SERVOPRO FID
Trace Total Hydrocarbons
OPERATOR MANUAL

Part Number:	**01000001A**
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1 DESCRIPTION AND DEFINITIONS

1.1 Scope of this manual

This manual provides installation, operation and routine maintenance instruction for the Servomex SERVOPRO FID Online Total Hydrocarbons analyser, abbreviated SERVOPRO FID 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 FID. 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
Caution highlight hazards which, if not taken into account, can result in damage to the SERVOPRO FID 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

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

⚠	WARNING This analyser is used to measure a sample that may be explosive and the fuel used by the detector is flammable.

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

⚠	WARNING This analyser is not designed to be used for safety critical measurements and shall not be used as primary measurement in safety critical measurement. Validation and Calibration procedure must be suitable for the application.

⚡	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 The analyser must not be used as personal protective equipment

⚠	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**
>
> A fuel shut-off valve must be connected to the SERVOPRO FID to prevent the accumulation of fuel.

The SERVOPRO FID is a rackmount analyser to be used in fixed installations. It is used to measure the hydrocarbons contained in the sample.

The SERVOPRO FID uses a FID detector to measure the content of hydrocarbons. Because the FID is a carbon counter, it will have a different response to different types of hydrocarbons. The SERVOPRO FID is calibrated in the factory with a sample containing methane. Consequently, the measurement is a methane equivalent[1].

The SERVOPRO FID is simple to operate, with an intuitive user interface (see Section 4).

Gas sample measurement is shown on the SERVOPRO FID display, and can also be output to a serial device connected to the SERVOPRO FID (optional), or as milliamp (mA) output.

1.4 Sample measurement configurations

The SERVOPRO FID can be supplied to measure hydrocarbons in 5 different backgrounds. According to the background, the type of fuel can differ.

Background	Fuel type
Argon	Hydrogen, 60% N_2/ 40% H_2
Nitrogen	Hydrogen, 60% N_2/ 40% H_2
Helium	Hydrogen
Air	Hydrogen, 60% N_2/ 40% H_2
Oxygen	60% N_2/ 40% H_2, 60% He/ 40% H_2
Carbone Dioxide	Hydrogen

Table 1 : List of available backgrounds

1.5 Other product options

The standard SERVOPRO FID can be supplied with the following options:

- One RS-232 output
- Alarm relays (up to 2)

---

[1] The SERVOPRO FID will give a response to other hydrocarbons that is proportional to the number of hydrocarbons contain in the molecule. However, it will not necessarily be linearly proportional because of incomplete hydrocarbon oxidation of larger molecules.
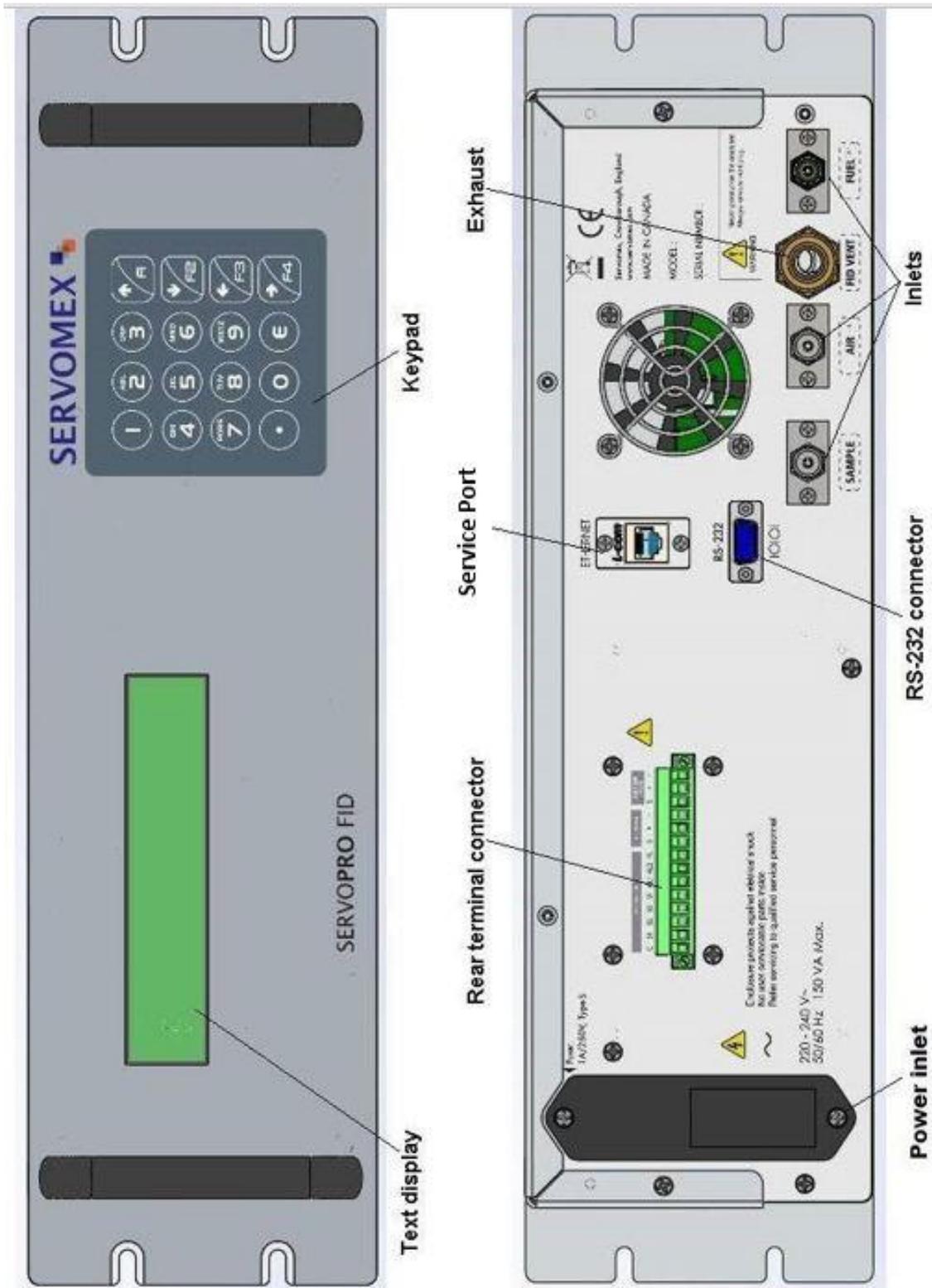
Figure 1 – Front and rear view of SERVOPRO-FID

2 SPECIFICATION

<table>
<tr><td>⚠</td><td>WARNING

You must install and use the SERVOPRO FID 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 FID may not operate as intended, sample gas measurements may not be accurate, or the SERVOPRO FID may be damaged.</td></tr>
</table>

2.1 General

Dimensions:
    Height x width x depth: 133 x 483 x 457 mm (5.25 x 19 x 18 ins)

Weight (maximum)   12 kg (26 lbs)

Electrical supply requirements:
    Voltage: 100 to 120 Vac or 220 to 240 Vac[2],[3]
    Frequency: 50 to 60 Hz
    Maximum power consumption: 150 VA

Fuse rating/type: Two fuses 1 amp / 250 V, Type "S", Slo-Blo miniature fuses 5 x 20 mm for 220-240 VAC version.
    Two fuses 2 amp / 250 V, Type "S" Slo-blo miniature fuses 5x20 mm for 100-120 VAC version

Gas flow rate[4]
    Minimum
        Air: 300 ml min^{-1}
        Fuel: 40 ml min^{-1}
        Sample: 30 ml min^{-1}
    Maximum:
        Air: 500 ml min^{-1}
        Fuel: 100 ml min^{-1}
        Sample: 100 ml min^{-1}

Table 2 : General specifications

---

[2] The analyser is supplied configured for operation with one of these voltage ranges. You must specify the voltage range when you order the analyser.
[3] This analyser is rated in accordance with Over Voltage Category II, Pollution Degree 2.
[4] Flow rates are background dependent. They must be set as specified in section 2.4.

CAUTION
Always use factory flow set points. Excessive flows could damage detector. Flow set points shall only be changed by a trained technician.

2.2 Gas

Pressure range

Air:	103.4 to 206.9 kPa (15 to 30 psig)
Fuel:	103.4 to 206.9 kPa (15 to 30 psig)
Sample:	34.5 to 103.4 kPa (5 to 15 psig)

Table 3 : Gas pressure specifications

2.2.1 Type of fuel

Refer to table 1 for combinations of Background and Fuel

2.3 Calibration gases

Zero calibration gas	5N Hydrocarbon free sample[5,6]
Span calibration gas	Sample gas containing methane[7,8]
Calibration gas flow rate	
Minimum	10 ml min^{-1}
Maximum	150 ml min^{-1}
Calibration gas pressure range	
Minimum	34.5 kPa (5 psig)
Maximum	103.4 kPa (15 psig)

Table 4 : Calibration gas specifications

2.4 Gas settings during normal operation

Air	300 to 500 ml min^{-1}
Fuel	40 to 100 ml min^{-1}
Sample	30 to 100 ml min^{-1}

Table 5 : Gas settings during normal operation

---

[5] The zero calibration gas must be of the same type as the ordered background. For example, a SERVOPRO FID measuring hydrocarbons in argon must be calibrated with a pure argon sample gas.

[6] A hydrocarbon trap must be used in order to remove all hydrocarbons.

[7] The span gas must of the same background as the ordered background.

[8] The suggested amount of methane in the sample is at least 80% of the range in use. If the range 0-1000 ppm is used, a sample containing at least 800 ppm of methane is required.

2.5 Typical gas settings for ignition

Argon, Nitrogen, Air, Helium, CO2	
Air	500 ml min^{-1}
Fuel	70 ml min^{-1}
Sample	50 ml min^{-1}
Oxygen	
Air	250 ml min^{-1}
Fuel	100 ml min^{-1}
Sample	10 ml min^{-1}

Table 6 : Ignitions settings

2.6 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 7 : Environmental limits

2.7 Performance

Display indication	ppm
Standard Ranges	0 – 10 ppm
	0 – 100 ppm
	0 – 1000 ppm

Ranges up to 20,000 ppm available on request

Resolution

0 – 10 ppm	0.01 ppm
0 – 100 ppm	0.1 ppm
0 – 1000 ppm	1 ppm

	Hydrogen	**60% N$_2$/40% H$_2$** **60% He/40% H$_2$**
Intrinsic error (accuracy)	< 1% Range	< 2% Range
Repeatability	≤ 0.5% Range	≤ 1% Range
Zero drift (24 hours)	1% Range	2% Range
Lower detection limit (LDL)	0.1 ppm	0.2 ppm

Table 8 : Performance

2.8 Mains cable

Type	IEC 60320-1-C13
Cable requirements	- Screened
	- Specified for 10 A @ 250 Vac
	- If the analyser is installed using a non-supplied cable, this cable must be screened, with the screen connected to earth at both ends.
Maximum length	2 m

Table 9 : Mains cable

2.9 milliAmp (mA) output

Maximum load	500 Ω
Connector type	Terminal block
Isolation voltage	500 V RMS
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^2 (18 AWG)

Table 10 : MilliAmp (mA) output specifications

2.10 Digital outputs

Total maximum current	1 Amp
Connector type	Terminal block
Maximum voltage	24 VDC
Cable requirements	
Type	Multi-core cable with overall screen
Maximum size	0.82 mm^2 (18 AWG)

Table 11 : Digital output specifications

2.11 Fuel shut-off/Hydrogen relay output

Total maximum current	1 Amp
Connector type	Terminal block
Maximum voltage	24 VDC
Cable requirements	
Type	Multi-core cable with overall screen
Maximum size	$0.82 \ mm^2$ (18 AWG)

Table 12 : Hydrogen output specifications

2.12 RS-232 Connector

Type	Male 9 way D connector
Cable requirements	NULL modem Shielded cable
Maximum length	30 m

Table 13 : RS-232 Connector

3 UNPACKING THE SERVOPRO FID

1. Remove the SERVOPRO FID and any other equipment from its packing.

2. Remove the wrapping plastic.

3. Remove protective caps from inlets.

4. Remove protective cap from exhaust.

5. Inspect the SERVOPRO FID 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 FID immediately:
   o Refit protective caps on inlets and exhaust.
   o Place the SERVOPRO FID and any other equipment supplied back in its protective packing.
   o Store the SERVOPRO FID 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 FID.

 Retain the shipping documentation and packaging for future use (for example, return of the SERVOPRO FID 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 FID. If you do not, you may damage the SERVOPRO FID when you try to pass gases through it.

---

4 SERVOPRO FID USER INTERFACE

4.1 Introduction

The SERVOPRO FID user interface comprises the following (see Figure 1 – Front and rear view of SERVOPRO-FID).

Power On/Off key	Use this key to switch the SERVOPRO FID on (see section 5.2) or to switch it off.
Keypad	Used to navigate in the user interface.

Table 14 : User interface description

4.2 Menu map

```
                                    Main
        ┌──────┬──────────┬──────────────────┬──────────────────┬──────────┐
    Run menu  Calibration           Configuration        Diagnostic          Hidden menu
               menu                    menu                 menu
          ┌─────┬─────┬──┐     ┌───────┬────────┬────────┐   ┌──────┬──────┬──────────┬──────┬──────┐
        Zero  Span  Calibrate  General  Parameters  Ethernet  Signal  Flow  Temperature System Alarm
                               config.  config.     config.   diag.   diag.  diagnostic  info  historic
```

Main → Run menu, Calibration menu, Configuration menu, Diagnostic menu, Hidden menu

Calibration menu → Zero, Span, Calibrate

Configuration menu → General configuration, Parameters configuration, Ethernet configuration

Diagnostic menu → Signal diagnostic, Flow diagnostic, Temperature diagnostic, System info, Alarm historic

Hidden menu → Flow, Filters, Comp, Clock, Log Amp, Oven, Starting, Ramp, Advance diagnostic, Flow table, Others

Flow table → Sample flow table → Air flow table → Fuel flow table → Slope → Pressure set point

4.3 Navigating and using the user interface

The text version of SERVOPRO FID user interface is built around a 4x40 text display. Figure 2 represents a typical menu of the SERVOPRO FID.

```
Measure: Flame off
Smp: 30 CC      Air: 300 CC      Fuel: 100 CC
Range:0-1       Status: Error
FID temp: 100C            PRESS F1 to ignite
```
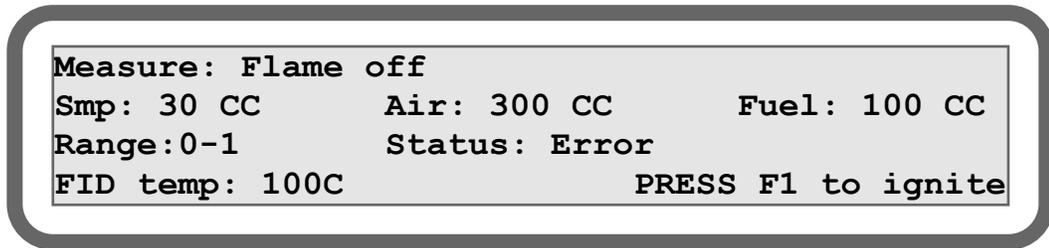
Figure 2 - User interface controls and features

4.3.1 Navigating

The navigation in the user interface is very simple. All menus are accessed using the keypad. To exit a menu, the ← must be pressed on the keypad. If a menu contains more than one page, a → will be displayed in the upper right corner. The → is used to access other pages.

When a field requires a numerical value to be entered, press the corresponding number on the keypad and enter the desired value. Validate by pressing the E key. If the field is used to toggle between modes, press the corresponding number to switch between modes.

4.4 Run menu

During normal operation, the analyser should be in this menu. It allows the user to retrieve the important data like actual impurity, status, alarms, flows and temperatures.

```
Measure: Flame off
Smp: 30 CC      Air: 300 CC      Fuel: 100 CC
Range:0-1       Status: Error
FID temp: 100C              PRESS F1 to ignite
```
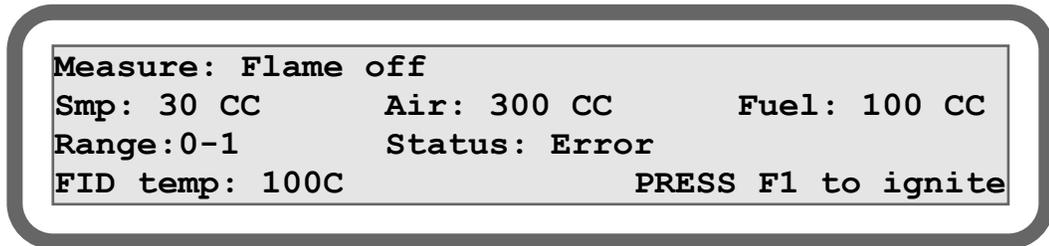
Figure 3 – Run menu

The SERVOPRO FID comes with three ranges. The active range can be changed using the keypad. To change range, use key 1, 2 or 3 on the keypad. Key 1 will select range 1 and so on.

Range can only be changed when ranging mode is set to manual.

This menu also has a flame indicator. When the flame is off, "Flame off" is displayed instead of measurement. When flame is off, "Press F1 to ignite" is displayed as show in figure 3.

It is normal that "PRESS F1 to ignite" is not displayed when errors are active.

The reading can be replaced by three types of error. If the analyser is in over range, the field will be replaced by over scale and if the analyser is underscale, the field will be replaced by underscale. See section 9.2 for more information. The other possibility is flame off as already explained.

Alarms are also reported in this menu. They are displayed below the fuel field. When there is no alarm, OK is displayed. When alarm one is active, Alarm #1 is displayed and when both alarms are on, Alarm #1,#2 is displayed. See section 6.2 for more information regarding how the alarms are working.

Alarms information is only displayed when this option is selected.

4.5 Configuration menu

This menu is used to set all important parameters. These parameters are explained in table 11.3.1.

```
<--          <<CONFIGURATION MENU>>
1)  General configuration
2)  Parameters configuration
3)  Ethernet configuration
```

Figure 4 – Configuration menu

```
<--          <<GENERAL CONFIGURATION>>
1) Auto. range :    NO          4) Auto-igni : OFF
2) Analog output: TRK           5) Alarms 1:  50
3) mA failure:      OFF         6) Alarms 2:  100
```

Figure 5 – General configuration menu

CAUTION

Always use factory flow set points. Excessive flows could damage detector. Flow set points shall only be changed by a trained technician.

```
<--          <<PARAMETERS  CONFIGURATION>>
1) Smp flow SP:   0.0           4) FID Temp: 0.0
2) Air flow SP:    0.0
3) Fuel flow SP:  0.0
```

Figure 6 – Parameters configuration

This menu has been divided into 3 sections: General parameters, Parameters configuration and Ethernet. These menus can be accessed using key 1 to 3 on the key pad. To exit these menus, use arrow ←. To access the second page of a menu, use arrow → on the keypad.

When the field requires a numerical value, press the corresponding number on the keypad and enter the desired value. Validate by pressing the E key. If the field is used to toggle between modes, press the corresponding number to switch between modes.

Parameter	Unit	Range	Description
Sample flow	ml min^{-1}	0-200	Sample flow set point.
Fuel flow	ml min^{-1}	0-200	Fuel flow set point.
Air flow	ml min^{-1}	0-1000	Air flow set point.
Temp FID	Celsius	0-100	FID temperature set point.
Auto ranging			Ranging mode: 1. **NO**: User has to change range manually. 2. **YES**: SERVOPRO-FID changes range automatically according to process value. See section 6.5 for more information.
Analogue output			Analogue output mode: 1. **HOLD**: 4-20 mA output is only refreshed when the analyser is in the run menu. 2. **TRACK**: 4-20 mA output is refreshed whichever the menu.
mA failure mode			4-20 mA failure mode: 1. **OFF**: System errors have no effect on 4-20 mA analogue output. 2. **LOW**: If a system error occurs, 4-20 mA analogue output is set below 4 mA. 3. **HIGH**: If a system error occurs, 4-20 mA analogue output is set above 20 mA.
Alarm #1	ppm	0-1000	Alarm #1 set point. If the calculated impurity is over this set point, an alarm #1 is generated. Alarm #1 must always be smaller then alarm #2. See section 6.2 for more information.
Alarm #2	ppm	0-1000	Alarm #2 set point. If the calculated impurity is over this set

			point, an alarm #2 is generated. See section 6.2 for more information.
Auto-ignition		1-5	This is the number of times that the analyser will try to restart the flame if the flame goes out. See section 6.4.1.

Table 15 : Configuration parameters

Parameter	Range	Description
Ethernet enabled		**YES**: Analyser can be remotely controlled **NO**: It is impossible to get connected to the SERVOPRO FID.
DHCP enabled		**YES**: DHCP is on. **NO**: SERVOPRO FID uses a static IP address.
IP	0-255	If DHCP is enabled, the field is set read-only. Otherwise, user can set the static IP.
Mask	0-255	If DHCP is enabled, the field is set read-only. Otherwise, user can set the network mask.
Gateway	0-255	If DHCP is enabled, the field is set read-only. Otherwise, user can set the network gateway.
MAC		This field is read-only. This is the analyser's MAC address.

Table 16 : Connectivity parameters

4.6 Diagnostic

This menu is very useful for troubleshooting. This menu groups many sensor signals like pressures, temperatures and detector signal. All parameters are explained in table 8.

```
<--            <<DIAGNOSTIC MENU>>
1) Signal diag.
2) Flow diag.              5) System info.
3) Temperature diag.       6) Alarm historic
```

Figure 7 - Diagnostic menu

```
<--            <<<SIGNAL DIAGNOSTIC>>>
Chrom signal: 0.9542     V
Chrom counts: 3201763    Counts
```

Figure 8 – Signal diagnostic

```
<--            <<<FLOW DIAGNOSTIC>>>
Smp:   30  CC    2.5 PSI   7714  Cnts      0.0 %
Air:  300  CC   72.5PSI   45658 Cnts     66.1 %
Fuel: 100  CC   68.1PSI   32587 Cnts     52.1 %
```

Figure 9 – Flow diagnostic

```
<--               <<<TEMP DIAGNOSTIC>>>


FID:      100.0C          912544 Counts        35.1%
```

Figure 10 – Temp diagnostic

```
<--            <<<SYSTEM DIAGNOSTIC>>>            -->
      UI v1.90.5                   IO Board v1.83.5
Reg. Smp v9.53  Air v9.53  Fuel v9.53
Last maintenance: 01/01/2009
```

Figure 11 – System diagnostic

```
<--          <<<<SYSTEM DIAGNOSTIC>>>>
Serial Number: 10000


www.servomex.com          info@servomex.com
```

Figure 12 – System diagnostic

```
PRV|00)01/01/2009 Smp Dev          19:12:45
<--|01)01/01/2009 Flame Off        19:12:42
NXR|02)01/01/2009 Fuel Low         19:12:41
-->|03)01/01/2009 Air Low          19:12:25
```

Figure 13 – Alarm historic

Parameter	Unit	Range	Description
Air flow	cc/min	0-1000	Actual air flow.
Air pressure	PSI	0-100	Actual air pressure.
Air counts	Counts	0-65535	Actual air sensor signal.
Air output	%	0-100	Actual air pressure regulator control output.
Fuel flow	cc/min	0-200	Actual fuel flow.
Fuel pressure	PSI	0-100	Actual fuel pressure.
Fuel counts	Counts	0-65535	Actual fuel sensor signal.
Fuel output	%	0-100	Actual fuel pressure regulator.

			control output.
Sample flow	cc/min	0-200	Actual sample flow.
Sample pressure	PSI	0-100	Actual sample pressure.
Sample counts	Counts	0-65535	Actual sample sensor signal.
Sample output	%	0-100	Actual sample pressure regulator control output.
FID temperature	Celsius		Actual FID. temperature
FID counts	Counts	0-16777216	Actual FID. temperature sensor's signal.
FID output	%	0-100	The power of the FID heater.
Chrom signal	Volts	0-5	Actual detector signal.
Chrom signal count	Counts	0-16777216	Actual detector signal.
UI v			User interface software version.
IO Board v			IO Board software version.
Smp v.			Sample pressure regulator software version.
Air v.			Air pressure regulator software version.
Fuel v.			Fuel pressure regulator software version.
Last maintenance			Date of the last maintenance.
Serial number			Serial number of analyser.

Table 17 : Diagnostic parameters

The alarm historic menu is used to report alarms and system errors. Every time an alarm or an error occurs, a message is displayed with the time and date. When the error is resolved, the same message is displayed with time and date as well as: OK. For example if a flame off occurs and then the error is resolved, flame off:ok will be displayed.

Here is the list of error messages that can appear in the historic menu. This table describes every error message. For more information about an error, refer to section 9.

Message	Meaning
Alarm #1	There is an alarm #1. If OK is written next to this message, the error is resolved.
Alarm #2	There is an alarm #2. If OK is written next to this message, the error is resolved.
Air Dev	Air flow deviation. If OK is written next to this message, the error is resolved.
Air low	Low air flow. If OK is written next to this message, the error is resolved.
Fuel Dev	Fuel flow deviation. If OK is written next to this message, the error is resolved.
Fuel Low	Low fuel flow. If OK is written next to this message, the error is resolved.
Smp Dev	Sample flow deviation. If OK is written next to this message, the error is resolved.
FID T Dev	FID oven temperature deviation. If OK is written next to this message, the error is resolved.
Flame Off	The FID flame is off. If OK is written next to this message, the error is resolved.
Glow Plug	The glow plug is damaged. If OK is written next to this message, the error is resolved.
IO Prob.	IO board communication problem. If OK is written next to this message, the error is resolved.
Smp Prob.	Sample pressure regulator communication error. If OK is written next to this message, the error is resolved.
Air Prob.	Air pressure regulator communication error. If OK is written next to this message, the error is resolved.
Fuel Prob.	Fuel pressure regulator communication error. If OK is written next to this message, the error is resolved.
RTD Prob.	RTD sensor is damaged. If OK is written next to this message, the error is resolved.
Therm Pro.	Thermistor sensor for flame detection is damaged. If OK is written next to this message, the error is resolved.

Table 18 : Error message and meaning

You can toggle between log pages pressing the ← → arrows. Refer to system error section for error messages.

It is normal to see alarm messages when starting the analyser since parameters like flow and temperature are not yet stable.

4.7 Calibration menu

Calibration menu is used to calibrate the analyser. In this menu, you have access to three different menus. Zero and Span are used to enter the value of calibration gases. The calibrate menu is used to perform the calibration.

```
<--              <<CALIBRATION MENU>>
1)Zero                            2)Span

3)Calibrate
```

Figure 14 - Calibration menu

```
<--              <<CALIBRATION MENU>>
Input ZERO value:0.00
Actual value:0.10
Value must be in PPM
```

Figure 15 – Zero menu

```
<--              <<CALIBRATION MENU>>
Input SPAN value:0.00
Actual value:981
Value must be in PPM
```

Figure 16 – Span menu

To set a zero or a span value, select the appropriate menu and enter the desired value. Validate using the E key. Entering a value does not recalibrate the analyser.

When changing a zero or span value, the status text in the calibrate menu will change to "changed". Once recalibrated, the status will come back to "OK". If an error occurs during calibration, the status will be "error".

To recalibrate your zero or your span, press the appropriate number on the key pad. Validate using F1 or cancel using F2.
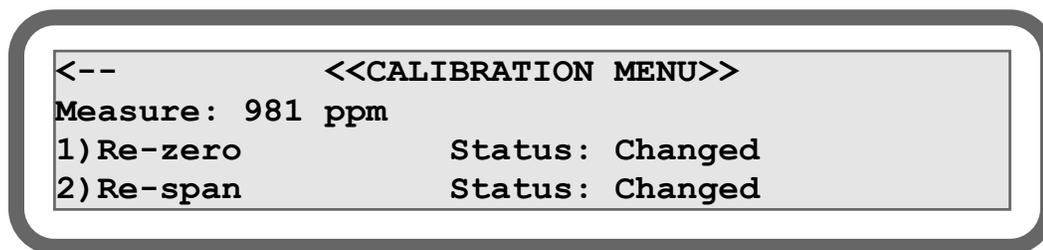
```
<--            <<CALIBRATION MENU>>
Measure: 981 ppm
1)Re-zero            Status: Changed
2)Re-span            Status: Changed
```

Figure 17 – Calibrate menu

For more information on how to calibrate the SERVOPRO FID, see section 6.1.

4.8   Hidden menus

The SERVOPRO FID has hidden menus. This means that a code sequence of keys must be entered in order to access those menus. Important data and parameters are contained in those menus and care must be taken when changing one of them.

To access hidden menus, the SERVOPRO FID must be in the main menu. From this menu press keys F1,F2,F3 (one after the other) and then press the E. Menu show in figure 20 should appear.

```
<--                <<HIDDEN MENU>>
0)Flow      1)Filter                    3)Clock
4)Log amp   5)Oven         6)Starting   7)Ramp
8)Adv diag  9)Flow table  F1)Other
```
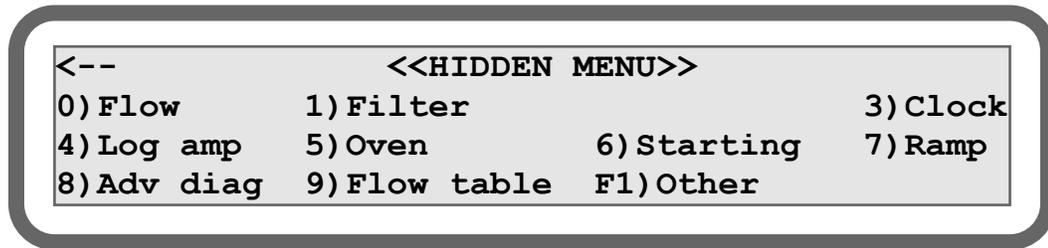
Figure 18 – Main page of hidden menus

To navigate to the hidden menus, use the same principle as standard menus.
To exit hidden menus, press ← arrow

Hidden menus are divided into 10 sections. All parameters are explained in the next sections.

4.8.1 Flow

The flow menu allows configuring PID constants for all electronic pressure regulators.

```
<--           <<<HIDDEN 1: Flow PID>>>
Air  1)P: 12.00      2)I: 7.00     3)D: 0.00
Smp  4)P: 0.15       5)I: 0.05     6)D: 0.00
Fuel 7)P: 0.15       8)I: 0.05     9)D: 0.00
```

Figure 19 - Hidden 1 menu

4.8.2 Filter

The filter menu allows configuring filtering algorithms that are used to filter FID signal.

```
<--            <<<HIDDEN 2: Filter>>>
1) Averaging number: 30
2) Averaging edge: 0.5
3) Median number: 5
```
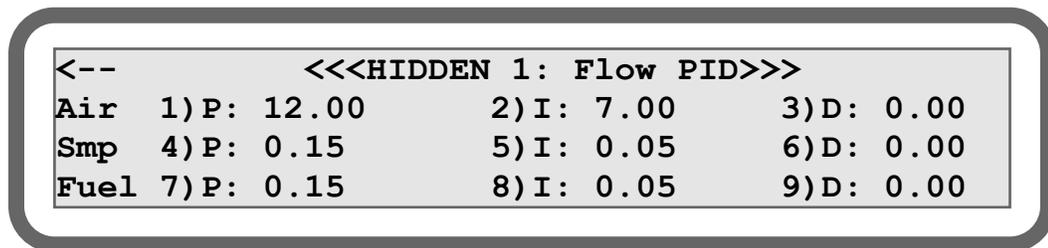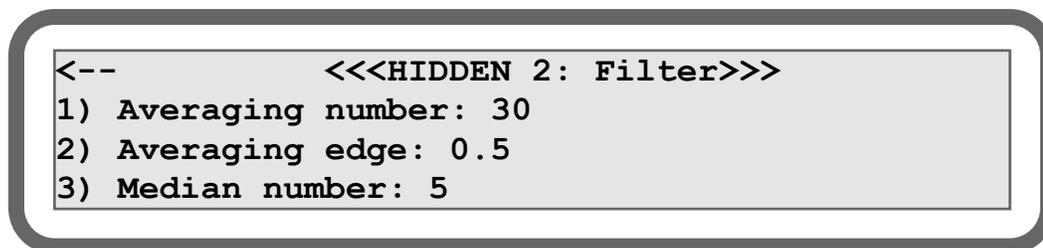
Figure 20 – Filter menu

4.8.2.1 Averaging number

The measurement can be filtered using a moving average. The moving average principle is very simple. For example, a moving average of 10 readings is the sum of previous 10 readings divided by 10. If readings are R_M, R_{M-1},…,R_{M-9}, the formula is:

$$result = \frac{R_M + R_{M-1} + ... + R_{M-9}}{10}$$

The range of this value is between 1 and 30.

4.8.2.2 Averaging edge

The averaging edge is used to reset the moving average. The unit of this value is the same as the process. For example, if this value is configured to 1, the moving average will be reset if the reading, without filtering, increases by 1.

This is used to reset the filter when a fluctuation occurs in the reading. This increases the response time of the filter.

The range of this value is between 0 and fullscale.

4.8.2.3 Median number

The median number is used to perform a median filter on the measurement. The median is performed before the moving average filter.

For example, a median filter of 10 readings is the median of previous 10 readings. If readings are R_M, R_{M-1},…,R_{M-9}, the formula is:

$$Result = median[R_M, R_{M-1},…,R_{M-9}]$$

The range of this value is between 0 and 10.

4.8.3 Clock

The clock menu allows configuring the date and time of analyser. This is used to report error messages.
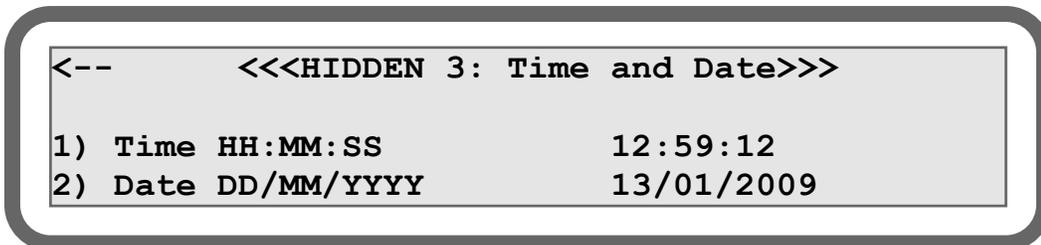
```
<--          <<<HIDDEN 3: Time and Date>>>


1) Time HH:MM:SS              12:59:12
2) Date DD/MM/YYYY            13/01/2009
```

Figure 21 – Time and date menu

To configure the time, press 1 and then enter hour, minute and second. Between each value, press E to validate. Do the same for the date.

4.8.4 Log Amp

This menu allows configuring the amplifier board.

```
<--          <<<HIDDEN 4: Log amplifier>>>
1) Preamp: 10             Counts: 3298034
2) Gain:   10.0000
3) Offset: 5.0300
```
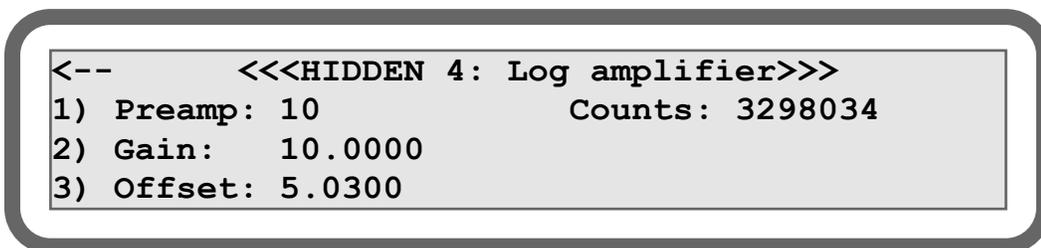
Figure 22 - Log amplifier menu
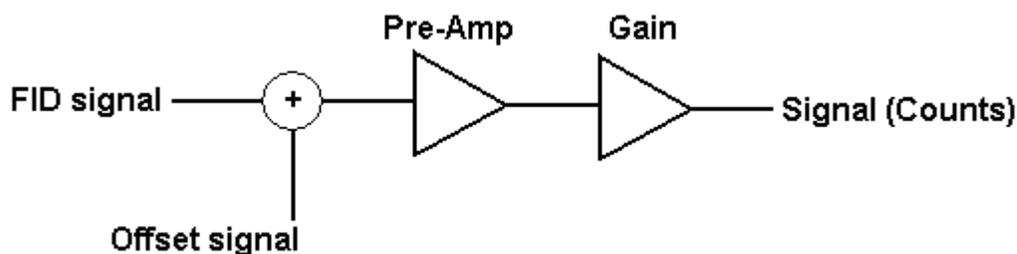
Figure 23 – Log Amp schematic

Parameter	Range	Description
Pre-amp	1-1000	First stage gain of the conditioning module
Gain	1-4095	Gain of the conditioning module
Offset	0-10	Offset in volt[9].
Counts	0-16777216	Amplifier signal.

---

[9] From 0 to 4.9999 the offset is negative and from 5.0001 and 10 the offset is positive.

4.8.5 Oven

This menu allows configuration of oven PID parameters.

```
<--            <<<HIDDEN 5: Oven>>>
1) Oven ctrl: YES
2) P: 7.00      3)I: 0.01      4)D: 0.00
```

Figure 24 - Oven menu

Press 1 to toggle between YES and NO. Yes enables the oven control and No disables it. 2, 3 and 4 are used to changed PID constants.

4.8.6 Starting parameters

This menu is used to configure ignition flows and the flame detection threshold.

```
<--   <<<HIDDEN 6: Starting parameters>>>
1) Sample: 30.0 CC      4) Starting: 200000
2) Air:   500.0 CC          Actual: 65526
3) Fuel:  100.0 CC
```

Figure 25- Starting parameters menu

During ignition, the analyser will automatically modify operating flows to those specified in this menu.

The flame is ON when actual flame counts are below starting counts.

4.8.7 Ramp parameters

This menu is used to configure how fast the pressure regulators will change flows between ignition and running mode.

```
<--       <<<HIDDEN 7: Ramp parameters>>>
1) Number of steps: 1
2) Time between steps: 1 sec
```

Figure 26 – Ramp parameters menu

Parameter	Range	Description
Number of steps	0-100	Number of intermediate steps to reach operating parameters. For example: operating air parameter is 300 cc/min and ignition air parameter is 500 cc/min and step is set to 2. Once flame is on, the SERVOPRO FID will go from 500 cc/min to 400 cc/min and then to 300 cc/min. This is used to avoid fast flow variation.
Time between steps	0-60	Time between each steps in seconds.

4.8.8 Advanced diagnostic

This page is used to diagnose the system. You can test all contacts on the rear panel of the SERVOPRO FID. You can also use this menu to calibrate or test the 4-20 mA output.

```
<--   <<<HIDDEN 8: Output diagnostic>>>
1)Status:  0     2)Alarm#1:  0     3)Alarm#2:  0
4)Range#1: 1     5)Range#2:  0     6)Range#3:  0
7)Flame:   0     8)4-20mA:   0%
```

Figure 27- Output diagnostic

To test the 4-20 mA output, the SERVOPRO FID must be configured in hold mode. Hold mode is configured in the configuration menu. 0% represents 4 mA and 100 represents 20 mA.

4.8.9 Flow table

These menus are used to configure flow tables and to generate them. This menu is divided into 5 pages. ← and → are used to toggle between pages.

```
<--   <<<HIDDEN 10:Smp flow table >>>        -->
1)0.0  PSI. 0.0  CC        4)3.0   PSI.60.0 CC
2)1.0  PSI.20.0  CC        5)4.0   PSI.80.0 CC
3)2.0  PSI.40.0  CC        6)5.0   PSI.100.0CC
```

Figure 28 : Flow table page 1

```
<--    <<<HIDDEN 11:Air flow table >>>      -->
1)0.0  PSI. 0.0  CC        4)3.0  PSI.60.0 CC
2)1.0  PSI.20.0  CC        5)4.0  PSI.80.0 CC
3)2.0  PSI.40.0  CC        6)5.0  PSI.100.0CC
```

Figure 29 - Flow table page 2

```
<--    <<<HIDDEN 12:Fuel flow table >>>     -->
1)0.0  PSI. 0.0  CC        4)3.0  PSI.60.0 CC
2)1.0  PSI.20.0  CC        5)4.0  PSI.80.0 CC
3)2.0  PSI.40.0  CC        6)5.0  PSI.100.0CC
```

Figure 30 - Flow table page 3

The first three pages contain flow tables for each pressure regulator. To enter a value, press the appropriate number on the keypad. Then, enter the pressure and validate with the E key. Once the E key is pressed, enter the flow value and press the E key to validate.

```
<--    <<<HIDDEN 13:Slope parameters >>>    -->
1)  Sample: 963790587
2)  Air:    986114319
3)  Fuel:   986114319
```

Figure 31 – Flow menu page 4

The slope parameter page is used to configure each pressure regulator. Those parameters must never be changed except when pressure regulator is physically changed.

```
<--       <<<HIDDEN 14: Pressure >>>
1)  Sample: 4.0 PSI          (4.0 PSI)
2)  Air:   60.0 PSI         (60.0 PSI)
3)  Fuel:  40.0 PSI         (40.0 PSI)
```

Figure 32 - Flow menu page 5

This menu is used to generate flow tables used during manufacturing or if a restrictor is changed. Pressure set point of each regulator can be changed using this menu.

4.8.10 Other parameters

This menu is used to configure the Ethernet password that is used to get connected to the analyser using Ethernet network and the lock range feature.
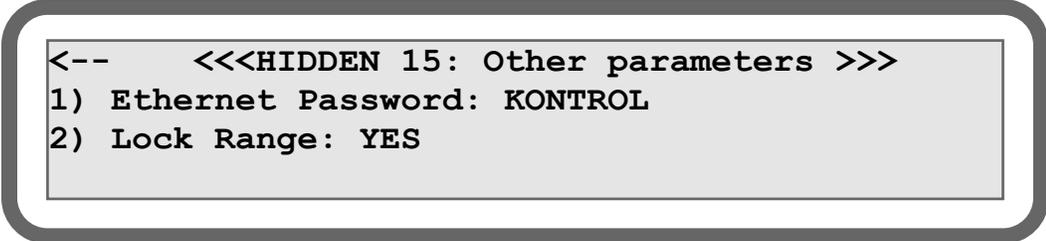
```
<--    <<<HIDDEN 15: Other parameters >>>
1) Ethernet Password: KONTROL
2) Lock Range: YES
```

Figure 33 – Other parameters menu

4.8.10.1 Lock range

This feature enables the user to lock the operating range. To lock a range, the analyser must be in manual ranging mode. This feature is used when the customer does not monitor the actual operating range. Because the weight of the 4-20 mA output is affected by the operating range (see Appendix A5), locking the range makes sure that the reading on the 4-20 mA is not false.

5 INSTALLATION AND SETUP

5.1 Installation and switch-on

⚠	WARNING Ensure fan is not blocked or covered.

⚠	WARNING Installation leak testing must be conducted before potentially flammable, toxic gasses are introduced.

⚠	WARNING Ensure that cables and tubes that you connect to the SERVOPRO FID are routed so that they do not present a trip hazard.

⚠	WARNING Fuel and sample gas may be explosive. Fuel gas will be flammable when mixed in the FID chamber. Sample gas may be flammable. Ensure that the external connections are leak free at full operating pressure.

⚠	WARNING Analyser uses Hydrogen fuel gas and may be explosive. Ensure that the analyser is installed in a forced ventilated cabinet to ensure adequate dilution and/or extraction can be achieved, and installation complies with all applicable site safety requirements including requirements for area monitoring.

⚠	WARNING For analysers measuring CO_2 Carbon dioxide is an asphyxiant. Ensure that the Installation location is vented to ensure a CO_2 can be diluted to levels below 5000 ppm and installation complies with all applicable site safety requirements including requirements for area monitoring.

<div style="border:1px solid black">

CAUTION

Do not use the SERVOPRO FID in an area subject to high levels of vibration or sudden jolts. If you do, sample measurement may not be accurate, or the SERVOPRO FID may be damaged.

</div>

1. Place the SERVOPRO FID in a suitable operating location, within easy reach of a suitable electrical supply outlet. Fit the power cord to the SERVOPRO FID's power inlet.
2. Fit the power cord to a suitable electrical outlet.
3. Connect air, fuel and sample inlet. For all gas line connections (including calibration gas and sample gas), we recommend the use of 1/8'' stainless steel tubing in full length, with no fittings. You must avoid pipe thread connections: they are usually sealed with Teflon tape and some particles can get into lines. By using compression-type tube fittings, the venturi aspiration of outside contaminants is virtually eliminated. Tube quality is often overlooked. For a 1/8'' O.D. tube, use a minimum wall thickness of 0.028''. The tube must be purchased to meet ASTM69 specifications. Inferior quality tubes may have irregularities on their circumference, causing inadequate sealing with compression tube fittings. All lines must be cleaned and purged to remove any trace of moisture, particles or hydrocarbons. Particles can damage your stream selection valves. Also, particles in the inlet filter will trap moisture. It is very important to use clean tubing. Improper tubing can result in noisy signal and drift.
4. Install hydrocarbon traps on fuel and air to remove hydrocarbons. The presence of hydrocarbons in air and fuel could result in drift and noise.
   Install a ½'' OD Tygon or equivalent tube on the exhaust.

<div style="border:1px solid black">

CAUTION

When the detector is in operation, water vapour comes out of the exhaust. The tube <u>must</u> have a slope of at least 10° to avoid water accumulation in the pipe.

</div>

5. Connect the 4-20 mA output to your recorder. See appendix A6.
6. If your SERVOPRO FID has the RS-232 option, connect it to your recorder. See appendix A3.
7. If you use a fuel shut-off valve, connect it to the rear terminal. See appendix A6. For specification of the valve, see appendix A7. The use of a fuel shut-off valve is strongly recommended. The internal control valve of the SERVOPRO FID is not a tight shut-off valve. Even if the internal valve is closed, a small amount of gas can pass through it.
8. If you need to monitor SERVOPRO FID's digital outputs, connect them as specified in appendix A6.
9. Adjust all external pressure regulators to SERVOPRO FID's pressure specifications.

10. Turn the power switch ON. It takes a few seconds for the SERVOPRO FID to initialize. The run menu should then appear.

 Note on initial use the FID heater, like all new heating elements, may emit a slight burning smell, this smell will disappear during initial use. Ensure the installation is well ventilated during the initial period.

 Use clean gloves when installing tubes and fittings. Human skin contains natural grease. Touching a tube or a fitting with hands could result in drift or noisy signal.

5.2 Mechanical installation

SERVOPRO FID analyser must be installed as shown in picture 36 and 37. Two brackets are necessary, one to support the front and one to support the back of the analyser.
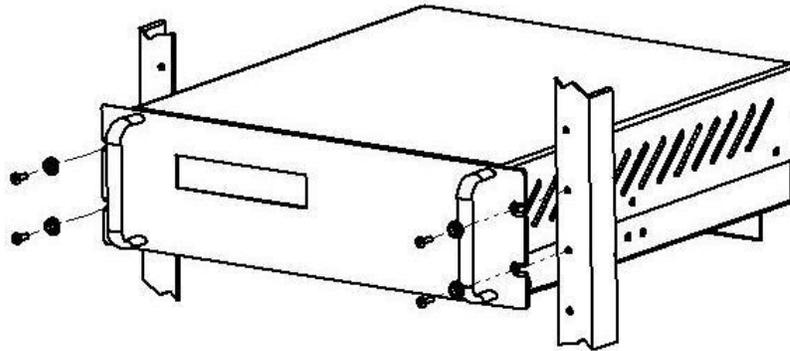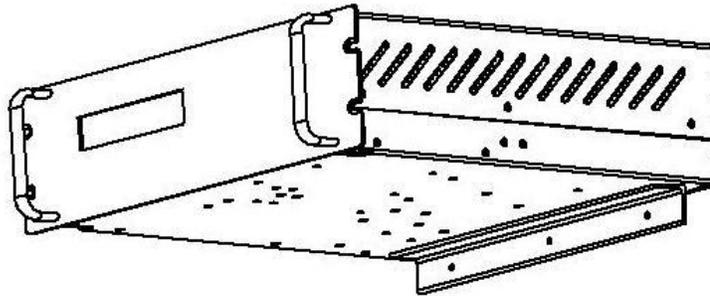

Figure 34 – Front bracket assembly

Figure 35 – Rear braket assembly

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

5.3 Electrical installation

	WARNING
⚠	Ensure that electrical installation of the SERVOPRO FID and the power supply unit conforms with all applicable local and national electrical safety requirements.

5.3.1 Mains power

CAUTION
To comply with EMC requirements, a screened cable must be used to connect the analyzer to the mains supply. If the analyser is installed with a non-supplied cable, the cable should be screened, with the screen connected to earth at both ends.

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.
   • 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 for temperatures 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 cable connected to the power inlet (Figure 1).

5.3.2 mA output

	WARNING
⚠	The 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 voltage by at least reinforced insulation.

> **CAUTION**
>
> **To comply with EMC requirements, a screened cable must be used to connect the mA output.**

> **CAUTION**
>
> **To comply with EMC requirements, the cable connected to the mA output terminal shall not be longer than 30 m, nor shall it leave the building in which the analyser is installed without suitable isolation.**

Connect the wires in your cable to the screw terminals on the rear terminal connector (Figure 1). Section 2.7 provides information on the rating and size of cable.
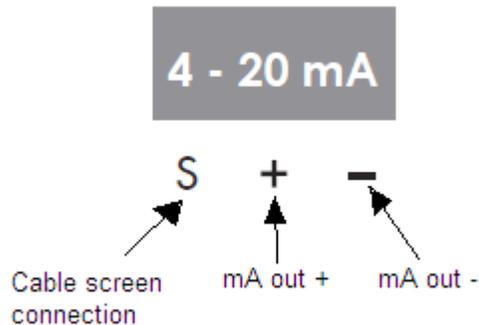

Figure 36 mA output connections

5.3.3 Digital outputs

> **WARNING**
>
> The 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 voltage by at least reinforced insulation.

> **CAUTION**
>
> **To comply with EMC requirements, a screened cable must be used to connect the digital outputs.**

Connect the wires in your cable to the screw terminals on the rear terminal connector (Figure 1). Section 2.8 provides information on the rating and size of cable.

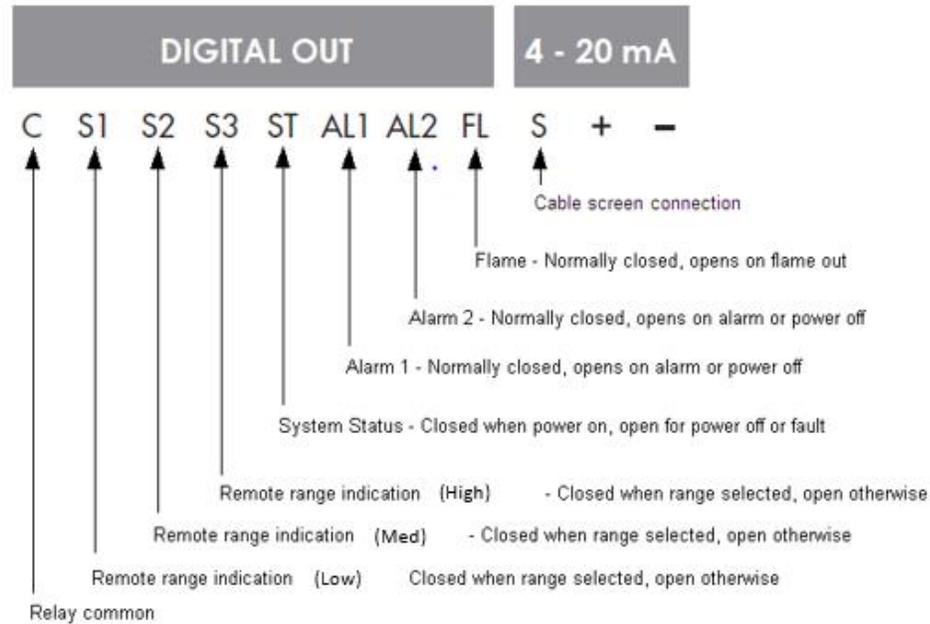Further details are given in Appendix A.6.

Figure 37 Digital output connections

5.3.4 Fuel shut-off/Hydrogen relay output

⚠	WARNING
	The 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 voltage by at least reinforced insulation.

CAUTION

To comply with EMC requirements, a screened cable must be used to connect the outputs.

Connect the wires in your cable to the screw terminals on the rear terminal connector (Figure 1). Section 2.9 provides information on the rating and size of cable.
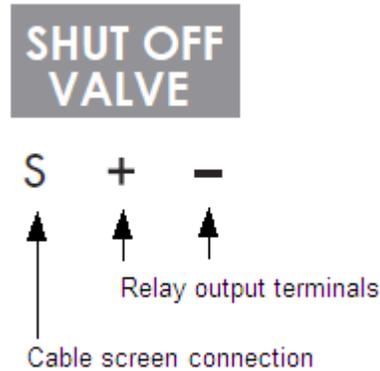
Further details are given in Appendix A.7.

Figure 38 Fuel shut-off/hydrogen relay output connections
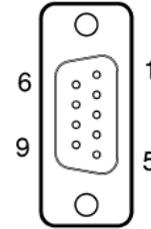
5.3.5 RS-232 connector

	WARNING
⚠️	The RS23 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 voltage by at least reinforced insulation.

CAUTION

To comply with EMC requirements, a screened cable must be used to connect the RS232 output.

The RS-232 connector on the rear of the SERVOPRO FID is a standard RS232 9-way 'D' type connector.

The pins on the connector are used as shown in Figure 39 below:

Pin(s)	Use
1	Not used
2	Rx (to Multi Purpose)
3	Tx (from Multi Purpose)
4	Not used
5	0 V
6, 7, 8, 9	Not used

Figure 39 – RS232 connection pin details

The SERVOPRO FID can be directly connected to the 9-way 'D' type serial port (usually designated « COM1 » or « COM2 ») on your PC. Use a compatible 9-way 'D Null Modem' cable (with a recommended maximum length of 3 m), with female-to-female connectors.

If your PC only has USB serial ports, use a commercially available 9-way 'D' type serial to USB converter to connect the SERVOPRO FID to one of the serial ports.

6 GENERAL OPERATION

CAUTION

Sample and calibration gas must be as specified in Sections 2.2 and 2.3. If your sample or calibration gas pressures and/or flow rates are above those specified in Section 2.2 and 2.3, you must regulate them externally before they enter the SERVOPRO FID.

6.1 Calibrating the SERVOPRO FID

CAUTION

You must calibrate the SERVOPRO FID before initial set-up. We also recommend calibrating the SERVOPRO FID at least every month or more often depending on the required accuracy. Periodic calibrations are important in order to verify the functionality of the analyser.

The pressure of your calibration gas supply must be the same as the pressure of the gases to be sampled. If the pressures are different, sample gas measurements may not be accurate.

If you do not allow calibration gas to pass through the SERVOPRO FID for a proper period of time before calibrating, the calibration may not be accurate. Typically, 15 minutes is considered enough, however, it depends on the installation. The SERVOPRO FID is well purged when the reading is stable.

Before calibrating the SERVOPRO FID, make sure that flows and FID temperature are stable (typical warm-up time is 1 hour).

1. Connect your calibration gas to the sample gas inlet. Ensure that the calibration gas pressure is as specified in Section 2.3.
2. Allow the calibration gas to pass through the SERVOPRO-FID and wait for stabilization.

If the gas measured during normal operation has a high content of hydrocarbons, it may be necessary to wait longer period of time for stabilization of zero gas.

3. Go into calibration menu. Make sure that span and zero gas values are properly entered and that they represent the calibration gases.
4. Once current reading is stable, press the calibration button:
    a. If you are calibrating the span, press the "re-span" button.
    b. If you are calibrating the zero, press the "re-zero" button.

6.2 Configuring the measurement alarms

This section is only applicable if your SERVOPRO FID has the alarm option.

Two alarms levels are available: Alarms #1 and Alarm #2. An alarm will occur when the current reading of the analyser goes above the alarm setting. For example, if alarm #1 is set to 10 ppm and reading is 12 ppm, alarm #1 will be activated. Alarm #2 must always be higher than alarm #1. When an alarm is activated, a relay contact is opened. When there is no alarm, the relay contact is closed. Alarms can be monitored by an external monitoring system (see section 8). Also, alarms are displayed in the run menu as explained in section 4.3.

To configure the alarm levels, refer to Section 4.4.

6.3 Configuring milliAmp output alarms

The 4-20 mA output can also be used to monitor system errors. System errors are different from measurement alarms. Three modes are available for the milliamp (mA) output.

The first one is "OFF". This means that system errors (see section 9) will not affect the milliamp output. The second one is "LOW". This means that the milliamp output will go below 4 mA if a system error occurs. The other setting is "HIGH". This means that the milliamp (mA) output will go above 20 mA if a system error occurs.

To configure the 4-20 mA output, refer to section 4.4.

6.4 Igniting the detector

The SERVOPRO FID is based on a FID detector. To measure hydrocarbons, the FID must be ignited. The process to ignite the flame is very simple.

1. Start the analyser and wait for all errors to be resolved.
2. Once all errors are resolved, press the ignite button (see section 4.3). A sequence will be launched. It is normal to see air, fuel and sample vary during ignition sequence. Once ignition parameter is reached, the SERVOPRO FID will try to ignite the flame automatically. If it succeeds, a "flame on" message will appear in the run menu (see section 4.3). If not, the ignition button will remain there and you will have to re-start the sequence. Once flame is ignited, flow will comeback automatically to operating parameters. If the flame doesn't ignite on the first try, you will not be allowed to re-start the sequence within 5 minutes. If the flame doesn't ignite after a few attempts, refer to section 7.

Because fuel automatically shuts-off when flame is off for more than 5 minutes, you will have to enter fuel operating set point before being able to ignite flame.

6.4.1 Auto ignition

The SERVOPRO FID has an automatic ignition feature that automatically ignites the flame when it goes off.

If the flame goes off for more than 5 minutes, the automatic ignition algorithm will not be able to restart the flame automatically since the fuel set point will be set to 0 cc/min and fuel shut-off valve will be closed to avoid hydrogen build-up. To ignite the flame, a new fuel flow set point will have to be entered manually.

If the flame goes off because of a fast pressure change on any of the gas streams or for any other hazardous conditions, the analyser will automatically try to restart the flame when all errors are resolved.

6.5 Auto-ranging

When the reading increases and auto-ranging is activated, the range will change automatically when the reading goes over the actual range. When the reading decreases, the range will change automatically when the reading goes below previous range – 10% of previous reading. For example, if the analyser is using range 0 – 1000 ppm and reading goes down, the SERVOPRO FID will change the range automatically when the reading reaches 90 ppm.

6.6 Routine maintenance

6.6.1 Recommended calibration frequency

After start-up, daily analyser calibration is suggested. The analyser requires typically one day for stabilization. After initial start-up, the time between calibrations can be increased. The time between calibrations is determined by the required accuracy and by experience.

6.6.2 Leak testing

It is recommended to periodically checking for leaks inside the analyser, especially the fuel connections. Use SNOOP or other suitable leak-test liquid. Do not use any organic liquid or soap.

6.6.3 Verify fan

It is important to verify that fan works properly. The fan is not only used for cooling the analyser but also to avoid fuel build up in the analyser in case of a leak. Verify the fan periodically.

6.6.4 Exhaust

Verify that there is no water or debris in the exhaust tube. This will affect the measurement.

7 FAULT FINDING

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.
Analyser's reading is noisy	Air or fuel are contaminated.	Replace air or fuel cylinder. Add hydrocarbon traps. Purge tubing.
	There is a leak on the sample line.	Leak test your sampling system.
	Flows are not stable.	Verify that all gas pressures are stable. Verify that flow readings are stable. Optimize PID loop constants.
	Tubing used to connect gases to the SERVOPRO FID were 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 19 :Fault finding

8   STORAGE AND DISPOSAL

8.1   Storage

Refit any protective cover (see Section 3) and place the SERVOPRO FID and any associated equipment in its original packing before storage.

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

8.2   Disposal

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

The SERVOPRO FID is not suitable for disposal in municipal waste streams (such as landfill sites, domestic recycling centres and so on). Refer to appendix A1 for disposal requirements in accordance with the WEEE Directive within the EC.

9 ERROR MANAGEMENT

9.1 System error

This section describes in detail 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 40°C.

FID temperature deviation: This error occurs when the difference between actual F.I.D temperature and FID temperature set point is higher then 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 the set point of hydrogen is not 0 cc/min, it will automatically be set to 0 cc/min and the hydrogen shut off valve will be de-activated.

When one of the gases 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.

9.2 Over and Under scale

The analyser will display, instead of the reading, under scale or over scale in the following situation:

Over scale: Range 0-10   reading above 10 ppm
                Range 0-100   reading above 100 ppm
                Range 0-1000   reading above 1000 ppm
Under scale: Range 0-10   reading below -0.01 ppm
                Range 0-100   reading below -0.1 ppm
                Range 0-1000   reading below -1 ppm

When SERVOPRO FID is in automatic ranging, the SERVOPRO FID will change the range instead of displaying over range. In automatic ranging, over range only occurs when the analyser's range is 0 – 1000 ppm.

APPENDIX

A 1 DISPOSAL IN ACCORDANCE WITH THE WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT DIRECTIVE (WEEE)

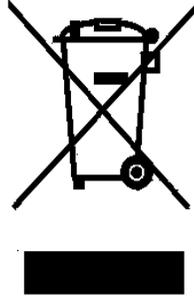The label shown in Figure 42 is fitted to the analyser.

Figure 40 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 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.

APPENDIX

A 2   SERIAL OUTPUT FORMAT

With this option installed, this analyser retransmits the operating parameters and process values to a remote computer through a serial link. 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. Any commercial software can be used to receive the data.

The communication parameters of the analyser are:

- Baud rate: 9600
- Parity bits: none
- Data bits: 8
- Stop bits: 1

The different parameters are transmitted in the following order:

Data	Details
Impurity	Impurity value with two digits after the dot.
Tab	ASCII character 11.
Air flow	Air flow value with two digits after the dot.
Tab	ASCII character 11.
Fuel flow	Fuel flow value with two digits after the dot.
Tab	ASCII character 11.
Sample flow	Sample flow value with two digits after the dot.
Tab	ASCII character 11.
Detector numerical value	Detector numerical value in counts.
Tab	ASCII character 11.
FID Temperature	FID temperature in Celsius with two digits after the dot.
Tab	ASCII character 11.
Reserved	
Tab	ASCII character 11.
Reserved	
Tab	ASCII character 11.
Status	The status of analyser is given on a single byte. This is a bitwise information.
Tab	ASCII character 11.
Checksum	CRC16 checksum. Be aware that TAB characters are not part of the CRC16 checksum.
Carriage return	ASCII 13.
New line	ASCII 10.

Status bitwise table:

Bit	Description	State
7	Alarm 2	1 if alarm 2 ON / 0 if alarm 2 OFF
6	Alarm 1	1 if alarm 1 ON / 0 if alarm 1 OFF
5	Status	1 if status ON / 0 if status OFF
4	Flame	1 if flame ON / 0 if flame OFF
3-1	Range	001 = range 1 / 010 = range 2 / 100 = range 3
0	Reserved	Always 0

Table 20 : RS-232 protocol description

Note: The checksum is calculated with the decimal value of ASCII character.

APPENDIX

A 3   COMPLIANCE AND STANDARD INFORMATION

- The analyzer complies with the European Community "Electromagnetic Compatibility Directive":
    - Emissions and Immunity: Type 1 - Equipment suitable for use in residential, 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 55011:2007.

- L'analyseur est conforme aux Conditions B numériques d'appareillage de classe de NMB-003 du Canada par l'application du EN 55011:2007.

- 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.

APPENDIX

A 4   MILLIAMP (mA) ANALOG OUTPUT

The milliamp (mA) output is used to monitor the reading of the SERVOPRO FID. The range of this output is from 4 mA to 20 mA. 4 mA always represents 0 ppm and 20 mA represents the highest value of the range in use. Consequently, if the range in use is 0 – 10 ppm, 20 mA will represent 10 ppm. If the range in use is 0 – 100 ppm, 20 mA will represent 100 ppm and so on.

When monitoring the milliamp (mA) output, it is important to monitor the range in use using the digital output relays. If it is not possible to monitor the range in use, it is recommended to lock the range in use (see Section 4.10.1.4).

Use a differential input to monitor 4-20 mA output on your data acquisition system.
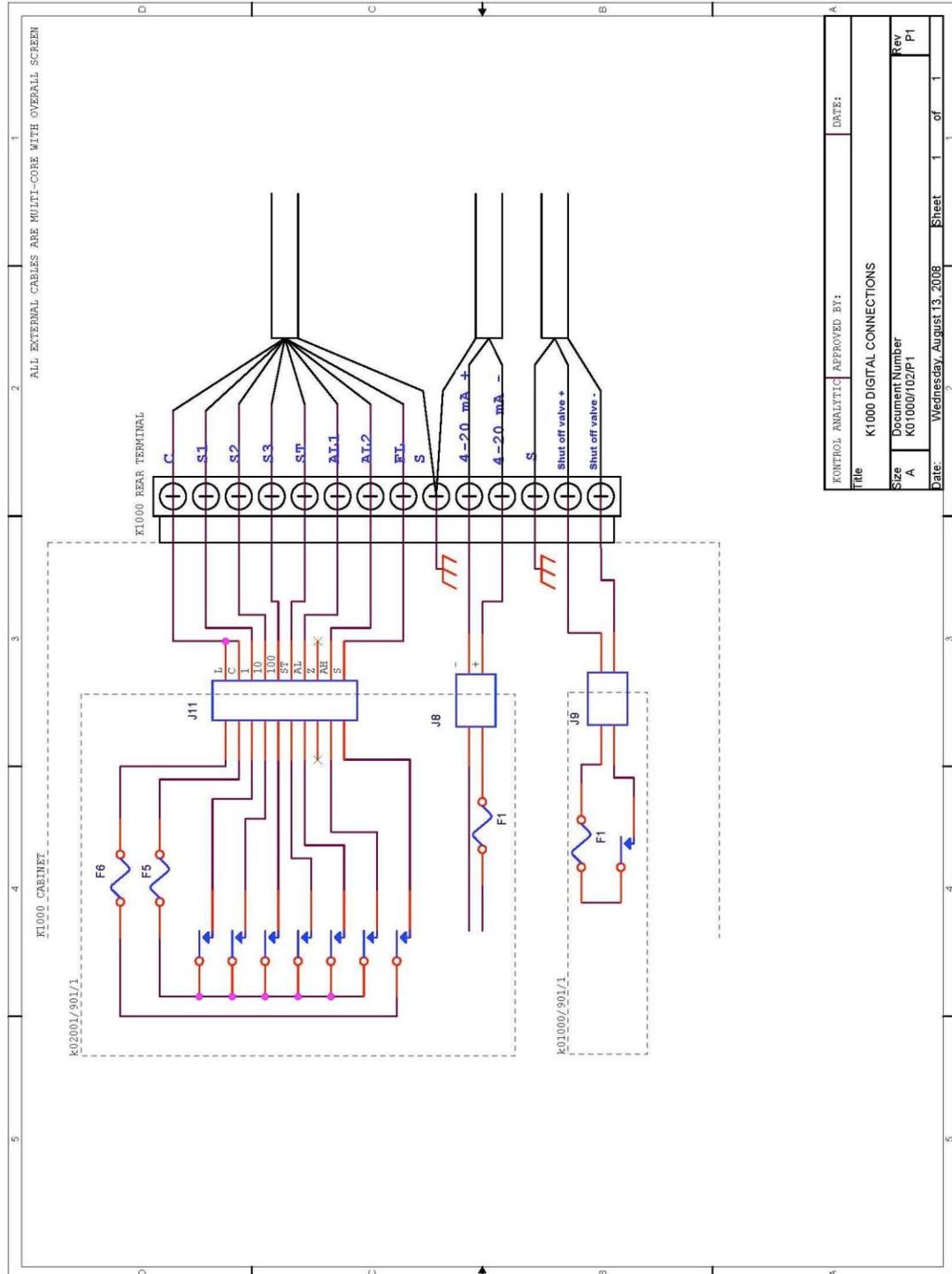
APPENDIX

A 5   CONNECTING DIGITAL OUTPUTS

Figure 41 – Digital output connections

The 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 at least reinforced insulation.

APPENDIX

A 6   FUEL SHUT-OFF/Hydrogen relay output

⚠	WARNING A fuel shut-off valve must be connected to the SERVOPRO FID to prevent the accumulation of fuel. The inside control valve is not considered tight shut-off.

A fuel shut-off valve must be connected to the rear connector of the analyser. This valve must be normally close. This valve is controlled by the SERVOPRO FID software. When an error occurs, it closes this valve automatically to prevent the accumulation of fuel inside the SERVOPRO FID. See section 9.1 to know more.
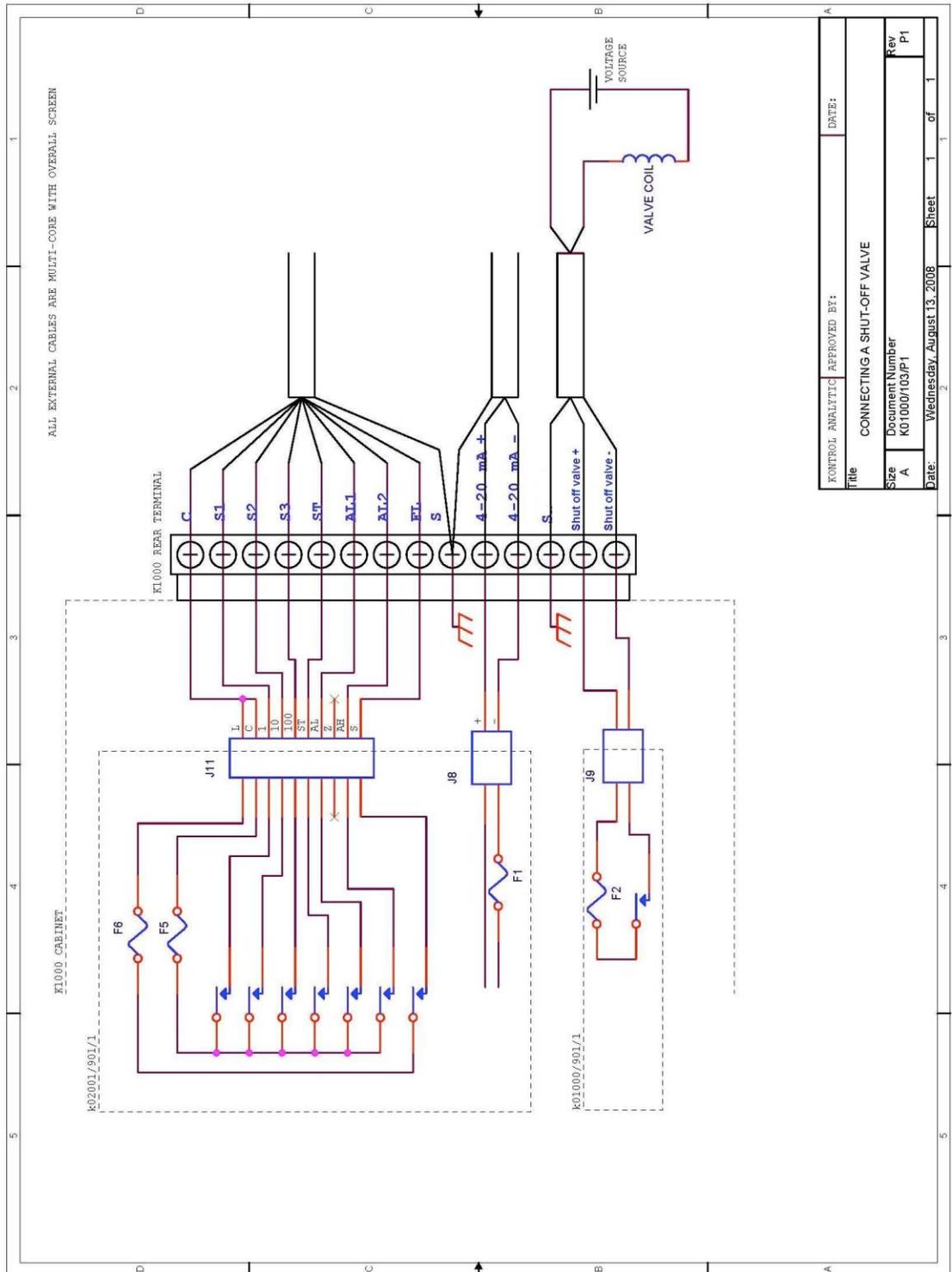
Figure 42 – Connecting a fuel shut-off valve