



## SERVOPRO Chroma Trace Gas Analyser

# User Manual

Part Number: 04400/001  
Revision: 2  
Language: UK English

This page intentionally blank

## TABLE OF CONTENT

Section	Page
1 Description and Definitions .....	8
1.1 Scope of this manual .....	8
1.2 Safety information .....	8
1.3 Description .....	9
1.3.1 Servopro Chroma Complete Rear Connector .....	9
1.3.2 Servopro Chroma Reduced Rear Connector .....	10
1.3.3 FID Modification .....	11
1.3.4 Auxiliary Oven Rear Connecton .....	11
1.3.5 Standalone PC Rear Connecton .....	12
2 Software license .....	14
2.1 Microsoft Software License Term for Windows XP Embedded .....	14
3 Specifications .....	19
3.1 General .....	19
3.2 Gas .....	21
3.3 Oven Specification .....	22
3.4 Environmental Limits .....	22
3.5 Digital Relay Outputs .....	22
3.6 4-20 mA Outputs .....	23
3.7 Digital Inputs .....	23
3.8 Hydrogen Relay Output .....	23
3.9 Ethernet Port .....	24
3.10 RS-232 Port .....	24
3.11 RS-485 Port .....	24
3.12 USB Connector .....	24
3.13 Mains input cables (Master/Slave/Stand alone PC) .....	25
3.14 Standard features .....	25
4 System Description .....	26
4.1 Introduction .....	26
4.2 Plasma cell .....	27
4.3 Electric and electronic hardware description .....	29
4.3.1 Signal conditioning .....	29
4.3.2 Main PC and graphic display .....	29
4.3.3 Oven heater and control .....	29
4.3.4 I/O board .....	30
5 Unpack the Servopro Chroma .....	31
6 Servopro Chroma User Interface .....	32
6.1 User interface control description .....	32
6.1.1 Edit Box control .....	32
6.1.2 Radio control .....	32
6.1.3 Slide control .....	33
6.1.4 Push button control .....	33
6.1.5 Grid control .....	34

---

6.1.6	Combo control .....	34
6.1.7	Check Box control .....	35
6.1.8	Tab control .....	35
6.2	Menu Description.....	36
6.2.1	Run.....	36
6.2.1.1	Real Time Chromatogram.....	36
6.2.1.1.1	Historic values menu.....	40
6.2.1.1.2	Alarm historic menu .....	41
6.2.2	Diagnostic .....	44
6.2.2.1	Diagnostic .....	44
6.2.2.2	Analyse Chromatogram .....	47
6.2.2.3	Trending.....	50
6.2.2.4	Advanced Diagnostic.....	53
6.2.3	Configuration .....	55
6.2.3.1	System.....	55
6.2.3.2	PID .....	59
6.2.3.3	Flow .....	59
6.2.3.4	Cycle .....	63
6.2.3.5	Date and Time.....	69
6.2.3.6	Advanced Configuration.....	70
6.2.3.7	Alarm .....	76
6.2.3.8	Printers .....	77
6.2.4	Calibration.....	78
6.2.4.1	Calibration.....	78
6.2.4.2	Calibration of the 4-20mA outputs .....	81
6.2.5	Remote .....	83
6.2.5.1	Report Software .....	83
6.2.5.2	Remote Control.....	84
6.2.6	About.....	85
6.2.7	Chromatogram saving.....	86
6.2.8	Quit .....	87
7	Installation and Setup.....	88
7.1	System power up.....	88
7.2	Electrical installation .....	88
7.2.1	Electrical safety.....	88
7.2.2	Master chassis connection.....	90
7.2.3	Slave chassis connection.....	91
7.2.4	Stand alone PC with slave chassis .....	92
7.3	Connecting Servopro Chroma rear connector.....	93
7.3.1	Digital input .....	93
7.3.2	Digital output contacts .....	94
7.3.3	4-20 mA outputs .....	95
7.3.4	FID fuel shut-off relay/Hydrogen relay output.....	96
7.3.5	RS-485 port.....	97
7.3.6	RS-232 .....	97
7.3.7	Auxiliary oven port.....	97

---

---

7.4	Gas installation.....	98
7.4.1	Introduction.....	99
7.4.2	Carrier Gas Hardware Selection .....	100
7.4.3	Connecting the Servopro Chroma.....	101
8	General Operation.....	102
8.1	Routine maintenance.....	102
9	Storage and Disposal.....	103
9.1	Storage .....	103
9.2	Disposal.....	103
10	Compliance .....	104
11	FID Addendum .....	105
11.1	Introduction.....	105
11.2	Overview.....	105
11.3	Logarithm based amplifier.....	105
11.4	MENUS.....	106
11.4.1	CONFIGURATION-ADVANCE MENU .....	106
11.4.2	CONFIGURATION-ADVANCE FID MENU.....	107
11.4.3	CONFIGURATION-ADVANCE DETECTOR MENU .....	109
11.4.4	CONFIGURATION-ADVANCE FLOW MENU.....	110
11.4.5	CONFIGURATION-ADVANCE OVEN MENU .....	111
11.4.6	MONITORING AND CONFIGURATION MENUS .....	112
11.4.7	DIAGNOSTIC-DIAGNOSTIC MENU.....	115
11.4.8	CONFIGURATION-CYCLE MENU .....	116
11.5	Startup.....	117
11.6	System errors .....	118
11.7	Troubleshooting.....	120
12	RS-232 Addendum.....	121
12.1	Start analysis .....	121
12.2	Analyser status .....	121
12.3	Send results .....	122
12.4	Enable-Disable Calibration.....	123
12.5	Respan.....	123
13	Product disposal In accordance with the Waste Electrical and Electronic Equipment (WEEE) Directive .....	124
14	REACH Regulation .....	124

---

## LIST OF TABLES

Table name	Page
Table 1 : General Specification.....	21
Table 2 : Gas Specification.....	21
Table 3 : Oven specification .....	22
Table 4 : Environmental limits .....	22
Table 5 : Digital relay outputs .....	22
Table 6 : 4-20 mA outputs .....	23
Table 7 : Digital inputs .....	23
Table 8 : Hydrogen relay output .....	24
Table 9 : Ethernet cable .....	24
Table 10 : RS-232 port.....	24
Table 11 : RS-485 port.....	24
Table 12 : RS-485 port.....	24
Table 13 : Mains cable.....	25
Table 14 : Run time Menu .....	40
Table 15 : Diagnostic menu .....	46
Table 16 : Diagnostic menu 2 .....	46
Table 17 : Configuration menu .....	49
Table 18 : Trending menu.....	52
Table 19 : Unregulated flow .....	57
Table 20 : Oven set point.....	57
Table 21 : Flow Factor.....	61
Table 22 : Peak Configuration Columns.....	65
Table 23 : Peak Configuration Menu.....	65
Table 24 : Digital Output Contacts .....	94
Table 25 : 4-20 mA connections and associated fuses .....	95
Table 26 : Advanced FID menu parameters .....	107
Table 27 : Gas flow set point .....	117
Table 28 : Gas flow set point 2 .....	117
Table 29 : Gas ignition Point .....	117
Table 30 : Troubleshooting.....	120
Table 31 : RS-232 Start Analysis.....	121
Table 32 : RS-232 Analyser Status.....	121
Table 33 : RS-232 Send Results .....	122
Table 34 : RS-232 Enable-Disable Calibration .....	123
Table 35 : RS-232 Respan .....	123

---

## LIST OF FIGURES

Figure name	Page
Figure 1 : Servopro chroma complete rear connection.....	9
Figure 2 : Servopro chroma reduced rear connection.....	10
Figure 3 : FID Modification.....	11
Figure 4 : Auxiliary oven rear connection.....	11
Figure 5 : Standalone PC rear connection.....	12
Figure 6: Edit Box control.....	32
Figure 7 : Radio control.....	32
Figure 8 : Slide control.....	33
Figure 9 : Button control.....	33
Figure 10 : Grid control.....	34
Figure 11 : Combo Box control.....	34
Figure 12 : Check Box control.....	35
Figure 13 : Check Box control.....	35
Figure 14 : Menu description.....	36
Figure 15 : Real time menu.....	37
Figure 16 : Diagnostic menu.....	44
Figure 17 : Analyse chromatogram.....	47
Figure 18 : Trending menu.....	50
Figure 19 : Trending menu valve state.....	51
Figure 20 : Advanced diagnostic menu.....	53
Figure 21 : System menu.....	55
Figure 22 : PID menu.....	59
Figure 23 : Unregulated flow configuration menu.....	60
Figure 24 : Regulated flow configuration menu.....	61
Figure 25 : General cycle menu.....	63
Figure 26 : Peak configuration menu.....	64
Figure 27 : Peak detection configuration menu.....	66
Figure 28 : Valve configuration menu.....	67
Figure 29 : Typical sequence for valve timing.....	67
Figure 30 : Flow timing configuration menu.....	68
Figure 31 : Date and Time menu.....	69
Figure 32 : Advanced configuration menu.....	70
Figure 33 : Detector configuration menu.....	72
Figure 34 : Advanced flow configuration menu.....	73
Figure 35 : Advanced valve configuration menu.....	74
Figure 36 : Advanced oven configuration menu.....	75
Figure 37 : Alarm outputs configuration menu.....	76
Figure 38 : Printers configuration menu.....	77
Figure 39 : Calibration menu.....	78
Figure 40 : Span calibration menu.....	79
Figure 41 : 4-20 mA outputs calibration menu.....	81
Figure 42 : Remote software menu.....	83

Figure 43 : Remote control menu .....	84
Figure 44 : About menu .....	85
Figure 45 : Chromatogram saving menu .....	86
Figure 46 – Master chassis electrical connections.....	90
Figure 47 – Master and slave chassis electrical connections.....	91
Figure 48 – External PC connections.....	92
Figure 44– Digital input connection .....	93
Figure 45 – Digital outputs connection.....	94
Figure 46– 4-20 mA schematic and external connections .....	95
Figure 47 – Connecting a fuel shut-off valve .....	96
Figure 48: Advanced menu .....	106
Figure 49: Advanced FID menu .....	107
Figure 50: Advanced detector menu .....	109
Figure 51: Advanced flow menu.....	110
Figure 52: Advanced oven menu .....	111
Figure 53: Monitoring fig 1 .....	112
Figure 54: Monitoring fig 2 .....	112
Figure 55: Monitoring fig 3 .....	113
Figure 56: Monitoring fig 4 .....	113
Figure 57: Monitoring.....	114
Figure 58 : Diagnostic menu.....	115
Figure 59: Cycle menu.....	116
Figure 60 :The WEEE label.....	124



# 1 DESCRIPTION AND DEFINITIONS

## 1.1 Scope of this manual

This manual provides installation, operation and routine maintenance instruction for the Servomex Servopro Chroma online total hydrocarbons analyser, abbreviated Servopro Chroma where applicable in the remainder of this manual.

## 1.2 Safety information

Read this manual and ensure that you fully understand its content before you attempt to install, use or maintain the Servopro Chroma. Important safety information is highlighted in this manual as WARNINGS and CAUTIONs, which are used as follows.



### WARNING

Warnings highlight specific hazards which, if not taken into account, may result in personal injury or death.

### CAUTION

Cautions highlight hazards which, if not taken into account, can result in damage to the Servopro Chroma or other equipment or property.

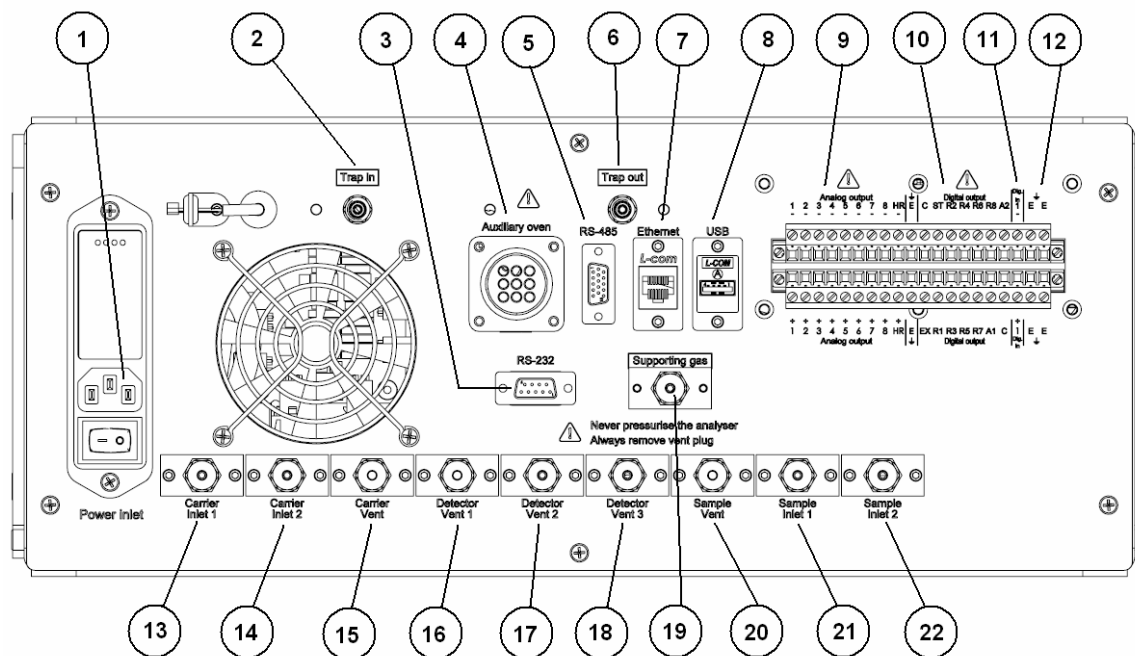
This manual also incorporates “Be aware of” information, which is used as follows:



This highlights information which it is useful for you to be aware of (for example, specific operating conditions, and so on).

## 1.3 Description

### 1.3.1 Servopro Chroma Complete Rear Connector



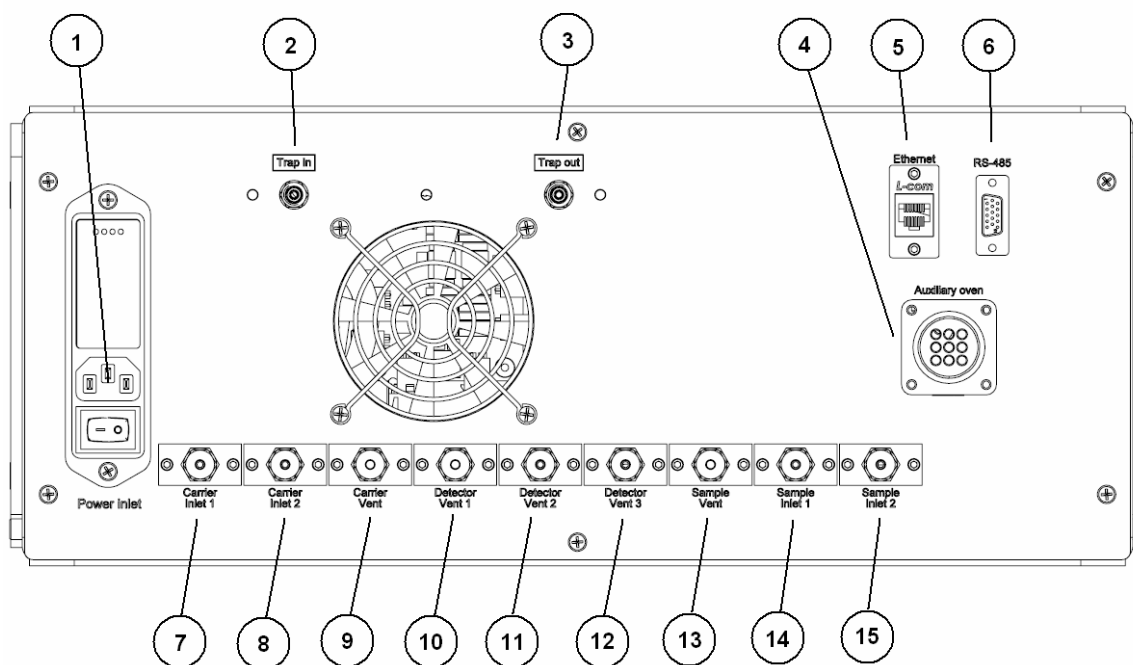
**Figure 1 : Servopro chroma complete rear connection**

This rear panel is present on all master units and on slave units in configurations involving a standalone pc.

- |                                     |                                       |
|-------------------------------------|---------------------------------------|
| 1. Power inlet with switch and fuse | 12. Earth terminals for cable screens |
| 2. Gas trap inlet                   | 13. Carrier gas inlet to detector 1   |
| 3. RS-232 socket                    | 14. Carrier gas inlet to detector 2   |
| 4. Auxiliary oven                   | 15. Vent for carrier gasses           |
| 5. RS-485 socket                    | 16. Vent from detector 1              |
| 6. Gas trap outlet                  | 17. Vent from detector 2              |
| 7. Ethernet port                    | 18. Vent from detector 3              |
| 8. USB port                         | 19. Supporting gas inlet              |
| 9. Analogue 4-20 mA outputs         | 20. Sample gas vent                   |
| 10. Digital outputs                 | 21. Sample gas inlet to detector 1    |
| 11. Digital input                   | 22. Sample gas inlet to detector 2    |

Many of these ports are optional and may not be present on a particular analyser, depending on the configuration and number of detectors and intended use.

### 1.3.2 Servopro Chroma Reduced Rear Connector

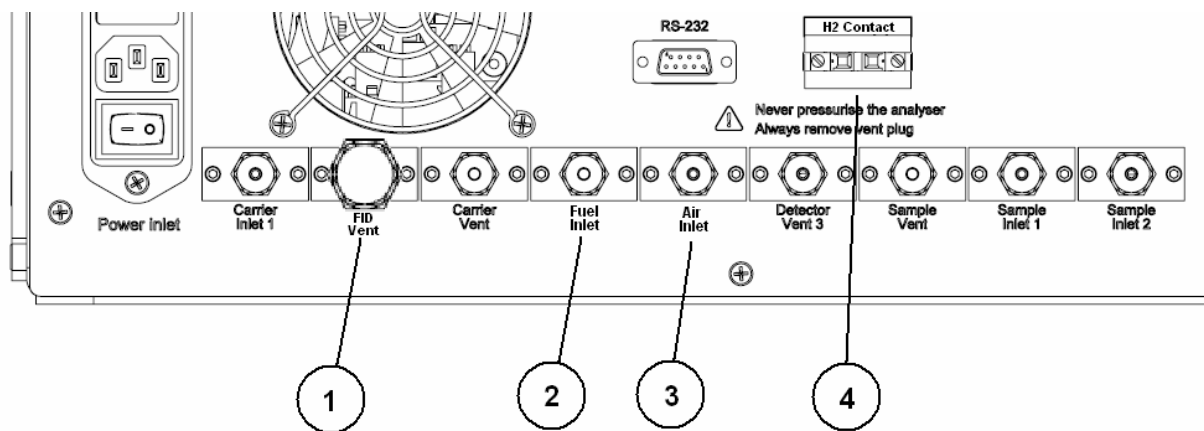


**Figure 2 : Servopro chroma reduced rear connection**

This rear panel is present on all slave units in a system which contains a master unit.

- |                                     |                                    |
|-------------------------------------|------------------------------------|
| 1. Power inlet with switch and fuse | 9. Vent for carrier gasses         |
| 2. Gas trap inlet                   | 10. Vent from detector 1           |
| 3. Gas trap outlet                  | 11. Vent from detector 2           |
| 4. Auxiliary oven                   | 12. Vent from detector 3           |
| 5. Ethernet port                    | 13. Sample gas vent                |
| 6. RS-485 port                      | 14. Sample gas inlet to detector 1 |
| 7. Carrier gas inlet to detector 1  | 15. Sample gas inlet to detector   |
| 8. Carrier gas inlet to detector 2  |                                    |

### 1.3.3 FID Modification



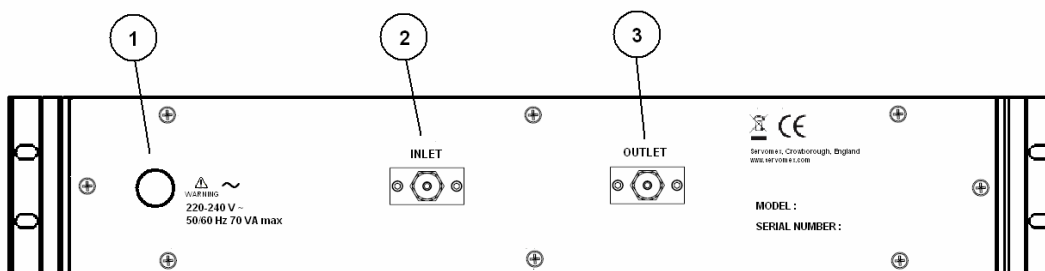
**Figure 3 : FID Modification**

When a FID detector is installed in a Servopro Chroma, the rear connector is modified to allow for the different connections required. These modifications are:

1. Carrier inlet 1 is replaced by the FID vent
2. Detector vent 1 is replaced by a fuel inlet
3. Detector vent 2 is replaced by an air inlet
4. The supporting gas inlet is replaced by H2 contacts, which control the fuel shut-off valve (see section 7.3.5)

See section 10 for more information on the FID detector.

### 1.3.4 Auxiliary Oven Rear Connecton



**Figure 4 : Auxiliary oven rear connection**

1. Power inlet
2. Sample inlet
3. Sample outlet

### 1.3.5 Standalone PC Rear Connecton

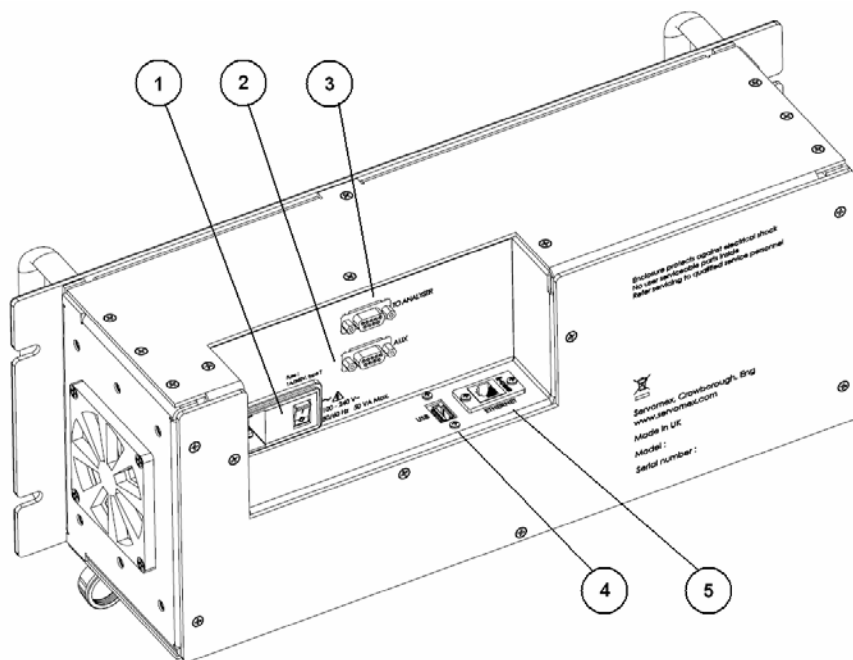


Figure 5 : Standalone PC rear connection

1. Power inlet with switch and fuse
2. RS-232 port for slave unit 1 (marked "To Analyser")
3. RS-232 port for slave unit 2 (marked "Aux")
4. USB port
5. Ethernet port

#### CAUTION

To comply with the requirements of the EU EMC Directive, data cables used with the standalone PC (USB, Ethernet,) must be fitted with ferrite beads (Würth 74271131 or 74271221, depending on cable size), these beads should be clamped around 2 turns of cable.

#### CAUTION

To comply with the requirements of the EU EMC Directive, the front USB port should be use with a USB memory stick only. Rear USB port to be used with Keyboard mouse or USB memory stick only.  
Only keyboard supplied by Servomex shall be used

#### CAUTION

To comply with the requirements of the EU EMC Directive, a single turn ferrite (Würth type 742-711-31) shall be fitted to the RS232 output cable.



**WARNING**

This analyser is not a medical device as defined in the medical devices directive 93/42/EEC and is not intended to be used on human beings for the diagnosis, prevention, monitoring, treatment or alleviation of disease, injury or replacement or modification of the anatomy.



**WARNING**

The Servopro Chroma must not be used as personal protective equipment.



**WARNING**

Improper installation, operation or service of this analyser may cause damage to the analyser and void the manufacturer's warranty



**WARNING**

All connections must be properly connected and leak free. Improper gas connection could result in explosion or death.



**WARNING**

Do not operate unless the cabinet is securely closed. Servicing this instrument implies possible exposure to shock hazard level voltages which cause death or serious injury.



**WARNING**

Any equipment connected to standalone PC shall be separated by mains voltage by at least double insulation.

The Servopro Chroma is a rack-mount type analyser to be used in fixed installations.

## 2 SOFTWARE LICENSE

### ***2.1 Microsoft Software License Term for Windows XP Embedded***

Microsoft Software License Terms for:

#### **Windows XP Embedded and Windows Embedded Standard Runtime**

---

These license terms are an agreement between you and Servomex. Please read them. They apply to the software included on this device. The software also includes any separate media on which you received the software.

The software on this device includes software licensed from Microsoft Corporation or its affiliate.

The terms also apply to any Microsoft

- Updates,
- Supplements,
- Internet-based services, and
- Support services

for this software, unless other terms accompany those items. If so, those terms apply. If you obtain updates or supplements directly from Microsoft, then Microsoft, and not Servomex, licenses those to you.

**As described below, using some features also operates as your consent to the transmission of certain standard computer information for Internet-based services.**

**By using the software, you accept these terms. If you do not accept them, do not use or copy the software. Instead, contact *Servomex* to determine its return policy for a refund or credit.**

If you comply with these license terms, you have the rights below.

#### **1. Use Rights.**

You may use the software on the device with which you acquired the software.

#### **2. Additional Licensing Requirements and/or Use Rights.**

- a. Specific Use.** *Servomex* designed this device for a specific use. You may only use the software for that use.
- b. Other Software.** You may use other programs with the software as long as the other programs
  - Directly support the manufacturer's specific use for the device, or
  - Provide system utilities, resource management, or anti-virus or similar protection.

Software that provides consumer or business tasks or processes may not be run on the device. This includes email, word processing, spreadsheet, database, scheduling and personal finance software. The device may use terminal services protocols to access such software running on a server.

**c. Device Connections.**

- You may use terminal services protocols to connect the device to another device running business task or processes software such as email, word processing, scheduling or spreadsheets.
- You may allow up to ten other devices to access the software to use
  - File Services,
  - Print Services,
  - Internet Information Services, and
  - Internet Connection Sharing and Telephony Services.

The ten connection limit applies to devices that access the software indirectly through “multiplexing” or other software or hardware that pools connections. You may use unlimited inbound connections at any time via TCP/IP.

**3. Scope of License.** The software is licensed, not sold. This agreement only gives you some rights to use the software. *Servomex* and Microsoft reserve all other rights. Unless applicable law gives you more rights despite this limitation, you may use the software only as expressly permitted in this agreement. In doing so, you must comply with any technical limitations in the software that allow you to use it only in certain ways. For more information, see the software documentation or contact *Servomex*. Except and only to the extent permitted by applicable law despite these limitations, you may not:

- Work around any technical limitations in the software;
- Reverse engineer, decompile or disassemble the software;
- Make more copies of the software than specified in this agreement;
- Publish the software for others to copy;
- Rent, lease or lend the software; or
- Use the software for commercial software hosting services.

Except as expressly provided in this agreement, rights to access the software on this device do not give you any right to implement Microsoft patents or other Microsoft intellectual property in software or devices that access this device.

You may use remote access technologies in the software such as Remote Desktop to access the software remotely from another device. You are responsible for obtaining any licenses required for use of these protocols to access other software.

- Remote Boot Feature. If the *Servomex* enabled the device Remote Boot feature of the software, you may
  - (i) use the Remote Boot Installation Service (RBIS) tool only to install one copy of the software on your server and to deploy the software on licensed devices as part of the Remote Boot process; and
  - (ii) use the Remote Boot Installation Service only for deployment of the software to devices as part of the Remote Boot process; and
  - (iii) download the software to licensed devices and use it on them.



For more information, please refer to the device documentation or contact *Servomex*.

- Internet-Based Services. Microsoft provides Internet-based services with the software. Microsoft may change or cancel them at any time.

a. **Consent for Internet-Based Services.** The software features described below connect to Microsoft or service provider computer systems over the Internet. In some cases, you will not receive a separate notice when they connect. You may switch off these features or not use them. For more information about these features, visit

<http://www.microsoft.com/windowsxp/downloads/updates/sp2/docs/privacy.msp>.

**By using these features, you consent to the transmission of this information.** Microsoft does not use the information to identify or contact you.

b. **Computer Information.** The following features use Internet protocols, which send to the appropriate systems computer information, such as your Internet protocol address, the type of operating system, browser and name and version of the software you are using, and the language code of the device where you installed the software. Microsoft uses this information to make the Internet-based services available to you.

- **Web Content Features.** Features in the software can retrieve related content from Microsoft and provide it to you. To provide the content, these features send to Microsoft the type of operating system, name and version of the software you are using, type of browser and language code of the device where the software was installed. Examples of these features are clip art, templates, online training, online assistance and Appshelp. These features only operate when you activate them. You may choose to switch them off or not use them.
- **Digital Certificates.** The software uses digital certificates. These digital certificates confirm the identity of Internet users sending X.509 standard encrypted information. The software retrieves certificates and updates certificate revocation lists. These security features operate only when you use the Internet.
- **Auto Root Update.** The Auto Root Update feature updates the list of trusted certificate authorities. You can switch off the Auto Root Update feature.
- **Windows Media Player.** When you use Windows Media Player, it checks with Microsoft for
  - Compatible online music services in your region;
  - New versions of the player; and
  - Codecs if your device does not have the correct ones for playing content. You can switch off this feature. For more information, go to:  
<http://microsoft.com/windows/windowsmedia/mp10/privacy.aspx>.

- **Windows Media Digital Rights Management.** Content owners use Windows Media digital rights management technology (WMDRM) to protect their intellectual property, including copyrights. This software and third party software use WMDRM to play and copy WMDRM-protected content. If the software fails to protect the content, content owners may ask Microsoft to revoke the software's ability to use WMDRM to play or copy protected content. Revocation does not affect other content. When you download licenses for protected content, you agree that Microsoft may include a revocation list with the licenses. Content owners may require you to upgrade WMDRM to access their content. Microsoft software that includes WMDRM will ask for your consent prior to the upgrade. If you decline an upgrade, you will not be able to access content that requires the upgrade. You may switch off WMDRM features that access the Internet. When these features are off, you can still play content for which you have a valid license.
  - c. *Misuse of Internet-based Services.* You may not use these services in any way that could harm them or impair anyone else's use of them. You may not use the services to try to gain unauthorized access to any service, data, account or network by any means.
4. **Windows Update Agent (also known as Software Update Services).** The software on the device includes Windows Update Agent ("WUA") functionality that may enable your device to connect to and access updates ("Windows Updates") from a server installed with the required server component. Without limiting any other disclaimer in this Microsoft Software License Terms or any EULA accompanying a Windows Update, you acknowledge and agree that no warranty is provided by MS, Microsoft Corporation or their affiliates with respect to any Windows Update that you install or attempt to install on your device.
  5. **Product Support.** Contact *Servomex* for support options. Refer to the support number provided with the device.
  6. **Backup Copy.** You may make one backup copy of the software. You may use it only to reinstall the software on the device.
  7. **Proof Of License.** If you acquired the software on the device, or on a disc or other media, a genuine Certificate of Authenticity label with a genuine copy of the software identifies licensed software. To be valid, this label must be affixed to the device, or included on or in Servomex's software packaging. If you receive the label separately, it is not valid. You should keep the label on the device or packaging to prove that you are licensed to use the software. To identify genuine Microsoft software, see <http://www.howtotell.com>.
  8. **Transfer to a Third Party.** You may transfer the software only with the device, the Certificate of Authenticity label, and these license terms directly to a third party. Before the transfer, that party must agree that these license terms apply to the transfer and use of the software. You may not retain any copies of the software including the backup copy.
  9. **Not Fault Tolerant.** **The software is not fault tolerant. Servomex installed the software on the device and is responsible for how it operates on the device.**
  10. **Restricted Use.** The Microsoft software was designed for systems that do not require fail-safe performance. You may not use the Microsoft software in any device or system in which a malfunction of the software would result in

foreseeable risk of injury or death to any person. This includes operation of nuclear facilities, aircraft navigation or communication systems and air traffic control.

**11.No Warranties for the Software.** The software is provided "as is". You bear all risks of using it. Microsoft gives no express warranties, guarantees or conditions. Any warranties you receive regarding the device or the software do not originate from, and are not binding on, Microsoft or its affiliates. When allowed by your local laws, Servomex and Microsoft exclude implied warranties of merchantability, fitness for a particular purpose and non-infringement.

**12.Liability Limitations.** You can recover from Microsoft and its affiliates only direct damages up to two hundred fifty U.S. Dollars (U.S. \$250.00). You cannot recover any other damages, including consequential, lost profits, special, indirect or incidental damages.

This limitation applies to:

- Anything related to the software, services, content (including code) on third party internet sites, or third party programs; and
- Claims for breach of contract, breach of warranty, guarantee or condition, strict liability, negligence, or other tort to the extent permitted by applicable law.

It also applies even if Microsoft should have been aware of the possibility of the damages. The above limitation may not apply to you because your country may not allow the exclusion or limitation of incidental, consequential or other damages.

**13.Export Restrictions.** The software is subject to United States export laws and regulations. You must comply with all domestic and international export laws and regulations that apply to the software. These laws include restrictions on destinations, end users and end use. For additional information, see [www.microsoft.com/exporting](http://www.microsoft.com/exporting).

### 3 SPECIFICATIONS



#### WARNING

You must install and use the Servopro Chroma in accordance with the requirements of this section and subsequent sections of the manual. If you do not, the protection facilities incorporated into the design of the Servopro Chroma may not operate as intended, sample gas measurements may not be accurate, or the Servopro Chroma may be damaged.

#### CAUTION

**To comply with the applicable requirements of EU EMC Directive:  
The case of the Auxiliary oven shall be bonded to the case of the Master/Slave unit  
using braid less than 20 cm long.**

#### CAUTION

**To comply with the applicable requirements of EU EMC Directive:  
The case of the Stand Alone PC shall be bonded to the case of the Master/Slave unit  
using braid less than 20 cm long.**

#### CAUTION

**To comply with the applicable requirements of EU EMC Directive:  
The assembly shall be bonded to a local EMC earth. The bond shall be less than 1 m  
in length.**

#### CAUTION

**The Master, Slave, Stand alone PC and Auxiliary oven enclosures does not contain  
any user replaceable parts inside.**

### 3.1 General

---

Master chassis dimensions:	
Height x width x depth:	178 x 483 x 610 mm (7 x 19 x 24 ins)
Slave chassis dimensions:	
Height x width x depth:	178 x 483 x 610 mm (7 x 19 x 24 ins)
Auxiliary oven dimensions:	
Height x width x depth:	83 x 483 x 457 mm (3.25 x 19 x 18 ins)
Stand alone PC dimensions:	
Height x width x depth:	178 x 483 x 130 mm (7 x 19 x 5.125 ins)
Master chassis mass:	11 - 27 kg
Slave chassis mass:	11 - 27 kg
Auxiliary oven mass:	7.5 kg
Stand alone PC mass:	5 kg
Electrical supply requirements:	
Voltage:	100 to 120 Vac or 220 to 240 Vac <sup>1, 2</sup>
Frequency:	50 to 60 Hz
Master chassis power (maximum):	400 VA
Slave chassis power (maximum):	400 VA
Auxiliary oven power (maximum):	400 VA
Stand alone PC power (maximum):	60 VA
Fuse rating/type:	
Master/Slave chassis	Two fuses 4 amp / 250 V, Time delay, Type "T" or equivalent miniature fuses 5 x 20 mm
Stand alone PC	Two fuses 1 amp / 250 V, Time delay miniature fuses 5 x 20 mm

---

<sup>1</sup> The analyser is supplied configured for operation with one of these voltage ranges. You must specify the voltage range when you order the analyser

<sup>2</sup> This analyser is rated in accordance to IEC 60664-3 Over Voltage Category II, Pollution Degree

Carrier gas pressure rating	
Minimum (plasma):	630.6 kPa (90 psig)
Minimum (FID):	828.6 kPa (120 psig)
Maximum:	828.6 kPa (120 psig)
Sample gas pressure rating	
Minimum:	69.0 kPa (10 psig)
Maximum:	137.9 kPa (20 psig)
Detector type:	Plasma, TCD and FID

---

**Table 1 : General Specification**

### 3.2 Gas

Carrier gas:	
Type	Argon, Helium or Neon
Pressure range	630.6 to 690.5 kPa (90 to 100 psig)
Flow	30 ml/min to 1000 ml/min
Sample gas:	
Type	Hydrogen, Oxygen, Nitrogen, Argon, Neon, Helium, Carbon dioxide, Carbon monoxide
Pressure range	69.0 to 137.9 kPa (10 to 20 psig)
Flow	25 ml/min to 150 ml/min
FID Specific gas information <sup>3</sup>	
Gas used for combustion	Air and Hydrogen <sup>4</sup>
Pressure range for Air and Fuel	103.4 to 206.9 kPa (15 to 30 psig)
Air flow	300 to 500 ml/min
Fuel flow	30 to 100 ml/min

**Table 2 : Gas Specification**


---

<sup>3</sup> Only if FID detector is installed

<sup>4</sup> Hydrocarbon traps must be used to remove hydrocarbons

### 3.3 Oven Specification

Chromatographic oven:	
Maximum temperature	300 °C
Minimum temperature	Ambient
Auxiliary oven:	
Maximum temperature	300 °C
Minimum temperature	Ambient
FID Oven:	
Maximum temperature	100 °C
Minimum temperature	Ambient
TCD oven:	
Maximum temperature	300 °C
Minimum temperature	Ambient

---

**Table 3 : Oven specification**

### 3.4 Environmental Limits

Ambient temperature range	+5°C to +40°C
Operating ambient humidity range	0 to 95% RH non-condensing
Maximum Operating altitude	2000 m (max)
Ingress protection	IP20

**Table 4 : Environmental limits**

### 3.5 Digital Relay Outputs

Maximum voltage:	24 VDC
Maximum current:	1 Amp
Cable requirements:	
Type:	Multi-core cable with overall screen
Maximum size:	0.82 mm <sup>2</sup> (18 AWG)
Maximum length	30 m

---

**Table 5 : Digital relay outputs**

**3.6 4-20 mA Outputs**

Maximum load:	500 $\Omega$
Isolation voltage:	500 V (dc or ac)
Output range	
Normal sample measurement	4 to 20 mA
Under range	Less than 4 mA
Over range	Over than 20 mA (24 mA maximum)
Cable requirements:	
Type:	Multi-strand twisted pair with overall screen
Maximum size:	0.82 mm <sup>2</sup> (18 AWG)
Maximum length	30 m

**Table 6 : 4-20 mA outputs****3.7 Digital Inputs**

Maximum voltage:	24 VDC
Maximum current:	1 Amp
Cable requirements:	
Type:	Multi-core cable with overall screen
Maximum size:	0.82 mm <sup>2</sup> (18 AWG)
Maximum length	30 m

**Table 7 : Digital inputs****3.8 Hydrogen Relay Output**

This relay is only available when a FID detector is installed in the Servopro Chroma.

Maximum voltage:	24 VDC
Maximum current:	1 Amp
Cable requirements:	
Type:	Multi-core cable with overall screen
Maximum size:	0.82 mm <sup>2</sup> (18 AWG)
Maximum length	30 m



Table 8 : Hydrogen relay output

**3.9 Ethernet Port**

Cable requirements

Standard

10 BaseT

Connector type

RJ45 (CAT5 UTP)

Maximum length

30 m

Caution: This cable shall not be routed outside the building in which the analyser is installed without the application of screening or similar protection.

Table 9 : Ethernet cable

**3.10 RS-232 Port**

Type

Male 9 way D connector

Cable requirements

NULL modem

Shielded cable

Maximum length

10 m

Table 10 : RS-232 port

**3.11 RS-485 Port**

Type

D-sub HD15 Male/Male shielded

Cable requirements

Wired straight

Shielded cable

Maximum length

0.75 m

Table 11 : RS-485 port

**3.12 USB Connector**

Type

USB Type A

Cable requirements

Shielded standard USB cable with male

Type A connector

Maximum length

1 m

Table 12 : RS-485 port

**3.13 Mains input cables (Master/Slave/Stand alone PC)**

---

Type	IEC 60320-1-C13
Cable requirements	-Screened -Specified for 10 A / 250 Vac -Fit with a main plug that meets the requirement of the country where analyser is used.
Maximum length	2 m

**Table 13 : Mains cable****3.14 Standard features**

- Isolated 4-20 mA output, used as process value transmission up to 8 outputs
- High resolution isolated mA chromatogram output
- Remote range identification contact output, one per peak, up to 8
- Two alarm dry contact outputs, user pre-settable limits
- One digital isolated inputs
- System status dry contact output
- Self-diagnostic system software
- Electronic carrier flow monitoring
- Electronic sample flow control system
- Colour graphic display
- Ethernet connection

## 4 SYSTEM DESCRIPTION

### 4.1 Introduction

The Servopro Chroma trace gas analyzer system is a basic mainframe configured for the final application. Each system is shipped pre-configured and ready to run.

The most frequent application is the measurement of impurities in bulk gases, i.e. H<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>, CH<sub>4</sub>, CO, CO<sub>2</sub> and NMHC in H<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>, Ar and He. Other applications are feasible like the sub ppb measurement of Argon

How the instrument is configured, i.e. detector, columns and valves are application dependent. The Servopro Chroma can be fitted with detector types T.C.D. (Thermal Conductivity Detector), F.I.D. (Flame Emission Detector) and Plasma Emission Detector.

When an application asks for it, a Servopro Chroma system can have one or more slave chassis to hold various detectors and columns.

A slave chassis has its own electronic system to control detector and data acquisition. All system parameters are controlled by the Servopro Chroma analytical software package.

Once properly configured, the system is started and operated as a stand alone online process analyzer with minimum operator intervention. There is no need to define any chromatographic method to detect and integrate a peak. Simple key parameters are entered into some configuration tables and it's done. The system can be calibrated and used.

Each peak is reported on screen with its process value, i.e. percentage, ppm or ppb. The software has advanced diagnostic tools and trending features that ease the trouble shooting process and configuration parameter definition.

The system comes standard with one 4-20 mA isolated output (up to 8 for the main chassis). There is also up to 8 dry contact remote range identification outputs. There are 2 operating ranges per peak with a user selectable multiplication factor between ranges of 2, 5 or 10. A high resolution isolate mA output is provided as standard feature to retransmit the real-time chromatogram signal. This output can be used with third party data acquisition on chromatographic software package. Two process alarm dry contact outputs are included. Two alarm set points per peak can be entered.

Contrôle Analytique was the first to include since the introduction of the first instrument a fail safe dry contact output used as a status alarm. This contact will be

activated in the event where there is a risk(s) that may lead to believing that the reported value may begin to be or become unreliable.

It can be seen as a common alarm for the system. All digital I/O can be configured as normally closed or open. Finally, there are 2 isolated digital inputs. One input is used as a remote start function. The other one is reserved for custom request.

The Servopro Chroma is the most complete G.C. based gas analyzer presently available.

Please, in order to appreciate and understand all the features of your Servopro Chroma system, take the time to read and understand all parts of the User's Manual.

If you have any doubt or questions as a customer of Servomex, you may contact us directly for technical support free of charge.

### **4.2 Plasma cell**

The carrier gas flows at atmospheric pressure through a proprietary design pure quartz cell. This cell is submitted to a high frequency high intensity electromagnetic field.

The plasma cell is based on a spectroscopic emission cell, which in itself is not a new technique. On the other hand the characteristics which make this system stable and selective are the frequency, the intensity, the regulation, as well as the coupling technique and focusing (stabilizing) electrodes used to keep the plasma stable.

Under these conditions, the plasma becomes the centre of a luminous phenomenon (electroluminescence). In fact, the plasma is electromagnetically induced. Plasma is a collection of charged particles; in this case, the plasma consists of a stream of carrier gas (Ar, He or Ne). This process being an emission technique, it is very efficient for quantitative analysis. The recent advances in semiconductors as well as in optical coating and devices make the development of new instruments based on the plasma technology easier; this without the cost normally associated with this category of analytical instruments.

Once the carrier gas is ionized (charged), many spectral lines are emitted. Here, we think a few words regarding the technique used to create the plasma are necessary. There are many ways of producing light from a gas stream for analytical purposes. The electroluminescence phenomenon includes luminescence from all kinds of electrical discharges, such as sparks, arcs or tubes of different kinds, operating on direct or alternating current of low or high frequency. Some experiments were conducted in the microwave range by surface-wave induced plasma, also for the study of gas by optical emissions.

Excitation, in these cases, results mostly from electron or ion collision; that is, the kinetic energy of electrons or ions accelerated in an electric field in which the atoms or molecules of a gas are subjected to, which cause the emission of light.

By any of the above mentioned methods, characteristic emission spectra can be obtained for carrier gas and each substance in it. The emission usually varies for a given substance, depending on the mode of excitation.

## **4.3 Electric and electronic hardware description**

### **4.3.1 Signal conditioning**

The signal conditioning module is based on the latest technology state of the art electronic devices. Only the highest resolution with the lowest noise is used. Operational amplifiers are the best grade ones. Electrical resistors have the lowest noise and zero thermal coefficient. This leads to an analogue signal conditioning that could have a very high gain with minimum drift and noise. A special design low noise high stability analogue power supply is on board.

The signal conditioning board can accept signals from up to 8 detectors. TCD, FID and plasma emission detectors could be used. The various signals can be monitored from the diagnostic menu. The signal conditioning module has its own microcontroller to communicate with the main PC.

### **4.3.2 Main PC and graphic display**

The main PC board runs the Servopro Chroma chromatographic software. It manages all user interface I/O and sends the information to the I/O board and the Signal Conditioning board via RS-485. Keypad and colour graphic display are directly connected to it.

### **4.3.3 Oven heater and control**

Up to 8 ovens can be installed in the Servopro Chroma main chassis. The temperature electronic control hardware is mounted on the I/O board. There are 8 temperature control loops (PID) in the software. The temperature is measured with a RTD. The analogue to digital resolution is 24 bit (A/D converters). The heater is controlled in a pulse with modulation (PWM) scheme.

There are 8 electronic relays mounted on the I/O board. These relays turn ON at zero crossing voltage and turn OFF at zero crossing current thus eliminating EMI. Oven circuits are also protected by a fuse mounted on the I/O board.

#### 4.3.4 I/O board

The I/O board holds all the I/O functions of the instrument. See following table.

Digital I/O	<ul style="list-style-type: none"><li>❖ 1 isolated digital inputs</li><li>❖ 8 remote range dry contact outputs</li><li>❖ 2 alarm dry contact outputs</li><li>❖ 1 system status dry contact output</li><li>❖ 1 extra relay</li><li>❖ 10 G.C. valve contact outputs</li><li>❖ 8 oven power relays</li></ul>
Analogue I/O	<ul style="list-style-type: none"><li>❖ 8 oven temperature RTD input</li><li>❖ 8 isolated process 4-20 mA output</li><li>❖ 1 high resolution isolated mA output for the chromatogram</li></ul>

All digital inputs and outputs, analogue inputs and outputs are transient and fuse protected. The I/O board is connected to an external 40 pin I/O connector through a flat cable connector

The 40 pin I/O connector mounted on the rear panel of the instrument may be disconnected from the analyzer without the need to unscrew each wire individually

The I/O board holds the fuses for the I/O. Each fuse is socket mounted and easily replaced.

## 5 UNPACK THE SERVOPRO CHROMA

1. Remove the Servopro Chroma and any other equipment from its packing.
2. Remove the wrapping plastic.
3. Remove protective caps from inlets.
4. Remove protective cap from exhaust if a FID is installed.
5. Inspect Servopro Chroma and other items supplied, and check that they are not damaged. If any item is damaged, immediately contact Servomex or your local Servomex agent.
6. If you do not intend to use the Servopro Chroma immediately:
  - Refit protective caps on inlets and exhaust if a FID is installed.
  - Place the Servopro Chroma and any other equipment supplied back in its protective packing.
  - Store the Servopro Chroma as described in Section 8.

Otherwise, read section 4 (User Interface), then continue at Sections 5 onwards to install, set up, and use the Servopro Chroma.



Retain the shipping documentation and packaging for future use (for example, return of the Servopro Chroma to Servomex for servicing or repair).

### CAUTION

**You must remove the protective covers as specified in Steps 3 and 4 above before you use the Servopro Chroma. If you do not, you may damage the Servopro Chroma when you try to pass gases through it.**



## 6 SERVOPRO CHROMA USER INTERFACE

All analyzer's functions are controlled through different menus of the user interface in which controls are found. The user has to interact with these controls which are explained in this section. You must become familiar with these.

### 6.1 *User interface control description*

#### 6.1.1 Edit Box control

The Edit Box control is used to input or view a numerical value. A typical use of this control might be the input of the cycle length.

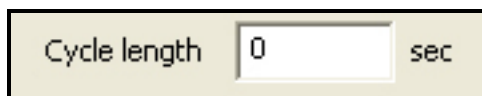


Figure 6: Edit Box control

When an Edit Box control that can accept user input is active, a cursor appears in this control.

To operate an Edit Box control from the keyboard:

- Press LEFT or RIGHT to move the cursor.
- Press HOME to move the cursor to the beginning of text.
- Press END to move the cursor to the end of the text.

#### 6.1.2 Radio control

The Radio control is used to select a mode of operation. The range mode is a good example.

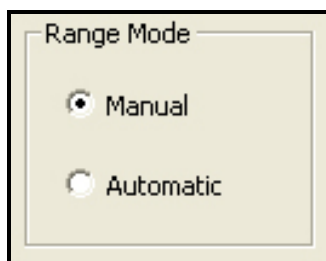
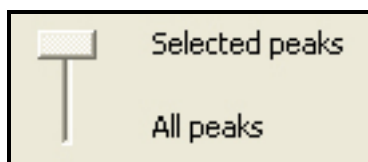


Figure 7 : Radio control

To operate an Edit Box control, the mouse or the keyboard can be used. The left and right or the up and down arrows will switch between values.

### 6.1.3 Slide control

The slide control is used when the user may choose between items; for example, when the user has to choose between “selected peaks” or “all peaks” in the calibration menu.



**Figure 8 : Slide control**

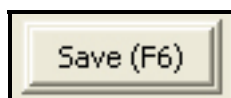
To operate a slide from the keyboard:

- Press UP to move the slider up one position.
- Press DOWN to move the slider down one position.
- Press HOME to move the slider to the top of the slide.
- Press END to move the slider to the bottom of the slide.

To operate from the mouse, move the slider to the position desired.

### 6.1.4 Push button control

The user clicks on a push button to trigger an action which is displayed on the button.



**Figure 9 : Button control**

To operate a button from the keyboard:

- Use the hot key corresponding to the button.

To operate from the mouse, left click on the button.

### 6.1.5 Grid control

The grid is used to show, change or highlight data.

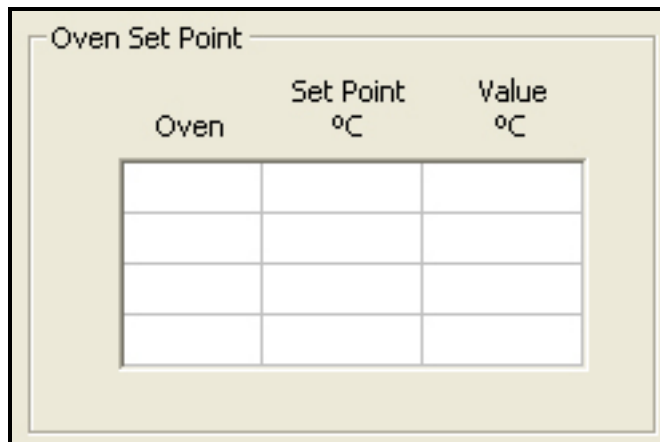


Figure 10 : Grid control

To operate a grid from the keyboard:

- To change a value, enter the new value and change cell.

To operate a grid with the mouse, just left-click on the desired cell to highlight it.

### 6.1.6 Combo control

The Combo Box control is used to choose a value between sets of predetermined values.

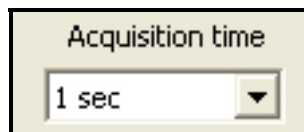


Figure 11 : Combo Box control

To operate a Combo Box with the keyboard, press UP and Down to change between the different values.

To operate it with a mouse, left-click on the arrow and then left-click on the desired value.

### 6.1.7 Check Box control

The Check Box control is used to enable a feature.

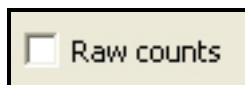


Figure 12 : Check Box control

To operate it with the keyboard, press the space key to make it checked (enabled) or unchecked (disabled).

To operate it with the mouse, left-click in the check box to make it checked (enabled) or unchecked (disabled).

### 6.1.8 Tab control

The Tab control is used to switch between different pages of data. For example, a tab in the **RUN-REAL TIME CHROMATOGRAM MENU** can be selected to toggle between each conditioning boards.

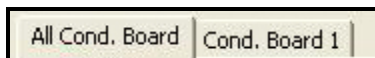


Figure 13 : Check Box control

To operate it with the mouse, just click on the desired tab.

## 6.2 Menu Description

The analyzer's functions are regrouped in menus which are structured as in the following figure.

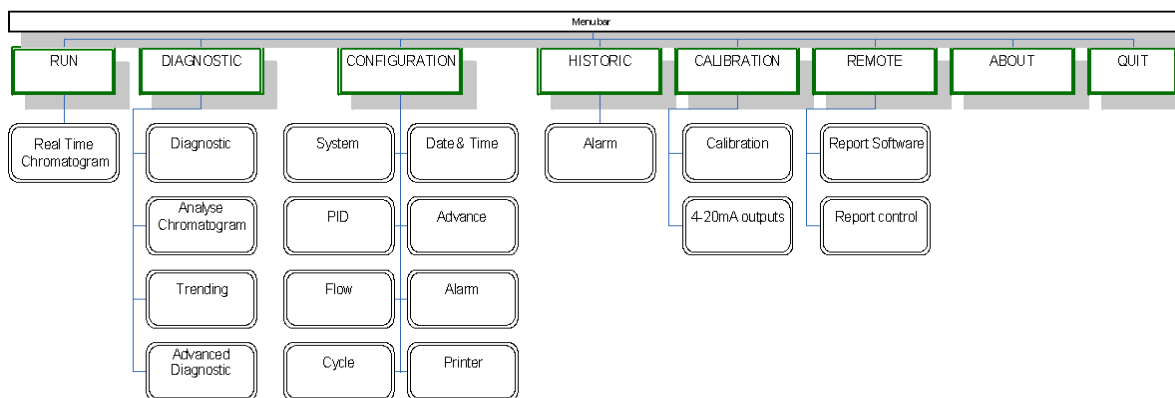


Figure 14 : Menu description

### 6.2.1 Run

#### 6.2.1.1 Real Time Chromatogram

Pressing CTRL-R or clicking **Run** and then **Real Time Chromatogram** on the menu bar brings you to the **RUN-REAL TIME CHROMATOGRAM MENU** (fig. 10).

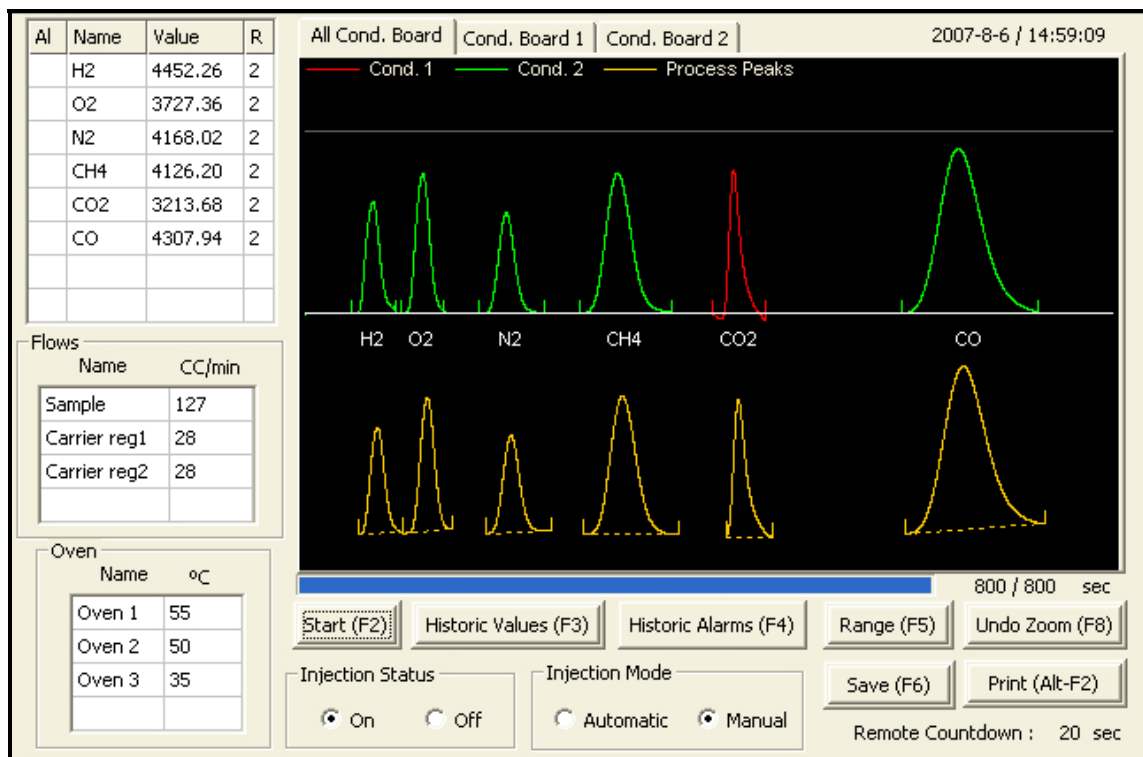


Figure 15 : Real time menu

The real time chromatogram menu is the main menu of the Servopro Chroma Trace Gas Analyzer software. In this menu, you can start a cycle and visualize the resulting real time chromatogram. This chromatogram takes into account all the peak data that can be configured in the **CONFIGURATION-CYCLE MENU**.

A cycle may be executed by pressing the **Start** button and stopped by using the same button that would show **Stop**. When a cycle is started, the analyser waits for the ending time of the first peak and begins its peak detection between the starting time and the ending time. If a peak is found, the peak that is detected and used for integration is shown in yellow below the raw signal coming from the detectors.

During the cycle, the progress bar rises with time. The bar starts at the left to end at the right. The cycle length can be set in the **CONFIGURATION-CYCLE MENU**. During a peak, a green circle appears at the corresponding peak of the upper grid alarm column (AI). When the peak detection process is done, the peak area is converted into the process value and displayed in the grid beside the peak name in the value field. Then, the analyzer waits for other peaks and applies the same procedure.



The cycle continues even if you exit the REAL-TIME CHROMATOGRAM MENU.

You may also choose between two injection modes using the **Injection mode** radio button. If you select **Manual**, only one cycle is executed after the Start button is pressed. If you choose **Automatic**, the analyzer restarts new cycles until you press the **Stop** button or select **Manual**.

The **Injection Status** group box let you choose if the system must inject the sample or not. When the **ON** radio button is selected, the injection will be done. If **OFF**, it will be disabled.

A radio button in the **CONFIGURATION-SYSTEM MENU** let you choose between **Manual** or **Automatic** ranging. If **Manual** is selected, you may toggle between the 2 ranges by pressing the **Range** button. The range used to do the last integration of a peak or the range selected is displayed in the *R* column, next to the peak value in the grid at the left of the chromatogram.

To change a peak range, highlight the corresponding peak in the grid and press the Range button.



When Manual ranging is selected, you can't change the Range during a peak. When Automatic ranging is selected, you can never change the Range by yourself; the range selection will be done based on the result of the last peak calculations.

Note that when calibration is enabled, *Warning: Calibration enabled* will be displayed in the chromatogram display.

Another important thing about peak values is the colour displayed in the Alarm column (Al) of the peak grid. The colour is used to display alarms for each peak. The following table represents the meaning of each colour.

Colour	Meaning
White	No alarm
Yellow	Alarm 1
Red	Alarm 2

From this menu, you can also access the alarm historic menu by pressing the **Historic Alarms** button. This button will turn red when an alarm occurs, turn yellow when the menu was opened but alarms are still active, and turn green if the problem is resolved. The **ALARM HISTORIC MENU** will be explained in section 4.2.1.1.2.

A trending can be saved by pressing the **Save** button at the end of a cycle. When the save button is pressed, a dialog box appears and asks you to enter a filename. You can load this file from the **ANALYSE CHROMATOGRAM MENU**. This

menu will be explained in detail later. The button is enabled only when no cycle is in progress.

The trending can also be zoomed using the mouse. Press the mouse's left button and keep it down while moving the mouse. A rectangle will appear on the screen to identify the zone to zoom. Releasing the button will apply the zoom. Pressing the **Undo Zoom** button will show the original trending without any zoom.



Remember to delete trendings that are not used anymore with the Delete button of the ANALYSE CHROMATOGRAM MENU in order to avoid filling the analyzer hard disk.



When saving a real-time chromatogram, a pop-up will advise you if the analyzer hard-drive is full. If so, delete trendings from the ANALYSE CHROMATOGRAM MENU with the delete button.

Note that a tickmark (little vertical line) is displayed on the real-time chromatogram at every starting and ending peak to help you see the integration windows.

You can view each conditioning board's trending independently by clicking on the corresponding tab at the top of the chromatogram.

Moreover, you have access to a **Print** button, which enables you to print the chromatogram. **To add a printer, see the CONFIGURATION-PRINTERS MENU description.**

A remote countdown field shows the time left when a remote starting is activated. The remote time can be set in the **CONFIGURATION-SYSTEM MENU**.

If the analyzer can hold multiple configurations, the name of the current configuration will appear in the bottom right corner of this menu. Analyzer with multiple configurations is optional and this could not apply to your machine.

The following information is also displayed in the **RUN-REAL TIME CHROMATOGRAM MENU**: the carrier flow, the sample flow, the ovens temperature and the cycle time.



Push Button	Hot key	Function
Start/ Stop	F2	Does an injection and begins a real-time chromatogram or stops a cycle and sets all gas chromatogram valves at their original position.
Range	F5	In <b>Manual</b> ranging only. Change the operating range.
Historic Values	F3	Accesses the <b>HISTORIC VALUES MENU</b>
Historic Alarm	F4	Accesses the <b>ALARM HISTORIC MENU</b>
Save	F6	Saves the real-time chromatogram in a file that can be opened from the <b>ANALYSE CHROMATOGRAM MENU</b> .
Print	Alt-F2	Sends the screen to the printer.
Undo Zoom	F8	Undoes the zoom on the trending.

Table 14 : Run time Menu

#### 6.2.1.1.1 Historic values menu

Displays the last 25 measures of concentration for the selected impurity. You first have to select a peak in the upper-left grid of the **REAL-TIME CHROMATOGRAM MENU** and then to press the Historic Values (F3) button to see these values.

#### 6.2.1.1.2 Alarm historic menu

Displays the last 200 system alarms, peak value alarms or event logs that occurred and all the current active alarms. See **HISTORIC-ALARM MENU** description for more details.

##### System alarms:

- *Low sample flow:*  
When the sample flow goes below 10 CC/min with a sample flow set point bigger than 10 CC/min;
- *Low carrier flow:*  
When the carrier flow falls below 5 CC/min for the plasma and 2 CC/min for the TCD during 30 seconds, a “Plasma #X on I/O Board #X shut down” or “TCD #X on I/O Board #X shut down” alarm will be initiated after 30 seconds to protect the system by turning off the plasma or TCD.
- *Plasma shut down or TCD shut down:*  
When a “Low carrier flow” alarm remains active for 30 seconds, turns the plasma or TCD off.
- *Plasma OFF:*  
When the cell signal counts are lower than the starting count, it indicates that the plasma is physically off.
- *Starting:*  
When a “Plasma off” alarm is active, no “Low carrier flow” alarm is active, the starting mode is automatic (see section 8.3.1 about the **SYSTEM CONFIGURATION MENU** for the **Starting mode** definition) and no cycle is progressing (real-time chromatogram stopped or between cycles), the plasma is restarted.
- *Plasma ON:*  
When the cell signal counts go above the starting counts after a “Plasma OFF”, it indicates that the plasma is physically on.
- *RTD problem:*  
When an oven temperature falls below 10 degrees Celsius.
- *Carrier flow deviation:*  
When the carrier flow is higher or lower than the carrier flow set point by 2 CC/min, the injection is still possible and the system continues to report process values.

- *Oven temperature deviation:*  
When an oven temperature is higher or lower than the oven temperature set point by 2 degree Celsius.
- *Communication problem:*  
When the user interface (PC) can not exchange any data with an electronic board inside the analyzer.

**Peak value alarms:**

(no impact on the system status alarm dry contact output)

- *Alarm 1 peak #:*  
When the concentration of impurity is greater than the Alarm 1 for the peak.
- *Alarm 2 peak #:*  
When the concentration of impurity is greater than the Alarm 2 for the peak.
- *Overscale peak #:*  
When the concentration of impurity is greater than the actual scale of the peak.

**Peripheral alarms:**

Some peripherals connected with the Servopro Chroma (FID detector, HPS<sup>2</sup>...) could show their alarms / errors status into the Alarm historic menu. Please, refer to their respective user's manual for more details.

When a problem arises, a new alarm is generated and the button of the **ALARM HISTORIC MENU** turns red. If the menu is opened and an alarm is still active, it turns yellow. If another alarm occurs, it turns red again. The button will turn green if all alarms are resolved.

Every system alarm will activate (or deactivate, depending the settings in the **ALARM CONFIGURATION MENU**) the system status alarm dry contact output. Peak value alarm 1 and 2 have each a separate dry contact output that is activated (or deactivated, still depending on the **ALARM CONFIGURATION MENU**) when the alarm thresholds are reached.

Some system functions such as a real-time chromatogram are disabled when alarms are active. Rectify the problems before proceeding with your analysis.

When the problem is resolved, the same alarm message is displayed, but with an "Ok" message (except for a "Plasma shut down" that is resolved with a "Starting" and for the "Plasma OFF" that is resolved with a "Plasma ON").

**Example:**

- If a “Low carrier flow” occurs, the following message is displayed:  
(date) Low carrier flow: (hour)
- When the flow problem is rectified, the following message is displayed:  
(date) Low carrier flow: Ok (hour)

## 6.2.2 Diagnostic

### 6.2.2.1 Diagnostic

Pressing **Diagnostic (CTRL-P)** on the menu bar and then on **Diagnostic** brings you to the **DIAGNOSTIC-DIAGNOSTIC MENU** (fig. 11). The system diagnostic menu can be used for troubleshooting or only for information about the system.

This menu is divided in hardware component groups:

- Acquisition boards: read signals coming from detectors;
- IO boards: have several functionalities related to the system as toggling relays, applying polarisation, reading mechanically regulated flows, regulating oven temperatures, etc;
- Pressure regulators: regulate flows.

The screenshot displays the 'Diagnostic' menu with two main tabs: 'Acq. Board Plasma #1' and 'Acq. Board Plasma #2'. The 'Acq. Board Plasma #1' tab is active, showing a 'Detector signal' section with a table of counts and voltages, and a 'Zero (F8)' button. The 'IO Board #1' tab is also visible, showing 'Flows', 'Ovens', 'Detector Generator Power', and 'Pressure Regulator' sections.

**Acq. Board Plasma #1**

Detector signal

	Count	Volt
Cell	3787200	1.128674
Chromatogram	14432185	4.301126

Gain: 70 Scale Factor: 1x  
Pre-Amp: 2 Polarity: Follower

Zero (F8)

**IO Board #1**

Flows

Name	Count	CC/min
Carrier1	179508	24
Carrier2	173481	14

Ovens

Name	°C
oven #1	50
oven #2	378
oven #3	50

Temperature (°C)  
In : 29.6 Out : 30.2

Detector Generator Power

Plasma #	Power
1	65

Pressure Regulator

Flow Name	Count	CC/min	PSI
Sample1	3600	75.0	5.5
Air	15890	150.0	24.1
H2	544	0.3	0.8
Sample1	6621	50.0	10.0
Sample2	8404	50.0	12.8

Figure 16 : Diagnostic menu

Depending on the configuration of the analyzer, different parameters are displayed under the corresponding tab of a hardware component. The following table lists the data that can be found in the **DIAGNOSTIC-DIAGNOSTIC MENU**,

Data	Meaning
Cell	The cell counts are the detector raw signal. This data is displayed in counts, from 0 to 16777215 and also in volts, from 0 to 5V.
Chromatogram signal	The chromatogram signal represents the signal that will be displayed on the chromatogram and used to do the peak integrations. This data is displayed in counts, from 0 to 16777215 and also in volt, from 0 to 5 V.
Active Detector	Displays the current detector. These detectors are configured by Servomex using the <b>CONFIGURATION-ADVANCED MENU</b> .
Gain	Displays the gain currently applied. This gain amplifies the data to be displayed on the real-time chromatogram.
Pre-Amp	Displays the Pre-Amp Gain applied to the signal. This gain will affect not only the Chromatogram Signal, but also the cell signal. There are 4 stages predetermined in factory that can be selected.
Offset	Displays the voltage applied at the input of the acquisition board in order to offset the signal. This is particularly used with a FID (flame ignition detector).
Scale Factor	Displays the factor presently used, which can be x1, x2, x5 or x10. This factor corresponds to the multiplier applied to the gain when range 1 is in use. The multiplier can be set in the <i>Range1 fact</i> column in the Peak data grid of the <b>CONFIGURATION-CYCLE MENU</b> . This factor also corresponds to the gain factor of the <b>DIAGNOSTIC-TRENDING MENU</b> .
Polarity	Displays the current polarity of the gain. If a gain of 100 and the “inverter” (negative) value is entered, the gain is –100. If the polarity is changed to follower (positive), the gain is +100. This allows negative peak to be trend positively and properly integrated.
Flows	Displays the carrier gas flows measured on this IO Board.
Oven temperatures	Represents the ovens temperatures in Celsius degrees.
Detector Generator Power	Indicates the power applied to the different plasmas.

Temperature	Shows the temperature in Celsius degrees inside the chassis and outside the chassis of a selected IO Board. If there's more than one IO Board into the analyzer, only the inside temperature is shown for the other.
Pressure Regulator	Displays the Flow's Name, the Counts, the flow in CC/min and the pressure in PSI of the different electronic pressure regulators in the analyzer.

**Table 15 : Diagnostic menu**

The following table lists parameters that can be manually changed to diagnose a problem or simply to observe the effects of a change.

Parameter	Meaning
Active Detector	Let you choose which detector should be seen by the system. Only detectors for the conditioning board selected with the tab control can be selected.
Gain	Changes the system gain.
Pre-Amp	Toggles between Pre-Amp gain stage which can be 1, 2, 3 or 4.
Scale Factor	Toggles between factors which can be x1, x2, x5 or x10.
Polarity	Changes the system polarity.
Zero (F8)	Executes a zero, which means the baseline is reset to the current counts: when the zero is executed, the chromatogram cell counts are supposed to be near 83886076.
Detector Generator Power	These values can be changed to apply a different power on the plasmas (in %).

**Table 16 : Diagnostic menu 2**

### 6.2.2.2 Analyse Chromatogram

Pressing **CTRL-L** or clicking on **Diagnostic** on the menu bar and then on **Analyse Chromatogram** brings you to the **DIAGNOSTIC-ANALYSE CHROMATOGRAM MENU** (fig. 12).

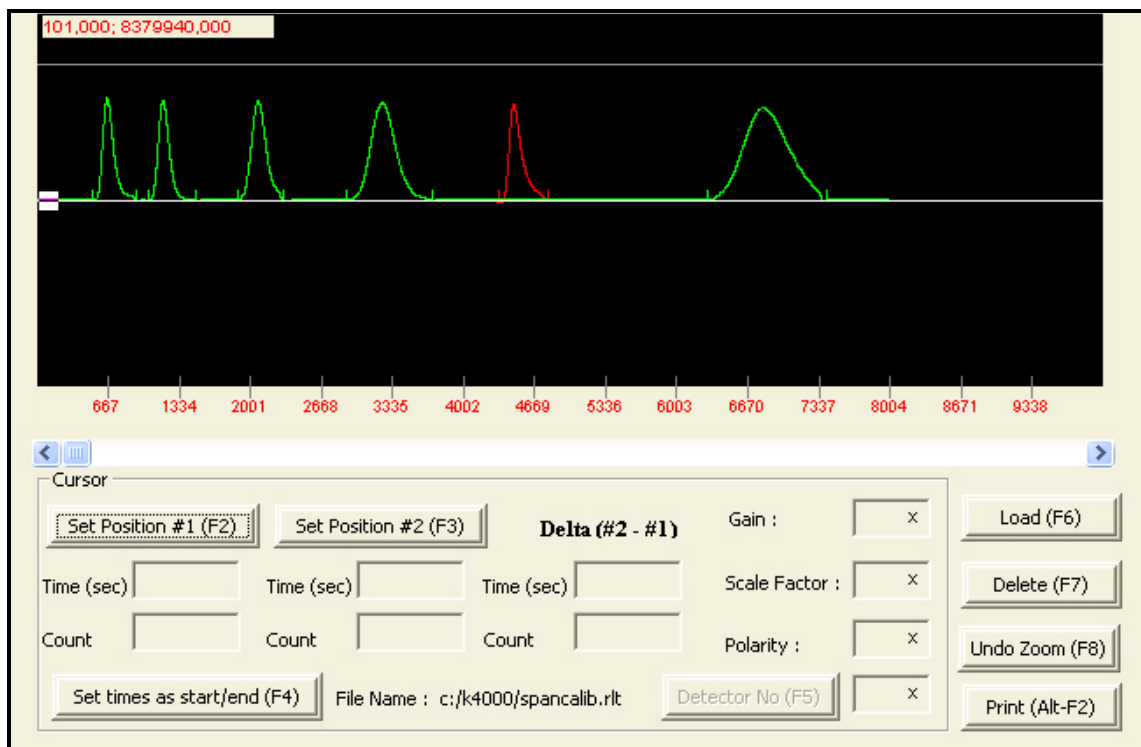


Figure 17 : Analyse chromatogram

The analyse chromatogram menu is used when you need to analyse a chromatogram and define the right starting and ending times for the peaks. When you open this menu, the software will ask you for a file that you have previously saved (it could either be a real-time chromatogram or a trending one). If you wish to change the chromatogram, you only have to load it using the **Load (F6)** button.

All real time chromatograms are saved with the .rlt extension and .trd for the trending.

A square cursor can be used to move through each line of the graph. You can see the position of the cursor on the top-left of the screen. The X axis shows time in 1/10 sec and the Y axis indicates values in counts.

You can scroll the graph with the scroll bar on the bottom of the graph.

You can zoom in the chromatogram by using the mouse. By clicking on the left button of the mouse and holding it while moving, you can zoom in the region



you want to observe. Pressing the **Undo Zoom (F8)** button will display the original chromatogram.

When you visualize a real time chromatogram, you cannot differentiate each conditioning board, you only get one line on the graph. But with a trending, each conditioning board read in the **DIAGNOSTIC-TRENDING MENU** can be seen with a different colour. In this case, the **Gain**, the **Scale Factor**, the **Polarity** and the **Detector No** edit box will be enabled. In these boxes, you can see the data that was active at a precise time in relation with the cursor; by moving the cursor, the data changes.

The **Detector No (F5)** button is enabled only when a trending is loaded. It will move the cursor on the graph for the corresponding detector.

You can use the **Set times as start/end (F4)** button to directly modify the peak data. The times specified in the edit control for each position will be automatically reported in the **Start** and **End** cells of the Peak data grid in the **CONFIGURATION-CYCLE MENU** for the peak selected after having pushed the **Set times as start/end (F4)** button. To change the time for each position, move the cursor to the desire position on the graph and click on the corresponding button, either **Set Position #1 (F2)** or **Set Position #2 (F3)**. The difference between both positions (delta) is automatically calculated.

You may also delete a chromatogram using the **Delete (F7)** button.



As the analyzer has limited hard disk space, it is a good habit to periodically delete unused trendings. Nevertheless, when saving a real-time chromatogram or a trending from the **DIAGNOSTIC MENU**, a pop-up will advise you if the analyzer hard-drive is full. If so, delete trendings from the **ANALYSE CHROMATOGRAM MENU** with the delete button.

---

Push Button	Hot key	Functions
Set Position #1	F2	Set time and counts for the position #1
Set Position #2	F3	Set time and counts for the position #2
Undo Zoom	F8	Resizes the trending to the normal size.
Delete	F7	Removes a trending from the memory.
Load	F6	Opens and displays a trending file saved in memory.
Set times as start/end	F4	Changes the starting and the ending of the peak you select with the values of time specified by the cursors positions.
Print	Alt-F2	Prints the screen.
Detector No	F5	Move the cursor on the graph for the corresponding detector.

Table 17 : Configuration menu

### 6.2.2.3 Trending

Pressing **CTRL-T** or clicking on the menu bar **Diagnostic** and then on **Trending** brings you to the **DIAGNOSTIC-TRENDING MENU** (fig. 13).

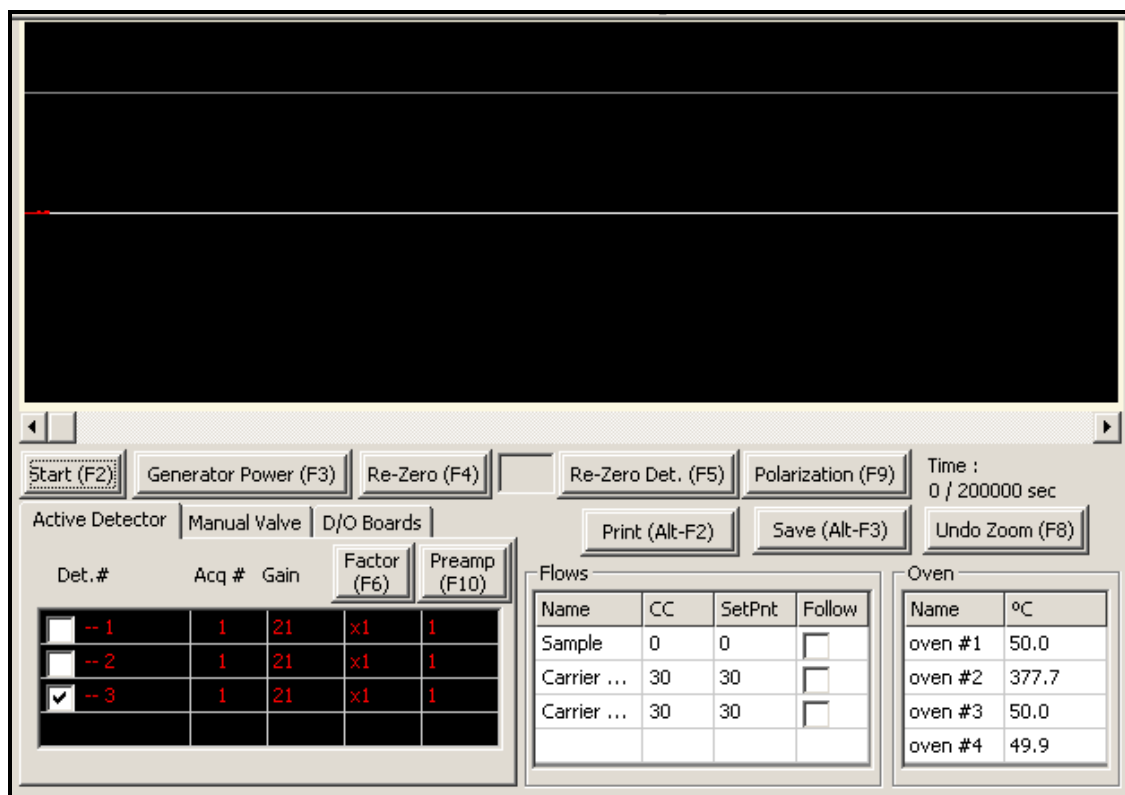


Figure 18 : Trending menu

The trending menu is useful when you need to find peaks and set the proper settings for each of them, i.e. peak starting and ending times, gain, generator power and frequency, etc... These values must then be entered in the peak data table.

Before starting a trending, be sure that all parameters set in the **CONFIGURATION-SYSTEM MENU** such as sample flow, carrier flow, oven temperature, etc., have stabilized. Be sure that the gain, the detectors and the generator power are configured correctly. Nevertheless, these parameters can be changed during the trending process, except for the detectors.

To start a trending, you just have to press the **Start (F2)** button. When a trending is in progress you cannot change the detector to be trend on the graph. To stop a trending, just press the same button that will show Stop instead of Start.

You can change the generator power by pressing **Generator Power (F3)** button. A Pop-Up will ask you a value between 0 and 100% for each generator in the analyzer.

You can do a Re-Zero for the detector indicated in the edit box control beside the **Re-Zero (F4)** button. To change the detector number, just press the **Re-Zero Det. (F5)** button and it will change the detector number in the edit box. To make a Re-Zero, just click on **Re-Zero (F4)** button.

The trending can also be zoomed using the mouse. Press the mouse's left button and keep it down while moving the mouse. A rectangle will appear on the screen to identify the zone to zoom. Releasing the button will apply the zoom. Pressing the **Undo Zoom (F8)** button will show the original trending without any zoom.

You can choose if you want to follow the valve table (timings for a valve to turn ON or OFF) or not in the **CONFIGURATION-FLOW MENU**. If the check box in the **Follow?** column is checked, the valve timing will be activated for that valve. You can also manually turn on and off a valve using the combo box located in the **State** column.

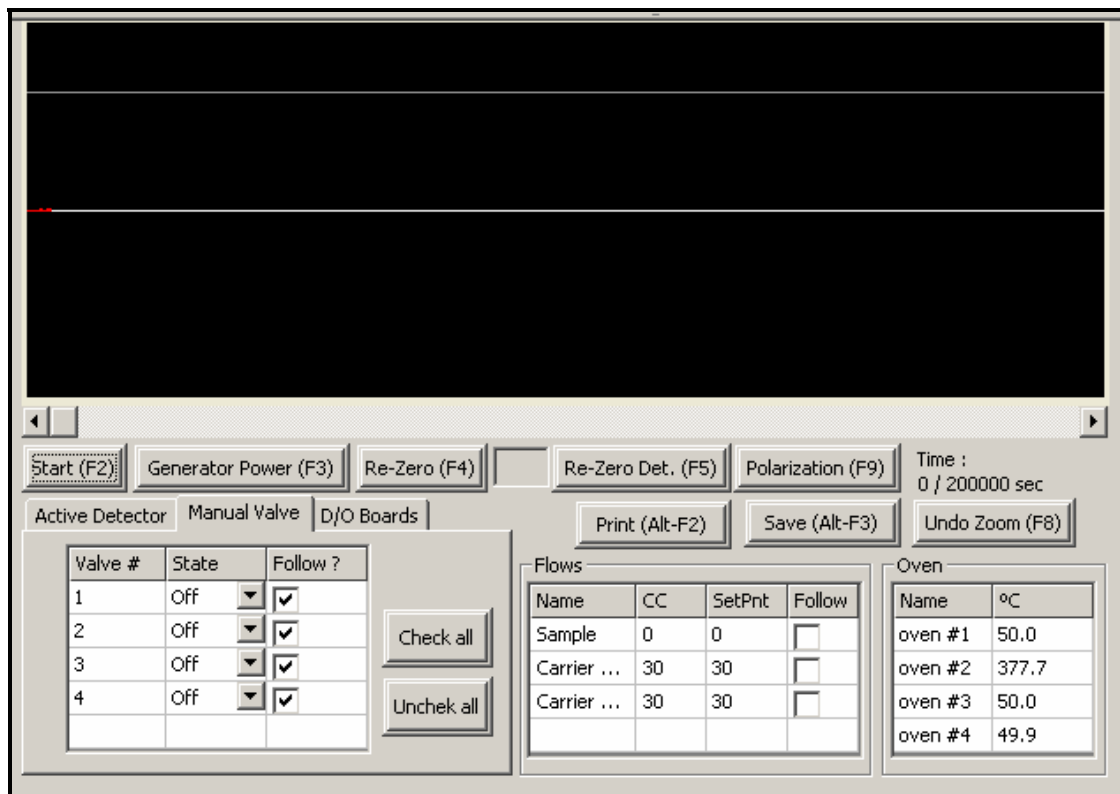


Figure 19 : Trending menu valve state

When the Active Detector tab of the left-bottom grid is selected, all configurations for each detector are shown. In the **Det. #** column, you can select the detector that you want to trend on the graph. A check box marked means that the detector will be trend. The **Cond** column indicates the conditioning board associated with the detector. The **Gain** column shows the actual gain for this conditioning board. If you want to change it, just change the value in the grid. The **Gain Factor** column indicates the Range Factor presently used. To change it, use the **Gain Factor (F6)** button. You have to select just one cell in the row for the desired conditioning board. You can select any detector row associated with that conditioning board. The **Peak Table** column let you choose if you want to follow the peak table and the **Baseline Re-Zero** column shows if the zero will be made between each peak. To make your choice, use the same procedure as for the Gain Factor with the **Peak Table** button and the **Baseline Re-Zero** button.

The **D/O Boards** tab is used to control the digital outputs of the D/O Boards (if any) into the analyzer.

Push Button	Hot key	Functions
Start/Stop	F2	Start and Stop a trending
Generator Power	F3	Set the generator power for the detector.
Re-Zero	F4	Executes a Zero.
Re-Zero Det.	F5	Change the detector to make the zero.
Print	Alt-F2	Print the graph
Save	Alt-F3	Save the trending
Undo Zoom	F8	Restore the zoom to the original trending

Table 18 : Trending menu

### 6.2.2.4 Advanced Diagnostic

Clicking **Diagnostic** on the menu bar and then **Advanced Diagnostic** brings you to the **DIAGNOSTIC-ADVANCED DIAGNOSTIC MENU** (fig. 15). This menu is used to trigger different components of the analyzer.

The screenshot displays the 'Advanced Diagnostic' menu with three main diagnostic sections and control options on the right.

**4-20 mA Diagnostic**

IOBoard #1

4-20 #	mA
1	4.0
2	4.0
3	4.0
4	4.0
5	4.0
6	4.0
7	4.0
8	4.0
9	4.0

**Relay Diagnostic**

IOBoard #1

Relay #	State
1	On
2	On
3	Off
4	Off
5	Off
6	Off
7	Off
8	Off

**Valves Diagnostic**

IOBoard #1

Valve #	State
1	Off
2	Off
3	Off
4	Off
5	Off
6	Off
7	Off
8	Off

**Status**

☒ Active  
☐ Not-Active

**Alarm 1**

☐ Active  
☒ Not-Active

**Alarm 2**

☐ Active  
☒ Not-Active

Figure 20 : Advanced diagnostic menu

#### 1) 4-20 mA Diagnostic:

This section is used to manually control the 4 to 20 mA analogue outputs.

First select the board to diagnose by using the combo box just under the title “4-20mA Diagnostic”. Enter a value in the grid from 4 to 20 for the corresponding 4-20 mA # and press **ENTER**. The analogue output will be set to this value and will stay at this value until it is changed from this menu or by normal operations from outside this menu.

## **2) Relay Diagnostic:**

This section is used to verify if the Range relays on the I/O Boards are working properly. First select the I/O Board to diagnose by using the combo box just under the title “Relay Diagnostic”. By using the combo box in the state column of the grid, you can switch the relay ON or OFF depending on the configuration in **CONFIGURATION-ADVANCED CONFIGURATION MENU**. The value is applied after an **ENTER** on the keypad or when a mouse click is performed outside the combo box.

## **3) Valves Diagnostic:**

This section is used to verify if the valves on the I/O Boards are working properly. First select the I/O Board to diagnose by using the combo box just under the title “Valves Diagnostic”. By using the combo box in the state column of the grid, you can switch the valve ON or OFF. The value is applied after an **ENTER** on the keypad or when a mouse click is performed outside the combo box.

## **4) Status, Alarm 1 and Alarm 2**

These group boxes let you change the state of the corresponding relays of Alarm and Status for a short period of time. If the analyzer processes a new alarm or error, these relays will return to their normal state after a short moment even if you have triggered a different state. By default, these relays are on the first IO board.

## 6.2.3 Configuration

### 6.2.3.1 System

Pressing **CTRL-S** or by clicking **Configuration** on the menu bar and then **System** brings you to the **CONFIGURATION-SYSTEM MENU** (fig. 16). The system configuration menu is another very important menu. Many parameters are set there. These parameters are listed in the following paragraphs.

The screenshot shows the 'CONFIGURATION-SYSTEM MENU' with various settings. The 'Analog output' section has 'Track' selected. 'mA Failure Mode' has 'Off' selected. 'Generator Starting Mode' has 'Automatic' selected. 'Range Mode' has 'Manual' selected. 'Auto-Start on Boot-Up' has 'No' selected. The 'Flow Set Point' table shows three rows: Sample, Carrier 1-S2, and Carrier 2-S2, all with Set Point and Value of 30.0 CC/min. The 'Oven Set Point' table shows four rows: oven #1, oven #2, oven #3, and oven #4, all with Set Point and Value of 50.0 °C. The 'Remote Starting Enable' section has a checkbox and a value of 1 sec. The 'Screen Saver Enable' section has a checkbox and a value of 600 sec. The 'Range Configuration' table shows H2 and O2 peaks, both with 'Opened' state. Buttons include 'Lock Range (F2)', 'Set all opened', 'Set all closed', 'Reload Manufacturing Setting', 'Print configuration', 'Change Password', 'Change Configuration', and 'Active Config : None'.

Flow Name	Set Point CC/min	Value CC/min
Sample	30.0	30.0
Carrier 1-S2	30.0	30.0
Carrier 2-S2	30.0	30.0

Oven	Set Point °C	Value °C
oven #1	50.0	50.0
oven #2	30.0	30.0
oven #3	50.0	50.0
oven #4	50.0	50.0

Peak #	Active State on Range #2
H2	Opened
O2	Opened

Figure 21 : System menu

#### 1) Analogue output:

You can choose between two modes. **Hold** mode maintains the 4-20 mA outputs even if a new cycle is started. In **Track** mode, analogue outputs always track input gas values.

#### 2) mA Failure mode:

In the case of a system status alarm, this control sets all the 4-20 mA outputs below 4mA if **LOW** is selected and higher than 20 mA if **HIGH** is selected. Selecting **OFF** will disable this function and the 4-20 mA outputs reflect signal values as in normal operation.



### **3) Generator Starting mode:**

- **Manual:** the automatic re-start feature is disabled and you may enter any plasma power value between 0 and 100%. It is useful when troubleshooting or re-configuring the system.
- **Automatic:** when the cell raw counts are lower than the cell **Plasma starting count** value, a higher power will be applied to the cell to restart the plasma.

**NOTE:** The system checks if the plasma is OFF between cycles. This feature is used only when the analyzer has a plasma cell.

### **4) Range Mode:**

**Automatic:** automatically changes the range according to the result of the previous peak integration. If the result of peak integration gives a value higher than 99% of the range presently used, the analyser switches automatically on the next higher range. The next integration gives the proper result. If the result of a peak is lower than 90% of the lower range presently used, the analyser switches to this lower range. **Manual:** you may change range manually.



This process is independent for all peaks, which means that in Automatic ranging, the second peak range can stay the same even if the first peak changes range.

### **5) Auto-Start on Boot-Up:**

When set to **Yes**, will try to start a cycle (or several cycles if The **Injection mode** has been set to **Automatic**) on the analyzer boot-up after all the alarms are resolved.

### **6) Flow Set Point:**

Indicates the flows and the set point for each of them. There are two kinds of flow, regulated flow and unregulated flow. A regulated flow is controlled by an autonomous electronic board called Pressure Regulator Board and an unregulated flow is not controlled at all, but only read by a sensor managed by the I/O Board.

#### **Regulated flow:**

This value is used by the flow control loop. In the third column of the Flow Set Point grid, the real flow is displayed. There can be a delay between the time you specify a new set point and the time the real flow is displayed and stabilized to the specified set point. To change the set point, change the value in the second column for the corresponding flow. The range of the values that can be set

corresponds to the range of the associated flow sensor table (see **CONFIGURATION-FLOW MENU**).

#### **Unregulated flow:**

This set point value is only used as a reference for flow deviation alarm. The real flow set point is determined by the pressure regulator on the back of the Servopro Chroma. If the actual flow is 2 CC/min lower or 2 CC/min higher than the reference, the flow deviation alarm is added in the **ALARM HISTORIC** and the contact status is opened (or closed, depending the configuration in the **CONFIGURATION-ALARM MENU**). This is, in fact, an alarm set point.

<b>Minimum</b>	0
<b>Maximum</b>	200
<b>Resolution</b>	1

Table 19 : Unregulated flow

#### **7) Oven set point:**

Defines the oven temperature in Celsius degrees. This is used by the oven temperature control loop. The real temperature of the oven is displayed in the third column of the Oven Set Point grid. To change the set point, change the value in the second column for the corresponding oven. Be aware that the desired set point can take several minutes to be reached and stabilized.

<b>Minimum</b>	0
<b>Maximum</b>	300
<b>Resolution</b>	1

Table 20 : Oven set point

#### **8) Remote Starting Enable:**

When this check box is checked, a cycle can be started by the digital input #1. The edit box specifies the time that elapsed before the cycle starts after the digital input #1 is activated. When the 24 Volts is applied to the digital input #1, the remote starting countdown starts (it can be viewed in the **RUN-REAL TIME CHROMATOGRAM MENU**). To start a cycle, the voltage must not be applied anymore when the countdown reaches 0. If voltage still applied, the countdown restarts.

#### **9) Screen Saver Enable:**

When this check box is checked, the screen saver is enabled. The edit box specified the time that elapsed before the screen power off. By moving the mouse or pressing a key, the screen will power on.

#### **10) Reload manufacturer settings:**

To reload the analyzer original configuration that was done in factory, click on this button. Before clicking on this button, please, call Servomex for more information.

#### **11) Range Configuration:**

This is used to configure the relays on the I/O Board for the Peak Ranges. By changing the value of the combo box for the corresponding peak, you can change its state when range 2 is active.

By the **Lock Range** button, you can also Lock or Unlock the analyzer ranges. If you press the **lock button**, the range will be locked until you press the **unlock button** (the lock button and the unlock button are the same. Only the text changes). *The range can be lock if the analyzer is in autoranging mode, but it will be ignored.* By locking the ranges, you disable the range button in the **RUN-REAL TIME CHROMATOGRAM MENU** so that the ranges cannot be changed even if manual ranging is ON.

#### **12) Print configuration**

This button is used to print the system configuration. In a multiple configurations environment, this will only print the current system configuration

#### **13) Change password**

This button is used to set a new password for the Servopro Chroma. This password is used when you want to quit the software or access the **CONFIGURATION-ADVANCED MENU**.

#### **14) Change configuration**

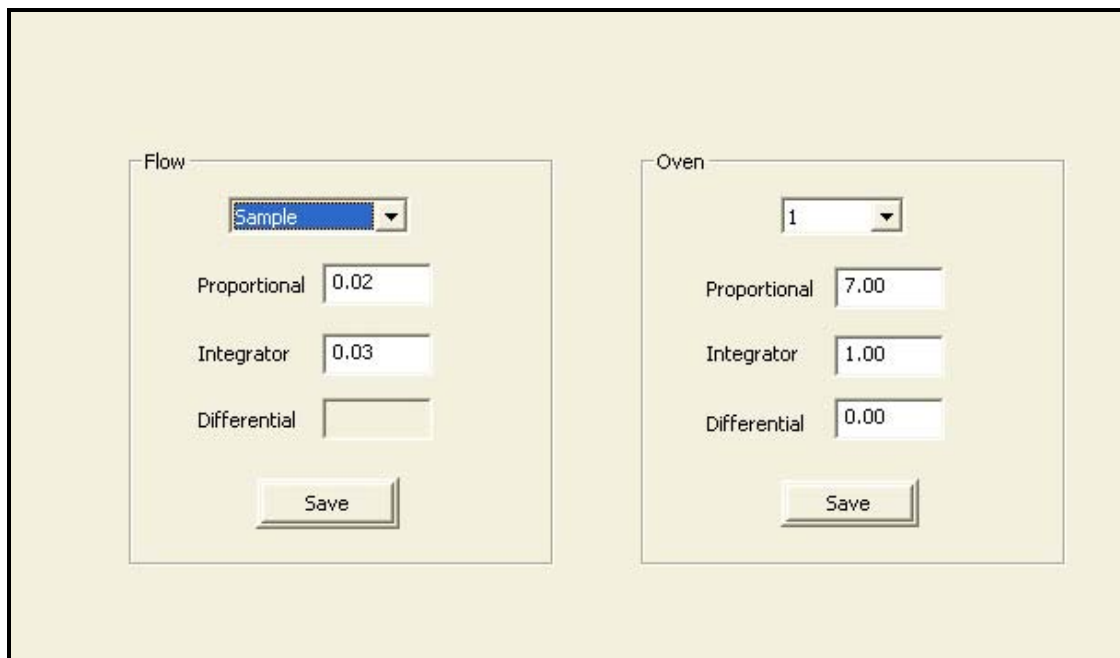
If you buy a Servopro Chroma with more then one configuration, you can change the active configuration by clicking the “Change configuration” button. When you change the active configuration, all parameters are uploaded according to the new selected configuration.

#### **15) Change password**

By default, the general password used in the analyzer is its serial number. If, for any reason, you need to change it, click on this button. A dialog window will ask you for the old password and will require you to input the new password twice.

### 6.2.3.2 PID

Clicking on **Configuration** on the menu bar and then on **PID** brings you to the **CONFIGURATION-PID MENU**.



The screenshot displays the 'CONFIGURATION-PID MENU' with two main sections: 'Flow' and 'Oven'. The 'Flow' section has a dropdown menu set to 'Sample', with input fields for Proportional (0.02), Integrator (0.03), and Differential (empty), and a 'Save' button. The 'Oven' section has a dropdown menu set to '1', with input fields for Proportional (7.00), Integrator (1.00), and Differential (0.00), and a 'Save' button.

Figure 22 : PID menu

This menu lets you set the PID settings for flows and ovens. ***Be sure to save your settings before changing Oven # and Flow #.***

### 6.2.3.3 Flow

Clicking on **Configuration** on the menu bar and then on **Flow** brings you to the **CONFIGURATION-FLOW MENU** (fig. 18).

This menu contains the flow sensor table. This data is set up by Servomex. If you have to recalibrate some of these data, follow these steps:

#### Unregulated flow:

First of all, you need to choose the flow that you want to calibrate with the combo box on the top-left of the view. There are two kind of gas: Regulated flow and unregulated flow. The Simple flow is changed using a gas regulator. For calibrating these sensors, you need a 0 CC/min point, a point higher than 200 CC/min and eight points between these values. Now, turn the gas valve and

note the Flow meter counts in the **Flow Setting Tool**. Use a bubble flow meter to find the reading of the flow in CC and write down these two values on paper. When you have 10 reading points, you must enter these in the flow table using the keyboard.

Flow	Counts
0.0	124609
6.4	134443
13.6	148618
28.2	168453
32.9	175482
38.2	182769
44.7	192787
50.3	198273
57.9	207309
72.6	221985

Flow Setting tools

Flow meter counts : 0

Flow Factor : 1.0

Validate (F3)    Print (Alt-F3)

Figure 23 : Unregulated flow configuration menu

### **Regulated flow:**

For the regulated flows, the same principle as in the unregulated flow sensor calibration is used, but you can control the gas pressure with the controlled valve using the **Flow Setting Tool**. Wait for the PSI of the pressure valve to stabilize to the new set point. Now, use a bubble flow meter to find the reading of the flow in CC. When you have 16 reading points, you must enter these in the flow table using the keyboard. Note that the Flow Control Type depends on the tubing configuration of the system (bypass or direct). Therefore, keep the Flow Control Type as it is.

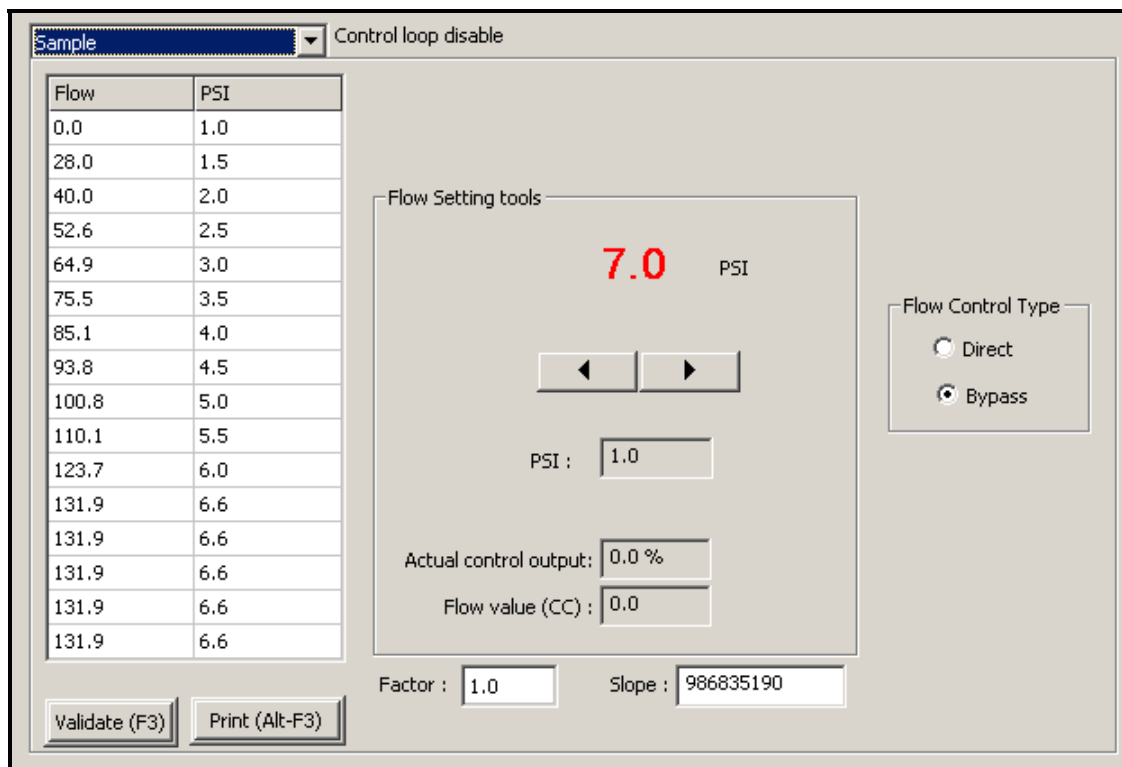


Figure 24 : Regulated flow configuration menu

In this menu, the control loops (flow set point values) are disabled. But as soon as this menu is closed, the control loops are re-enabled.

A flow association must be configured in the **CONFIGURATION-ADVANCED MENU** to know which flow is a regulated flow and which is a unregulated flow.

### **Flow Factor:**

Many different types of gases could be handled by the Servopro Chroma. Flow transducers use the thermal conductivity principle to determine the volumetric flow (CC/min) of the gas. Various gases have different conductivities, for example, Helium and Hydrogen have a much higher thermal conductivity compared to Argon or Oxygen. The **Flow Factor** can be applied to the flow table in order to obtain the proper flow for various gases. Here are some factors for various gases:

Gas	Factor
Argon	1.0
Hydrogen	8.7
Helium	8.5
Oxygen	0.92
Nitrogen	1.04

Table 21 : Flow Factor



The minimum pressure required for proper operation could need to be re-adjusted in order to avoid oscillation of the flow control loop when changing the sample gas type. This is application dependent.



The sample flow factor can be determined by using a bubble flow meter on the sample vent. To find a new flow factor for new sample gas, you may use a bubble flow meter connected on the sample vent bulkhead on the rear panel of the analyzer. Enter an arbitrary factor until the sample flow displayed on the LCD is close or equal to the flow measured with the bubble flow meter, that's all! For the sample flow, the absolute value is not critical, the stability is. This means that at the end of a cycle, the sample flow must be the same as the previous one. This is important for stability.

### 6.2.3.4 Cycle

Clicking on **Configuration** on the menu bar and then on **Cycle** brings you to the **CONFIGURATION-CYCLE MENU** (fig. 20).

This menu contains all the information that the system needs when a cycle (Real time chromatogram) is in progress.

#### 1) General (Cycle Data and 4-20 mA Peak Association):

This menu is used to set the duration of the cycle (length of one chromatogram) and the duration displayed in the **REAL-TIME CHROMATOGRAM MENU**. Also, it is used to assign a peak to a particular 4-20 mA output.



Don't change these values unless you know exactly what you are doing!

Peak #	I/O Board #	4-20 mA #
1	1	1
2	1	1
3	1	1
4	1	1
5	1	1

Figure 25 : General cycle menu



**2) Peak:****Peak Configuration:**

The data that is found in the next menu is used during an analysis. The system parameters change in real time according to each peak configuration.

Name	Avr	Start	End	Det	Alarm 1	Alarm 2	Range 2	Range 1	Unit
Ar	1	237.0	276.0	3	1000000.0	1000000.0	1000	1x	PPB
O2	1	303.0	423.0	2	1000000.0	1000000.0	1000	1x	PPB
N2	1	435.0	482.0	8	1000000.0	1000000.0	1000	1x	PPM
CO2	1	595.0	662.0	6	1000000.0	1000000.0	1000	1x	PPM
CO	1	675.0	789.0	6	1000000.0	1000000.0	1000	1x	%

Peak #1 data

Gain:  Plasma power:  %

Polarity:  Pre-Amplification:

**Figure 26 : Peak configuration menu**

In the grid at the top of this menu, you found general information that does not depend upon the kind of detector. Here's a description.

Column	Explanation
Name	Name of the peak.
Avr	Average that can be used to calculate the impurity value of the peak. An average of 1 disables the feature.
Start	The starting time of a peak.
End	The Ending time of a peak.
Det.	The detector number used to trend the peak. Refer to the CONFIGURATION-ADVANCED MENU for the detector number association.
Alarm 1	When the peak exceeds this value, the alarm 1 will be activated.

Alarm 2	When the peak exceeds this value, the alarm 2 will be activated.
Range 2	(Range 2 Scale) This value indicates the full scale of the analyzer (Range 2).
Range 1	(Range 1 factor) The multiplier applied to the system, when the analyzer is on the first range.
Unit	Unit of the peak (PPM, PPB or %)

**Table 22 : Peak Configuration Columns**

Underneath the grid, you find extra information about the peak that is currently selected in the grid. This information depends on the type of detector.

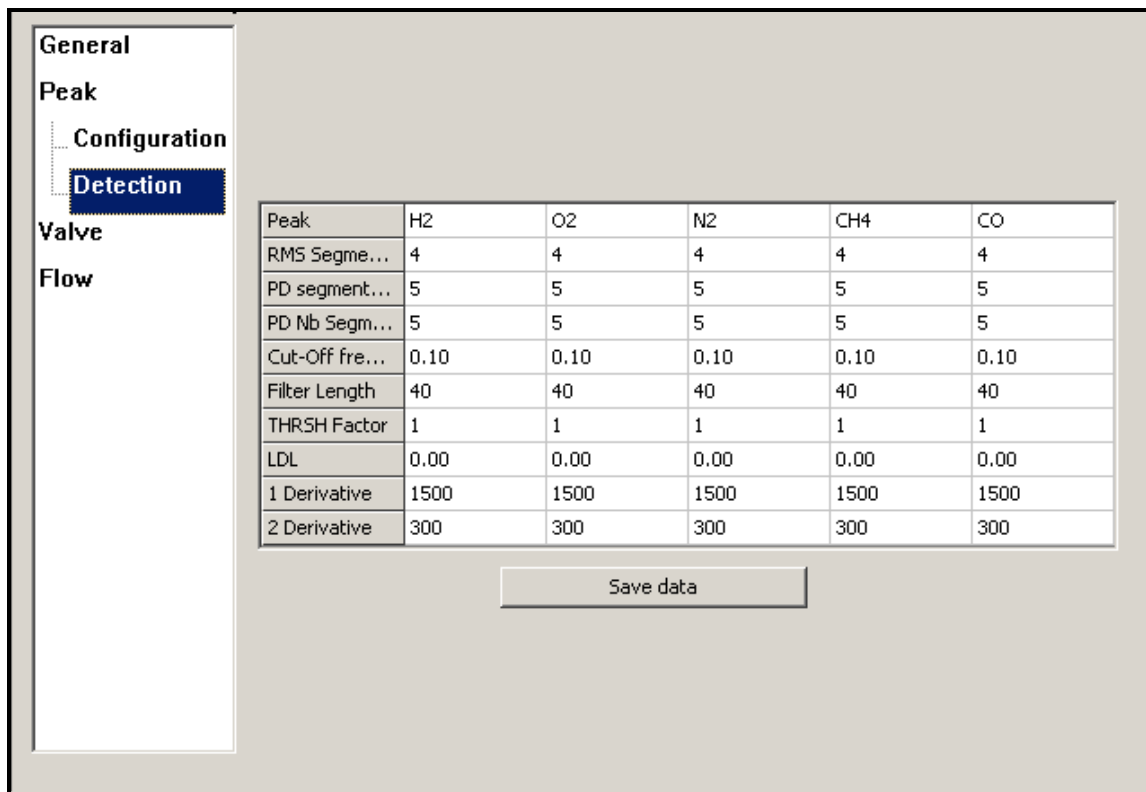
Polarity	The polarity: Follower or Inverter.
Gain	The peak gain.
Plasma/generator Pwr	Detector Generator Power used for the corresponding peak.
Pre-Amp	Shows the stage of the Pre-Amp for the corresponding peak.

Push Button	Hot key	Functions
Add Peak	F2	Add a peak to the grid
Delete selected peak	F3	Delete the peak selected in the grid.
Save peak table	F4	Save the peak grid
Print Peak Table	Alt-F2	Print the peak grid
Peak Detection Cfg.	None	Brings the Peak Detection Configuration Menu

**Table 23 : Peak Configuration Menu**

Peak Detection:

In this menu, you can modify constant that are used to detect if and when there is a peak.



Peak	H2	O2	N2	CH4	CO
RMS Segme...	4	4	4	4	4
PD segment...	5	5	5	5	5
PD Nb Segm...	5	5	5	5	5
Cut-Off fre...	0.10	0.10	0.10	0.10	0.10
Filter Length	40	40	40	40	40
THRSH Factor	1	1	1	1	1
LDL	0.00	0.00	0.00	0.00	0.00
1 Derivative	1500	1500	1500	1500	1500
2 Derivative	300	300	300	300	300

Save data

Figure 27 : Peak detection configuration menu



**AVOID CHANGING THESE SETTINGS:** they are configured in factory by Servomex.

### 3) Valve data:

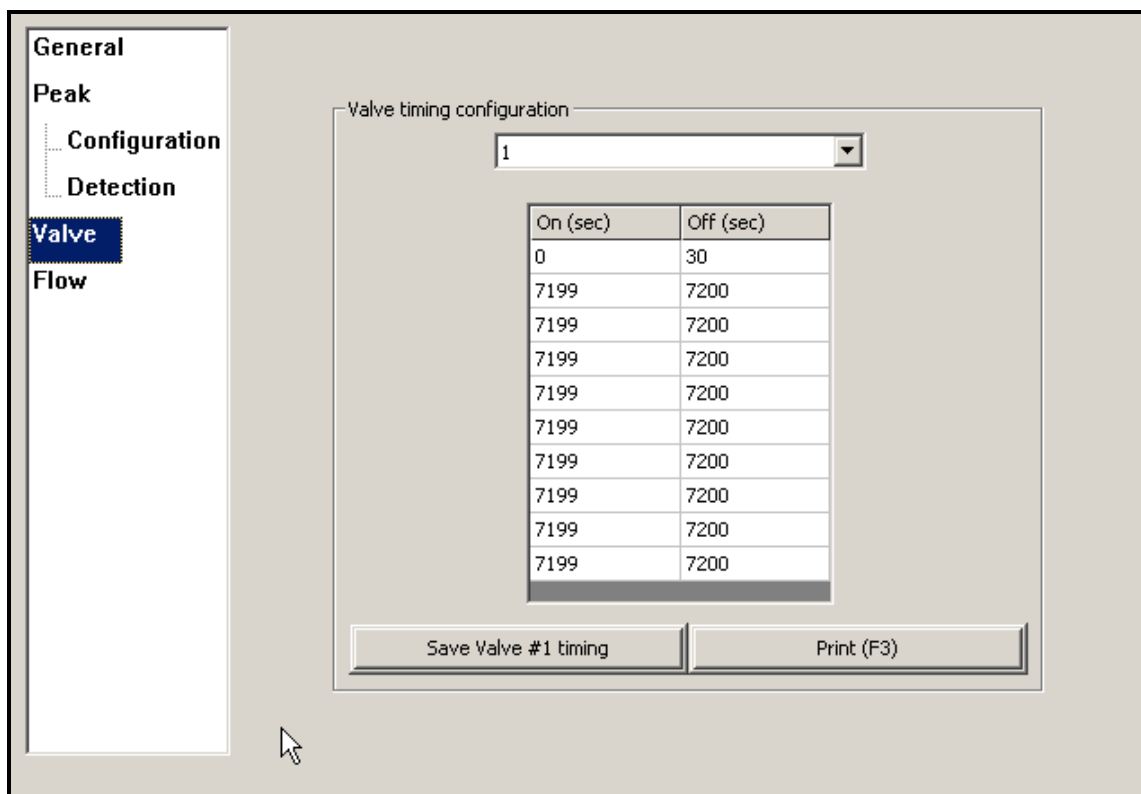


Figure 28 : Valve configuration menu

This group box is used to control the valve state. By clicking in the combo box, you can change the time at which the valve go ON (open) or OFF (close). Each row in the grid indicates a sequence for the selected valve.

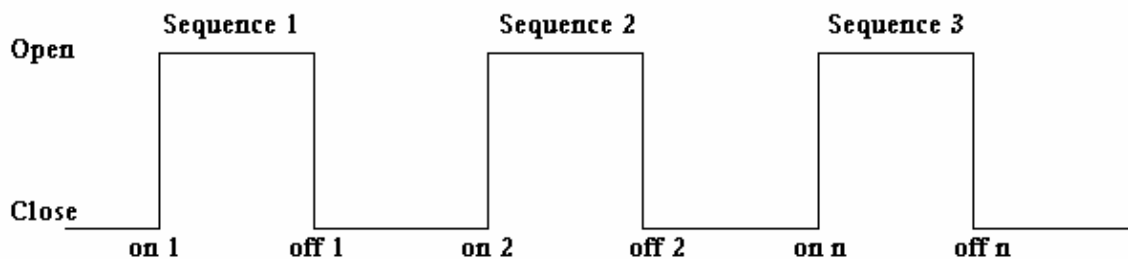


Figure 29 : Typical sequence for valve timing

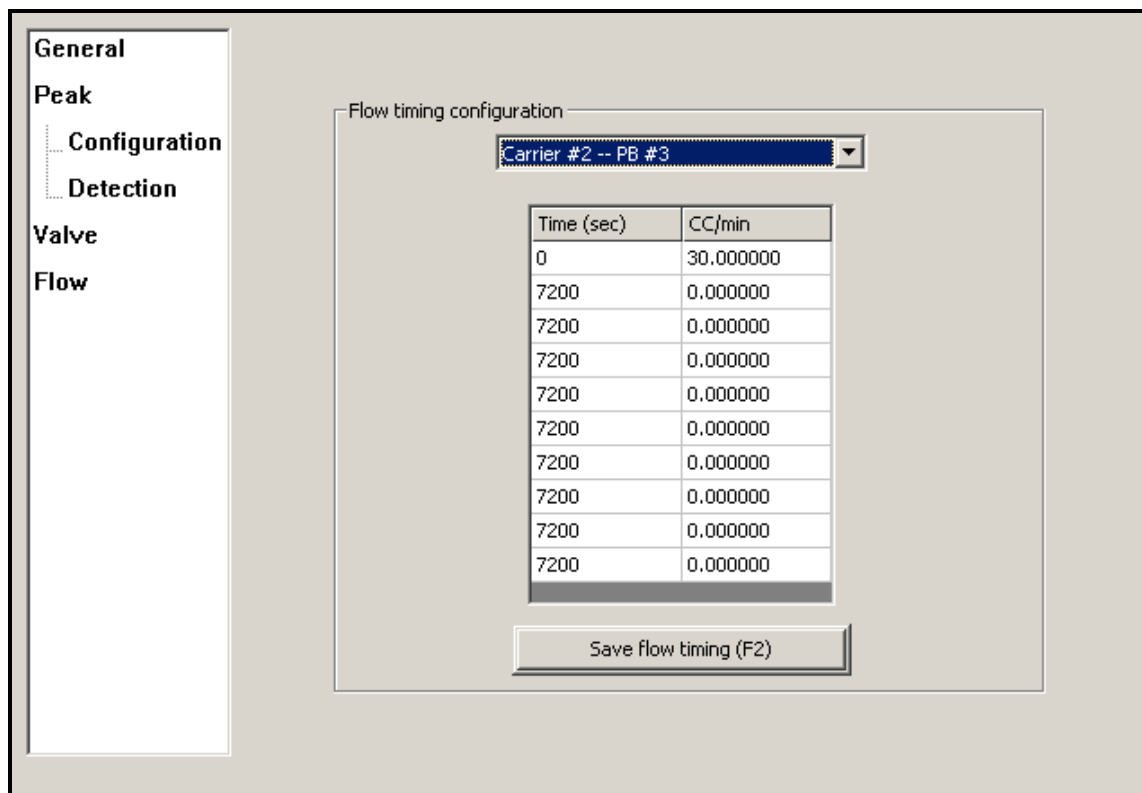
Don't forget to save valve timing data with the **Save Valve** button each time you select a new valve in the combo or if you quit the menu.



A valve timing won't be applied unless the timings are saved first.

#### 4) Flow

This group box is used to configure flow timing table. A flow timing table can be used to change a flow set point during a cycle.



The screenshot shows the 'Flow timing configuration' menu. On the left is a vertical sidebar with menu items: General, Peak, Configuration (highlighted), Detection, Valve, and Flow. The main area is titled 'Flow timing configuration' and contains a dropdown menu set to 'Carrier #2 -- PB #3'. Below this is a table with two columns: 'Time (sec)' and 'CC/min'. The table has 10 rows. The first row has '0' and '30.000000'. The remaining 9 rows have '7200' and '0.000000'. At the bottom of the main area is a button labeled 'Save flow timing (F2)'.

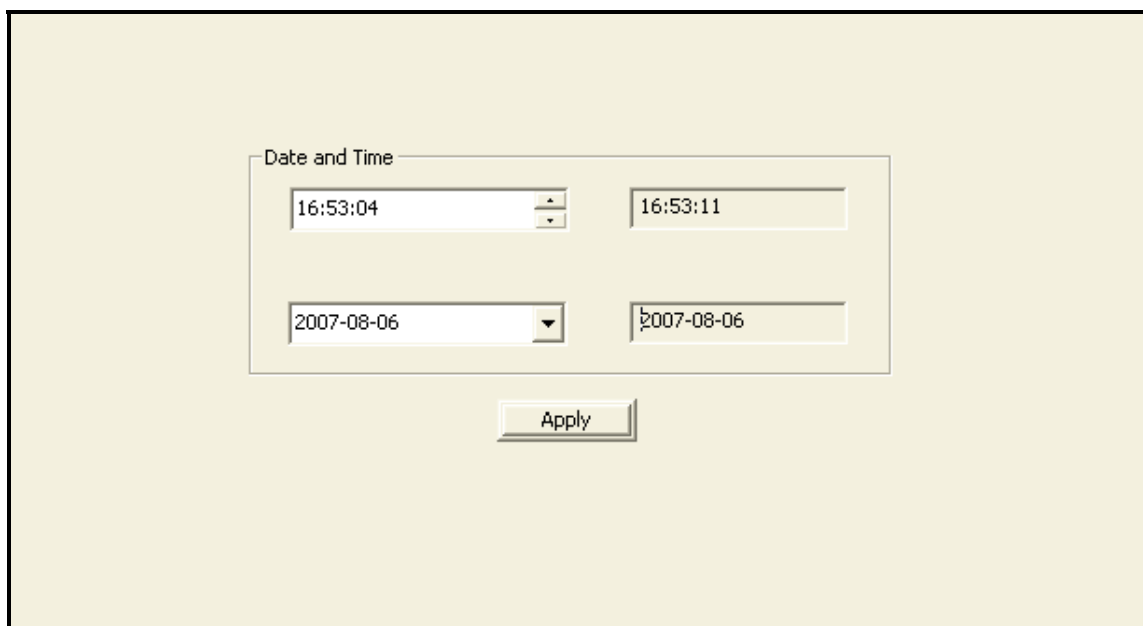
Time (sec)	CC/min
0	30.000000
7200	0.000000
7200	0.000000
7200	0.000000
7200	0.000000
7200	0.000000
7200	0.000000
7200	0.000000
7200	0.000000
7200	0.000000

Figure 30 : Flow timing configuration menu

To set a flow timing table, select the proper flow name using the combo box. Then enter times and the flows into the table. A time of 7200 sec means that this point isn't use. According to figure 25, the set point will be set to 30 cc/min at the beginning of the cycle and won't change during the cycle because other timings are set to 7200 sec. Once you have fill up the grid, push the **Save flow timing** button to save data.

### 6.2.3.5 Date and Time

Clicking on **Configuration** on the menu bar and then on **Date and Time** brings you to the **CONFIGURATION-DATE AND TIME MENU** (fig. 26).



**Figure 31 : Date and Time menu**

This menu lets you set the date and time of your analyzer. By using the combo box control, you can change the value of the date and of the time. Just click on Apply to set the desired value.

### 6.2.3.6 Advanced Configuration

Clicking on **Configuration** on the menu bar and then on **Advanced** brings you to the **CONFIGURATION-ADVANCED MENU** (fig. 27).

This menu is the analyzer core. It defines all the hardware components on which the Servopro Chroma is built.



Therefore, you normally don't have to change these configurations; they are set in factory and reflect the hardware of the analyzer.

Before entering the **Advanced Configuration** menu, the analyzer will ask you for the general password of this analyzer. This password is, by default, the serial number of the analyzer, but can be changed into the **CONFIGURATION-SYSTEM CONFIGURATION MENU**.

If for any reason you have to change any parameters of this menu, please contact Servomex.

#### 1) General:

Item	Quantity
Cond. Board	1
FID	0
I/O Board	1
Flow	3
Valve	4
Detector	3
Oven	4
Plasma	1
Press. Board	3
Temp. Ctrl.	0
D/O Board	0

System Alarm  
☒ On    ☐ Off

RS-232 Communication  
☐ On    ☒ Off

Take Snapshot

Figure 32 : Advanced configuration menu

In this menu, all Servopro Chroma alarm and error monitoring can be turned off when a user wants to work with the analyzer even if for example a flow is too low for a proper operation.

**NOTE: Turning off System Alarm can be dangerous, for example if you are working with Hydrogen: the Servopro Chroma will stop advising you of any further problems!**

Also, this is where the number of electronic boards, components and functionalities are entered.

Moreover, the RS232 communication can be turned ON and OFF if the system is purchased with this option.



**AVOID CHANGING THESE SETTINGS:** they are configured in factory by Servomex.

Finally, the **Take Snapshot** button can be used to help Servomex diagnose a problem into your analyzer. Use this button only under recommendation from Servomex.



**2) Detector Association:**

**Detector #1**

Detector Type  
Plasma

Cond. Board #	Channel #	Location	Plasma #
1	1	I/O Board #1	1

Save Cancel

**Figure 33 : Detector configuration menu**

When using a plasma cell, a conditioning board must also be selected with the right channel. Moreover, a plasma detector must be associated to the cell by selecting its location on an IO board and its number on this IO board. The plasma detector association is used to process alarms such as Plasma Off, Plasma On and Plasma Starting.

This list includes all detectors, including those contained within any slave units connected to the master unit or standalone PC. Bear in mind however that each individual conditioning board can only process up to 8 detectors.

Don't forget to save the new configuration by clicking on the Save button.



**AVOID CHANGING THESE SETTINGS:** they are configured in factory by Servomex.

**3) Flow:**

Name	Location	Sensor #	Associated Plasma
Carrier1	I/O Board #1	Sensor #4	Plasma #1
Carrier2	I/O Board #1	Sensor #5	Plasma #2
Sample1	Press. Reg. #1		
Air	Press. Reg. #2		
H2	Press. Reg. #3		
Sample1	Press. Reg. #4		
Sample2	Press. Reg. #5		
Carrier3	I/O Board #2	Sensor #3	Plasma #1
Carrier4	I/O Board #2	Sensor #4	FID

**Figure 34 : Advanced flow configuration menu**

The Flow menu associates a flow with a sensor on a certain I/O Board or Pressure Board. Name the flow, choose its location on the appropriate I/O Board, select Sensor number 3, 4 or 5 for a carrier, and associate a plasma detector (used to generate alarms and errors). If the location of the flow is Pressure Board, no sensor or plasma association is needed.

Don't forget to save the new configuration by clicking on the Save button.



**AVOID CHANGING THESE SETTINGS:** they are configured in factory by Servomex.

**4) Valve:**

Valve #	Location	Channel #
Valve #1	I/O Board #1	Channel #1
Valve #2	I/O Board #2	Channel #1
Valve #3	I/O Board #2	Channel #2

Save Cancel

Figure 35 : Advanced valve configuration menu

The Valve menu associates a valve number to a valve channel on an I/O Board.

**5) Oven:**

Name	Location	Channel #	Max °C	Min °C
Oven1	I/O Board #1	Channel #1	300.00	0.00
Oven2	I/O Board #1	Channel #2	300.00	0.00
Oven3	I/O Board #2	Channel #1	300.00	0.00
Oven4	I/O Board #2	Channel #2	300.00	0.00
FID	FID #1	Channel #1	300.00	0.00

**Figure 36 : Advanced oven configuration menu**

The Oven menu associates an oven with a certain I/O Board and a certain channel on this IO board. It is also possible to enter the maximum and minimum value for the temperature set point of this oven.

Don't forget to save the new configuration by clicking on the Save button.



**AVOID CHANGING THESE SETTINGS:** they are configured in factory by Servomex.

### 6.2.3.7 Alarm

Clicking on **Configuration** on the menu bar and then on **Alarm** brings you to the **CONFIGURATION-ALARM MENU** (fig. 32).

Status Alarm

☐ Opened when active ☒ Closed when active

Alarm State

I/O Board #	Active State on alarm 1	Active State on alarm 2
1	Opened	Opened

Set All Opened Set All Closed

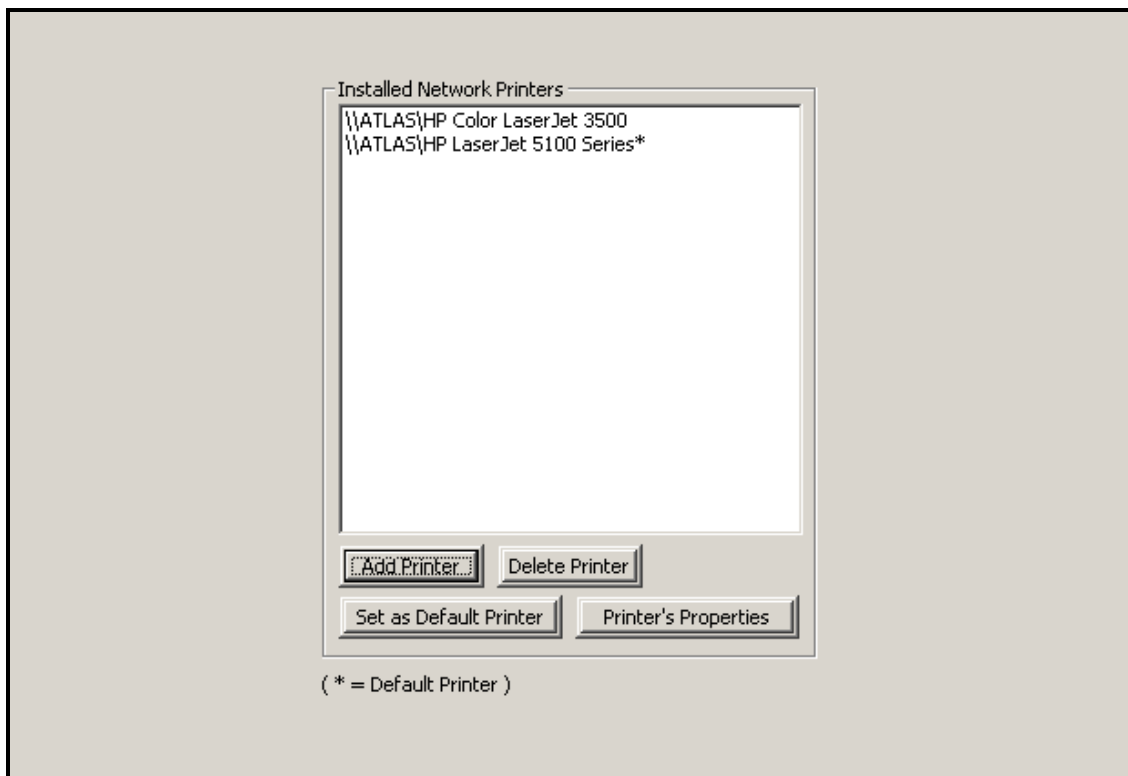
Figure 37 : Alarm outputs configuration menu

This menu lets you configure the alarms. The status alarm relay can be closed or opened when a status alarm is activated. Click on the desired radio box button.

To set the active state for the Alarm 1 and Alarm 2 relay on the I/O Board, use the corresponding combo box in the Alarm State grid.

### 6.2.3.8 Printers

Clicking on **Configuration** on the menu bar and then on **Printers** brings you to the **PRINTER CONFIGURATION MENU** (fig. 33).



**Figure 38 : Printers configuration menu**

The printers already installed on your analyzer will be listed in this menu. It is possible to configure a new printer by adding it with the **Add Printer** button. This will show a new dialog wizard window that will help you to choose a new printer shared over your network. The **Set as default** button determines which printer is used as default for printing. The printer's properties can be modified with the **Printer's Properties** button. To remove a printer, use the **Delete Printer** button.

## 6.2.4 Calibration

### 6.2.4.1 Calibration

By clicking **Calibration** on the menu bar and then **Calibration**, you access the **CALIBRATION-CALIBRATION MENU** (fig. 34).

Name	THRSH	Span Gas	Result	Rng	Select	TR5 Done	Span Done	Response Factor	Area Count
N2	1352.7	21.90	38.63		NO	YES	YES	0	10644726
CO2	2224.8	102.00	95.72		YES	YES	YES	0	54307524
AR	3329.6	16.00	< 1.00		NO	YES	YES	0	2135238
O2	4987.8	16.50	2.69		NO	YES	YES	0	9537891

Time : 0 sec

**Noise Threshold Calibration**

Enable (F2)

☐ Selected peaks  
☐ All peaks

**Span Calibration**

Add N2 calib. values    Enable (F3)

☐ Selected peaks  
☐ All peaks

☐ Automatic Re-Span

Figure 39 : Calibration menu

This menu is used to calibrate the system for the different gases you have to analyze.

Be sure to first configure all parameters of the system that you find in the **CONFIGURATION-SYSTEM MENU** and in the **CONFIGURATION-CYCLE MENU**. The analyzer must be properly started and purged before the execution of a calibration.

#### 1) Noise Threshold (THRSH) Calibration:

This calibration step will find the noise level used for the peak detection process. In this step, **no injection** will be done. It is just a noise baseline on range #1, as the highest gain applied is always on this range. When starting the cycle, it will automatically switch to range #1. The RMS (Root Mean Square) value of this noise will be saved as noise and used for the peak pre-recognition.

First, you need to enable the Noise Threshold Calibration with the corresponding **Enable** button. After a few cycles in automatic injection, you can press **Calculate Threshold** button. The RMS value will be shown in the THRSH column of the grid. You can **Calculate Threshold** for **All peaks** or only the **Selected peaks** by changing the corresponding slider state. When **Selected peaks** is selected, only peaks that have a **YES** in the **Select** column of the grid will be considered.

When the Noise Threshold Calibration is done, **YES** is displayed in the **TRS done** column of the grid.

## 2) Span calibration:

Calibration gas values must be set for each individual peak before starting a calibration run. To set calibration values, select a peak name with the mouse and then push **Add “peak name” calib values** button. A popup menu appears (Figure 35).

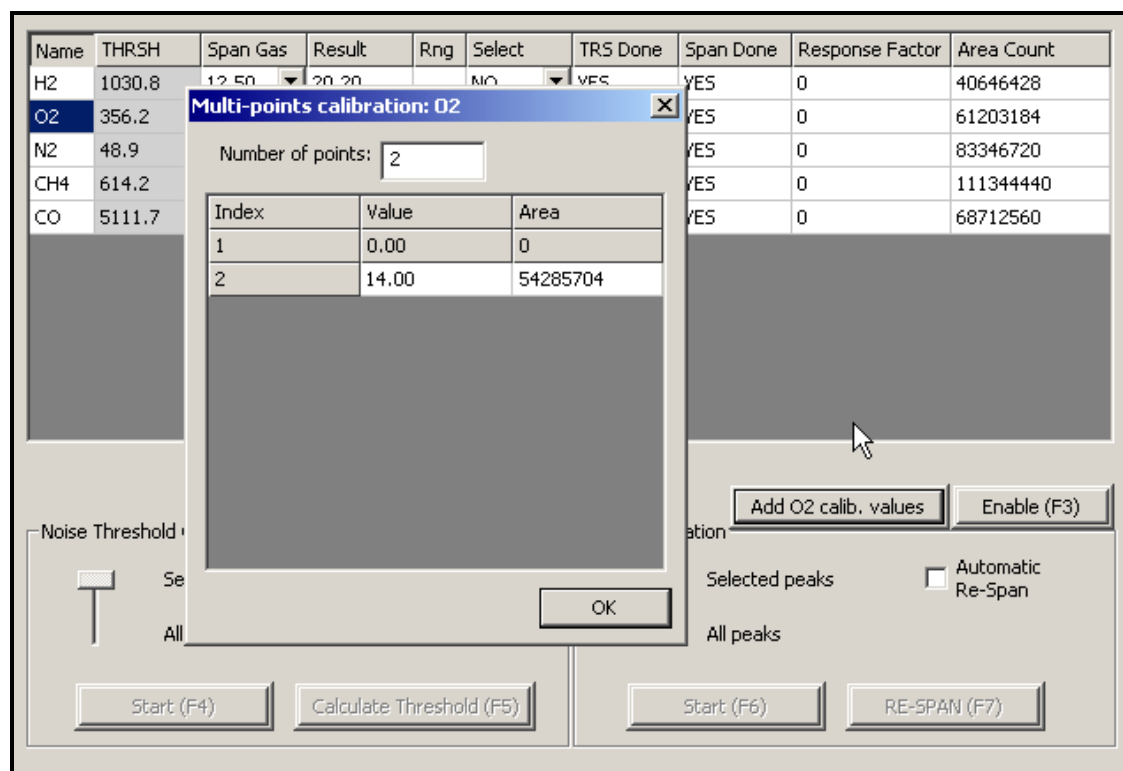


Figure 40 : Span calibration menu

First of all, you must enter the number of point that will be used to calibrate the system. Normally, user uses only two points: point 0.00 by default and another value. If you have a calibration system like Kontrol Analytik's GCS-100, you can calibrate your system for an unlimited number of impurities. Consequently,



the analyzer results will be more accurate. Once calibration values have been entered, click **OK** to go back to **Calibration** main menu. If you have more than one peak, do the same steps for the remaining peaks. Once all values are set, a calibration cycle can be performed. Click the **Enable** span calibration. Then select the impurity value for each peak using the combo box in the **span gas** column. Then, if you wish to calibrate only some peaks, select **YES** in the select column for the peaks you want to calibrate and then, select **Selected peaks** in span calibration menu. If you want to calibrate all peaks, select **All peaks**. To run a calibration cycle, push the start button and wait for cycle end. Actual cycle time is displayed under the grid. When the cycle is completed, push the **re-span** button to accept the calibration. If you want to calibrate other impurity values, select them in **span gas** column and repeat the previous steps. To disable calibration mode, click on **disable** span calibration.



*Calibration enabled* will be displayed in the **RUN-REAL TIME CHROMATOGRAM MENU**. It is suggested and of common sense to do the calibration in **Automatic** injection mode. This allows a better gas equilibrium.



When calibration is enabled, you can't change range configuration



Don't forget that prior to any calibration, the proper gas must be flowing through the analyzer, some runs must be done and the readings must be stabilized.

To perform a calibration, it is suggested to perform the following steps:

- Configure your system (peak data, valve timings, system configuration data, alarm data, range data, flow tables and PID settings) and your calibration data (zero and span gas).
- Enable Noise Threshold Calibration with the corresponding button in the **CALIBRATION-CALIBRATION MENU**.
- Start a calibration with the start button. Ranges #1 will be set automatically.
- After some cycles have been done (you are supposed to see a relatively straight line in the **RUN-REAL TIME CHROMATOGRAM MENU**), press **Calculate Threshold**.
- Disable **Noise Threshold** Calibration with the corresponding button.
- Enable Span calibration, select impurity values and press **Start**.
- After some cycles have been done (you are supposed to see peaks), press **ReSpan**.
- Disable span calibration with the corresponding button.
- Your system is calibrated.



Calculate Threshold, ReSpan and Start buttons are only accessible when calibration is enabled.

The other values displayed on the grid are:

- Area counts: this is the area that covers the peak in counts (digital converter units). This area is used to generate the concentration displayed in the Result column;
- Response factor: this is the area counts divided by the value in the Result column.

Moreover, there is an **Automatic Re-Span** option. When this option is checked, the analyzer automatically performs a re-span (same as pressing the **Re-Span** button) after a cycle of calibration reaches an end. In other words, after having press the **Start** button in the **Span** calibration, the cycle starts, then ends and the analyzer automatically calculates the value of this calibration with the last measured area counts and displays it in the **Result** column.

#### 6.2.4.2 Calibration of the 4-20mA outputs

By clicking **Calibration** on the menu bar and then **4-20mA outputs**, you access the **4-20MA OUTPUT CALIBRATION MENU** (fig. 37).

Figure 41 : 4-20 mA outputs calibration menu

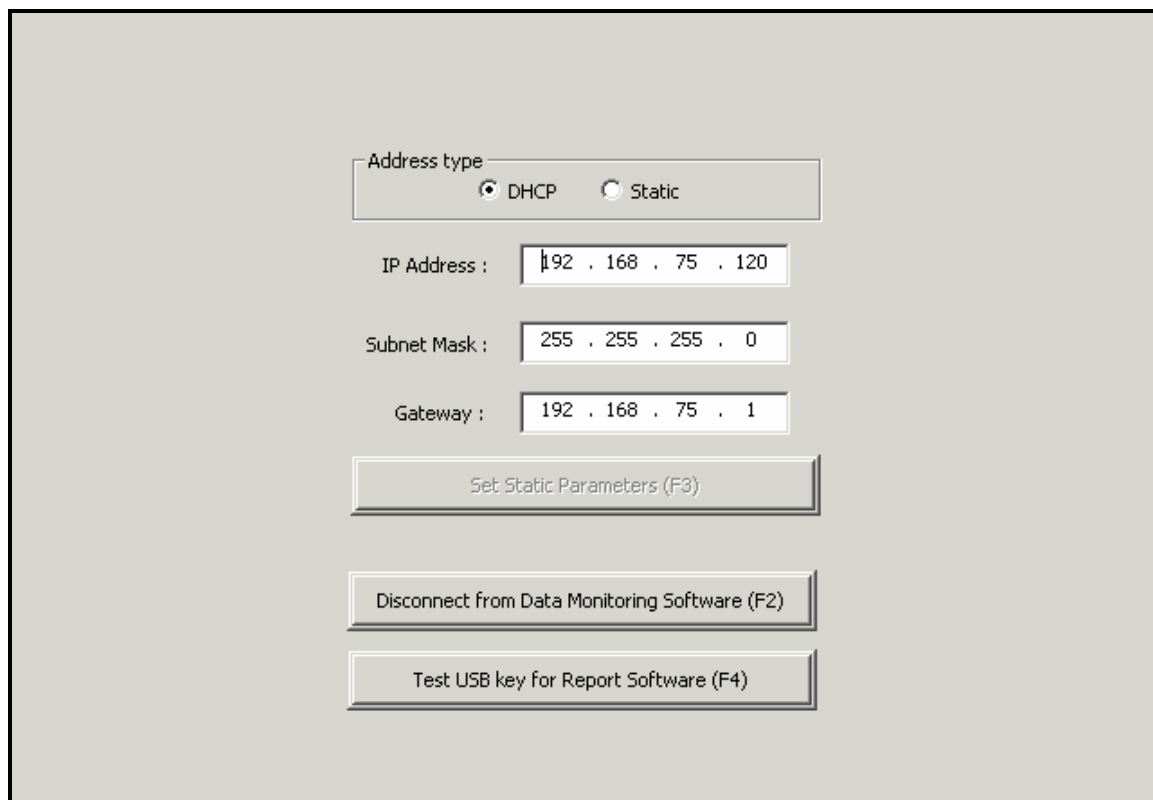
This menu is used to calibrate the 4-20mA outputs. This is originally performed in factory. Therefore, you normally don't have to do it again.

- ▶ **Step 1:** First choose the IO board on which you want to calibrate the 4-20mA outputs; normally, the 4-20mA outputs are on the first IO board;
- ▶ **Step 2:** Select the output you want to calibrate;
- ▶ **Step 3:** Connect an ampere-meter on the rear panel of the analyzer on the corresponding output;
- ▶ **Step 4:** Output a value between 0 and 100% (advise: 20%) by writing it in the edit box on the left of the “Set” button and click on “Set”;
- ▶ **Step 5:** Write in the edit box on the right of “Set as low value” the reading on your ampere-meter and press “Set as low value”;
- ▶ **Step 6:** Redo step 4 and 5 with a value higher than the first (advise: 80%) but enter it in the “Set as high value” edit box;
- ▶ **Step 7:** Press on the Calibrate button.

## 6.2.5 Remote

### 6.2.5.1 Report Software

Clicking on **Remote** on the menu bar and then on **Report Software** brings you to the **REMOTE-REPORT SOFTWARE MENU** (fig. 38).

The screenshot shows a menu interface with a light gray background. At the top, there is a section titled "Address type" containing two radio buttons: "DHCP" (which is selected) and "Static". Below this, there are three input fields for IP configuration: "IP Address :" with the value "192 . 168 . 75 . 120", "Subnet Mask :" with the value "255 . 255 . 255 . 0", and "Gateway :" with the value "192 . 168 . 75 . 1". Below these fields are three buttons: "Set Static Parameters (F3)", "Disconnect from Data Monitoring Software (F2)", and "Test USB key for Report Software (F4)".

**Figure 42 : Remote software menu**

In this menu you can visualize and configure the IP address of the Servopro Chroma that you'll need to use in the Servopro Chroma Report Software.

Two type of IP address can be configured: Static or DHCP. A static address is an address that is manually set one time by the user of this analyzer. A DHCP address is an address that is automatically set by a router on the network. For more details, ask your Information Technology (IT) technician.

If you want to set a Static IP address, select the Static type, enter the three configuration parameters, then press the **Set Static Parameter (F3)** button.

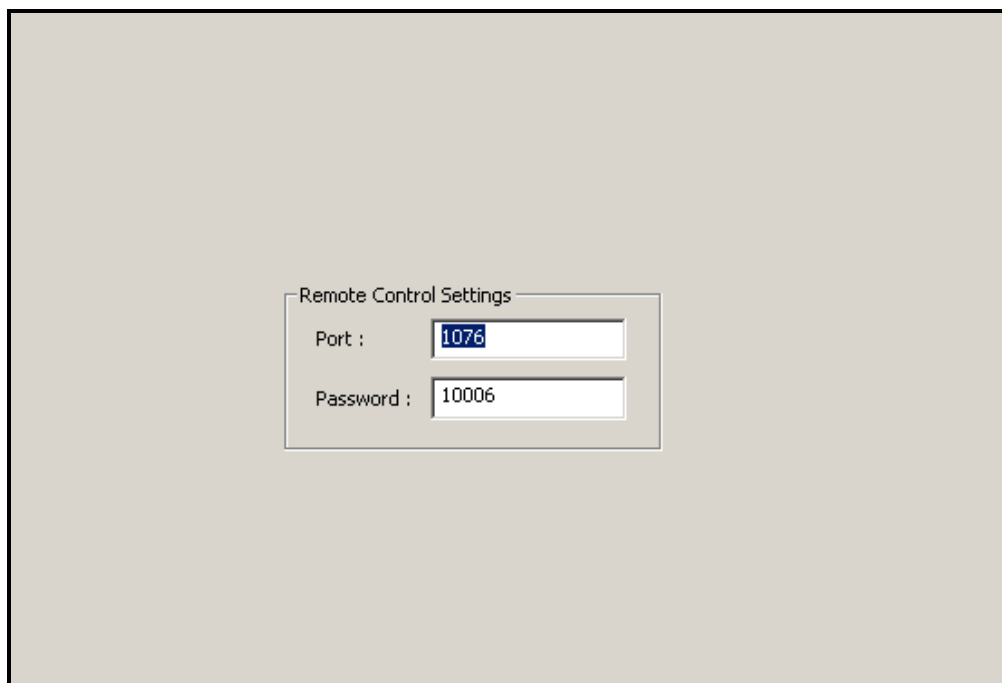
The **Disconnect** button is there if you want to close the communication between the Servopro Chroma and the PC Software. **If you close the Servopro Chroma**

**Report Software in the PC, you must use this button to tell the Servopro Chroma that the connection is terminated.**

Finally, the **Test USB key for Report Software** button is used to test if the analyzer detects a USB key that can then be used for acquiring data for the Report Software.

#### 6.2.5.2 Remote Control

Clicking on **Remote** on the menu bar and then on **Remote Control** brings you to the **REMOTE-REMOTE CONTROL MENU**.



**Figure 43 : Remote control menu**

In this menu, you are able to set the network port number on which the remote control software will communicate with the Servopro Chroma and the password used for the login connection.

## 6.2.6 About

Clicking on **About** on the menu bar brings you to the **ABOUT MENU**.

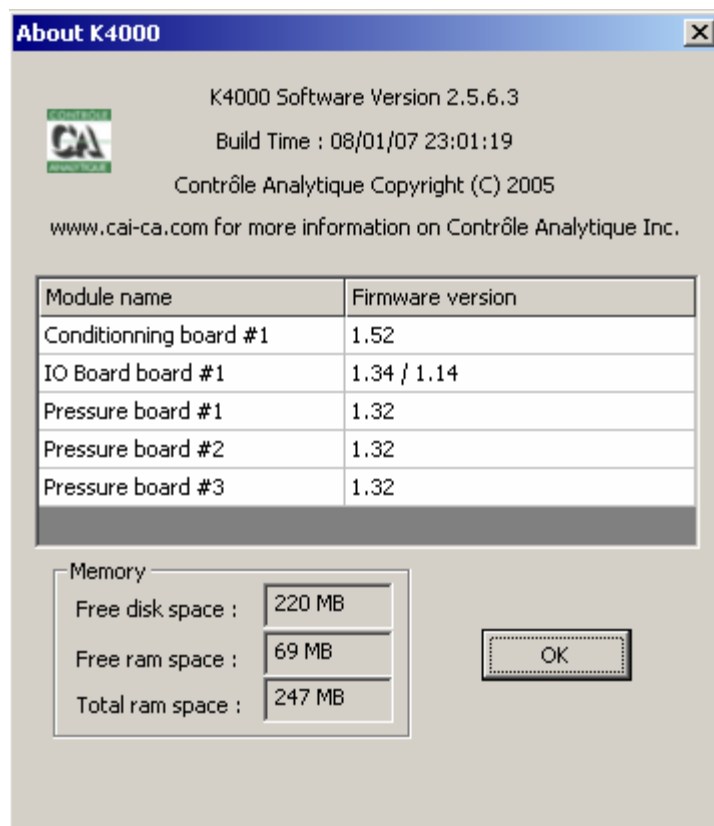
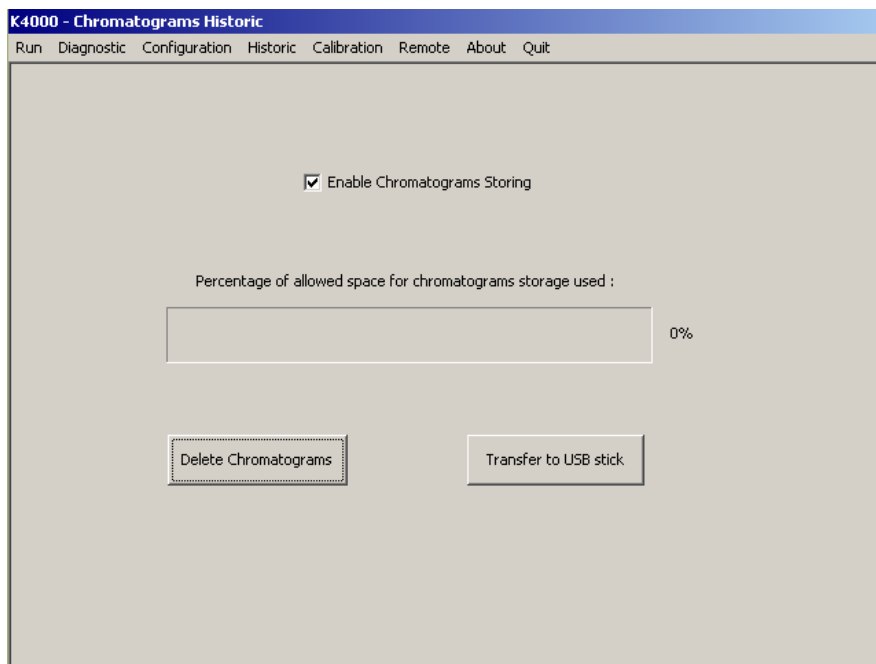


Figure 44 : About menu

In this menu, you have the software version of the user interface (PC), the firmware versions of the embedded electronic boards and information about the memory usage. This information can be very useful if you have to contact Servomex support.

## 6.2.7 Chromatogram saving

In version 2.6.3, a new feature was added to store chromatogram on the internal hard drive. This feature can be configured from menu Historic/Chromatogram. To enable this feature, the check box must be selected. When selected, chromatogram will be saved at the end of each cycle. If not selected, chromatogram will not be saved.



**Figure 45 : Chromatogram saving menu**

A space of 100 Mb is configured on the hard drive. This allow around one month of continuous data. To visualize data, insert a USB key into the port in front of analyzer and press "Transfer to USB stick" button. If USB key is not detected, an error message will be displayed. Chromatograms can be deleted by pressing delete button. This will delete all chromatograms on the hard drive.

Once chromatograms are transferred to the USB stick, copy them on a PC computer and use the import feature of ReportSoftware to import them.

The progress bar indicates the actual used space on the hard drive.

### 6.2.8 Quit

**It is important to always use the Quit button of the menu bar when the analyzer must be turned off.** If you close the analyzer without quitting, some data could be corrupted. After a quit is done, wait for the black screen and then turn the analyzer power supply off with the switch on the back of the Servopro Chroma.

When clicking on the **Quit** button, the analyzer will ask you for the general password of this analyzer. This password is, by default, the serial number of the analyzer, but can be changed into the **CONFIGURATION-SYSTEM CONFIGURATION MENU**.



## 7 INSTALLATION AND SETUP

### 7.1 System power up

If your system has slave chassis, they must be powered on before the master chassis. If your system has an external PC, start all chassis and finally power on the PC.

To power off the system, properly exit the PC software and you can then close chassis in any order.

### 7.2 Electrical installation

#### 7.2.1 Electrical safety



#### WARNING

Ensure that the electrical installation of the analyser conforms to all applicable local and national electrical safety requirements.



#### WARNING

Obey the safety instructions given below when you install the analyser; if you do not, the analyser warranty may be invalidated, the analyser may not operate correctly, or it may be damaged.



#### WARNING

All signal terminals are separated from the analyser mains circuits by reinforced insulation. The terminals must only be connected to circuits that are themselves separated from mains voltages by an isolation method that provides at least this level of protection.

#### The following warnings must also be considered:

- The electrical supply coupler or plug must be easily accessible for disconnection from the electrical supply.
- The electrical supply circuit must incorporate a suitable fuse or over-current protection device, set to or rated at no more than 10 A for each individual chassis of the system.
- Ensure that your electrical supply can provide the necessary maximum power consumption: refer to Section 2.1.
- All signal and electrical supply cables must be rated of temperature of 70 °C or higher.
- Ensure that the cables that you connect to the analyser are routed so that they do not present a trip hazard.

- When you carry out insulation testing, disconnect all cables from the analyser.
- Ensure the analyser is provided with a sound earth connection via the electrical supply plug.

## 7.2.2 Master chassis connection

The following drawing explains how to connect the different parts of a Servopro Chroma system that only have one slave chassis. The master chassis must be connected to a power source using a properly rated cable (see section 3.13). If an auxiliary oven is required for your application, connect the cable coming out of the auxiliary oven to the connector named “Auxiliary oven” (see section 1.3.1).

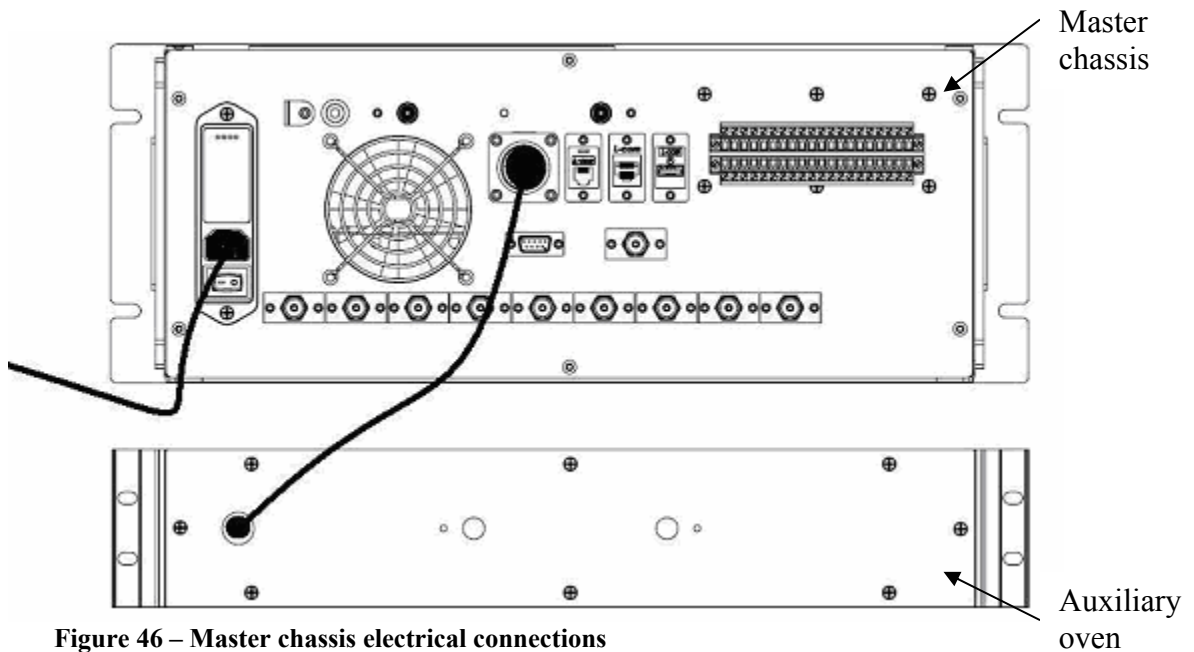


Figure 46 – Master chassis electrical connections



### WARNING

The units shall only be connected using the cables supplied by Servomex.

### 7.2.3 Slave chassis connection

The following drawing explains how to connect the different parts of a Servopro Chroma system that have master and slave chassis. The master and slave chassis must be connected to a power source using properly rated cables (see section 3.13). If an auxiliary oven is required for your application, connect the cable coming out of the auxiliary oven to the connector named “Auxiliary oven”. In case you have two auxiliary ovens, make sure that you connect the right oven to the right chassis.

In order to operate, the master chassis must be able to communicate with the slave chassis. Connect both RS-485 ports using the high density DB-9 cable provided with the system (see section 1.3.1).

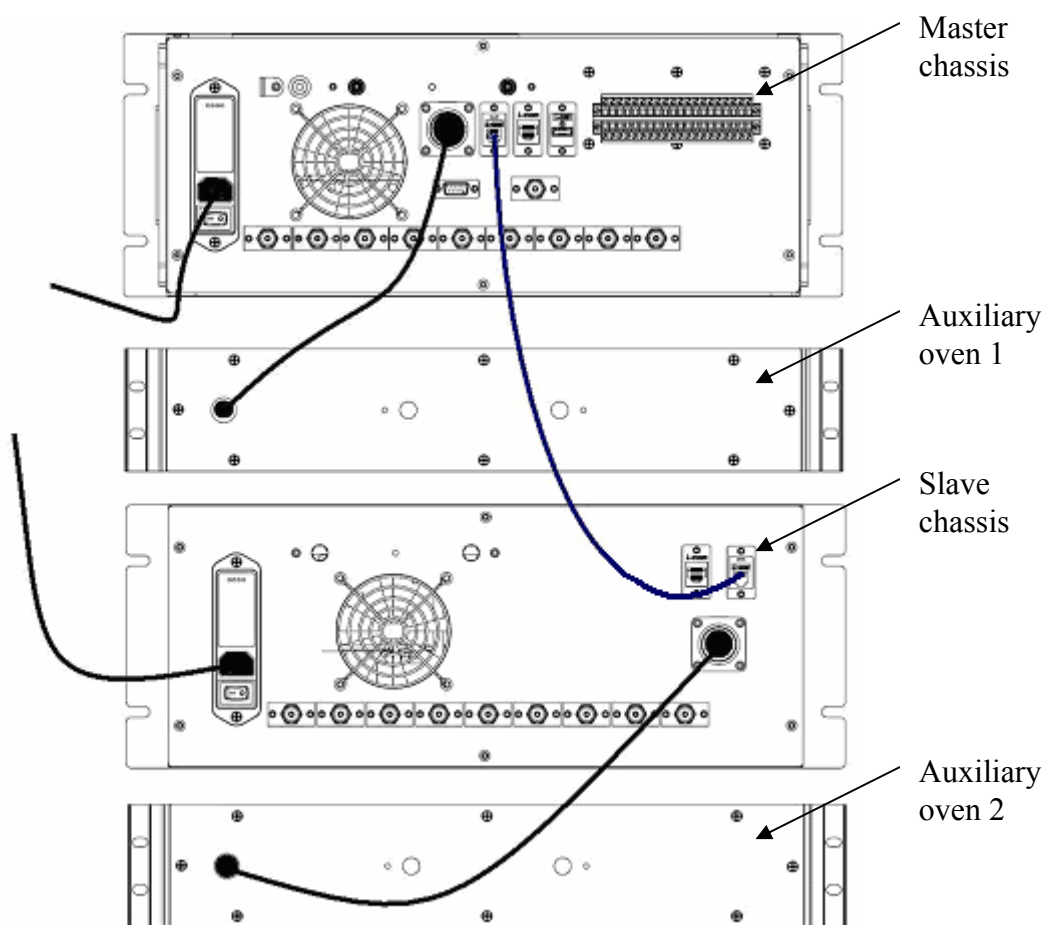


Figure 47 – Master and slave chassis electrical connections



#### WARNING

The units shall only be connected using the cables supplied by Servomex.

### 7.2.4 Stand alone PC with slave chassis

The Servopro Chroma can be supplied with a stand alone PC depending on the application. The stand alone PC must always be connected to the same protective earth as the slave chassis of the system

The following drawing explains how to connect the different parts of a Servopro Chroma system that have a stand alone PC and slave chassis. The stand alone PC and slave chassis must be connected to a power source using properly rated cables (see section 3.13). If an auxiliary oven is required for your application, connect the cable coming out of the auxiliary oven to the connector names “Auxiliary oven”. In case you have two auxiliary ovens, make sure that you connect the right oven to the right chassis.

In order to operate, the stand alone PC must be able to communicate with the slave chassis. Connect the port “To analyser” on the PC to the RS-232 port on slave unit 1. If you have a second slave in your system, connect port “Aux” on the PC to the RS-232 port on slave unit 2.

Both connections should use the high density DB-9 cable provided with the system (see section 1.3).

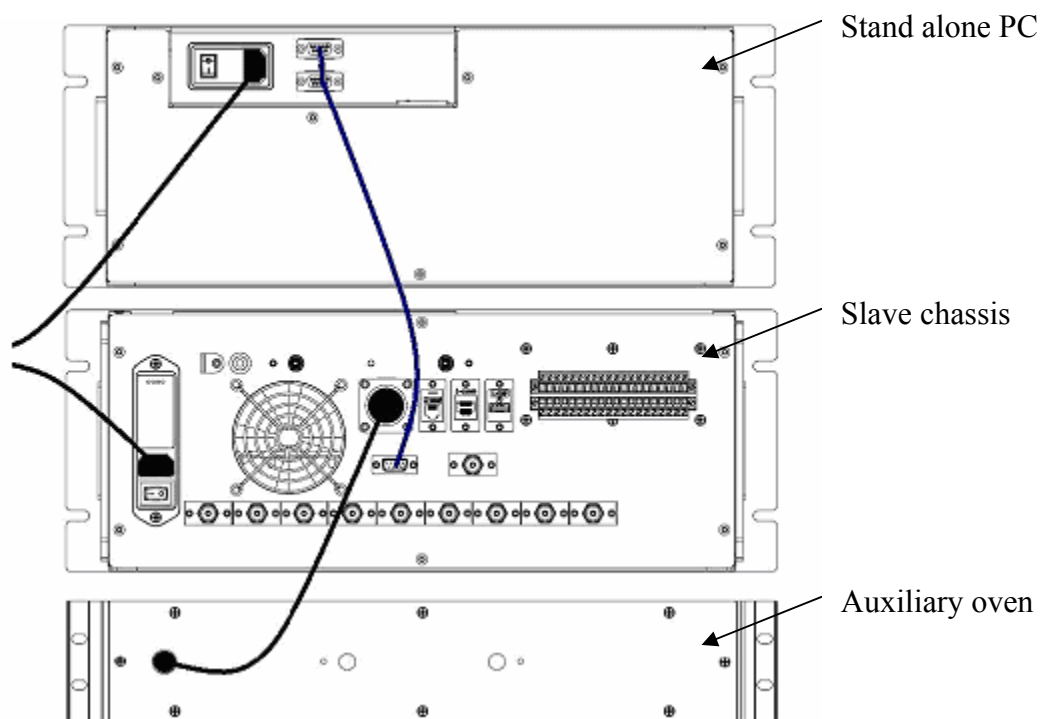


Figure 48 – External PC connections



#### WARNING

The units shall only be connected using the cables supplied by Servomex.

## 7.3 Connecting Servopro Chroma rear connector

### 7.3.1 Digital input

Servopro Chroma has one digital input that is used to start an analysis remotely. Connection between Servopro Chroma and Remote system is made with a shielded twisted cable. In case of fuse failure, change fuse F12, referring to section 7.3.1.

The shield of the digital input contacts cable must be terminated to the analyser on one the “E” ports of the rear connector.

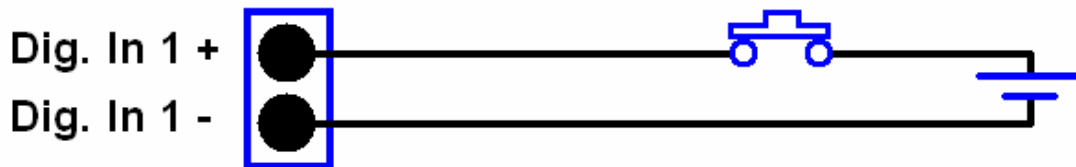


Figure 49– Digital input connection



#### WARNING

The digital input terminals are separated from the analyser mains circuits by reinforced insulation. The terminals must only be connected to circuits that are themselves separated from mains voltages by an isolation method that provides at least this level of protection.

### 7.3.2 Digital output contacts

Servopro Chroma can have up to 12 digital outputs. All those outputs are dry contacts. No power is provided by those outputs. They all connected to a common port and fused. Connection between Servopro Chroma is made using a shielded multi core cable. In the case of fuse failure, change fuse F14, referring to section 7.3.1.

Port Name	Purpose
E	Earth point for cable screening
R1 – R8	Range ID contacts
A1 – A2	Alarm indicators
ST	Status indicator
EX1	Calibration indicator <b>or</b> Cycle indicator

Table 24 : Digital Output Contacts

The shield of the digital output contacts cable must be terminated to the analyser on one the “E” ports of the rear connector.

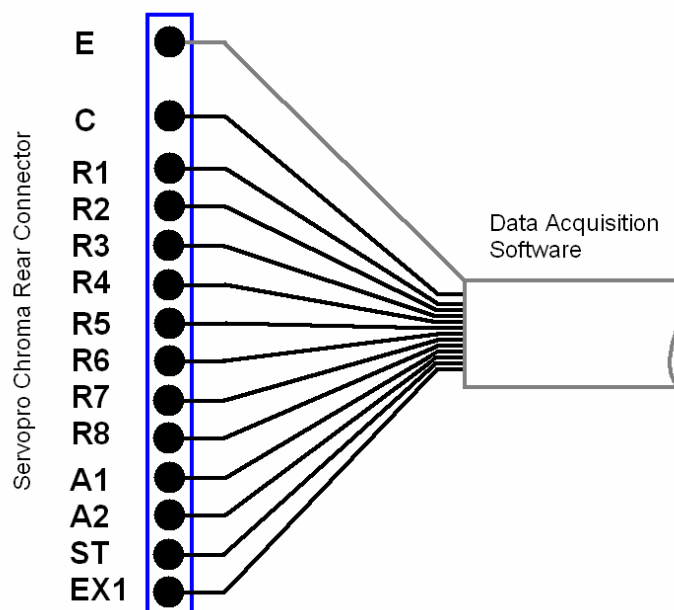


Figure 50 – Digital outputs connection



#### WARNING

The digital output terminals are separated from the analyser mains circuits by reinforced insulation. The terminals must only be connected to circuits that are themselves separated from mains voltages by an isolation method that provides at least this level of protection.

### 7.3.3 4-20 mA outputs

Figure 44 represents the circuit of Servopro Chroma 4-20 mA. The connection between the Servopro Chroma and the monitoring system must be done using a shielded twisted cable. Connect the load resistor on the monitoring system. A differential input must be used on the data acquisition system to properly monitor the data. In case of fuse failure, refer to Table 1 and section 7.3.1.

The twisted pair must be terminated at a matched pair (+ -) of numbered output ports and the shield must be terminated to the analyser on one the “E” ports of the rear connector.

Each numbered output is set to a particular impurity represented on the chromatogram and can be changed via the configuration menu.

The HR output is the high-resolution chromatogram, it is the current reading of the GC cell as it progresses through a cycle.

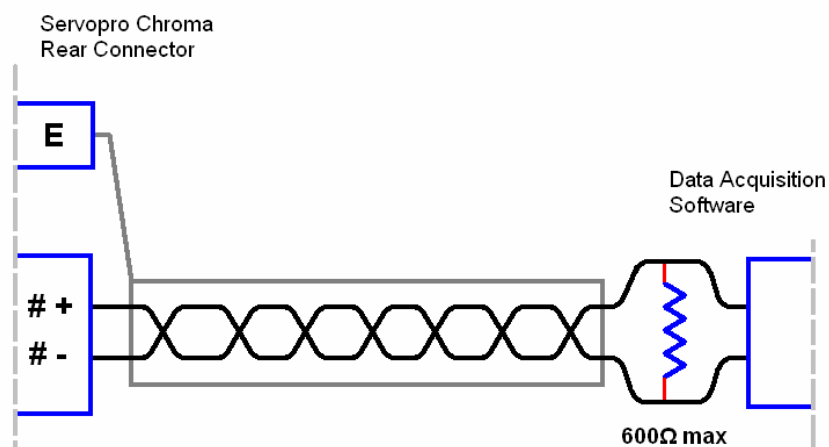


Figure 51– 4-20 mA schematic and external connections

#	Name	Positive pin	Negative pin	Associated fuse
1	4-20 mA #1	1+	1-	F1
2	4-20 mA #2	2+	2-	F2
3	4-20 mA #3	3+	3-	F3
4	4-20 mA #4	4+	4-	F4
5	4-20 mA #5	5+	5-	F5
6	4-20 mA #6	6+	6-	F6
7	4-20 mA #7	7+	7-	F7
8	4-20 mA #8	8+	8-	F8
9	HR	HR+	HR-	F9

Table 25 : 4-20 mA connections and associated fuses



#### WARNING

The analogue output terminals are separated from the analyser mains circuits by reinforced insulation. The terminals must only be connected to circuits that are themselves separated from mains voltages by an isolation method that provides at least this level of protection.



### 7.3.4 FID fuel shut-off relay/Hydrogen relay output



#### WARNING

A fuel shut-off valve must be connected to the Servopro Chroma if a FID detector is installed to prevent the accumulation of fuel. The inside control valve is not considered tight shut-off.

A fuel shut-off valve can be connected to the rear connector of the analyser. This valve must be normally closed. This valve is controlled by the Servopro Chroma software. When an error occurs, it closes this valve automatically to prevent the accumulation of fuel inside the Servopro Chroma.

See the FID Addendum (Section 10) for more information when using a FID detector.

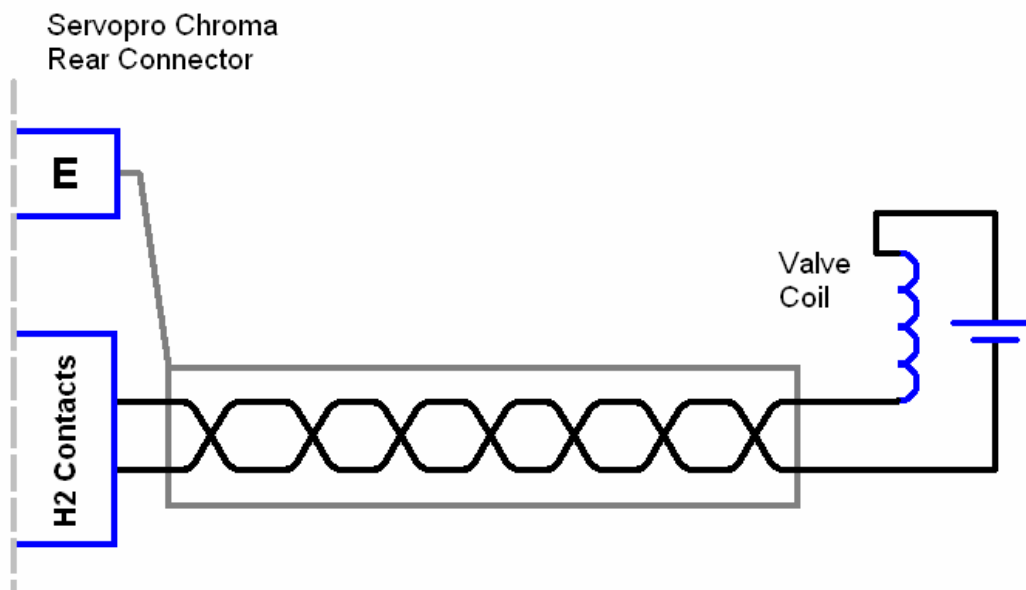


Figure 52 – Connecting a fuel shut-off valve



#### WARNING

The FID relay output terminals are separated from the analyser mains circuits by reinforced insulation. The terminals must only be connected to circuits that are themselves separated from mains voltages by an isolation method that provides at least this level of protection.

### 7.3.5 RS-485 port

The Servopro Chroma has a RS-485 port. This port is only used to communicate with other Servopro Chroma systems. It is not design to be used to interface with third party systems. If your system has multiple chassis, you need to connect them using shielded D-sub HD15 Male/Male cable.



#### WARNING

The RS-485 output terminals are separated from the analyser mains circuits by reinforced insulation. The terminals must only be connected to circuits that are themselves separated from mains voltages by an isolation method that provides at least this level of protection.

#### CAUTION

To comply with EMC requirements, the RS-485 shall only be connected using the supplied cable. Refer to section 7.3.2 before making any electrical connections.

### 7.3.6 RS-232

With this option installed, this analyser can be remotely controlled using a RS-232 port. The computer is connected to the analyser by the mean of a DB-9 RS-232C (Null-modem) cable. The computer must have appropriate software to read the data transmitted by the analyser. See the RS-232 addendum for information about the analyser communication protocol.



#### WARNING

The RS-232 output terminals are separated from the analyser mains circuits by reinforced insulation. The terminals must only be connected to circuits that are themselves separated from mains voltages by an isolation method that provides at least this level of protection.

### 7.3.7 Auxiliary oven port

The Servopro Chroma system can use auxiliary oven to perform some applications. The auxiliary oven normally contains a trap. The auxiliary oven must be connected to the auxiliary oven port on the rear panel. No third party oven can be connected to this port.

## 7.4 Gas installation



### WARNING

It is of the highest importance to never pressurize the analyzer because the quartz cell would be irreversibly damaged. So, before supplying any gas to the instrument, first remove the caps on the vent connections. However, in such a way as to not contaminate the analyzer it is better to leave all caps on gas connections until the gas installation is done and properly purged.



### WARNING

This analyser is not to be used with any sample gasses that form a flammable mixture.

### **7.4.1 Introduction**

The sampling system is the most important part of your analytical system. The performance of your analyzer can be dramatically limited by your gas transporting system. What we mean, by gas transporting system, any pressure regulator, valve, line, fitting, filter, purifier, etc. which are in contact with the sample or carrier gas to be introduced into the analyzer.

Absolutely, no leaks can be tolerated. Here, by a leak, we mean introduction of outside contaminants originally not present in the system. In our case, such leaks are atmospheric inboard leakage.

For all gas line connections (including calibration and sample), we recommend the use of 1/8" stainless steel tubing in full length, no fittings. You must avoid pipe thread connections, because they are usually sealed with Teflon tape and some particles can be introduced into the lines. By using compression type tube fittings, the venturi aspiration of outside contaminants is virtually eliminated.

Tube quality is often overlooked. For 1/8" O.D. tube, use a minimum wall thickness of .028". The tube must be purchased to meet ASTM69 specifications. Inferior quality tubes may have irregularities on their circumference causing bad sealing with compression tube fittings.

Install a by-pass rotometer on your sample line. It must be installed near the analyzer and close to the stream selection valve. This increases the gas velocity and allows a faster purging of the sample line, before selection. You will also get a faster response time this way. Also adjust your sample line pressure to a value, which will bring proper flow in the system. All lines must be cleaned and purged to remove any traces of moisture or particles. Particles can damage your stream selection valves. Also, particles in the inlet filter will trap moisture.



The best sampling system available today is our MSS, i.e. Manual Sampling System or our ISS. These will provide many years of trouble free service. They are easily remotely controlled, perfect for Auto Calibration Systems, etc. Please contact us or visit our Website for more information.

### 7.4.2 Carrier Gas Hardware Selection

We strongly recommend the use of a gas purifier fed by UHP grade gas cylinder as a source of carrier gas. The purer the carrier gas, the better the performance of the analyzer. The cost associated with research grade cylinder of argon is high. The carrier grade argon cylinder quality is not enough.

The least costly solution over time, and better for the quality of carrier gas is to use a heated type getter based purifier. The cost of UHP grade argon cylinders is inexpensive compared to carrier or research grade. The purifier will last many years.

#### *Gas Purifier*

You can buy such purifier from Servomex's representatives

The model number to order is:                      GP-200- 120: 120 VAC  
   GP-200- 240: 240 VAC

You must add the proper model definition digits for supply voltage and fittings type.  
**See purifier specification sheet.**

#### *Cylinder Pressure Regulator*

The pressure regulator must be a double stage type and made of stainless steel. The outlet pressure range must be selected according to the carrier pressure setting indicated in the configuration in the back cover of this manual.

The pressure stability is a critical parameter affecting the accuracy of the analyzer. A good quality pressure regulator must be used. For calibration gas cylinder, an outlet pressure of 200 kPag (30 psig) maximum is recommended.

#### *Isolation and Samples Stream Selection Valves*

The valves used for isolation or sample selection must be packless type i.e. diaphragm or bellows type. This is the only way to remove air diffusion.

### **7.4.3 Connecting the Servopro Chroma**

1. Once Servopro Chroma installed in a cabinet or rack, remove all caps. It is very important because avoiding removing caps on the outlet will damage the plasma cell.
2. Connect all carrier gas inlets. Make sure that pressure are according to specifications and that lines were properly purged. Up to two carrier gasses may be used.
3. If your system has a trap or an auxiliary oven, install it. Connect the trap or oven inlet first.
4. Connect sample lines. Make sure that pressures are set as specified in the specifications. Up to two sample gasses may be used.
5. Connect all vents. These lines should be unpressurised, as pressurising the detectors within the Servopro Chroma will damage them.
6. Power on the analyzer and wait for stabilization.

## 8 GENERAL OPERATION

### 8.1 *Routine maintenance*

The analyzer does not need a lot of supervision. But for accurate measurements you must be sure that:

1. Carrier flow is as per the value specified for your configuration. To check the carrier flow, put the injection mode in manual. Go back in «RUN» menu and watch the value. It is normal to have carrier flow deviation during a cycle. Between and before an injection the carrier flow must be correct.
2. From time to time, verify the oven temperature in the diagnostic menu. It must be constant and at the value specified in the configuration section in the back cover.
3. The sample flow must be at the same value of the previous calibration procedure. This is to make sure you have the same sample volume injected. The default value of 75 cc/min is OK.
4. Clean cabinet fan's filter periodically. This is very important, high internal temperature will eventually cause problems.

## 9 STORAGE AND DISPOSAL

### 9.1 Storage

Refit any protective cover (see Section 5) and place the Servopro Chroma and any associated equipment in its original packing before storage.

Store the Servopro Chroma and any associated equipment in a clean, dry area. Do not subject it to excessively hot, cold, or humid conditions: See section 2.5.

### 9.2 Disposal

Dispose of the Servopro Chroma and any associated equipment safely, and in accordance with all of your local and national safety and environmental requirements.



The Servopro Chroma is not suitable for disposal in municipal waste streams (such as landfill sites, domestic recycling centres and so on). Refer to section 13 for disposal requirements in accordance with the WEEE Directive within the EC.



## 10 COMPLIANCE

- The analyzer complies with the European Community "Electromagnetic Compatibility Directive":
  - Emissions: Class B - Equipment suitable for use in domestic establishments and in establishments directly connected to a low voltage supply which supplies buildings for domestic purposes.
  - Immunity: "Basic" – Considered appropriate to equipment intended for use in domestic, commercial and light industrial environments.
- The analyzer complies with the European Community "Low Voltage Directive", by the application of EN 61010-1 and rated for Over Voltage Category II, Pollution Degree 2.
- The analyzer complies with the Class B digital apparatus requirements of ICES-003 of Canada through the application of EN 61000-6-3:2007.
- L'analyseur est conforme aux Conditions B numériques d'appareillage de classe de NMB-003 du Canada par l'application du EN 61000-6-3:2007.
- This analyzer complies with Part 15 of the US FCC Rules for Class B equipment. It is suitable for operation when connected to a public utility power supply that also supplies residential environments.
- The analyzer has been assessed to IEC 61010-1 for electrical safety including any additional requirements for US and Canadian national differences.

## 11 FID ADDENDUM

### **11.1 Introduction**

This document explains how to set up and use a FID with the Servopro Chroma software.

### **11.2 Overview**

The low noise flame ionization detector (FID) is designed to measure hydrocarbons in the sub ppm level to percentage level. Measurement of atmospheric air for low level hydrocarbons and hydrocarbons content of exhaust emission from internal combustion engines are typical applications.

### **11.3 Logarithm based amplifier**

Contrôle Analytique has designed a circuit allowing the measurement of weak currents in order to interface some of its detectors. Other analyzers based on FID detector use electrometers based on high resistance values in order to amplify the current. However, it is difficult to obtain good resistances in this type of circuit, which produces variations with fluctuations in temperature. Moreover, these resistances introduce noise, according to Johnson's Law, which states that noise caused by a resistance is proportional to its value and temperature. Contrôle Analytique therefore became innovative by making use of the perfect logarithm feature of transistors to design a logarithm based electrometer that is not only extremely stable with variations in temperature but also very quiet. The use of transistors has thus allowed us to eliminate the high value resistances, but also the noise and drift that they cause. Also, this circuit has made it possible to measure a vast range of currents, from femtoampere ( $10^{-15}$ ) to the milliampere ( $10^{-3}$ ). It has greatly improved the quality of the measurement made with Contrôle Analytique's detectors.

## 11.4 MENUS

### 11.4.1 CONFIGURATION-ADVANCE MENU



You normally shouldn't have to change these configurations; they are set in factory and reflect the hardware of the analyser.

In the menu Advanced Configuration, you can add or remove FIDs by modifying the quantity.

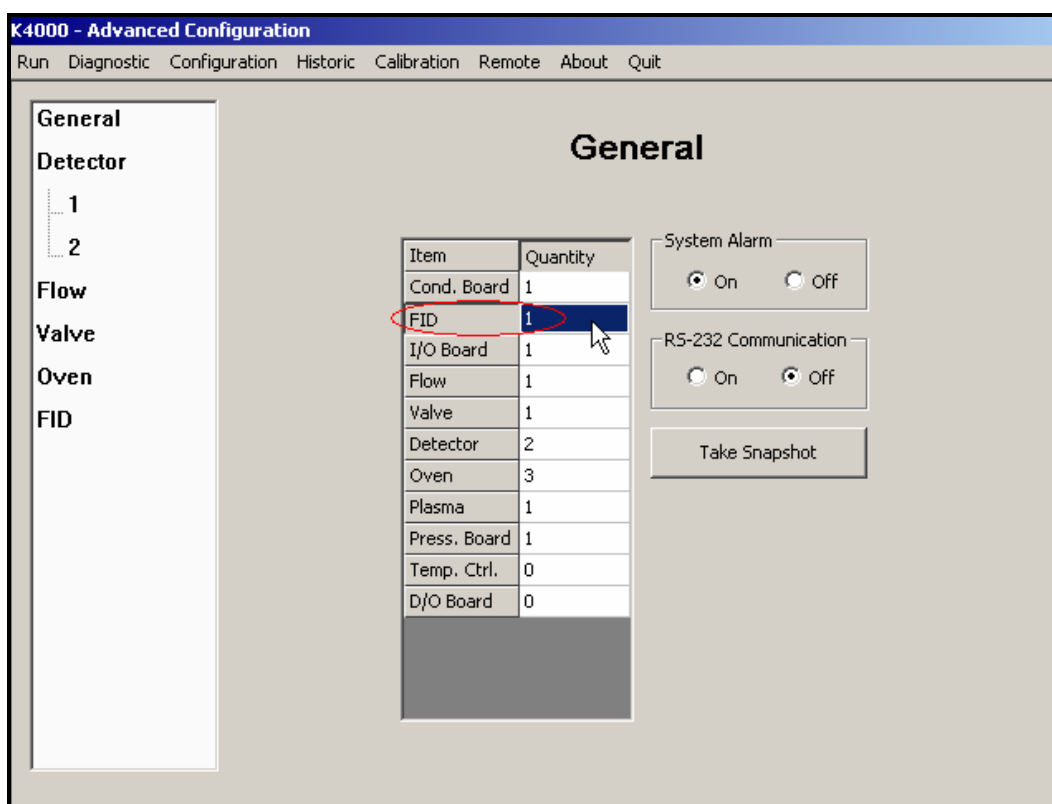


Figure 53: Advanced menu

### 11.4.2 CONFIGURATION-ADVANCE FID MENU

In this menu you will be able to modify the FID settings. You have to click on save for your modifications to take effect.

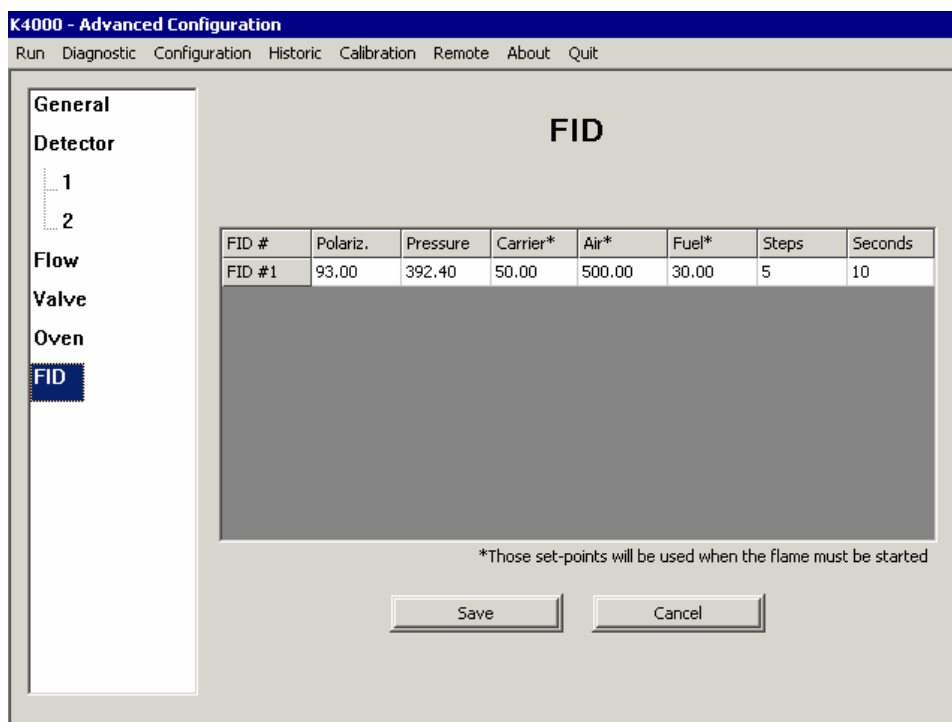


Figure 54: Advanced FID menu

Parameter	Range	Unit	Description
Polariz.	0-200	Volt	Voltage that is applied to the FID polarizer.
Pressure	300-500	In of H <sub>2</sub> O	This value is used to calibrate the pressure sensor used by the FID. When save is pressed, the pressure sensor is calibrated with the value entered in the box.
Carrier*	0-100	cc/min	This carrier set point is only used to ignite the FID. This set point is not used during normal operation.
Air*	0-1000	cc/min	This air set point is only used to ignite the FID. This set point is not used during normal operation.
Fuel*	0-200	cc/min	This fuel set point is only used to ignite the FID. This set point is not used during normal operation.
Steps	0-10	Steps	Number of steps for ramping flow to normal value
Seconds	0-60	Seconds	Time between each step.

Table 26 : Advanced FID menu parameters



Air, Fuel and carrier set points are for the ignition, if you press ignite flame in the Diagnostic menu, the Servopro Chroma will automatically change these set points to ignite flame and it will set back the normal value when the flame is lit.



***AVOID CHANGING THESE SETTINGS:** they are configured in factory by Servomex.*

### 11.4.3 CONFIGURATION-ADVANCE DETECTOR MENU

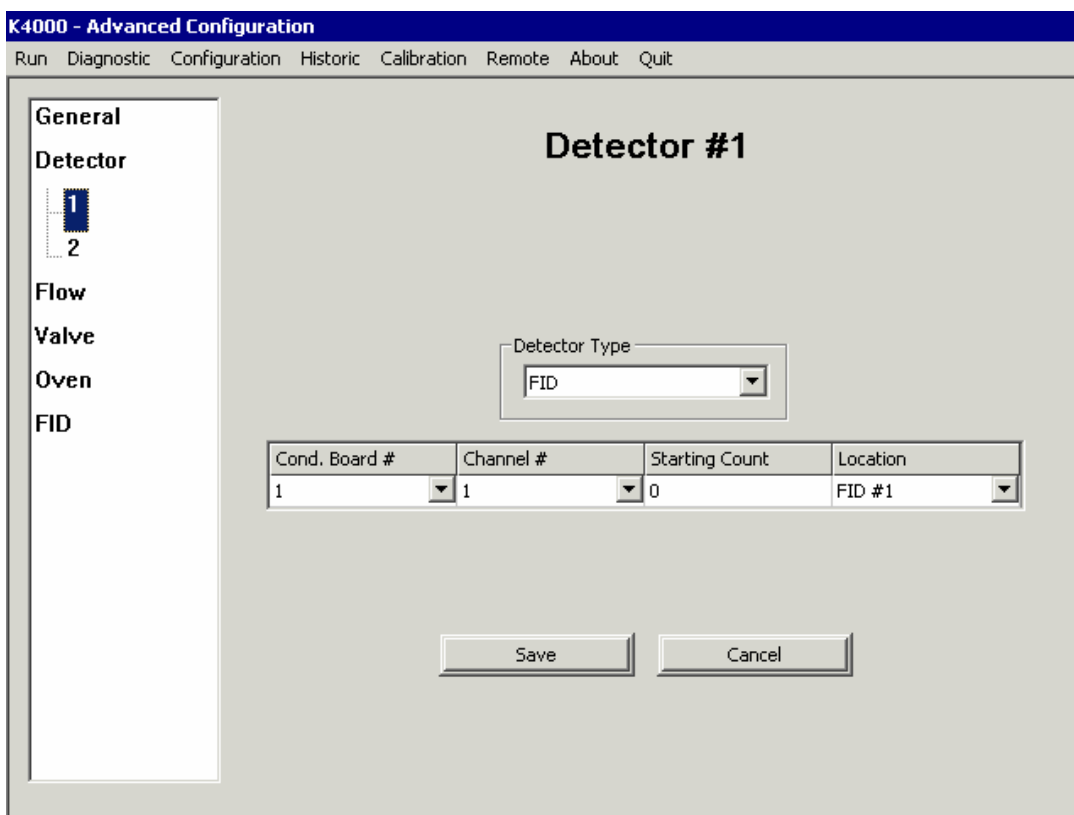


Figure 55: Advanced detector menu

In this menu you will be able to modify the FID detector settings. You have to click on save for your modifications to take effect.

- Cond. Board: Select on which acquisition board the FID is connected.
- Channel #: Select on which channel the FID is connected on the acquisition board.
- Starting Count: Threshold value read by the detector inside the FID to determine if the flame is lit.
- Location: The position of the detector.



**AVOID CHANGING THESE SETTINGS:** they are configured in factory by Servomex.

#### 11.4.4 CONFIGURATION-ADVANCE FLOW MENU

This menu gives you the possibility to give a name to each flow associated with the FID. To operate, a FID needs Air, Fuel and Carrier gas. So, pressure regulators associate to these gases must be configured. A name must be given to each one. To set a name for Air, select Air in the location field and then enter the name you want into the field Name. Make sure to select the right Parent and the FID type. You must do the same for Fuel and Carrier.

Name	Parent	Location	Type	Plasma
Sample	Regulator #1	IO Board #1	Sample	
Carrier	FID #1	Carrier	FID	
Air	FID #1	Air	FID	
Fuel	FID #1	Fuel	FID	

Figure 56: Advanced flow menu



*AVOID CHANGING THESE SETTINGS: they are configured in factory by Servomex.*

## 11.4.5 CONFIGURATION-ADVANCE OVEN MENU

The oven menu also works the same way. You can now select FID as a location, and you will be forced to use Channel #1 as the FID only allows configuring its first oven.

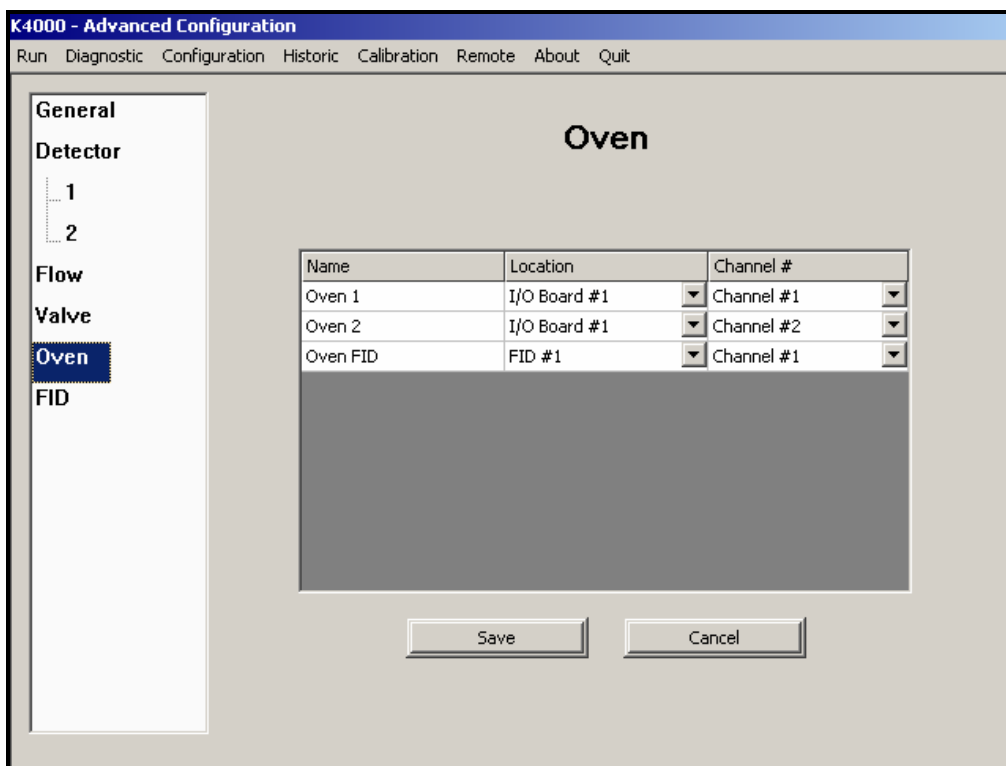


Figure 57: Advanced oven menu



*AVOID CHANGING THESE SETTINGS: they are configured in factory by Servomex.*



## 11.4.6 MONITORING AND CONFIGURATION MENUS

Throughout the application, the flows and ovens associated with your FID will be showed with the other flows and ovens in your analyzer and you will be able to interact with them in the same way you would interact with the others. The 5 next figures will show you some examples.

Inside the System Configuration menu:

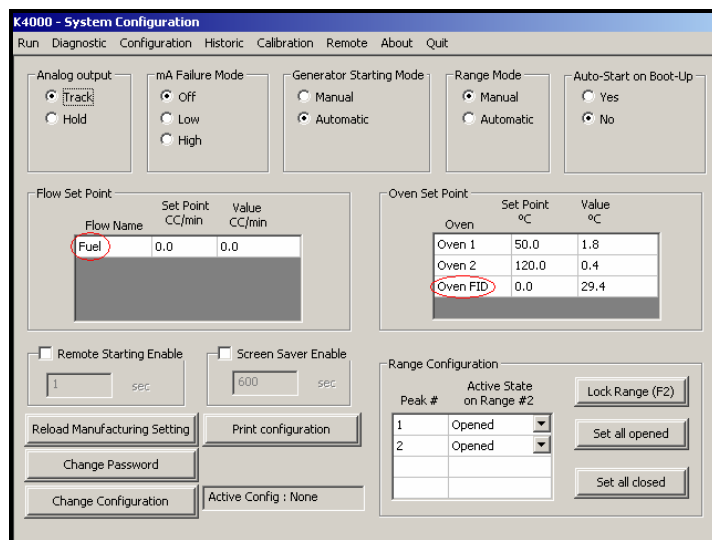


Figure 58: Monitoring fig 1

Inside the Real Time Chromatogram menu:

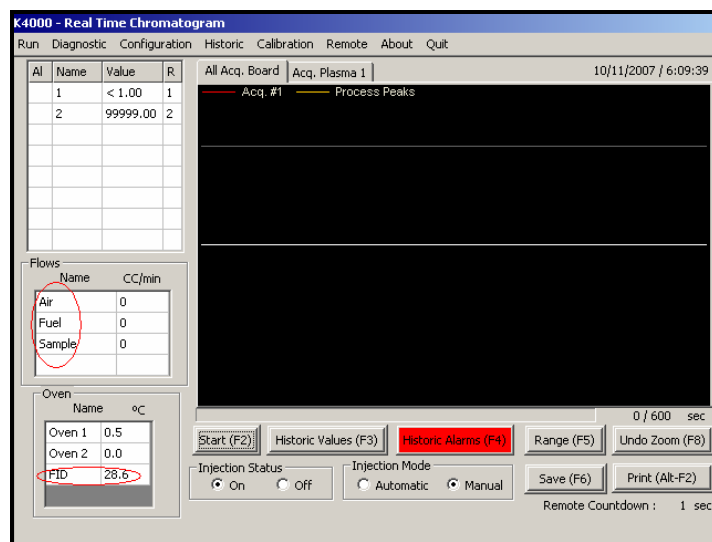


Figure 59: Monitoring fig 2

Inside the Trending menu:

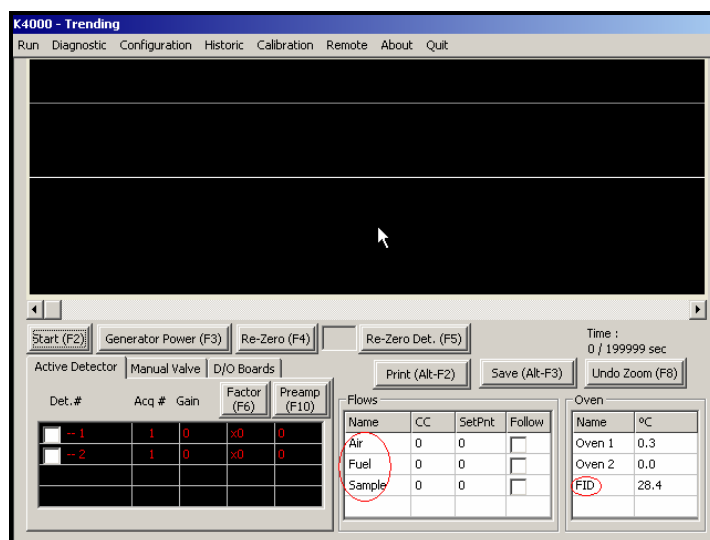


Figure 60: Monitoring fig 3

Inside the PID Configuration menu:

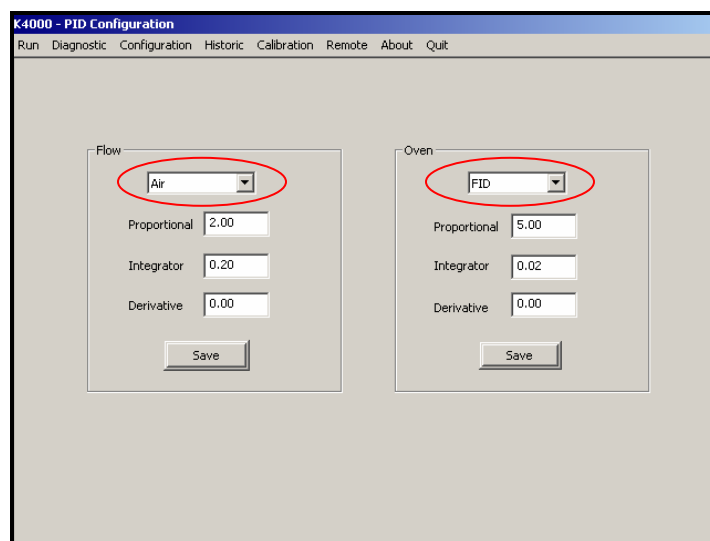


Figure 61: Monitoring fig 4

Inside the Flow Configuration menu:

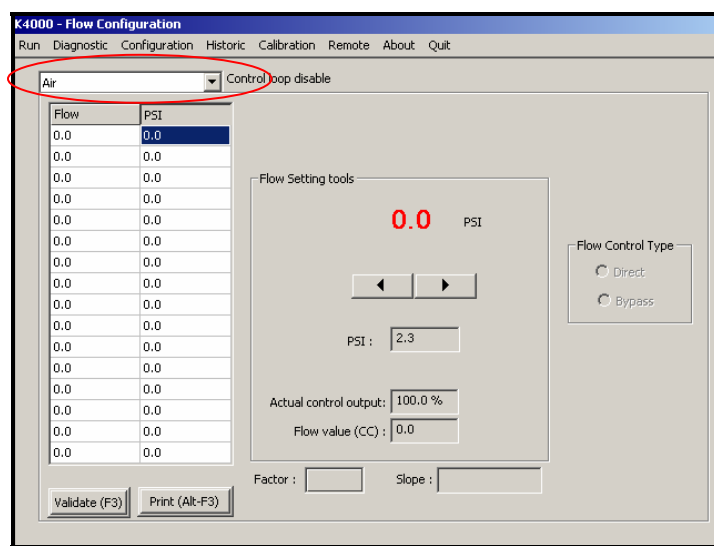


Figure 62: Monitoring

## 11.4.7 DIAGNOSTIC-DIAGNOSTIC MENU

In the Diagnostic menu, you will be able to change the FID parameters.

You'll have to click on the FID Board #X tab and then you'll be able to set its Gain, Offset and Pre-Amp. **These values are used in the trending menu.** You can also use these values to configure the default values in the Configuration/Cycle menu. You will also see its internal temperature as well as the flame's status. Finally, you'll be able to manually ignite the flame by clicking on the *Ignite Flame* button.

**K4000 - Diagnostic**

Run Diagnostic Configuration Historic Calibration Remote About Quit

Acq. Board #1

Detector signal

	Count	Volt
Cell	375836	0.112008
Chromatogram	8389127	2.500155

Gain: 7 Scale Factor: 1x

Pre-Amp: 1 Polarity: Follower

Detector # 1

Zero (F8)

ID Board #1 FID Board #1

Logarithmic amplifier

Gain : 10.00 Offset : 5.050000

Pre-Amp : 80

Environment

Temp. (°C) : 911.6 Press. (inH2O) : 444.6

Flame

Flame status : Off

Flame counts : 7296452

Ignite flame

Pressure Regulator

Flow	Count	CC/min	PSI	%
Sample	584	0.0	1.0	0.0
Carrier	18472	15.0	28.0	69.0
Air	579	0.0	0.9	83.1
Fuel	612	0.0	0.9	42.1

Figure 63 : Diagnostic menu

### 11.4.8 CONFIGURATION-CYCLE MENU

In the Cycle menu, you will be able to change the Log Amplifier parameters that are associated to each FID peak.

When you have right selected the parameters in the Diagnostic menu, you have to set them in the cycle menu to be sure these parameters will be set on each cycle. To do so, go into peak/Configuration and select a FID peak. The peak data panel will allow you to enter FID Boards parameters like gain, offset and Pre-Amplification.

**K4000 - Cycle Configuration**

Run Diagnostic Configuration Historic Calibration Remote About Quit

**General**

**Peak**

**Configuration**

**Detection**

**Valves**

**Flow**

**Scripts**

Name	Avr	Start	End	Det	Alarm 1	Alarm 2	Range 2	Range 1	Unit
C4...	1	160.0	212.4	1	1000000.0	1000000.0	5	1x	PPM
C4H6	1	220.0	230.0	1	1000000.0	1000000.0	5	1x	PPM
CH4	1	264.4	305.0	1	1000000.0	1000000.0	100	1x	PPM
C2H6	1	329.6	391.2	1	1000000.0	1000000.0	5	1x	PPM
C2H4	1	410.0	500.0	1	1000000.0	1000000.0	5	1x	PPM
C3H8	1	598.0	754.0	1	1000000.0	1000000.0	5	1x	PPM
C2H2	1	781.8	930.0	1	1000000.0	1000000.0	5	1x	PPM

Peak #1 data

Cond. Board : Gain: 13 Plasma power: 0 %

Polarity: Follower Pre-Amplification: 1

FID Board : Gain: 50 Offset: 5.0100

Pre-Amplification: 100

Add peak (F2) Delete peak (F3) Save peak table (F4) Print peak table (Alt-F2)

Figure 64: Cycle menu

### 11.5 Startup

1. Connect all gases to the analyzer and make sure that the tubes were properly purged.
2. Turn on the analyzer
3. Set flow set points to the following values for purging:

Gas	Flow set point (cc/min)
Fuel	0
Air	300
Carrier	50

**Table 27 : Gas flow set point**

4. Wait for FID temperature stabilisation. Once temperature is stable, set flow set points to the following values:

Gas	Flow set point (cc/min)
Fuel	40
Air	300
Carrier	50

**Table 28 : Gas flow set point 2**

Note: Those data can be different. See document settings that were sent with your Servopro Chroma.

5. Once flows are stable, press the ignite button to start the detector. The flow set point will automatically change to ignition set point and the detector will ignite.

Gas	Flow set point (cc/min)
Fuel	80
Air	500
Carrier	50

**Table 29 : Gas ignition Point**

Note: Those data can be different. See document settings that were sent with your Servopro Chroma.

6. When the flame is lit, the flow set points will come back to there normal values. (Step 4)
7. The Servopro Chroma /FID is ready to use.

## 11.6 System errors

This section describes in details all possible system errors.

**Air flow deviation:** This error occurs when the difference between air flow and air flow set point is higher than 5 cc/min. When this error is active, it is impossible to ignite the flame.

**Low air flow:** This error occurs when the air flow is below 10 cc/min. When this error is active, it is impossible to ignite the flame.

**Fuel flow deviation:** This error occurs when the difference between fuel flow and fuel flow set point is higher than 5 cc/min. When this error is active, it is impossible to ignite the flame.

**Low fuel flow:** This error occurs when the fuel flow is below 10 cc/min. When this error is active, it is impossible to ignite the flame.

**Sample flow deviation:** This error occurs when the difference between sample flow and sample flow set point is higher than 5 cc/min. When this error is active, it is impossible to ignite the flame.

**Ambient temperature deviation:** This error occurs when ambient temperature is out of range. Ambient temperature must be between 5°C and 50°C.

**F.I.D. temperature deviation:** This error occurs when the difference between actual F.I.D. temperature and F.I.D. temperature set point is higher than 10°C. When this error is active, it is impossible to ignite the flame.

**Glow plug damaged:** A glow plug is used to ignite the detector. If the glow plug is damaged, this error message is displayed. When this error is active, it is impossible to ignite the flame. The glow plug must be changed.

**Flame off:** This error occurs when the FID's flame is off.

**Sample flow reg. problem:** A problem appears with sample pressure regulator, the system will have to be restarted. If after rebooting, you still have this error, contact Servomex.

**Air flow reg. problem:** A problem appears with air pressure regulator, the system will have to be restarted. If after rebooting, you still have this error, contact Servomex.

**Fuel flow reg. problem:** A problem appears with fuel pressure regulator, the system will have to be restarted. If after rebooting, you still have this error, contact Servomex.

Every time an error occurs, the status contact relay is closed. Moreover, if you have set the “mA failure mode” to low or high, the 4-20 mA analogue output will be set according to this setting.

Because the SERVOPRO FID uses explosive gas, the software has built-in functions to reduce the risk of explosion. If the flame is off for more than 5 minutes and that the set point of hydrogen is not 0 cc/min, it will be automatically set to 0 cc/min and the hydrogen shut off valve will be de-activated.



When one of the gas is not flowing in the analyser, it is normal that the flame goes off. It is also normal that the flame goes off when there is no sample gas into the analyser.



## 11.7 Troubleshooting

Symptom	Problem cause	Possible remedy
Burner doesn't ignite	Fuel gas emerging from burner jet diluted with other gases because fuel system is insufficiently purged.	Purge fuel gas regulator.
	Air and fuel flow not properly set.	Adjust air and flow set points.
	Glow plug damaged.	Install a new glow plug.
	Analyser not able to reach starting flow set points	Verify all inlet pressures.
	Air or fuel is contaminated.	Replace air or fuel cylinder. Add hydrocarbon traps. Purge tubing.
Analyser's reading is noisy	There is a leak on sample line.	Leak test your sampling system. Verify that all gas pressures are stable.
	Flows are not stable	Verify that flow readings are stable. Optimize PID loop constants.
	Tubing used to connect gases to the SERVOPRO FID was not properly purged.	Clean tubing
	There is a dead volume on one of the gas stream.	Verify plumbing diagram and remove any dead volume.
	Exhaust is blocked by water	Make sure the exhaust tubing has a slope.
Loss of sensitivity or no signal	Electrical elements of burner partially short circuited by combustion products.	Clean burner.
	Polarisation spring is not in contact with FID jet.	Open FID detector and verify that the spring is in contact with the jet.
False flame indication	Flame sensor may be damaged.	Change flame sensor.

Table 30 : Troubleshooting

## 12 RS-232 ADDENDUM

The communication parameters of the analyser are:

- Baud rate: 38400
- Parity bits: none
- Data bits: 8
- Stop bits: 1

The following tables describe the command set:

### 12.1 Start analysis

Request / Command			K4000 Response			
ASCII Code			ASCII Code			
Character No	Character	No (hex)	Character No	Character	No (hex)	Meaning
1	>	3Eh	1	>	3Eh	command ID Analysis started
2	A	41h	2	A	41h	
3 (checksum)	A	41h	3	1	31h	
4	<	3Ch	4 (checksum)	q	72h	
			5	<	3Ch	
			1	>	3Eh	command ID Failure
			2	A	41h	
			3	0	30h	
			4 (checksum)	r	71h	
			5	<	3Ch	

Table 31 : RS-232 Start Analysis

### 12.2 Analyser status

Request / Command			K4000 Response			
ASCII Code			ASCII Code			
Character No	Character	No (hex)	Character No	Character	No (hex)	Meaning
1	>	3Eh	1	>	3Eh	command ID 1 = success Analyser ready: 1=ready; 0=not ready (still running) Run Modus: 1=measurement; 0=not measurement Run Modus: 1=calibration; 0=not calibration General Alarm: 1=OK; 0=Alarm active Flow Alarm Sample: 1=OK; 0=Alarm active Flow Alarm Carrier: 1=OK; 0=Alarm active Detector Alarm (Plasma off?): 1=OK; 0=Alarm active Calibration Alarm: 1=last cal. OK; 0=last cal. invalid Measurement Alarm 1=last measurement OK 0=invalid
2	B	42h	2	B	42h	
3 (checksum)	B	42h	3	1	31h	
4	<	3Ch	4	1 or 0	31h or 30h	
			5	1 or 0	31h or 30h	
			6	1 or 0	31h or 30h	
			7	1 or 0	31h or 30h	
			8	1 or 0	31h or 30h	
			9	1 or 0	31h or 30h	
			10	1 or 0	31h or 30h	
			11	1 or 0	31h or 30h	
			12	1 or 0	31h or 30h	
			13 (chksm)	X		
			14	<	3Ch	
			1	>	3Eh	command ID 0 = failure
			2	B	42h	
			3	0	30h	
			4 (chksm)	r	72h	
			5	<	3Ch	

Table 32 : RS-232 Analyser Status

## 12.3 Send results

Request / Command		K4000 Response	
Character No	ASCII Code No (hex)	Character	Meaning
1	>	3Eh	Command ID
2	C	2	0 = Failure, 1 = Success (if failure, jump to Char no 154 (checksum))
3 (pksum)	43h	0 or 1	30h or 31h
4	<	3Eh	Examples of format of Concentration Result from Peak No. 1: 15.00 (could be 15.00 %, 15.00 ppm or 15.00 ppb) 100000.00 (could be 1 Mio. ppm or 1 Mio. ppb)
5		Space or any Character between 0 and 9	20h or 30h to 39h
6		Space or any Character between 0 and 9	20h or 30h to 39h
7		Space or any Character between 0 and 9	20h or 30h to 39h
8		Space or any Character between 0 and 9	20h or 30h to 39h
9		Space or any Character between 0 and 9	20h or 30h to 39h
10		Space or any Character between 0 and 9	20h or 30h to 39h
11		Space or any Character between 0 and 9	20h or 30h to 39h
12		any Character between 0 and 9	20h or 30h to 39h
13		any Character between 0 and 9	20h or 30h to 39h
14		3Bh	Semicolon for Data Separation
15	1 or 2 or 4	31h or 32h or 34h	Dimension of concentration of Peak No. 1: 1=1%; 2=ppm; 4=ppb
16		3Bh	Semicolon for Data Separation
17	1 or 0	31h or 30h	measurement valid for Peak No. 1: 1=valid; 0=invalid
18		3Bh	Semicolon for Data Separation
19		Space or any Character between 0 and 9	20h or 30h to 39h
20		Space or any Character between 0 and 9	20h or 30h to 39h
21		Space or any Character between 0 and 9	20h or 30h to 39h
22		Space or any Character between 0 and 9	20h or 30h to 39h
23		Space or any Character between 0 and 9	20h or 30h to 39h
24		Space or any Character between 0 and 9	20h or 30h to 39h
25		Space or any Character between 0 and 9	20h or 30h to 39h
26		2Eh	Concentration Result Peak No. 2:
27		any Character between 0 and 9	20h or 30h to 39h
28		any Character between 0 and 9	20h or 30h to 39h
29		3Bh	Semicolon for Data Separation
30	1 or 2 or 4	31h or 32h or 34h	Dimension of concentration of Peak No. 2: 1=1%; 2=ppm; 4=ppb
31		3Bh	Semicolon for Data Separation
32	1 or 0	31h or 30h	measurement valid for Peak No. 2: 1=valid; 0=invalid
33		3Bh	Semicolon for Data Separation
34		Space or any Character between 0 and 9	20h or 30h to 39h
35		Space or any Character between 0 and 9	20h or 30h to 39h
36		Space or any Character between 0 and 9	20h or 30h to 39h
37		Space or any Character between 0 and 9	20h or 30h to 39h
38		Space or any Character between 0 and 9	20h or 30h to 39h
39		Space or any Character between 0 and 9	20h or 30h to 39h
40		Space or any Character between 0 and 9	20h or 30h to 39h
41		2Eh	Concentration Result Peak No. 3:
42		any Character between 0 and 9	20h or 30h to 39h
43		any Character between 0 and 9	20h or 30h to 39h
44		3Bh	Semicolon for Data Separation
45	1 or 2 or 4	31h or 32h or 34h	Dimension of concentration of Peak No. 3: 1=1%; 2=ppm; 4=ppb
46		3Bh	Semicolon for Data Separation
47	1 or 0	31h or 30h	measurement valid for Peak No. 3: 1=valid; 0=invalid
48		3Bh	Semicolon for Data Separation
49		Space or any Character between 0 and 9	20h or 30h to 39h
50		Space or any Character between 0 and 9	20h or 30h to 39h
51		Space or any Character between 0 and 9	20h or 30h to 39h
52		Space or any Character between 0 and 9	20h or 30h to 39h
53		Space or any Character between 0 and 9	20h or 30h to 39h
54		Space or any Character between 0 and 9	20h or 30h to 39h
55		Space or any Character between 0 and 9	20h or 30h to 39h
56		2Eh	Concentration Result Peak No. 4:
57		any Character between 0 and 9	20h or 30h to 39h
58		any Character between 0 and 9	20h or 30h to 39h
59		3Bh	Semicolon for Data Separation
60	1 or 2 or 4	31h or 32h or 34h	Dimension of concentration of Peak No. 4: 1=1%; 2=ppm; 4=ppb
61		3Bh	Semicolon for Data Separation
62	1 or 0	31h or 30h	measurement valid for Peak No. 4: 1=valid; 0=invalid
63		3Bh	Semicolon for Data Separation
64		Space or any Character between 0 and 9	20h or 30h to 39h
65		Space or any Character between 0 and 9	20h or 30h to 39h
66		Space or any Character between 0 and 9	20h or 30h to 39h
67		Space or any Character between 0 and 9	20h or 30h to 39h
68		Space or any Character between 0 and 9	20h or 30h to 39h
69		Space or any Character between 0 and 9	20h or 30h to 39h
70		Space or any Character between 0 and 9	20h or 30h to 39h
71		2Eh	Concentration Result Peak No. 5:
72		any Character between 0 and 9	20h or 30h to 39h
73		any Character between 0 and 9	20h or 30h to 39h
74		3Bh	Semicolon for Data Separation
75	1 or 2 or 4	31h or 32h or 34h	Dimension of concentration of Peak No. 5: 1=1%; 2=ppm; 4=ppb
76		3Bh	Semicolon for Data Separation
77	1 or 0	31h or 30h	measurement valid for Peak No. 5: 1=valid; 0=invalid
78		3Bh	Semicolon for Data Separation
79		Space or any Character between 0 and 9	20h or 30h to 39h
80		Space or any Character between 0 and 9	20h or 30h to 39h
81		Space or any Character between 0 and 9	20h or 30h to 39h
82		Space or any Character between 0 and 9	20h or 30h to 39h
83		Space or any Character between 0 and 9	20h or 30h to 39h
84		Space or any Character between 0 and 9	20h or 30h to 39h
85		Space or any Character between 0 and 9	20h or 30h to 39h
86		2Eh	Concentration Result Peak No. 6:
87		any Character between 0 and 9	20h or 30h to 39h
88		any Character between 0 and 9	20h or 30h to 39h
89		3Bh	Semicolon for Data Separation
90	1 or 2 or 4	31h or 32h or 34h	Dimension of concentration of Peak No. 6: 1=1%; 2=ppm; 4=ppb
91		3Bh	Semicolon for Data Separation
92	1 or 0	31h or 30h	measurement valid for Peak No. 6: 1=valid; 0=invalid
93		3Bh	Semicolon for Data Separation
94		Space or any Character between 0 and 9	20h or 30h to 39h
95		Space or any Character between 0 and 9	20h or 30h to 39h
96		Space or any Character between 0 and 9	20h or 30h to 39h
97		Space or any Character between 0 and 9	20h or 30h to 39h
98		Space or any Character between 0 and 9	20h or 30h to 39h
99		Space or any Character between 0 and 9	20h or 30h to 39h
100		Space or any Character between 0 and 9	20h or 30h to 39h
101		2Eh	Concentration Result Peak No. 7:
102		any Character between 0 and 9	20h or 30h to 39h
103		any Character between 0 and 9	20h or 30h to 39h
104		3Bh	Semicolon for Data Separation
105	1 or 2 or 4	31h or 32h or 34h	Dimension of concentration of Peak No. 7: 1=1%; 2=ppm; 4=ppb
106		3Bh	Semicolon for Data Separation
107	1 or 0	31h or 30h	measurement valid for Peak No. 7: 1=valid; 0=invalid
108		3Bh	Semicolon for Data Separation
109		Space or any Character between 0 and 9	20h or 30h to 39h
110		Space or any Character between 0 and 9	20h or 30h to 39h
111		Space or any Character between 0 and 9	20h or 30h to 39h
112		Space or any Character between 0 and 9	20h or 30h to 39h
113		Space or any Character between 0 and 9	20h or 30h to 39h
114		Space or any Character between 0 and 9	20h or 30h to 39h
115		Space or any Character between 0 and 9	20h or 30h to 39h
116		2Eh	Concentration Result Peak No. 8:
117		any Character between 0 and 9	20h or 30h to 39h
118		any Character between 0 and 9	20h or 30h to 39h
119		3Bh	Semicolon for Data Separation
120	1 or 2 or 4	31h or 32h or 34h	Dimension of concentration of Peak No. 8: 1=1%; 2=ppm; 4=ppb
121		3Bh	Semicolon for Data Separation
122	1 or 0	31h or 30h	measurement valid for Peak No. 8: 1=valid; 0=invalid
123		3Bh	Semicolon for Data Separation
124		Space or any Character between 0 and 9	20h or 30h to 39h
125		Space or any Character between 0 and 9	20h or 30h to 39h
126		Space or any Character between 0 and 9	20h or 30h to 39h
127		Space or any Character between 0 and 9	20h or 30h to 39h
128		Space or any Character between 0 and 9	20h or 30h to 39h
129		Space or any Character between 0 and 9	20h or 30h to 39h
130		Space or any Character between 0 and 9	20h or 30h to 39h
131		2Eh	Concentration Result Peak No. 9:
132		0	20h or 30h to 39h
133		0	20h or 30h to 39h
134		3Bh	Semicolon for Data Separation
135	1 or 2 or 4	31h or 32h or 34h	Dimension of concentration of Peak No. 9: 1=1%; 2=ppm; 4=ppb
136		3Bh	Semicolon for Data Separation
137	1 or 0	31h or 30h	measurement valid for Peak No. 9: 1=valid; 0=invalid
138		3Bh	Semicolon for Data Separation
139		Space or any Character between 0 and 9	20h or 30h to 39h
140		Space or any Character between 0 and 9	20h or 30h to 39h
141		Space or any Character between 0 and 9	20h or 30h to 39h
142		Space or any Character between 0 and 9	20h or 30h to 39h
143		Space or any Character between 0 and 9	20h or 30h to 39h
144		Space or any Character between 0 and 9	20h or 30h to 39h
145		Space or any Character between 0 and 9	20h or 30h to 39h
146		2Eh	Concentration Result Peak No. 10:
147		0	20h or 30h to 39h
148		0	20h or 30h to 39h
149		3Bh	Semicolon for Data Separation
150	1 or 2 or 4	31h or 32h or 34h	Dimension of concentration of Peak No. 10: 1=1%; 2=ppm; 4=ppb
151		3Bh	Semicolon for Data Separation
152	1 or 0	31h or 30h	measurement valid for Peak No. 10: 1=valid; 0=invalid
153		3Bh	Semicolon for Data Separation
154	K	K	Checksum
155	<	3Ch	

Table 33 : RS-232 Send Results

## 12.4 Enable-Disable Calibration

Request / Command			K4000 Response			
Character No	Character	ASCII Code No (hex)	Character No	Character	ASCII Code No (hex)	Meaning
1	>	3Eh	1	>	3Eh	Command ID Success
2	D	44h	2	D	44h	
3	0 or 1 (0 = disable / 1 = enable)	30h or 31h	3	1	31h	
4 (chksm)	t or u	74h or 75h	4 (chksm)	u	75h	Failure
5	<	3Ch	5	<	3Ch	
			1	>	3Eh	
			2	D	44h	
			3	0	30h	
			4 (chksm)	t	74h	
			5	<	3Ch	

Table 34 : RS-232 Enable-Disable Calibration

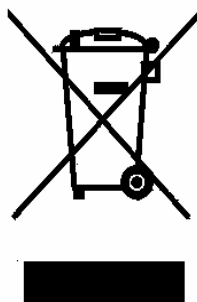
## 12.5 Respan

Request / Command			K4000 Response			
Character No	Character (meaning)	ASCII Code No (hex)	Character No	Character	ASCII Code No (hex)	Meaning
1	>	3Eh	1	>	3Eh	command ID
2	E	45h	2	E	45h	
3	Any number from 1 to 9 (number of the calibration point if multi-point)	31h to 39h	3	0 or 1	30h or 31h	
4 (Peak 1)	0 or 1 (0 = don't respan, 1 = respan)	30h or 31h	4	u or v	75h or 76h	Checksum
5 (Peak 2)	0 or 1	30h or 31h	5	<	3Ch	
6 (Peak 3)	0 or 1	30h or 31h				
7 (Peak 4)	0 or 1	30h or 31h				
8 (Peak 5)	0 or 1	30h or 31h				
9 (Peak 6)	0 or 1	30h or 31h				
10 (Peak 7)	0 or 1	30h or 31h				
11 (Peak 8)	0 or 1	30h or 31h				
12 (Peak 9)	0 or 1	30h or 31h				
13 (Peak 10)	0 or 1	30h or 31h				
14 (Chksm)	X					
15	<	3Ch				

Table 35 : RS-232 Respan

## 13 Product disposal In accordance with the Waste Electrical and Electronic Equipment (WEEE) Directive

The label shown in Figure & is fitted to the analyser.



**Figure 65 :The WEEE label**

This label identifies that:

- The analyser is considered to be within the scope of the Waste Electrical and Electronic Equipment (WEEE) Directive.
- The analyser is not intended for disposal in a municipal waste stream, but shall be submitted for material recovery and recycling in accordance with the local regulations which implement the WEEE Directive.
- For additional information and advice on the disposal of the analyser in accordance with the requirements of the WEEE Directive, contact Servomex at [info@servomex.com](mailto:info@servomex.com) or your local Servomex agent.
- If you send the analyser to Servomex or your local Servomex agent for disposal, the analyser must be accompanied by a correctly completed decontamination certificate.

## 14 REACH Regulation

In pursuance of the requirements included in Article 33 of the European REACH Regulation on the Registration, Evaluation, Authorisation and Restriction of Chemicals, information on Substances of Very High Concern (SVHC) contained in Servomex products is provided on [www.servomex.com](http://www.servomex.com)