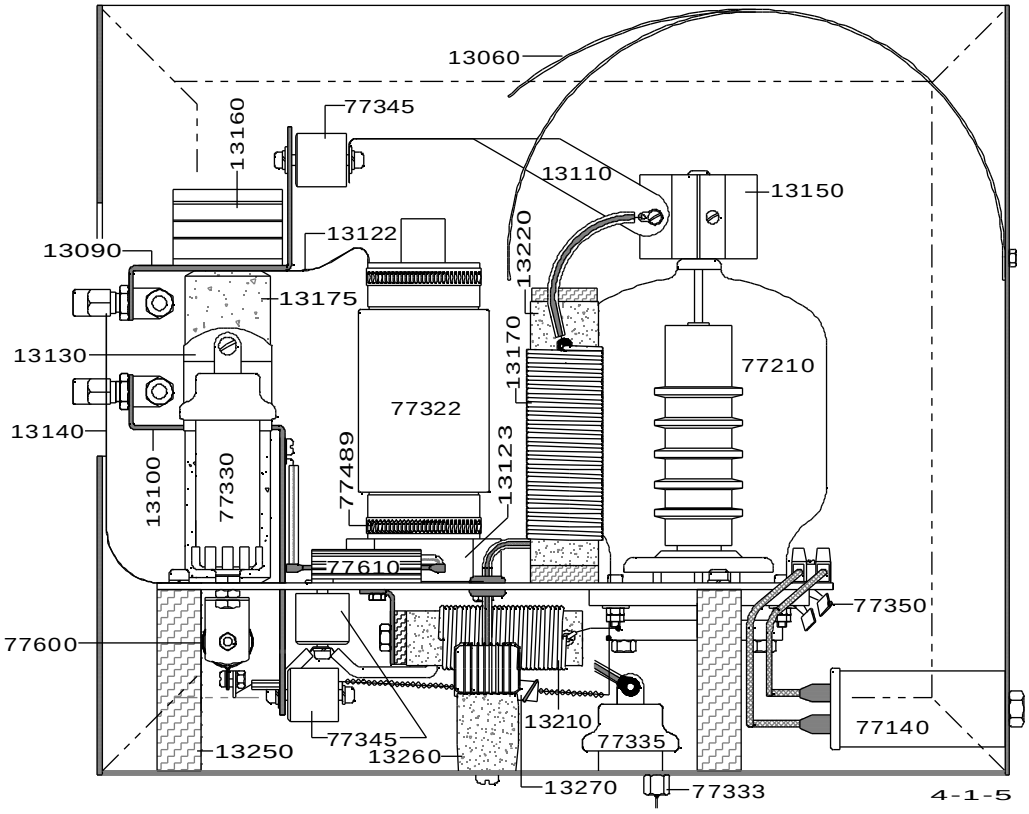
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Pneumatic valve block 11822



26319	Hollow screw
26618	Valve block
60234	Pneumatic valve
60240	Silencer
60513	Fiting
60522	Fiting
60631	Closure
60635	Seal

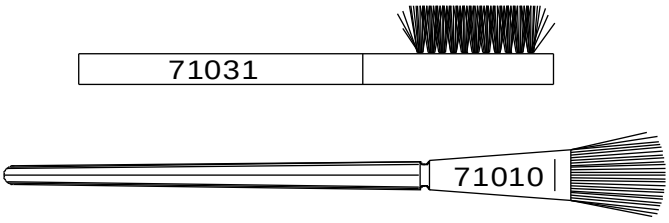
Oscillating circuit:

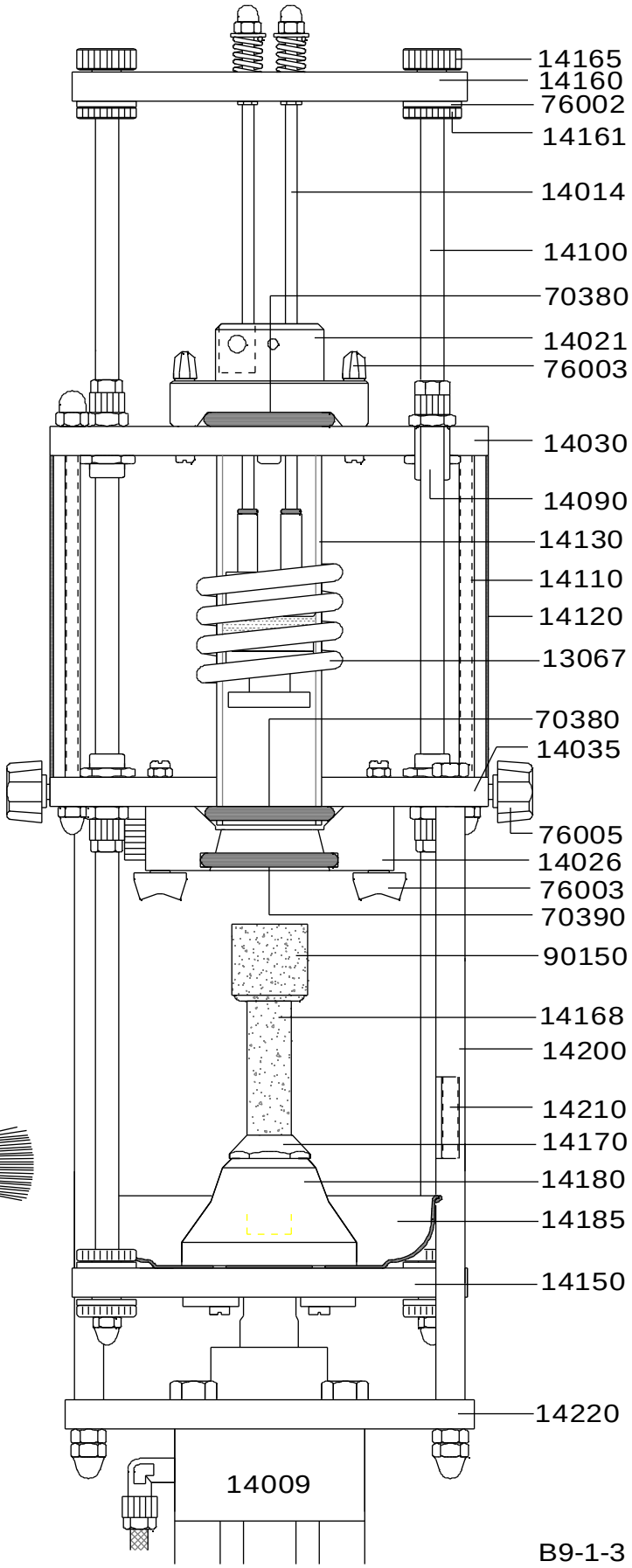


13060	Protection sheet
13081	Capacitor support
13090	Upper coil connector
13100	Lower coil connector
13110	Anode connector
13122	Capacitor connector
13130	Capacitor connector
13140	Ground connector
13150	Anode heat sink
13160	Coil heat sink
13170	Radiation shield
13175	Insulator
13210	Grid choke
13220	Anode choke
13250	Chassis support
13260	High voltage filter
13270	Resistor
77140	HF-filter
77210	Oscillator tube
77322	Capacitorr
77330	Capacitor
77335	Capacitor
77333	Filter
77345(13261; 13262; 77340; 77341; 77342)	Capacitor
77350	Capacitor 100 nF
77489	Bracket
77600	Resistor
77610	Resistor

Furnace:

13067	Combustion coil
14009	Pneumatic cylinder for furnace lift
14021	Upper furnace lock
14026	Lower furnace lock
14030	Upper furnace plate
14035	Lower furnace plate
14090	Bearing
14100	Mounting rod
14110	Threaded rod
14120	Furnace cover
14130	Combustion tube
14150	Lower log
14160	Upper log
14161	Lower knurled nut
14165	Upper knurled nut
14168	Pedestal
14170	Pedestal mount
14180	Furnace closure
14185	Tray
14200	Metal tube
14210	Threaded rod
14220	Cylinder support
70380	O-ring
70390	O-ring
71010	Cleaning brush for pedestal
71031	Cleaning brush for radiation shield
76002	Washer
76003	Wing nut
76005	Knurled nut
90150	Crucibles

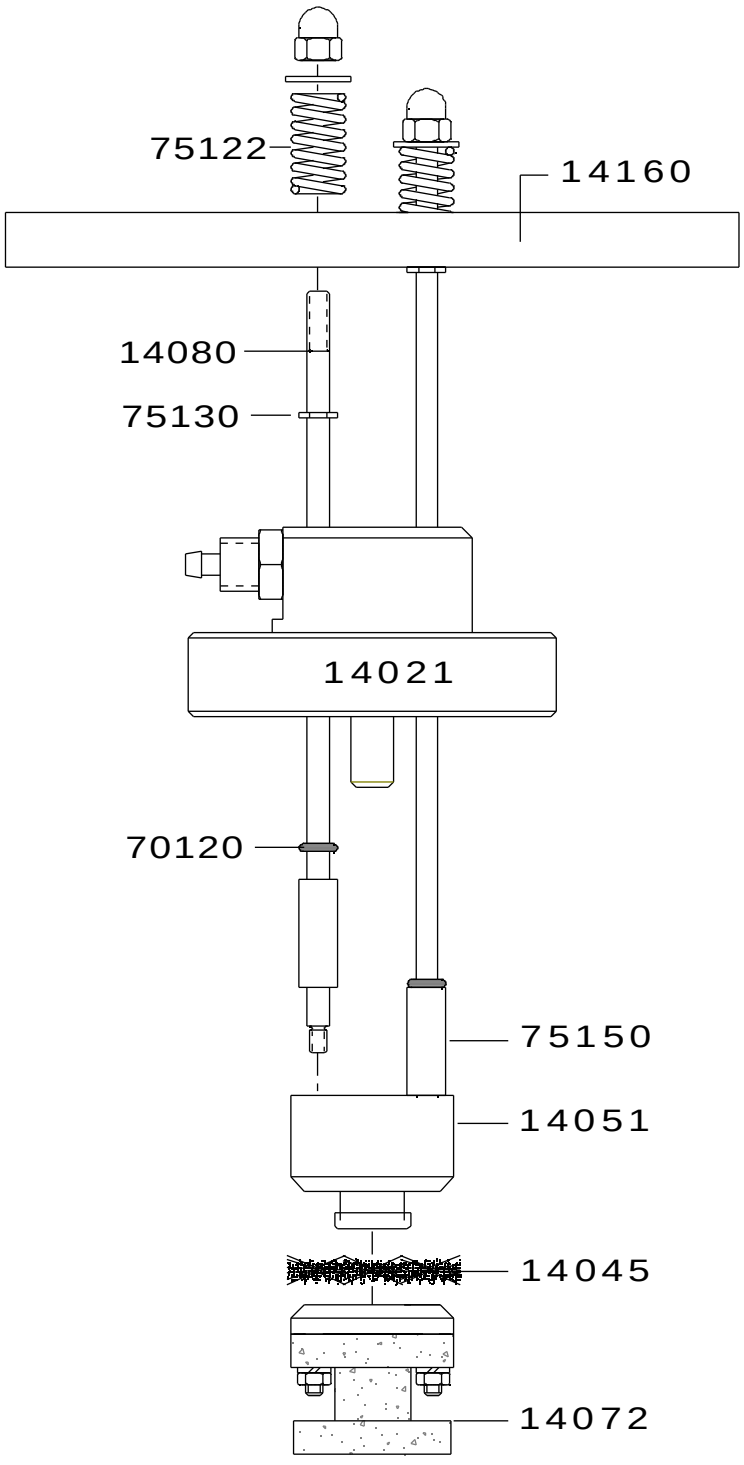




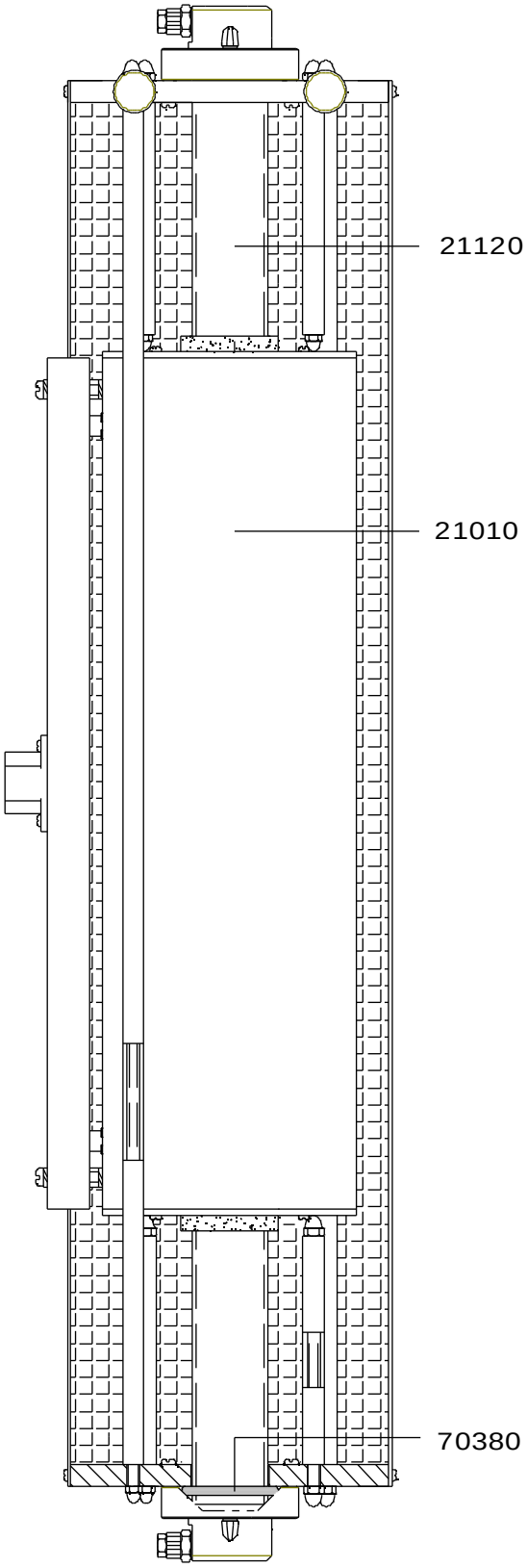
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Furnace cleaning:

14014	**Complete furnace cleaning assembly unit:**
14021	Upper furnace lock
14045	Cleaning brush for combustion tube
14051	Brush holder
14072	Ceramic heat shield for brush
14080	Cleaning mechanism Rod
14160	Upper log
70120	O-ring
75122	Spring
75130	Safety spring
75150	Metal tube



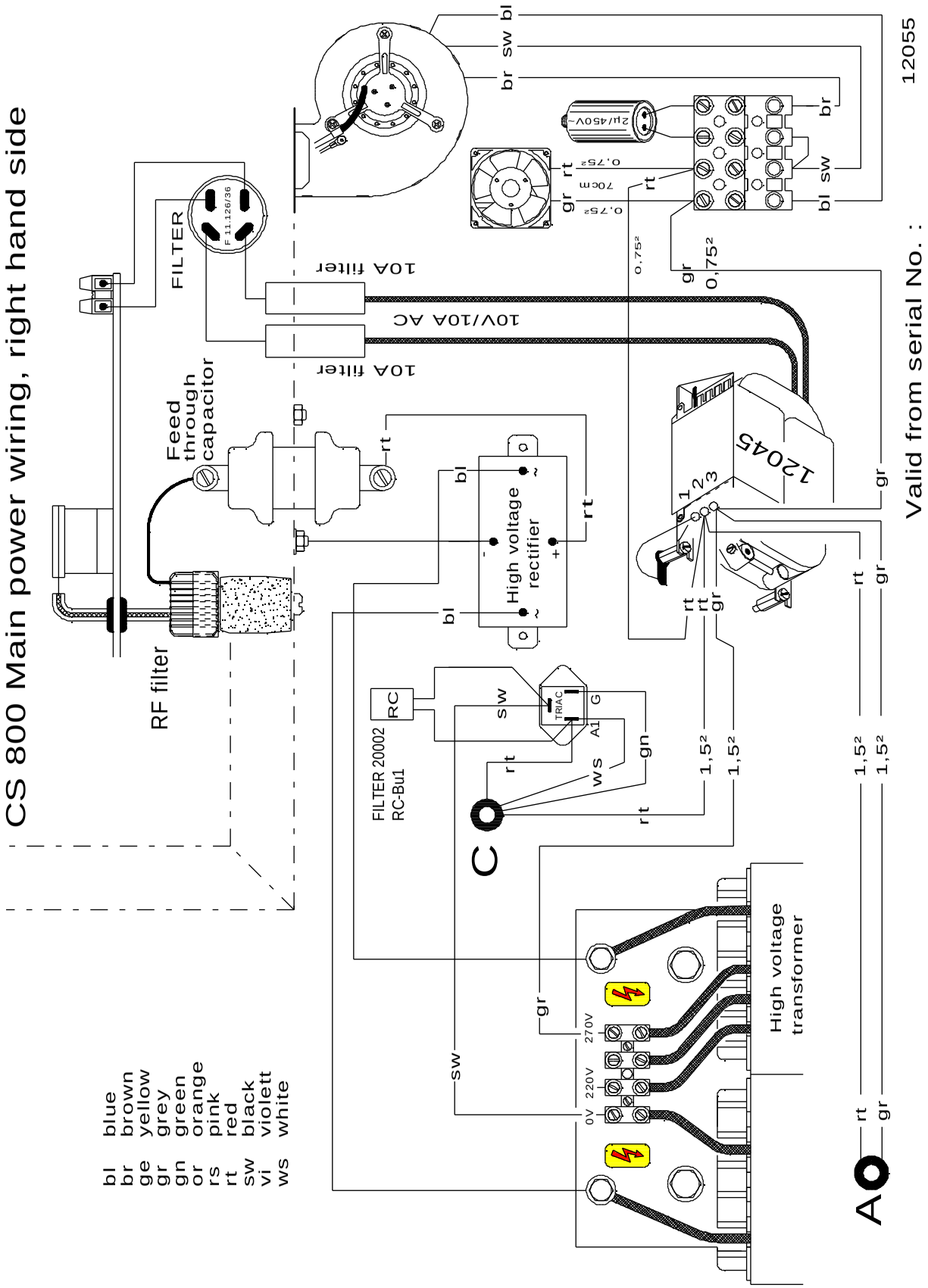
Oxygen purifying furnace:



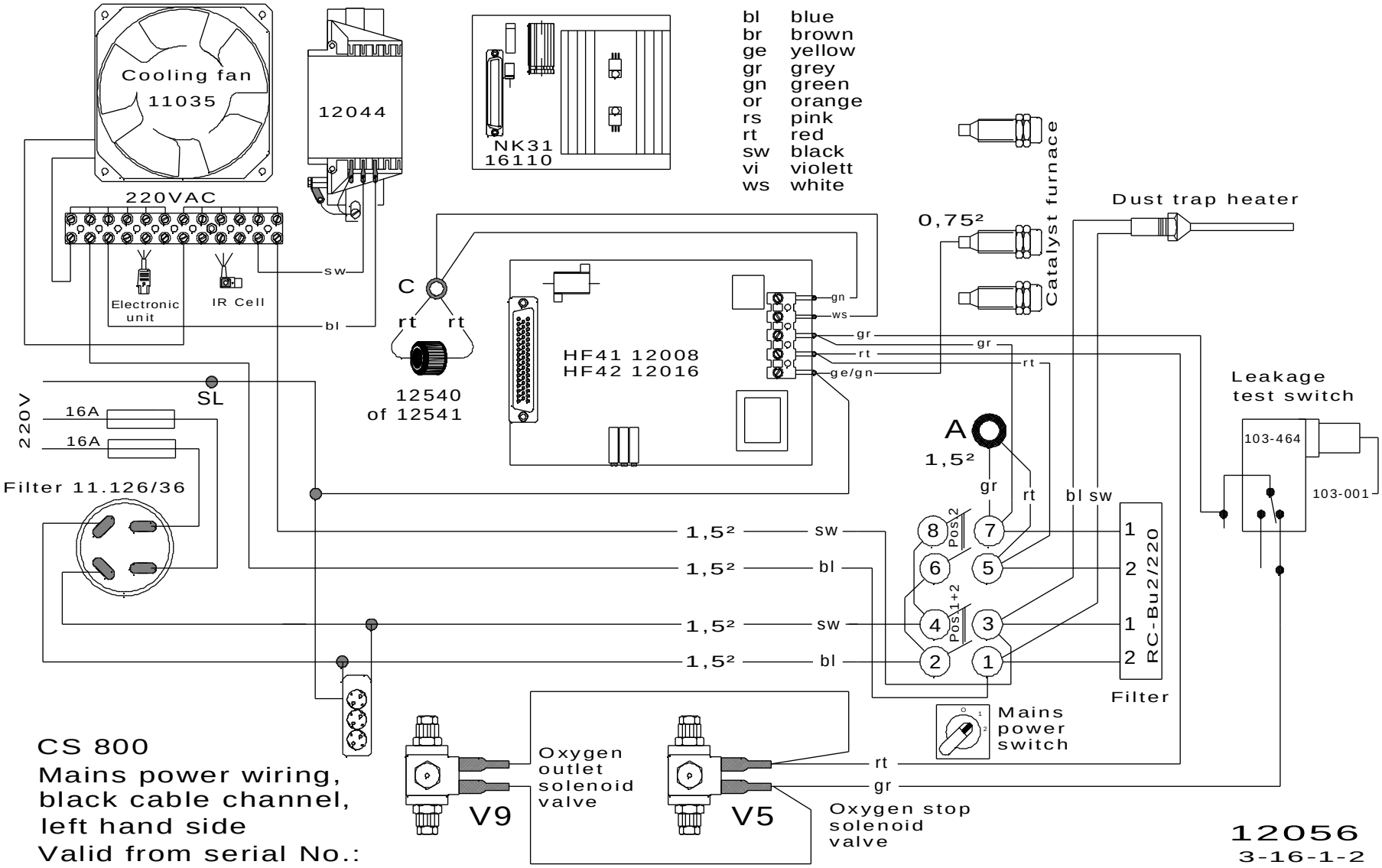
21010	Heather section
21120	Quartz tube
70380	O-Ring

4.2 Wiring and gas flow diagrams:

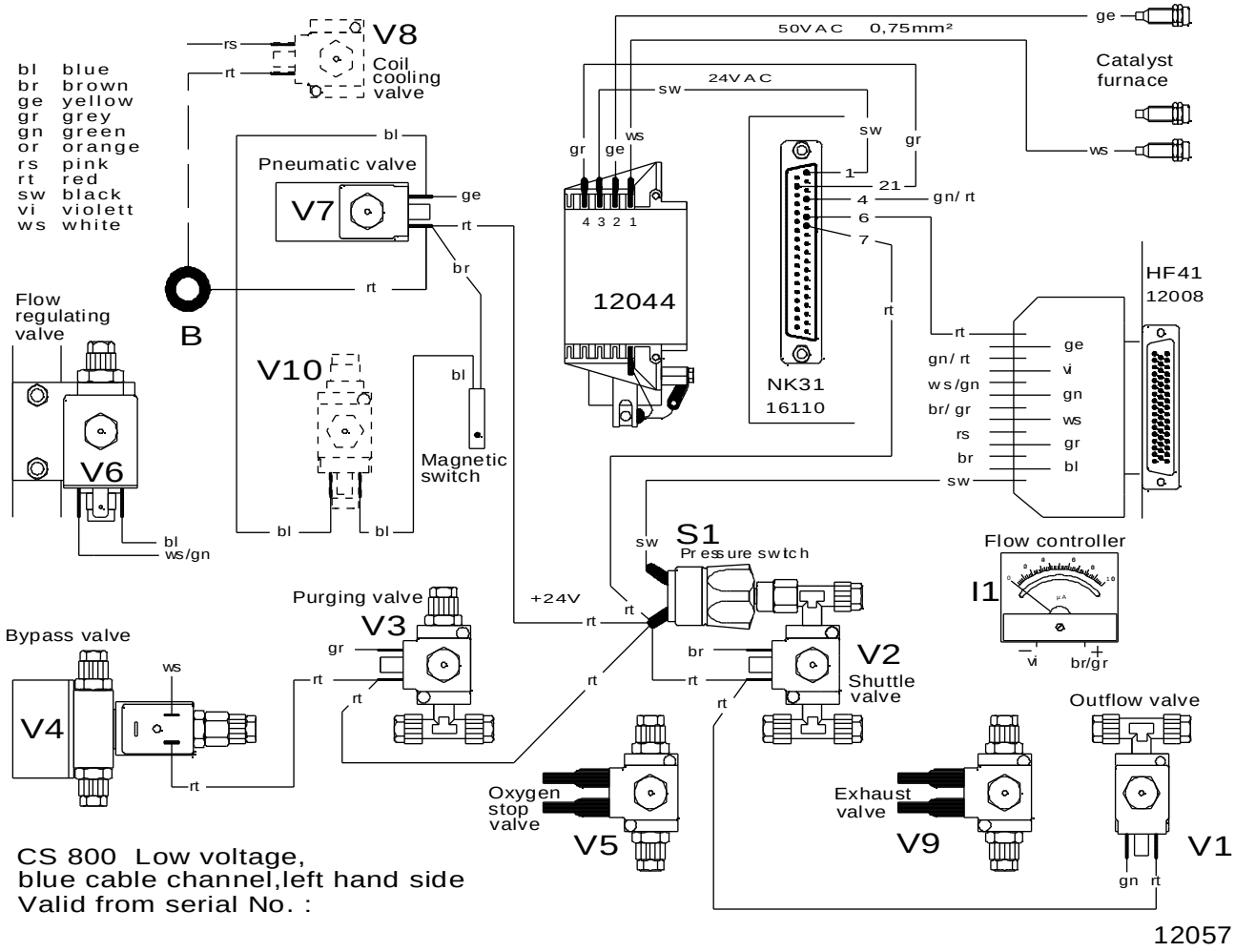
Right side:



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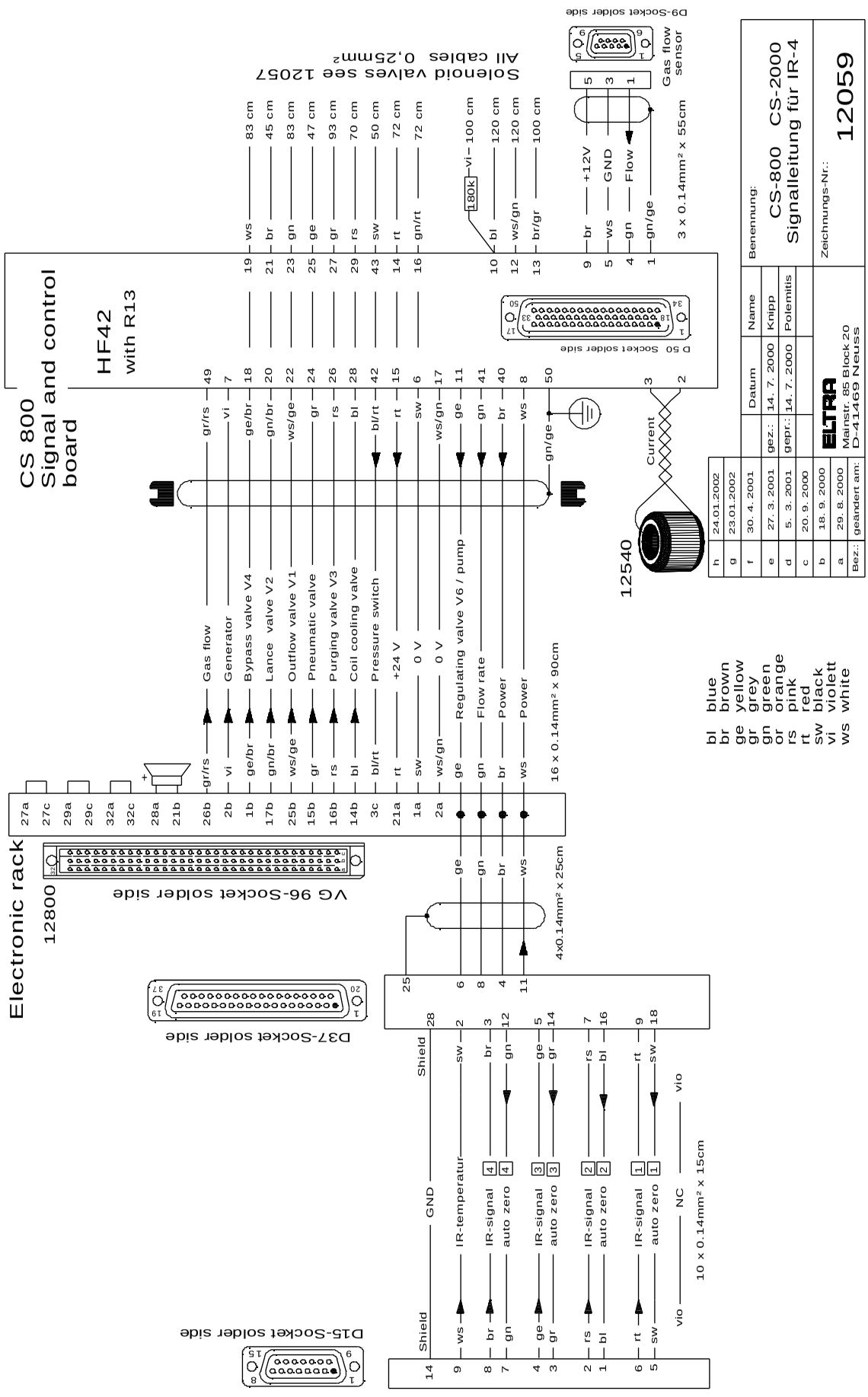


Valve wiring:



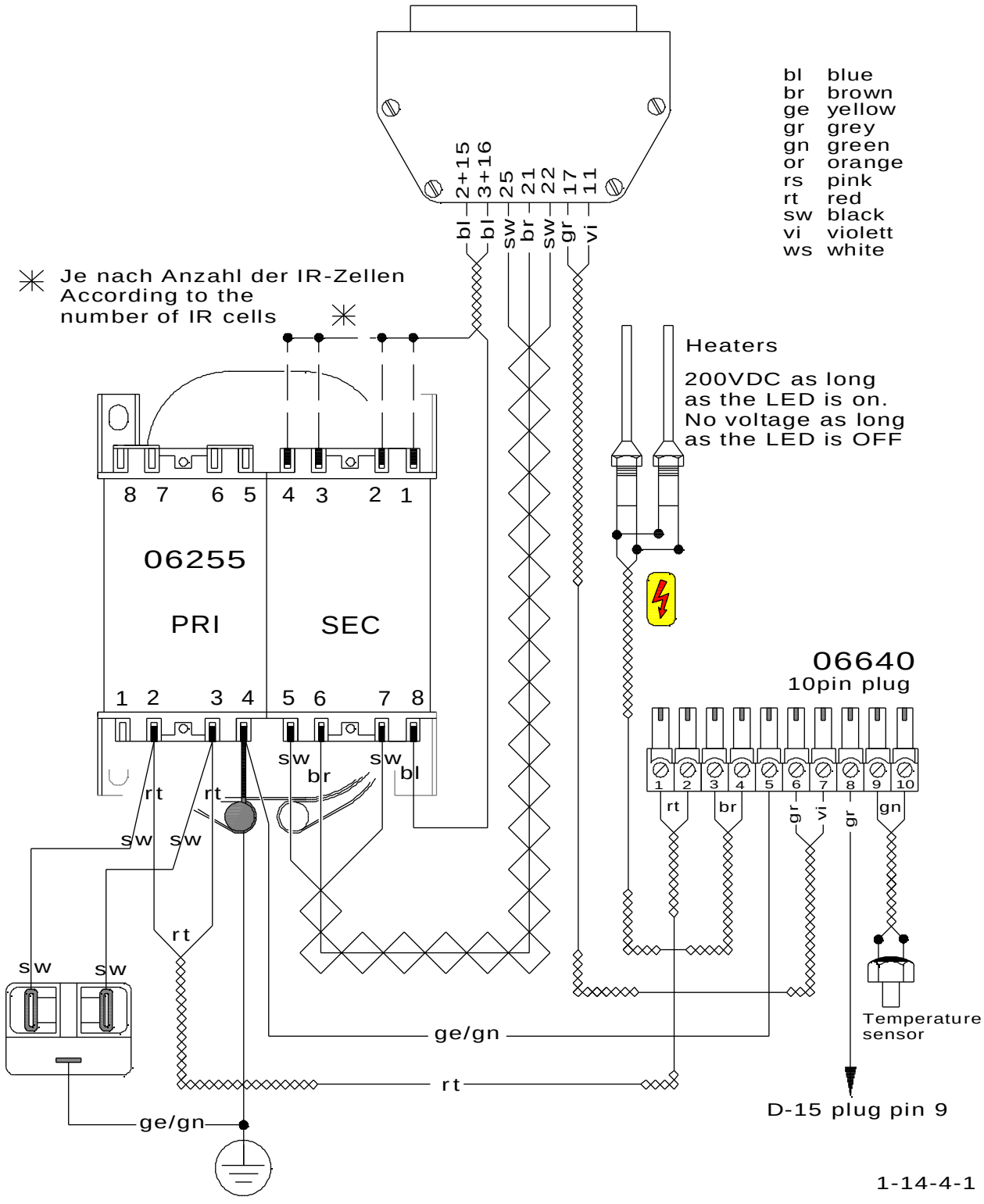
A	To rear (V8)
V1	Outflow valve
V2	Shuttle valve
V3	Purging valve
V4	Bypass valve
V5	Oxygen valve
V6	Regulating valve
V7	Pneumatic valve
V8	Coil cooling valve
V9	Outlet valve
V10	Pressure switch over valve for furnace lift
S1	Pressure switch
I1	Panel meter

Control wiring:



IR-current supply:

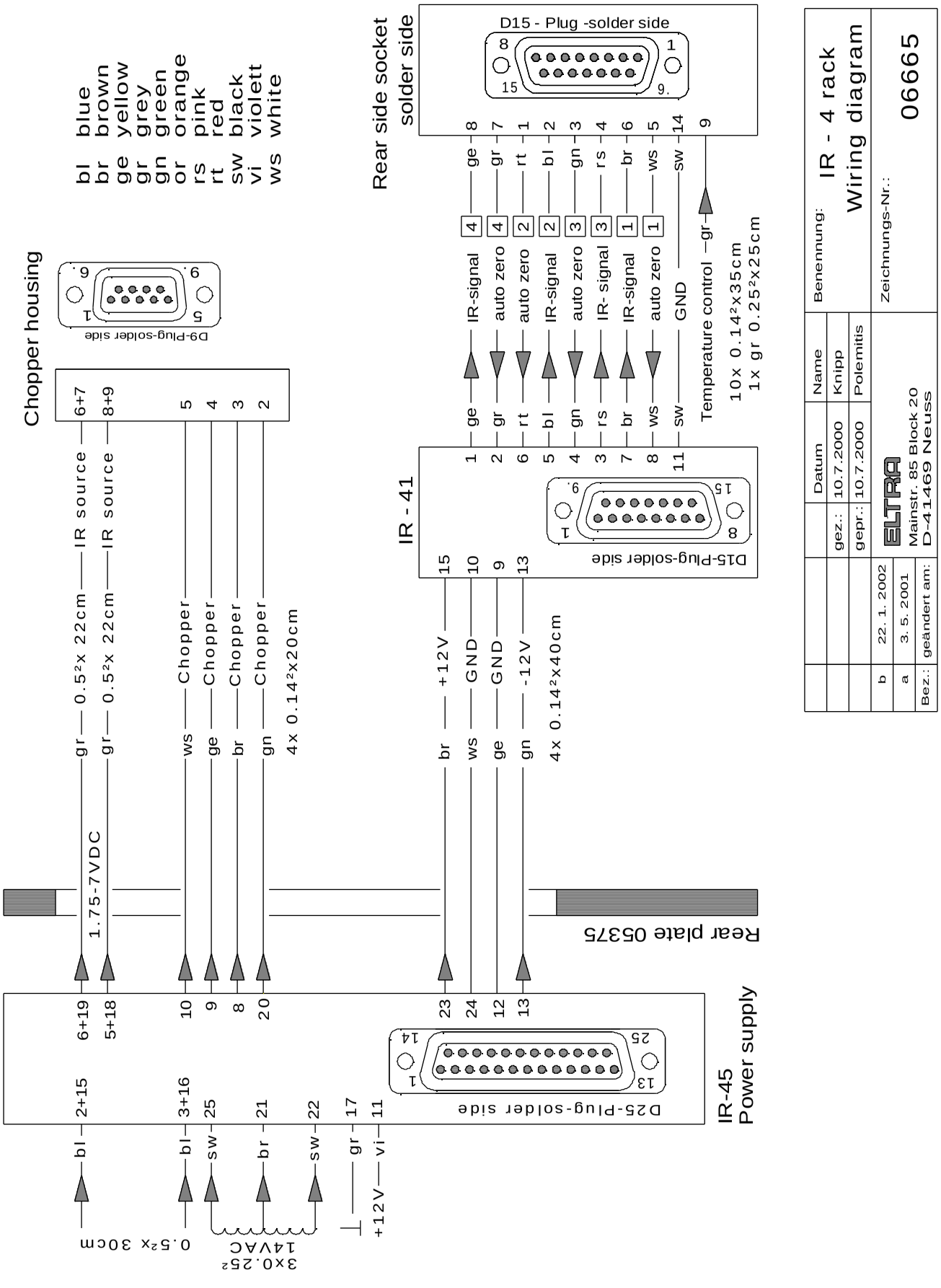
Attention:
The next four drawings consider the IR-rack with four IR-cells
The pages after, Connection between TH 62 and NR 32 are for the older Model (S/N 1080 till S/N 1079)



1-14-4-1

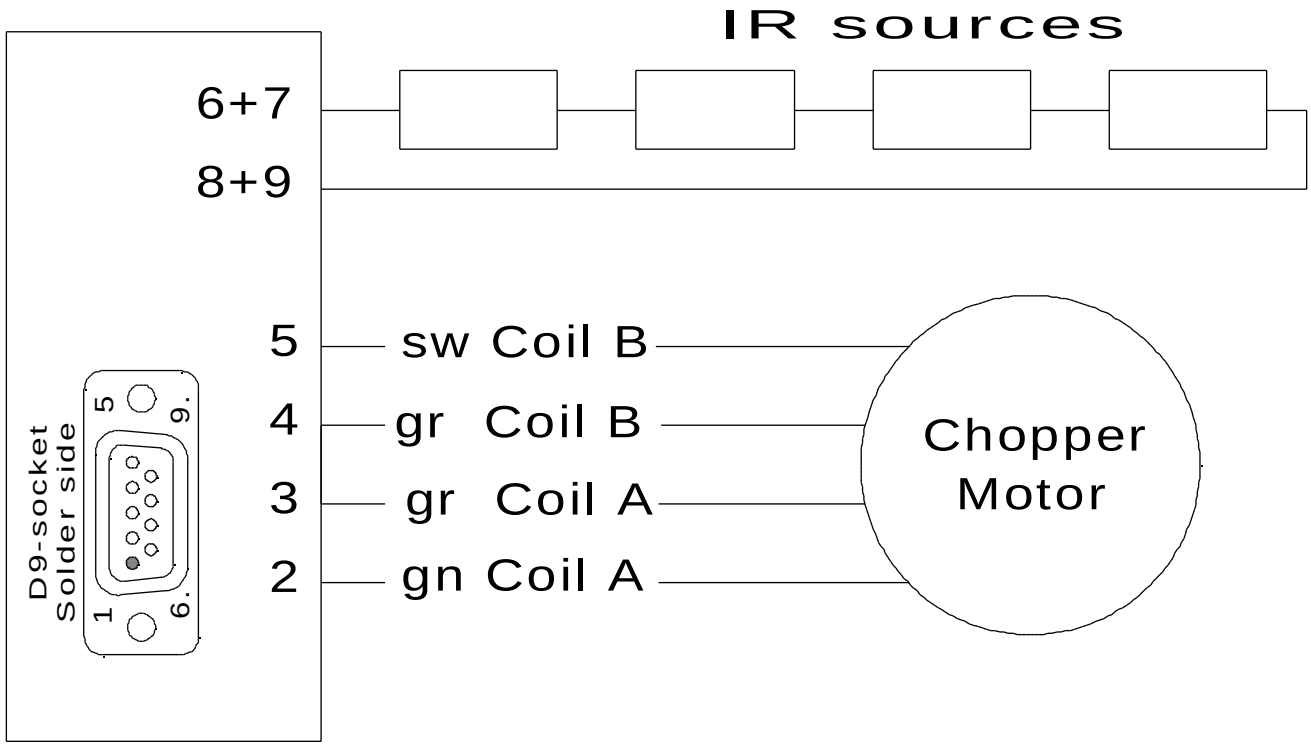
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Infrared cell:



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Chopper motor and IR-source:

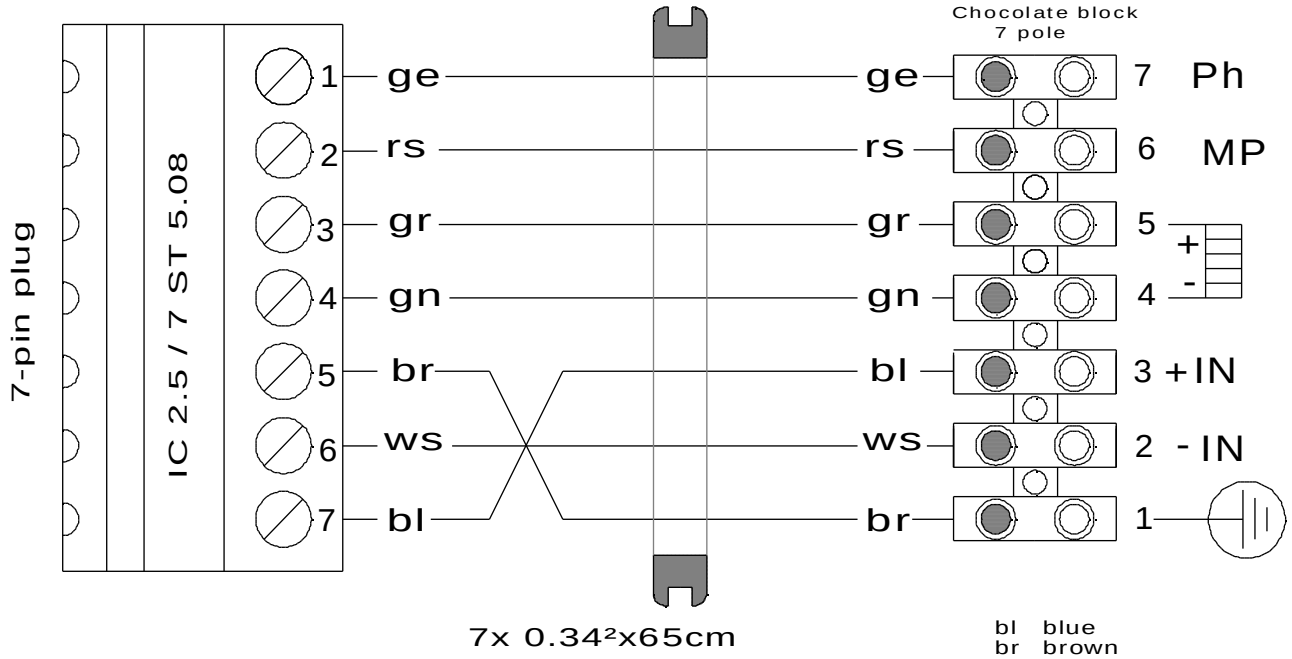


bl blue
br brown
ge yellow
gr grey
gn green
or orange
rs pink
rt red
sw black
vi violett
ws white

				Datum	Name	Benennung:
			gez.:	10.7.2000	Knipp	Chopper motor and IR source
			gepr.:	10.7.2000	Polemitis	
			ELTRA Mainstr. 85 Block 20 D-41469 Neuss			Zeichnungs-Nr.: 06660
Bez.:	geändert am:	gepr.:				

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Connections between TH62 and NR32:

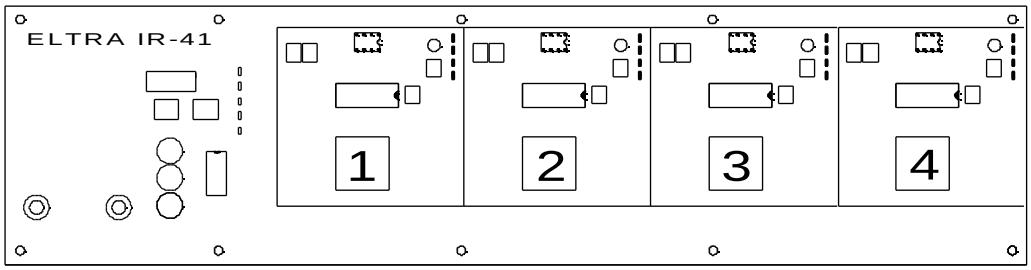


bl blue
br brown
ge yellow
gr grey
gn green
or orange
rs pink
rt red
sw black
vi violett
ws white

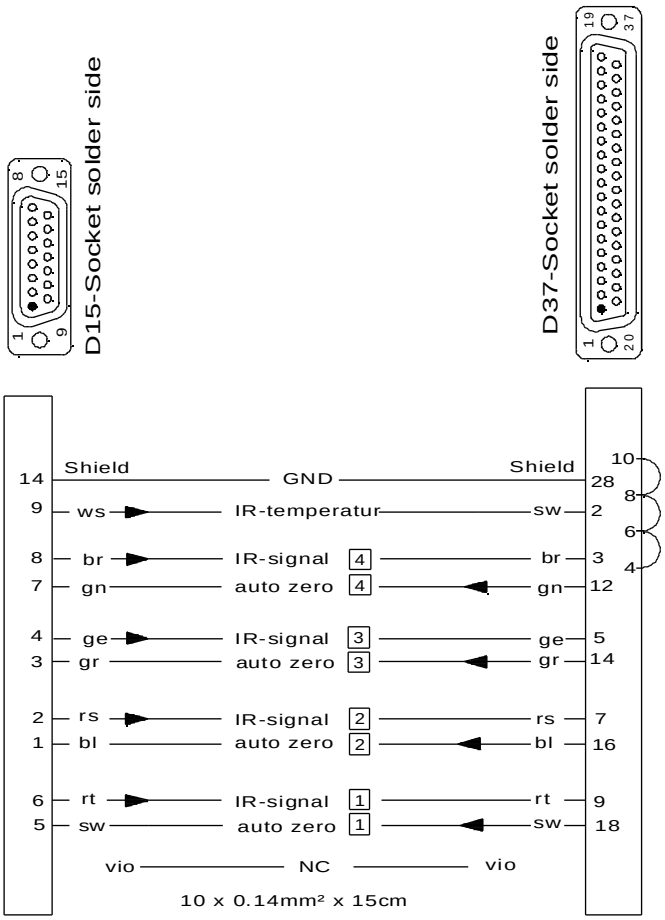
			Datum	Name	Benennung:
		gez.:	25.08.2000	Knipp	Cable conection
		gepr.:	26.08.2000	Polemitis	TH 62 - NR 32 (15037)
		ELTRA			Zeichnungs-Nr.:
		Mainstr. 85 Block 20			06645
Bez.:	geändert am:	D-41469 Neuss			

Attention:

Some **CS-800** analysers may be furnished with the previous model of **IR-rack**, which was designed for maximum three **IR-cells**. The wiring and the plugs of that rack are different to the rack **IR-4** which is described in this manual. The adapter of the drawing below is used to adapt the new **IR-rack** to the **CS-800** analyser. The drawings of the previous rack wiring can be found in the following **5 pages, these are the older models.**



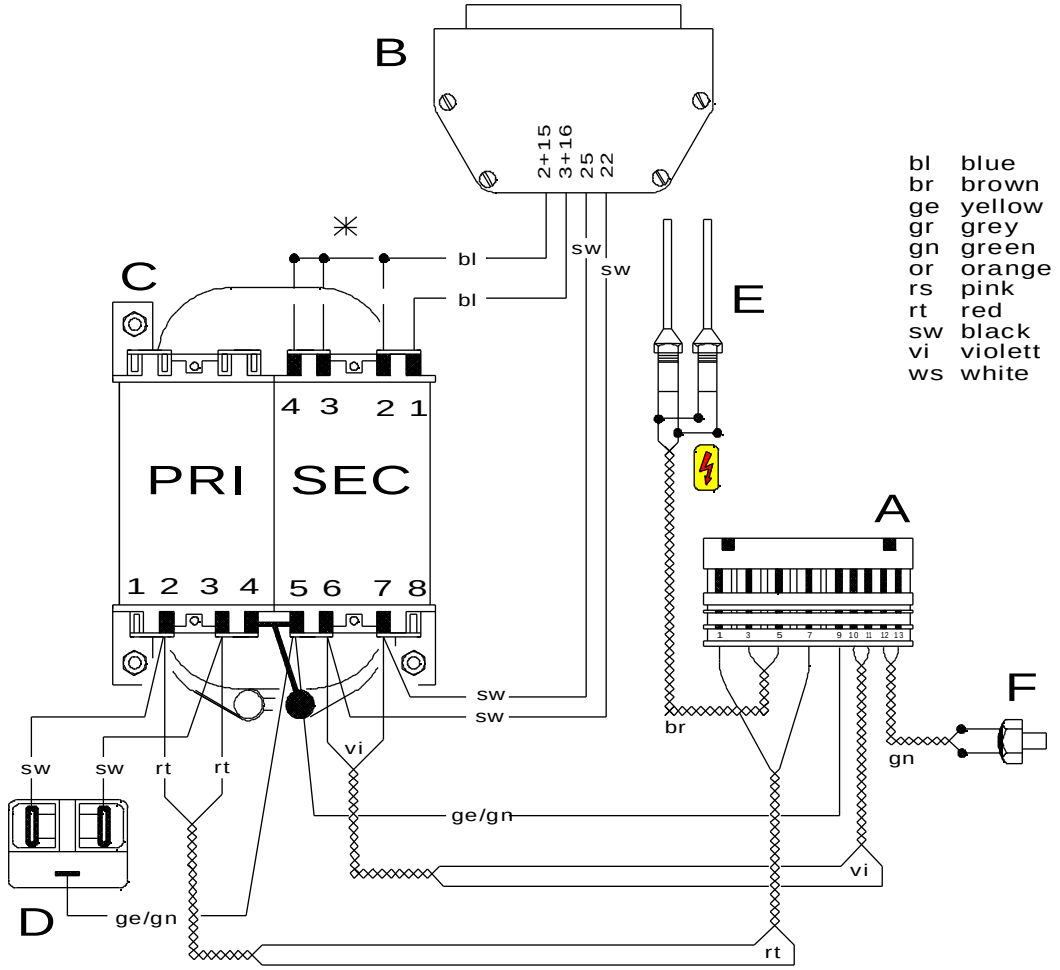
Use they adapter below to install the new IR-cell IR-4 in a previous analyzer wired for the previous IR-cell model.
The **EPROMs and the Windows** software must also correspond to the new IR-cell. Also the **coding** of the IR-ranges must match. See 3.11-1.



bl	blue
br	brown
ge	yellow
gr	grey
gn	green
or	orange
rs	pink
rt	red
sw	black
vi	violett
ws	white

			Datum	Name	Benennung:
		gez.:	07.06.2001	Sanda	IR Signal adapter
c	07.06.2002	gepr.:	07.06.2001	Polemitis	
b	24.01.2002	ELTRA Mainstr. 85 Block 20 D-41469 Neuss			Zeichnungs-Nr.: 12069
a	13.07.2001				
Bez.:	geändert am:				

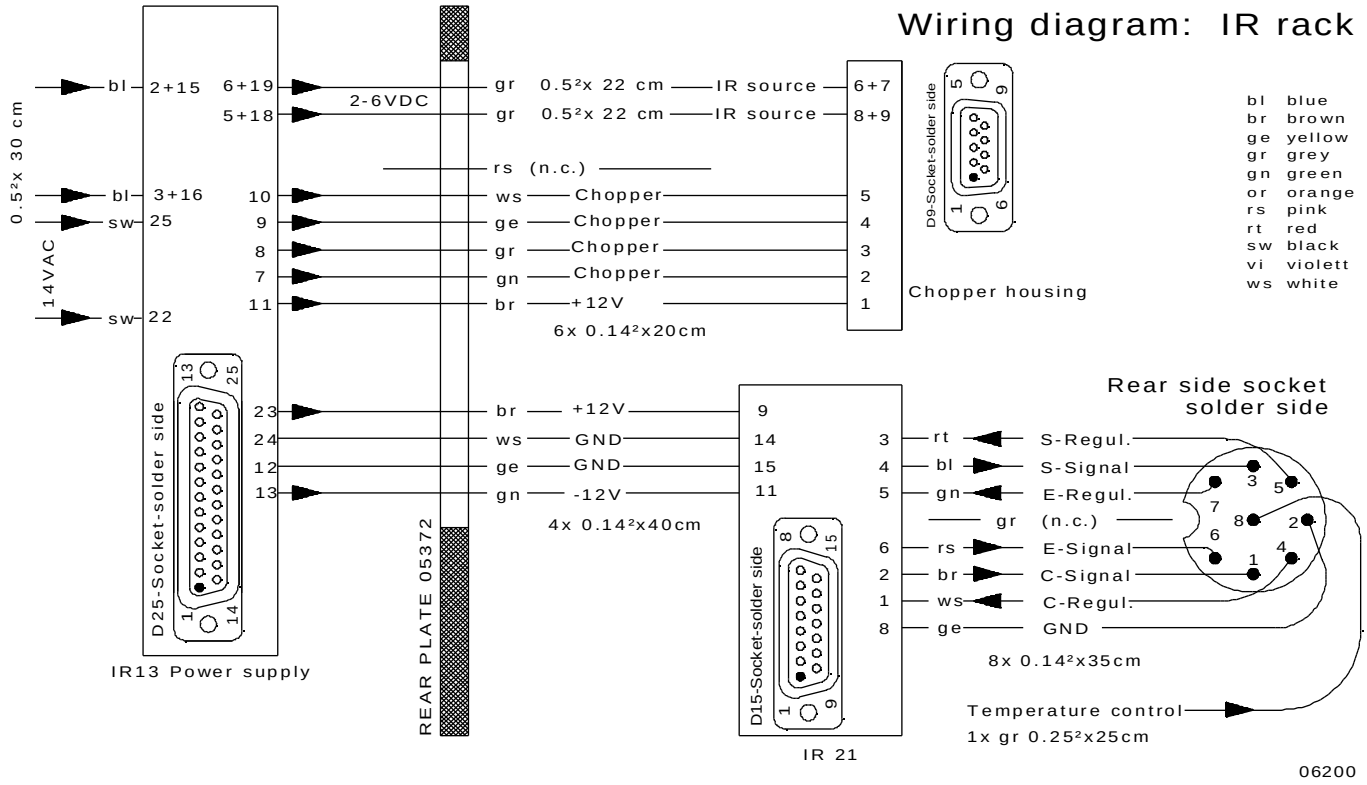
IR-current supply:



✳ According to the number of channels see 2.4

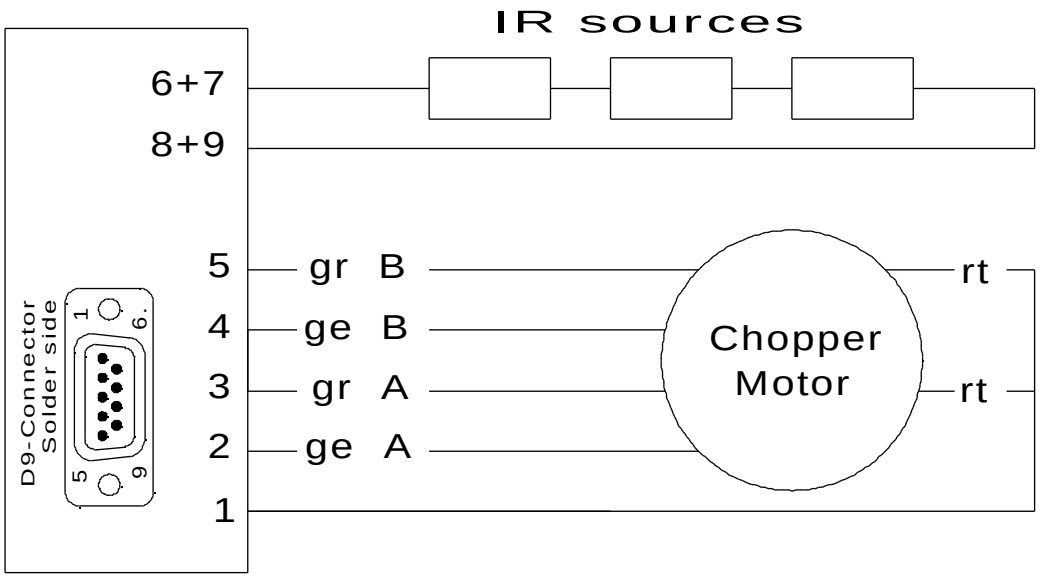
A	13-pin plug connector
B	25-pin plug
C	Transformer
D	Energy filter
E	Heating elements
F	Temperature sensor
*	**According to the number of channels**, see **2.4**

Infrared cell:



1 C-signal
2 GND
3 S-signal
4 Control voltage
5 Control voltage
6 Control signal for low channel
7 Regulating voltage for low channel

Chopper motor and IR-source:

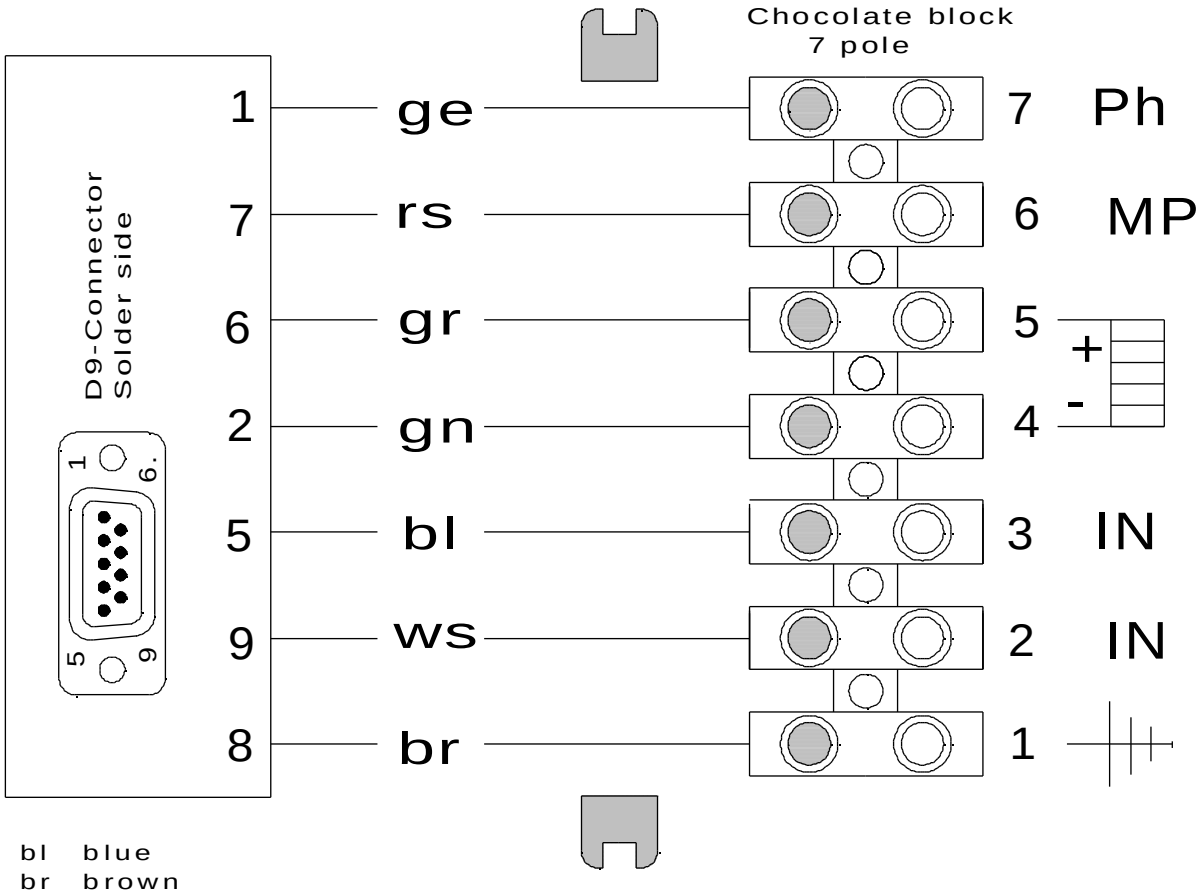


bl blue
br brown
ge yellow
gr grey
gn green
or orange
rs pink
rt red
sw black
vi violett
ws white

Chopper motor and IR source

06190

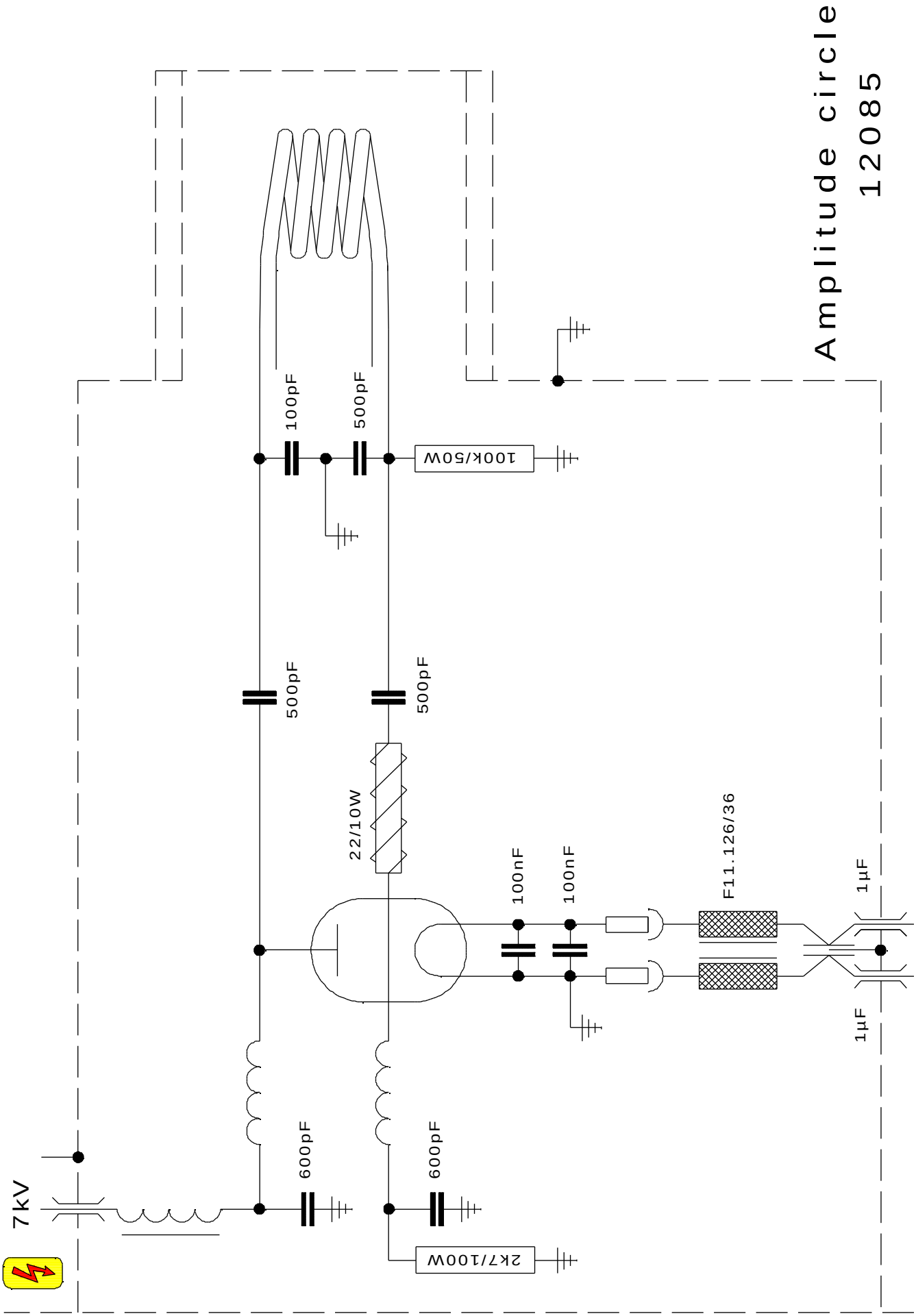
Connection between TH 61 and NR 32:



bl blue
br brown
ge yellow
gr grey
gn green
or orange
rs pink
rt red
sw black
vi violett
ws white

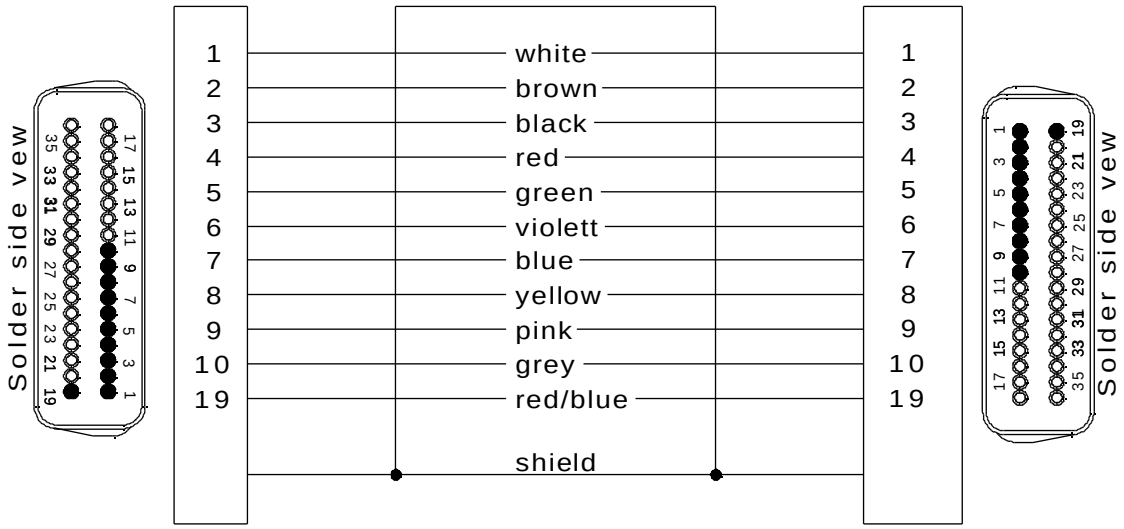
7x 0.34²x65cm

Cable connection
TH 61 - NR 32 (15037) 06090

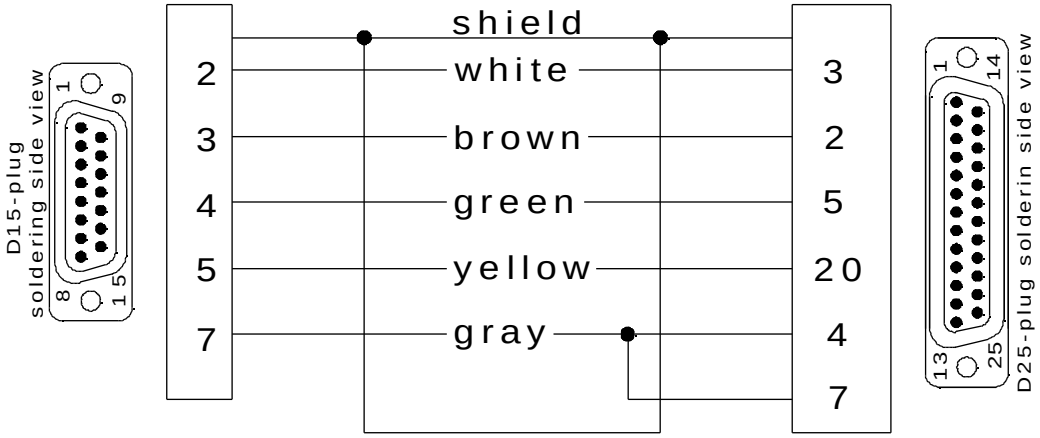

Amplitude circle
12085
100pF
500pF
100k/50W
500pF
500pF
22/10W
100nF
100nF
F11.126/36
1µF
1µF
600pF
600pF
7kV
2k7/100W

Connecting cables:

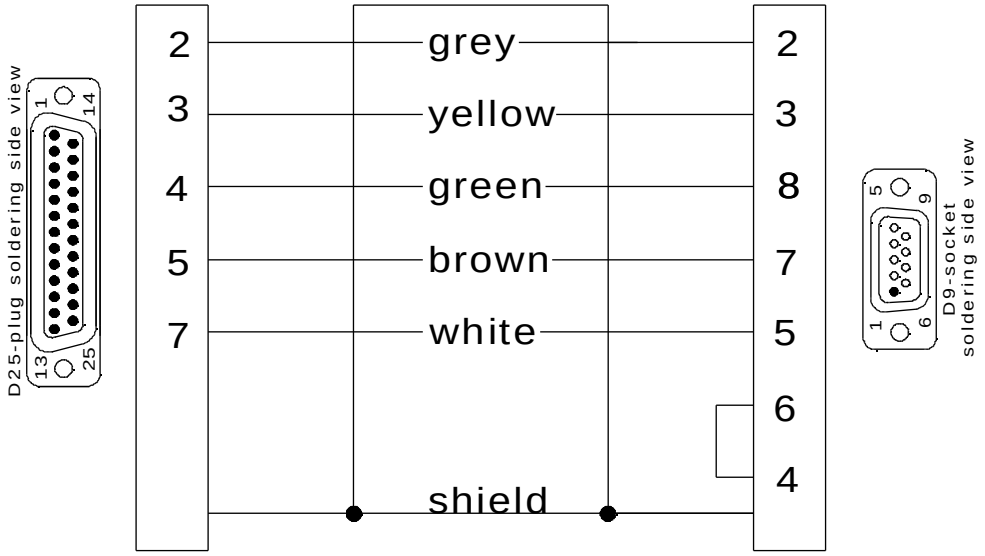
Analyzer-Parallel printer



Analyzer-Sartorius balance

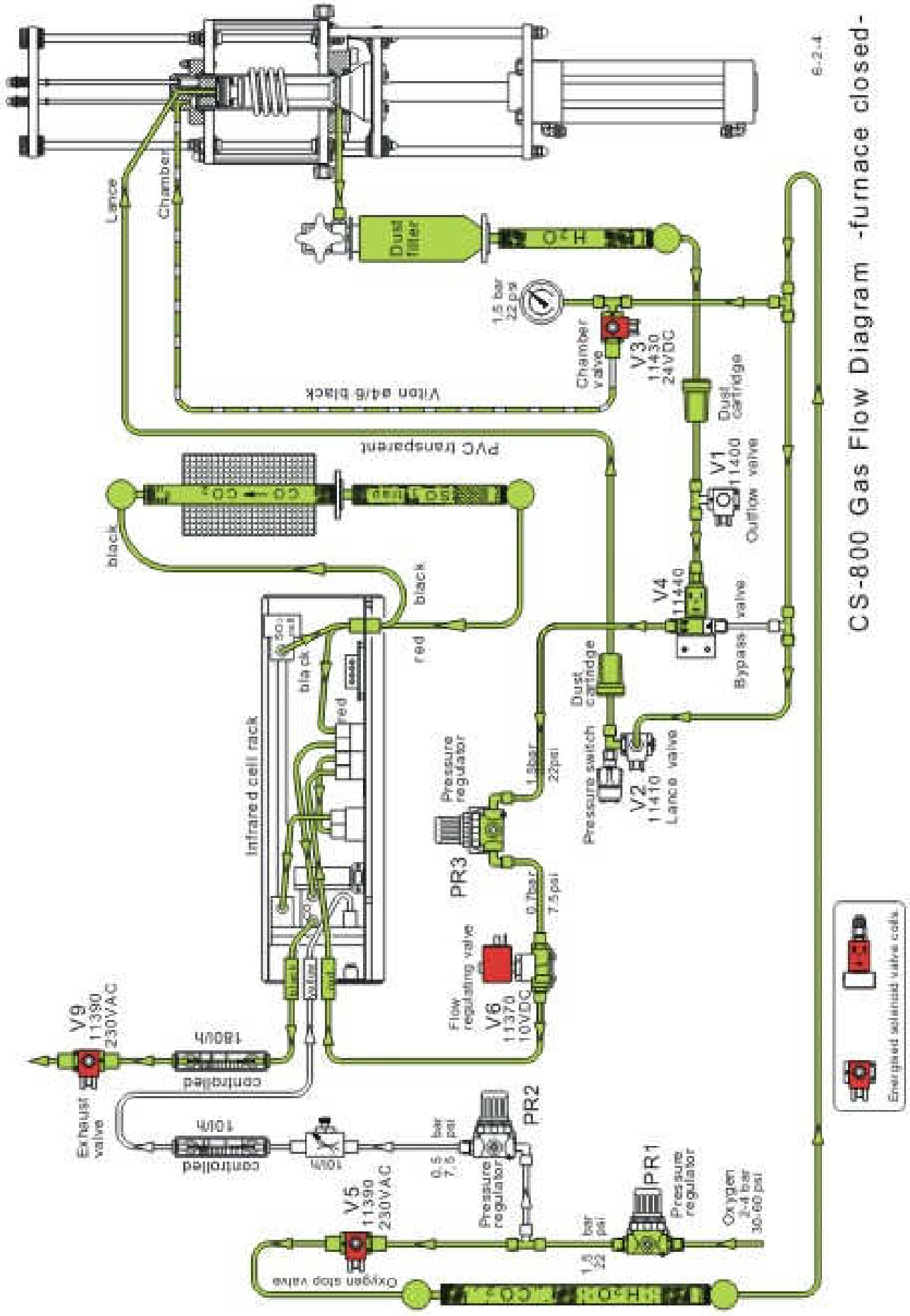


Analyzer-PC

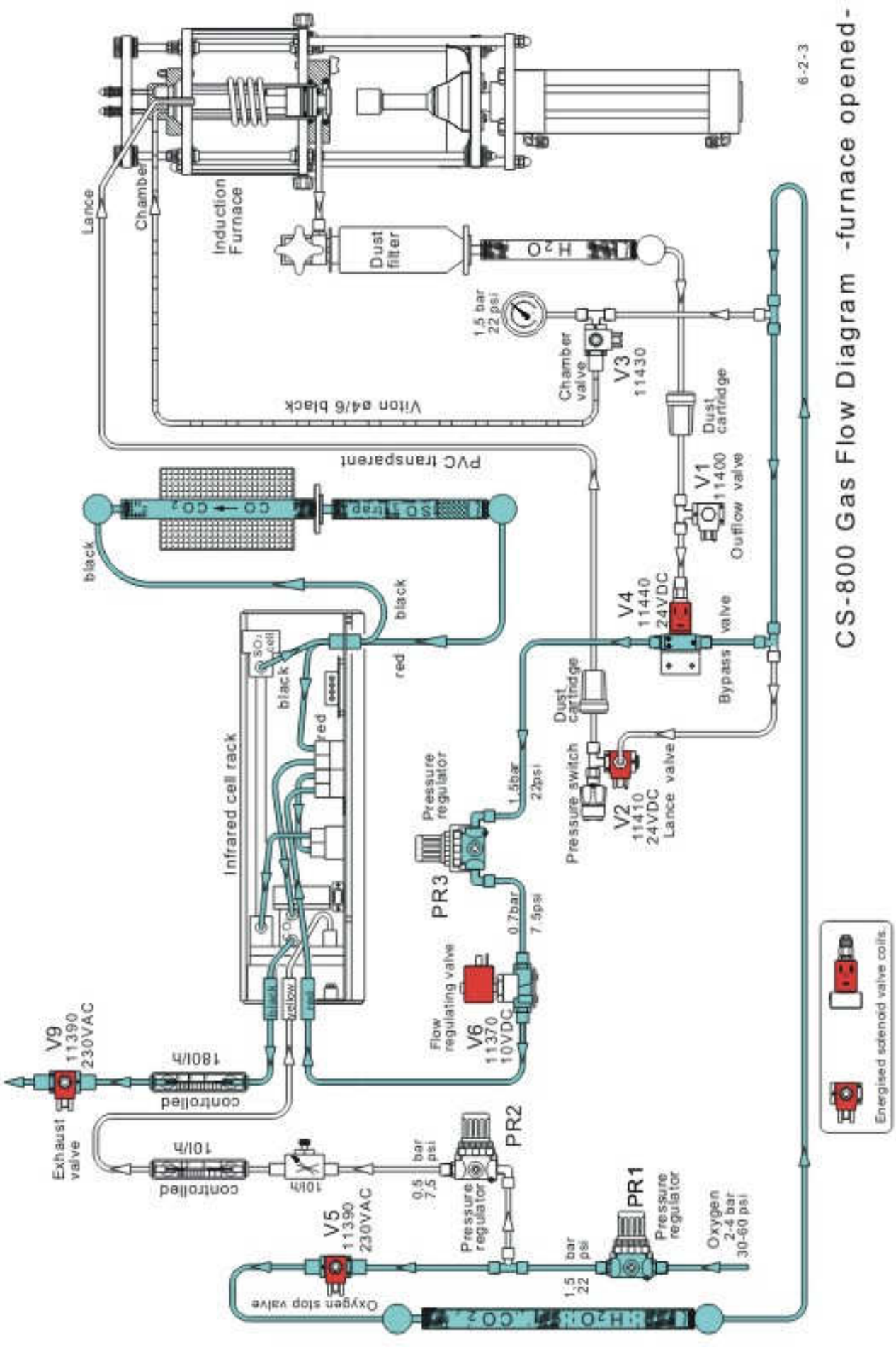


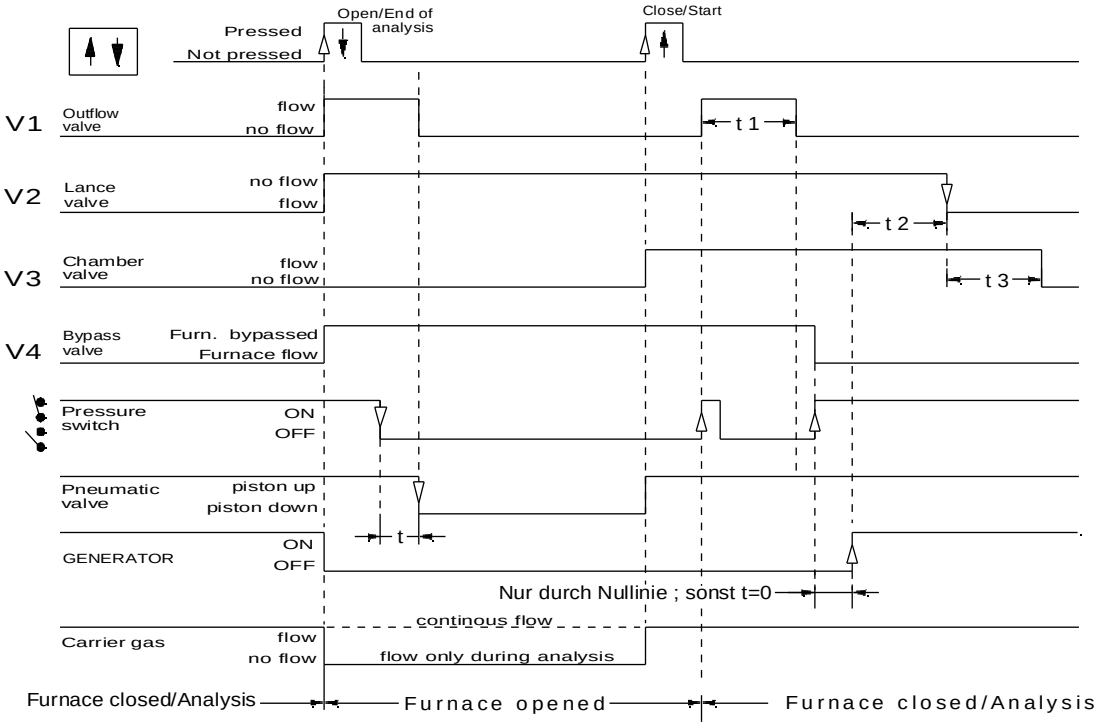
CAUTION! Connect the shield on both connector frames.

Gas flow diagram:



Gas flow diagram:





V2	V3	
H	H	Only chamber flow
H	L	No flow
L	H	Lance and chamber flow
L	L	Only lance flow

t1 : Purging befor combustion
t2 : Chamber oxygen only
t3 : Lance and chamber oxygen
Rest of combuston after t3, lance oxygen only

NOTE: V1 and V3 enable the oxygen flow when they are energised.
V2 stops the oxygen flow when it is energised.
Valid for all valves (V1 to V4 and for the pneumastic valve):
High means the coil is energised.
Low means the coil is not energised.

12202

Low = de-energised (Zero volts on the coil)
High = energised (24 V DC on the coil)

Opening and closing of the furnace, sequence:

(Please refer to above drawing)

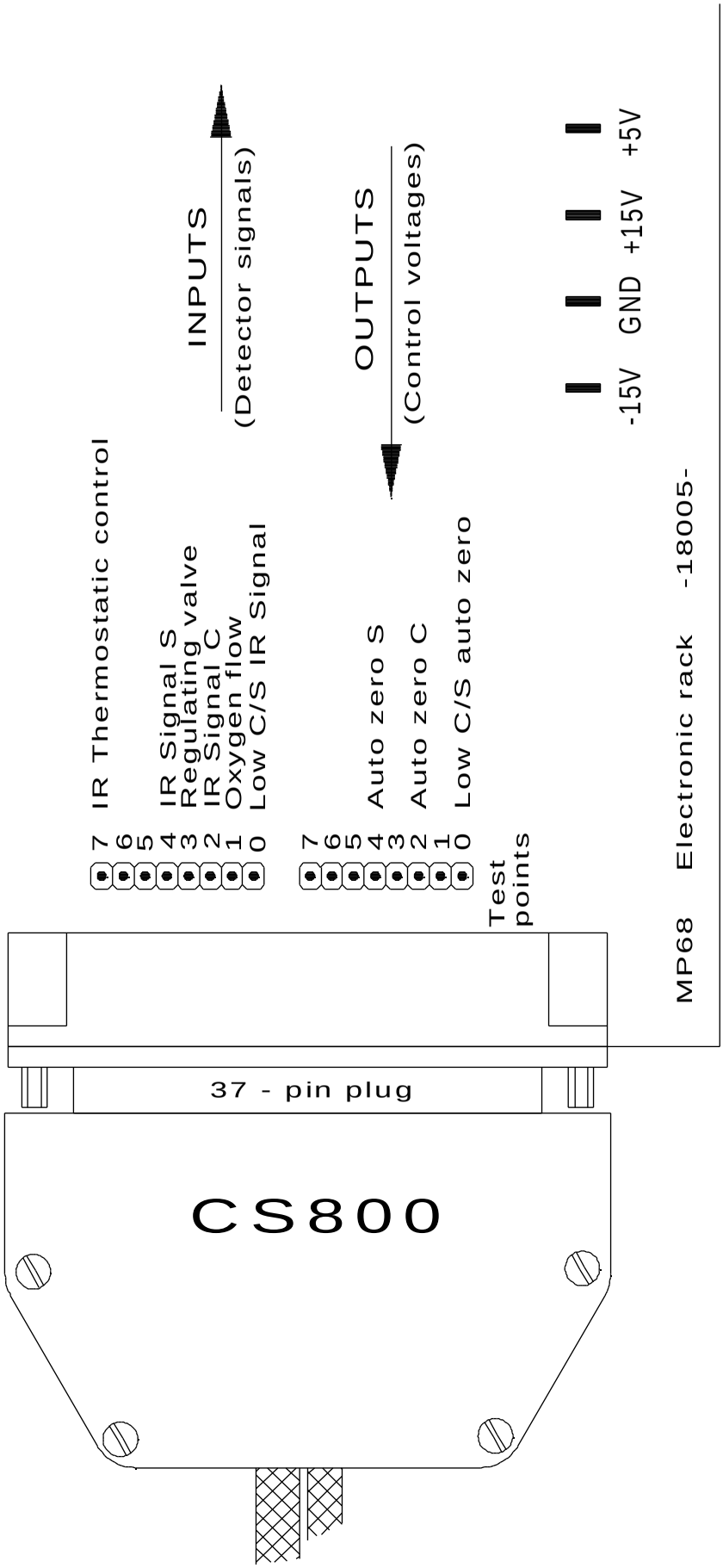
Opening the furnace:

At the moment when the key is pressed to open the furnace,
V1, V2 and **V4** are energised.
V1 releases the oxygen out of the furnace.
V2 stops the oxygen supply to the furnace.
V4 keeps the oxygen flow to the **IR-cell**, bypassing the furnace.
About **one second** later, the pressure in the furnace drops lower than **one bar** (15 psi) so that the pressure switch opens (no contact any more)
resp. **24V DC** between its two leads.
After a short delay produced by the software, thus allowing sufficient time for the oxygen pressure in the furnace to fall practically to **zero**, the pneumatic valve is de-energised, causing the piston to move down, opening the furnace.

Closing the furnace:

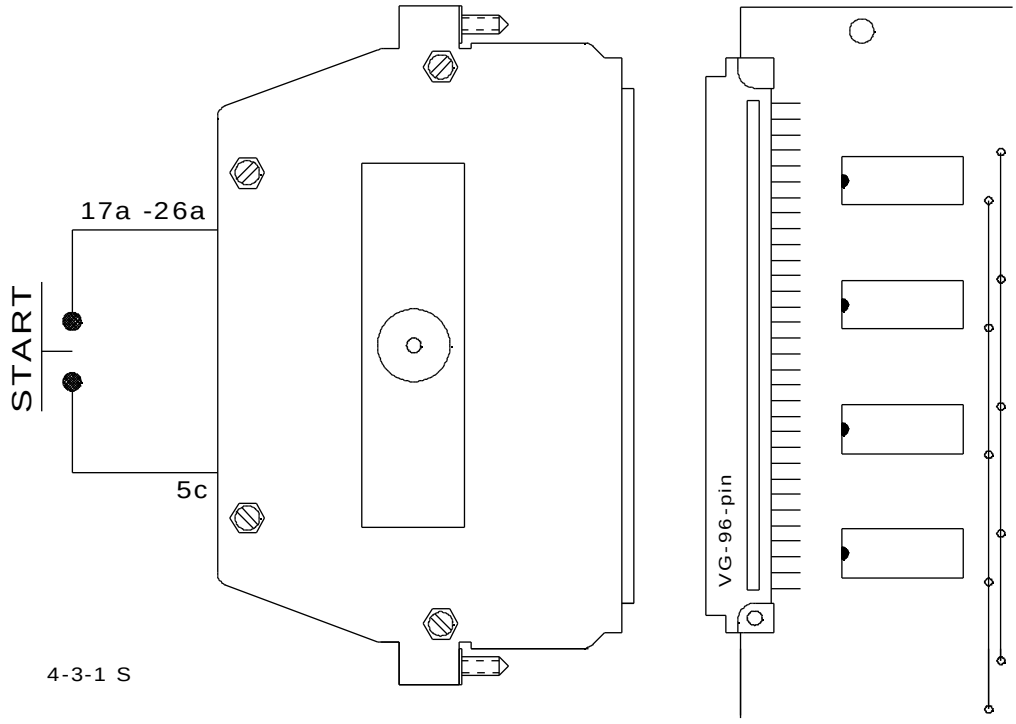
By pressing the key to close the furnace, the pneumatic valve is energised and the piston moves up. At the same time **V3** is also energised, letting oxygen into the furnace area from the top and from the bottom (through the dust filter).
Before the furnace closing cone reaches the **O-ring** to **seal**, the oxygen which enters the furnace area escapes, purging the air out of the furnace. After the cone seals the furnace, the incoming oxygen leads to a growing pressure in the furnace.
When this pressure reaches approx. **one bar** (15 psi) the pressure switch will close **(zero volts between its two leads)**.
After a short delay by the software, **V2, V3** and **V4** will be de-energised.
The closed furnace condition is now reached.

Analogue I/0 signals of the electronic unit:



4.3 Starting through external key:

The analysis can be started by means of an external connected key, if desired.

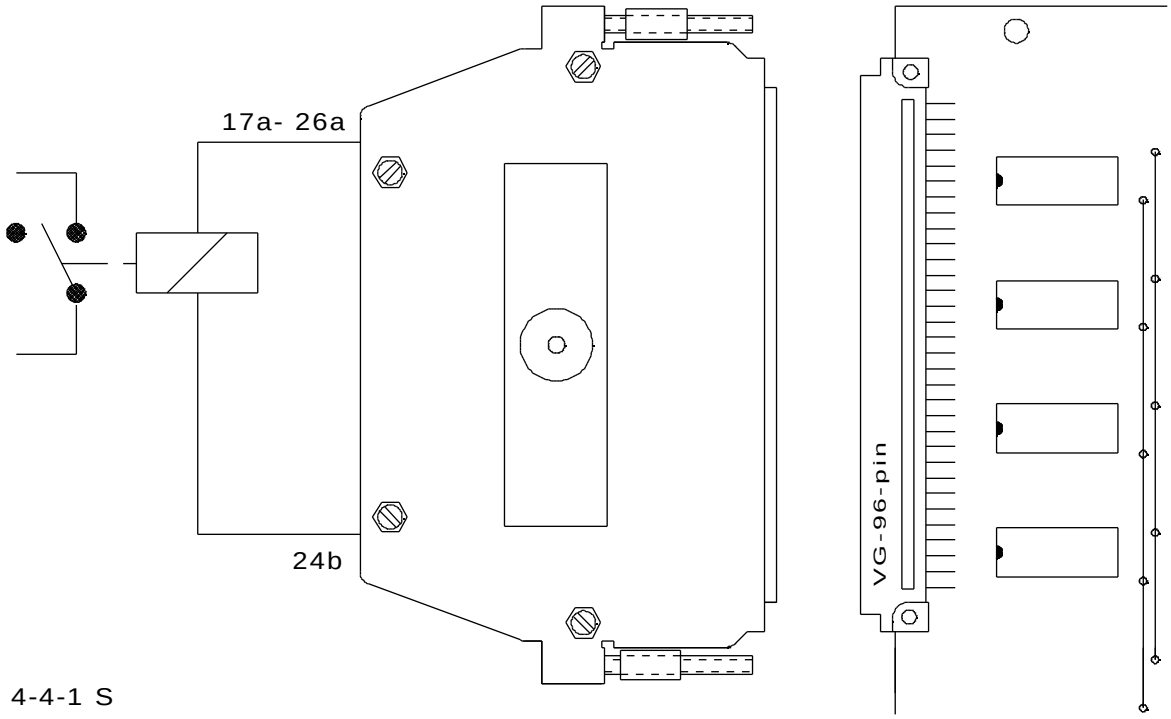


- The key is connected to a **96-pin** connector on the rear-side of the electronic unit. For this purpose, remove the **case** of the **96-pin** plug and connect a wire to the key **(pins 17a to 26a). (All carry +24 volts)**

- The second wire is connected to pin **5C**.

4.4 External report of analysis conditions:

The analysis is running; while the word **"ANALYSIS"** stands on the display; the **pin 24B** on the **96-pin connector** on the rear-side of the electronic is switched to **zero**.



One could, for example, attach a **24 V relay** in order to receive a potential-free contact message that an analysis is underway.

- The relay is attached to the **96 - pin connector**, on the rear-side of the electronic unit. To do this, remove the cover of the **96-pin connector** and attach a **relay wire** to **17a to 26a** (all carry +24 volts).
- The second wire is attached to **pin 24B**.

4.5 Spare parts kits:

Common spare parts kit for all analysers

92610	Tube of grease	1
11064	Reagent tubes 280mm x 16mm	2
11480	Adjustable flow restrictor	1
15087	Gasflow meter 300 l/h	1
15095	Gasflow meter 600 l/h	1
18175	Electronic unit	1
72010	Pressure gauge 2,5 bar (37.5 psi)	1
11035	Cooling fan	1
11492	Inlet pressure regulator	1
11390	Oxygen solenoid valve	1
35310	Pressure switch	1
05067	IR path for high carbon	1
05068	IR path for sulphur	1
05150	IR path connector with window source side	1
05160	IR path connector with window detector side	1
05260	IR path tube (80 to 320 mm)	1
05275	Infrared preamplifier	1
06005	Infrared electronics board IR 21	1
06741	Infrared electronics board IR 41	1
06032	Infrared detector with CO_2 filter	1
06034	Infrared detector with SO_2 filter	1
06421	Infrared power supply assembly IR13	1
06675	Infrared power supply assembly IR45	1
06058	IR Temperature control board TH61	1
06630	IR Temperature control board TH62	1
15037	IR Temperature regulation board NR32	1
11408	Pressure switch	1
15063	Gasflow sensor 300 l/h	1
05042	Chopper motor	1
05065	Chopper motor	1
05048	Infrared source (emitter)	1
05060	Reflector	1
75120	Spring	1
75130	Retaining washer	1
75190	Washer	1
18150	Printer interface-cable	1
18160	Balance interface-cable	1
18171	PC-cable	1
73020	Tube transparent	5m
73030	Tube black id = 4 od = 5	5m
73040	Tube black id = 6 od = 9	1m
90290	Copper oxide	100g
11062	Reagent tubes 160 x 16mm	2
21120	Quartz tube for purification furnace	1
15083	Gasflow meter 15 l/h	1

72020	Gauge 10 bar/140 psi	1
78010	Mains power switch	1
11380	Pneumatic valve	1
16110	Power supply board NK 32	1
77140	HF-filter 250 V	1
15098	Gas flow control board FC 21	1
71004	PLOTON Windows software (for OH/ON 900)	1
71006	PLOTCS Windows software (for CS 500/800)	1
70280	O-ring 18 x 2 VT for chopper motor	2
70330	O-ring 21 x 2 VT for infrared source	6
70120	O-ring 3.4 x 1.9 VT furnace cleaning rods (CS 800)and for furnace platform	1
70150	O-ring 6 x 2.5 VT	1
70210	O-ring 8 x 3.5 VT for catalyst tube (CS 800)and for reagent tube (OH/ON 900)	1
70230	O-ring 9 x 3 VT for reagent tubes and dust filter	1
70320	O-ring 20 x 5 VT for dust filter(CS 800) and for furnace glass tube (CS 500)	1
70350	O-ring 29 x 5 VT for dust filter (CS 800)	1
70370	O ring 34 x 3 VT for dust filter (CS 800)	1
70380	O-ring 35 x 5 VT for combustion tube (CS 800) and for furnace internal (CS 500)	1
70390	O-ring 38 x 5 VT for furnace (CS 800)	1
70285	O-ring 19 x 3 VT for furnace ON/OH 900 (top)	1
70405	O-ring 47.2x 5.7 VT for furnace closure ON/OH	1
70410	O-ring 48 x 3 VT for furnace internal (CS 500)	1
70415	O-ring 62 x 3 VT for furnace ON/OH 900 (centre)	1
70425	O-ring 90 x 2.5 VT for furnace ON/OH (bottom)	1

Spare parts kit for CS-800

90220	Tungsten	2500g
90260	Iron chips	908g
91300	Steel standards (advice %C and %S)	100g
91600	Cast iron standards (advice %C and %S)	100g
92200	Alloy steel standards (advice %C and %S)	100g
11105	Metal dust filter	1
11180	Dust filter cartridge	2
11185	Paper filters	10
13067	Combustion coil	1
14045	Cleaning brush for combustion tube	1
14130	Combustion tube l=145 id=32 od=36 mm	2
77210	Oscillator tube	1
14072	Ceramic heat shield for brush	1
14168	Pedestal	1
20040	Catalyst tube 200 x 16mm	1
80925	Sets of fuses	3
11115	Plastic tube	75mm
11120	Paper filter holder	1
11370	Gasflow regulating valve	1
11400	Pressure outlet solenoid valve	1

11410	Oxygen stop solenoid valve	1
11430	Purge solenoid valve	1
11440	Bypass solenoid valve	1
11470	One way valve	1
12005	Gasflow and furnace control board HF3	1
12016	Gasflow and furnace control board HF42	1
12080	Rectifier	1
77050	Triac	1
77135	Capacitor 2µF for blower (at the generator unit)	1
13175	Insulator	1
13260	High voltage filter	1
77337....	10V/10A filter	2
13270	Resistor	1
77320	Capacitor 100 pF/30KVA	1
13262	Capacitor 700 pF/40KV	1
77350	Capacitor 1µF/50V	2
77600	Grid resistor	1
77610	Resistor	1
14080	Cleaning mechanism rod	1
75122	Spring	1
75130	Safety ring	1
20000	Catalyst furnace	1
11490	Pressure regulator	1
15116	Gas flow sensor	1

4.6 Maintenance CS 800:

- ☐ Is the furnace closure cone still firm? See **2.8**
- ☐ Check whether the imprint of all the O-rings exceeds 2 mm.
- ☐ Is the inlet pressure regulator set on 1,5 bar (22.5 psi)?
- ☐ Are the other two pressure regulators set on 0,35 bar (5 psi)? See **2.7**
- ☐ Check for leaks. See **3.7**
- ☐ Is the gas flow rate correct? See **2.1**
- ☐ Pressure switch: change over at_____ bar. See **2.2**
- ☐ Does the thermostabilisation work correctly? See **2.5**
- ☐ Check the infrared baseline. See **2.3**
- ☐ Check if all the screws of the generator housing are tightened.
- ☐ Check whether all four „high voltage“ stickers are still in place.
- ☐ Check if the 96-pole plug at the back of the CS 800 is firmly plugged in.
- ☐ Check if all the warning labels are still attached to the side-panels.
- ☐ Calibration of all measuring ranges.