PCF Elettronica's MOD. 530/NR
BTEX Analyser

Benzene, Toluene, Ethyl-Benzene, Xylenes

SHOWING
EXCLUSIVE PURGE AND TRAP SYSTEM
GASCHROMATOGRAPHIC SEPARATION AND
RUNNING CROMATOGRAM DISPLAYED ON VIDEOGRAPHIC

Operating manual

[Operating Manual version 2, FEB. 18th 2019]

Contents :

1.0 FOREWORDS

PCF Mod. 530/NR BTEX analyser is an automatic gas chromatograph (GC) programmed to continuously and automatically measure aromatic compounds (BTEX, Benzene, Toluene, Ethyl-Benzene and m-p-o-Xylenes) in ambient air at trace levels.

Working philosophy of an automatic GC is completely different from the standard ambient air analysers; the analysis is not continuous and the refreshing of measured values is at the end of analytical cycle (20 minutes)

1.1 INTRODUCTION

The present manual includes the following sections:

- general description of the analyser component parts
- description of commissioning and start up procedure
- concise description of firmware
- concise analyser maintenance procedure
- most frequent trouble shootings.

The in-built operative functions, the status, the temperatures and the data management are controlled by a powerful microprocessor.

Thanks to a high capacity flesh memory unit (digital key), the analytical reference procedure (default configuration), each single measured value, the half hour-hour- eight hour and 24 hour mean values can easily be memorised.

The RS 232 serial connection can be employed either for printing reports on local printer or for remote and local connection to a data acquisition system.

Up to eight analogue 0-1Vdc or 4-20mA signals, relevant to the concentration of eight different components are always available on the analogue output PCB.

A LCD graphic digital display, a touch screen control facility is also available for most operations, shows statuses, measured values, recorded menus, that may be selected by the front panel key board, according the need and the variables of analytical program.

2.0 OPERATING PRINCIPLE

The PCF Elettronica Mod. 530/NR BTEX analyser detects and records basic aromatic hydrocarbons such as Benzene, Toluene, Ethyl-Benzene and m- p- o-Xylenes in a wide range of ambient conditions without any possibilities of water condensation or limitation in the ranges, measuring range from few tenths of ppbs up to a few ppms (from fraction of $\mu g/m^3$ up to mg/m^3).

The instrument can be either employed in automatic monitoring systems or as a transportable version for air quality monitoring.

The basic analytical cycle is anticipated by a purge and trap step as to accumulate species and increase sensitivity of overall analysis.

The full analytical cycle is calibrated through calibration sources, such as traceable gas cylinders, permeation tubes or multipoint calibrators.

A pulling membrane pump fills a capillary (sampling loop), whose content, by switching of rotation valve (bimatic eight port valve), is passed on a GR tenax trap by a carrier gas (that can be indifferently Nitrogen, Helium or Hydrogen; when changing the carrier gas the whole analytical recipe must be reprogrammed).

In order to increase sensitivity of the full system the latter operation can be repeated different times.

A capillary column will separate chemical species that are successively detected by PID detector.

The Photo Ionisation Detector (PID) is based on the ionisation of organic compounds by a UV lamp. The detector is therefore insensitive to the compounds structure and the generated ions quantity are detected by polarised electrodes, generating microcurrents.

The chromatogram of the analysis is continuously displayed on the touch screen graphic video display. The interval times of peak integration are displayed by different colour (red).

The values obtained by the above describe procedure are managed by the electronics then showed on digital display as well as made available at the outputs as analogue signals for local or remote recording and control.

3.0 TECHNICAL SPECIFICATIONS
(Benzene as reference)

- Measuring ranges : 0-10/100/1,000 $\mu g/m^3$
- Measuring units : ppb or $\mu g/m^3$
- Sampled volume : 10 – 100 ml of air.
- Detector : PID (Photo Ionisation Detector).
- Measuring signal : direct or corrected for calibration values
- Background noise : $\leq 0.05 \mu g/m^3$
- Lower Detectable Limit (LDL) : $0.1 \mu g/m^3$
- Interference equivalent : $<1 \mu g/m^3$
- Zero stability (24 hours) : corrected automatically at every cycle
- Span drift (24 hours) : $\leq 1 \mu g/Nm^3$
- Measuring cycle : 15-20 minutes (according to analytical cycle)
- Response time : 15-20 minutes (according to analytical cycle)
- Linearity : better than 1% full scale
- Precision : $\pm 0.5 \mu g/ m^3$ Benzene equivalent
- Sample flow rate : 500 ml/min
- Instrument configuration : via key board on front panel or through RS 232
- Operating temperature range : 0 – 40 °C
- Display : 800 x 480 pixel touch screen colour LCD graphic display.
- Analogue outputs : (8 x) 0-1 Vdc/4-20 mA, analogue outputs
- Digital I/O : 24 pin connectors for 12 opto-isolated digital signals
- Serial outputs : RS 232-485, (9 pin connector), Ethernet/LAN.
- Services Carrier gas : 10 ml/min, either nitrogen or Hydrogen
- Calibration : via calibration loop from gas cylinder, multipoint calibrator or benzene permeation tube
- Sampling pump : WISA WIDO
- Mounting : standard 19" rack and/or transportable bench top
- Dimensions : 480x250x560 mm (19"x10"x22", WxHxD)

- Weight : 20 Kg
- Standard power supply : 220/110 Vac 50/60 Hz (to be specified in order)
- Power consumption : 650 W during heating up mode, 250 W in working mode
- Suggested calibration mixture : 5 ppb of Benzene, Toluene, Ethyl-Benzene and m-p-o-Xylene, air (Nitrogen) balance
- Pneumatic connections : 1/4" or 4/6 mm and 1/2 mm diameter tubes

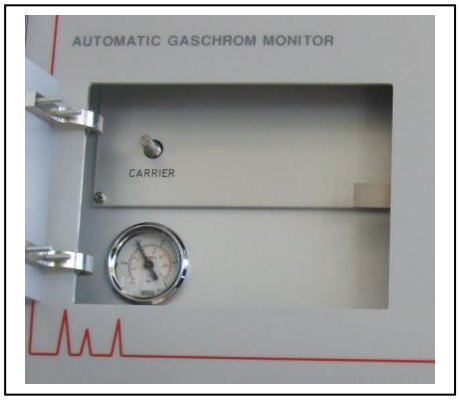
4.0 FRONT PANEL DESCRIPTION

The front panel (see above figure) shows on the right-hand side the touch screen colour video graphic display, no more key board, the operating menu is user friendly, easy to select as well as correct the selection if needed.

The left-hand side magnetic closed door gives access to the gases controls as well as to the USB port for the digital pen.

As the instrument is fundamentally a very compact and simple gas chromatograph, the configuration of the same, namely NMH, BTEX and specific HC, is indicted on the video display at the switching ON of the instrument.

The touch screen is of the types mounted on modern phones and tablets, it must touched with the fingertips, no nails, pens or stick.



Access to the manometer set with relevant pressure reducer to allow the setting of instrument service gas pressures is allowed through a small door on the left hand side of the panel.

On top of each gauge a trimmer allows the regulation and setting of the gas pressures.

Please remember that:
pressures/flows of gases (excluded sample flow rate) are strictly connected to PID response and therefore to calibration.

Keep the setting of the pressures/flow as much constant as possible (take care to tag the set values in your installation), better if at the same value indicated in the FINAL CHECK RECORDS supplied with each instrument.

By opening the left-hand side door access to USB port for a digital pen slot is allowed, on the latter digital pen analytical data, instrument set up and analytical method, that supervises the automatic procedure of desired analysis. The digital pen can be extracted and easily read by any reading support connected to a PC.

The basic operating menu (HOME MENU) is displayed on the lower part of the video display. As said it is user friendly and allows easy correction, by back return, if some selection proved wrong.

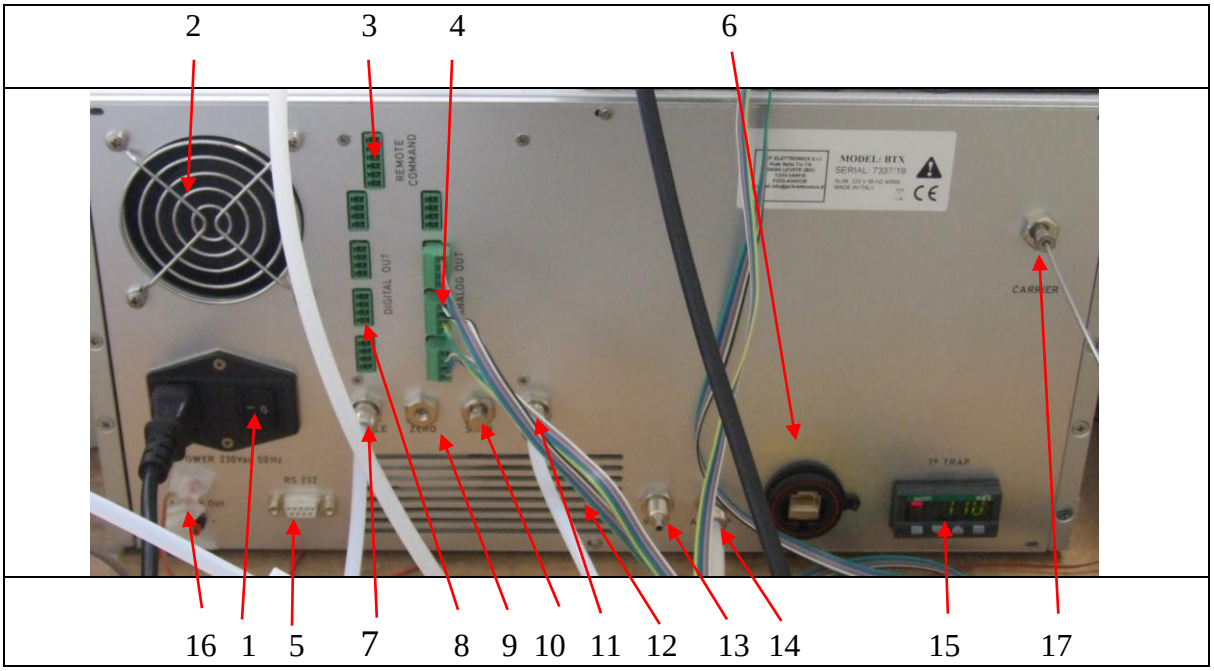
RANGE: select range of the instrument (usually 4 or 6 ranges freely selectable)
IGNITE: for the lighting of PID UV lamp.
DIAGNOSTICS: information on working set and conditions.
AZERO: electronical zeroing of the PID signal.
ZERO: ZERO command (the instrument enters ZERO at the end of running cycle).
SPAN: SPAN command (the instrument enters SPAN at the end of running cycle).
MONITOR: measuring condition.
STOP: the instrument stops working and enters into STAND BY condition.
GRAPHS: the running chromatogram is displayed.
SETTINGS: the working sets and condition of the instrument may be modified while in operation (MONITOR), front end/back end feature.

BEN TOL XIL integration windows	
	Status of the instrument Number of runs/00 = continuous running Elapsed time of last run Last cycle measurements HOME menu

SETTINGS: the working sets and condition of the instrument may be modified while in operation (MONITOR), front end/back end feature.

5.0 REAR PANEL VIEW

FROM OUTSIDE

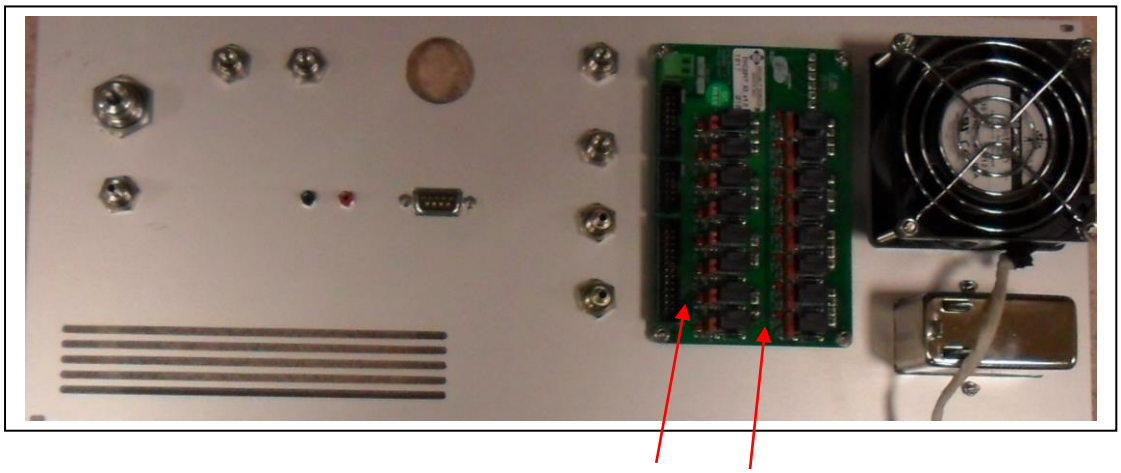


The rear panel (see figure above) includes the following items:

1. Input Power supply, 220/110 Vac, 50/60/Hz, 3-pin socket, with ON/OFF switch (1)
2. Cooling fan (2).
3. Instrument status and alarm output standard 25 pin male Cannon connectors (3).
4. Analogue signal output standard 13 pin female Cannon connectors (4).
5. RS-232/485 serial output, standard 9 pin female Cannon connector (5).
6. Ethernet/LAN, standard connector (6).
7. SAMPLE IN, gas connection 4/6 tubes of (14" Swagelock), for the sample gas input (7)
8. Digital outputs (8)
9. ZERO gas connection, 1/2 tubes, For checking/calibrating zero (9)
10. SPAN, gas connection, 1/2 tubes, for the calibration gas input (10)
11. VENT connection 1/2 tubes, of calibration gases (11)
12. Ventilation grid (12)
13. Sample vent (13)
14. Service AIR connection, 1/2 tubes, > 4.5 Bar (65 Psi) (14)

15. Temperature control of the Tenax Trap (15)
16. PID analogue OUTPUT, 0-10 Vdc, directly from electrometer PCB (16).
17. Nitrogen, as carrier gas, pneumatic connection (17)

FROM INSIDE



With red bridges ON the output are in Vdc (selection 0-1/10 Vdc from front panel)

In the first versions of Mod. 530/NRs the selection for the 8 analogue outputs either in Vdc or mA is done via hardware with bridges on the reverse of back panel.

With the red bridges ON the analogue outputs are programmed for Vdc while with the red bridges OFF the analogue outputs are set for mA.

Once selected either Vdc or mA the ranges 0-1 Vdc or 0-10 Vdc are set from the front panel HOME menu.

The same for the analogue output 0-20 mA or 4-20 mA.

6.0 INSIDE VIEW

The great development in the field of integrate circuits, as well as the use of very high integrated chips, has greatly reduced the room occupied by electronics that manages all the instrument firmware. Inside the instrument we find the main Mother Board located under the analytical part of the instrument, while the PCB LCD display is on the inner front panel; on the rear, the PCB with all status and alarm signals, the analogue outputs and the connectors for remote connection is located.

The electrometer, the only electronic part that's separated from main electronics as it is a very high gain analogue amplifier, is located on the right-hand side of equipment (as near as possible to PID detector).

The temperature controlled analysis chamber is the part that takes the largest room inside the instrument. It is located on the left-hand side and takes one third of the whole instrumental room. Inside the chamber the whole analytical circuit, the chromatographic column, the sampling and gas flow rate control capillaries, the eight-port rotation valve as well as the PID detector are positioned.

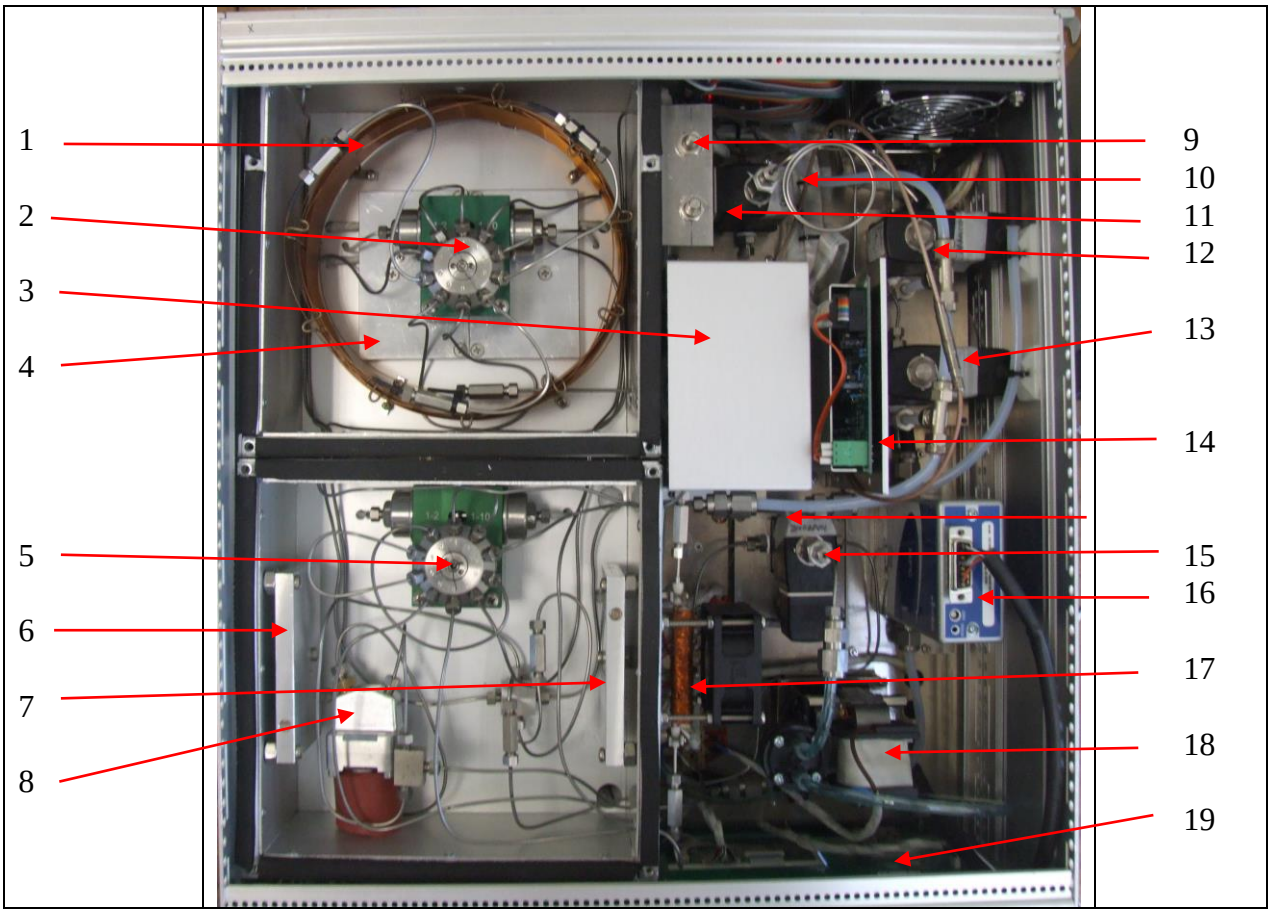


Figure captions:

1- Capillary pre-column and separation column (1)

2- Eight port rotation valve (2)

3- PID detector with metal cover (3)

4- Electrically heating element (4)

5- Eight port rotation valve (5)

6- Electrically heating element (6)

7- Electrically heating element (7)

8- Nitrogen pressure regulator (8)

9- Potentiometer to regulate Electrometer PCB (9)

10- Nitrogen interception Electro Valve (10)

11- Potentiometer to regulate Mass Flow Meter (MFM) unit (11)

12- ZERO Electro Valve (EV). The instrument is intended, as default, to be zeroed with a Zero Air (ZA) gas cylinder. When activated the EV passes the Zero Air into the instrument. The excess of the Zero Air (ZA) is vented through the sample line. In case of calibration through a multipoint gas calibrator where the mixture is available at room temperature either the SAMPLE line or the SPAN line must be closed.

13- SPAN Electro Valve (EV). The instrument is intended, as default, to be calibrated with a traceable compressed gas mixture. When activated the EV passes the calibration gas mixture into the instrument. The excess of the calibration mixture is vented through the sample line. In case of calibration through a multipoint gas calibrator where the mixture is available at room temperature either the SAMPLE line or the SPAN line must be closed.

14- Electrometer PCB (14)

15- N_2 interception Electro Valve, for Nitrogen flowing through the Tenax Trap (15)

16- Mass Flow Meter(MFM) unit (16)

17- Tenax Trap (17)

18- Sampling pump. The flow rate into the instrument is not related to the instrument response (18)

19- Touch screen LCD Colour Display (19)

6.1 (OPEN) BOTTOM VIEW

To have access to the bottom of the instrument, you have to tilt the tool on the left side, unscrew the bolts and remove the metal cover.

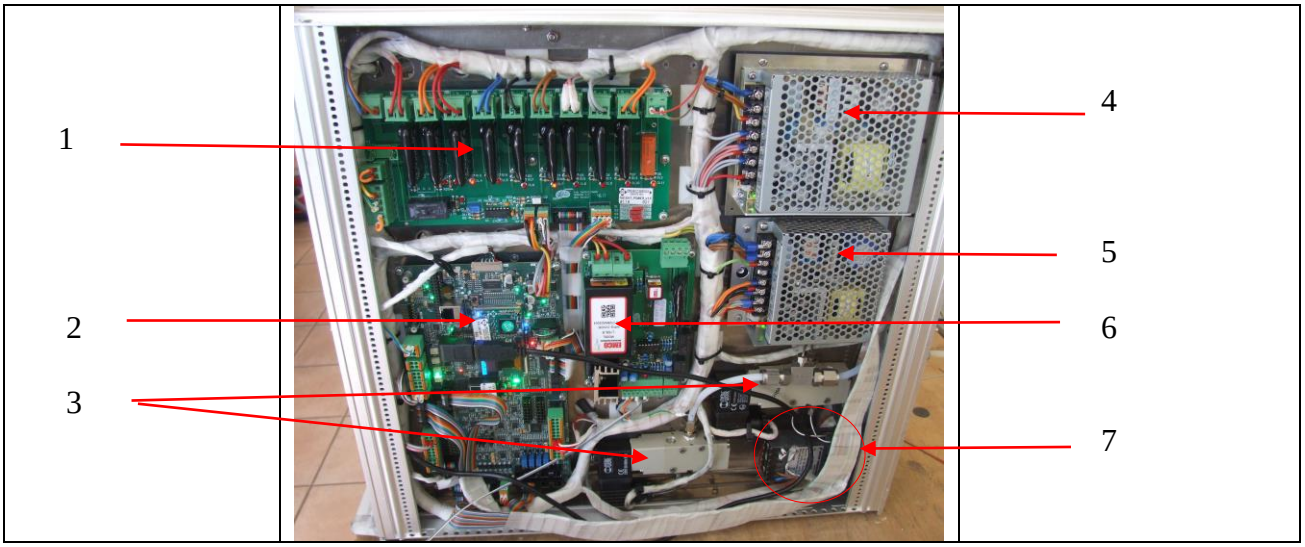


Figure captions:

1- Auxiliary PCB with power relays (1)

2- Main PCB (Mother Board) (2)

3- Activation valves of rotation valves (3)

4- +5 Vdc/+24 Vdc Power Supply (4)

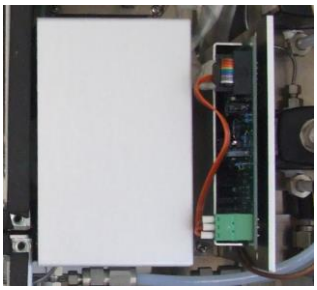
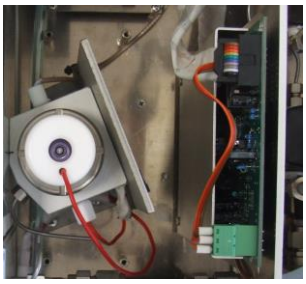
5- ±15 Vdc/+5 Vdc Power Supply (5)

6- UV lamp Power Supply PCB.

NOTE: Do not regulate the excitation voltage of the UV lamp over 2 Vdc: **you will damage the UV lamp Power Supply PCB** (6)

7- Temperature Regulator of Tenax Trap (7)

6.2 PHOTO IONISATION DETECTOR (PID)

Closed PID with the amplification electrometer PCB.	Open PID, with Power Supply wires to UV lamp and the shielded signal wire.
	

The PID, Photo Ionisation Detector, with the capillary columns is the core item of the analytical part of the monitor.

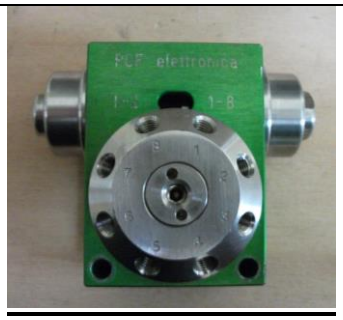
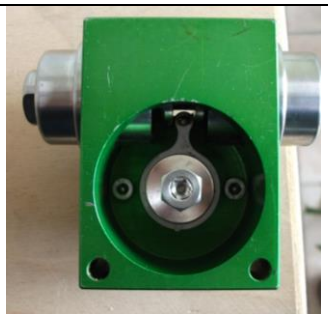
The carrier gas (Nitrogen) flows through the capillary columns and brings the traces of separated BTEX to the detector.

The UV wavelengths ionise the hydrocarbon molecules generating a current signal through the collecting plaques. The micro current is amplified and normalized by the electrometer PCB. The output is fed to the main PCB and as output on the rear panel of the instrument.

Very important: do not overstep the 2 Vdc for the excitation voltage of UV lamp.

Over 2 Vdc you will damage the UV lamp Power Supply PCB.

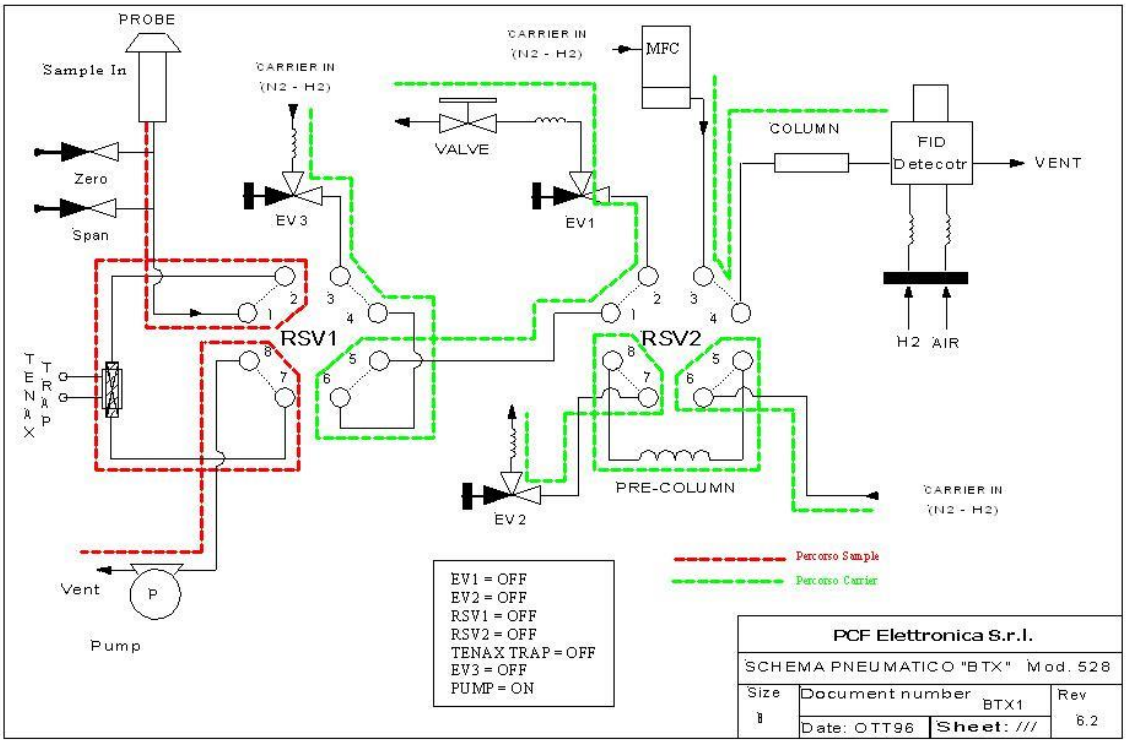
6.3 BIMATIC ROTATION VALVE

	
Rotation valve top view	Rotation valve bottom view

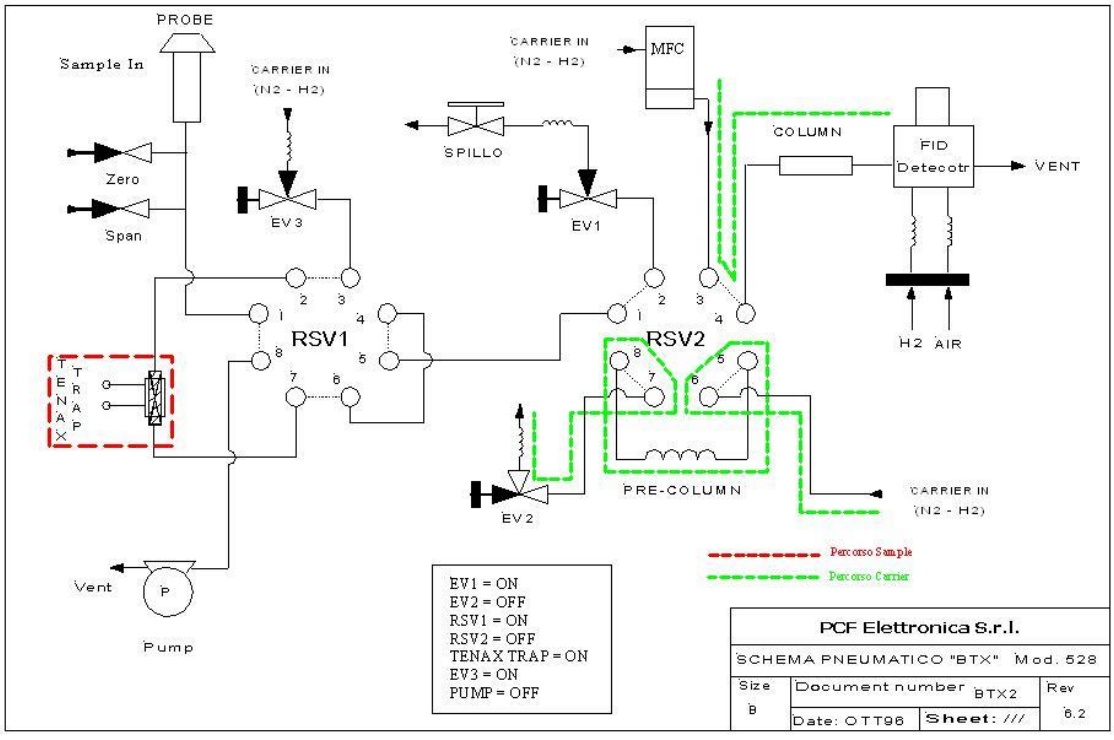
The installed ones are eight port rotation valve that connects all the pneumatic circuits. The switching of the valves is controlled by compressed air supplied through a four-way command solenoid valve. These valves allow the interconnection of other pneumatic circuits. In the Mod. 530/NR BTEX analyser a double rotation valves provide sampling of gas as well as the full sequences of analysis.

7.0 WORKING SEQUENCES

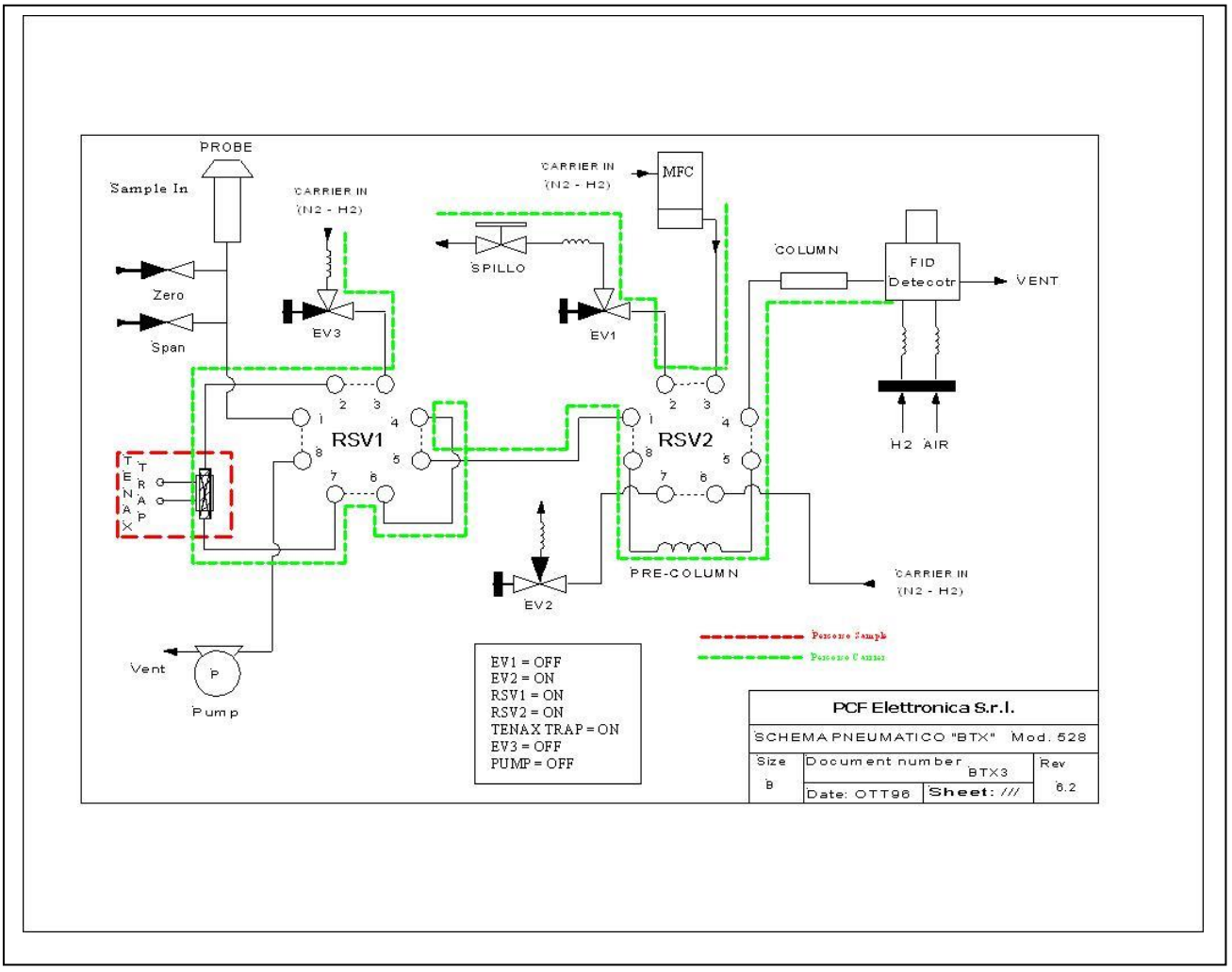
Phase 1 *(see BTX1 scheme)*
Sample is sucked in by the **PUMP** and passes through "Tenax Trap".
Meanwhile **CARRIER GAS**, controlled and shown by **Carrier** manometer, located on the front panel of instrument, flows through capillary **COLUMN** to **PID** detector.
The same CARRIER GAS during phase 1 flashes both the **PRE-COLUMN** and **COLUMN**.



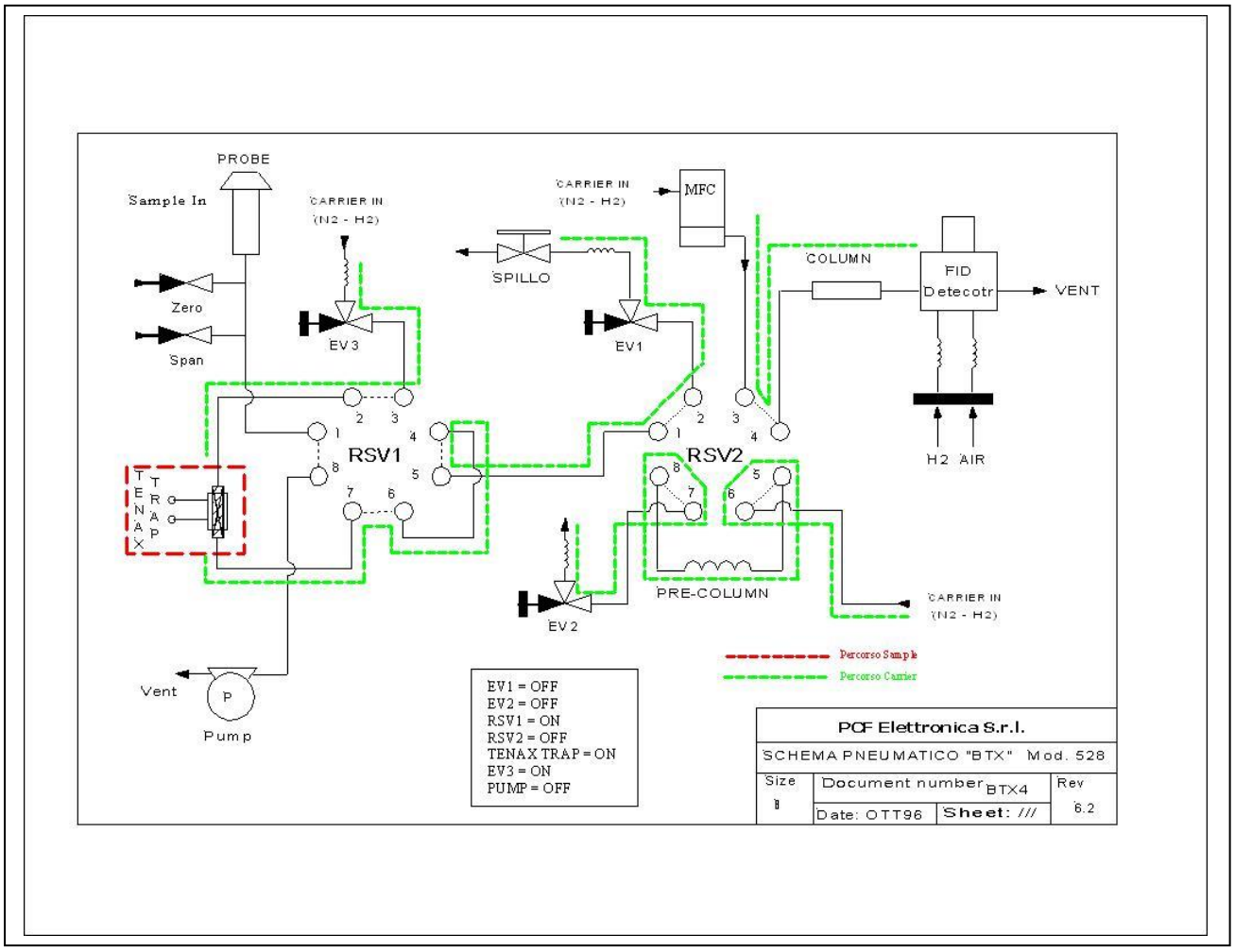
Phase 2 *(see BTX2 scheme)*
Sample sucking **PUMP** is switched off. "**TENAX TRAP**" is heating in flash at a very high temperature, then **RSV1** rotation Bimatic valve switches, Valves **EV1** and **EV3** are switching in on and stop **CARRIER** gas flow into the "**TENAX TRAP**" where the species under analysis are trapped. During this second phase **CARRIER** gas flows continuously through the **COLUMN** and the **PRE-COLUMN**.



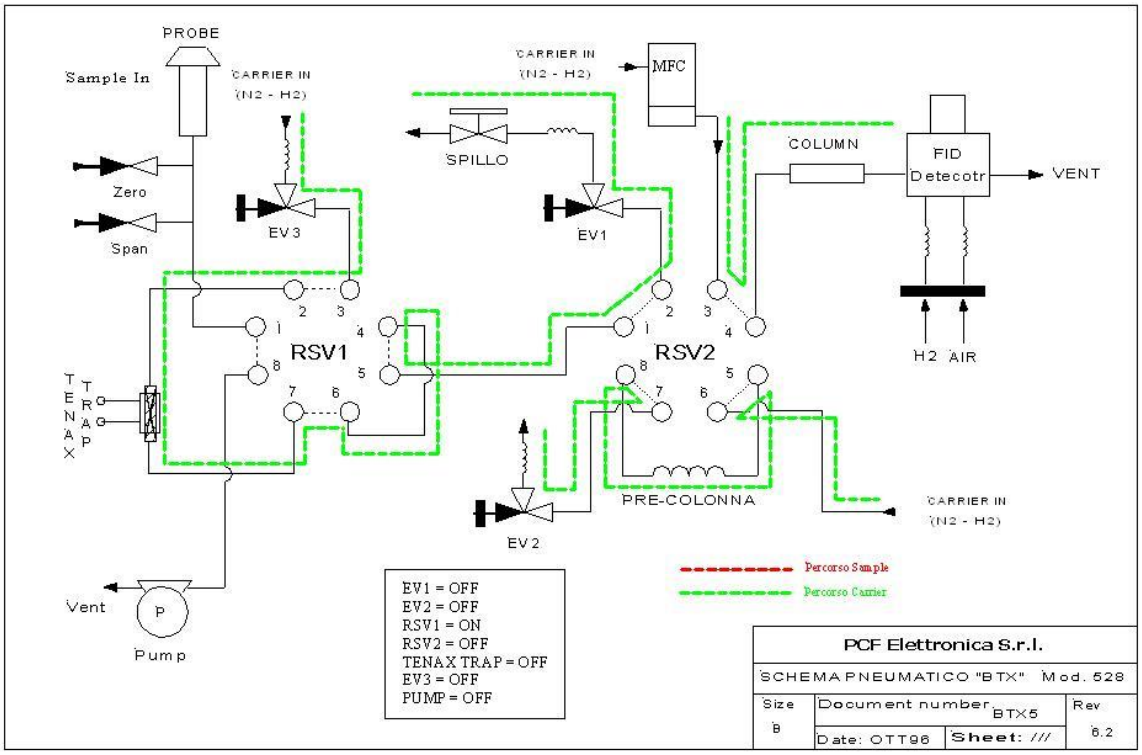
Phase 3 *(see BTX3 scheme)*
In phase three valves **EV1** and **EV3 s**witching in off and **CARRIER** gas flows into an heated "**TENAX TRAP**". **RSV2** switch on and inject sample into **PRE-COLUMN** All other working conditions are as from phase 2. **PRE-COLUMN** divide aromatics from others hydrocarbons.



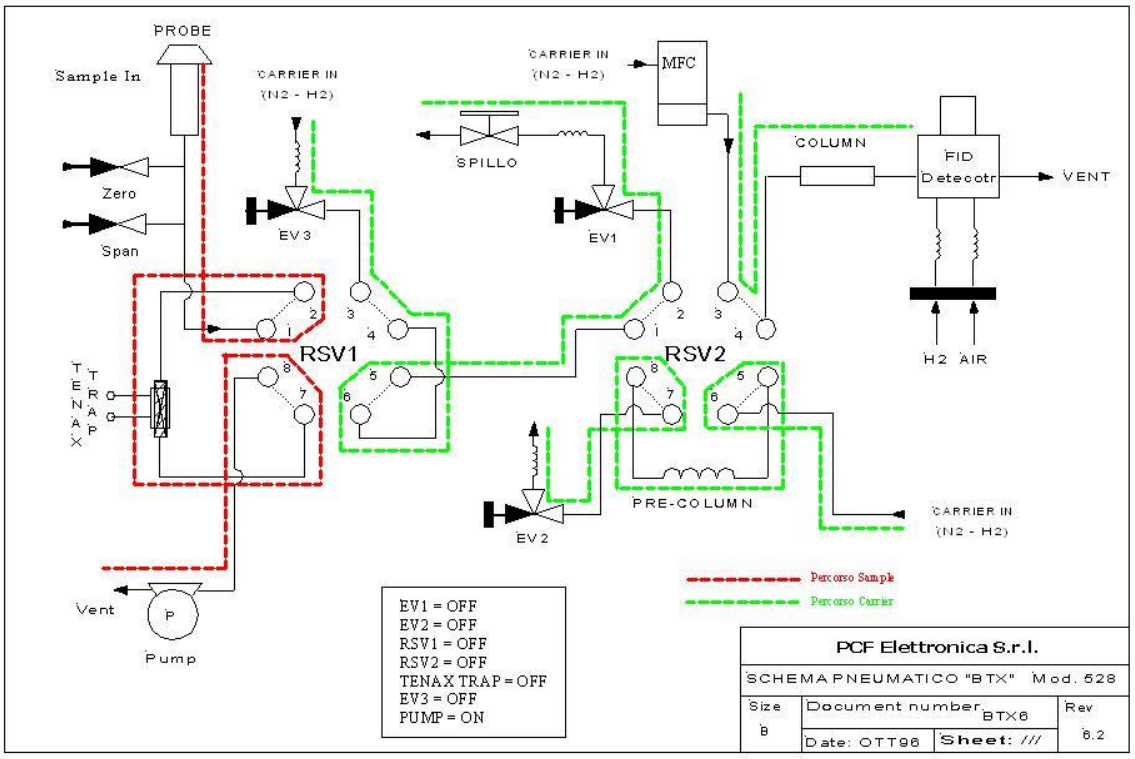
Phase 4 *(see BTX4 scheme)*
Valve **RSV2** switch off. **PRE-COLUMN** is washing in back flush. At the same time "**TENAX TRAP**" is heated up to high temperature as to desorbe all species there trapped (purge phase). **COLUMN** is dividing aromatics hydrocarbons



Phase 5 *(see BTX5 scheme)*
"**TENAX-TRAP**" heating system stop. Other condition are the same of phase 4. **COLUMN** continued separation of aromatics compound and finally reach **PID** detector.



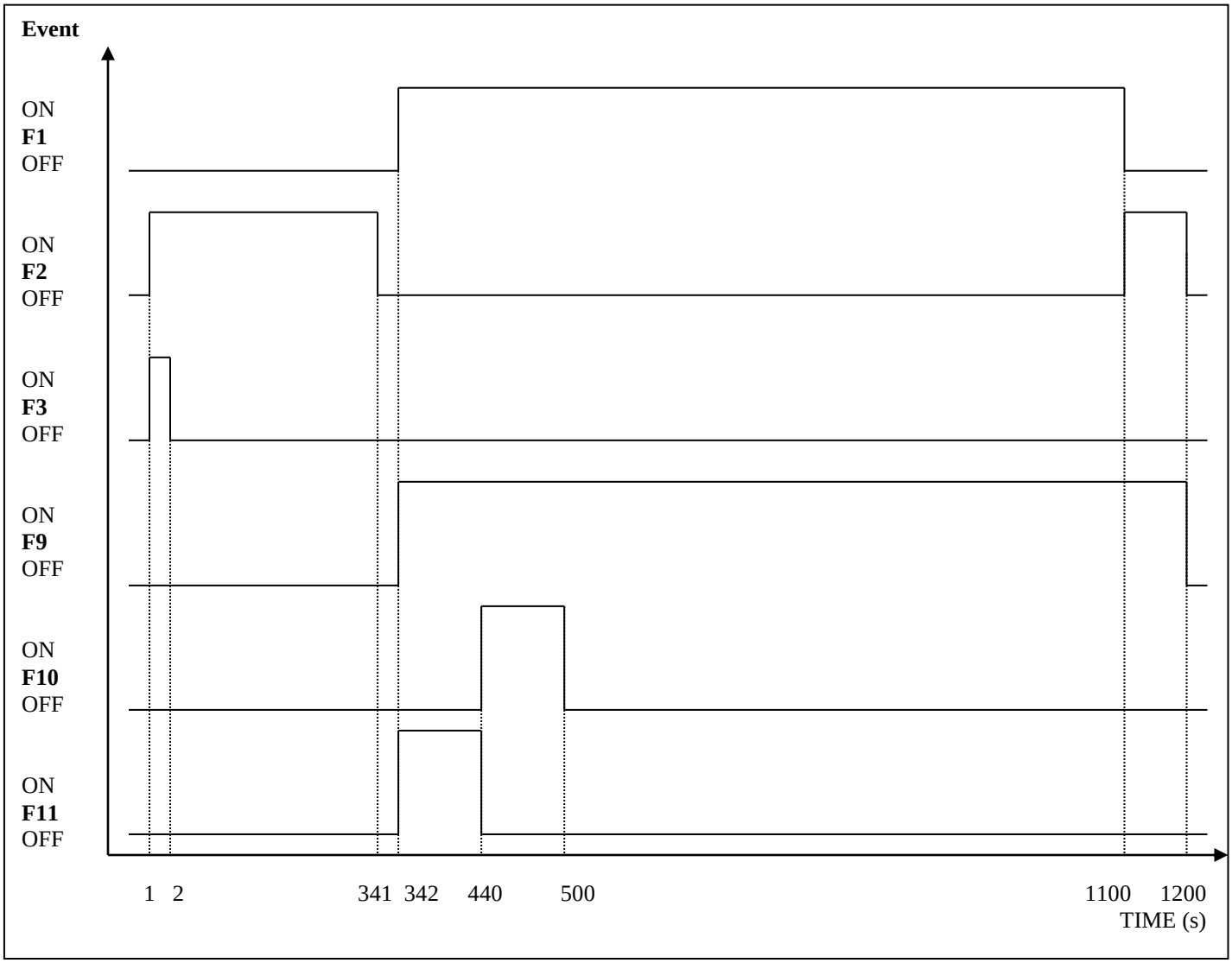
Phase 6 *(see BTX6 scheme)*
In the last phase of the cycle, while hydrocarbons eluted from capillary **COLUMN** are detected by PID and managed by micro computerised electronics. **RSV1** Bi-matic rotation valve return into stand still position allowing the "**TENAX-TRAP**" start new sampling phase. Sapling pump switch in on and suck sample.



Adjustable 0÷10 Vdc analogue signals (as optional also 4 –20 mA) will be available on the output connectors (Rear Panel).
Instrument operating conditions as well as all set values are shown in the final check card.
Analytical cycle will be repeated every 10-20 minutes (according to the programmed chemical analysis); measured data will be updated every 10-20 minutes.

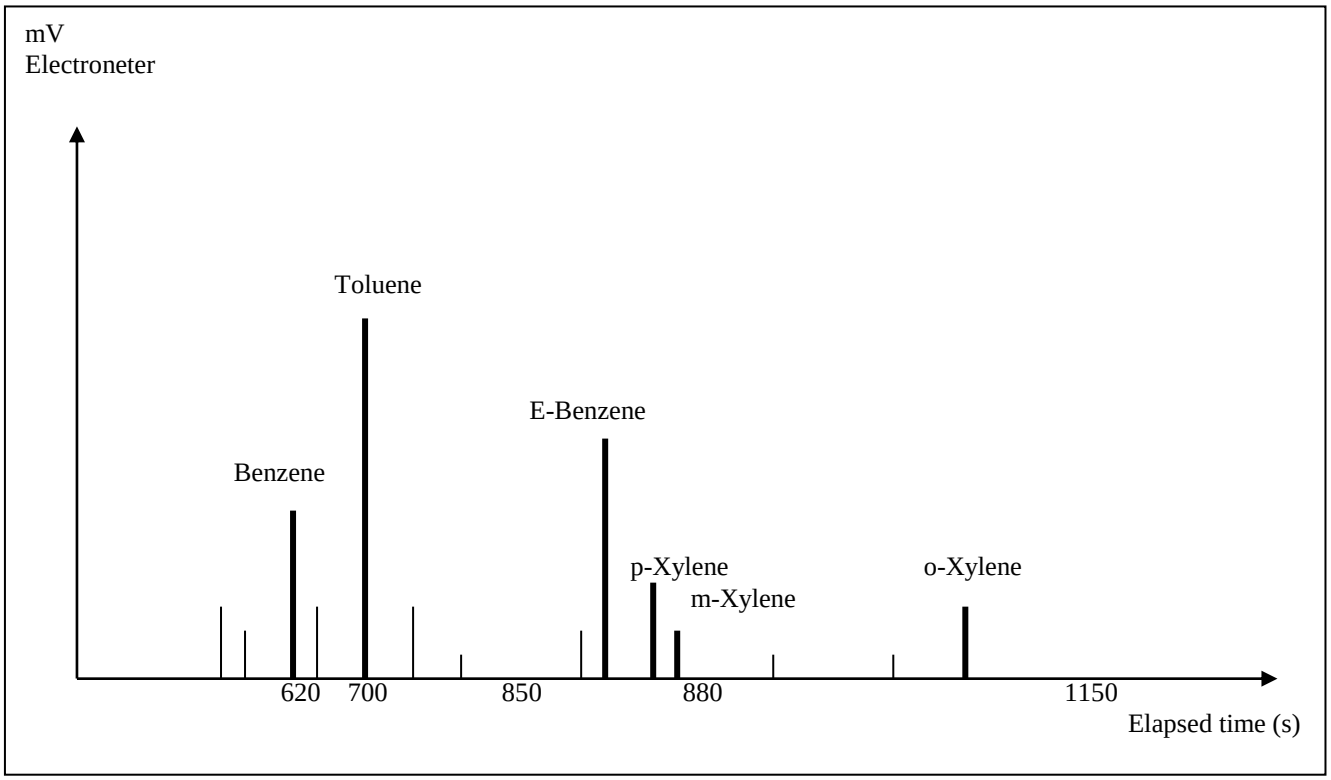
NOTE: According to required detection limits of the species under analysis phases 1, 2, 3 can be repeated many times.

The analytical cycle (in case of 20 minutes cycle, one of the longest) can be visually summarised:



FUNCTION	DESCRIPTION	EVENT #	ON1 Seconds	OFF1 Seconds	ON2 Seconds	OFF2 Seconds
F1	TRAP ENRICHMENT HEATING	1	181	780		
F2	SAMPLING PUMP	2	1	180	940	999
F3	AUTO ZERO	1	1	2		
F9	ENRICHMENT ROTATION VAL	1	181	1000		
F10	INJECTION VALVE	1	275	370		
F11	ENRICHMENT TRAP E/V	1	182	275		

The relevant Electrometer (0 -10 V range) output will be:



CHANNEL	CHANNEL STATUS	INTEGRATING WINDOW	
		TIME ON seconds	TIME OFF seconds
BENZENE	ON	451	470
TOLUENE	ON	527	557
ETHYL-BENZENE	ON	650	671
m-XYLENE	ON	673	676
p-XYLENE	ON	678	710
o-XYLENE	ON	778	812

The length of analytical cycle is programmable according to the needs connected to the application; the above described one lasts 1200 seconds.

After 1200 seconds the analyser is ready to repeat the same cycle, in a logic of either defined numbers of cycles or of continuous operation according to the operator choice.

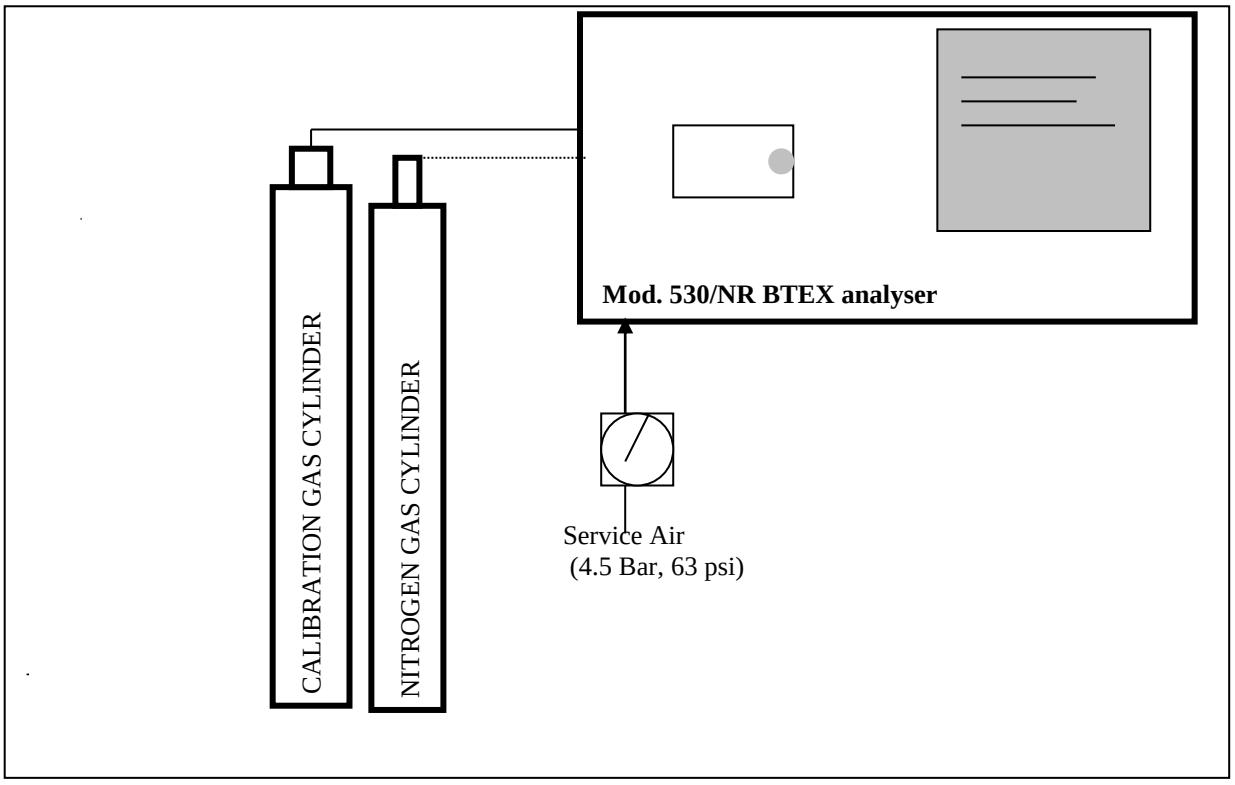
The versatility of user-friendly firmware both from the analytical point of view and the program configuration, allows, by choosing the suitable chromatographic column and the relevant software program to detect specific compounds in air quality monitoring and at emissions. This is a great advantage with respect to the instrumentation actually available on the market.

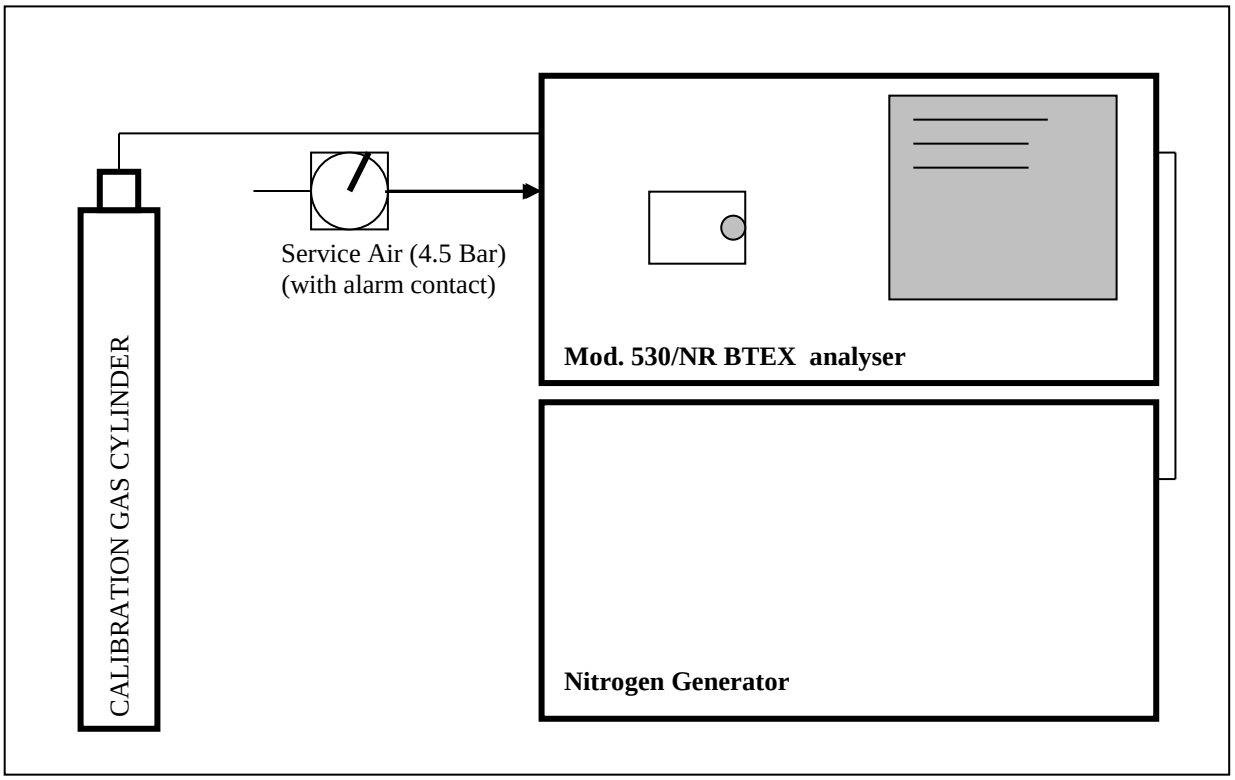
8.0 FIELD COMMISSIONING AND INSTRUMENT START UP

- Connect the plumbing between the cylinder gas pressure reducer and the relevant gas connector located on the analyser rear panel and indicated as and Carrier.
- Connect the power cord to the main power supply (220/110 Vac, 50/60 Hz, 300 VA).
- Open the cylinder interception valve and regulate the relevant output pressures from the cylinder as follows:

  Nitrogen 2 Bar,

  if for the servo commands a separated compress air is used, regulate it to 5 Bar.
- The relevant pressure on the manometer located on the instrument front panel (behind the front panel door), instead, must be set according to the value indicated in the instrument **final check card** at the end of this operating manual, that goes with each instrument.
- Switch the Power switch, on the rear panel of the instrument, in to position **ON** (indication I), now the instrument is **ON**, the display is **ON**, the start up procedure is running and the working display is on the screen.
- As the instrument reaches the set temperature, it starts the control of the UV lamp.
- When UV lamp in **ON**, the instrument enters into the **STAND-BY** mode.
- If on the display any alarm messages are present, as long as all alarm conditions are not corrected the indication "**STAND-BY**" will not be displayed.
- Wait further 5 minutes then press the push button **AUTOZERO**.
- Finally press "**MONITOR**" push button. The instrument starts the analysis cycle(s).


Mod. 530/NR BTEX analyser
CALIBRATION GAS CYLINDER
NITROGEN GAS CYLINDER
Service Air
(4.5 Bar, 63 psi)


Service Air (4.5 Bar)
(with alarm contact)
Mod. 530/NR BTEX analyser
CALIBRATION GAS CYLINDER
Nitrogen Generator

9.0 IN BUILT FIRMWARE

(Do not enter the service menu unless necessary)

At the switching ON, after a few seconds the front page (HOME PAGE) is displayed.

RANGE: select range of the instrument (usually 4 or 6 ranges freely selectable)
IGNITE: for the ignition of PID flame.
DIAGNOSTICS: information on working set and conditions.
AZERO: electronical zeroing of the PID signal.
ZERO: ZERO command (the instrument enters ZERO at the end of running cycle).
SPAN: SPAN command (the instrument enters SPAN at the end of running cycle).
MONITOR: measuring condition.
STOP: the instrument stops working and enters into STAND BY condition.
GRAPHS: the running chromatogram is displayed.
SETTINGS: the working sets and condition of the instrument may be modified while in operation (MONITOR), *front end/back end feature*.

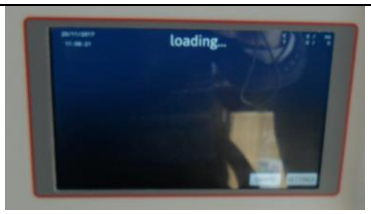
9.1 MENU GENERAL DESCRIPTION

As previously said, the basic instrument menu is self-explaining, user friendly menu. With simple information the operator may carry out the fundamental operation on the instrument:

i)Start the instrument operation (MONITOR icon).
ii) Check/Calibrate ZERO
iii) Check/Calibrate SPAN.
iv) Modify the instrument basic configurations, excluded the modifications done only in the service menu.
v) Some important information to note:
1- Whenever you open a window from the HOME menu you always may return BACK without recording the possible modifications.
2- When the instrument is switched ON and starts warming up, he reads automatically the default configuration from the USB port (see picture …) provided that the digital pen with the default configuration is inserted in the USB slot.
3- The New Software is of the type multitasking (or front end – back end). It means that the operator may dialogue with the electronics while the cycle is carried on.

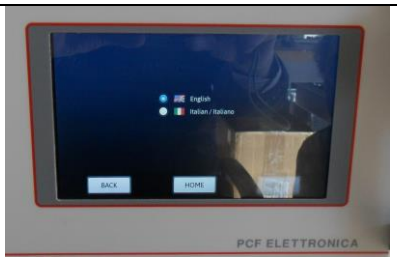
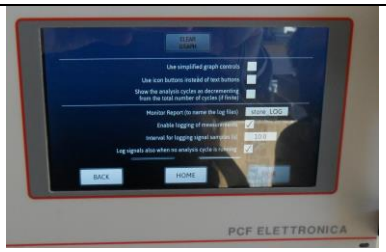
9.2 HOME MENU

Let' see step by step what happens when you switch ON the instrument.

STEP	DESCRIPTION	PICTURE
1	At switching ON the instrument shows the PCF's LOGO. The Model Number of the unit in operation is displayed. Remember that the same electronics may be configured for Mod. 529/NR NMH, 530NR BTEX and for Specific Compounds (e.g. AROMATICS)	
2	The instrument reads the default configuration from the USB port.	
3	The instrument warms up. No monitoring in this phase. Please note that on the bottom lines of the display the basic icons are displayed.	
4	The instrument concluded the warm up phase, note that the temperature of the analytical temperature reached the set value (left-hand, middle of the screen) The SW informs the operator that the FID flame is OFF. If the switching ON of the flame is programmed as automatic the instrument will switch on the same otherwise the operator must switch it on by touching IGNITE icon.	
5	The instrument is telling that it tries to switch ON the flame. Please note that it will do three trials. If they are unsuccessful an alarm will be shown. The first time the ignition of the flame could be difficult because there is air in the H2 tubes. We suggest to purge the H2 tube before starting the igniting of the instrument.	

6	The SW tells that it is ready to: - Start the cycle (MONITOR icon) - Check/Calibrate ZERO - Check/Calibrate SPAN (the range)	
7	The operator has chosen MONITOR. The instrument enters in monitoring (measuring) phase. Do not bother about the absolute values. As the instrument was opened and set different times the first analysis will not be reliable.	
8	This is the video display when the operator chooses SETTING icon. All the simple settings of the instrument are displayed. The more advanced settings are reachable from the Service Menu. Note that whenever you open an icon you have three choices: - To return back to the previous step. - To return to HOME display. - To save the introduced modifications. -	
9	Once the IGNITE icon was touched the operator may choose to ignite the flame - Automatically: auto-ignition tipped off - Manually, auto-ignition **not** tipped off - Switch OFF the flame.	
10	Whenever the operator did not save the set modification.	
11	RANGE, to choose the measuring range as default one. The instrument may be programmed for up to 6 ranges: from 0-5 mg/m^3 up to 0-10,000 mg/m^3	

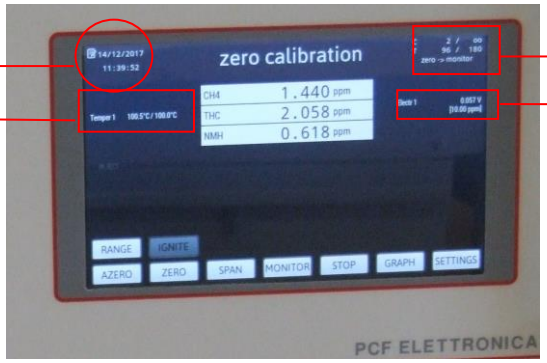
12	TEMPERATURE, the setting of the temperature controlled chamber temperature.	
13	CALIBRATION, for setting the calibration reference values.	
14	ANALYSIS PROGRAM (CYCLES), to set the number of measuring cycles. When setting 00, the instrument measures continuously for infinite cycles. Till STOP Is selected.	
15	DATE AND TIME, to set the correct date and time.	
16	IP ADDRESS, setting of the instrument identification code.	
17	DIAGNOSTIC, it shows the working conditions of the instrument. No setting possible.	

18	LANGUAGE selection.	
19	OPTIONS, further setting of the instrument operating mode.	
20	SERVICE, the way to enter into the service menu Is protected by a password. **Do not enter unless strictly necessary**.	

10.0 ANALYSER CALIBRATION

Whenever either a *check of or a full calibration* is required the instrument must be in the analysis mode. Only with the instrument in analysis mode the "SPAN" and "ZERO" function can be activated.
In order to start these procedures, the relevant icons must be selected on the lower part of the screen by moving around with arrow push buttons.

If the "ZERO" or "SPAN" icon is selected *the instrument performs the given command at the end of the current analysis cycle.*
Please note that, as the instrument measures with the second injection the TVOC, the latter in the calibration cylinder should not be higher than the selected range.

	Please read carefully the display you will find the fundamental working conditions of the instrument	
Date and time GC chamber temperature (present and set one)		Cycle number/00 (continuous) Elapsed time After ZERO it returns to MONITOR Electrometer output Vdc Selected measuring range

When the instrument is in “READY” condition it is like in a stand by conditions, waiting for next command.

Always press MONITOR button to resume the monitoring cycle.

Always keep in mind that the instrument is working per cycles, therefore after any command you must wait till the instrument concluded the previous operation.

10.1 "SPAN" CALIBRATION PROCEDURE

The instrument is on line; it is working regularly on sample gas.

1- Connect to “SPAN”, on the rear panel of the instrument, the calibration gas source, namely gas cylinder, permeation tube or multipoint calibrator.

2- Open the valve of calibration gas cylinder and check/regulate a flow of 20-40 ml/min that is getting out of “VENT” output on the rear panel of the instrument.

3- From front panel display select “SPAN” procedure, by touching the icon on the screen.
At the end of running analytical cycle the instrument enters the calibration procedure and start a new analytical cycle.

4- Select the correct measuring range to cover calibration concentration values by relevant push button.

5- Follow the indications and requests from the in-built SW. All the steps are self-explaining.

6- Operator must wait 3-5 full analysis cycles. Then the instrument will ask if the operator intends to carry out a full calibration.

7- Once the calibration was performed press MONITOR icon and the instrument returns to monitoring conditions after the end of running cycle. The calibration gas source can be closed.

Example:
Gas cylinders contains 4 ppm of CH_4 and 1 ppm of C_3H_8, air balance.
The THC equivalent, normalised against methane is (4+3) = 7 ppm.
By the above calculation we normalised all measurements taking methane as reference molecule.
The suitable range can either be 10 or 20 ppm full scale

NOTE: do not go with the amplification value lower than 01.00 as it would mean a gain factor lower than 1.
At the end of calibration procedure shut the calibration gas cylinder.

10.2 "ZERO" CALIBRATION PROCEDURE

Select the "ZERO" check procedure; once the instrument carries out the current analysis cycle, with the new analytical cycle the instrument enters into "ZERO" mode.

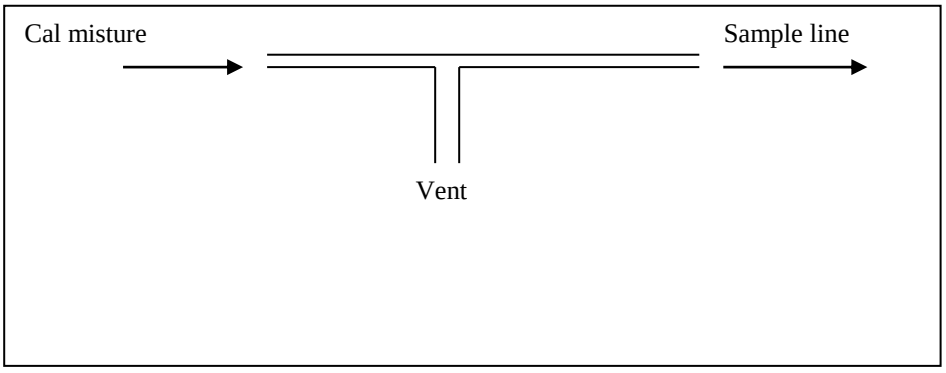
The "ZERO" mode consist in a certain number of analysis in "Blank", i.e. a UPP air is introduced into the chromatographic column, that exactly the same air used as carrier in order to evaluate the base line behaviour with no sample in the instrument.

The "ZERO" regulation on the present type of chromatograph does not make sense, as the auto zero function carries out an instrumental zero before any analysis.

10.3 **ZERO/SPAN CHECK**

FID detector is a very stable detector in the time.
Provided you keep the gas supply pressures and flows constant you will get a constant response of the instrument.
Instead of performing a full calibration of the instrument, with adjustment of response factors, you may just check the status of calibration of the same.
For this matter please carry our just a calibration check:

a. supply on the sample line either a zero or calibration mixture under vented conditions.



2- Check the response of the instrument, if it's within 5% of full scale do not modify the response factors.

11.0 ANALYSER MAINTENANCE PROCEDURE

(CONCISE INFORMATION, EXTENSIVE INFO IN THE SERVICE MANUAL)

All the operations described in the present section must be performed with main power supply to the instrument OFF (disconnect the mains plug) as well as the carrier gas cylinder closed

Please remember that whenever you take a step in the maintenance of the instrument be sure you will be able to return back in the original conditions.

REPLACEMENT OF INPUT SILICA WOOL FILTER (Whenever is present in the analyser)

- Open the measuring chamber. If the instrument is just switched off wait for the cooling down to about room temperature.

- With an 8-mm spanner disconnect the silica wool holder "F" inserted between the "sample-in" connection and the "U2" SPAN solenoid valve.

- Open the filter older by employing two 17 mm spanner; either replace the steel sintered filter or wash it in a ultrasonic bath with a solvent at 80°C. Mount back everything with great care taking special care to the tightness of the pneumatic connections.

- Close the measuring chamber. If the instrument is just switched off wait for the cooling down to about room temperature.

- Bring the analyser into measuring mode (again following the standard procedures previously described in this manual) and leave the instrument to work for about an hour without performing any setting.

- Perform a calibration check and eventually adjust the Calibration values. ….

REPLACEMENT OF INPUT SINTERED FILTER

- Open the measuring chamber. If the instrument is just switched off wait for the cooling down to about room temperature.

- With an 8 mm spanner disconnect the steel filter holder "F" inserted between the "sample-in" connection and the "U2" SPAN solenoid valve.

- Open the filter older by employing two 17 mm spanner; either replace the steel sintered filter or wash it in a ultrasonic bath with a solvent at 80°C. Mount back everything with great care taking special care to the tightness of the pneumatic connections.

- Close the measuring chamber. If the instrument is just switched off wait for the cooling down to about room temperature.

- Bring the analyser into measuring mode (again following the standard procedures previously described in this manual) and leave the instrument to work for about an hour without performing any setting.

- Perform a calibration check and eventually adjust the Calibration values. ….

CARRIER flow rate check

By employing an 8 mm spanner disconnect the 2 mm steel tube connected to PID detector through the "IN" tagged input; then by a soap bubble flow meter and/or by a digital flow meter check that flow rate corresponds to the value indicated in the final check table.
In case for the same air pressure the flow rate differs from the reported one in the check table restore the correct flow rate by varying the pressure of Carrier air operating on the relevant pressure regulator located on instrument front panel. If the correct flow rate cannot easily restored replace the capillary.
When the check is completed connect back the steel tube to PID detector.
In the operation of connecting the steel tube to the PID detector a special care and attention must be given to the correct screwing of the connection in order to both avoid any damage to the thread as well as to have a tight connection.
The tightness of all connection are fundamental for a correct working condition of the instrument.

11.1 SUGGESTED MAINTENANCE SCHEDULE

Basically PCF Mod. 530/NR BTEX analyser is a relatively simple process gas chromatograph with tested parts to last years without maintenance.

The ten port valves, with purge and trap device, the most sophisticated parts in the instrument, should last more than three years without maintenance.

For a good performance in the field it is suggested to commission the instrument since the beginning with the correct gas qualities and pressure as well as to check regularly its working conditions.

For a good commissioning of the instrument we recommend:

- standard tool case
- digital multi-meter and oscilloscope
- strip chart recorder (0-10 Vdc).

Time	Operations	Actions (if necessary)
Commissioning	Check: Power Supply Gas Supplies (quality and pressure) Service Gas pressure Analogue outputs	
Monthly	Sample flow	Replace or clean filters Front filter and/or Sintered filter
Every 3 months	Sample flow Membrane pump	 Rebuild pump
Every 6 months	Calibration check	Change coefficients
Every year	Retention times Check MFM	Adjust retention times Replace
Every 3 years	Chromatographic Column Rotation valve	Replace column Maintain or replace

11.2 TROUBLE SHOOTING

Instrument completely dead:	
- Check the mains power supply	Connect power supply
- Check the fuse on the power supply socket	Eventually replace the fuse
- Mother Board is not working	Replace Mother Board
The UV lamp does not light	
- Mother Board is not working	Replace Mother Board
Auto zero does not perform	
- Electrometer board not working	Replace electrometer
- Mother Board not working	Replace Mother Board
- Key Board not working	Replace key board
Output signals dead	
- PID detector not working	Replace PID detector
- Electrometer board not working	Replace electrometer board
- Output signal board not working	Replace output signal board
- Mother board not working	Replace Mother board
4-20 mA signal not present	
Check external connection	Restore external connection
4-20 mA board not working	Replace 4-20 mA board
Lack of Carrier gas pressure	
- Supply air cylinder either empty or with closed interception valve	Open the gas cylinder or replace it
- Leakage in the relevant circuit	Find and mend the leakage
- Pressure regulator not working	Replace it
- Manometer not working	Replace it
Auto zero function not operative	
- Electrometer board not working	Replace electrometer board
- Mother Board not working	Replace Mother Board
- Key Board not working	Replace key Board
No variations on output signals	
- PID detector not working	Replace PID detector
- Electrometer board not working	Replace electrometer board
- Output signal board not working	Replace output signal board

- Mother Board not working	Replace Mother Board

Missing 4-20 mA signal

- Check the external interconnection	Restore the interconnection
- 4-20 mA output signal board not working	Replace it

No pressure on carrier gas

- Air gas cylinder either empty or closed	Open the air gas cylinder or replace it
- Leakage in the relevant circuit	Amend the leakage
- Pressure regulator not working	Replace pressure regulator
- Manometer not working	Replace manometer

No circulation of sample

- Adduction sample line either intercepted or clogged	Restore correct sample flow
- Membrane pump not working	Either replace or repair membrane pump
- Mother Board not working	Replace Mother Board
- Rotation valves not working properly	Replace rotation valves
- Clogging in the analytical circuit	Find and amend the clogging cause and restore the correct flow

Low calibration values

- New calibration procedure must be performed	Carry out a new calibration
- Sampling loops partially clogged	Replace sampling loops
- Defective rotation valves	Replace rotation valves
- Gas chromatographic column not active any more	Replace GC column

12.0 RS-232 SERIAL AND ELECTRICAL CONNECTIONS

The new Mod. 529/NR foresees three types of serial communication: RS 232-345 and Ethernet/LAN.

All the serial communications operate both ways i.e. for the input as well for the output of the instrument.

The serial communication takes place in ASHI code at 9600 baud rate, no parity bit, 8 start bit 1 stop bit.

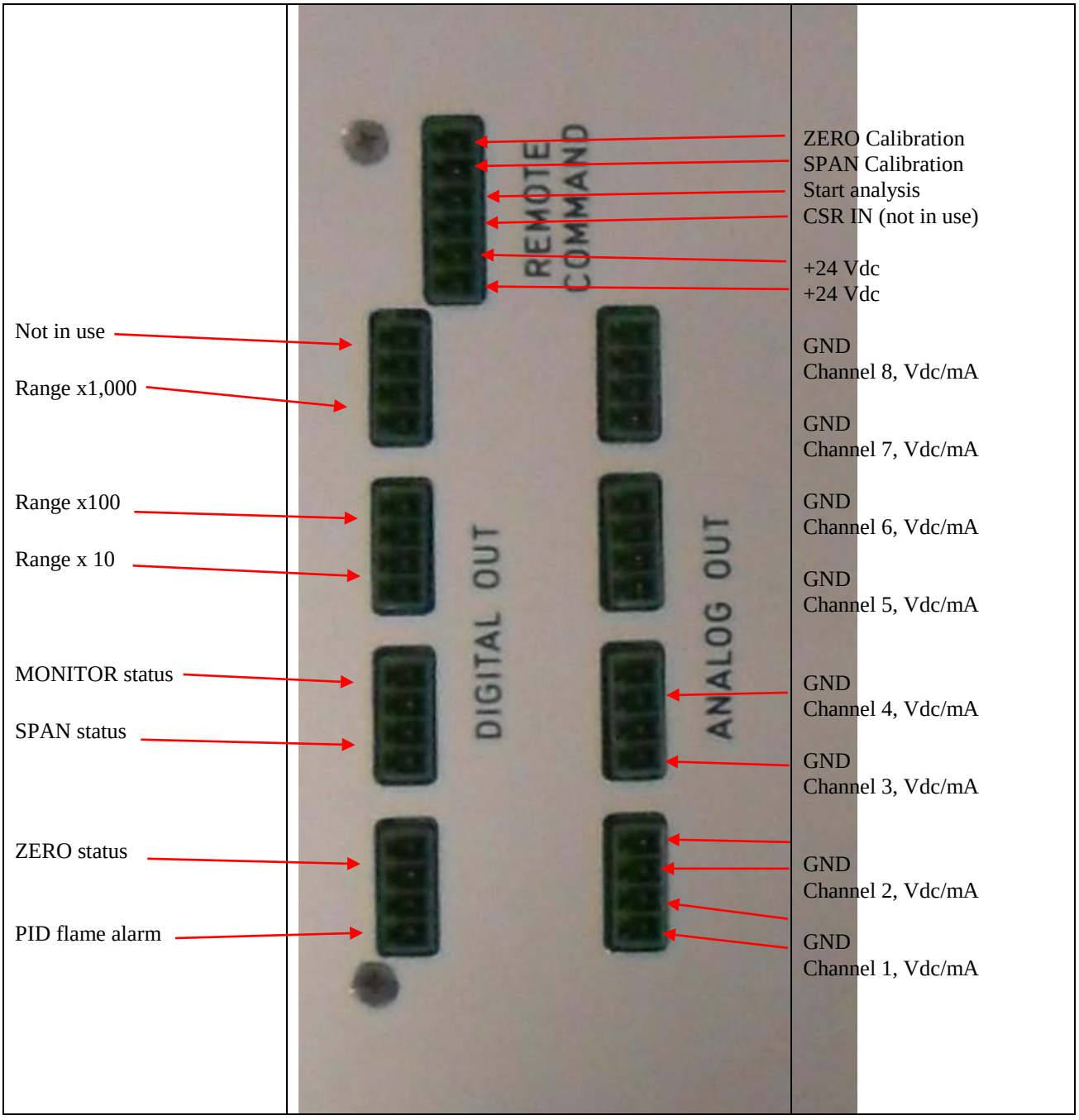
RS 232 serial output port connection scheme (11)

7 = GND

3 = RX

2 = TX

ELECTRICAL CONNECTIONS



NOTE:

1- Clean contacts, normally CLOSED/OPEN according to the setting from the front panel.

2- Ranges:

Range x1 No contact closed	Range x 10 Relevant contact closed	Range x 100 Relevant contact closed	Range x1,000' Relevant contact closed	Range x10,000 Ranges x10+1,000 closed	Range x100,000 Ranges x100+1,000 closed

13.0 SPARE PARTS

Code Number	Description
09520114	Sample capillary
09520115	Hydrogen capillary
09520116	Air capillary
09520192	Nitrogen/Hydrogen mass flow controller
09520120	Pressure regulator
09520121	Bar gauge
09520125	PID detector sub assembly
09520130	Red LED
09520131	Green LED
09520132	Return switch
09520133	Stable switch
09520134	SPAN potentiometer
09520135	Digital display
09520136	Power supply transformer
09520137	Power supply socket
09520138	Cooling fan
09520141	Electrometer PCB
09520147	4-20 mA output PCB
09520143	Function programming PCB, main PCB, mother board
09520144	Auxiliary services PCB
09520145	Temperature regulator PCB
090-0025	+5 Vdc, +24 Vdc Stabilised Power Supply PCB
090-0026	+5 Vdc, ±15 Vdc Stabilised Power Supply PCB
09520150	PT 100 temperature probe
09520152	PID detector heating resistance
09510115	Eight port bi-matic rotation valve
09510123	Rotation valve rebuild kit
09514822	Stainless steel tubing (10 m)
09514123	Seal set
09514124	Stainless steel pneumatic connections
09510112	SPAN solenoid valve
09510113	Purge & Trap device sub assembly
09510193	Purge & heating element
09510193	RSV rebuild kit
09514125	Fuse set
09510351	Sampling pump
09514126	Sampling pump rebuild kit
09510201	Hydrogen interception solenoid valve
09514127	Sintered filter
09510202	Rotation valve pilot solenoid valve
09514128	Flame ON temperature sensor
09514129	Flame ignition resistance

10010402	Controller PCB
09510501	Analogue and status signals PCB
09510336	Electrometer amplifier PCB
	UV Lamp Driver Board
	UV lamp for PID detector
090-0014	Touch screen colour digital display
09514130	Mains switch
09510943	Chromatographic column

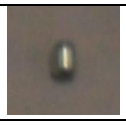
Consumables set (including)

09510123	N.1 RSV rebuild kit
09514126	N.1 Sampling pump rebuild kit

Spare parts set (including)

09510943	N.1 Chromatographic column
09510113	N.1 Purge and Trap device
09510221	N.1 Pressure regulator
09510115	N.1 Rotation valve

The most frequently used pneumatic connections

POS.	P/N	DESCRIPTION	PIC
1	062-6119	M12 Bolt with tightness	
2	100-0993	Ferrules for tube 2/1 (10 pcs x set)	
3	100-0992	6MB adapter for tube 2/1 (10 pcs set	
4	100-6125	Linear conjunction for tubes 2/1	
5	100-6126	T-junction/adapter for tubes 2/1	
6	100-6127	2/1 tube to 6/4 tube adapter	
7	062-6302	Pieces of 2/1 tubes	

PCF ELETTRONICA S.r.l.
MOD. 530/NR (BTEX)
AROMATIC HYDROCARBON ANALYSER

Before shipment each instrument is thoroughly checked in our laboratories.
Final reports are produced that accompany in copy the equipment.
Please keep the documents with the original operating manual enclosed with the instrument.

FINAL CHECK CARD

CARRIER Bar …… ml/min ……

OVEN ……°C
COLUMN TYPE : ……..

CALIBRATION PARAMETERS

Range:	Component		Component	
		: …….. ug/m^3		: …….. ug/m^3
100	BENZENE	: …….. ADJ	TOLUENE	: …….. ADJ
		: …….. µg/m^3		: …….. µg/m^3
100	E- BENZENE	: …….. ADJ	p-XYLENE	: …….. ADJ
		: …….. µg/m^3		: …….. µg/m^3
100	m-XYLENE	: …….. ADJ	o-XYLENE	: …….. ADJ
		: …….. ug/m^3		: …….. ug/m^3
500	BENZENE	: …….. ADJ	TOLUENE	: …….. ADJ
		: …….. µg/m^3		: …….. µg/m^3
500	E- BENZENE	: …….. ADJ	p-XYLENE	: …….. ADJ
		: …….. µg/m^3		: …….. µg/m^3
500	m-XYLENE	: …….. ADJ	o-XYLENE	: …….. ADJ

Service Engineer: _____ Date: _____