HORIBA

ONLINE GAS ANALYZER

fdg

TECHNICAL MANUAL

CEM500

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Safety warning and liability




Chemicals used as reagent or used as cleaning solution or used to prepare calibration solutions might be toxic, corrosive or irritant. Refer to the material safety data sheets (MSDS) for each chemical. Wear protection glass and gloves.

The documentation and/or Product are provided on an “as is” basis only and may contain deficiencies or inadequacies. The Documentation and/or Product are provided without warranty of any kind, express or implied.

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CE

This equipment meets the requirements of all relevant European safety directives. The equipment carries the CE mark.

To prevent electric shock:

- Unplug the power cord before any servicing, wiring or any operation inside the instrument.
- Connect this instrument only at a properly grounded power socket.
- Keep the screws well tight.

This instrument must be earthed!
In order to prevent any electric shock, verify that the power socket used for this instrument has an earth connection in accordance with regulations.

The security provided by this product is only assured for the intended use.
Maintenance can only be performed by qualified personnel.

Do not dispose of this product as household waste. Use an approved organization that collects and/or recycles waste electrical and electronic equipment.

CONTENTS

1. Maintenance Schedule

The maintenance of the CEM500 analyser is limited to the replacement of spare parts such as the lamp block after one year if used in continuous mode, and to the replacement of the membrane of the sampling pump (optional).

The maintenance schedule of spare-parts is detailed in **Table 1**.

Table 1. Maintenance schedule

Spare part	Reference	Frequency of replacement
Xenon lamp block	E-XEN-G-1	Given for 10^9 flashes (3 years of lifetime in continuous mode)
Internal membrane pump with heated head	MKIT-SPL- G-1	Every year

In rare cases, there might be exceptional maintenance, depending on the use of the analyser (refer to **Table 2**).

Table 2. Exceptional maintenance

Spare part	Reference	Frequency of replacement
Lens (diameter 12 mm) with one O-ring	O-LENS-1	3 to 10 years depending on the use
Disk (diameter 12 mm) with three O-rings	O-DISK-G	3 to 10 years depending on the use

2. Procedures

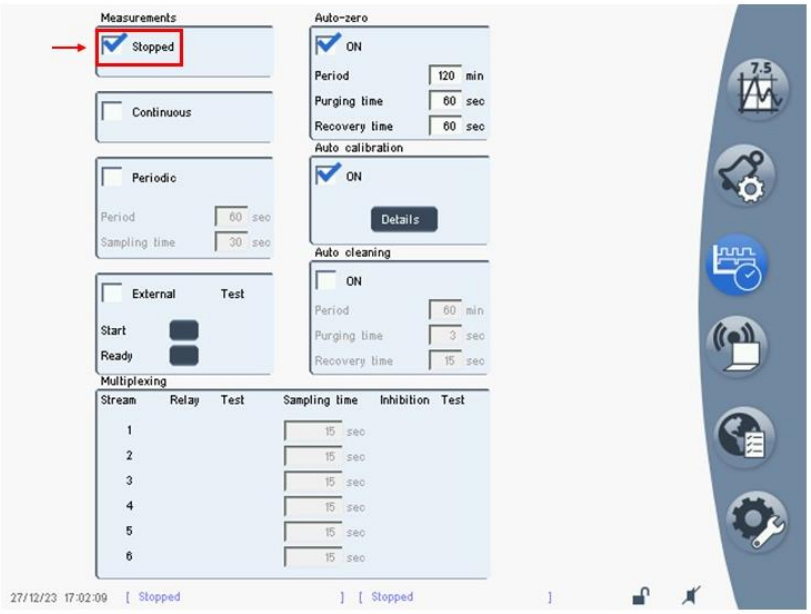
2.1. Maintenance Procedures for the Gas Circuit

2.1.1. How to Change the Internal Membrane Pump

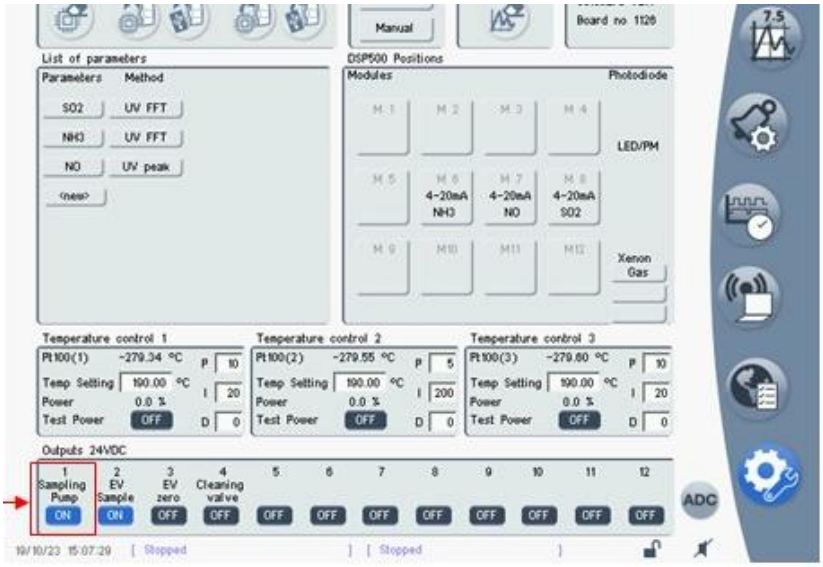
The sampling pump is optional.
The head of the pump is heated with the rest of the gas circuit and has a flow rate of about 6 L/min.
If the pump runs continuously, the membrane must be changed once per year.

Procedure to check the head of peristaltic sampling pump
To check if the head of the peristaltic sampling pump needs to be changed, proceed as follows:

a. Put the analyser in stopped mode in the Timing screen shown below:



b. Disconnect any outlet tubing from the analyser.
c. Connect the outlet to a flow meter (0 - 10 L/min, preferentially a ball model) to the zero inlet of the analyser. Leave the inlet of the flow meter free on ambient air.
d. On the Factory screen, go to the “Outputs 24 VDC” and press on OFF below the “Sampling pump”, as shown on the following screenshot.



A strong noise must be heard when the pump is running. If not, check the electrical connections of the pump.
The flow meter must indicate a flow rate of about 6 L/min. If lower than 4 L/min, change the membrane of the pump.

Procedure to change the internal membrane of peristaltic sampling pump
The following figure shows the different elements of the peristaltic sampling pump and their assembly order:

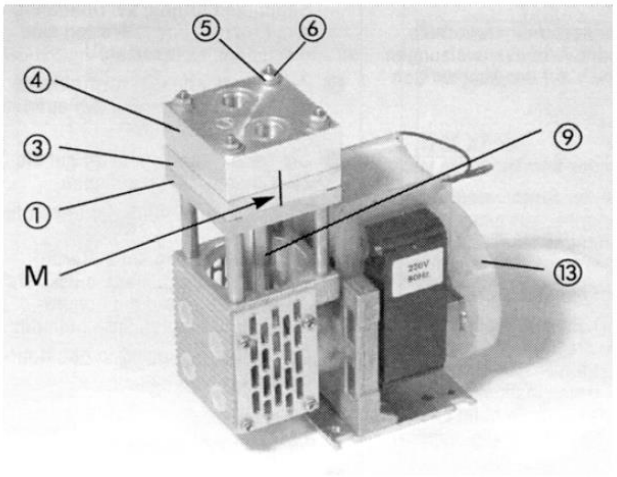


Fig. 1

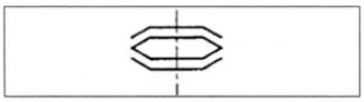
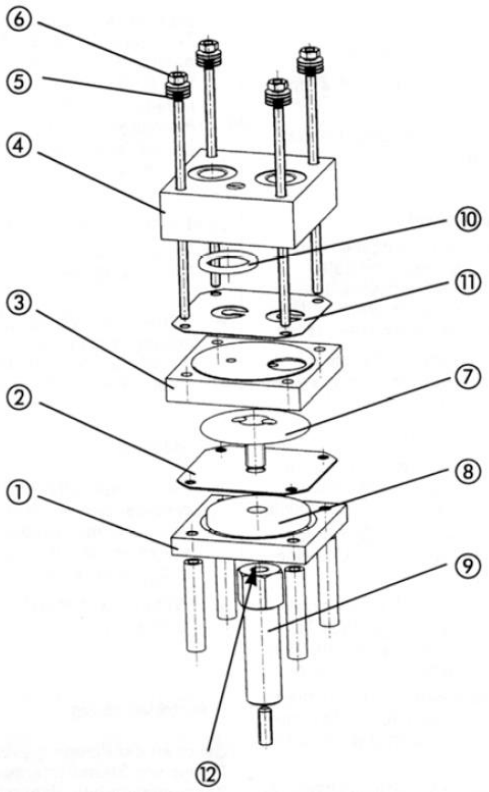


Fig. 3,
Disposition des rondelles



To change the membrane of the peristaltic sampling pump, the following tools and materials are required:

- Fork wrench or socket wrench 5.5mm
- Pin-wrench for two-hole nuts, pin diameter 4mm
- Holding tool
- Heat-resistant thread adhesive

To change the membrane of the peristaltic sampling pump, proceed as follows:

a. **Preparatory step**
Disconnect the pump from the power supply. Check that the pump is electrically dead and secure this.

b. **Removing pump head**

- Mark the position of the carrier (1), intermediate plate (3), and head plate (4) relative to each other by a drawing line (M) with a felt-tip marker. This is to ensure that the parts will be reassembled in the correct position at a later stage.
- Release the nuts (6) and remove them together with the disk springs (5).

⇨ The disk spring are fitted in order to maintain the tension of the wave diaphragm right across the temperature range of the pump.

- Remove head plate (4).
- Remove o'ring (10) from head plate (4).
- Remove the valve plate (11) and the intermediate plate (3).

c. **Changing diaphragm**

- Release the retainer plate (7) by turning it anti-clockwise with a pin wrench or a wrench for retainer plate. While doing so, hold the connecting rod extension (9) in place with holding tool.

Take care to ensure that the washer (12) does not slip under the diaphragm support (8).

- Remove wave diaphragm (2).
- Check that all parts are free from dirt and clean them if necessary.
- Slide a new wave diaphragm (2) onto the threaded bolt of the retainer plate (7).

⇨ The wave diaphragm assembly consists of two equivalent parts placed on top of one another; the top and bottom are identical.

- Apply a small amount of heat-resistant thread adhesive to the thread of the retainer plate (7).
- Screw the retainer plate (7) with wave diaphragm (2) into the connecting rod extension (9); to tighten the retainer plate, use the wrench for retainer plate/the pin wrench to turn it clockwise (torque: 4.6Nm). While doing so, hold the connecting rod extension (9) in place with the holding tool; and hold the wave diaphragms so that they do not twist.

d. **Changing valve plate and sealing ring**

- Check that intermediate plate and head plate are clean. If damages, distortion, or corrosion are evident on these parts they should be replaced.
- Place the intermediate plate (3) on the carrier (1) in the position indicated by the felt tip pen mark (M).
- Lay the new valve plate (11) onto the intermediate plate (3).

⇨ Regarding the placement of the vale plate: The notch on outer edge of the valve plate must be at the left rear, when looking at the pump from the motor.

- Fit the new o'ring (10) in the head plate (4).

e. **Refitting pump head**

- Place the head plate (4) on the intermediate plate (3) in the positions indicated by the felt-tip pen marking.
- Place disk spring (5).
- Put the nuts (6) in place and tighten them diagonally, until each of them lies level on the top spring washer; realign the pump head. From when you start applying pressure on the disk springs, tighten the nuts through an angle of 340°. That is equivalent to a torque of 80Ncm.

f. **Final step**

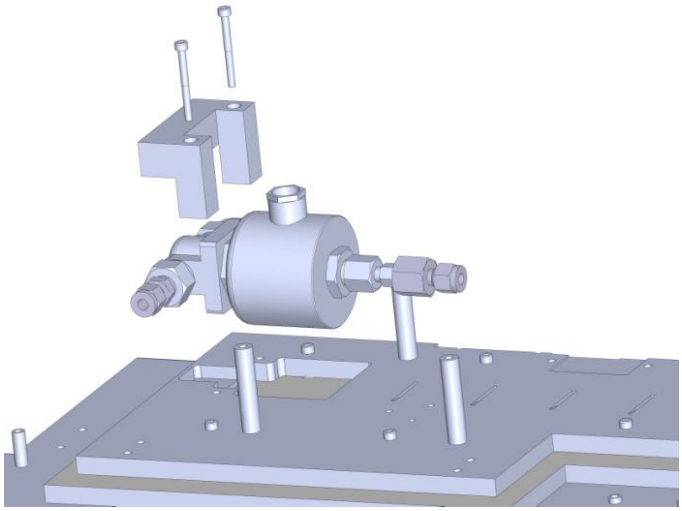
- Reconnect the pump to the electricity supply.

2.1.2. How to Check the Solenoid Valve

The main element of the gas circuit is the 3-way solenoid valve represented below that selects the zero air (deactivated) or the sample (activated) to the measuring flow cell.
In stopped mode, the solenoid valve stays deactivated to the zero air.
If the gas circuit has not reached the temperature setting point (with a tolerance of 10 °C), the solenoid valve stays on the zero-air inlet to prevent humid and dirty sample to enter in the cold flow cell that may produce condensation and deposits.

To check the solenoid valve, proceed as follows:

a. Disconnect the sample line.
b. Put the analyser in stopped mode in the Timing screen.

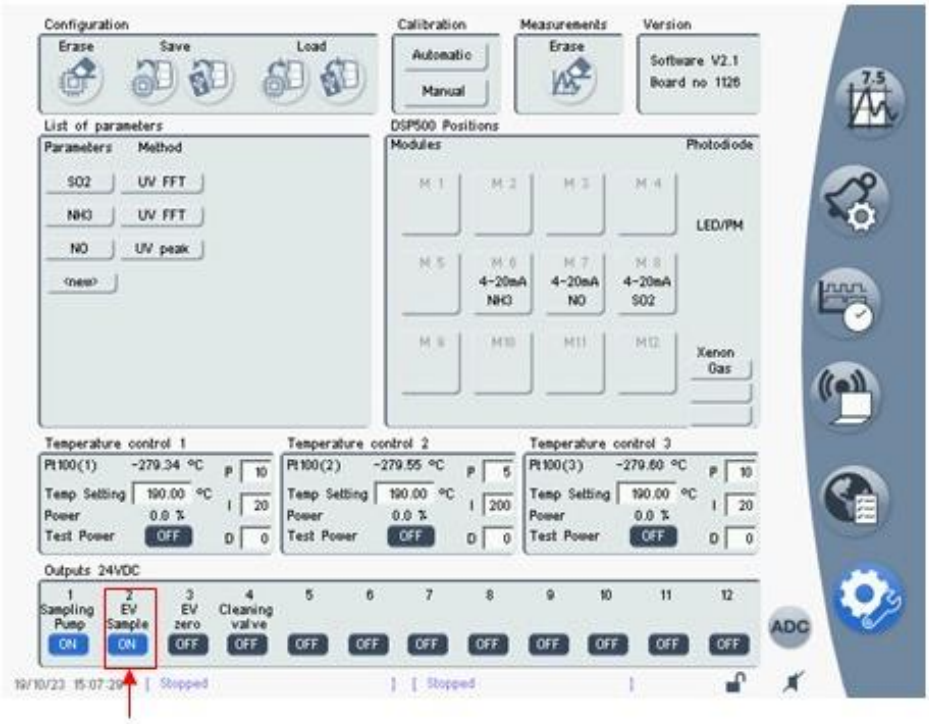


c. Connect a flow meter (preferentially ball model) on an air cylinder or small air pump to get a flow rate of about 2 L/min.
d. Connect the outlet of the flow meter to the zero inlet and check that the flow rate stays roughly unchanged around 2 L/min.
e. On the Factory screen, go to the “Outputs 24 VDC” and press on OFF below the “EV sample”, as shown below.

A strong sound "click" must be heard just when pressing on the OFF key. If not, check the solenoid valve connection on the DSP500 board.
The flow meter must immediately go down to a null flow. A small flow rate remaining may indicate a

leakage on the zero circuit or inside the solenoid valve.

f. Now connect the flow meter outlet to the sample inlet and check that the flow rate goes up again to roughly 2 L/min (go back to the previous screen if expired).



A strong sound "click" must be heard again just when pressing on the ON key.
The flow meter must immediately go down to a null flow. A small flow rate remaining may indicate a leakage on the inlet circuit or inside the solenoid valve.

2.1.3. How to Check / Recalibrate the Pressure Sensor

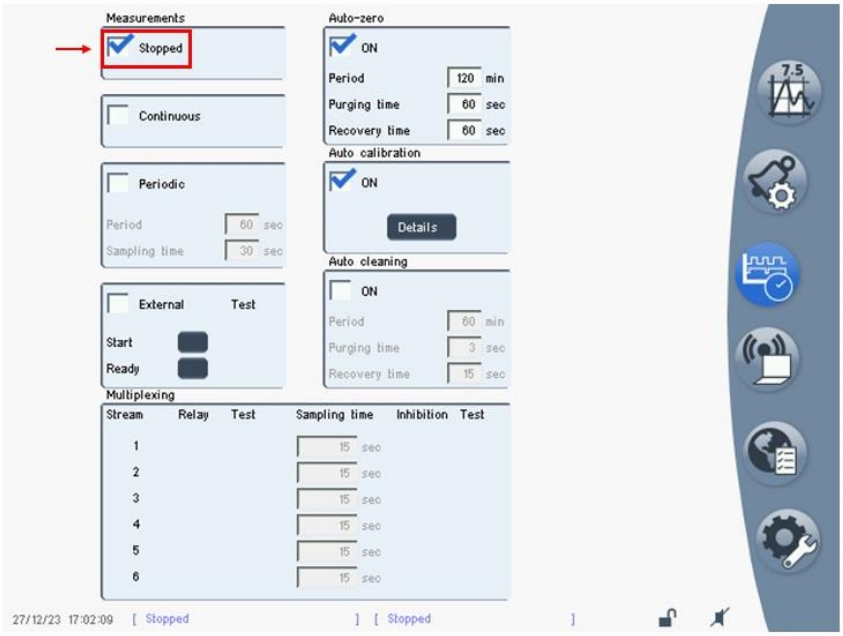
The pressure probe is used for two reasons:

- To automatically compensate the gas pressure (above or under the atmospheric pressure) as the measurement is directly affected by over / under pressure.
- To give a flow rate indication. This flow rate must be calibrated according to the outlet circuit if a good accuracy is needed, but this will not affect the measurements.

If the sampling pump is placed before the flow cell (recommended configuration), the pressure during measurements is always above the atmospheric pressure. With an outlet going to the atmospheric pressure (recommended) the over pressure generally stays below 5 to 10 mbar, generating a very small pressure compensation.

To check or recalibrate the pressure probe, proceed as follows:

a. Disconnect any tubing from the back of the analyser.
b. Put the analyser in stopped mode in the Timing screen.



c. On the Process screen, press anywhere highlighted by the red. This opens a new screen for temperature, pressure and flow rate.

d. Press on the zero key. The relative pressure must go down to zero hPa.
e. Connect a pressure meter (range 0 - 1 bar) on the gas outlet.
f. Connect an air cylinder on the zero inlet and adjust the regulator to 0.5 bar (note: a small membrane pump can be used instead of the air cylinder).
g. Read the pressure on the pressure meter and compare it to the displayed relative pressure.
h. In case of minor difference, the pressure factor can be readjusted to get the right value.
i. In case of no response or incoherent response, the pressure sensor must be changed.

2.1.4. How to Check / Calibrate the Flow Rate

To check and / or calibrate the flow rate, proceed as follows:

a. Keep the analyser is stopped mode as explained before and make sure that the pressure reading is zero (inlets out outlet free).
b. Insert a mass flow meter or ball flow meter (range 0 - 10 L/min) between an air cylinder and the zero inlet.
c. Adjust the regulator of the air cylinder to get a flow rate of about 1 L/min.
d. On the Process screen, press anywhere highlighted by the red. This opens a new screen for temperature, pressure and flow rate.

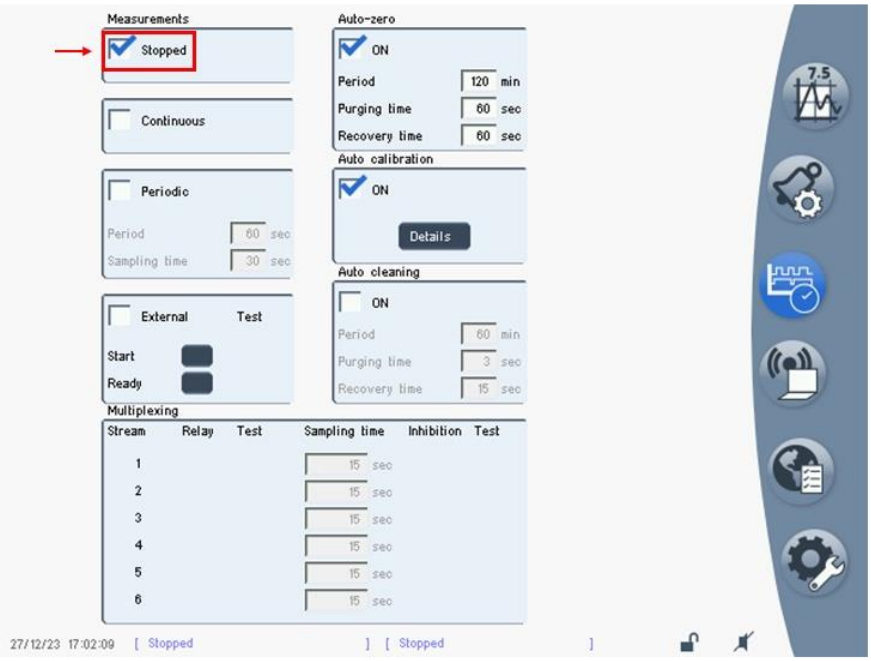
e. Adjust the flow factor proportionally to get the same flow rate reading than the flow meter.

2.2. Maintenance Procedures for Optics and Flow Cell

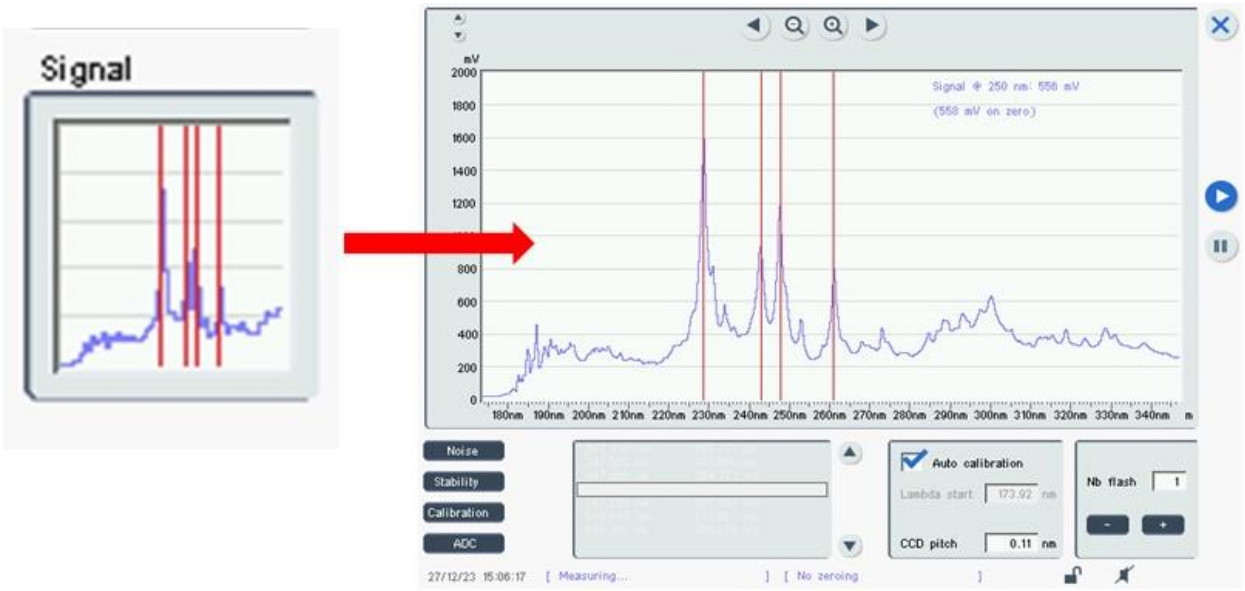
2.2.1. How to Set the Signal Intensity

The intensity of the signal can be monitored and changed. To do so, proceed as follows:

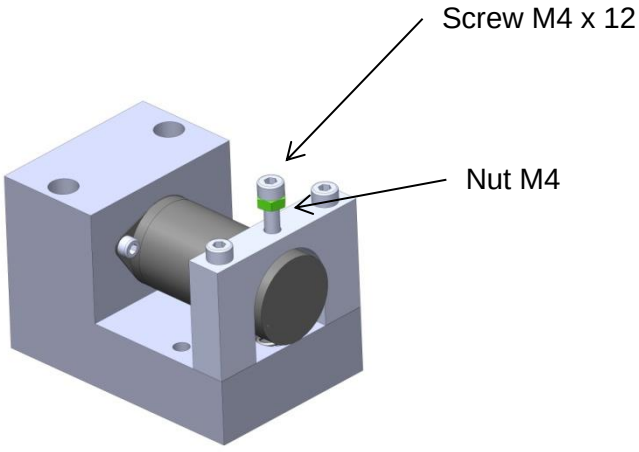
a. Put the analyser in stopped mode in the Timing screen.



b. Go to the Check screen and select the signal button. This button displays the lamp spectrum obtained after the last measuring cycle, as shown below:



c. The intensity of the signal can be modified by playing on the screw of the lamp block, as shown below. First, untight the M4 nut. Then untight the screw as much as possible.



d. Once untighted, press PLAY on the screen displaying the lamp spectrum.
e. By tightening the screw, you can follow the evolution of the intensity of the signal on the screen.
f. The signal requirements depending on the wavelengths are:
    - the more intense peak at 229 nm (aligned on the red reference line) should be between 1400 and 1600 mV.
    - The peak at 200 nm should have a signal of about 200 mV.
g. Once the signal is meeting the previous requirements, tight the M4 nut while making sure the M4 x 12 screw does not move. The lamp is now well aligned and will not move.
h. Go back to the lamp screen and adjust for number of flashes to get a signal of about 200 mV at 200 nm.

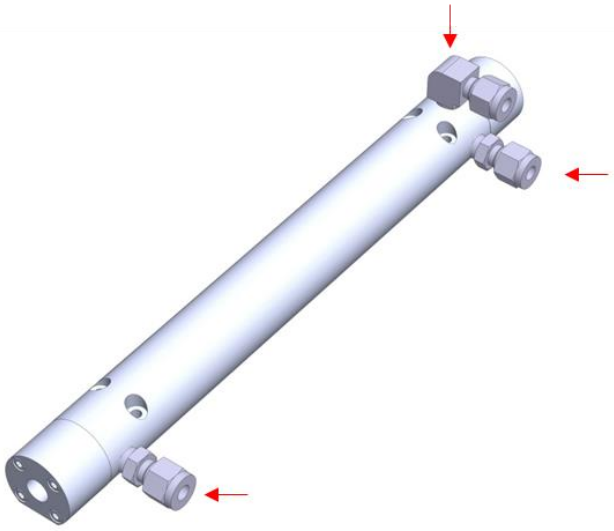
The lamp alignment is necessary after a change of lamp.

2.2.2. How to Clean the Quartz Disks of The Flow Cell

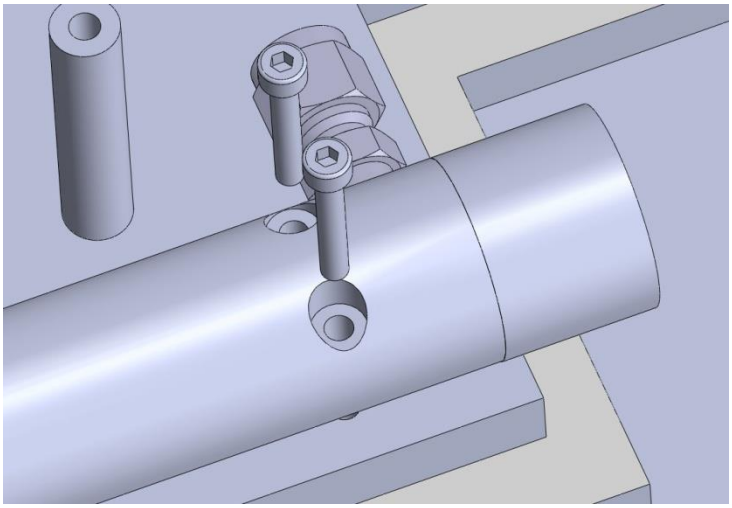
The two quartz windows of the flow cell may have to be cleaned in case of abnormal operation like insufficient heating, abnormal level of dust or particles in the sample gas.
They may have to be replaced after a long operating time (over years of continuous operation) in case the transparency has decreased due to UV irradiation.

To clean the flow cell windows, proceed as follows:

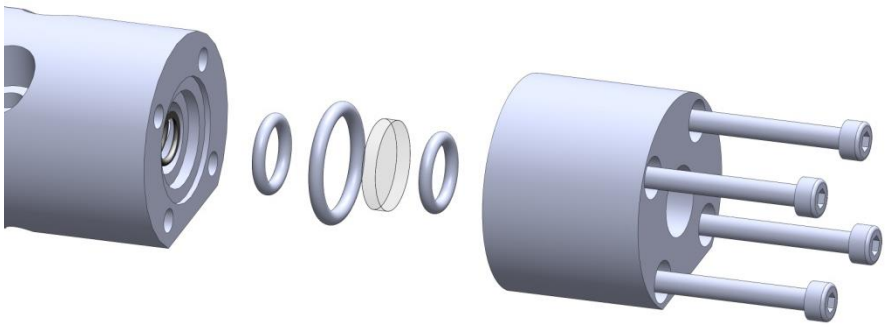
a. Make sure the power cord is disconnected.
b. Unscrew the four knurled knob maintaining the cover of the heated compartment and remove the cover.
c. If necessary, wait for the heated parts to cool down to ambient temperature to avoid any burning during manipulations.
d. Unscrew the three fitting nuts of the flow cell to remove the tubing as shown in the following figure:



e. Unscrew the four M4x25 screws of the flow cell as shown below:



f. Unscrew the four screws maintaining the extensions on each side of the flow cell as shown below:



g. The disks can be cleaned with a soft tissue imbibed of alcohol. If they remain dirty, you can soak them (and the absorption flow cell) in a 5% sulfuric acid H_2SO_4 solution for about 30 minutes. Then take them out and dry them with a soft tissue. If the disks are not totally clear

after cleaning, replacing them is recommended. It is also recommended to change the O-rings if the geometry is affected. Only use O-rings provided by the manufacturer.

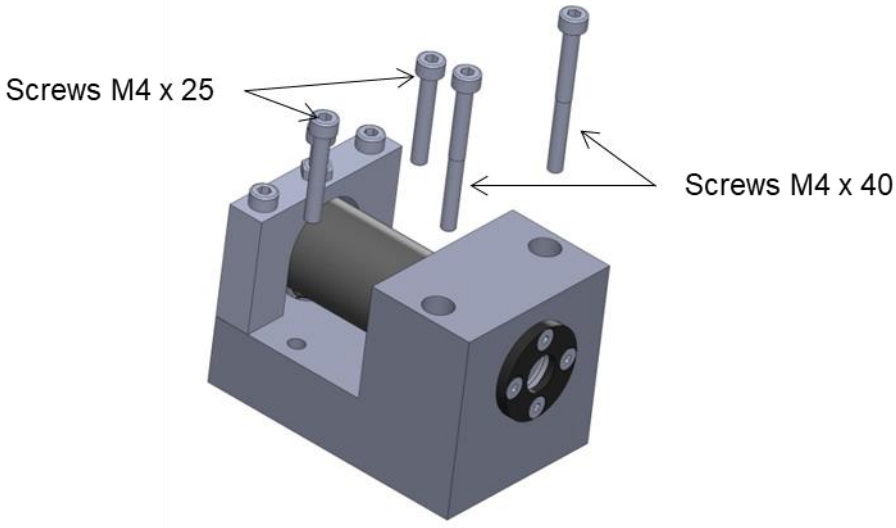
Once all elements are clean and dry, assemble the flow cell as indicated in the previous picture:

a. Be careful to dry the O-ring before putting them back.
b. Place the absorption flow cell back in the CEM500 enclosure using four M4x25 screws.
c. Check the signal.

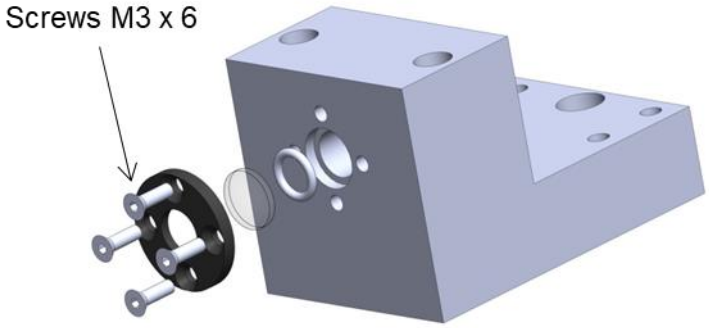
2.2.3. How to Change the Xenon Block Lamp

As for the quartz windows of the flow cell, the quartz lens can be damaged by the UV irradiation after a long time of exposure (over three years of continuous operation).
To clean or replace the lens from the lamp block, proceed as follows:

a. Turn off the analyser.
b. Unscrew the four screws of the lamp block as shown below and disconnect the lamp connector.



c. Unscrew the four screws maintaining the lens as shown below:



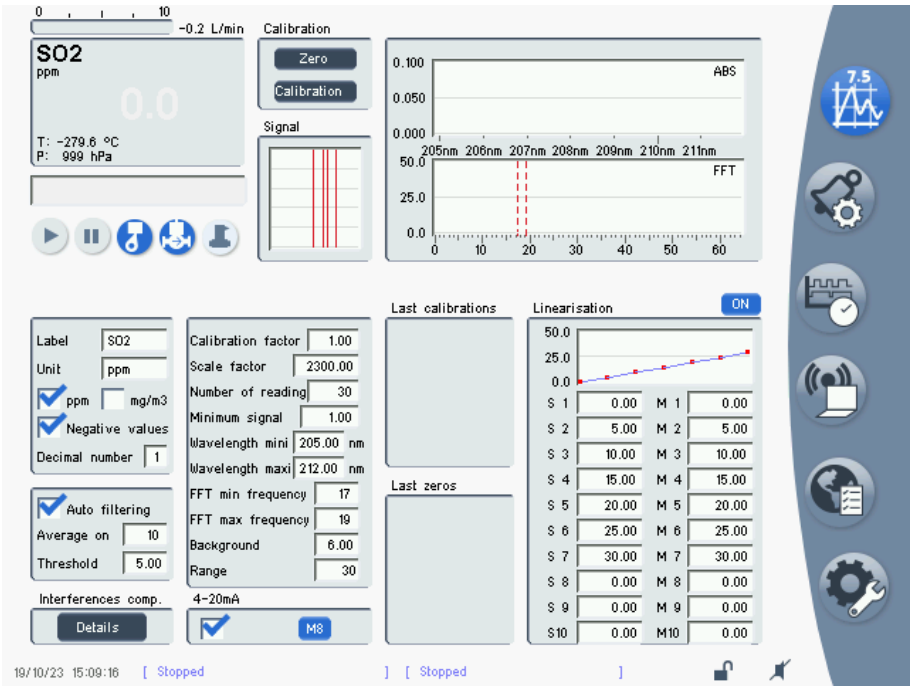
d. The lens can be cleaned with a soft tissue imbibed of alcohol. If the lens is not totally clear after cleaning, it must be replaced.
e. Reassemble following the reversed order and check the light level (refer to section 2.2.1).

2.2.4. Calibration of Spectrograph

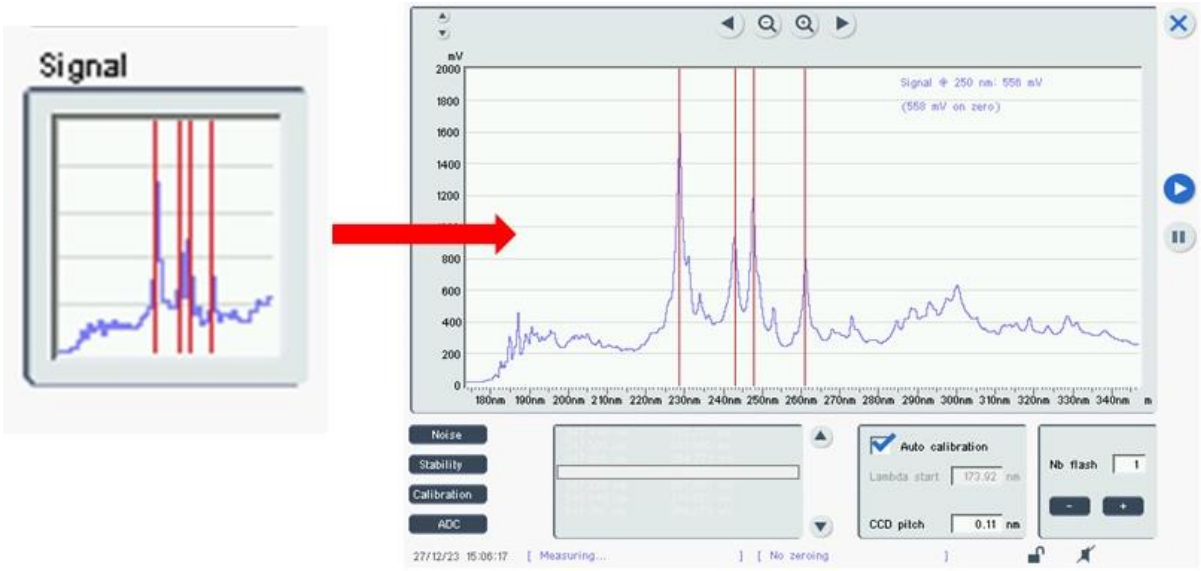
Never neither try to open the spectrograph nor to clean the grating. The grating will be immediately destroyed by the contact to any tissue, even very soft.

The spectrograph might need to be recalibrated in case of replacement or software update.
To calibrate the spectrograph, proceed as follows:

a. Cycle some air several times to make sure the gas circuit and flow cell are cleaned.
b. Go on the Check screen:



c. Select the signal button. This button displays the lamp spectrum obtained after the last measuring cycle, as shown below:



d. On the Check screen, refer to the two wavelength bands used for the absorbance calculation defined as “Peak wavelength” and “Ref wavelength”. Check that the signal are not saturated (around 2000 mV). If yes, an error will occur during the measurements.
   The values can be read by moving the cursor with the vertical arrows. If necessary, use the horizontal arrows to displace the graph or press on the graph to zoom it. The Y scale is automatic but may be override by the small arrows placed above the Y axis.
e. Press on “CALIBRATION” on the left side of the screen. The four main peaks will automatically match the four red lines.
f. If not, you can manually calibrate the spectrograph by unticking “Auto calibration” and adjusting the “Lambda start” wavelength.

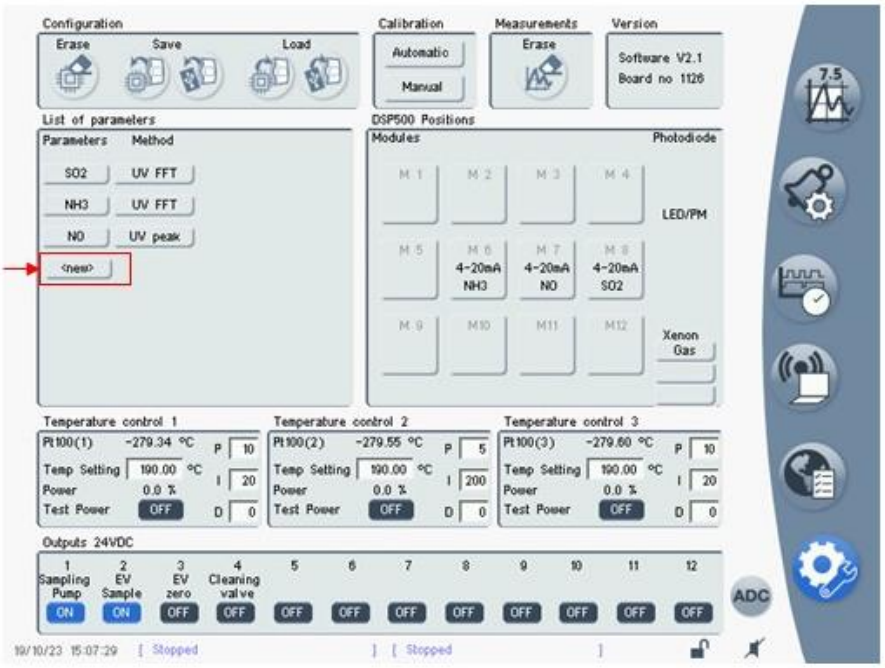
2.3. How to Add / Remove a Gas

2.3.1. How to Add a Gas

The CEM500 analyser is made for one gas, including gas declaration, linearity, compensations (offsets and gains) and an output 4-20 mA module.
Any additional gas requires an extra cost to include complete calibration and output 4-20 mA.

In case you need to declare a new parameter, proceed as follows:

a. In the Factory screen, select <NEW> on the frame called “List of parameters”.



b. Select the parameter you want in the list and click on the green arrow.
c. Enter the password to be able to add the gas.
d. The following stream is about MULTIPLEXING and the number of streams, if any.
e. The last screen is about the positions of 4-20 mA output modules.

The parameter is now added to the list on the frame called “List of parameters”.

2.3.2. How to Remove a Gas

In case you need to remove a parameter, proceed as follows:

a. On the Factory screen, click on the parameter you wish to delete on the frame called “List of parameters”.
b. A window will appear, to confirm the erasing of the parameter. Click on the green arrow.

The parameter will be deleted from the list on the frame called “List of parameters”.

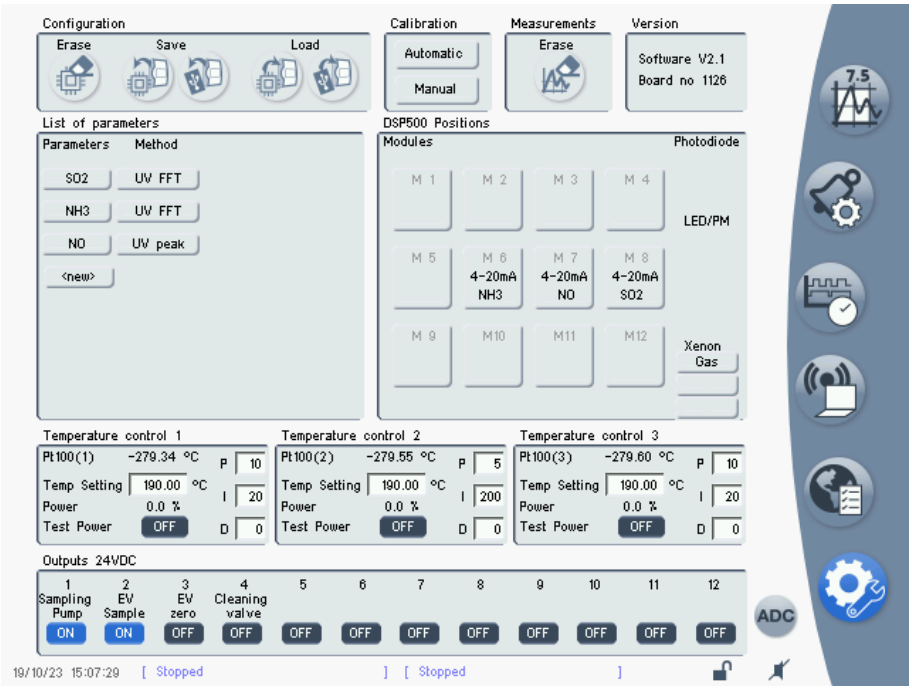
2.4. Memory Re-initialization

This procedure erases all the configuration (channel, parameters, general settings…). It may be exceptionally used in case of board replacement. The configuration must then be-reintroduced either manually or from a configuration file saved on a USB key.

To do a memory re-initialization, you must be logged as administrator by using the password 7895. Then, proceed as follows:

a. In the Factory screen, select ERASE on the “Configuration” frame.

b. Note that you can select SAVE before doing the re-initialization. It will save the configuration on a USB key. This configuration back-up includes: the gas channels with their linearity and compensation tables (offsets and gains).

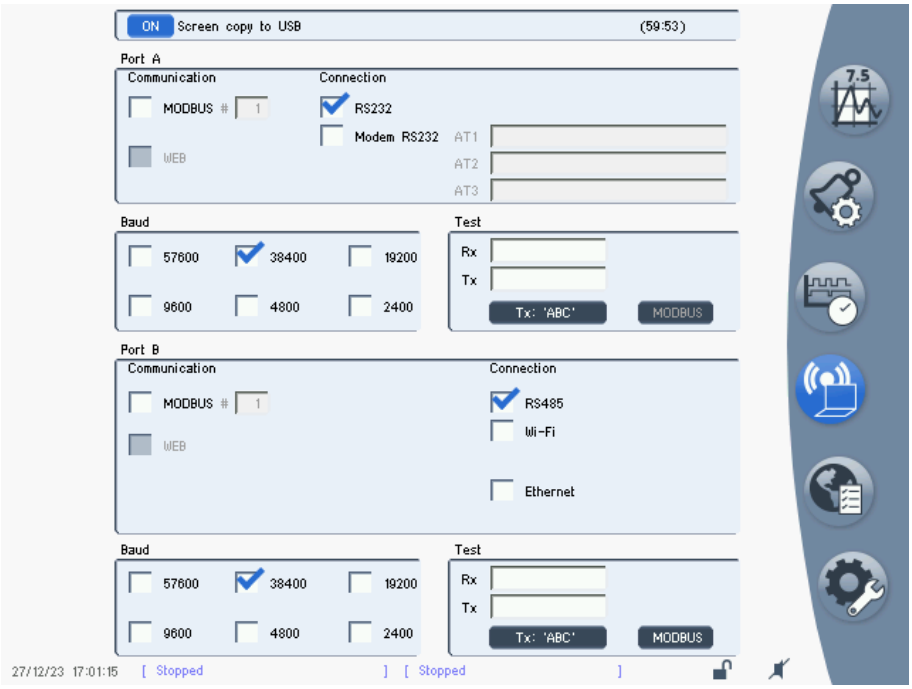


2.5. USB

2.5.1. How to Take Screenshots

To take screenshots, proceed as follows:

a. Go on the Communication screen.



b. Select ON at the top left of this screen.

From now on, a screenshot will be saved on your USB key when you insert it in the USB plug on the CEM500 enclosure. This configuration will last for 1 hour. Then, do this procedure again to reactivate the USB screen copy.

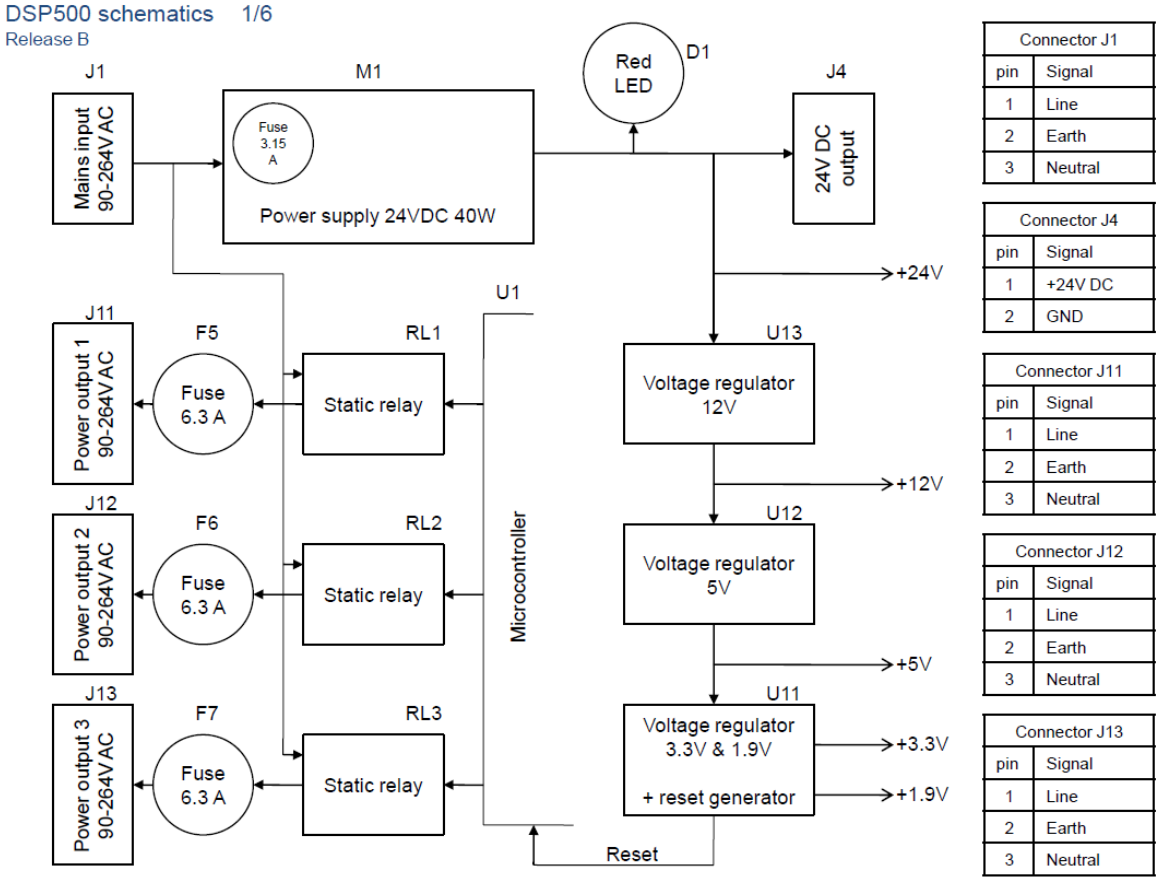
2.5.2. How to Update the Software

In case you need to update the software, proceed as follows:

a. On one hand, on the analyser: save the configuration (in the factory screen) on a USB key.
b. On the other hand, save the software file on this USB key.
c. Turn off the analyser.
d. Plug in the USB key on the analyser.
e. Turn on the analyser.
f. Choose the version of software you want to download and press on START.
g. Once the downloading is finished, remove the USB stick.
h. On the factory screen, you can load the configuration again. You can then start using the analyser.

2.6. Boards Synoptics

2.6.1. DSP500



Connector J1	
pin	Signal
1	Line
2	Earth
3	Neutral

Connector J4	
pin	Signal
1	+24V DC
2	GND

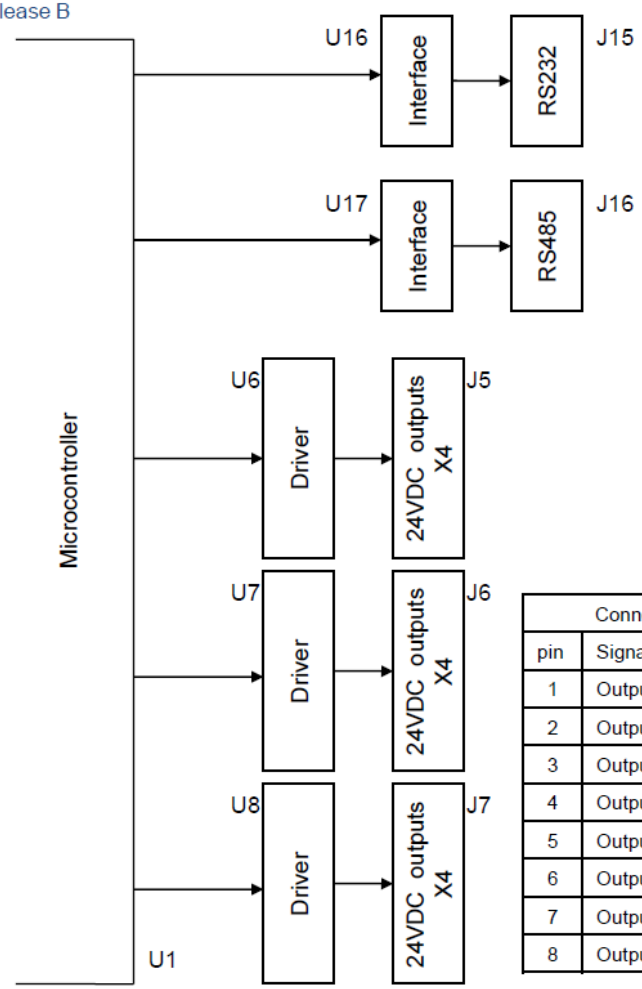
Connector J11	
pin	Signal
1	Line
2	Earth
3	Neutral

Connector J12	
pin	Signal
1	Line
2	Earth
3	Neutral

Connector J13	
pin	Signal
1	Line
2	Earth
3	Neutral

DSP500 schematics 2/6

Release B



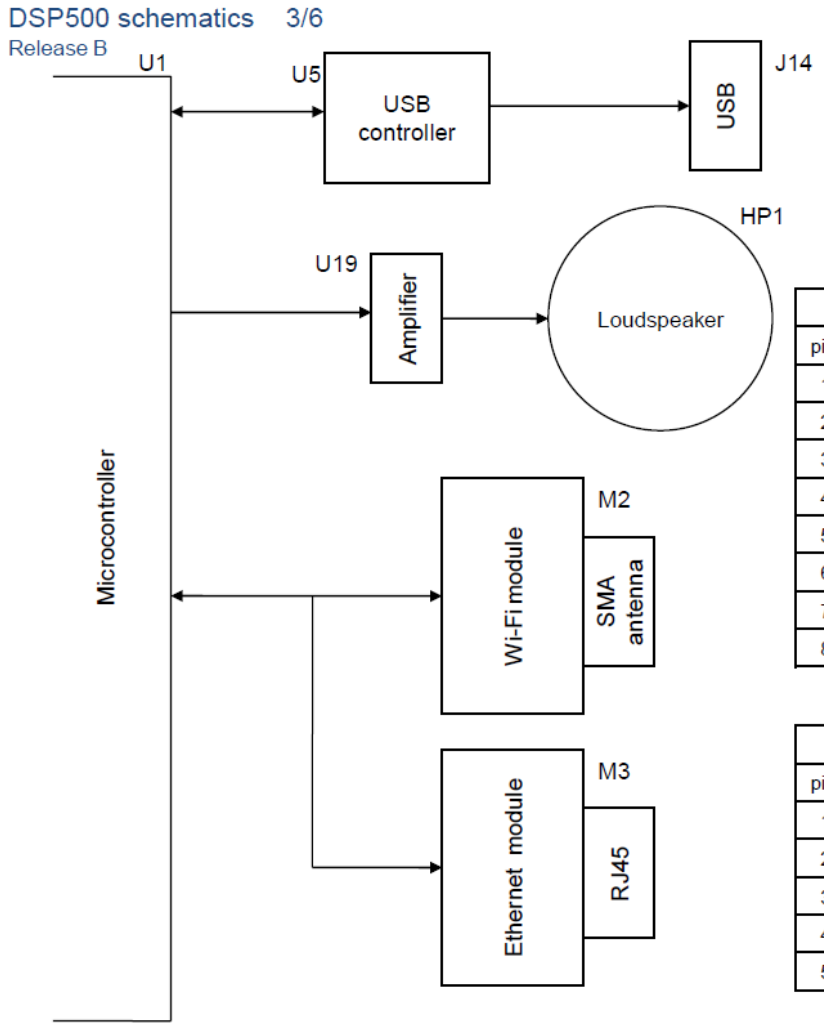
Connector J15	
pin	Signal
1	Not connected
2	RXD
3	TXD
4	Connected to no 6
5	GND
6	Connected to no 4
7	Connected to no 8
8	Connected to no 7
9	Not connected

Connector J16	
pin	Signal
1	Rx +
2	Rx -
3	Tx +
4	Tx -
5	GND
6	GND

Connector J5	
pin	Signal
1	Output no 1 +24V
2	Output no 1 GND
3	Output no 2 +24V
4	Output no 2 GND
5	Output no 3 +24V
6	Output no 3 GND
7	Output no 4 +24V
8	Output no 4 GND

Connector J6	
pin	Signal
1	Output no 5 +24V
2	Output no 5 GND
3	Output no 6 +24V
4	Output no 6 GND
5	Output no 7 +24V
6	Output no 7 GND
7	Output no 8 +24V
8	Output no 8 GND

Connector J7	
pin	Signal
1	Output no 9 +24V
2	Output no 9 GND
3	Output no 10 +24V
4	Output no 10 GND
5	Output no 11 +24V
6	Output no 11 GND
7	Output no 12 +24V
8	Output no 12 GND



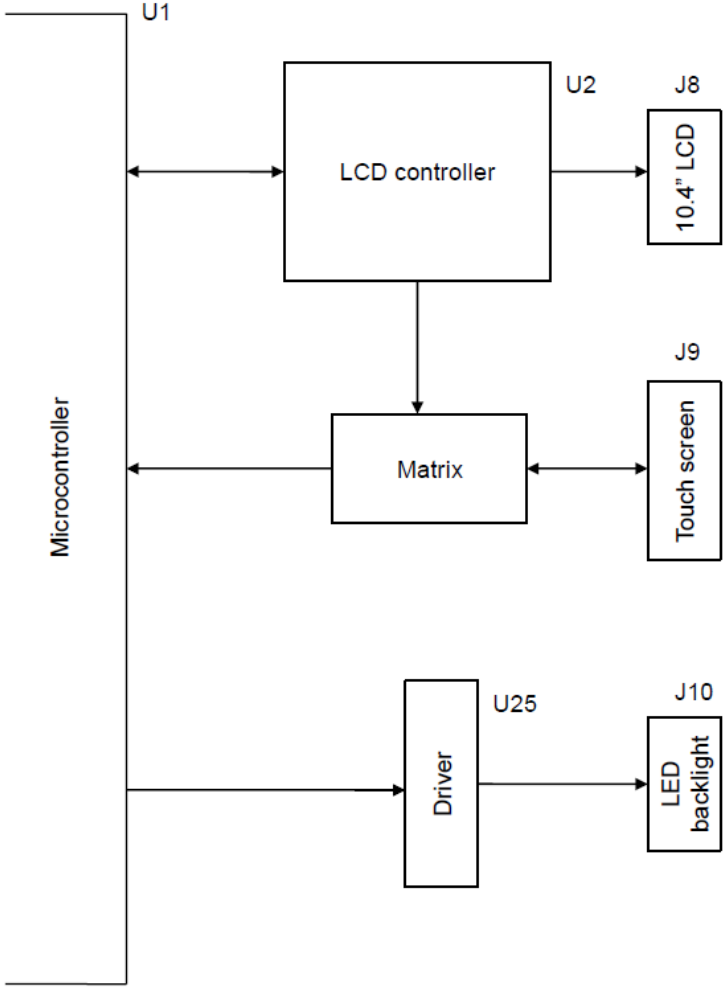
Connector RJ45	
pin	Signal
1	TXD+
2	TXD-
3	RXD+
4	unused
5	unused
6	RXD-
7	Unused
8	unused

Connector J14	
pin	Signal
1	+ 5V
2	D-
3	D+
4	GND
5	GND

Connector M2 & M3	
pin	Signal
1	Not connected
2	Not connected
3	Not connected
4	Not connected
5	Not connected
6	Not connected
7	TXD
8	RXD
9	Not connected
10	Not connected
11	Not connected
12	
13	Not connected
14	
15	
16	
17	Not connected\
18	Not connected
19	Not connected
20	Init/

DSP500 schematics 4/6

Release B

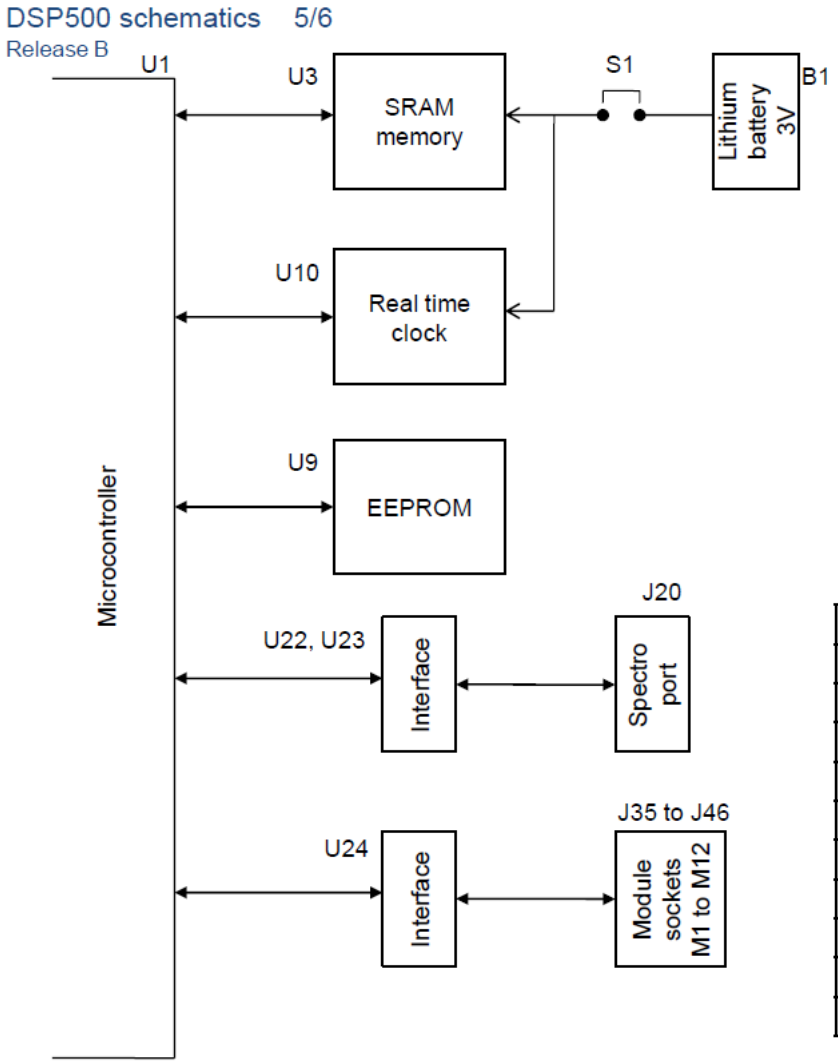


Connector J10	
pin	Signal
1	+ch3
2	+ch2
3	+ch1
4	-ch1
5	-ch2
6	-ch3

Connector J9	
pin	Signal
1	Bottom
2	Left
3	Top
4	Right

Connector J8 (continued)	
pin	Signal
24	B4
25	B5
26	GND
27	ENAB
28	VCC
29	VCC
30	R/L
31	U/D

Connector J8	
pin	Signal
1	GND
2	CK
3	H sync
4	V sync
5	GND
6	R0
7	R1
8	R2
9	R3
10	R4
11	R5
12	GND
13	G0
14	G1
15	G2
16	G3
17	G4
18	G5
19	GND
20	B0
21	B1
22	B2
23	B3

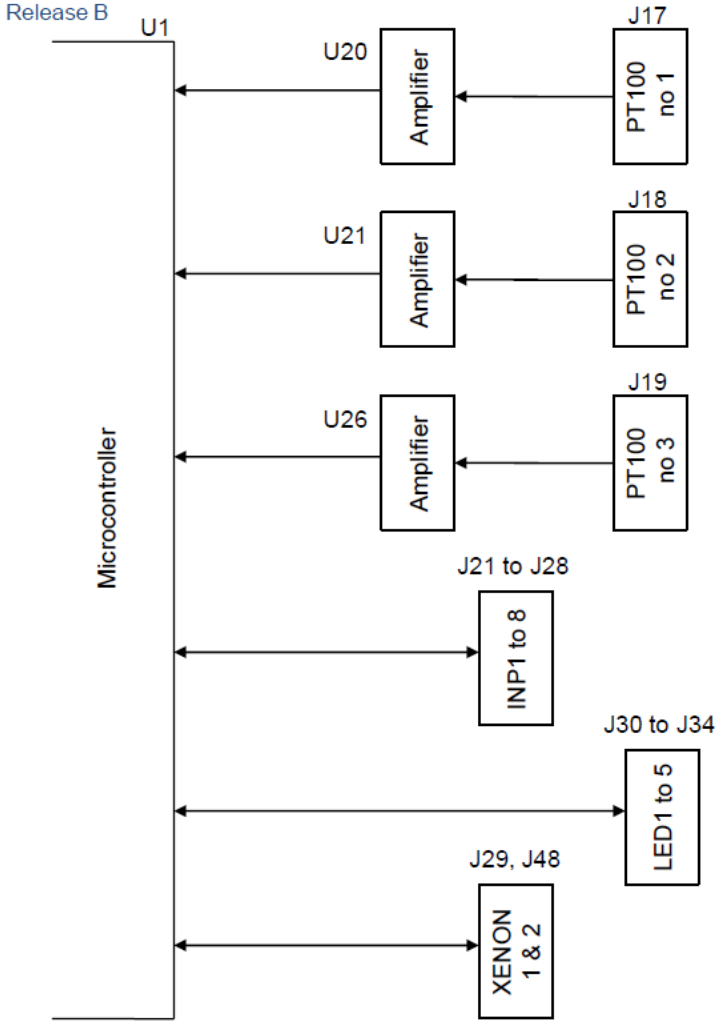


Connector J35 to J46	
pin	Signal
1	GND
2	CS
3	DIN/
4	SCLK/
5	DOUT
6	+3.3V
7	0VP
8	+24V
9	+12V

Connector J20	
pin	Signal
1	+24V
2	+3.3V
3	P1V
4	P1H
5	P2V
6	P2H
7	RG
8	CE/
9	CLK+
10	CLK-
11	DIN+
12	DIN-
13	DOUT+
14	DOUT-
15	GND
16	GND

DSP500 schematics 6/6

Release B



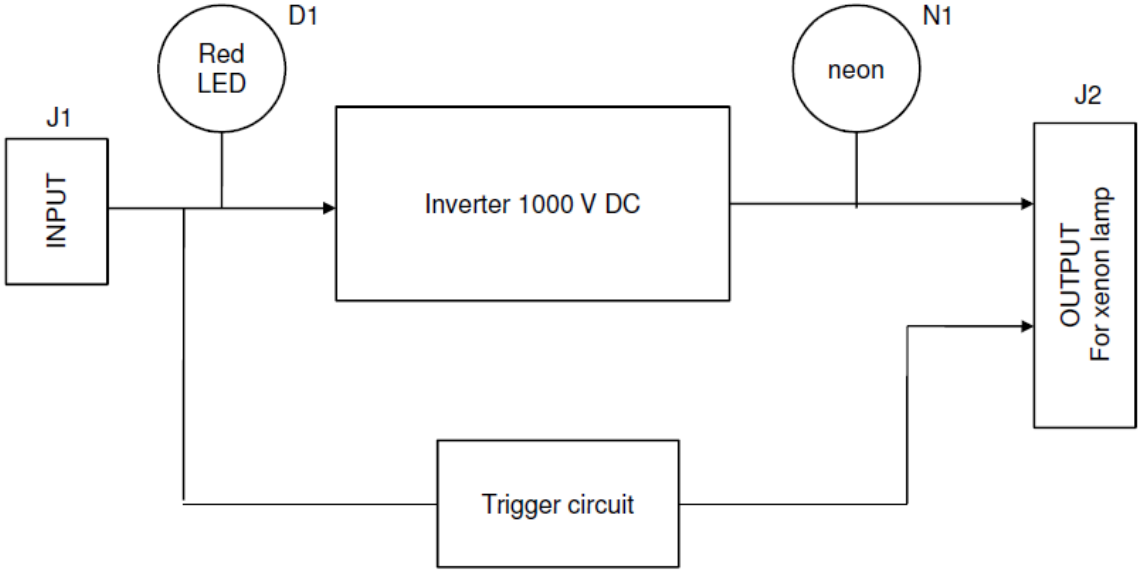
Connector J17, J18, J19	
pin	Signal
1	Pt100 side 1
2	Pt100 side 1
3	Pt100 side 2
4	Pt100 side 2

Connector J21 to J28	
pin	Signal
1	CMD
2	AGND
3	Signal
4	+3.3V

Connector J30 to J34	
pin	Signal
1	+12V
2	CMD
3	GND
4	Signal
5	AGND

Connector J29, J48	
pin	Signal
1	+24V
2	CMD
3	GND

2.6.2. XENON500

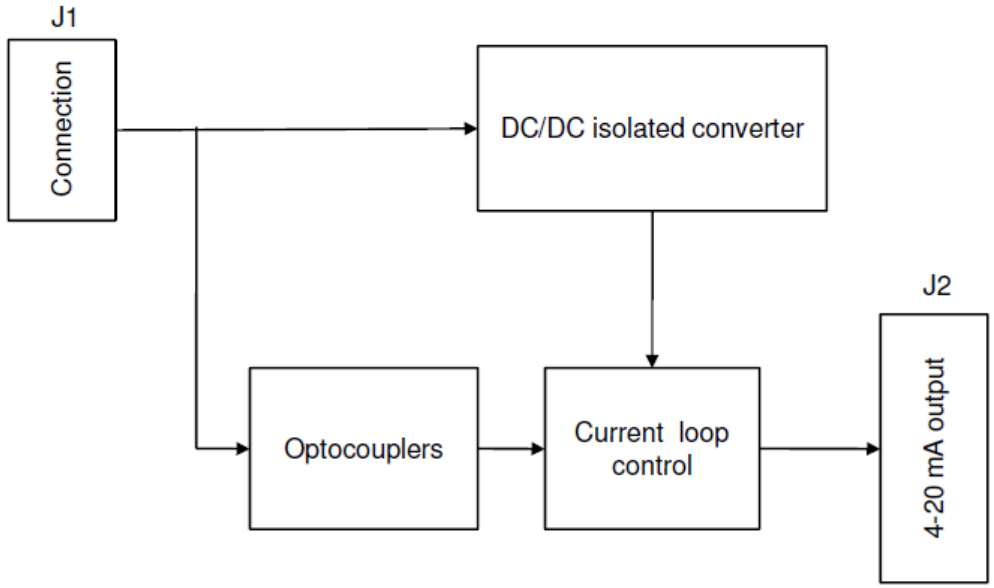


Connector J1	
pin	Signal
1	+24V
2	CMD
3	GND

Connector J2	
pin	Signal
1	Anode
2	GND
3	GND
4	Trigger

XENON500 schematics 1/1
Release A

2.6.3. OUT-4-20-500

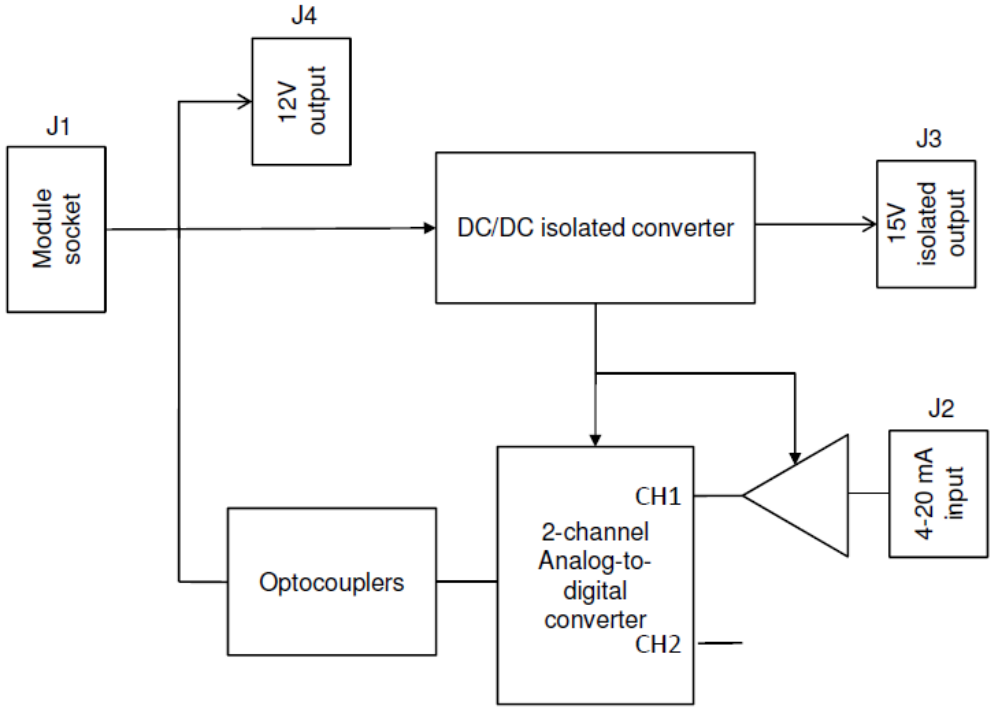


Connector J1	
pin	Signal
1	GND
2	CS
3	DIN/
4	SCLK/
5	DOUT
6	+3.3V
7	0VP
8	+24V
9	+12V

Connector J2	
pin	Signal
1	(+) 4-20 mA output
2	(-) 4-20 mA output

OUT4-20-500 schematics 1/1
Release A

2.6.4. IN-4-20-500



IN4-20-500 schematics 1/1
Release A

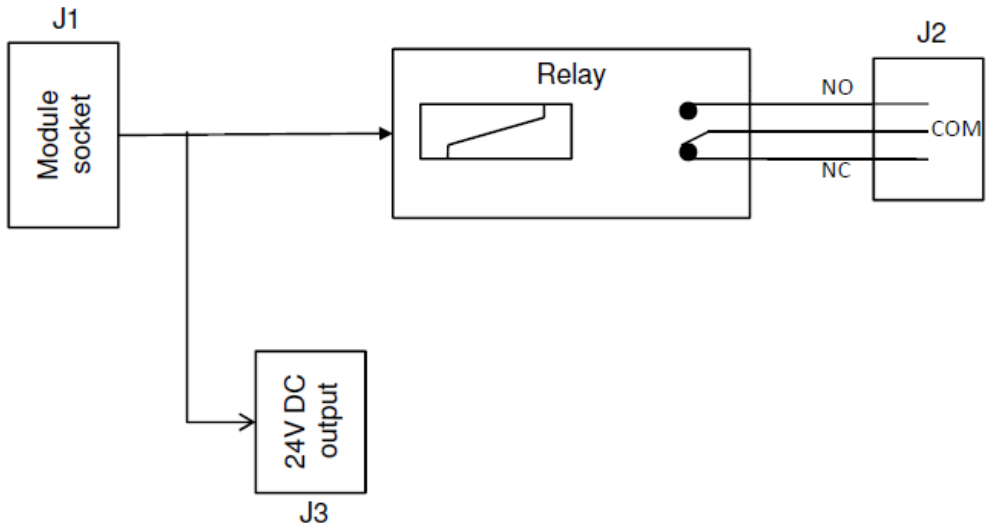
Connector J1	
pin	Signal
1	GND
2	CS
3	DIN/
4	SCLK/
5	DOUT
6	+3.3V
7	0VP
8	+24V
9	+12V

Connector J2	
pin	Signal
1	4-20 mA input
2	4-20 mA input

Connector J3	
pin	Signal
1	+15V (max 20mA)
2	0 V

Connector J4	
pin	Signal
1	+12V (max 200mA)
2	GND

2.6.5. RELAY500



RELAY500 schematics 1/1
Release A

Connector J1	
pin	Signal
1	GND
2	CS
3	DIN/
4	SCLK/
5	DOUT
6	+3.3V
7	0VP
8	+24V
9	+12V

Connector J2	
pin	Signal
1	NO contact
2	Common
3	NC contact

Connector J3	
pin	Signal
1	+ 24V DC output
2	GND

2.7. Modbus Addresses

Category	Address in Decimal	Type	Description	Unit	Comment
ZERO	**512**	Table of 16x6 intergers (year, month, day, hour, min, sec)	Last zeroing date		For each channel
	96	Table of 16xIEEE754 float (32 bit)	Concentration of zero gas	ppm	For each channel
	352	IEEE754 float (32 bit)	Optical signal at 250 nm on last zero	mV	
	128	Table of 16xIEEE754 float (32 bit)	Zero drift	ppm	For each channel
CALIBRATION	**640**	Table of 16x6 intergers (year, month, day, hour, min, sec)	Last calibration date		For each channel
	160	Table of 16xIEEE754 float (32 bit)	Concentration of standard gas	ppm	For each channel
	192	Table of 16xIEEE754 float (32 bit)	Optical signal at 250 nm on standard	mV	For each channel
	224	Table of 16xIEEE754 float (32 bit)	Difference (measurement minus standard)	ppm	For each channel
MEASUREMENT	**768**	Table of 16x6 intergers (year, month, day, hour, min, sec)	Last measurement date		
	64	Table of 16xIEEE754 float (32 bit)	Optical signal at 250 nm on measurement	mV	For each channel
	16	Table of 16xIEEE754 float (32 bit)	Measurement	ppm	For each channel
	48	Table of 16xinteger (16 bit)	Error code		0=no error, refer to operating manual

Category	Address in Decimal	Type	Description	Unit	Comment
MAIN PARAMETERS	**256**	Table of 16xIEEE754 float (32 bit)	Range	ppm	For each channel
	288	Table of 16xIEEE754 float (32 bit)	Calibration coefficient		For each channel
	320	Table of 16xIEEE754 float (32 bit)	Offset value	ppm	For each channel
OTHER PARAMETERS	**354**	IEEE754 float (32 bit)	Pressure (relative)	hPa	
	356	IEEE754 float (32 bit)	Temperature	°C	
	352	IEEE754 float (32 bit)	Optical signal at 250 nm on last zero	mV	
	896	Integer (16 bits)	Automatic zero period	Minutes	
	897	Integer (16 bits)	Automatic calibration period	hours	
STATUS	**898**	Integer (16 bits)	Measurement		Value = 1
	898	Integer (16 bits)	Standby		Value = 2
	898	Integer (16 bits)	Zeroing		Value = 3
	898	Integer (16 bits)	Calibration		Value = 4
	898	Integer (16 bits)	Full system calibration		Not applicable
	898	Integer (16 bits)	Backflush		Value = 6
	898	Integer (16 bits)	Maintenance		Value = 7
ALARMS	**899**	Integer (16 bits)	Analyser failure		Value = 1
	899	Integer (16 bits)	Light failure		Value = 2
	899	Integer (16 bits)	Range limit alarm		Value = 3
	899	Integer (16 bits)	Minimum range alarm		Value = 4
	899	Integer (16 bits)	Temperature failure		Value = 5
	899	Integer (16 bits)	Pressure failure		Value = 6
REMOTE CONTROL	**900**	Integer (16 bits)	Start zero		Write 1, go back to

					zero when finished
	901	Integer (16 bits)	Start calibration		Write 1, go back to zero when finished
	902	Integer (16 bits)	Start measurement		Write 1, go back to zero when finished
	903	Integer (16 bits)	Stop measurements		Write 1, go back to zero when finished
	904	Integer (16 bits)	Start full system calibration		Not applicable
	905	Integer (16 bits)	Startbackflush		Write 1, go back to zero when finished
	906	Table of 6xintergers (year, month, day, hour, min, sec)	Clock adjustment		Any engaged cycle will be aborted

From Software V1.14

3. Troubleshooting

3.1. General Troubleshooting

Disconnect the power cord before servicing!

Symptoms	Checking / Origin
The screen remains totally black after connecting the power cord. **AND** The red LED D1 on the DSP500 board is OFF.	- Check the power socket - Check J1 connector (mains input, high voltage!) - Check J2 connector on the DSP500 (mains input for the power supply, high voltage!) - Check J3 connector (24V output from the power supply) - Failure on the power supply of the DSP500 board
The screen remains totally black after connecting the power cord. **AND** The red LED D1 on the DSP500 board is ON.	- Check the backlight connector of the screen J10. - Failure off the DSP500 board.
The screen is lighted but nothing is displayed.	- Check the screen connector J8 on the rear of the DSP500 board - Failure off the DSP500 board.

3.2. Measurements troubleshooting

Symptoms	Origin
Frozen value	- Check the mode and select the continuous mode - A zeroing cycle is in progress, wait for the end of the cycle (< 1 min) - A automatic calibration cycle is in progress, wait the end of the cycle (<1 min)
Value is too low	- Bad zeroing: check or redo the zero - Bad calibration: check the instrument with a standard - No flow rate: check the gas circulation
Value is too high	- Bad calibration: check the instrument with a standard. - Internal temperature no stabilised, wait 4 hours after power on for full accuracy
Unstable value	- Deposit or dirty on the optical parts (lens and/or windows), check the light level at 200 nm, must be typically around 200 mV - Interference from another gas: check the gas composition - Bad calibration (too sensitive): check with a standard.

3.3. Measuring Errors for Parameters

Error no	Signification	Origin / Remediation
1	Gas circuit temperature too low (more that 10 °C bellow the set point)	- Wait for temperature stabilisation after power on, minimum 10 min on 230V AC. - Wong configuration: check the temperature setting screen. - Failure on the heating system or temperature probe.
2	Detector fault	- Check the spectrograph connection. - Failure on the spectrograph board.
3	The light level is too high on the range of wavelengths used for the considered gas	- Reduce the number of flashes in the lamp screen - Failure on the CCD500 or SPECTRO500 board (replace)
4	The light level is too low on the range of wavelengths used for the considered gas	- Deposits inside the gas flow cell: clean the windows (or mirrors for CEM500-L). Check also that the temperature setting is correct, normally 190°C (or 240°C for CEM500-L) - Deposits on the lens, clean the lens (in front of the lamp) with alcohol - Bad lamp alignment: check the alignment by adjusting the screw on the rear of the lamp holder - Failure on the xenon lamp circuit if no flashes are visible during the measurement: check the connection of the XENON500 board on the DSP500 board (the orange neon lamp N1 on the XENON500 board must always be on, if not replace the XENON500 board) and check the lamp connection on the XENON500 board
5	Pressure fault	- Check the pressure probe connection - Over pressure (>2 bar or > 2000 hPa) - Pressure probe failure
6	Flow alarm	- Value is superior to upper limit value - Value is lower than lower limit value - Check if alarm values are relevant - Check if gas is still flowing in the gas circuit

4. General Specifications

Sample temperature:	0 °C to 400 °C
Sample pressure:	0 to 2 bar (2000 hPa or 30 psi) absolute pressure
Outlet pressure:	Atmospheric pressure (recommended)
Sample contact materials:	Stainless steel, quartz, PTFE, FFKM
Zero inlet:	Air or nitrogen (air recommended)
Zero pressure:	Without pump: 10 to 50 hPa above the atmospheric pressure With pump: atmospheric pressure
Zero temperature:	0 ºC to 400 ºC (ambient temperature recommended)
Sample Inlet/outlet:	Stainless steel fittings (Swagelok) for external diameter 6.4 mm (1/4”)
Display:	Colour TFT LCD, Size: 10.4”, resolution: 640 x 480 pixels LED backlight with screen saver. Resistive touch screen
Memory:	5000 records (up to 16 measurement channels) with date and time
Communication:	RS232 - MODBUS protocol RS485 - MODBUS protocol
USB port:	For USB memory keys, any format (FAT16, FAT32) Standard USB connector type A with IP68 protective cap Recorded measurement downloads (compatible with Excel®) Complete configuration backup/restore (proprietary format) Screen copy in BMP format (compatible with Windows®) Software
Extensions:	12 internal sockets for input modules (logical input, 4-20 mA input), output modules (4-20 mA) or relays modules
Outputs:	Active 4-20 mA (optional), load 500 Ohm maxi, resolution 0.005 mA, Individual galvanic isolation Connection on removable screw terminals
Relays (optional):	Normally open (NO) and normally closed (NC) contacts Contact rating: 5A @ 277VAC/30VDC resistive Connection on removable screw terminals

Power supply:	110-264 VAC / maxi 900 W / 50-60Hz (250 VA after stabilization)
Operating limits:	0 to 40 °C
Safety standard:	IEC 61010-1, EN 61010-1
EMC standard:	EN61326/A1/A2/A3, IEC61000-3-2, IEC61000-3-3, IEC61000-4-2, IEC61000-4-3, IEC61000-4-4, IEC61000-4-5, IEC61000-4-6, IEC61000-4-11
Enclosure:	IP65 / Nema 4X, stainless steel 316L with painting
Dimensions:	521 x 345 x 252.5 mm
Weight:	30 kg approx.
