Gas Analyzer Performance Tester
Mod. D/P 99

Operating Manual
(Short Guide to use the SW)

PCF Elettronica

1. FOREWORDS

Mod. D/P 99, the Gas Analyzer Performance Tester, automatically performs linearity, Lower Detectable Limit (LDL) and repeatability tests on environment and stack analyzers at different steps either with continuous or alternative runs.
It differs from the most frequently used dynamic diluters because it checks automatically continuous analyzers, automatically reporting on the operating status of the same.

1.1 Key features

- Up to four mass flow meters lodged.
- Mixing chamber made of "Duraglass".
- Linearity tests under programmable multipoint.
- Preliminary test s of hysteresis and drift.
- Linearity test at different levels (according to UNI EN 14181).
- Repeatability limit test s (according to ISO 9169:2005)
- Lower Detectable Limit tests (according to ISO 9169:2005)
- Uncertainty on the generated concentration <1%

1.2 General description

Mod. D/P 99, also called metrologic dynamic diluter, has been studied, developed and manufactured to check and report on linearity of specific gas analyzers such as NO, NO_2, SO_2, O_2, CO, COV, HCl etc. starting from certified gas mixtures by generating multiple dynamic dilutions.
Our exclusive unit differs from most of similar instruments, proposed on the market, because further to generating dilution steps it calculates the monitor actual performances taking into account the outputs from the analyzers under test procedure.
By a specially designed SW package it automatically calculates linearity responses, employing procedures that take into account possible drift and hysteresis of the analyzer under test.
So Mod. D/P 99, connected to a PC through an USB port, is capable to determine and report the instrument linearity error , define the best calibration line related to the relative oscillation band, determining the uncertainty of concentration precision of the test gas from which the accuracy of the measures directly derives.
It should be noted that the performance of this calibrator allows to verify the linearity of gas analyzers on all scales for different concentrations, with the use of a single gas mixture for each specific compound.
The flow mixing chamber is made of glass Duraglass that enables better and homogeneous dilution of reference gas mixture, but, on request, we can also supply mixer chamber made of other materials.

2. TECHNICAL SPECIFICATIONS

2.1 General specifications

Stabilization time: 15 minutes max.

Input Gas Pressure: 0,1 - 2,5 Bar.

Calibration gas inputs: from 1 to 4 intercepted by solenoid valves.

Contact materials: PTFE - VITON - GLASS.

Mass Flow Meter (MCF) range: 0-5000 ml / min.

MFCs for sample gas: from 1 to 3 (each one with various ranges on request)

Sample gas MFC: from 100 ml / min. up to 1,000 ml / min. (to be defined at order)

Dilution gas MFC: from 5,000 ml / min. up to 10,000 ml / min. (to be defined at order)

MFC Accuracy: 0.5% of full scale

MFC Linearity: 0.1% of full scale

MFC Reproducibility: 0.05% of full scale

Dilution factor (on request): from 1-100 to 1-50

Concentration: min. 1 ppm

Accuracy: 0.005% - 0.01%

Dilution MFC precision: 0.8% of full scale

MFC flow variation : 0.35% of full scale

Power supply: 220/110 Vac. 50/60Hz (specify in the order).

Dimensions: 150 x 216 x 360 mm (6 "x8.5" x 14 ", HxWxD)

Weight: from 4 to 8 Kg.

2.2 Available reports:

- Report on linearity tests.
- Detailed information about the calculated tests.
- Validation test spreadsheet according to UNI EN 14181.
- Validation test spreadsheet according to ISO 9169: 2005.

2.3 Our device may automatically run 12 tests

- Linearity Check, in discontinuous mode, 4 concentrations, 3 repetitions (UNI EN 14181 2005).
- Linearity Check, in continuous mode, 4 concentrations, 3 repetitions (UNI EN 14181 2005).
- Linearity Check, in continuous mode, 5 concentrations, either 3 or 5 repetitions (UNI EN 14181 2005).
- Linearity Check, in discontinuous mode, 5 concentrations, either 3 or 5 or 10 repetitions.
- Linearity Check, in continuous mode, 5 concentrations, either3 or 5 or 10 repetitions.
- Linearity Check, with Lower Detection Limit and repeatability limit report (UNI EN ISO 9169: 2005)

2.4 Special SoftWare package

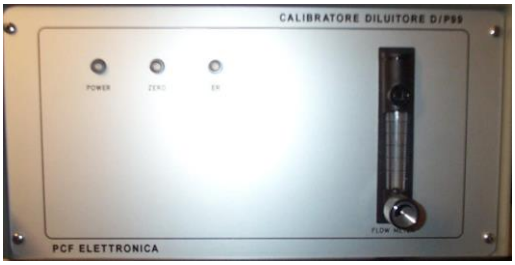
Developed and validated in accordance with the UNI EN14181 and ISO 9169, it shows the synoptic panel of the calibrator pneumatic circuit.
It is able to work on windows XP, Win 7 win 8 SW operating systems, it allows the setting of the test parameters.
It is possible to choose up to a maximum of five concentration levels of the gas in analysis for the drawing of calibration curve, covering the entire scale.
It automatically calculates the programmed concentration
samples of the gaseous mixture, the values of analyzer response as well as the calibration curve.

3. PANEL DESCRIPTION AND COMPONENT PARTS

3.1 Front panel view
(Portable version)

Description of front panel controls and connections (portable version)

3.2 Front panel view
(rack mounted version)

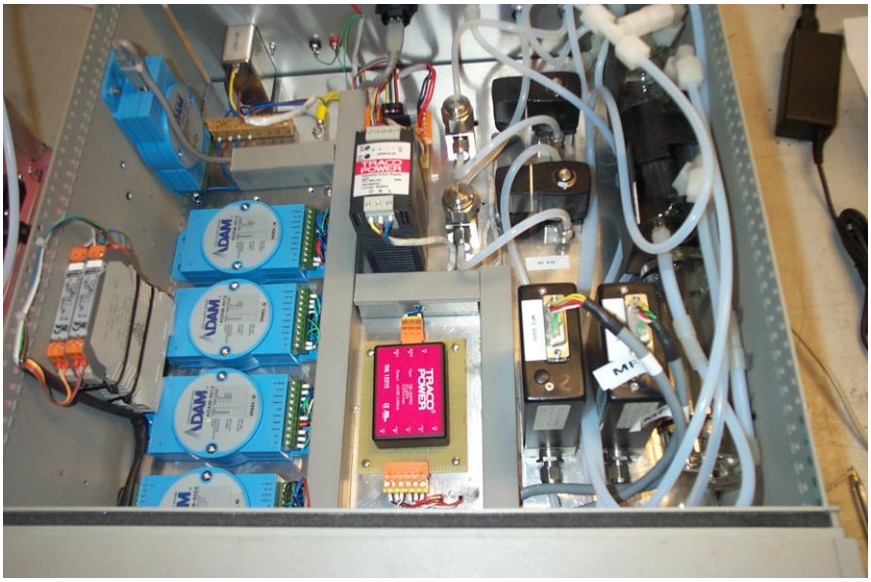


Description of front panel controls (rack mounted version)

3.3 Rear panel view

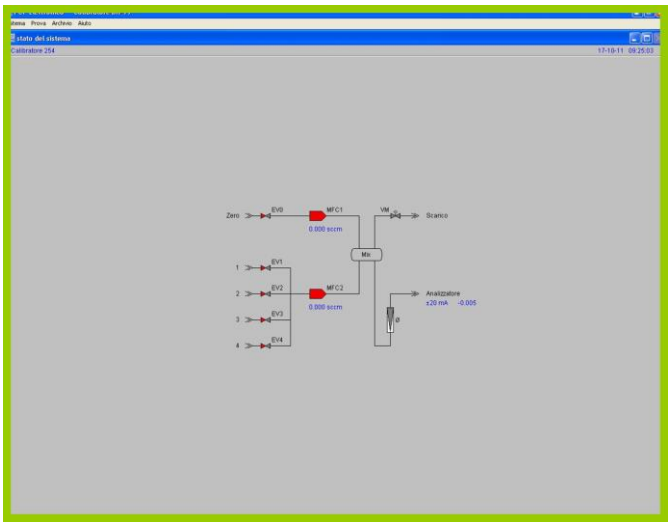
Description of rear panel controls and connections (rack mounted version)

3.4 Inner view



Description of inner parts

3.5 Pneumatic circuit



4 STARTING UP

Instructions for installing and configuring the supplied A.0.9 special SoftWare package

4.1 Specifications of the overall system required

- Operating system

The Windows operating system must be installed in the manner prescribed by its installation manual.
After installation the PC hard drive must ensure a clearance of at least 40 Mbytes.

- Video display and video PCB

The program is able to work with any combination of video card and video supported by Windows software package.
For optimal viewing, it is recommended to have at least 800x600 pixels and 16 colors.

- Printer

The program is able to use any printer supported by Windows, with A4 paper.

For good print quality it is recommended to take a printer with a resolution of at least 300x300 dpi.

You may also work without any printer. In the "*System menu / Settings*" command, for **printer** select -no. All print commands will be disabled.

- Security key

The security key received with the software must be connected to the USB port of your PC all the time of use of the program.

The connection and disconnection of the key must only be carried out with PC and printer OFF.

4.2 Special software package

4.2.1 Installation

The installation and the first execution of the program on NT, Win2000, Win XP systems must take place with administrator access type.

Run the program SETUP.EXE in the installation folder of the CD.

Then copy the entire contents of the CD folder DP99 in: C: \ program files \

4.2.2 Initial set up of the program

Start the program by double clicking with the mouse on the icon.

• Run the command menu **System** \ **Settings**.

• Set items, possibly referring to the guide-line “help”.

• If necessary, the system recognizes the new connected calibrator and asks for confirmation to create a default configuration

4.2.3 Entering parameters of the calibrator

Running the command menu **System** \ **Calibrator** you open a box that displays the parameters of the calibrator but does not allow to change them.

In order to change these parameters you should not use the command menu but are supposed to type on the small keypad the sequence **ALT + 0255** while the program displays the graphical pneumatic circuit schematics.

• Set the parameters required for the MFC (mass Flow Controller), using the results from the printed test 'Calibration curve' performed on the PCF lab bench CESI-LMIA.

• Click the **Edit** button to confirm the changes.

Note: Changes take effect from the next restart of the program: Before running the tests, close and restart the program.

You can also align the MFC to make sure that the set-point controlled is as close as possible to the actual set-point desired.
• After setting the parameters, close the dialog with the **Edit** button and then re-open it using **ALT + 0255**.
• Connect the calibrator vent to the exhaust gas extraction system.
• Connect a cylinder of nitrogen gas at the entrance of the calibrator zero.
• Open the manual regulator to the maximum flow.
• Click with the mouse on the button **Align** at the side of the data of the first MFC; the system performs the alignment and then closes the valves.
• Disconnect the nitrogen cylinder entrance zero gas and connect it to 4.
• Click with the mouse on the button **Align** at the side of the data of the second MFC; the system performs the alignment and then closes the valves.
• Disconnect the nitrogen cylinder, disconnect the vent (drain), close the calibrator manual flow regulator.
• Close the dialog with the **OK** button.

4.3. Creating test sequences.

4.3.1 Introduction

Tests carried out by the system are customizable.

You can add, edit or delete test sequences.

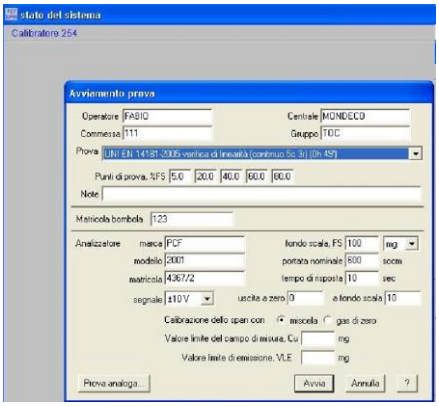
Each test sequence is described in an **ASCII** file stored in subdirectories **SEQ** (Sequence) program.

These files can be edited with a standard text editor such as Windows Notepad.

The following chapter describes the syntax used for sequences.

4.4. Configuring the controls (Control menus)

4.4.1 System



4.4.2 Setting

This command allows the program configuration.

a. Serial communication port
Select the serial port used for connection with the calibrator equipped with a 9-pin port.

b. USB communication port
Select the serial port used to connect with the calibrator equipped with USB port.

c. Location description:
Specify the text to use to identify the locations of tested systems (eg., Central, Calibrator D / P99).

d. Plant description
Specify the text to use to identify the tested plants (e.g. Group, stack, plant).

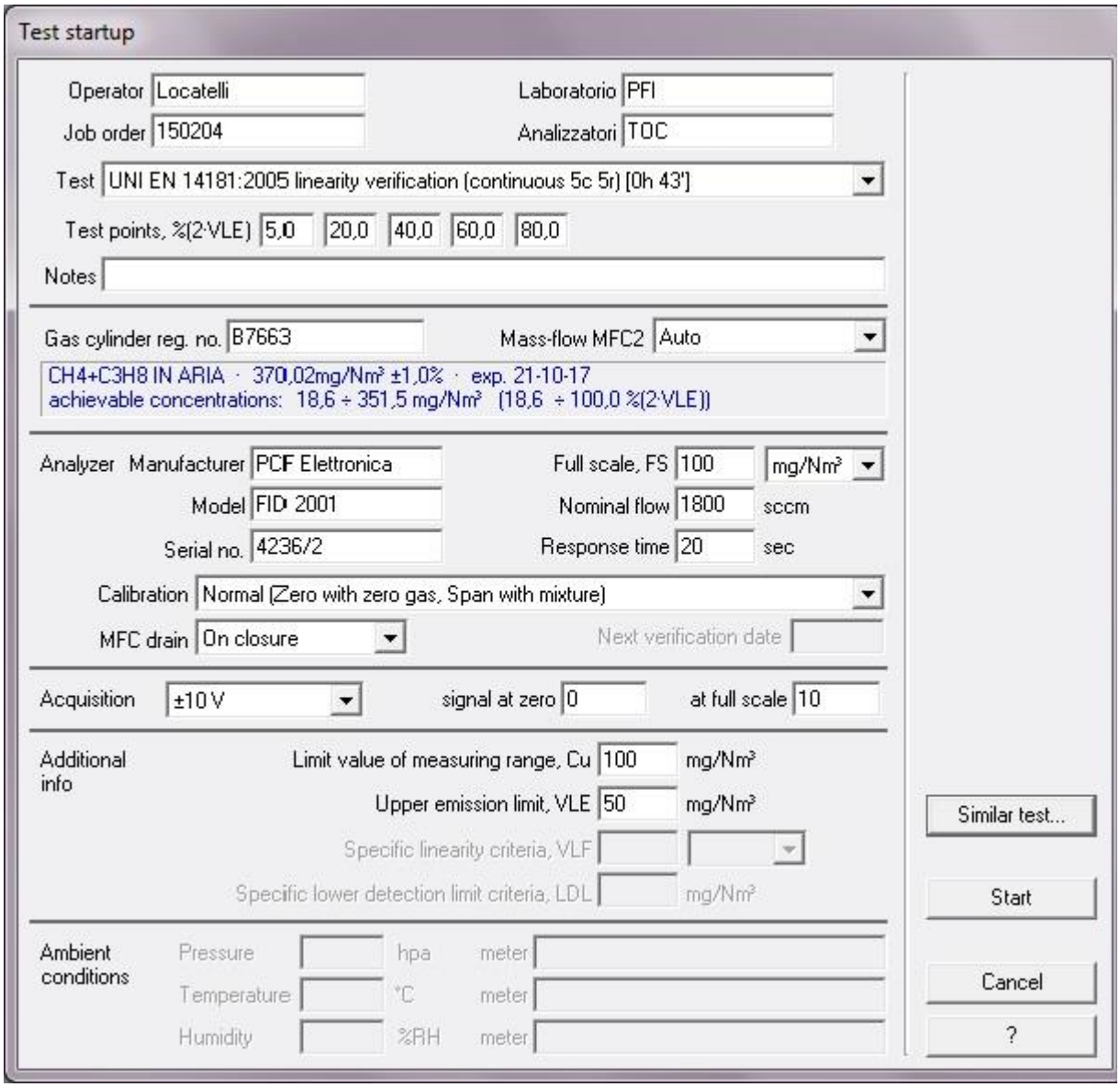
e. Printer
Select the printer you want to use.

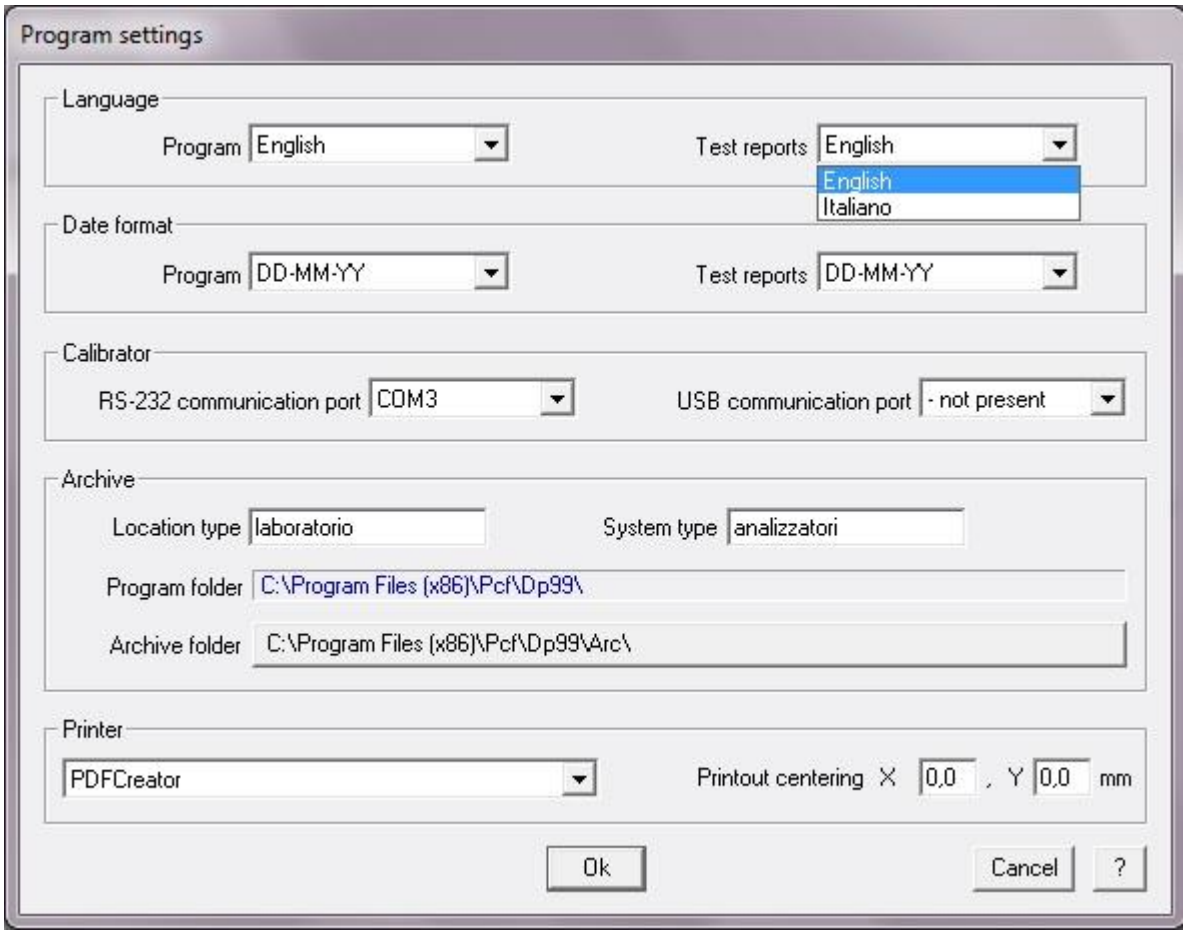
*Note: selecting – **none**, all print commands will be disabled.*

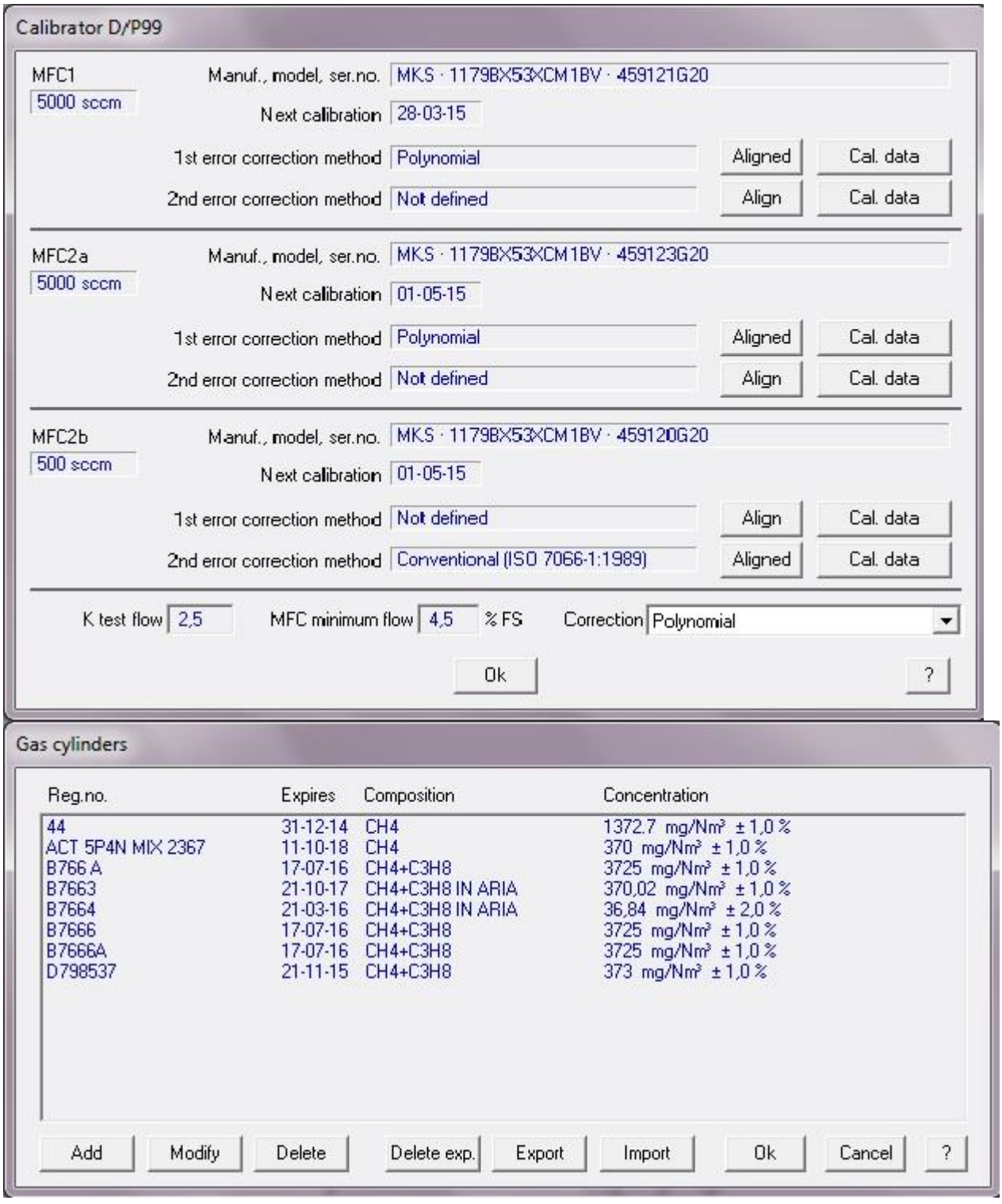
f. Printing format
Indicate the offset horizontal (x) and vertical (y) to be applied to centre prints on paper.
Note: Typically, prints are already centred leaving both values to zero.

g. Ok
Clicking this button settings are stored and made active; do not need to restart the program.

h. Skip
Clicking this button will skip change settings.


Test startup
Operator Locatelli
Laboratorio PFI
Job order 150204
Analizzatori TOC
Test UNI EN 14181:2005 linearity verification (continuous 5c 5r) [0h 43']
Test points, %(2·VLE) 5,0 20,0 40,0 60,0 80,0
Notes
Gas cylinder reg. no. B7663
Mass-flow MFC2 Auto
CH4+C3H8 IN ARIA · 370,02mg/Nm³ ±1,0% · exp. 21-10-17
achievable concentrations: 18,6 ÷ 351,5 mg/Nm³ (18,6 ÷ 100,0 %(2·VLE))
Analyzer Manufacturer PCF Elettronica
Full scale, FS 100 mg/Nm³
Model FID 2001
Nominal flow 1800 sccm
Serial no. 4236/2
Response time 20 sec
Calibration Normal (Zero with zero gas, Span with mixture)
MFC drain On closure
Next verification date
Acquisition ±10 V
signal at zero 0
at full scale 10
Additional info
Limit value of measuring range, Cu 100 mg/Nm³
Upper emission limit, VLE 50 mg/Nm³
Specific linearity criteria, VLF
Specific lower detection limit criteria, LDL mg/Nm³
Ambient conditions
Pressure hpa meter
Temperature °C meter
Humidity %RH meter
Similar test...
Start
Cancel
?


Program settings
Language
Program
English
Test reports
English
English
Italiano
Date format
Program
DD-MM-YY
Test reports
DD-MM-YY
Calibrator
RS-232 communication port
COM3
USB communication port
- not present
Archive
Location type
laboratorio
System type
analizzatori
Program folder
C:\Program Files (x86)\Pcf\Dp99\
Archive folder
C:\Program Files (x86)\Pcf\Dp99\Arc\
Printer
PDFCreator
Printout centering X
0,0
Y
0,0
mm
Ok
Cancel
?



4.4.3 Calibrator

This command displays the calibration and operation parameters of the D/P 99.

a. Serial Number (S/N)
It shows the MFC Serial Number (S/N).

b. Calibration curve

It shows the formula as wells the data of the MFC calibration curve, as obtained during the last maintenance performed on the system.

c. **Puntual uncertainty**
It shows the formula as well as the data of the MFC puntual uncertainty, as obtained during the last maintenance performed on the system.

d. **Extended uncertainty**
It shows the formula as well as the data of the MFC extended uncertainty, as obtained during the last maintenance performed on the system.

e. **Date**
It shows the date of the last test performed on the MFC.

f. **Expiry**
It shows the MFC calibration expiry date.
Note: If the calibration empire in the next 30 days, the system automatically alerts the operator to any restart of the program.

g. **Test flow rate**
It indicates the multiplication factor used to calculate the test flow rate, taking into account the flow rate of the analyzer under test.

h. **MFC lower threshold**
It indicates the lower threshold that can be used by the Mass Flow Meters.

i. **Ok**
Clicking this button closes the window.

4.4.3 Exit

This command terminates the program execution.
Equivalent to clicking on the **X** in the upper right corner of the program window, or to press the key combination **Alt + F4**.
If there are not cycles running, the system ends the execution of the program.

4.4.4 Test (Control Menu)

Start
It allows you to set and start the running of a test.

a. **Operator**
Give the name of the operator conducting the test.

b. **Job**
Enter the name or code of the actual job.

c. **Location**
Indicate the location of the system under test.
Note: the actual text that appears in front of the field is set with the command System - Settings.

d. **Plant**

Indicate the system under test.
Note: the actual text that appears in front of the field is set with the command System - Settings.

e. **Test**
Select the type of test that you do.
Note: the time indicated in parentheses to the left of each type of test corresponds to the time taken the last time that the same test was performed
before the field is set with the command System - Settings.

f. **Test points**
After selecting the type of test, the system displays the test points recommended. If necessary, you can change the value of each test point.

g. **Notes**
You can enter a short note to the test.
After the test, this record is modified with the command Archive - Remarks.

h. **Gas cylinder serial number**

Enter the serial number of the reference bottle.

Note: The system maintains a list of recently used 50 cylinders. If the cylinder is one of these, the system automatically presents the data; otherwise, it will appear a request for information relating to the cylinder.

i. **Manufacturer**
Indicate the manufacturer of the analyzer under test.

j. **Model number**
Indicate the model number of the analyzer under test

k. **Serial Number (S/N)**
Indicate the Serial Number (S/N) of the analyzer under test

l. **Full Scale Deviation**
Indicate the full scale and select the appropriate measuring unit of the analyzer under test.

m. **Nominal flow rate**
Enter the nominal flow rate of the sample gas required by the analyzer.

n. **Response time**
Enter the analyzer nominal response time.

o. **Analog signal**
Select the type of analog signal supplied by the analyzer.

p. **Output at zero, at full range**
Enter the value of the output signal corresponding to a reading of the analyzer, zero and full scale.

q. **Span calibration**
Select the required type of calibration.
Note: Normally, the span is calibrated with the sample gas (mixture). Only some analyzers require the span calibration with zero gas.

r. **Limit value of the measuring range, Cu**
Enter the upper limit of the measuring range.

s. **Emission limit value, VLE**
Enter, optionally, the emission limit value. If this information is present, the test points are calculated as a percentage of 2 * VLE, if not as a percentage of instrument full scale.

t. **Similar test …**
Clicking this button, you can pre-fill the fields on the form with those of a test already made previously and available in the test archive.

u. **Ok**
Clicking this button, the system accepts the data and, after verifying the adequacy, starts the test.

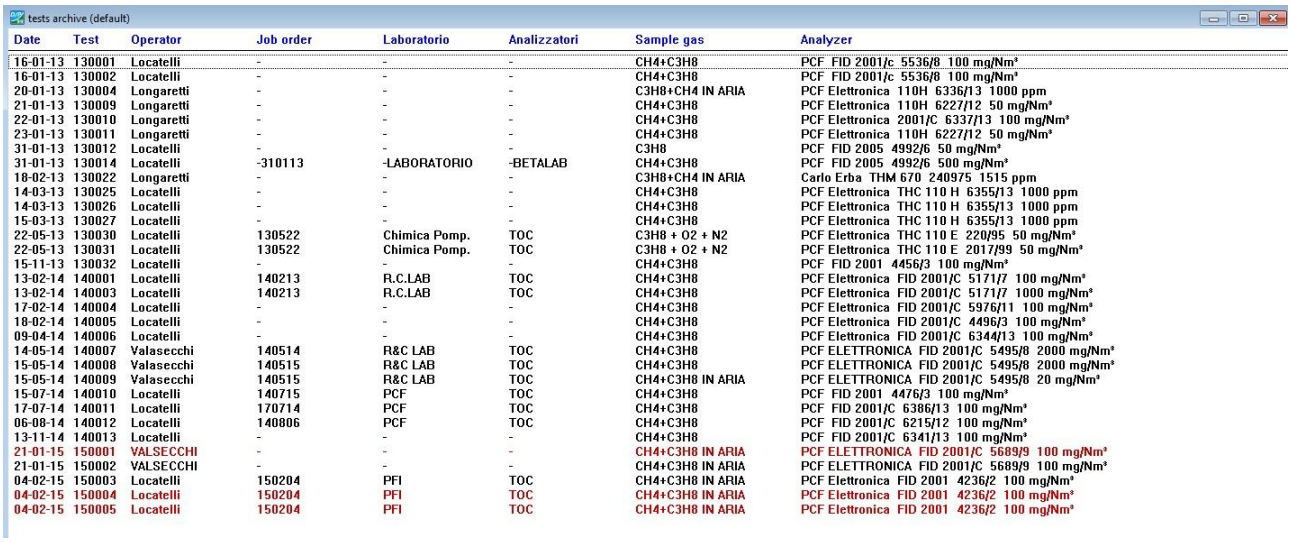
v. **Skip**
Clicking this button you skip (abort) to start the test.

Interrupt
It allows to stop the test currently in progress.

a. Yes
Clicking this button the test is terminated. The sampled data are lost and the test is recorded in the database as interrupted.

b. No
Clicking this button the test is not interrupted.

4.4.5 Archives



Date	Test	Operator	Job order	Laboratorio	Analizzatori	Sample gas	Analyzer
16-01-13	130001	Locatelli	-	-	-	CH4+C3H8	PCF FID 2001/c 5536/8 100 mg/Nm³
16-01-13	130002	Locatelli	-	-	-	CH4+C3H8	PCF FID 2001/c 5536/8 100 mg/Nm³
20-01-13	130004	Longaretti	-	-	-	C3H8+CH4 IN ARIA	PCF Elettronica 110H 6336/13 1000 ppm
21-01-13	130009	Longaretti	-	-	-	CH4+C3H8	PCF Elettronica 110H 6227/12 50 mg/Nm³
22-01-13	130010	Longaretti	-	-	-	CH4+C3H8	PCF Elettronica 2001/C 6337/13 100 mg/Nm³
23-01-13	130011	Longaretti	-	-	-	CH4+C3H8	PCF Elettronica 110H 6227/12 50 mg/Nm³
31-01-13	130012	Locatelli	-	-	-	C3H8	PCF FID 2005 4992/6 50 mg/Nm³
31-01-13	130014	Locatelli	-310113	-LABORATORIO	-BETALAB	CH4+C3H8	PCF FID 2005 4992/6 500 mg/Nm³
18-02-13	130022	Longaretti	-	-	-	C3H8+CH4 IN ARIA	Carlo Erba THM 670 240975 1515 ppm
14-03-13	130025	Locatelli	-	-	-	CH4+C3H8	PCF Elettronica THC 110 H 6355/13 1000 ppm
14-03-13	130026	Locatelli	-	-	-	CH4+C3H8	PCF Elettronica THC 110 H 6355/13 1000 ppm
15-03-13	130027	Locatelli	-	-	-	CH4+C3H8	PCF Elettronica THC 110 H 6355/13 1000 ppm
22-05-13	130030	Locatelli	130522	Chimica Pomp.	TOC	C3H8 + O2 + N2	PCF Elettronica THC 110 E 220/95 50 mg/Nm³
22-05-13	130031	Locatelli	130522	Chimica Pomp.	TOC	C3H8 + O2 + N2	PCF Elettronica THC 110 E 2017/99 50 mg/Nm³
15-11-13	130032	Locatelli	-	-	-	CH4+C3H8	PCF FID 2001 4456/3 100 mg/Nm³
13-02-14	140001	Locatelli	140213	R.C.LAB	TOC	CH4+C3H8	PCF Elettronica FID 2001/C 5171/7 100 mg/Nm³
13-02-14	140003	Locatelli	140213	R.C.LAB	TOC	CH4+C3H8	PCF Elettronica FID 2001/C 5171/7 1000 mg/Nm³
17-02-14	140004	Locatelli	-	-	-	CH4+C3H8	PCF Elettronica FID 2001/C 5976/11 100 mg/Nm³
18-02-14	140005	Locatelli	-	-	-	CH4+C3H8	PCF Elettronica FID 2001/C 4496/3 100 mg/Nm³
09-04-14	140006	Locatelli	-	-	-	CH4+C3H8	PCF Elettronica FID 2001/C 6344/13 100 mg/Nm³
14-05-14	140007	Valasecchi	140514	R&C LAB	TOC	CH4+C3H8	PCF ELETTRONICA FID 2001/C 5495/8 2000 mg/Nm³
15-05-14	140008	Valasecchi	140515	R&C LAB	TOC	CH4+C3H8	PCF ELETTRONICA FID 2001/C 5495/8 2000 mg/Nm³
15-05-14	140009	Valasecchi	140515	R&C LAB	TOC	CH4+C3H8 IN ARIA	PCF ELETTRONICA FID 2001/C 5495/8 20 mg/Nm³
15-07-14	140010	Locatelli	140715	PCF	TOC	CH4+C3H8	PCF FID 2001 4476/3 100 mg/Nm³
17-07-14	140011	Locatelli	170714	PCF	TOC	CH4+C3H8	PCF FID 2001/C 6386/13 100 mg/Nm³
06-08-14	140012	Locatelli	140806	PCF	TOC	CH4+C3H8	PCF FID 2001/C 6215/12 100 mg/Nm³
13-11-14	140013	Locatelli	-	-	-	CH4+C3H8	PCF FID 2001/C 6341/13 100 mg/Nm³
21-01-15	150001	VALSECCHI	-	-	-	CH4+C3H8 IN ARIA	PCF ELETTRONICA FID 2001/C 5689/9 100 mg/Nm³
21-01-15	150002	VALSECCHI	-	-	-	CH4+C3H8 IN ARIA	PCF ELETTRONICA FID 2001/C 5689/9 100 mg/Nm³
04-02-15	150003	Locatelli	150204	PFI	TOC	CH4+C3H8 IN ARIA	PCF Elettronica FID 2001 4236/2 100 mg/Nm³
04-02-15	150004	Locatelli	150204	PFI	TOC	CH4+C3H8 IN ARIA	PCF Elettronica FID 2001 4236/2 100 mg/Nm³
04-02-15	150005	Locatelli	150204	PFI	TOC	CH4+C3H8 IN ARIA	PCF Elettronica FID 2001 4236/2 100 mg/Nm³

See

This command gives you access to the archives of the performed tests.
The system presents a list of tests, organized in the following columns:

a. Date
The date of the start of the test.

b. Test
The identification number assigned to the test.

c. Operator
The name of the operator who performed the test.

d. Job
The job order.

e. Location
The location of the tested plant.
Note: the actual text that appears as a column header is set with the command System - Settings.

f. Plant

The identification of the tested system.

Note: the actual text that appears as a column header is set with the command System - Settings.

Select

This command allows you to define the selection criteria of the tests that are listed in the window of the historical summary.
Each text field performs a search of typed characters.
Leaving the field blank, the system does not use the voice as a selection criterion

a. Operator
Name of the operator who performed the test.

b. Job
The contract work.

c. Location
The location of the tested plant.
Note: the actual text that appears as a header is set with the command System - Settings.

d. Plant
The identification of the tested plant.
Nota: il testo effettivo che appare come intestazione è quello impostato con il comando System – Settings.

e. **Gas cylinder S/N**
The identification number of the cylinder used for the test.

f. **Analyzer brand**
The tested analyzer brand.

g. **Analyzer model number**
The tested analyzer model number.

h. **Analyzer S/N**
The tested analyzer Serial Number.

i. **All**
Clicking this button resets the system texts in the fields, thus enabling the viewing all the performed tests.

j. **Ok**
Clicking this button, the system applies the new selection criteria.

k. **Skip**
Clicking this button you surrender to change current selection criteria.

Close Archives
This command closes the window summary of the historical archive.
Equivalent to clicking on the **X** in the upper right of the window contents of the archive itself.
The system returns to display the graph of the operating status.

Remark Archives
This command allows you to add, edit or delete the brief notes from the test conducted.
These annotations are displayed both in display and printing or export of test results.

a. **Ok**
Clicking this button records are changed.

b. **Skip**
Clicking this button you skip to edit annotations.

Archives details
This command displays all available information, relative to the selected test.
Is equivalent to double-click with the mouse on the line of the desired test.

a. **Date**
The date of the start of the test.

a. **Test number**
Progressive number associated with the test and availability status of the associated information.

b. **Operator**
The name of the operator who performed the test.

c. Job
Contract work for which the test was performed.

d. **Location**
The location of the tested plant.
Note: the actual text that appears as a header is set with the command system-Settings.

e. Plant
The identification of the tested system.
Note: the actual text that appears as a header is set with the command System - Settings.

f. Test
Description of the type of the performed test.

g. Mixture
It shows the composition, the concentration with relevant tolerance values, the identification number (S/N) of the used cylinder and its expiration date.

h. Notes
Annotations associated with the performed test.

i. Analyzer
It shows the brand, the model, the serial number of the tested analyzer, as well as the full scale and the nominal response time used in the test

j. The calculation type
It lists the types of calculations that can be performed on the acquired data with the test.
Note: Normally you can run only one type of calculation and the system will automatically perform the selection.

k. Results
This window summarizes all the results of the performed processing.

l. Export
Clicking this button, the system allows you to save disk the selected processing results.
Data is saved in ASCII table, with columns separated by <TAB, tabs> and rows by <CR, CarriageReturn> + <LF, linefeed>.
This format is readable by both custom programs as well as by directly imported into standard packages such as Word, Excel.

m. Print
Clicking this button, the system requires information to print the test result, then it prints.
This command is disabled if you did not select a printer with the command System - Settings.

n. Ok
Clicking this button, the system closes the detail view and goes back to the historical tests carried out

Delete archives

This command allows you to delete the test data from the archive. The system will poses three questions in sequence:

1. Delete the sampled data

Responding **Yes**, the system deletes the raw data sampled; is no longer possible to print the detail calculations, but the test results remain still available (you can still view, print, export).

2. Delete the results of calculations

Responding **Yes**, the system eliminates the results of calculations; it is no longer possible to present the result of the test, but it still retains a record of the trial in the history list.

3. Delete the recording

Responding **Yes**, a record of the test is also deleted.

4.4.6. Help

a. index

This command activates the online help and the guide presents the general index.
Equivalent to pressing the **F1** function key.

b. Information on ...

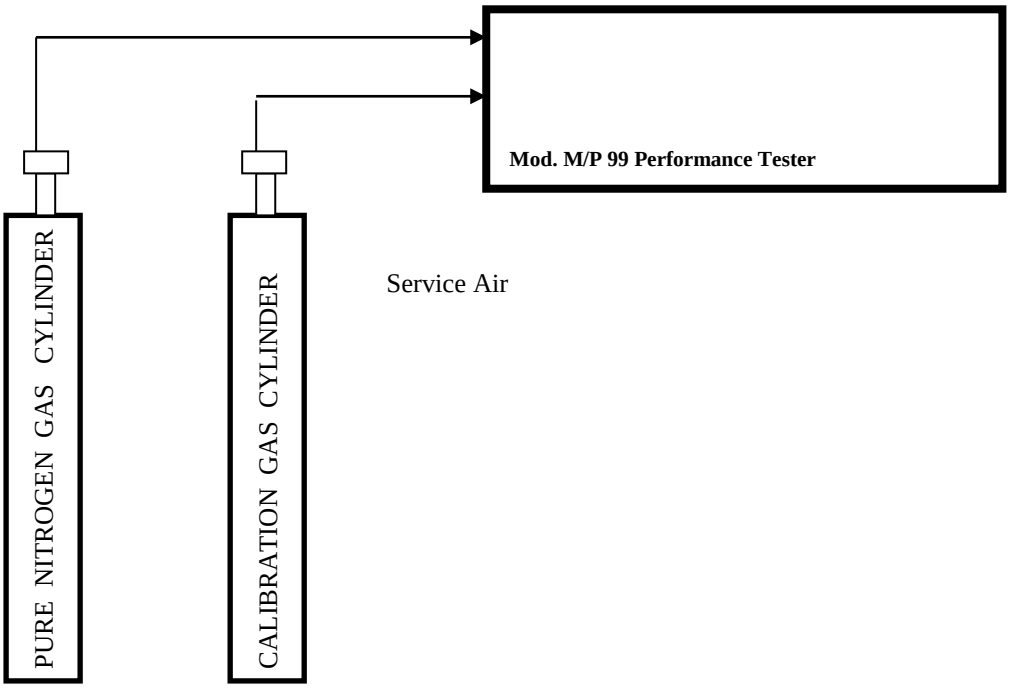
This command displays information about the program itself.

5. Suggested plumbing

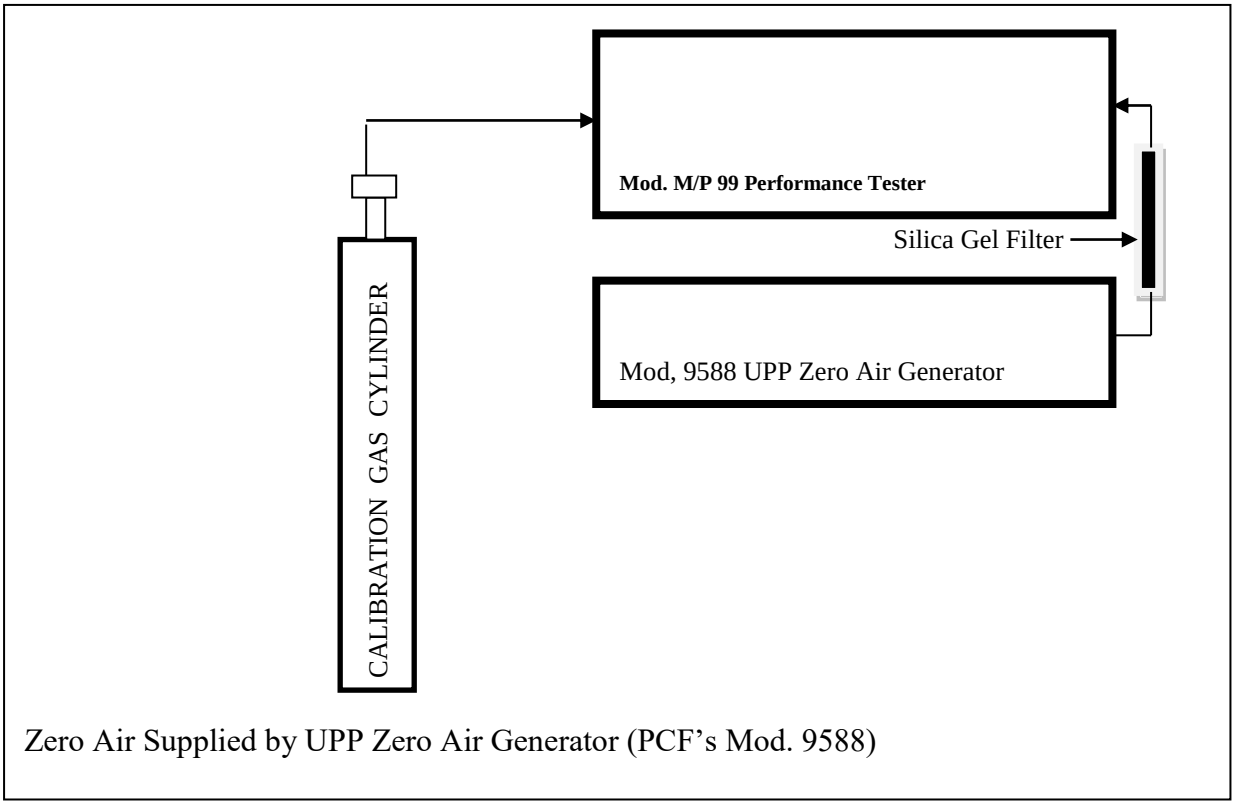
The instrument requires:
- hydrogen supply, 25-35 ml/min, as combustible gas of FID detector;
- pure air supply, 250 -300 ml/min, as supporter of combustion, and carrier gas, the hydrocarbon content must be lower than 0.1 ppm;
- service air, 4-5 bar, to activate the inner rotation valve, any service air will do the job.

The gases can either be supplied by compressed gas cylinders or by pure gas generators. The basic requirements are the purity as well as the supply pressure, high enough to guarantee the gauge set values.

Here below we show the two possible solutions of gas supply, intermediate solutions are also possible, according to the availability in the field or customer's specifications.



Gas Supply from two compressed gas cylinders



Zero Air Supplied by UPP Zero Air Generator (PCF's Mod. 9588)

6. D/P 99 maintenance procedure

All the operations described in the present section must be performed with main power supply to the instrument OFF (disconnect the mains plug) and with the H_2, Air, Span service gases intercepted by the main manometers and valves on the gas cylinders.

REPLACEMENT OF MIXING CHAMBER

- With a spanner disconnect the gas connection to the pump.
- Release the bolts that keep the pump in place.
- Disconnect power supply.
- Replace the pump.
- Fix the bolts and the gas connection.
- Perform a calibration check and eventually adjust the SPAN amplification potentiometer.

REPLACEMENT OF MASS FLOW CONTROLLER (MFC)

7. Suggested maintenance schedule

Basically PCF Elettronica's Mod. THC 110 Hot FID V.O.C. monitor is a very simple process FID instrument with tested parts to last years without maintenance.
The eight port valve, the most sophisticated part 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 high measuring ranges (> 100 ppm) it is not necessary to have very pure combustion air, dry and compressed ambient air passed into carbon filters will do.

For good maintenance operations of the instrument we recommend:
- standard tool case
- digital multi-meter,
- strip chart recorder (0-10 Vdc)
- bubble flow meter with stop watch and/or digital flow meter.

Time	Operations	Actions (if necessary)
Commissioning	Check: Power Supply Gas Supplies (quality and pressure) Service Gas pressure Analogue output(s)	
Weekly	Sample flow	Replace or clean filters Front filter and/or Sintered filter
Monthly	Sample flow Sintered filter Zero check Calibration check	 If necessary adjust zero by ZERO potentiometer If necessary adjust span by SPAN potentiometer
Every 3 months	Sample flow Membrane pump	 Rebuild pump
Every 6 months	Calibration procedure	Change amplification
Every year	Check Cycle times H_2 capillary Air capillary Carrier capillary	Adjust retention times Replace
Every 3 years	Rotation valve	Maintain or replace

8. Trouble shooting

POWER LED OFF	
- Check the mains power supply	Connect power supply
- Check the fuse on the power supply	Eventually replace the fuse
- Thermostatic PCB not working	Replace thermostatic PCB
- Signalling LED broken	Replace signalling LED
- PT100 thermo-resistance open	Replace thermo-resistance
Power LED ON, the others OFF	
- Fuses on power supply PCB broken	Replace fuses
- Stabilised power supply PCB not working	Replace stabilised power supply PCB
Output signals dead	
- FID detector not working	Replace FID detector
- Electrometer board not working	Replace electrometer board
- Auxiliary service PCB not working	Replace auxiliary service PCB
0-10 Vdc signal live **4-20 mA signal dead**	
Check external connection	Restore external connection
4-20 mA board not working	Replace 4-20 mA board

Lack of pneumatic Sample gas pressure	
- Supply 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
Lack of Nitrogen pressure	
- Hydrogen gas cylinder either empty or closed	Either open the air gas cylinder or replace it
- Leakage in pneumatic circuit	Amend the leakage
- Pressure regulator not working	Replace pressure regulator
- Intercepting solenoid valve not working	Replace solenoid valve
- Auxiliary services PCB not working	Replace auxiliary services PCB
- Manometer not working	Replace manometer
No variations on output signals	
- FID detector not working	Replace FID detector
- Electrometer board not working	Replace electrometer board
- Output signal board not working	Replace output signal board

No circulation of calibration mixture	
- Adduction sample line either intercepted or clogged	Restore correct sample flow
- Membrane pump not working	Either replace or repair membrane pump
- Lack of air on air ejector	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
- Auxiliary services PCB not working	Replace A.S. PCB
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

SWITCHING OFF

- Take Power switch on OFF position
- Take AUTO OFF MAN switch on OFF position
- Wait for some ten minutes then close the valves on the supply gas cylinders or generators.

9. Spare part list

Code Number	Description	Suggested expendable parts	Suggested spare parts
095020114	Sample capillary		
095020116	Air capillary		
095020120	Pressure regulator		
095020121	Bar gauge		
095020130	Red LED		
095020131	Green LED		
	Red switch		
	Green switch		
095020136	Power supply transformer		
095020137	Power supply socket		
095020138	Cooling fan		
095020143	Function programming PCB		
095020145	Temperature regulator PCB		
095020146	Stabilised Power Supply PCB		
095020150	PT 100 temperature sensor		
09514822	Stainless steel tubing (1 m)		
09514123	Seal set		
09514124	Stainless steel pneumatic connections		
09514125	Fuse set		
09510201	Gas interception solenoid valve		
09514130	Mains switch		
	Mass Flow Control low flow rate		
	Mass Flow Controller high flow rate		
	Glass mixing chamber		

PCF ELETTRONICA MOD. THC 110E
V.O.C HOT FID DETECTOR

FINAL CHECK RECORD

CARRIER	Bar ……	ml/min ……
H_2	Bar ……	ml/min ……
AIR	Bar ……	ml/min ……
SAMPLE CARRIER	Bar ……	ml/min ……

OVEN °C ……

ANALYTICAL PROGRAM SET

Injection	……..	4"
Back flush	……..……	14"
Acquisition time	……..….	3-13"
Auto Zero	……..	27"
Cycle length	……..…….	30"

CALIBRATION PROGRAM

Compounds employed for the calibration:
……..

Traceable cylinder concentration: …… ppm …… mg/m^3 V.O.C. …… mg/m^3

Concentration : …… ppm …… mg/m^3 V.O.C. …… mg/m^3

SPAN RANGE set point: ……. DIV

Service Engineer: …….. Date: ……

APPENDIX 1 DESCRIPTION OF TWO SEQUENCES

A.1.1 Description of the procedure for checking the linearity using " Continuous Method, with 4 Concentrations, 3 Reps"

After the preliminary guided operations, namely Zero and Span adjustment of the analyzer under test, the system starts the automatic verification process for providing the linearity of the same, performing a series of operations as follows:

1. Descends from SPAN to ZERO value.
   Waits for 5 Tn (Nominal Response Time) to 15 Tn, for the return in stable condition before trimming the Zero.
2. Waits for 4 Tn, then 60 sec. of sampling takes place, repeated for 3 times (C = 0).
3. Changes the concentration and repeats, as in step 2 for C = 1.
4. Changes the concentration and repeats, as in step 3 for C = 2.
5. Repeats the same operations as in steps 3 and 4 (C = 3 and C = 4).
6. After running the test at the maximum concentration, returns to zero, then waits for 4 Tn and samples for 60 sec. this is repeated 3 times (as from step 2)

N.B. Naturally in the case where a test is initiated under continuous method, with 5 Concentrations, 5 Repetitions, the values of Zero acquired will be 10 instead of 6 as for the 3 repetitions.

A.1.2 Description of the procedure for the linearity verification using "Discontinuous Method, 4 Concentrations, 3 Reps"

After the preliminary guided operations, namely Zero and Span adjustment of the analyzer under test, the system starts the automatic verification process for providing the linearity of the same, performing a series of operations as follows:

1. Descend from SPAN to ZERO value.
   Wait for 5 Tn (Nominal Response Time) to 15 Tn, for the return in stable condition before trimming the Zero.
2. Wait for 4 Tn, then 60 sec. of sampling takes place, repeated for 3 times (1st zero).
   Wait 4 Tn, then 60 sec. of sampling takes place, repeated for 3 times (2 ° zero).
3. Change the concentration, wait for 4 Tn, then 60 sec. sampling (C = 1) takes place, which is followed by the return to Zero; await for 5 Tn, return to the concentration, hold for 4 Tn, then for the following 60 sec. sample (C = 1), which is followed by the return to Zero, await for 5 Tn, return to the concentration, hold for 4 Tn, then the following 60 sec. sample (C = 1) for the third time. Then return to Zero for 5 Tn.
4. Wait for 4 Tn, then for the following 60 sec. sampling is repeated for 3 times (3 ° zero), and then change the concentration and repeat the steps, as in point 3 (C = 2).
5. Repeat the same operations as in steps 3 and 4 (C = 3 and C = 4).

APPENDIX 2

Linearity, repeatability limit, and lower detection limit tests (according to ISO 9169-6.4:2006)

Here below an example of the test report produced by D/P 99.

The format of the report is .pdf to avoid any off line potential modification by the operator.

(Prova 150003 - Risultato verifica di lir

(Prova 150003 - Risultato verifica di lir

APPENDIX 3

Linearity tests (according to UNI EN 14181:2005**).**

Here below an example of the test report produced by D/P 99.

The format of the report is .pdf to avoid any off line potential modification by the operator.

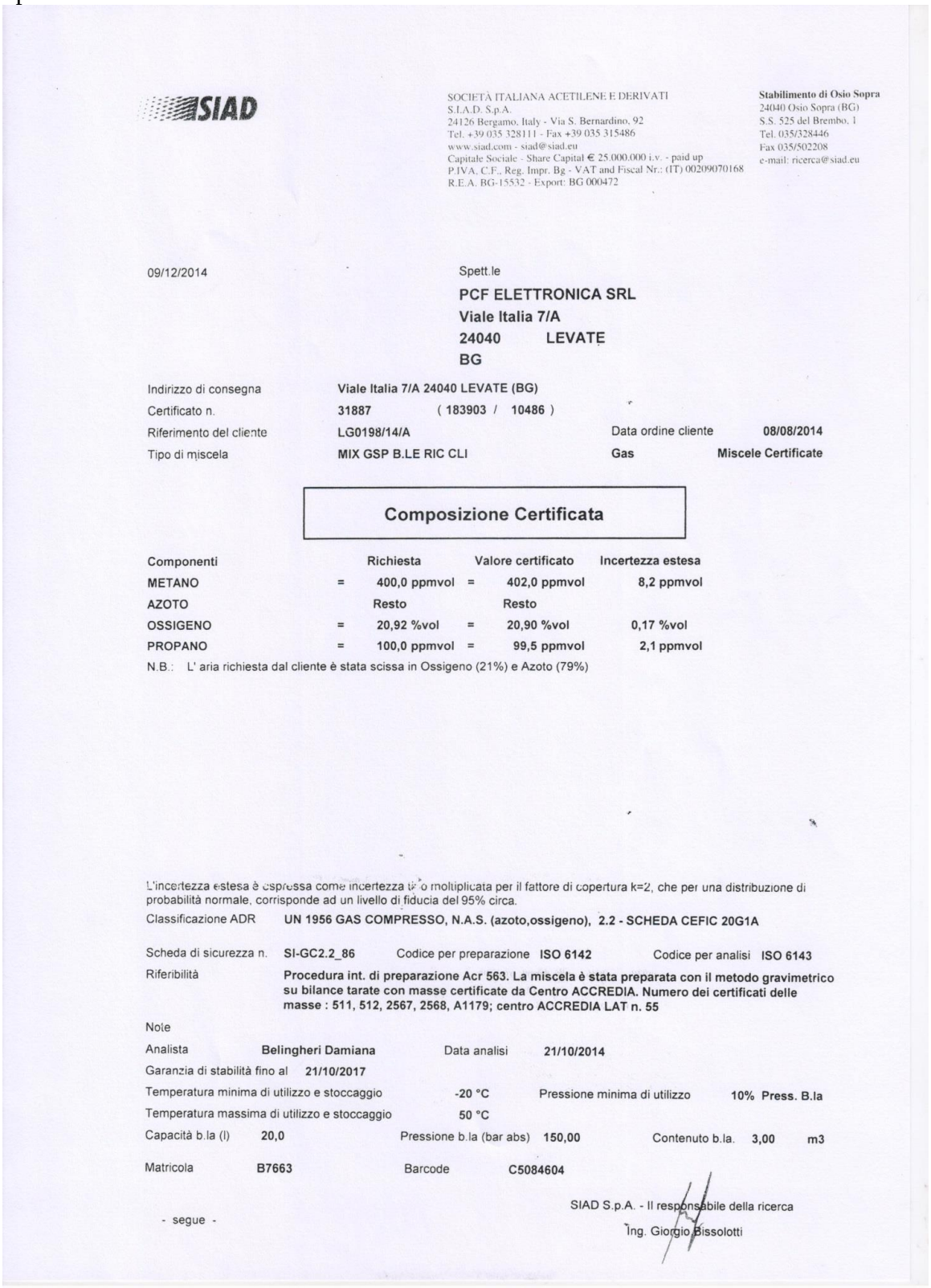
(Prova 140012 - Dettaglio calcoli verifi

(Prova 140012 - Risultato _(verifica di

Appendix 4

Laboratory certification card of the traceable reference gas mixture.

The format of the report is .pdf to avoid any off line potential modification by the operator.



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24040 Osio Sopra (BG)
S.S. 525 del Brembo, 1
Tel. 035/328446
Fax 035/502208
e-mail: ricerca@siad.eu

09/12/2014

Spett.le
PCF ELETTRONICA SRL
Viale Italia 7/A
24040 LEVATE
BG

Indirizzo di consegna	Viale Italia 7/A 24040 LEVATE (BG)		
Certificato n.	31887 (183903 / 10486)		
Riferimento del cliente	LG0198/14/A	Data ordine cliente	08/08/2014
Tipo di miscela	MIX GSP B.LE RIC CLI	Gas	Miscele Certificate

Composizione Certificata

Componenti		Richiesta		Valore certificato	Incertezza estesa
METANO	=	400,0 ppmvol	=	402,0 ppmvol	8,2 ppmvol
AZOTO		Resto		Resto	
OSSIGENO	=	20,92 %vol	=	20,90 %vol	0,17 %vol
PROPANO	=	100,0 ppmvol	=	99,5 ppmvol	2,1 ppmvol

N.B.: L' aria richiesta dal cliente è stata scissa in Ossigeno (21%) e Azoto (79%)

L'incertezza estesa è espressa come incertezza tipo moltiplicata per il fattore di copertura k=2, che per una distribuzione di probabilità normale, corrisponde ad un livello di fiducia del 95% circa.

Classificazione ADR **UN 1956 GAS COMPRESSO, N.A.S. (azoto,ossigeno), 2.2 - SCHEDA CEFIC 20G1A**

Scheda di sicurezza n. **SI-GC2.2_86** Codice per preparazione **ISO 6142** Codice per analisi **ISO 6143**

Riferibilità **Procedura int. di preparazione Acr 563. La miscela è stata preparata con il metodo gravimetrico su bilance tarate con masse certificate da Centro ACCREDIA. Numero dei certificati delle masse : 511, 512, 2567, 2568, A1179; centro ACCREDIA LAT n. 55**

Note

Analista **Belingheri Damiana** Data analisi **21/10/2014**

Garanzia di stabilità fino al **21/10/2017**

Temperatura minima di utilizzo e stoccaggio **-20 °C** Pressione minima di utilizzo **10% Press. B.la**

Temperatura massima di utilizzo e stoccaggio **50 °C**

Capacità b.la (l) **20,0** Pressione b.la (bar abs) **150,00** Contenuto b.la. **3,00** m3

Matricola **B7663** Barcode **C5084604**

- segue -

SIAD S.p.A. - Il responsabile della ricerca
Ing. Giorgio Bissolotti

APPENDIX 5
Command syntax

The sequence file is divided into two sections. In each of these sections the information is provided in the form *Variable = value, value, value ...*

The first section, prefixed by [**IDENTIFICATION**] text provides general information about the sequence itself.

Title: Title of the sequence, max 60 characters.

Concentrations: number of concentrations and their values in % f.s.

Duration: actual length of the sequence, in minutes. Is recalculated and updated automatically at each sequence end.

Print: type of processing and reporting generated by this test, the sum of the following values:
0 no processing.
1 preliminary test.
2 linearity verification.

The second section, prefixed by [**SEQUENCE**] text provides information about the test run. Each sequence line, progressively numbered from 00001 to 99999, provides an instruction, followed by each parameters, all separated by commas.
The following is a list of instructions for use.

ACQ (Acquisition)**,** to sample data.
Parameters:
• sampling modes:
TN (Nominal Time) stays for a time related to the nominal response time of the analyzer under test.
RTZ (Zero Reference Time) the time taken by the reading to reach the reference zero (which must have been previously calculated using the instruction CAL).

Runtimes:
- If TN, multiple of Tn.
- If RTZ, minimum and maximum multiple of Tn.
• sampling rate in seconds (0 = maximum speed).

Operation:
• acquires the necessary points for the calculations until:
- If TN, the waiting time, has elapsed.
- If RTZ, at least the minimum time (increased to 60 seconds), has passed and the analyzer is returned to zero, or the maximum time elapsed.
It records:
• one or more acquisitions of measurement points.

CAL(Calibration), to carry out the analyzer calibration.
Parameters:
• concentration to be used for the span, 1..10.
• calculation methods:
NZR (No Zero Reference) doesn't do calculations.

ZRF (Zero Reference)**,** to perform calculation of the reference zero and span, with the indexes of stability.
Operation:
• introduces the zero gas to the analyzer.
• waits for a time equivalent to 5 * Tn of the analyzer (Tn, Time for normalization).
• requires zero calibration.
• in ZRF mode, waits for rhe 5 * Tn time and calculates the zero reference.
• introduces the test gas to the analyzer.
• waits for time analyzer 5 * Tn.
• requires the span calibration.
• in ZRF mode, waits for 5 * Tn time and then calculates the reference span.
• introduces zero gas into the analyzer.
• waits for the 5 * Tn analyzer time.
• in ZRF mode, washing extends up to a maximum of 15 * Tn to allow the analyzer to fall to zero.

It memorizes:
• only if calculated: zero and span reference, with the indexes of stability.

CHD (Calculation of Hysteresis and Drift)**,** to test and calculate the hysteresis and drift.
Parameters:
• concentration to be used for the span, 1..10.
• number of repetitions (n) to be made for the calculation of the drift, 3..20. The calculation of the hysteresis automatically uses a repetition number (n- 1).
• duration of the peak, in multiples of Tn, 5..99.
• duration of zero, in multiples of Tn, 5..99.
Operation:
• alternating peak and zero as from "*parameters*":
- Extending the time to 60 "if the specified multiples of Tn are lower than this value.
- Coming to timeout after 5 x Tn over the specified time if the analyzer does not stabilize.
• calculating the hysteresis and drift, using, as reference, the zero which must have been previously calculated using the **CAL** instruction.

Record:
• the calculation of hysteresis and drift.

CNC (Concentration), to set mixture on MFC.
Parameters:
• concentration to use, 1..10.
Operation:
• no action, the command will be executed by the first met SWP instruction.
Record:
• the selected state of concentration.

DLY (Delay), waiting without any action.
Parameters:
• Standby mode:
FIX for a fixed time.
TN for a time related equal to the nominal time response of the analyzer under test.
RTZ until the reading is not within the reference zero, which must have been previously calculated using the instruction **CAL**.
• Waiting times:
- If FIX, time in seconds.
- If TN, waiting time in multiples of Tn.
- If RTZ, minimum and maximum time, in multiples of Tn.
Operation:
• waits until:
- if FIX, the time indicated is not spent yet.
- If TN, the time to wait is not spent yet.
- If RTZ, at least the minimum time (increased by 60 ") is not spent and the analyzer is returned to zero, or the maximum time not spent.
Record:
• the start and the end of the waiting period.

GC (Calibration Gas), request for control of the valve that carry the gas sample to the MFC2.
Parameters:
• ON / OFF control.
Operation:
• if the command is OFF, closes the MFC2.
• controls the valve (automatically selecting Evgas (EV1..EV4).
Record:
• No record.

GZ (Zero Gas) request for control of the valves that carry the zero gas to the MFC1.
Parameters:
• ON / OFF control.
Operation:
• if the command is OFF, closes the MFC1.
• controls the valve EV0.
Record:
• No record.

MAN (Manual), request for manual operation.
Parameters:
• text message to be presented to the operator (max 100 characters).
Operation:
• displays the message to the operator.
• waits for you to make click on the button <OK>.
Record:
• the start and the end of the manual operation.

SWP (Swapping), switching the gas sent to the analyzer.
Parameters:
• ZERO / MISC mode.
Operation:
• varies flows of MFC1 and MFC2.
Record:
• The new flow values set for each MFC.

WSH, (washing), system washing.
Parameters:
• duration, in seconds.
Operation:
• closes MFC2 and EVgas. (1..4)
• sends zero gases, via MFC1, to the analyzer and exhaust for the specified time.
• invites the operator to disconnect the analyzer and close the output.
• invites the operator to open at maximum the flow regulator.
• closes MFC1 and EV0.
• invites the operator to shut down and unplug the zero gas and plug the inlet.
• invites the operator to close the gas cylinder sample.
• opens EVgas (1..4) and MFC2 to release the residual pressure of the sample (reference) gas.
• waits 5 seconds for discharging the pressure.
• invites the operator to disconnect the gas sample and connect nitrogen.
• waits for the specified time.
• invites the operator to plug the vent and closes the flow regulator.
• closes the MFC2 as well as the Evgas (1..4).
• invites the operator to disconnect the zero gas and plug the connector.
• updates the [IDENTIFICATION] / Duration parameter of the test sequence.
Record:
• No record.