

## SERVOPRO HFID Analyzer

# Operator Manual

Part Number: 221196  
Revision: Rev. 0  
Language: US English



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### Description

The Servomex SERVOPRO HFID analyzer is an exceptionally accurate Flame Ionization Detection (FID) gas analyzer designed for measuring hydrocarbons concentrations in gaseous samples. The analyzer utilizes a highly sensitive flame ionization detector for measuring volatile hydrocarbon concentrations in industrial stationary source or mobile source (such as vehicle or engine certification) emission applications.

The SERVOPRO HFID family of heated analyzers includes the standard unit reporting only total hydrocarbon (THC) or it can be equipped with a non-methane hydrocarbon “cutter” that removes all hydrocarbons except methane from the sample gas. This capability allows the operator to obtain the methane (CH<sub>4</sub>), non-methane hydrocarbon (NMHC) and total hydrocarbon (THC) concentrations of the sample.

The heated sample gas is maintained above the typical volatile hydrocarbon dew point by a self-contained, internally adjustable oven. The oven temperature is factory-set to be controlled at 191°C until it exits via the bypass outlet, preventing any loss of heavier hydrocarbons before reaching the FID detector.

### Features

- The standard analyzer measures THC from 1 to 30,000 ppmc full-scale
- The NMHC analyzer measures THC/CH<sub>4</sub>/NMHC from 1 to 30,000 ppmc full-scale
- Heated to 191°C for maximum THC accuracy providing “hot/wet” direct sampling
- Temperature-stabilized FID detector
- Electronic flow control


- Selectable analog output options: current in mA or volts in DC of 0 -1, 0-5 or 0 - 10
- Digital Output options: Modbus via TCP/IP, and AK Protocol via RS232 or TCP/IP
- Automatic fuel and air shutoffs
- Automatic calibration and ranging
- Fast response time
- ETL listed – conforms to UL STD 61010-1, certified to CAN/CSA C22.2 STD 61010.1
- EPA 40 CFR Part 1065/1066 and Euro VI HD and Euro 6 LD compliant configurations

The analyzer offers four basic factory ranges 30/300/3,000/30,000 (C1 as ppm or mg/m<sup>3</sup>) or 10/100/1,000/10,000 (C3 as ppm or mg/m<sup>3</sup>) which can be scaled and preset to either ppm or mg/m<sup>3</sup> at the factory per customer specifications. The ranges can also be re-scaled in the field at any time via the analyzer keypad but conversion from ppm to mg/m<sup>3</sup> is more involved so should be determined upon ordering. The customer requested analog output signal (0 – 1 0 – 5, 0-10 VDC, 4-20 mA or 0-20 mA) is scaled at the factor according to the selected range but it can be rescaled to different concentration ranges or different analog outputs in the field by the customer. The operating range of the analyzer can be selected through the keypad, by a contact closure, via the RS232 or TCP/IP interface, or automatically when the analyzer is placed in the Auto Range mode.

The SERVOPRO HFID can be optionally configured with an internal heated sample pump, and internal zero and span solenoids for automatic zero and calibrations. It includes a backlit 3 x 5 inch liquid-crystal display and a 20-key data/operation input keypad.

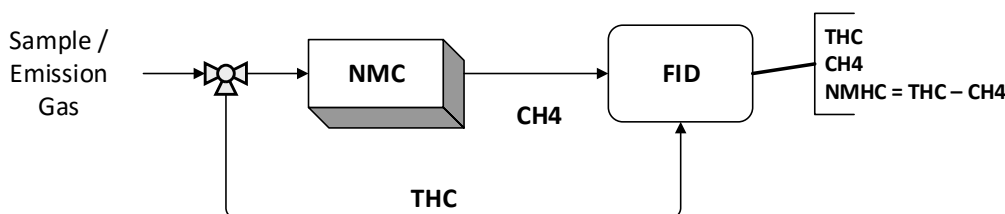
The SERVOPRO HFID can be configured to use either 100% H<sub>2</sub> or a 40/60 % H<sub>2</sub>/He fuel blend. In the NMHC version that uses 100% H<sub>2</sub> as the fuel, the air inject circuits have been eliminated which requires all of the applications that will use this analyzer to

ensure that the moisture content does not fluctuate more than a few % and that the O<sub>2</sub> levels in the sample are always maintained at 10% or above in order for the FID to remain lit. If these conditions are not met then the analyzer performance will be adversely affected and/or it may damage the cutter material.

 <b>CAUTION</b>	<b><i>If using 100% H<sub>2</sub> fuel and running the CH<sub>4</sub> mode in the NMHC version, make sure the moisture content does not fluctuate more than a few % or lower and that the O<sub>2</sub> levels are always maintained at 10% or above, if not then the analyzer performance will be adversely affected and/or it may damage the cutter material.</i></b>
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## Operating Principle`

The SERVOPRO HFID family of analyzers use the principle of Flame Ionization Detection (FID) to determine the total concentration of hydrocarbons within the gaseous sample. The standard SERVOPRO HFID analyzer produces only one output which is the total hydrocarbon (THC) content present in the sample. The non-methane hydrocarbon (NMHC) version has the option to run in THC or CH<sub>4</sub> mode. In the CH<sub>4</sub> mode the sample is diverted through a non-methane cutter (NMC) assembly that oxidizes all the hydrocarbons except methane to CO<sub>2</sub> and H<sub>2</sub>O which is the only hydrocarbon that then reaches the FID and is detected. The methane cutter has an efficiency of 98% or higher for the preferential removal of ethane and heavier hydrocarbons, with less than a 10% loss of methane. The NMHC value is obtained by subtracting the CH<sub>4</sub> value from the THC value so in this case you must switch the sample stream between the NMC and by-pass line into the FID detector. The analyzer can present all the concentrations, the NMHC value is obtained by subtracting the CH<sub>4</sub> value from the THC value.



For those applications that require 1 Hz or even 5Hz data reporting, two analyzers must be used side by side with one running in the THC only mode and the other running in the CH<sub>4</sub> only mode. Post-processing of the data provides the final NMHC value by



processing the data according to the requirements as prescribed by the regulatory body. In many cases this is not a simple subtraction process, so please consult your regulatory agency to determine how you are required to obtain the final NMHC value.

A heated oven (191°C) contains a burner and an optional heated pump. The small flame of the burner is elevated and sustained by the regulated flows of air and either pure hydrogen or a 40/60 mixture of hydrogen and helium (a hydrogen / nitrogen option is available but is not offered as a standard product – consult Servomex if this option is required).


The split-ring detector contains two electrodes. One electrode is negatively polarized using a precision power supply, and the other electrode (known as the collector) is connected to a high-impedance, low-noise electronic amplifier. The two electrodes establish an electrostatic field.

When a gaseous sample is introduced to the burner, it is ionized in the flame, and the electrostatic field causes the charged particles (ions) to migrate to their respective electrodes. The ion migration creates a small current between the electrodes. This current is measured by the precision electrometer amplifier and is directly proportional to the hydrocarbon concentration of the sample. The concentration is based upon a collective signal of the hydrocarbons present within the sample.

As a note, some oxygenated hydrocarbons have a lower response to the FID when compared to straight chain hydrocarbons and in particular formaldehyde has no response, so unlike a gas chromatograph where the hydrocarbons can be individually calibrated for, an FID analyzer provides a bulk hydrocarbon response that is calibrated with respect to methane and reported on a C1 total carbon response or to propane and reported on a C3 total carbon response. In general C1 reporting is seen in mobile source emissions monitoring or engine or vehicle certification testing while C3 reporting is seen in stationary source emissions monitoring reporting.

## Heated Oven

The heated sample gas is maintained above its dew point by a self-contained internal oven. The oven temperature is adjusted at the factory to be controlled at 191°C. The sample gas is maintained at this elevated temperature until it exits the analyzer's bypass outlet, preventing any loss of hydrocarbon concentration in the sample due to condensation.

 <b>CAUTION</b>	<b><i>Because the sample gas is analyzed HOT/WET you must make sure to keep the vent tubing on the bypass outlet short and pointed downwards to avoid plugging the vent line with condensed moisture.</i></b>
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## Flow System

Combustion air and fuel used by the instrument are controlled by an Electronic Proportional Control (EPC) valve whose function is to maintain a constant pressure for combustion air at the inlet to a capillary. The pressure is factory-set for optimum analyzer performance.

<b>NOTE</b>	<i>The correct pressures are determined by the factory for optimal analyzer performance and measured with NIST traceable standards. They are recorded on the analyzer's <a href="#">Factory Settings Screen</a>.</i>
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### ANALYZER SPECIFICATIONS

**Specifications are subject to change without notice.**

Component	Specification
<b>Detector</b>	Flame Ionization Detection
<b>THC, CH<sub>4</sub>, NHMC Ranges</b>	Four operator-definable ranges from 0-30 to 0-30,000 as C1 ppm or 0-10 to 0-10,000 as C3 ppm
<b>Response Time</b>	T90 < 2 seconds
<b>Detection Limit</b>	10 ppb Carbon
<b>Accuracy</b>	Better than 2% of reading at or above 3.0 ppm
<b>Repeatability</b>	Better than 1% of full scale
<b>Linearity</b>	Better than 1% of full scale
<b>Noise</b>	Less than 1% of full scale
<b>Zero and Span Drift</b>	Less than 1% of full scale per 24-hour period
<b>O<sub>2</sub> Effect</b>	Less than 2% with H <sub>2</sub> /He fuel
<b>CH<sub>4</sub> Effect</b>	Less than 1.2 to propane

<b>Flow Control</b>	Electronic proportional pressure controller (EPC)
<b>Sample Flow Rate</b>	2.0 to 2.5 LPM
<b>Fuel Requirements</b>	THC Version (40/60)% H <sub>2</sub> /He (140cc/min) or 100% H <sub>2</sub> (60cc/min) NMHC Version (40/60)% H <sub>2</sub> /He or 100% H <sub>2</sub> (250cc/min)
<b>Fuel Inlet Pressure</b>	25 psig
<b>Zero and Span Gas Requirements (for 100% H<sub>2</sub> Version)</b>	For the 100% H <sub>2</sub> fuel version the sample gas and calibration / span gases must maintain a minimum of 10% O <sub>2</sub> for the FID to work.
<b>Air Requirements</b>	Less than 1 ppm HC purified or synthetic air and Dew point < -10°C
<b>Air Flow and Inlet Pressure</b>	Flow ~ 450 cc/min at 25 psig
<b>Readout</b>	As ppm or mg/m <sup>3</sup> proportional to Methane (C1) or Propane (C3)
<b>Outputs</b>	- AK Protocol (TCP/IP and Serial RS-232) - Modbus TCP/IP - 4 programmable, scalable analog outputs (Voltage or Current)
<b>Diagnostics</b>	Temperatures (Oven, Burner Temperature and Cutter), Pressures (Sample, Fuel and Air), Flow Rates and EPC Control Voltages
<b>Special Features</b>	Calculated NMHC, Auto ranging
<b>FID Ignition</b>	Local, remote or automatic
<b>Sample Temperature</b>	Up to 191°C non-condensing sample
<b>Ambient Temperature</b>	5 to 40°C
<b>Ambient Humidity</b>	Less than 90% RH non-condensing
<b>Warm-up Time</b>	1 hour (typical).
<b>Fittings</b>	¼-inch (6mm ) tube fittings.
<b>Power Requirements</b>	115 VAC/60 Hz or 230 VAC/50 Hz (±10% 750 Watts maximum)
<b>Dimensions</b>	133.35mm (5.25”) high x 482.6mm (19”) wide x 584.2mm (23”) deep
<b>Weight</b>	Approximately 22.7kg (50lb) depending on options

### SAFETY INFORMATION



Safety Alert  
Caution or Warning



Temperature Hazard  
Caution or Warning



Electrical Shock Hazard  
Caution or Warning


Note, Caution and Warning symbols appear on the instrument and in this manual to draw your attention to important operational and safety information.

A “**NOTE**” marks a short message to alert you to an important detail.


A “**CAUTION**” safety alert appears with information that is important for protecting your equipment and its performance.

A “**WARNING**” safety alert appears with information that is important for protecting you, other people and equipment from damage. Pay especially close attention to all warnings that apply to your application.




The  symbol (an exclamation point in a triangle) precedes a general CAUTION or WARNING statement.




The  symbol (wavy vertical lines with an underscore in a triangle) precedes an elevated temperature hazard CAUTION or WARNING statement.




The  symbol (a lightning bolt in a triangle) precedes an electrical shock hazard CAUTION or WARNING statement.

Some or all of the above symbols may appear in this manual or on the equipment. This manual should be consulted whenever one of these symbols is encountered on the equipment.


	<b>WARNING: ALWAYS REMOVE POWER BEFORE CONNECTING OR DISCONNECTING SIGNAL CABLES OR WHEN SERVICING THE EQUIPMENT.</b>
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### Potential Explosion Hazard

	<b>WARNING: This analyzer uses a fuel that contains a FLAMMABLE LEVEL OF HYDROGEN. Any leakage from this fuel can result in an explosion. Carefully check the fuel supply system for leaks upon installation, before initial startup, during any maintenance or after the integrity of the system is compromised.</b>
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Do not apply power to the analyzer or attempt to ignite the burner until ALL leak checks are performed and the analyzer environment is verified as non-hazardous. This analyzer is NOT designed for use with a hazardous sample.

Use of substitute components may cause a safety hazard. Use only factory-authorized replacement parts.


	<b><i>CAUTION: Use of substitute components may cause a safety hazard. Use only factory-authorized replacement parts.</i></b>
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### Electrical Shock Hazard

Do not operate the analyzer without the cover secured. Servicing the analyzer requires access to live electrical circuits that can cause death or serious injury. Refer servicing to qualified service personnel. For safety and proper performance, connect this instrument to a properly grounded three-wire receptacle.


## Fuel Requirements

The SERVOMEX factory configures the SERVOPRO HFID analyzer for either 100% Hydrogen or 40%/60% Hydrogen/Helium fuel. Please make sure to use the correct fuel as specified on the fuel label affixed to the back panel of the analyzer.

	<b><i>WARNING: Use of incorrect fuel will damage the instrument and could cause an explosion. Before initial startup, carefully check the fuel supply system to the analyzer for leaks. The operating technician should be properly trained for working with hazardous materials.</i></b>
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## Potential Sample Pump Damage

The analyzer can be calibrated using the optional zero and span gas ports located on the back panel. It can also be calibrated using the internal sample pump. Care must be taken to ensure that the sample pump is not exposed to excessive pressure using this calibration method.

	<b><i>WARNING: Any pressure exceeding 2.0 psig can result in a NON-WARRANTY failure.</i></b>
--	--

## Removing Protective Caps

Do not apply AC power to this analyzer until you have removed the plastic 1/4-inch caps from the sample/zero/span/fuel fittings on the rear panel.

	<b><i>CAUTION: Failure to remove the Protective Caps will result in analyzer contamination.</i></b>
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## Filter Housing Maintenance

1. Whenever you replace the filter element, always apply a liberal coating of hydrocarbon-free silicone lubricant to the threads of the filter housing before re-assembly to prevent galling and seizing of the threads.

<b><i>NOTE</i></b>	<b><i>Use a silicone lubricant that is free of hydrocarbons to eliminate contamination of the analyzer and measurement errors.</i></b>
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2. Always use a second wrench on the body of the filter housing when attempting to inspect or replace the filter.
3. Always allow the filter housing to cool to room temperature before attempting any maintenance.



**WARNING:** *Never attempt to disassemble or reassemble the filter housing while it is hot.*

4. The sealing of the filter housing is accomplished with the o-ring. **Do not** over tighten. Re-assembly of the filter housing should be sealed just past finger-tight and only when the filter housing is at room temperature.

## Unpacking Instructions

Open the shipping container and carefully remove the analyzer from the packing materials. Inspect the instrument for any sign of damage. Remove the top-cover retaining screws. Visually check for loose parts or connectors that are not properly seated. Verify that all circuit boards and circuit board connections are secure. If all internal components and their alignments look correct, re-install the cover.

**IMPORTANT:** You should save the original shipping container your analyzer arrives in. The shipping container and packaging are specially designed to protect the analyzer in transport. If you ever need to return the analyzer to SERVOMEX for repair or any other reason, the original shipping container and packaging should be used.

## Reporting Damage

Should there be any apparent damage to either the inside or outside of the instrument due to shipping or handling, immediately notify the shipping company and SERVOMEX. The shipping container or packing materials should be retained for inspection by the shipper.

## Contact Information

<http://www.servomex.com/service-network>

### **US Technical and Service Center**

4 Constitution Way

Woburn, MA 01801-1087

United States

Tel: +1 781 935 4600

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Shanghai 201108, P.R.China

Tel: +86 021 6489 7570

Asia\_Sales@Servomex.com

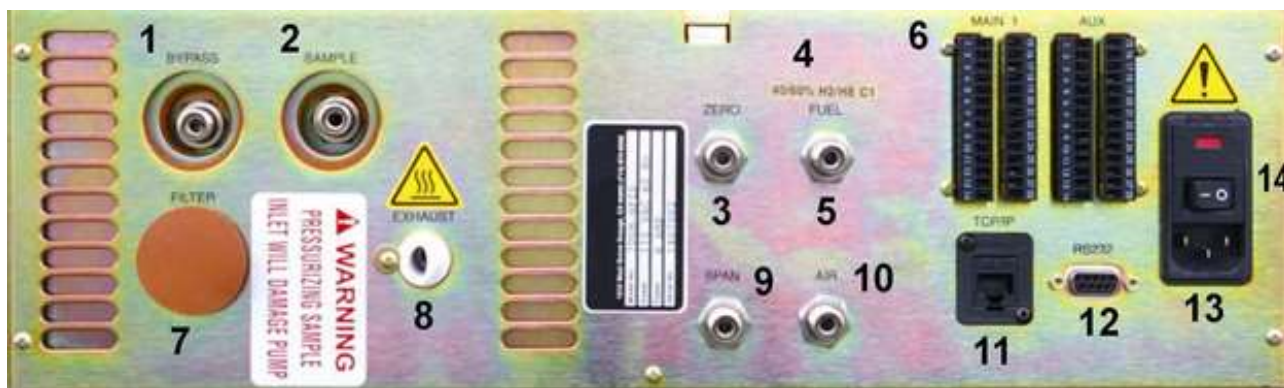
Asia\_Service@Servomex.com

## Rack Mounting

The front panel is designed for mounting into a standard 19-inch rack enclosure. Holes are located on the left and right side to allow the panel to be secured in the rack by screws. Optional rack slides allow the analyzer to be pulled out of the rack enclosure for access.



## Rear Panel



The rear panel includes the following:

- 1) Sample Gas Bypass outlet (vent) for exhaust of sample 1/4-inch (6mm) tube.
- 2) Sample Gas inlet for delivering gas to the analyzer 1/4-inch (6mm) tube.
- 3) Zero Gas inlet for delivering zero calibration gas to the analyzer (optional).
- 4) Label identifies the proper fuel to be used with this analyzer.
- 5) Fuel Gas inlet delivers fuel to the burner for combustion.
- 6) Connectors for analog and digital outputs and inputs.
- 7) Sample inlet filter access.
- 8) Exhaust vent from FID burner.
- 9) Span Gas inlet for delivering calibration gas to the analyzer.
- 10) Air inlet for delivering hydrocarbon-free air to the analyzer for burner combustion.
- 11) TCP/IP RJ-47connection to network cable.
- 12) RS232 Serial connection to serial cable.
- 13) Power Entry module for power connection, power switch, fuse compartment.
- 14) Rear-panel ON/OFF switch.

## Site Selection and Mounting




**CAUTION:** The following precautions must be carefully observed

1. Select a site free from direct sunlight, radiation from a high-temperature surface, or abrupt temperature variations.
2. This analyzer is *not* suitable for installation outdoors.
3. Select a site where the air is clean. Avoid exposing the instrument to corrosive or combustible gases.
4. Do not subject the analyzer to severe vibration. If severe vibration is present, use isolation mounts.

5. The instrument is designed for rack mounting. Optional rack-mount slides are available.

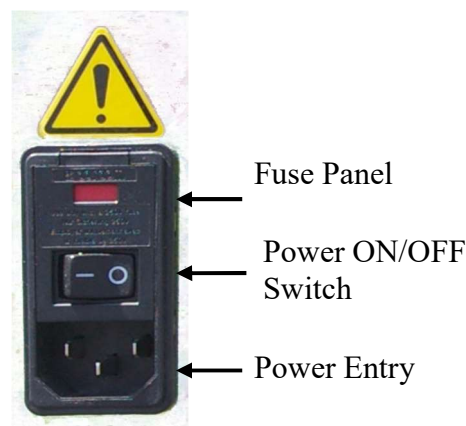
<b>NOTE</b>	<b><i>A front and rear supporting brace or equivalent are required if the optional rack mount slides were not purchased.</i></b>
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6. Do not install the SERVOPRO HFID near equipment that emits electromagnetic interference (EMI).

	<b><i>The Power On/Off switch is accessible from the rear of the analyzer only. DO NOT mount the analyzer in a manner that leaves the Power On/Off switch inaccessible.</i></b>
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## Electrical

All wiring is connected at the rear of the analyzer. The AC power cord is connected to the power entry as shown below:



*AC Power Switch, Connector and Fuse.*

<b>NOTE</b>	<b><i>A defective ground may affect the analyzer's operation. Shielded wiring is recommended for output signals.</i></b>
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## Output Connections

See the [Analog and Digital Interface](#) section of this Manual for instructions for the various output selection options. Shielded wiring is recommended for output signals.

## Recommended Gases and Gas Handling Equipment

1. Air (zero calibration gas and burner air, < 1 ppm C) in pressurized cylinder.
2. Fuel 40% H<sub>2</sub>/60% He or 100% H<sub>2</sub> in pressurized cylinder (as specified).
3. Standard span gas near full-scale concentration (typically 80-95% of the analyzer's measuring range) with an air balance in a pressurized, certified cylinder.
4. Pressure regulators for the zero, span, combustion air and fuel gas cylinders.
5. Corrosive-resistant gas tubing.
6. Heated pump, if not supplied as an analyzer option.
7. Heated sample line.

Calibration gases can be introduced through either the calibration ports on the back of the analyzer (if optional solenoid valves have been installed) or through the sample inlet.

Gases introduced through a calibration port should be at 20-25 PSIG. If introduced through the sample port, pressures should be as follows:

- a. Without sample pump, pressure should be 10-25 PSIG.
- b. With sample pump – no pressure.

## Gas Connections



**CAUTION:** *Be sure tubing and joints are clean. Dust entering the instrument may cause it to malfunction. Be sure that all tubing, fittings and other gas handling equipment are completely free of any type of hydrocarbon contamination.*

If optional solenoid valves have been installed and the calibration gases are not connected to calibration inlets on the back of the analyzer, the calibration gases will need to be delivered through the sample port at pressure settings listed above.

The tubing from the sampling system to the gas analyzer should be made from corrosive-resistant material such as Teflon<sup>®</sup> or stainless steel. Rubber or soft vinyl tubing should not be used since readings may be inaccurate due to gas absorption into the tubing material. For fast response, the tubing should be as short as possible. Optimum tube internal diameter is 0.16 inch (4 mm). Couplings to the instrument use 1/4-inch (6mm) tubing.

A sample gas bypass fitting is located on the rear panel. Keep pressure at this outlet at atmospheric level. Vent this gas away from the analyzer and ensure a safe atmospheric discharge.

In general, use heated sample lines for measuring heavy hydrocarbons and for the transportation of hot, wet gases. This instrument does not control the temperature in the external heated lines. There are provisions to terminate heated sample lines at the rear of the instrument. However, adequate precautions should be taken to eliminate the possibility of 'cold spots' between the end of the heated sample line and the inlet of the analyzer.

## **Sampling Requirements**

### **Filtration**

The SERVOPRO HFID contains an internal 0.01 micron filter in the sample input. It also has 0.7 micron filters on each of the air, fuel and optional zero/span gas solenoid valves. The final filter must be capable of removing any particles larger than 4 microns.

### **Condensation**

The analyzer is designed to measure hot wet (raw) sample gases. Unheated sample lines (or cold spots in heated lines) will cause the moisture contained in the sample gas to condensate. Any liquids entering the analyzer could damage it.

The dew point of the sample gases must be lower than the instrument temperature to prevent accidental condensation within the instrument. If necessary, bypass the sample through a dehumidifier to reduce the dew point to 4°C or less. If the sample contains an acid mist, use an acid-mist filter, cooler or similar device to remove all traces of the mist.

### **Presence of Corrosive Gases**

The useful service life of the instrument will be shortened if high concentrations of corrosive gases such as Cl<sub>2</sub>, SO<sub>2</sub>, F<sub>2</sub>, HCl etc. are present in the sampled gas.

## Gas Temperature

The SERVOPRO HFID temperature is factory set at 191°C unless specified otherwise by the customer. When measuring high-temperature gas streams, do not exceed the instrument's maximum temperature rating of 410°F (210°C).

## Pressure and Flow Rates

The sample gas flow entering the instrument is regulated by an electronic proportional control (EPC) valve to ensure that constant pressure is maintained at the sample capillary. The pressure is factory set for optimal analyzer performance. The fuel and air entering the instrument are also controlled by a factory-set EPC valve. The supply pressures should be set at approximately 25 PSIG.

- If the analyzer does not contain the optional internal sample pump, the sample gas entering the instrument should be between 8 and 25 PSIG with a minimum flow capacity of 3 liters/min.
- If the analyzer does contain the optional sample pump, **DO NOT** pressurize sample inlet.



***CAUTION: If the analyzer contains an optional internal sample pump, the introduction of a sample gas with pressure in excess of 2.0 PSIG will damage the pump.***

The optional pump is capable of drawing a sample through a ¼-inch (6mm) heated sample line of approximately 85 feet (~26 meters).

## Sample Gas Bypass Outlet and Vent

A sample gas bypass outlet connector is located on the analyzer's rear panel ¼-inch (6mm) tube. Pressure at this outlet (Exhaust port) should be kept at atmospheric level. **ANY** backpressure will cause an error in reading. Vent the bypass gas away from the analyzer.



***CAUTION: Vent the bypass gas using larger diameter tubing to prevent ANY backpressure which will cause an error in reading.***

Before using the SERVOPRO HFID, make sure the external plumbing and wiring have been connected correctly as shown in the Rear Panel description. All connections (combustion air, combustion fuel, zero gas and span gas) should be leak tight, and inlet pressure settings adjusted as previously described. To aid flame ignition, purge the fuel line at the analyzer to remove any residual air.

<b>NOTE</b>	<i>DO NOT energize the sample pump or introduce any sample that contains moisture until the oven has reached an operating temperature of at least 191°C. Before Ignition is attempted, the oven temperature should be a minimum of 120°C.</i>
-------------	---

Turn on the Power switch on the analyzer's rear panel. After the analyzer is turned on, it needs at least 30 seconds for initialization. After a short delay, the digital display should illuminate. If the display does not come on, check the power source and the fuse. If the problem persists, call SERVOMEX Technical Support.

Refer to the [Using the Keypad](#) section and review the complete Operator's Manual for detailed instructions on proper setup and operation of the SERVOPRO HFID analyzer.

## Shutdown Procedure

1. Turn off the tank valves on the zero and span cylinders.
2. If the analyzer contains the optional internal sample pump, disconnect the sample line from the rear inlet port.



<b>CAUTION: Do NOT turn off the sample pump or analyzer power at this point. Any pressurization of the pump could cause damage.</b>
---

3. Allow the analyzer to draw in room air for approximately 10 minutes, or flush out any remaining sample that could cause condensation as the analyzer cools.
4. Turn off the optional internal sample pump by setting the analyzer to [Standby](#).
5. Turn off the analyzer power.

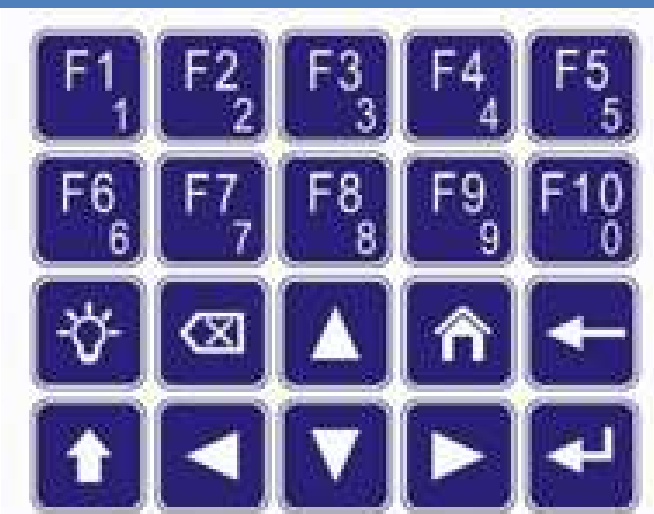
## Proper Storage


After power down, allow the heated analyzer components to cool to room temperature before preparing for storage.

If the original shipping box was retained, the analyzer should be stored in the box in the packing material supplied. If the original box is not available and another appropriate box cannot be obtained, the analyzer can be placed in a clean, dry plastic bag.

Storage should be in a reasonably temperature-controlled environment and away from any possible exposure to dust and water or other liquids.

### USING THE KEYPAD



When the Measure screen is displayed, the ten **Function keys (F1 through F10)** are shortcuts to commonly used screens. On other screens, these keys can either be used as function keys or to enter numeric values. This is why each number key includes both the larger **Function number** at the top (for example, F1) and the smaller number underneath for **numeric value** (for example, 1). 



The Light key is used to turn the display's backlight on and off.



This button serves two purposes:

1. In the Number Entry (N) mode, this key is used to set a decimal in place.

2. Any other time the analyzer is in the Function mode (**F**) and the key is used to return you to the measurement screen.

<b>NOTE</b>	<i>An <b>N</b> will be displayed in the bottom-right corner of the screen when the analyzer is in <b>Numeric Entry</b> mode. An <b>F</b> is displayed when the analyzer is being used for <b>Function</b> mode.</i>
-------------	---



The Menu key is used to bring you to the Main Menu at any time.



The Back key is used to return to the previous screen.








The Enter key:

1. In Function mode (**F**), the Enter key selects the highlighted function.
2. In Numeric mode (**N**), when a field is highlighted for numeric input, pressing the Enter key opens the selected field for numeric entry with a blinking cursor.

Pressing the Enter key a second time exits the Numeric Entry field.

<b>NOTE</b>	<i>An <b>N</b> will be displayed in the bottom-right corner of the screen when the analyzer is in <b>Numeric Entry</b> mode. An <b>F</b> is displayed when the analyzer is being used for <b>Function</b> mode.</i>
-------------	---



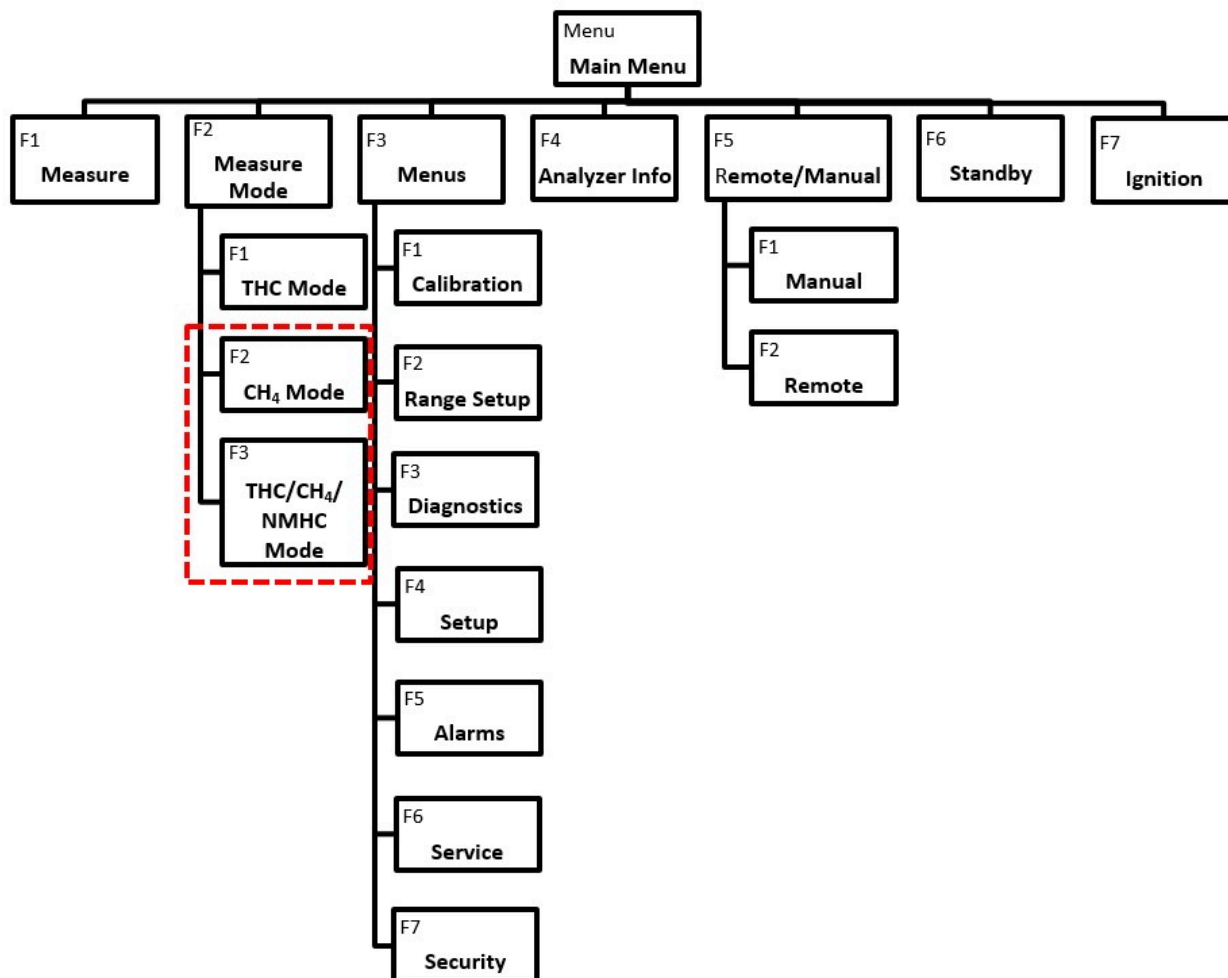
1. In Function mode (**F**)
  - a. The arrow keys move the highlight up, down, left and right.
  - b. Press the Enter key  to accept the highlighted function.
2. In Numeric mode (**N**)
  - a. These keys control the cursor and are also used to scroll the input possibilities and edit the numbers.
  - b. Arrow key functions will vary depending upon the screen.
  - c. The left and right arrow keys   allow you to move the blinking cursor.
  - d. The up and down arrow keys   change the value within a field that has the cursor underneath it.



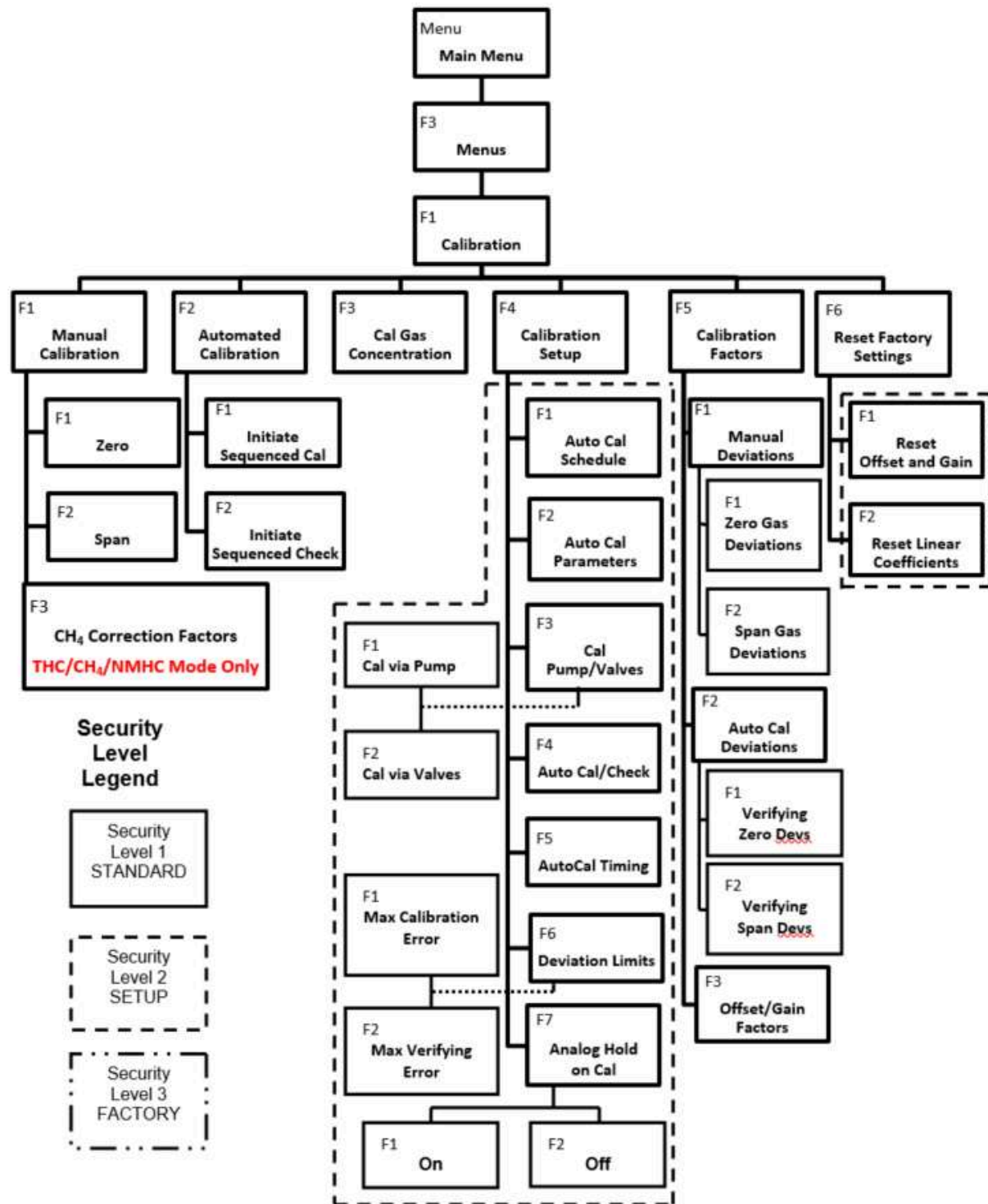
## MENU FLOW CHART

The menu flow chart is a handy reference that will help you familiarize yourself with the operation of the SERVOMEX System SERVOPRO HFID Analyzer. Start by pressing **MAIN Menu**

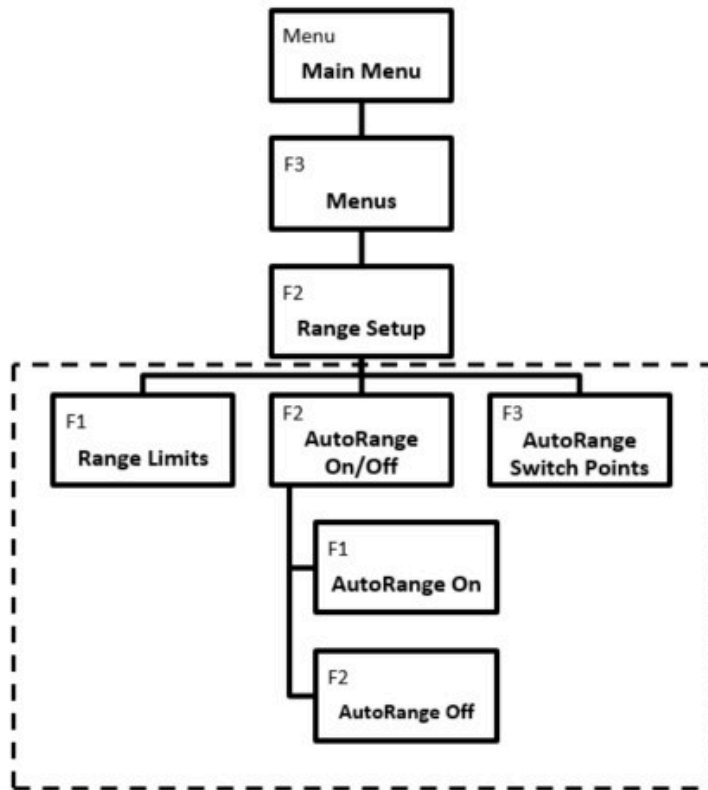
In the diagram below all functions are available except under the **Measure Mode** (F2) function where the **CH<sub>4</sub> Mode** (F2) and the **THC/CH<sub>4</sub>/NMHC Mode** (F3) are only available when the SERVOPRO HFID THC/CH<sub>4</sub>/NMHC model is purchased.



## CALIBRATION Menu



## RANGE Menu



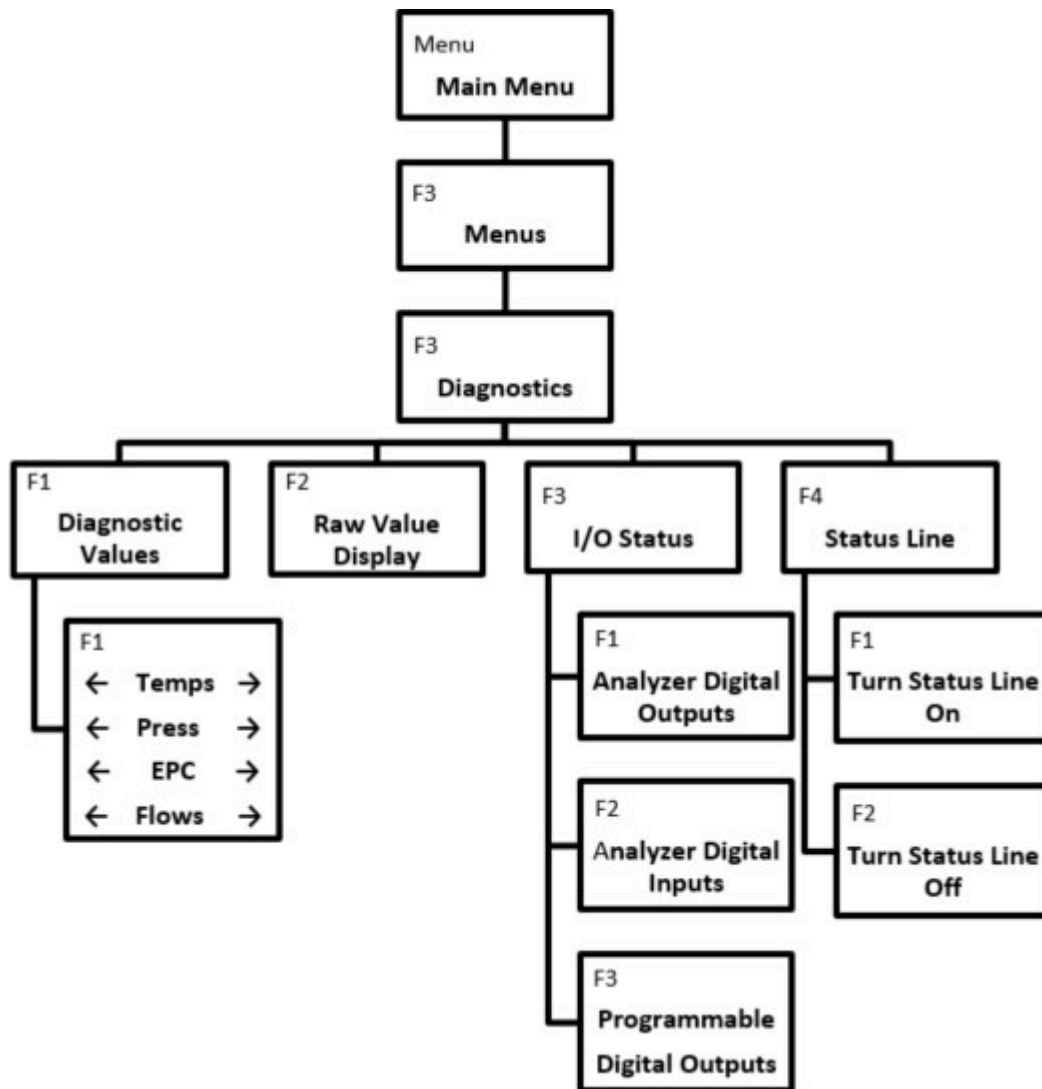
## Security Level Legend

Security  
Level 1  
STANDARD

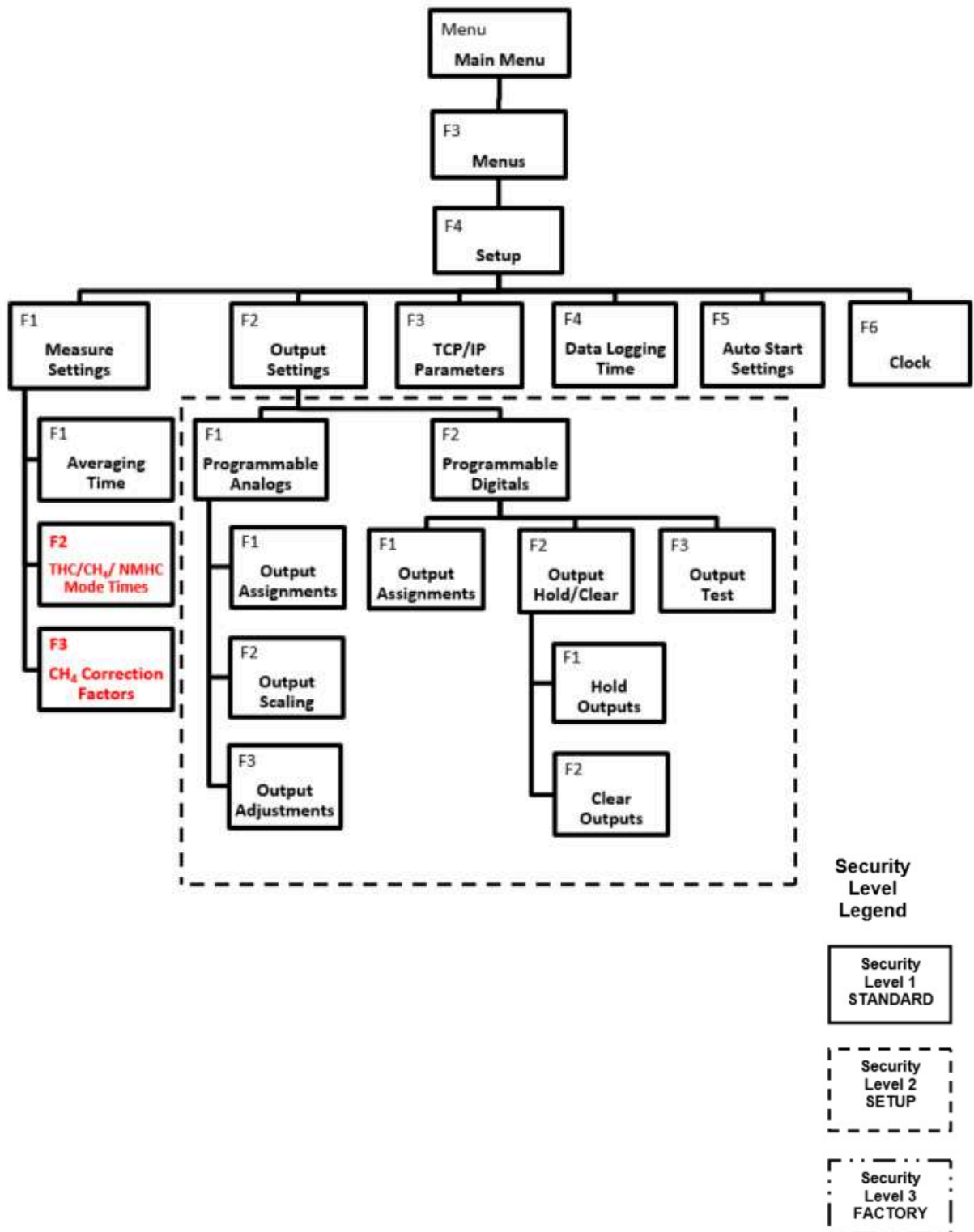
Security  
Level 2  
SETUP

Security  
Level 3  
FACTORY

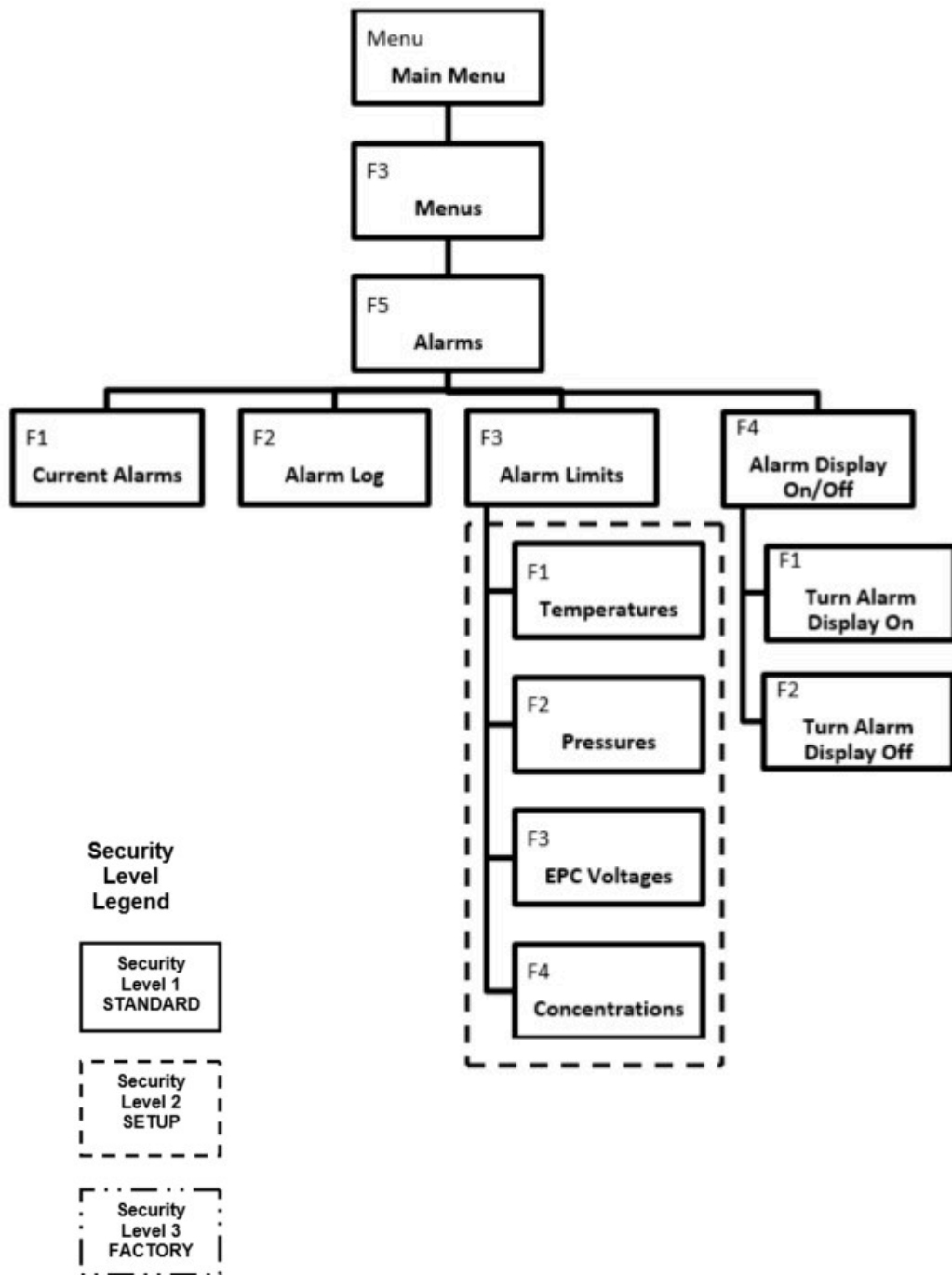
## DIAGNOSTICS Menu



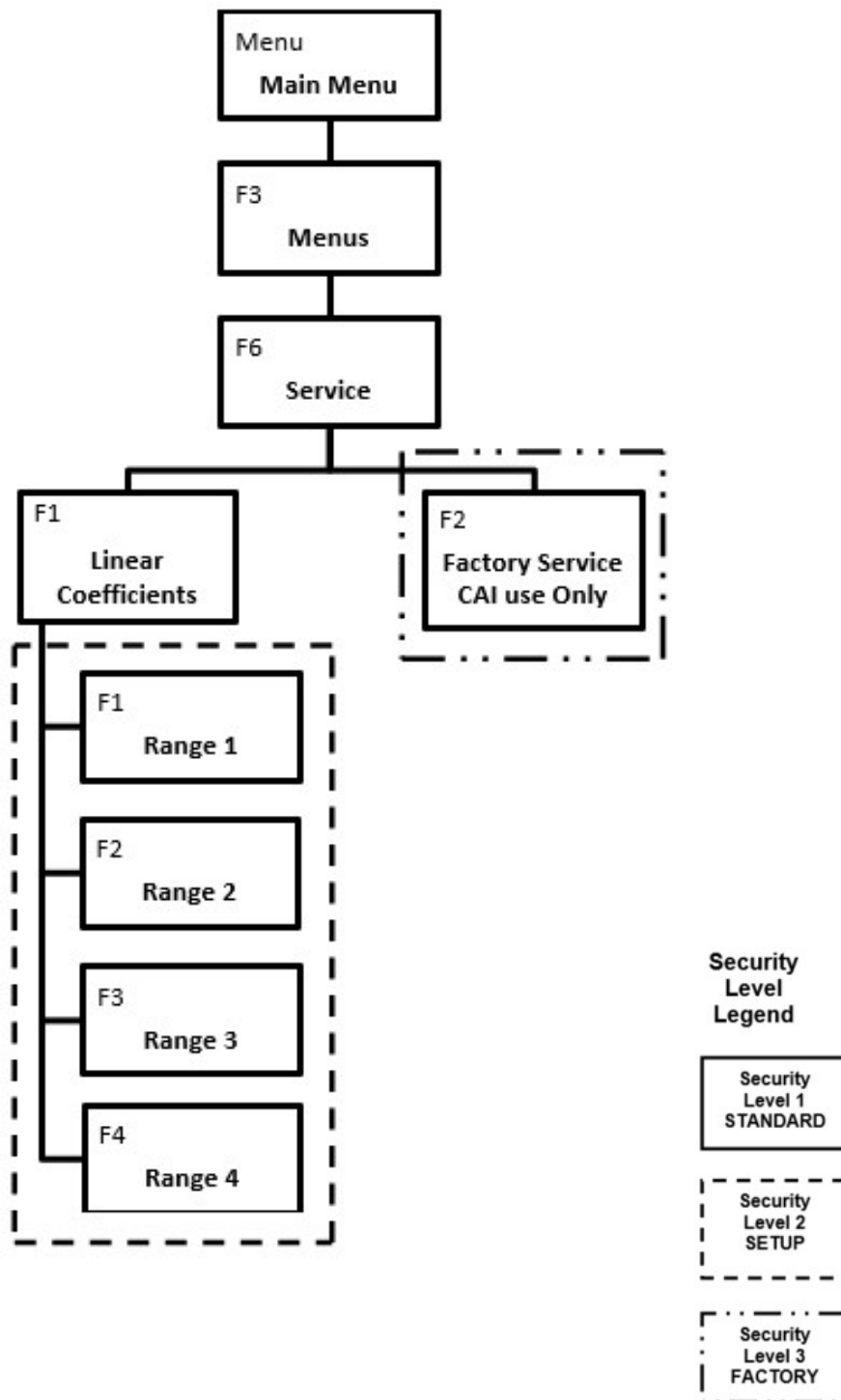
## SETUP Menu



## ALARMS Menu



## SERVICE Menu



\_\_\_\_\_







**NOTE** *The Main Menu is your gateway to operational, setup and maintenance functions on the SERVOPRO HFID analyzer via the corresponding function keys*

Main Menu
F1 Measure
F2 Measure Mode
F3 Menus
F4 Analyzer Info.
F5 Remote/Manual... SREM
F6 Standby
F7 Ignition

All software functions of the SERVOPRO HFID analyzer can be reached via the menu above from the Main Menu screen.


Operation starts by pressing the Menu key to bring up the Main Menu. Use the Arrow keys to highlight the desired function and press to open the screen. You can also access the desired function by pressing the corresponding function key.

## MEASURE SCREEN

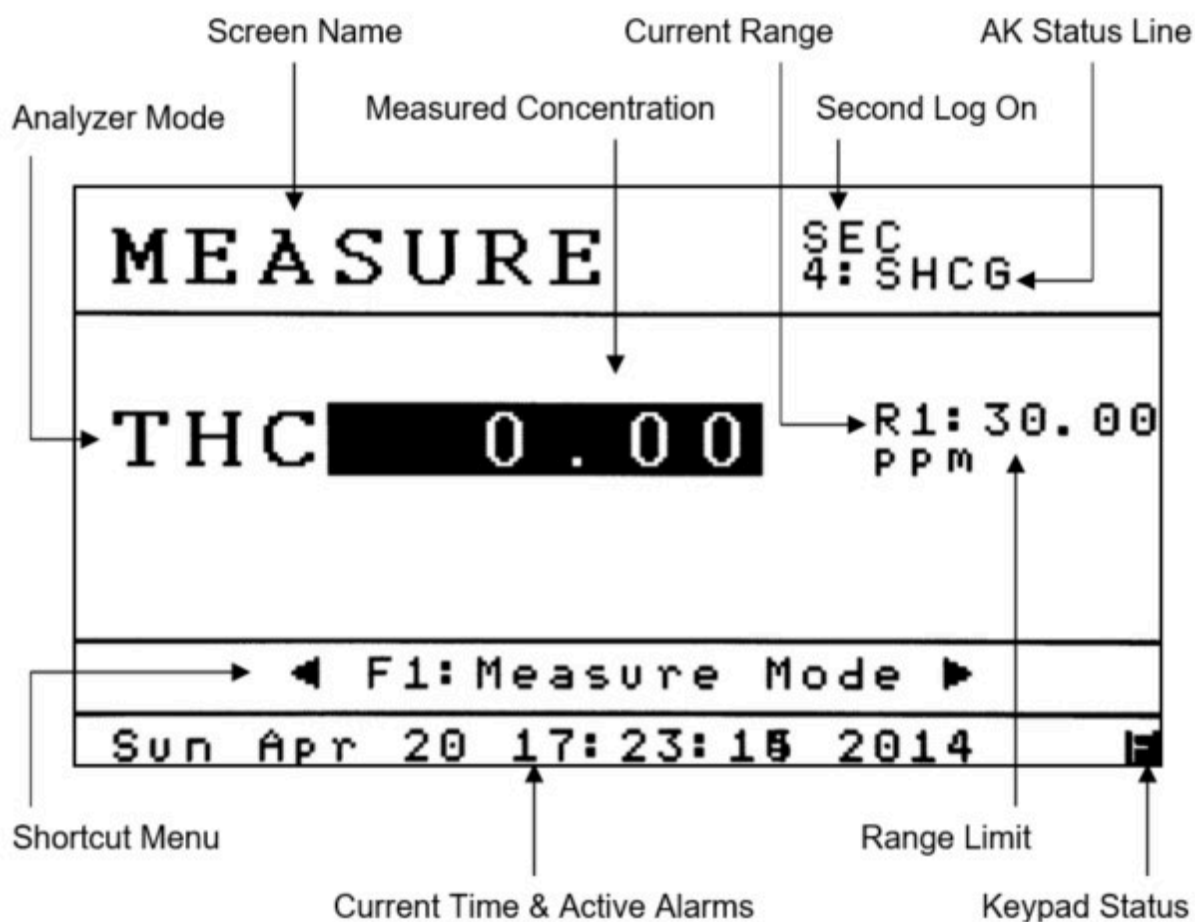


in Function Mode (F)

**NOTE** The Measure Screen provides a visual of the current concentration of the gas being analyzed, along with other pertinent information.



The Measure Screen is accessed by pressing the  key. To access the Measure Screen

from the Main Menu, press .









**NOTE** If the analyzer is equipped with a pump, the pump will not start until the oven, pump and burner temperatures are within the alarm settings.







Please review the following descriptions (corresponding with the callouts on the illustration above) to familiarize yourself with the Measure Screen.

Diagram Above Call Outs	Description
<b>Screen Name</b>	The name of the active screen the Analyzer is in; in this case the Measure screen.
<b>Second Log On</b>	SEC appears when the Second log is enabled. See <a href="#">Data Logging Time</a> .
<b>AK Status Line</b>	When the AK Status line is enabled, it will scroll through the analyzer's present state using AK Protocol. See <a href="#">AK Protocol</a> .
<b>Analyzer Mode</b>	The active mode the analyzer is in (1) THC (2) CH4 or (3) THC/CH4/NMHC.
<b>Measured Concentration</b>	The current concentration that is displayed on the screen.
<b>Current Range</b>	The range currently being used by the analyzer. Auto Range is indicated by an (A) in front of the range number.
	Up and down arrows   to change the analyzer's current range.
<b>Range Limit</b>	The analyzer's full-scale value of the range currently in use.
<b>Current Time/Active Alarms</b>	Scrolls between Time and Date and any active alarms.
<b>Keypad Status</b>	Indicates how the keypad input is currently being used. (F) is for functions, (N) is for numeric input.

## Shortcut Menu

Scrollable list of shortcut functions available from the Measurement screen. See the shortcuts below:

Shortcut Tag	Description
 	Left or right arrows are used to scroll through the shortcut menu.
 <b>Measure Mode</b>	Allows the operator to change the analyzer's mode to THC, CH4 or THC/CH4/NMHC if using the NMHC Model analyzer.
 <b>Raw Values</b>	An advanced diagnostic tool used for troubleshooting.
 <b>Diags</b>	Diagnostic Values is used to view Temperatures, Pressures, EPC Percent Full scale and Flows.
 <b>Auto Range</b>	Allows operators to turn Auto Range ON or OFF.

 <b>F5 Manual Cal</b>	Allows operators to Zero or Span the analyzer from the Manual Calibration menu.
 <b>F6 Menus</b>	The Menus screen is the starting point for advanced setup and functions.
 <b>F7 Standby</b>	When the analyzer is in Standby mode, it closes all valves and turns off the analyzer's optional sample pump.
 <b>F8 Range Limits</b>	This screen allows operators to customize the analyzer's ranges.
 <b>F9 Span Conc</b>	Operators can change Span gas concentrations for multiple ranges.
 <b>F10 CH<sub>4</sub> Factors</b>	Allows operators to set or adjust the CH <sub>4</sub> Correction Factors if using the NMHC Model analyzer.

## MEASURE MODE



Measure Mode
F1 <b>THC Mode</b>
F2 CH4 Mode
F3 THC/CH4/NMHC Mode

<b>NOTE</b>	<i>The Measure Mode menu is used to select one of three measurement modes: THC, CH<sub>4</sub> or THC/CH<sub>4</sub>/NMHC if using the NMHC Model analyzers otherwise only the THC Mode is allowed.</i>
-------------	---

The Measure Mode menu is accessed by pressing the key on the Main Menu. This menu will affect how the analyzer operates and what is displayed in the Measure screen.

Press to set the analyzer in THC only mode. (Total Hydrocarbons)

Press to set the analyzer in CH<sub>4</sub> only mode. (Methane) *NMHC Model analyzers*

Press to set the analyzer in THC/CH<sub>4</sub>/NMHC mode. *NMHC Model analyzers*


<b>NOTE</b>	<i>The standard SERVOPRO HFID analyzers only offers the Total Hydrocarbon Mode. Pressing  will bring the analyzer back to the Measure screen.</i>
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### THC MODE (NMHC MODEL ONLY)



MEASURE		
THC	0.00	R1: 30.00 ppm
◀ F1: Measure Mode ▶		
Sat Apr 19 13:24:01 2014		


To move to the THC mode, press  while in the Measure Mode menu. In THC mode, the sample gas does not pass through the analyzer's non-methane cutter. The final reading is Total Hydrocarbons or THC.

---

#### CH<sub>4</sub> MODE (NMHC MODEL ONLY)



MEASURE		
CH <sub>4</sub>	0.00	R1: 30.00 ppm
◀ F1: Measure Mode ▶		
Sat Apr 19 13:24:27 2014		

To change to the CH<sub>4</sub> mode, press  while in the Measure Mode menu. In CH<sub>4</sub> mode, the sample gas passes through the non-methane cutter and the analyzer measures Methane.


---

### THC/CH<sub>4</sub>/NMHC MODE (NMHC MODEL ONLY)



MEASURE		
THC	0 . 00	CH4
CH4	0 . 00	R1: 30.00
NMH	0 . 00	PPM
◀ F1: Measure Mode ▶		
Sat Apr 19 13:25:14 2014		

<b>NOTE</b>	<i>The THC/CH<sub>4</sub>/NMHC mode activates the “sample and hold” feature which allows the analyzer to automatically cycle between THC and CH<sub>4</sub> measurement.</i>
-------------	--

To change to the THC/CH<sub>4</sub>/NMHC mode, press  from the Measure Mode menu.

The current measuring mode (cycle) is indicated above the analyzer range on the right hand side of the display (**Example above: CH<sub>4</sub>**).

The cycle times of the sample read are set on the THC/CH<sub>4</sub>/NMHC Mode Times screen. All THC and CH<sub>4</sub> readings are displayed as averaged values.


The cycle begins with the CH<sub>4</sub> reading. When the CH<sub>4</sub> (through the non-methane cutter) reading is completed, the analyzer switches to the THC mode. When the THC cycle is completed, the analyzer updates the averaged CH<sub>4</sub> and THC values on the screen and the analog outputs. At that point, the difference between the averaged value of THC and CH<sub>4</sub> is calculated as the NMHC (Non-Methane Hydrocarbon) concentration. The cycle continues to repeat.

For advanced calibration and operation in THC/CH<sub>4</sub>/NMHC mode, see CH<sub>4</sub> Correction Factors



Analyzer Info 192.168.002.092	
Model	SERVOPRO HFID
S/N	1412001
Sample Pres	1.50PSI/11cc
Fuel Pres	8.00PSI/139cc
Air Pres	7.00PSI/317cc
Software Version	
FMAIN	7.100
FUSER	7.666
OSMSR	63.024

**NOTE** *The Analyzer Info screen contains the basic identity of your SERVOPRO HFID Analyzer.*

The Analyzer Info screen is accessed by pressing the  key on the Main Menu.

This screen includes the Model and Serial Number of your analyzer (for easy identification if you are discussing your analyzer with SERVOMEX), factory settings for Sample pressure, Fuel pressure and Air pressure, and the software versions being used.


The analyzer's current IP address appears in the upper-right corner of the screen.





Remote/Manual	SREM
F1 Manual	
F2 Remote	

**NOTE** *The Remote/Manual menu gives the operator the ability to control the instrument manually using the keypad or via a remote computer.*

The Remote/Manual menu is accessed by pressing the  key on the Main Menu. The current setting (Remote Mode) is displayed in the upper right-hand corner of the screen.

**Example: SREM.**

The analyzer can be controlled remotely via:

- TCP/IP Modbus
- RS-232 AK Protocol
- Digital inputs (contact closure) located on the rear of the analyzer.

**NOTE** *AK Protocol works with both TCP/IP and Serial. Modbus only works with TCP/IP.*

## STANDBY

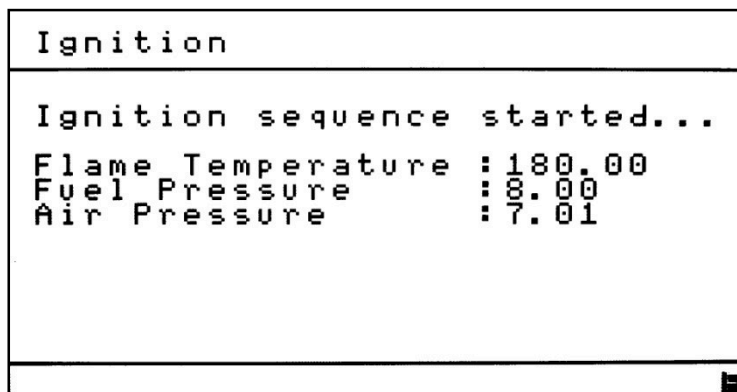


### **NOTE**


*When the analyzer is in Standby Mode, the pump is turned off and the solenoid valves are closed.*

The SERVOMEX logo is displayed along with the Serial Number. Standby mode is

accessed by pressing the  key from the Main Menu.



<b>NOTE</b>	<i>Before Ignition is attempted the oven temperature should be a minimum of 120° C.</i>
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To start the ignition sequence, press  from the Main Menu.

At the start of the ignition sequence the fuel valve will open five seconds before the air valve to prime the burner. The analyzer will try to ignite up to five times (280 seconds). Once the flame temperature reaches above 250° C, the analyzer is lit and will return to the Main Menu.

**Notes:**


- If the air pressure is not within the alarm limits, the fuel valve will close and the burner will not ignite.
- If the analyzer fails to ignite, it will be indicated by a No Flame and Check Burner Temperature alarm.


## MENUS





Menu s
F1 Calibration
F2 Range Setup
F3 Diagnostics
F4 Setup
F5 Alarms
F6 Service
F7 Security


<b>NOTE</b>	<i>The Menu screen provides access to most instrument features, including Calibration, Setup and Diagnostics.</i>
-------------	---


From the Main Menu press  to bring up the Menu screen.


Press  to access the Calibration menu.


Press  to access the Range Setup menu.

Press  to access the Diagnostics menu.

Press  to access the Setup menu.

Press  to access the Alarms menu.


Press  to access the Service menu.

Press  to access the Security menu.



Calibration
F1 Manual Calibration
F2 Automated Calibration
F3 Cal Gas Concentrations
F4 Calibration Setup
F5 Calibration Factors
F6 Reset Factory Settings






**NOTE** *The SERVOPRO HFID Analyzer requires initial calibration with zero and span calibration standards before operation.*

These calibrations can be performed manually or initiated automatically. From the Menus screen press  to access the Calibration menu. The Calibration menu includes important features including basic setup for both manual and automated calibration.

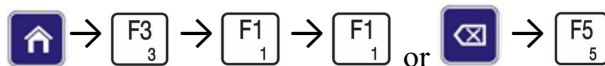
### Preparing the Analyzer for Calibration

**NOTE** *If you are not making changes to the factory settings, proceed to the next section: Manual Calibration.*

**NOTE** *If you are changing the analyzer's factory settings, Calibration Setup must be completed prior to your initial calibrations.*

From the Calibration menu press  to access the Calibration Setup, or you can use this menu path to access the [Calibration Setup](#) menu:  →  →  → .

## MANUAL CALIBRATION



Manual Calibration
F1 Zero
F2 Span

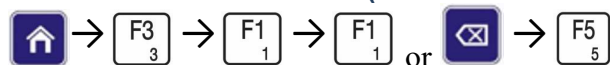
<b>NOTE</b>	<b><i>Whether you are calibrating a single range or multiple ranges, each range requires its own complete zero and span calibration.</i></b>
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- If you are calibrating multiple ranges during one session, the zero calibrations can all be performed before any of the span calibrations, as long as they are within the same relatively short time period.
- If multiple ranges are used, the calibrations are typically done in ascending order of range.
- Anytime a zero calibration is performed, a span calibration or check should be done afterward.

The analyzer has two separate manual calibration menus (if you purchased the unit with the non-methane cutter otherwise only the THC mode is available), one for THC or CH<sub>4</sub> mode and a second menu for THC/CH<sub>4</sub>/NMHC mode. The analyzer automatically chooses the menu depending on the mode it is in at the time it enters the Manual Calibration menu.


In THC or CH<sub>4</sub> mode, the analyzer has basic zero and span calibration capability in either THC or CH<sub>4</sub> mode. In THC/CH<sub>4</sub>/NMHC mode the analyzer has basic zero and span capability in THC mode and also includes the added CH<sub>4</sub> Correction Factor feature. See [CH<sub>4</sub> Correction Factors](#) for details.

## MANUAL CALIBRATION (SINGLE MODE: THC OR CH<sub>4</sub>)



Manual Calibration
F1 Zero
F2 Span

<b>NOTE</b>	<i>When a manual calibration is performed in Single Mode operation (THC or CH<sub>4</sub> mode) the analyzer will remain in that mode during calibration.</i>
-------------	---

In Single Mode operation (THC or CH<sub>4</sub> Mode) the analyzer can only be calibrated for one mode. The Manual Calibration menu is accessed by pressing  from the Calibration menu.

Press  to access the Manual Zero Calibration screen.


Press  to access the Manual Span Calibration screen.



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## MANUAL ZERO (SINGLE MODE: THC OR CH<sub>4</sub>)





<b>NOTE</b>	<i>Zero calibration should be performed before a span calibration.</i>
-------------	--


From the Manual Calibration menu press  to access the Manual Zero Calibration screen.

Make sure the analyzer is in the range you wish to calibrate. Use the Up/Down arrows   to go to the desired range. The screen illustration above shows the range (R1) next to the maximum range limit (30.00 ppm).

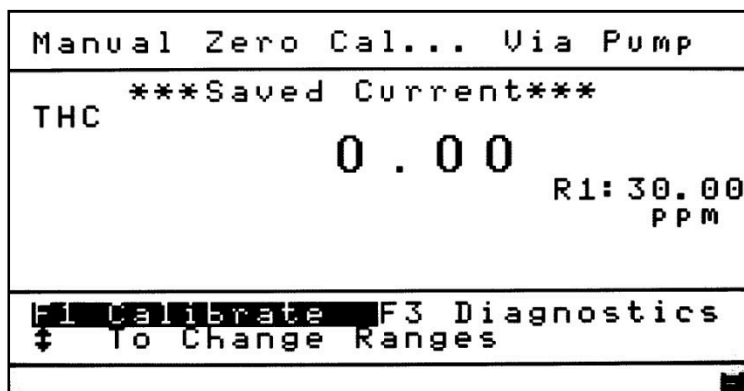
In the upper-right corner of the screen, you will see a status line that indicates how the calibration gas is being introduced into the analyzer. In this case, **Cal... Via Valves** is displayed. The other option is **Cal... Via Pump**. See [Calibration Setup](#) for details.

Start flowing zero gas into the rear of the analyzer.

- Press  to go to the [Diagnostic Values](#) screen to view the current diagnostic values.
- Check the temperatures and pressures to be sure they are within their limits.
- If all diagnostic values are within their limits, press the  button to return to the Manual Zero Calibration screen.

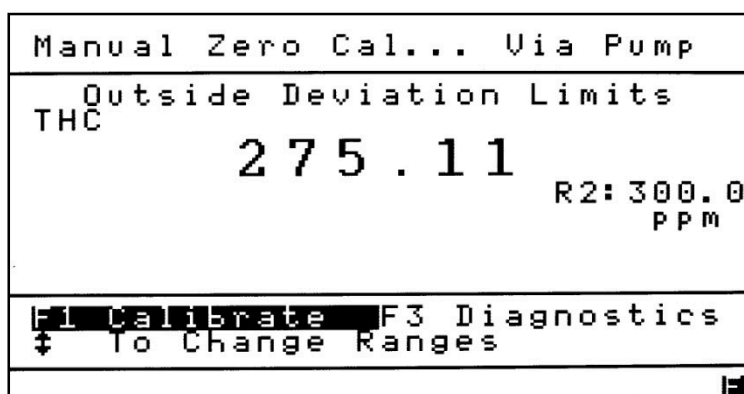
When the concentration value has stabilized, press  to set the zero calibration. The zero portion of the calibration should now be complete.





Example of a successful Manual Zero calibration.

<b>NOTE</b>	<i>If the calibration was successful, the screen will say <b>***Saved Current***</b> above the concentration value.</i>
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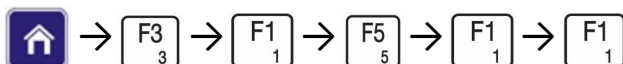


Example of an unsuccessful Manual Zero calibration.

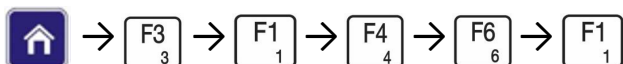
<b>NOTE</b>	<i>If the calibration was unsuccessful, the screen will say <b>Outside Deviation Limits</b>.</i>
-------------	--


If the zero calibration is unsuccessful, check the following:

1. Make sure the correct gas was introduced into the analyzer.
2. Verify the [Diagnostic Values](#) while flowing gas.
3. Check Zero Gas Deviations under [Manual Deviations](#):



4. Check [Maximum Calibration Error](#) under Calibration Setup:




After a successful Manual Zero Calibration, press the back  button to return to the Manual Calibration menu.





## MANUAL SPAN (SINGLE MODE: THC OR CH<sub>4</sub>)




Manual Span Cal... Via Pump	
THC	275.11
	R2: 300.0 PPM
Span Gas: 270.000000	
F1 Calibrate ↓ To Change Ranges	F3 Diagnostics


**NOTE** *SPAN calibration should be performed after a successful ZERO calibration.*


From the Manual Calibration menu press  to access the Manual Span Calibration screen.

1. Make sure the highlighted span gas value (see above) matches the value on the certificate for the span calibration gas being supplied to the analyzer.
  - If the span gas concentration does not agree with the value on the certificate, press the Enter  button and change the concentration to match it.
  - Press the Enter  button again to close the span gas concentration field.
2. Make sure the analyzer is in the range you wish to calibrate.
  - Use the Up/Down arrows   to go to the desired range.
  - The illustration shows the range (R2) listing the maximum range limit as 300.0 ppm.

Introduce span gas into the rear of the analyzer.

- Press  to go to the [Diagnostic Values](#) screen to view the current Diagnostic values.
- Check the temperatures and pressures to be sure they are within their limits.

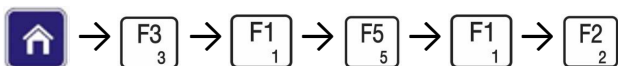
- If all diagnostic values are within their limits, press the back  button to return to the Manual Span Calibration screen.

When the concentration number has stabilized, press  to set the span calibration. The calibration should now be complete.

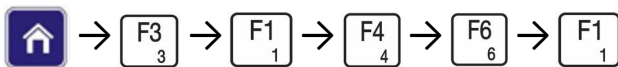
- If the span calibration was successful, the screen will say \*\*\*Saved Current\*\*\*.
- If the calibration was unsuccessful, the screen will say Outside Deviation Limits.
- See the [Manual Zero Calibration](#) section for examples of screens showing successful and unsuccessful calibrations.

If the span calibration is unsuccessful, check the following:

1. Make sure the correct gas was introduced into the analyzer.
2. Verify the [Diagnostic Values](#) while flowing gas.
3. Check Span Gas Deviations under [Manual Deviations](#):



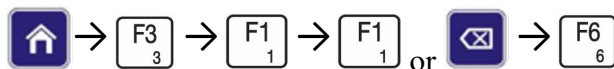
4. Check [Maximum Calibration Error](#) under Calibration Setup:



After a successful Manual Zero and Span Calibration, the analyzer is ready for use.

---

## MANUAL CALIBRATION (SWITCHING MODE: THC/CH<sub>4</sub>/NMHC)



Manual Calibration
F1 Zero THC
F2 Span THC
F5 CH <sub>4</sub> Correction Factors

<b>NOTE</b>	<i>When performing a calibration in Switching mode (THC/CH<sub>4</sub>/NMHC mode), the operator has the option of using the same basic calibration set up seen in the SINGLE MODE for THC or CH<sub>4</sub> or creating correction factors for the CH<sub>4</sub> response on the FID to use in the THC and CH<sub>4</sub> modes.</i>
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When in Switching mode, the Manual Calibration menu can be accessed by pressing

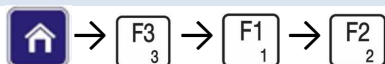
from the Calibration menu.

Press to access the Manual Zero Calibration screen. For details on zero calibration see [Manual Calibration THC or CH<sub>4</sub> Mode](#).

Press to access the Manual Span Calibration screen. For details on span calibration see [Manual Calibration THC or CH<sub>4</sub> Mode](#).

Press to access the CH<sub>4</sub> Correction Factors menu. For details on advanced calibration see [CH<sub>4</sub> Correction Factors](#).

## AUTOMATED CALIBRATION



<b>NOTE</b>	<i>An automated calibration should not be attempted before a Manual ZERO and Manual SPAN calibrations have been successfully performed.</i>
-------------	---

Automated Calibration
F1 <b>Initiate Sequenced Cal</b>
F2 Initiate Sequenced Check


<b>NOTE</b>	<i>An automated calibration is a timed zero calibration immediately followed by a timed span calibration.</i>
-------------	---

The Automated Calibration menu offers two choices: Sequenced Calibration and Sequenced Check of the existing calibration.

The Automated Calibration menu is accessed by pressing F2  
2 from the Calibration menu. Sequenced means that the flow times of both zero and span gases are controlled using a timer. See [AutoCal Timing](#) located in the Calibration Setup menu.

### NOTES:

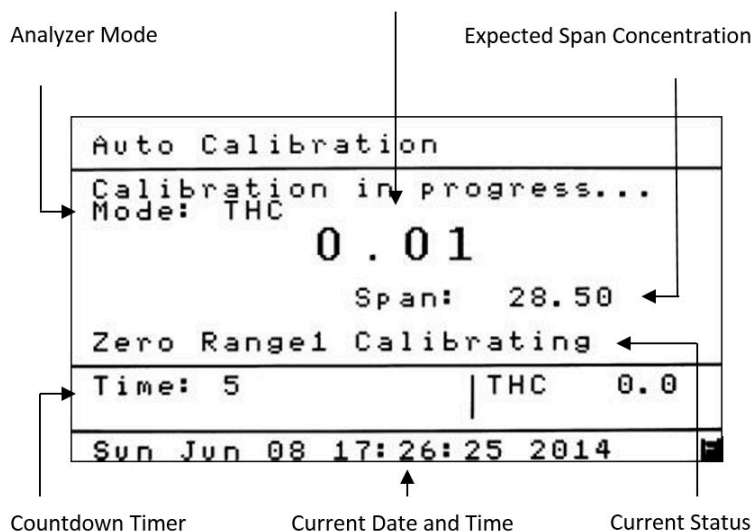
- If a manually initiated sequenced calibration or sequenced calibration check is selected, it will apply only to the range that is currently in use.
  - Each additional range must be calibrated separately.
  - This also applies if the analyzer is in auto range.

- This automated calibration is triggered manually and **not** by the analyzer's clock or via remote signal.
  - A fully automated sequenced calibration can be preset to include the desired interval for recurring analyzer-initiated calibrations. This requires additional setup. Automatic calibration of multiple ranges is also possible. See [Calibration Setup](#).
- If a sequenced calibration was unintentionally started, pressing the back  button before the Zero step is completed will cancel the calibration.

## INITIATE SEQUENCED CAL



Current Concentration



<b>NOTE</b>	<i>Because of timing requirements, sequenced calibrations are generally only used when the analyzer is controlling the flow of zero and span gases into the analyzer.</i>
-------------	---

To initiate a sequenced calibration, press from the Automated Calibration menu.

Once the sequenced calibration is initiated, it will calibrate the analyzer in the current mode and range. In this case the analyzer mode is THC shown near the upper-left corner of the screen.

A sequenced calibration has seven steps. The Current Status of each step is shown just below the expected gas concentration (in this case, it is **Zero Range1 Calibrating**). Each step uses a countdown timer set up in [AutoCal Timing](#), located in the Calibration Setup menu. The sequence (with the current range indicated) is as follows:

1. **Zero Range 1 Purging** – Allows time for the zero gas to flush out any residual gases that may still be present in the detection path.
2. **Zero Range 1 Calibrating** – The calculated averaged zero is set as the new offset value, as long as it is within the [Maximum Calibration Error](#) limits.



3. **Zero Range 1 Verifying** – The analyzer verifies that the calibrated zero value has not deviated outside the operator-set allowable [Maximum Verifying Error](#).
4. **Span Range 1 Purging** – Allows time for the span gas to flush out any residual zero gas that may still be present in the detection path.
5. **Span Range 1 Calibrating** – The calculated averaged span is set as the new gain value, as long as it is within the [Maximum Calibration Error](#) limits.
6. **Span Range 1 Verifying** – The analyzer verifies that the calibrated span value has not deviated outside the operator-set allowable [Maximum Verifying Error](#).
7. **Purging With Sample** – Introduces sample gas back into the analyzer and clears out any remaining gases so the current measurements will not be affected by any residual calibration gases.

If the calibration is successful:

- The display will briefly indicate ***Calibration Finished*** in place of ***Calibration in Progress*** at the top of the screen.
- The analyzer will then return to the Measure Screen.

If the calibration is unsuccessful:

- The display will briefly indicate ***Could Not Calibrate*** in the Current Status line.
- At the same time, you will be alerted to whether an error occurred in the zero or span portion of the calibration (for example, ***Span Gas Deviation Error!***).
- The analyzer will then return to the Measure Screen and revert to the last successful calibration values.
- A calibration error is set and will remain until cleared by a successful calibration.

To view or verify the zero or span deviations, go to the [AutoCal Deviations](#) menu under Calibration Factors. To view or change the maximum allowable calibration tolerances, see [Deviation Limits](#).


---

## INITIATE SEQUENCED CHECK



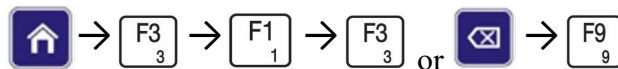
Auto Calibration	
Cal Check in progress...	
Mode: THC	
0 . 0 1	
Span: 28.50	
Zero Range1 Purging	
Time: 15	THC 0.0
Sun Jun 08 17:52:52 2014	

<b>NOTE</b>	<i>Initiate Sequenced Check is a useful tool for setting up Auto Calibration.</i>
-------------	---

From the Auto Calibration Menu screen, pressing  initiates a sequenced calibration **check**.

- Rather than initiating a calibration, it checks the validity of your most current calibration.
- A sequenced calibration check performs all of the steps of a [sequenced calibration](#) with the exception of the zero and span **calibrations**.
- It does not set new offsets, gains or any alarms.

## CAL GAS CONCENTRATIONS







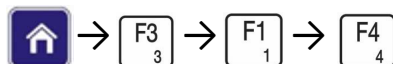
Cal Gas Concentrations		
Range	THC	Limits
Range 1	28.500	30.00
Range 2	270.000	300.00
Range 3	2700.000	3000.00
Range 4	28500.000	30000.00
F1 SAVE		

**NOTE** The Cal Gas Concentrations Screen allows operators to change calibration gas values for multiple ranges on one screen.

To access the Cal Gas Concentrations screen (shown above) press F3<sub>3</sub> from the Calibration Menu.

The Cal Gas Concentrations screen displays the range identification, the changeable span gas value and the full-scale value set for that range.

- Using the Up/Down arrows   move the highlighted field to the span gas value you wish to change (for example, 28.50 above).
- Press the Enter  button to open the span gas value field and change the value to match the span gas being supplied to the analyzer.
- Press the Enter  button again to close the span gas value field. Press F1<sub>1</sub> to save the changes.



Calibration Setup
F1 AutoCal Schedule
F2 AutoCal Parameters
F3 Cal Pump/Valves... Valves
F4 Auto Cal/Check... Check
F5 AutoCal Timing
F6 Deviation Limits
F7 Analog Hold On Cal... On

**NOTE** The Calibration Setup menu provides all the parameters necessary for completing a successful calibration.

To access the Calibration Setup menu, select **F4**<sub>4</sub> from the Calibration menu.

All parameters on the Calibration Setup menu apply to Automated Calibration. The following also apply to Manual Calibration: Cal Pump/Valves, Auto Cal/Check, Deviation Limits and Analog Hold on Cal. All settings should be verified for correct information before a manual or automated calibration is attempted.

Please note that the Calibration Setup menu shows the current settings on the right side of the screen after the (...).

- Example: **Cal Pump/Valves . . . Valves.**

## AUTO CALIBRATION SCHEDULE



Scheduled Calibration Interval	Screen Name	Next Scheduled Calibration Time and Date
AutoCal Schedule		
Start Time: 12: 0: 0 on Fri Date : 07. Jun 2013		
Scheduled Every : 3 Day(s)		
**Must Select One to Save**		
F1 Hourly		
F2 Daily		
F3 Weekly		
F4 Timed Cal On/Off... Off		
Thu Jun 05 15:33:23 2013		

Save Hourly, Daily or Weekly
Current Date and Time
AutoCal On / Off

**NOTE** The Auto Calibration Schedule screen allows the operator to run automated calibrations using the analyzer's internal clock.

In addition to the Start Time and Date, the Scheduled Calibration interval (in the example, scheduled every 3 days) can be changed by the operator.

- The Auto Calibrations screen is accessed by pressing F1  
1 from the Calibration Setup menu.
- Use the arrow buttons ▲ ▼ ◀ ▶ to move the highlight to changeable fields (in the example, Start Time: 12).
- Press Enter ↵ to open the field and change the value.
- Press Enter ↵ again to close the field after you have made your changes.

After all the changes have been made, you **must** choose one of the following: F1  
1  
(Hourly), F2  
2 (Daily) or F3  
3 (Weekly) to save your changes. **If this is not done**, the selected changes will not be made and the analyzer will revert to the previous settings.

To change Timed Auto Calibration to on or off, press F4  
4 (Timed Cal On/Off). A submenu will open with two choices. Press F1  
1 to turn Timed Cal On, or press F2  
2 to turn Timed Cal Off. Selecting F1  
1 or F2  
2 will bring you back to the AutoCal Schedule screen. The current setting is shown on the right side of the menu after the (. . .). In the example above the mode is OFF: **Timed Cal On/Off . . . Off**.


---





## AUTO CALIBRATION PARAMETERS





AutoCal Parameter	
**Select 0 for all ranges**	
Range [0 - 4]...	<input checked="" type="checkbox"/>
Mode...	THC
Cal Gases...	All
F1 Save	

<b>NOTE</b>	<i>Auto Calibration Parameters allows the operator to select the range, mode and choose between Zero and All calibration gases (both zero and span).</i>
-------------	--





To access the AutoCal Parameter screen, press  from the Calibration Setup menu.

- To navigate between parameters, use the up or down arrow   to move the highlight to the field you intend to change.
- Press Enter  to open the field and change the parameter.
- Press Enter  again to close the field after you have made your change.





The first changeable parameter is the Range to be calibrated.


- Press Enter  to open the field and change the range.
- Then select a Range (from 1 – 4) for calibration.
- To select all ranges, press 0.
- Press Enter  to close the field.

The second parameter the operator can change is the Mode. The SERVOPRO HFID analyzer can calibrate in either THC or CH<sub>4</sub> mode.

- Press Enter  to open the field
- Select the mode using the up or down arrows  
- Press Enter  to close the field.

Calibration Gases gives you a choice of calibrating with Zero gas only or All calibration gases (zero and span gases).

- Press Enter  to open the field
- Select the mode using the up or down arrows  
- Press Enter  to close the field.

Press  to save your settings. Once your changes have been saved, the analyzer will return you to the Calibration Setup menu.





## CALIBRATION VIA PUMP/VALVES



Cal via Pump/Valves	Valves
F1 Cal via Pump	
F2 Cal via Valves	


<b>NOTE</b>	<i>The use of <b>Cal via Pump/Valves</b> depends upon how calibration gases are being introduced into the analyzer – via a sample pump or internal valves (if equipped with internal valve option).</i>
-------------	---

To access the **Cal via Pump/Valves** menu, press  from the **Calibration Setup** menu.

Press  (**Cal via Pump**) to keep the analyzer's internal sample pump on and keep the valves closed during calibration. This will then return you to the Calibration Setup Menu.

- The Calibration Setup menu will now display the current settings on the right side of the screen
- Example: **Cal Pump/Valves . . . Pump**

<b>NOTE</b>	<i>If the analyzer is equipped with a pump, to prevent damage to the pump do not pressurize the sample inlet.</i>
-------------	---

Press  (**Cal via Valves**) to activate the appropriate calibration valve and keep the internal sample pump turned off during calibration. Keeping the sample pump turned off while the valves are activated will prevent sample from being mixed with calibration gas. You will then be returned to the Calibration Setup Menu.

- The Calibration Setup menu shows the current settings on the right side of the screen
- Example: **Cal Pump/Valves . . . Valves.**


---

## AUTO CALIBRATION/CHECK



Set Auto Cal/Check	Check
F1 Set Auto Cal to Calibrate	
F2 Set Auto Cal to Check	

<b>NOTE</b>	<i>Auto Calibration/Check lets the operator select whether the analyzer will calibrate or performs a check of the calibration.</i>
-------------	--

To access the Auto Cal/Check menu, press  from the Calibration Setup menu. The current setting is shown on the upper right corner of the screen.

Press  to set the analyzer **Auto Cal/Check** parameter to **Calibrate** (Cal). The setting will be saved automatically.

- The analyzer returns to the Calibration Setup menu.
- The Calibration Setup menu now shows the current setting on the right side of the screen after the (. . .).
- Example: **AutoCal/Check . . . Cal.**

Press  to set the analyzer **Auto Cal/Check** parameter to **Check**. The setting will be saved automatically.

- The analyzer returns to the Calibration Setup menu.


- The Calibration Setup menu shows the current setting on the right side of the screen after the (. . .).
- Example: **AutoCal/Check . . . Check.**





## AUTO CALIBRATION TIMING



AutoCal Timing [sec]		
Purge Before...		10
Calibrating		10
Verifying...		10
Purge After...		10
Zero	Span	Total
30	30	70
F1 SAVE		

**NOTE** *Auto Calibration Timing determines the length of time it takes the analyzer to perform the Zero and Span cycles during a sequenced auto calibration.*


To access the **AutoCal Timing** screen, press  from the **Calibration Setup** menu. All values on the screen are expressed in seconds.

- To navigate between parameters, use the up or down arrow   to move the highlight to the field you intend to change.
- Press Enter  to open the field and change the value (seconds).
- Press Enter  again to close the field after you have made your change.

A sequenced auto calibration consists of two cycles: Zero and Span. In both cases, the cycle duration is equal to the sum of the **Purge Before**, **Calibration** and **Verification** times. The Total Auto Calibration time is equal to the sum of the Zero and Span cycle times plus the Purge After time. See the example above.

1. **Purge Before:** the operator can set the amount of time necessary to flush the analyzer with calibration gases. This will ensure that there are no other gases remaining in the analyzer during the calibration process.

2. **Calibrating Time:** during this 10-second time, the analyzer will calculate new offset and gain factors. The calibrating time is factory-set at 10 seconds and cannot be changed by the operator.
3. **Verifying Time:** during this time the measured value is checked to make sure it does not deviate outside the upper or lower limit specified by the [Maximum Verifying Error](#). The verifying time is typically set for 10 seconds.
4. **Purge After:** the operator can set the time needed to flush any remaining calibration gases out of the analyzer before the In Cal Status is released and the measurement status is set.

After the Auto Calibration Timing has been set, press  to save the changes.

---

## DEVIATION LIMITS



Deviation Limits
F1 Maximum Calibration Error
F2 Maximum Verifying Error

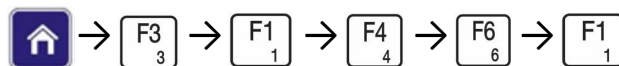
<b>NOTE</b>	<i>Deviation Limits are used by the operator to define the maximum acceptable error limits of the zero and span gases for both manual and sequenced calibration.</i>
-------------	--

To access the Deviation Limits menu, press  from the Calibration Setup menu.

Press  to set or view the Maximum Calibration Error Limits.

Press  to set or view the Maximum Verifying Error Limits.


## MAXIMUM CALIBRATION ERROR








Maximum Calibration Error [%]		
Range	Absolute	Relative
Range 1	10.00	10.00
Range 2	10.00	10.00
Range 3	10.00	10.00
Range 4	10.00	10.00
F1 SAVE		

**NOTE** *Maximum Calibration Error is used by the operator to define the maximum acceptable tolerances for Absolute and Relative deviations.*

Each range has its own set of **Absolute** and **Relative** tolerances. The deviations must be inside these tolerances to accept a calibration. To access the **Maximum Calibration**

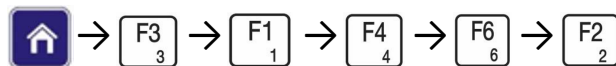
**Error** screen, press  from the **Deviation Limits** menu.

- To navigate between fields, use the up or down arrow   to move the highlight to the field you intend to change.
- Press Enter  to open the field to change the allowable tolerance in %.
- Press Enter  again to close the field.
- Press  to save your changes.
- Absolute Deviation** is used to compare the factory-set calibration to the current calibration.
- Relative Deviation** compares the current calibration to the previous calibration.




---

## MAXIMUM VERIFYING ERROR



Maximum Verifying Error [%]	
Range	Allowable
Range 1	1.00
Range 2	1.00
Range 3	1.00
Range 4	1.00
F1 SAVE	




<b>NOTE</b>	<i>Maximum Verifying Error is the allowable tolerance during the Verifying step of sequenced calibration.</i>
-------------	---

To access the Maximum Verifying Error screen press  from the Deviation Limits menu.

- To set the allowable tolerances for different ranges, use the up or down arrow



to move the highlight to the field you intend to change.

- Press Enter  to open the field to change the value in %.
- Press Enter  again to close the field.
- Press  to save your changes.


---


## ANALOG HOLD ON CAL




Analog Hold On Cal	Off
F1 Analog Hold On	
F2 Analog Hold Off	

<b>NOTE</b>	<i>Analog Hold on Cal will hold the analog outputs to the last measured value during calibration.</i>
-------------	---

To access the **Analog Hold On Cal** menu, press  from the Calibration Setup menu.

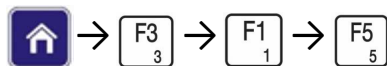
From the **Analog Hold On Cal** menu, press  to turn **Analog Hold On**

- This will hold the analog outputs at the last measured value.
- Once pressed it will return to the Calibration Setup menu.
- The Calibration Setup menu shows the current setting at the bottom-right corner of the screen after the (. . .).
- Example: **Analog Hold on Cal . . . On.**

From the **Analog Hold On Cal** menu, press  to turn **Analog Hold Off**.


- This will allow the analog outputs to be live and reporting out values during calibration.
- Once pressed it will return to the Calibration Setup menu.
- The Calibration Setup menu shows the current setting at the bottom-right corner of the screen after the (. . .).
- Example: **Analog Hold on Cal . . . Off.**

## CALIBRATION FACTORS



Calibration Factors
F1 Manual Deviations
F2 Auto Cal Deviations
F3 Offset/Gain Factors

<b>NOTE</b>	<i>Calibration Factors allow the operator to track and view changes from the factory and previous calibrations.</i>
-------------	---

To access the **Calibration Factors** menu, press  from the **Calibration** menu.

Press  to view the **Manual Calibration Deviations** menu.

Press  to view the **Auto Calibration Deviations** menu.


Press  to access the **Offset and Gain Factors** screen.

## MANUAL DEVIATIONS



Manual Deviations
F1 Zero Gas Deviations
F2 Span Gas Deviations

<b>NOTE</b>	<i>The Manual Deviations menu allows the operator to view the Zero and Span Deviations from Manual Calibrations.</i>
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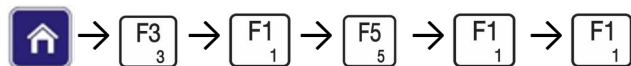
Press  from the **Calibration Factors** menu to access the **Manual Deviations** menu.

Press  to view **Zero Gas Deviations**.


Press  to view **Span Gas Deviations**.

---

## ZERO GAS DEVIATIONS



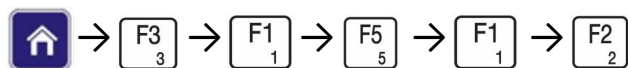
Zero Gas Deviations [%]		
THC	Abs	Rel
Range 1	0.00	0.00
Range 2	0.00	0.00
Range 3	0.00	0.00
Range 4	0.00	0.00

Press  from the *Manual Deviations* menu to view the *Zero Gas Deviations* screen.


- **Absolute Zero Gas Deviation** is the zero gas content calculated by the factory polynomial related to the calibrated range limit.
- **Relative Zero Gas Deviation** is the current deviation minus the deviation of the previous calibration related to the calibrated range limit.

---

## SPAN GAS DEVIATIONS

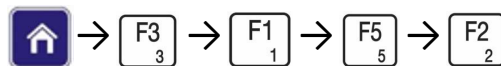


Span Gas Deviations [%]		
THC	Abs	Rel
Range 1	0.00	0.00
Range 2	0.00	0.00
Range 3	0.00	0.00
Range 4	0.00	0.00

Press  from the *Manual Deviations* menu to view the *Span Gas Deviations* screen.

- **Absolute Span Gas Deviation** is span gas bottle value minus span gas value calculated by the factory polynomial related to the calibrated range limit.
- **Relative Span Gas Deviation** is the current deviation minus the deviation of the previous calibration.

## AUTO CAL DEVIATIONS



Auto Cal Deviations
F1 Verifying Zero Devs
F2 Verifying Span Devs

<b>NOTE</b>	<i>The Auto Calibration Deviations menu gives the operator a choice of viewing either zero or span verifying deviations.</i>
-------------	--

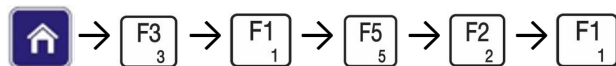
The verifying deviations are taken during the verifying stage of sequenced and auto calibrations. Press **F2<sub>2</sub>** from the Calibration Factors menu to access the Auto Cal Deviations menu.

Press **F1<sub>1</sub>** to view the Verifying Zero Deviations screen.


Press **F2<sub>2</sub>** to view the Verifying Span Deviations screen.

---

## VERIFYING ZERO DEVIATIONS



Zero Gas Deviation Verifying			
THC	Meas	Var	%FS
R1	0.0	0.00	0.01
R2	0.0	0.00	0.00
R3	0.0	0.00	0.00
R4	0.0	0.00	0.00
F			

Press  from the Auto Cal Deviations menu to view the Verifying Zero Deviations screen.

**Measured Value** is the averaged concentration during the Verifying Zero stage of sequenced and auto calibrations.

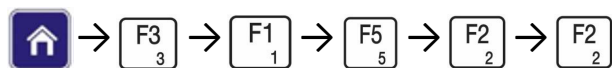
**Variance** is the difference of the measured value and zero.

**% FS** is the percent of full scale related to the calibrated range limit.




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## VERIFYING SPAN DEVIATIONS



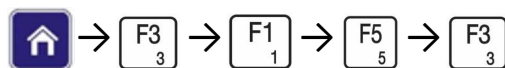
Span Gas Deviation Verifying			
THC	Meas	Var	%FS
R1	0.0	0.00	0.00
R2	0.0	0.00	0.00
R3	0.0	0.00	0.00
R4	0.0	0.00	0.00

Press  from the Auto Cal Deviations menu to view the Verifying Span Deviations screen.

**Measured Value** is the averaged concentration during the Verifying Span stage of sequenced and auto calibrations.

**Variance** is the difference of the measured value and span gas concentration.

**% FS** is the percent of full scale related to the calibrated range limit.



Offset/Gain Factors		
THC	Offset	Gain
Range 1	0.00	1.00
Range 2	0.00	1.00
Range 3	0.00	1.00
Range 4	0.00	1.00

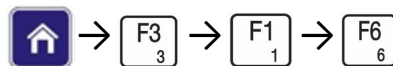
**NOTE:** When used in conjunction with the Manual Calibration Deviations, an increasing or decreasing change in Offset or Gain will provide insight into changes in analyzer performance.

Press **F3<sub>3</sub>** from the Calibration Factors menu to access the Offset/Gain Factors screen.

**Offset** is the difference between factory zero and the value stored during zero calibration.

**Gain** is the value stored during span gas calibration using the operator-defined calibration gas


## RESET FACTORY SETTINGS




Reset Factory Settings
F1 Reset Offsets and Gains
F2 Reset Linear Coefficients

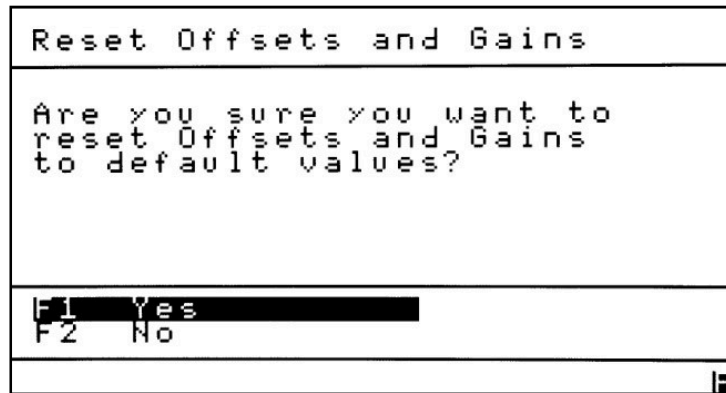
**NOTE:** The Reset Factory Settings menu gives the operator a choice of resetting the Offsets and Gains, or both Factory Linear Coefficients and Offsets and Gains for all calibrated ranges.

Resetting factory settings will not affect any other operator-changed parameters.

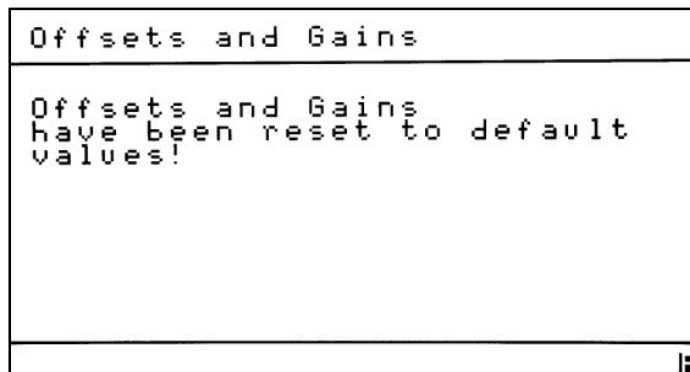
Press  to reset the Offsets and Gains.

Press  to reset the Linear Coefficients, Offsets and Gains and CH<sub>4</sub> Factors.

## RESET OFFSETS AND GAINS



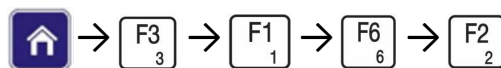
Pressing **F1<sub>1</sub>** from the Reset Factory Settings menu will prompt the operator to confirm resetting Offsets and Gains for all ranges. Pressing **F1<sub>1</sub>** (Yes) from this screen resets the Offset and Gain factors to factory default settings (0 and 1 respectively) and brings you to this confirmation screen:



- Offset and Gain factors are created when the analyzer is zeroed and spanned.
- If the Offsets and Gains are reset, the analyzer must be zeroed and spanned again before use.
- All recorded deviations will be set to zero.

If you press **F2<sub>2</sub>** (No) from the Reset Offsets and Gains screen, the analyzer will return to the Reset Factory Settings menu without resetting the Offsets and Gains.

## RESET LINEAR COEFFICIENTS



Reset Linear Coefficients	
Are you sure you want to reset Linear Coefficients to default values?	
F1	Yes
F2	No

Pressing **F2<sub>2</sub>** from the Reset Factory Settings menu will prompt the operator to confirm resetting the Linear Coefficients for all ranges. Pressing **F1<sub>1</sub>** (Yes) from this screen resets all the **Linear Coefficients, Offset and Gain Factors and CH<sub>4</sub> Correction Factors** to factory default settings and brings you to this confirmation screen:

Linear Coefficients
Linear Coefficients have been reset to default values!

**NOTE:** After resetting Linear Coefficients, the analyzer must be zeroed and spanned before further use.

If you press **F2<sub>2</sub>** (No) from the Reset Linear Coefficients screen, the analyzer will return to the Reset Factory Settings menu without resetting the Linear Coefficients, Offsets and Gains Factors or CH<sub>4</sub> Correction Factors.



Range Setup	
F1	Range Limits
F2	AutoRange... Off
F3	AutoRange Switch Points

**NOTE:** Range Setup allows the operator to change Range Limits, turn Auto Range On or Off, and change Auto Range Switch Points.

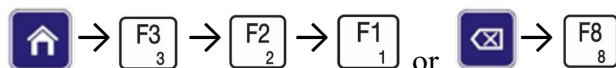
From the Menus screen press F2  
2 to access the Range Setup menu.

Press F1  
1 to view or change Range Limits.

Press F2  
2 to access the Auto Range On/Off menu. In either case, you will return to the Range Setup menu. The Range Setup menu shows the current status on the right side of the screen after the (...). **Example: Auto Range On/Off... Off.**


Press F3  
3 to view or change Auto Range Switch Points.








## RANGE LIMITS



Range Limits	
***Must be Ascending***	
Range 1	30.00
Range 2	300.00
Range 3	3000.00
Range 4	30000.00
Maximum Range Limit 30000	
F1 SAVE	

**NOTE:** The analyzer is factory-configured with four physical ranges (Range 1 -Range 4).

The operator can change the number of ranges and select a new specific full-scale concentration in ppm. From the Range Setup menu press  to access the Range Limits screen.

To change the Range Limits from the factory settings, use the up or down arrows   to move the highlight to the field you intend to change. Press Enter  to open the field to change the value in ppm. Press Enter  again to close the field. Press  to save your changes. To initiate the saved changes, press , then press  and select new ranges.

### NOTES:

1. The Range Limits values must be set in ascending order.
2. The analyzer will not allow any of the range limits to exceed the maximum range limit on the Range Limits screen. **Example: Maximum Range Limit 30,000.**
3. To set a single range, set Range 1 to the desired value and all others to zero.
4. To set two ranges, set Range 1 to the lowest value, Range 2 to the highest value, and the others to zero.

5. If new ranges are saved, the Auto Range Switch Points will be set to default percentages of range limits. See [AutoRange Switch Points](#).



## AUTORANGE ON/OFF



AutoRange	Off
F1	AutoRange On
F2	AutoRange Off

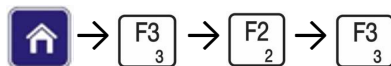
**NOTE:** The Auto Range Function allows the analyzer to automatically switch up and down between ranges at predetermined concentrations.

From the Range Setup menu press **F2<sub>2</sub>** to access the Auto Range On/Off screen. The current Auto Range status appears in the upper-right corner of the screen.

Press **F1<sub>1</sub>** to turn Auto Range On. This function allows the analyzer to automatically change ranges without the presence of an operator.

Press **F2<sub>2</sub>** to turn Auto Range Off. When Auto Range is Off, the operator will need to manually change the ranges. The Range Setup menu shows the current status on the right side of the screen after the (...). **Example: *AutoRange On/Off. . . Off.***

## AUTORANGE SWITCH POINTS



AutoRange Switch Points		
Range	Down	Up
Range 1		27.00
Range 2	24.30	270.00
Range 3	243.00	2700.00
Range 4	2430.00	
F1 SAVE F2 Default Switch Points		

**NOTE:** Auto Range Switch Points determine when the analyzer automatically changes a range up or down when the Auto Range function is turned on.

From the Range Setup menu press to access the AutoRange Switch Points screen.

**The Default Switch Points** are created by the range limits. The Up Switch Point is 90% of the Range Limit. The Down Switch Point is 90% of the previous range's Up Switch Point.


To change the Auto Range Switch Points, use the up/down arrows to move the highlight to the field you intend to change. Press Enter to open the field to change the value in ppm. Press Enter again to close the field. Press to save your changes. To initiate the saved changes, press , then press and select new Auto Range Switch Points.


**EXAMPLE:** In the example above, if Range 1 concentration reaches 27.00 ppm, the analyzer will switch to Range 2. If the concentration for Range 2 gets as low as 24.30 ppm, the analyzer will switch back to Range 1.




Diagnostics	
F1	<b>Diagnostic Values</b>
F2	Raw Value Display
F3	I/O Status
F4	Status Line... OFF


**NOTE:** The Diagnostics menu allows the operator to access key troubleshooting screens including Diagnostic Values, Raw Values and Input / Output statuses.

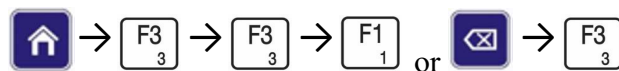
From the Menus screen press  to access the Diagnostics menu.

Press  to access the Diagnostics Values screen. It allows you to check analyzer temperatures, pressures, EPC voltage percentages and flows.

Press  to access the Raw Value Display menu.

Press  to access the I/O Status menu. You can check the status (Open or Closed) of the analyzer's digital outputs and inputs.


Press  to turn On or Off the AK Status Line. The current setting is shown on the Diagnostics menu on the right side of the screen after the (...). **Example: Status Line. . . Off.**





### Temperatures Screen

Temperatures [°C]			
Device	Value	LoLimit	HiLimit
Burner	350.0	250.00	750.00
Oven	191.0	180.00	200.00
Filter	191.0	180.00	200.00
Pump	191.0	180.00	200.00
Cutter	310.0	250.00	350.00
Case	25.4		
**Use ◀ ▶ keys to scroll** Temps Press EPC Flows			

**NOTE:** The Diagnostic Values screens allow the operator to check analyzer temperatures, sample and air pressures, EPC voltage percentages and flows.

The Diagnostic Values screens allow the operator to check analyzer temperatures, sample and air pressures, EPC voltage percentages and flows. These important screens are accessed by pressing  from the Diagnostics menu.

The first screen that appears is the Temperatures screen. The Temperatures screen displays the current temperature and low and high alarm limits for key analyzer components.

As indicated at the bottom of the screen, use the left and right arrow keys   to scroll to different screens. The current screen will be highlighted (Temps in the example).

The Temperatures, Pressures and Electronic Pressure Controller (EPC) Voltage Percent screens include the current device Values and the Low and High Alarm Limits. For example, if the analyzer's burner temperature drops lower than 250°C or exceeds 750°C, an alarm will be triggered and displayed at the bottom of the [Measure Screen](#).

## Pressures Screen

Pressures [PSIG]			
Device	Value	LoLimit	HiLimit
Sample	1.50	1.35	1.65
Air	7.00	6.70	7.30
Fuel	8.00	7.70	8.30
A inj	1.50	1.35	1.65
F inj	1.60	1.45	1.75
**Use ◀ ▶ keys to scroll** Temps Press EPC Flows			

The Pressures screen displays current sample and air pressures and low and high alarm limits in PSIG.

## EPC Voltage Percent Screen

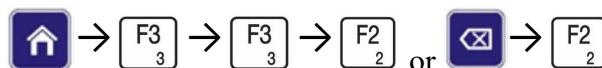
EPC Voltage [%]			
Device	Value	LoLimit	HiLimit
Sample	50	10	90
Air	45	10	90
Fuel	40	10	90
A inj	40	10	90
F inj	50	10	90
**Use ◀ ▶ keys to scroll** Temps Press EPC Flows			

The EPC screen displays the percentage of EPC voltage being supplied to the EPC valve.

## Flows Screen

Flows [mL/Min]	
Device	Value
Sample	11.0
Air	317.6
Fuel	138.6
A inj	10.0
F inj	5.0
**Use ◀ ▶ keys to scroll** Temps Press EPC Flows	

The Flows screen displays the current flow of sample and air in mL/minute. It does **not** include an alarm function because flows are calculated values based on the pressures.



THC Raw Values	Raw Volts
F1 Mode...THC	0.501
F2 Alarms	Raw Conc.
F3 Diagnostics	0.01
F4 Flow Zero	Meas Conc.
F5 Flow Span	0.01
	Meas
↑ Range Up/Down	R1: 30.00



**NOTE:** The Raw Values Display screen is a diagnostic tool for viewing detector Raw Volts and Calculated Concentrations.

This screen is accessed by pressing from the Diagnostics menu.


- **Raw Voltage:** This is a 0.512 VDC to 4.512 VDC that will be digitized by the microprocessor to generate the calibration curve from which the Raw Concentration and Measured Concentration are derived. The 0.512 volts is equal to 0 ppm and 4.512 is equal to the four factory-set range limits. (**Example of standard analyzer range limits as C1: 30, 300, 3000 and 30000**)
- **Raw Concentration:** This value (in ppm) is calculated from the Raw Volts before linearization and offset and span corrections are applied.
- **Measured Concentration:** This value (in ppm) is calculated from the Raw Concentration. Then linearization and offset and span corrections are applied.


**From the Raw Values Display screen, the following functions can be useful for diagnosing and monitoring the analyzer's performance:**



Press to change the analyzer's mode to THC or CH<sub>4</sub> (Methane option only). If the analyzer is in THC/CH<sub>4</sub>/NMHC mode it will continue to switch between THC and CH<sub>4</sub> automatically. The current mode is indicated after the (...). **Example: Mode... THC.**

Press  to access the [Current Alarms](#) screen. Press Back  button to return to the Raw Values Display screen.

Press  to view the [Diagnostic Values](#) screens.

Press  to open the Zero valve (if your analyzer is equipped with optional calibration valves). **Zero** will be indicated above the range (at the bottom right of the screen). To return to the Measure mode, press F4 again. **Meas** will be indicated above the range on the screen.

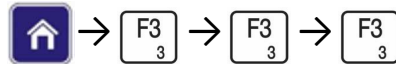
Press  to open the Span valve (if your analyzer is equipped with optional calibration valves). **Span** will be indicated above the range (at the bottom right of the screen). To return to the Measure mode, press F5 again. **Meas** will be indicated above the range on the screen.

To change ranges, use the Up/Down arrows  . The current range is shown in the bottom-right corner under the “Meas” text. **Example: R1: 30.00.**

**NOTE:** *If the analyzer's AutoRange function is turned On, the operator will not be able to manually change ranges until AutoRange is turned Off.*

When AutoRange is turned On, it is indicated with an **A** before the range shown in the bottom-right corner under the “Meas” text: **Example: AR1: 30.00**





I/O Status
F1 Analyzer Digital Outputs
F2 Analyzer Digital Inputs
F3 Programmable Digital Out

**NOTE:** The I/O Status menu gives the operator a choice of viewing the statuses of the analyzer's digital outputs or digital inputs (open or closed).

To access the I/O Status menu, press from the Diagnostics menu.

Press to view the status of the analyzer's standard digital outputs.

Press to view the status of the analyzer's digital inputs.


Press to view the status of the Programmable Digital Outputs.

## ANALYZER DIGITAL OUTPUTS



Analyzer Digital Outputs		
Pin	Function	Status
M7	AutoRange	Open
M8	Range 1	Closed
M9	Range 2	Open
M10	Range 3	Open
M11	Range 4	Open
M22	Zero Gas	Open
M23	Span Gas	Open
M24	Sample Gas	Closed
M25	In Remote	Open
M26	In Calib.	Open

**NOTE:** The Analyzer Digital Outputs screen allows the operator to view the status of an analyzer output (Open or Closed) and where to find the corresponding pin number.

To access the Analyzer Digital Outputs status screen, press  from the I/O Status menu.

The Pin column indicates the connector and the pin number that is used to control the digital output function. **In the example (M7)**, **M** is the Main Connector on the analyzer's back panel, and **7** is the Pin Number on that connector.

The **Status** becomes closed when the function is true. In the example above, the analyzer is in Range 4. Range 4's status is closed. This will result in a closed contact to digital ground. It can be measured from the Main Connector Pin 6 (digital ground) to the Main Connector Pin 11.


**NOTE:** These analyzer functions are not user-changeable and have static pin outs. These screens are for viewing only.



## ANALYZER DIGITAL INPUTS



Analyzer Digital Inputs		
Pin	Function	Status
M12	AutoRange	Open
M13	Range1	Open
M14	Range2	Open
M15	Range3	Open
M16	Range4	Open
M17	AutoCal	Open
M18	CalCheck	Open
M19	Zero	Open
M20	Span	Open
Next page ►		Page1

**NOTE:** The Analyzer Digital Inputs screen allows the operator to view the status of an analyzer input (Open or Closed) and where to find the corresponding pin number.

To access the Analyzer Digital Inputs status screen, press  from the I/O Status menu.

As indicated at the bottom of the screen, press the left and right arrow buttons   to scroll to different Analyzer Digital Input screens.

The Pin column indicates the connector and the pin number that is used to control the function. **In the example (M12)**, **M** is the Main Connector on the analyzer's back panel, and **12** is the Pin Number on that connector. The abbreviations are as follows:

**M = Main Connector**

**A = Auxiliary**

**Int = internal, for SERVOMEX use only.**

When the analyzer is in Remote Mode and the digital input is pulled to digital ground (Main Connector, Pin 6), the status will become Closed.


**NOTE:** These analyzer functions are not user-changeable and have static pin outs. These screens are for viewing only.



## PROGRAMMABLE DIGITAL OUTPUTS



Programmable Digital Outputs					
AUX	Pin	DO	Function	Status	
5	to 9	1	Off	Open	
5	to 10	2	Off	Open	
5	to 11	3	Off	Open	
5	to 12	4	Off	Open	
6	to 13	5	Off	Open	
6	to 14	6	Off	Open	
6	to 15	7	Off	Open	
6	to 16	8	Off	Open	
Next page ▶			Page 1		

**NOTE:** The Programmable Digital Outputs screen allows the operator to check the status of the analyzer's programmable digital outputs (Open or Closed) according to pin numbers and programmed functions.

From the I/O Status menu press  to view Programmable Digital Output statuses.

As indicated at the bottom of the screen, press the left and right arrow buttons   to view the next or previous page of Programmable Digital Output statuses.

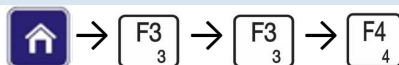
The column key is as follows:

Column Key	Description
Aux Pin	Auxiliary connector on the back panel and pin number on the connector
DO	Programmable digital output number
Function	Operator-programmed function
Status	The state the programmed relay is in (open or closed)

### NOTES:

- To set functions, see [Programmable Digitals](#).
- Programmed statuses are closed when true.
- Programmed alarms are open when true.

## STATUS LINE



Status Line	OFF
F1 Turn Status Line On	
F2 Turn Status Line Off	

**NOTE:** The AK Command Status Line can be displayed at the top of the Measure Screen.

This field contains the current AK Protocol information. See [AK Protocol](#). The current status is shown in the upper-right corner of the Status Line menu.

**Example above: Status Line OFF**

From the Diagnostics menu, Press **F4**<sub>4</sub> to select On or Off.

Press **F1**<sub>1</sub> from the Status Line menu to turn the AK Status Line On.

Press **F2**<sub>2</sub> from the Status Line menu to turn the AK Status Line Off.

Example of the Status Line turned on: **4: SHCG**

MEASURE	SEC 4: SHCG
THC 0.00	R1: 30.00 PPM
◀ F1: Measure Mode ▶	
Sun Apr 20 17:23:15 2014	


## SETUP MENU





Setup
F1 <b>Measure Settings</b>
F2 Output Settings
F3 TCP/IP Parameters
F4 Data Logging Time
F5 Auto Start Settings
F6 Clock
F7 Auto Ignite On/Off... Off

**NOTE:** The Setup menu provides access to key setup screens including Measure Settings, Output Settings and TCP/IP Parameters.


From the Menus screen press  to access the Setup menu.


Press  to access the Measure Settings menu. These setup screens allow the operator to view or change averaging times, THC/CH<sub>4</sub>/NMHC mode times and CH<sub>4</sub> correction factors.

Press  to access the Output Settings menu. The Programmable Analog and Programmable Digital outputs can be viewed or set up to fit the operator's needs.

Press  to view or change the current TCP/IP parameters.

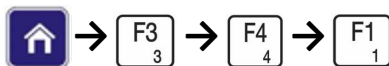
Press  to access the Data Logging Time screen. (For SERVOMEX use only)

Press  to view or make changes to the Auto Start Settings.

Press  to view or change the analyzer's time and date.


Press  to turn the Auto Ignite at Startup feature on or off.


## MEASURE SETTINGS




Measure Settings
F1 Averaging Time
F2 THC/CH <sub>4</sub> /NMHC Mode Times
F3 CH <sub>4</sub> Correction Factors

**NOTE:** The Measure Settings menu provides access to the following Setup parameters: Averaging Time, THC/CH<sub>4</sub>/NMHC Mode Times and CH<sub>4</sub> Correction Factors.

The Measure Settings menu is accessed by pressing  from the Setup menu.

Press  to view or change the Averaging Time of the measured concentration.

Press  to view or change THC/CH<sub>4</sub>/NMHC mode switching times.

Press  to view or set the CH<sub>4</sub> Correction Factors.

---

## AVERAGING TIME



Averaging Time
*Save will restart averaging*
Averaging Time (0..60)... 1
F1 SAVE

**NOTE:** *The Averaging Time screen allows the operator to set the averaging time of the measured concentration.*

From Measure Settings menu press to access the Averaging Time screen.

The Averaging Time is a sliding average. As shown above, it can be set from 0 – 60 seconds.

Press Enter to open the field to change the time. After making your change, press

Enter again to close the field. Press to save your changes and restart the averaging of the measured concentration. You will return to the Measure Settings menu.




## THC/CH<sub>4</sub>/NMHC MODE TIMES








CH <sub>4</sub> /THC/NMHC Mode Times	
Purge Time before Integration in Seconds...	10
Integration Time after Purge in Seconds...	10
F1 SAVE	

**NOTE:** The THC/CH<sub>4</sub>/NMHC Mode Times screen allows the operator to set the Purge Time and the Integration Time.

From Measure Settings menu press  to access the THC/CH<sub>4</sub>/NMHC Mode Times screen.

The Purge and Integration times are set to allow adequate purging and integration times between the THC and CH<sub>4</sub> cycles. Any gas remaining in the sample stream from the previous mode is purged before integration into the next mode. All THC and CH<sub>4</sub> readings are displayed as averaged values, and the sample read times can be adjusted by the operator. See [THC/CH<sub>4</sub>/NMHC Mode](#) for more information.

Use the Up/Down arrows   to highlight the field you intend to change. Press Enter  to open the field to change the time (in seconds). After making your change, press Enter  again to close the field. Press the Back  button to exit the screen and return to the Measure Settings screen.

## CH<sub>4</sub> CORRECTION FACTORS





CH <sub>4</sub> Correction Factors	
F1 Zero THC	
F2 CH <sub>4</sub> Zero Offset	0.000
F3 Span THC	
F4 CH <sub>4</sub> Correction	1.000
CH <sub>4</sub> Response	1.000
F6 Edit CH <sub>4</sub> Factors	


Current Settings

**NOTE:** CH<sub>4</sub> Correction Factors allows the operator to adjust small offsets between the THC and CH<sub>4</sub> modes while operating in the THC/CH<sub>4</sub>/NMHC Mode.




Press  to access the CH<sub>4</sub> Correction Factors menu from the Measure Settings menu.





### Notes:





- CH<sub>4</sub> Correction Factors is for advanced operators only and not necessary for normal operation.
- CH<sub>4</sub> Response Factor should be added before correction Factors.
- To properly adjust for any offsets, all four steps need to be done in order from  thru .
- There is only one set of Offset and Correction Factor for all ranges.
- Calibrating in CH<sub>4</sub> single mode will automatically reset the Offset and CH<sub>4</sub> Correction Factor to the default settings of “0” and “1”.

Press  to set the analyzer in THC mode and enter the Manual Zero Calibration screen. Introduce zero gas into the rear of the analyzer. Once the concentration stabilizes,


press  to set the Zero. Press the Back  button to return to the CH<sub>4</sub> Correction Factors menu.

Press  to set the analyzer in CH<sub>4</sub> mode and enter the manual zero calibration screen. Introduce zero gas into the rear of the analyzer. Once the concentration stabilizes, press  to set the Zero Offset. Press the Back  button to return to the CH<sub>4</sub> Correction Factors menu.

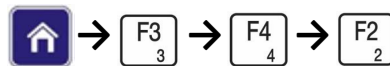
Press  to set the analyzer in THC mode and enter the manual span calibration screen. Introduce THC span gas into the rear of the analyzer. Verify the span concentration on the screen matches the Total Hydrocarbon concentration on the bottle certificate. If the concentration does not match, press Enter  and change the concentration to match. Once the concentration stabilizes, press  to set the span. Press the Back  button to return to the CH<sub>4</sub> Correction Factors menu.

Press  to set the analyzer in CH<sub>4</sub> mode and enter the manual span calibration screen. Introduce CH<sub>4</sub> span gas into the rear of the analyzer. Set the concentration on the screen to match the Methane concentration from the bottle certificate. Press Enter  and change the concentration, then press Enter  again to close the field. The concentration value is temporarily set and will revert back to the original span concentration. Once the concentration stabilizes, press  to set the CH<sub>4</sub> correction factor. The correction factors are now set.

CH <sub>4</sub> Factors	
CH <sub>4</sub> Zero Offset...	0.00
CH <sub>4</sub> Correction...	1.00
CH <sub>4</sub> Response...	1.00
F1 Save	
F2 Reset Default	


Press  to manually edit the CH<sub>4</sub> Factors.


## OUTPUT SETTINGS




Output Settings
F1 Programmable Analogs
F2 Programmable Digitals

**NOTE:** The Output Settings menu allows the operator to change the analyzer's Programmable Analog and Programmable Digital outputs to suit the operator's needs.

The Output Settings menu is accessed by pressing  from the Setup menu.

Press  to see the Programmable Analogs menu, which allows the operator to view or change the analog Output Assignments, Output Scaling or make Output Adjustments.

Press  to see the Programmable Digitals menu, which allows the operator to view or change the digital Output Assignments, choose Output Hold or Clear, or conduct an Output Test.



Programmable Analogs
F1 <b>Output Assignments</b>
F2 Output Scaling
F3 Output Adjustments

**NOTE:** The Programmable Analogs menu provides access to the following Setup parameters: Output Assignments, Output Scaling and Output Adjustments.

The Programmable Analogs menu is accessed by pressing **F1\_1** from the Output Settings menu.

Press **F1\_1** to view or reassign the four programmable analog output signals.

Press **F2\_2** to view or set the output scaling of programmable analog output signals.

Press **F3\_3** to set or adjust the analog outputs. The operator can set the output to either current or voltage, and calibrate the outputs to exactly match the results obtained on a PLC or other remote data-recording device.

## OUTPUT ASSIGNMENTS



Output Assignments	
Output	Signal
AO-1	RealTime
AO-2	RealTime
AO-3	RealTime
AO-4	RealTime
F1 SAVE	

**NOTE:** The Output Assignments screen allows the operator to view or change the signals assigned to the programmable analog outputs.

From the Programmable Analogs menu press to access the Output Assignments screen.

Use the Up/Down arrows to highlight the field you intend to change. Press Enter to open the field and use the Up/Down arrows to change it to the desired signal. Press Enter again to close the field. Press to save your changes.

### NOTES:

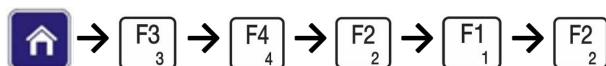
1. Analog Output 1 (for example) is listed as AO-1 in the Output column.
2. For information on analog output connections see [Analog and Digital Interface](#).

**The following output signals can be programmed by the operator using the Output Assignments screen:**

Output Signals	Description
<b>RealTime</b>	In either THC or CH <sub>4</sub> mode the concentration's output will be a live reading.
<b>CH<sub>4</sub></b>	In CH <sub>4</sub> mode the output concentration will be a live reading. In THC/CH <sub>4</sub> /NMHC mode the output will be a read and hold.

<b>THC</b>	In THC mode the concentration's output will be a live reading. In THC/CH <sub>4</sub> /NMHC mode the output will be a read and hold.
<b>NMHC</b>	The calculated concentration's output will be updated after each complete cycle in THC/CH <sub>4</sub> /NMHC mode.
<b>SamplePres</b>	Sample pressure (psig).
<b>AirPres</b>	Air pressure (psig).
<b>FuelPres</b>	Fuel Pressure.
<b>AirInjPres</b>	Air Inject Pressure.
<b>FuelInjPres</b>	Fuel Inject Pressure.
<b>FilterTemp</b>	Filter temperature (°C).
<b>BurnerTemp</b>	Burner temperature (°C).
<b>OvenTemp</b>	Oven temperature (°C).
<b>CutterTemp</b>	Non-CH <sub>4</sub> Cutter temperature (°C).
<b>PumpTemp</b>	Internal pump temperature (°C).
<b>Sample EPC</b>	% of voltage supplied to the Sample electronic proportioning control valve.
<b>AirEPC</b>	% of voltage supplied to the Air electronic proportioning control valve.
<b>FuelEPC</b>	% of voltage supplied to the Fuel electronic proportioning control valve.
<b>AirInjEPC</b>	% of voltage supplied to the Air inject electronic proportioning control valve.

## OUTPUT SCALING




Output Scaling		
**Default scaling use 0.00**		
Output	Lower	Upper
AO-1	0.00	0.00
AO-2	0.00	0.00
AO-3	0.00	0.00
AO-4	0.00	0.00
F1 SAVE		



**NOTE:** The Output Scaling screen allows the operator to scale the analyzer's Analog Outputs to a specific value for each of the four output signals.

This is generally used for scaling of temperatures or pressures, but it can also be used to set an output for a specific concentration. From the Programmable Analogs menu press

 to access the Output Scaling screen.

Use the Up/Down arrows   to highlight the field you intend to change. Press

Enter  to open the field to change the value. After making your change, press Enter

 again to close the field. Press  to save your changes and return to the Programmable Analogs menu.

### NOTES:

- Analog Output 1 is indicated as AO-1 in the Output column.
- 0 to 10 VDC output is used for the following three examples:

### EXAMPLES:

1. When the analog [Output Assignment](#) is set for Burner Temperature and the lower setting is set to 0.00 and the upper setting is set to 1000, 375°C will = 3.75 VDC.



2. When the analog [Output Assignments](#) are set for concentrations and the default upper and lower settings are 0.00 and 0.00, the default settings allow the output voltage to follow the range limits.

**Example:** If Range 1 is set to 10 ppm and Range 2 is 100 ppm, in Range 1 10 ppm will = 10 VDC and in Range 2 100 ppm will = 10 VDC.

3. When the analog [Output Assignment](#) is set for concentrations and the lower setting is set to 0.00 and the upper setting is set to 10.00, the output will no longer follow the range limit and will be locked to 10 ppm.

**Example:** If Range 1 is set to 10 ppm and Range 2 is 100 ppm, in Range 1 10 ppm will = 10 VDC and in Range 2 10 ppm will = 10 VDC.

## OUTPUT ADJUSTMENTS







Output Adjustments			
Output Type...			100
Output	%FS	Offset	Gain
AO-1	Meas	0.8303	0.8297
AO-2	Meas	0.8324	0.8293
AO-3	Meas	0.8253	0.8225
AO-4	Meas	0.8275	0.8235
F1 SAVE			








**NOTE:** The Output Adjustments screen allows the operator to set the output to either mA or voltage and calibrate the outputs to exactly match the results obtained on a PLC or other remote data-recording device.




Using the Output Adjustments screen, the operator can force the analog outputs to 0%, 50% or 100% of full scale and back to Measure. For information on analog output connections see [Analog and Digital Interface](#).





From the Programmable Analogs menu press F3  
3 to access the Output Adjustments screen.


Output Adjustment	Description
<b>Output Type</b>	Can be set for mA or 1, 5 or 10 VDC
<b>Output AO-1</b>	Refers to analog output 1
<b>% FS</b>	Used to toggle between Measurement, 0%, 50% and 100% Full scale.
<b>Offset</b>	Or Zero is used to adjust the output at 0%.
<b>Gain</b>	Or Span is used to adjust the output at 100%.

To select the **Output Type** press Enter  to open the highlighted field. Use the Up/Down arrows   to make your selection. Press Enter  again to close the field.

Once the output type has been selected, use the Left/Right arrows   to move the highlight into the % FS column of the output to be checked. Press Enter  until the % FS value reads 0.000. To adjust the zero (Offset), use the Left/Right arrows   to highlight the Offset column and press Enter  to open the field. Make a small adjustment to the Offset value and then press Enter  to close the field. Repeat this procedure as necessary.

To adjust the output to Full Scale, use the Left/Right arrows   to move the highlight into the % FS column and press Enter  until the % FS column value reads 100.0.

Then use the Left/Right arrows   to highlight the Gain column. Press Enter  to open the field. Make a small adjustment and press Enter  again to close the field and check the output. Repeat this procedure as necessary for other outputs.

When you are finished making all your changes press  to save them. You will return to the Programmable Analogs menu.

**NOTE:** *Failure to save your adjustments will result in the numbers reverting back to the defaults after power is turned off and back on.*

The following table includes typical Programmable Analog Output values:

OUTPUT	OFFSET	GAIN
0-20 mA	0.000	0.828


4-20 mA	1.658	0.662
0-1 V	0.828	0.828
0-5 V	0.828	0.828
0-10 V	0.828	0.828

## PROGRAMMABLE DIGITALS





Programmable Digitals	
F1	Output Assignments
F2	Output Hold/Clear... Clear
F3	Output Test

**NOTE:** The Programmable Digitals menu provides access to the analyzer's digital outputs for viewing and changing Output Assignments, holding or clearing alarms, and testing the outputs.


The Programmable Digitals menu is accessed by pressing  from the Output Settings menu.

From the Programmable Digitals menu:

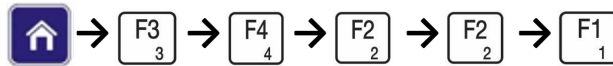
Press  to assign any of the 15 programmable digital outputs to a specific alarm or status.

Press  to set the programmable digital alarms to hold or clear after the alarm is gone.

The current Output Hold/Clear status is shown on the right side of the Programmable Digitals screen after the (...). **Example: Output Hold/Clear. . . Clear.**

Press  to access the Output Test screen.

## OUTPUT ASSIGNMENTS



Output Assignments			
**15 programmable outputs**			
1	Off	2	Off
3	Off	4	Off
5	Off	6	Off
7	Off	8	Off
9	Off	10	Off
11	Off	12	Off
13	Off	14	Off
15	Off		
F1 SAVE			

**NOTE:** The Output Assignments screen allows the operator to assign any of the 15 programmable digital outputs to a specific alarm or status.

From the Programmable Digitals menu press to access the Output Assignments screen.

Use the left and right arrow buttons to highlight the field you intend to change.

Press Enter to open the field and use the up or down arrow button to change the signal. Press Enter again to close the field. Press to save your changes.

### NOTES:

1. For information on digital output connections see [Analog and Digital Interface](#).
2. Alarms go open when present and statuses go closed when alarms are active.
3. See the following tables for a list of Alarms and Statuses:

## Alarms

- **Flame:** No Flame
- **SampP:** Sample Pressure
- **AirP:** Air Pressure
- **FuelP:** Fuel Pressure
- **AinjP:** Air Inject Pressure
- **FinjP:** Fuel Inject Pressure
- **FiltT:** Filter Temperature
- **BurnT:** Burner Temperature
- **OvenT:** Oven Temperature
- **CuttT:** Cutter Temperature
- **PumpT:** Pump Temperature
- **SEPC:** Sample EPC Voltage
- **AEPC:** Air EPC Voltage
- **FEPC:** Fuel EPC Voltage
- **AIPEC:** Air Inject EPC Voltage
- **FIEPC:** Fuel Inject EPC Voltage
- **ROvr :** Over Range
- **AOvr:** ADC Over Range
- **AUnd:** ADC Under Range
- **R1NC:** Range 1 not calibrated
- **R2NC:** Range 2 not calibrated
- **R3NC:** Range 3 not calibrated
- **R4NC:** Range 4 not calibrated
- **Conc1:** Concentration Alarm 1
- **Conc2:** Concentration Alarm 2
- **GenAlarm:** General Alarm
- **Cal Alarm:** Calibration Alarm

## Statuses

- **Zero:** In Zero Mode
- **Span:** In Span Mode
- **Sample:** In Sample Mode
- **InTHC:** In THC Mode
- **InCH4:** In CH<sub>4</sub> Mode
- **InOflow:** In Wet Mode
- **InPurge:** In Purge
- **Dual:** In THC/CH<sub>4</sub>/NMHC Mode
- **InRem:** In Remote
- **AutoR:** In Auto Range
- **R1:** In Range 1
- **R2:** In Range 2
- **R3:** In Range 3
- **R4:** In Range 4
- **InCal:** In Calibration Mod

## **General Alarms**

- **Sample Pressure**
- **Air Pressure**
- **Fuel Pressure**
- **Air Inject Pressure**
- **Fuel Inject Pressure**
- **Oven Temperature**
- **Cutter Temperature**
- **Pump Temperature**
- **Filter Temperature**
- **Sample EPC Voltage**
- **Air EPC Coil Voltage**
- **Fuel EPC Coil Voltage**
- **Air Inject EPC Coil Voltage**
- **Fuel Inject EPC Coil Voltage**
- **ADC Over Range**
- **ADC Under Range**



## OUTPUT HOLD/CLEAR



Output Hold/Clear	Clear
F1 Hold Outputs	
F2 Clear Outputs	

**NOTE:** The Output Hold/Clear menu allows the operator to choose whether to hold or clear a triggered alarm when the alarm is no longer present.

The current status is shown in the upper-right corner of the Output Hold/Clear menu. The Output Hold/Clear menu is accessed by pressing from the Programmable Digitals menu.

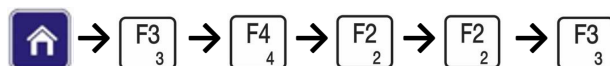
Press to hold programmed alarm outputs until they are manually cleared.

Press to set the outputs to automatically clear when alarms are no longer present.

### NOTES:

- To manually clear held alarms, press from this menu. An output alarm cannot be cleared until the alarm is back within its limits.
- Once the outputs are cleared, the outputs will not hold on alarms until they are set back to Hold.

## OUTPUT TEST







Output Test			
**Must reboot after testing**			
1	Open	2	Open
3	Open	4	Open
5	Open	6	Open
7	Open	8	Open
9	Open	10	Open
11	Open	12	Open
13	Open	14	Open
15	Open		
F1 ALL			



**NOTE:** The Output Test Screen allows the operator to test the Programmable Digital Outputs to make sure they are functioning properly.

The Output Test Screen is accessed by pressing **F3<sub>3</sub>** from the Programmable Digitals menu. The Output Test Warning screen (shown below) first appears, asking if you wish to continue the output test. If you proceed with the test, you **must** reboot the analyzer to exit the output test.

Output Test	
<b>**WARNING**</b>	
Going into the Output Test will require you to REBOOT the analyzer after you are done testing the outputs	
Would you like to continue?	
F1	Yes
F2	No

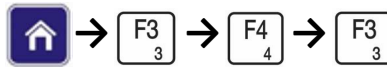
To exit the Output Test screen and proceed with normal operation press **F2<sub>2</sub>**. To continue to the Output Test screen press **F1<sub>1</sub>**. For information on output connections see [Analog and Digital Interface](#).

To test outputs one at a time, use the Up/Down arrows   to highlight the desired output, then press Enter  to change the state of the output (open or closed). Press Enter  again to change the state back.

To test all the outputs at once, press  to change the state of all the outputs (they are all Open in the example). Press  again to change all the output states back.

Upon completion of the test, you will be required to reboot the analyzer to resume operation.

## TCP/IP PARAMETERS



TCP/IP Parameters	
**Must REBOOT after saving**	
HWaddress	00.E0.4B.1A.FA.B0
IP-address	192.168.002.092
Netmask	255.255.255.000
Port	7700
Gateway	000.000.000.000
WinIfPort	2000
F1 SAVE	

**NOTE:** The TCP/IP Parameters screen is used for setting up the parameters for communication between an analyzer and computer.

The TCP/IP Parameters screen is accessed by pressing from the Setup menu.

**TCP (Transmission Control Protocol)** is a standard protocol for sending information between devices connected to a computer network. It includes a format of packets, also called datagrams.

**IP (Internet Protocol)** specifies the addressing scheme. Most networks combine IP with TCP, establishing a virtual connection between destination and source.

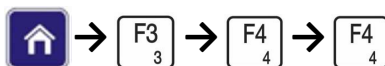
The **IP-address**, **Netmask** and **Gateway** may be defined by the user. The Port and WinIfPort are assigned 7700 and 2000 by SERVOMEX and should not be changed unless required for a certain location.

Use the Up/Down arrows to move the highlight to the setting you wish to change.

Press Enter to open the field to change the value. After making your change, press Enter


again to close the field. Press to save your changes and return to the Setup menu. The new settings will take effect after the analyzer is rebooted.




## DATA LOGGING TIME




```
Data Logging Time
There are 16 user timed data
log files.
Each holds 1800 data lines.
The minimum time is 1 second.
At 1 Sec. each file holds
30 minutes of snapshot data.
Logging Interval 0=Off... 0
F1 SAVE
```

**NOTE:** Data logging allows the analyzer to store internal variables to support SERVOMEX troubleshooting.

When troubleshooting with SERVOMEX Technical Support, the operator may be asked to turn this feature on. These files can only be accessed by SERVOMEX. To access the Data Logging screen, press  from the Setup menu.

To turn Data Logging on press Enter  to open the field, then change the Logging Interval from 0 to the desired time (in seconds). After making your change, press Enter  again to close the field. Press  to save your change and return to the Setup menu.

To turn Data Logging off, change the interval to 0 and press  to save.

## AUTO START SETTINGS



Auto Start Settings	
Auto Startup	On
Wait for [min]	1
Calibrations	00
Startrange	00
Access Level	2
Remote/Manual	Manual
THC/CH <sub>4</sub> -Mode	THC
F1 SAVE	

**NOTE:** The Auto Start Settings screen allows the operator to set parameters that will take effect upon power up of the analyzer.

The Auto Start Settings screen is accessed by pressing from the Setup menu.

If the Auto Startup function is turned off, the analyzer will boot up with the same settings the analyzer was last in. The operator can set the following parameters:

Parameters	Functional Setting
<b>Auto Startup</b>	Turn the Auto Startup function on or off.
<b>Wait for (min)</b>	Allow for the time it takes for the analyzer to warm up before calibration.
<b>Calibrations</b>	Set the number of calibrations the analyzer will perform
<b>Start Range</b>	Specify the range to set upon Power Up.
<b>Access Level</b>	Select the Operator Security Level.
<b>Remote/Manual</b>	Set whether the analyzer starts up in Remote or Manual mode.
<b>THC/CH<sub>4</sub> Mode</b>	Select the mode the analyzer starts up in; THC, CH <sub>4</sub> or THC/CH <sub>4</sub> /NMHC mode.

.To change a setting, use the Up/Down arrows to move the highlight to the setting

you wish to change. Press Enter to open the field to change the value. After making your


change, press Enter again to close the field. Press to save your changes and return to the Setup menu.






## CLOCK SETTINGS



Clock	
**Current System Time** Sat Jun 07 10:51:31 2013	
Change Time and Date	
Week day	Tue
Date (mm.dd.yy)	Jun 07 2013
Time (HH:MM:SS)	10:49:08
F1 SAVE	

**NOTE:** The Clock Settings screen allows the operator to set the analyzer's internal clock.

The internal clock is used for auto calibrations and data time stamping. The Clock Settings screen is accessed by pressing  from the Setup menu.

To change a setting, use the Up/Down arrows   to move the highlight to the setting you wish to change. Press Enter  to open the field to change the value. After making your change, press Enter  again to close the field. Press  to save your changes and return to the Setup menu.


## ALARMS MENU





Alarms
F1 Current Alarms
F2 Alarm Log
F3 Alarm Limits
F4 Alarm Display On/Off... On


**NOTE:** *The Alarms menu allows the operator to view Current Alarms, the Alarm Log and settable Alarm Limits.*

From the Menus screen press  to access the Alarms menu.

Press  to access the Current Alarms screen and view the alarms that are currently active.

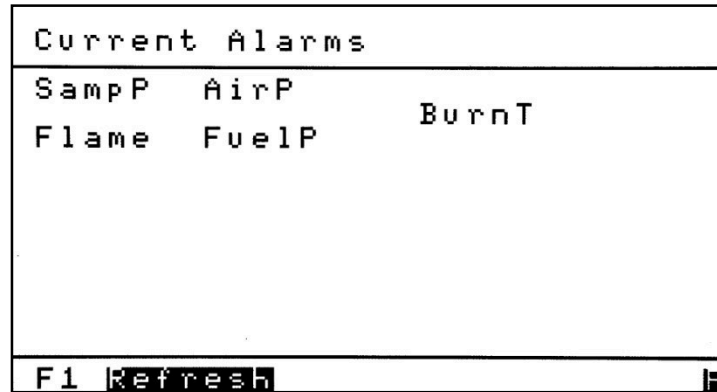
Press  to access the Alarm Log. The operator can view a log of the last 40 alarms.

Press  to access the Alarm Limits menu. The operator can view or change the existing alarm limits.


Press  to turn On or Off the display of the active alarms that scroll across the bottom of the Measure screen. The current setting is shown on the Alarms menu on the right side of the screen after the (...). **Example: Alarm Display. . . On.**



## CURRENT ALARMS



**NOTE:** *The Current Alarms screen allows the operator to view the analyzer's current alarms at the time this screen was accessed.*

To access the Current Alarms screen press  from the Alarms menu.

Press  to refresh this screen. (This screen does not auto refresh.)

## Current Alarm Abbreviations

**Flame:** No Flame

**FEPC:** Fuel EPC Voltage

**SampP:** Sample Pressure

**AIEPC:** Air Inject EPC Voltage

**AirP:** Air Pressure

**FIEPC:** Fuel Inject EPC Voltage

**AInjP:** Air Inject Pressure

**ROvr:** Over Range

**FuelP:** Fuel Pressure

**AUnd:** ADC Under Range

**FInjP:** Fuel Inject Pressure

**AOvr:** ADC Over Range

**OvenT:** Oven Temperature

**R1NC:** Range 1 not calibrated

**PumpT:** Pump Temperature

**R2NC:** Range 2 not calibrated

**BurnT:** Burner Temperature

**R3NC:** Range 3 not calibrated

**FiltT:** Filter Temperature

**R4NC:** Range 4 not calibrated

**CuttT:** Cutter Temperature

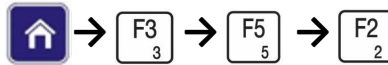
### Conc1: Concentration Alarm 1

**SEPC:** Sample EPC Voltage

**Conc2:** Concentration Alarm 2

**AEPC:** Air EPC Voltage

## ALARM LOG



Screen Name			Alarm Abbreviation			Alarm Status		
Year / Month / Day			Hour / Minute		Alarm Value			
Alarm Log								
Yr	Mon	Da	Hr	Mn	Ala	rm	Val	St
13	Jun	07	10	27	SEPCU	4.000	OFF	
13	Jun	07	10	27	AEPCU	4.500	OFF	
13	Jun	07	10	27	RC P	0.000	OFF	
13	Jun	07	10	27	LoConc	0.100	OFF	
13	Jun	07	10	27	HiConc	0.100	OFF	
13	Jun	07	10	26	SPres	3.847	ON	
13	Jun	07	10	26	APres	14.98	ON	
13	Jun	07	10	26	Ovent	85.00	ON	
F1 Next Page			F2			BACK		

**NOTE:** The Alarm Log allows the operator to view the analyzer's last 40 alarms and their current statuses.

Press to access the Alarm Log screen from the Alarms menu.

Press to view the next page.

Press to return to the previous screen.

## Alarm Abbreviations and Descriptions

**Flame:** No Flame

**SampP:** Sample Pressure

**AirP:** Air Pressure

**AInjP:** Air Inject Pressure

**FuelP:** Fuel Pressure

**FInjP:** Fuel Inject Pressure

**OvenT:** Oven Temperature

**PumpT:** Pump Temperature

**BurnT:** Burner Temperature

**FiltT:** Filter Temperature

**CuttT:** Cutter Temperature

**SEPC:** Sample EPC Voltage

**AEPC:** Air EPC Voltage

**FEPC:** Fuel EPC Voltage

**AIPEC:** Air Inject EPC Voltage

**FIEPC:** Fuel Inject EPC Voltage

**ROvr:** Over Range

**AUnd:** ADC Under Range

**AOvr:** ADC Over Range

**R1NC:** Range 1 not calibrated

**R2NC:** Range 2 not calibrated

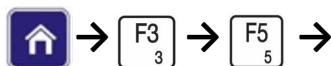
**R3NC:** Range 3 not calibrated

**R4NC:** Range 4 not calibrated

**Conc1:** Concentration Alarm 1

**Conc2:** Concentration Alarm 2

## ALARM LIMITS





Alarm Limits
F1 Temperatures
F2 Pressures
C Voltages
F4 Concentrations


**NOTE:** The Alarm Limits menu allows the operator to view or change the current upper and lower alarm tolerances.


When the signals go above or lower than the assigned limit an alarm is triggered. To access the

Alarm Limits menu, press  from the Alarms menu.

Press  to access the Temperatures screen. It allows the operator to set the upper and lower temperature alarm limits.

Press  to access the Pressures screen. It allows operator to set the upper and lower alarm limits for sample and air pressure.

Press  to access the EPC % screen. It allows the operator to view or change the existing alarm limits of EPC voltage being supplied to the EPC valve.

Press  to access the Concentration Alarms screen. It allows the operator to view or change the upper and lower gas concentration alarm limits.

## TEMPERATURES



Temperature [°C]		
Alarms	LoLimit	HiLimit
Burner	250.00	750.00
Oven	180.00	200.00
Filter	180.00	200.00
Pump	180.00	200.00
F1 SAVE		

From the Alarm Limits menu, press to access the Temperatures screen. Use the left or right arrow to highlight the alarm limit you wish to change. Press Enter to open the field to change the value. After making a change, press Enter again to close the field. Press to save your changes.

## PRESSURES



Pressure [PSIG]		
Alarms	LoLimit	HiLimit
Sample	1.35	1.65
Air	6.70	7.30
Fuel	7.70	8.30
F1 SAVE		

From the Alarm Limits menu, press **F2<sub>2</sub>** to access the Pressures screen. Use the left or right arrow **◀ ▶** to highlight the alarm limit you intend to change. Press Enter **↵** to open the field to change the value. After making a change, press Enter **↵** again to close the field. Press **F1<sub>1</sub>** to save your changes.

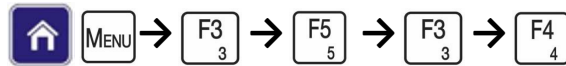
## EPC VOLTAGES



EPC [%]		
Alarms	LoLimit	HiLimit
Sample	10	90
Air	10	90
Fuel	10	90
A inj	-10	90
F inj	10	90
F1 SAVE		

From the Alarm Limits menu, press **F3<sub>3</sub>** to access the EPC Voltage Alarm Limits screen. Use the left or right arrow **◀ ▶** to highlight the alarm limit you intend to change. Press Enter **↵** to open the field to change the value. After making a change, press Enter **↵** again to close the field. Press **F1<sub>1</sub>** to save your changes.

## CONCENTRATIONS



Concentration Alarms [ppm]				
Alarms		Limit	Type	
Conc	1	30000.00	Hi	Lo/Hi
Conc	2	30000.00	Hi	Lo/Hi
F1 SAVE				

**NOTE:** Concentration alarms can be set to trigger an alarm below or above a specified concentration.

From the Alarm Limits menu, press to access the Concentration Alarm Limits screen.

From the Alarm Limits menu, press to access the Concentration Alarm Limits screen.

Use the left or right arrow to highlight the concentration alarm limit you intend to

change. Press Enter to open the field to change the value. After making a change, press

Enter again to close the field. After the concentration limit is set, specify whether the

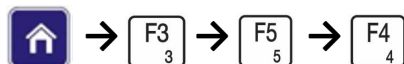
alarm will be set for a High or Low alarm. Use the left or right arrow to highlight the

alarm type (High or Low). Press Enter to toggle between Hi or Lo. Press to save your changes.

To set the alarm to a digital output, see Programmable Digitals [Output Assignments](#).



## ALARM DISPLAY ON/OFF



Alarm Display On/Off	On
F1 Turn Alarm Display On	
F2 Turn Alarm Display Off	

**NOTE:** The Alarm Display On/Off menu allows the operator to turn On or Off the Alarm Display that scrolls across the bottom of the Measure screen.

Programmed digital output alarms will not be affected by this setting; only the display will be turned off. The scrolling alarms will be replaced with the SERVOMEX phone number when an alarm is active. If there are no alarms, only the date and time will be displayed.

Press from the Alarms Menu to access this menu. The current setting is shown in the upper-right corner of the Alarm Display menu. (In the above example, On.)

From the Alarm Display On/Off menu:

Press to turn the Alarm Display On.


Press to turn the Alarm Display Off.


## SERVICE MENU




Service
F1 Linear Coefficients
F2 Factory Service

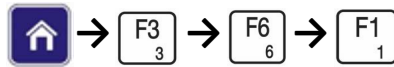
**NOTE:** *The Service Menu is for advanced operators and SERVOMEX Service.*

The Service menu provides access to operator-level linear coefficients and SERVOMEX factory service. From the Menu screen press  to access the Service menu.

Press  to view or change operator-level linear coefficients.


Press  to access Factory Service menus. **For SERVOMEX use only.**

## LINEAR COEFFICIENTS




Linear Coefficients	
F1	Range 1
F2	Range 2
F3	Range 3
F4	Range 4

**NOTE:** The Linear Coefficients function allows the operator to optimize linearity by inputting up to five coefficients for each range to generate up to a fourth-order curve.










From the Service menu press  to access the Linear Coefficients screen.

### NOTES:

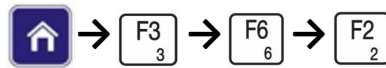
- Changing linear coefficients can compromise the analyzer's accuracy and ability to function properly.
- To reset Factory Coefficients see Reset Factory Settings.

Select the corresponding function key for the range you wish to edit. In the example,  was pressed to allow the Range 1 Linear Coefficient to be changed.

Range 1	
a0	0.000000e+00
a1	1.000000e+00
a2	0.000000e+00
a3	0.000000e+00
a4	0.000000e+00
F1 SAVE	

Use the Up/Down arrows   to highlight the coefficient you intend to change. Press Enter  to open the field, use the left and right arrow buttons   to position the cursor, and use the Up/Down arrows   or number keys to make your change. Press Enter  again to close the field. Press  to save your changes.

## FACTORY SERVICE



Unauthorized Access
**Current Level 2**
Current level does not allow You to change Settings.
F1 to Change Level

**NOTE:** *The Factory Service menus can only be accessed by Servomex.*

The best way to contact SERVOMEX with a support question is contact the regional support at <http://www.servomex.com/locations/>.


## SECURITY





Security
F1 Operator Levels
F2 Change Password
F3 Reset Password

**NOTE:** The Security menu allows the operator to change the access to Standard or Setup Function menus and change or reset the Setup Function password.

From the Menus screen press  to access the Security menu.

Press  to set the operator's access level. The Operator Levels menu allows the operator to choose either Standard Functions or advanced Setup Functions.

Press  to change the password that allows the operator access to the Setup Functions menu.


Press  to enter the master password that resets the Setup Functions password to the original factory setting.


## OPERATOR LEVELS





Operator Levels
F1 <b>Standard Functions</b>
F2 Setup Functions
F3 Factory Functions

**NOTE:** The SERVOPRO HFID has three operator access levels which allow the operator to access different analyzer functions.

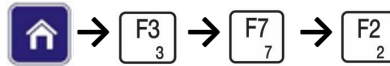
From the Security Menu screen press  to access the Operator Levels screen. See [Menu Flow Chart](#) for security levels and functions.

Press  to set the operator level to Standard Functions for basic operation and calibration. No password is required.

Press  to set the operator level to Setup Functions for advanced operators. This allows the operator access to all Standard Functions, Setup Functions and Parameters. Setup Functions requires the operator to enter the password “222.” The analyzer will remain in this level until the operator changes it.

 Factory Functions is for SERVOMEX use only.

## CHANGE PASSWORD





Change Password	
Standard Functions	111
Setup Functions	222
F1 SAVE	

**NOTE:** The Change Password screen allows the operator to change the Setup Functions password from the factory-preset **222** to a new password.

From the Security menu screen press  to access the Operator Levels screen.

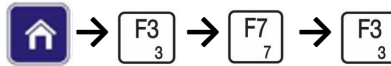
To change the password, press Enter  to open the field.

Enter a new 3-digit password. Press Enter  again to close the field.

Press  to save the new password.





## RESET PASSWORD





**NOTE:** *The Reset Password screen allows the operator to reset the Setup Password to the original factory password (222).*

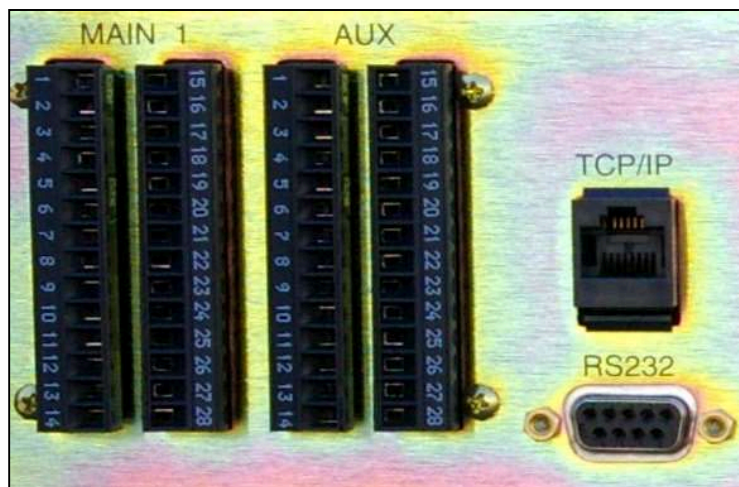
From the Security menu screen press  to access the Reset Password screen.

To return the password to the original factory password, you must enter **WIZARD** in the field.

Press Enter  to open the field and bring up a cursor. Use the Up arrow  to scroll to **W**.

Use the Right arrow  to move to the next letter and scroll to **I** and so on.

Repeat this procedure until you have finished entering **WIZARD**. Press Enter  and the password for the Setup functions will be reset to **222**.



### Analog and Digital Interface

The Main and Auxiliary connectors provide the analog outputs for concentrations and other variable signals. Digital Status outputs, Control inputs and Calibration drive signals are also provided. There are four analog outputs, whose type (mA or specific voltage range) and signal assignments are assignable from the Setup menu. See the following tables for pin numbers and functions.

### Serial Interface

The 9-pin Serial Interface connector provides RS-232 remote control and data access to the analyzer via the AK protocol.

### Network Port

The TCP/IP port allows the analyzer to be accessed via a network connection. The analyzer requires a static IP address that is settable from the Setup menu. Either AK or Modbus protocol can be used to access the analyzer remotely.

## Hardware Capabilities of Main and Aux Connectors

### ANALOG OUTPUT

The operator can choose one of the following output types:

- As voltage outputs – 0 to 1V, 5V or 10V
- As current outputs – 0 to 20 mA or 4 to 20 mA

When set as current outputs, the maximum drive voltage provided by the analyzer is slightly more than 20 Volts, requiring that the maximum loop resistance does not exceed 1,000 Ohms.

The Isolated Analog Ground (Main, Pin 1) is the only pin that should be used as the return line for the four analog outputs.

See [Programmable Analog Output Adjustments](#).

### DIGITAL OUTPUT

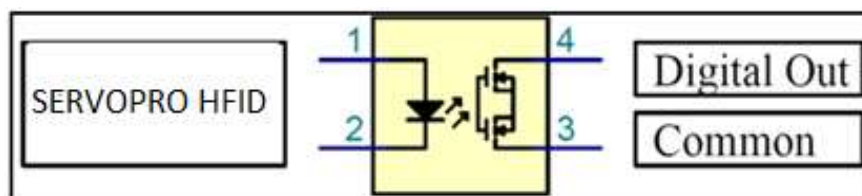
There are two types of digital outputs:

- **Static Digital Outputs** – Permanently assigned to often-needed functions. These are opto-isolated, solid-state Normally Open (NO) relays that connect to the Digital Ground (Main, Pin 6 and Pin 28).
- **Programmable Digital Outputs** – Have dedicated returns for each block of four outputs. Refer to the Aux Connector Pinout chart below to determine which pin is used for the corresponding Programmable Digital Output. When the output is programmed as a status it will close to indicate the function. When programmed as an alarm the output will open to indicate an alarm.

**NOTE:** All opto-isolated relays are rated for 48VDC, 0.5 Amp maximum. The user is required to limit the drive current supplied to each input. All inputs are DC only and will not operate on AC current.



**CAUTION:** Do not connect these pins directly to both sides of a voltage power supply as unrestricted current will damage the relay.



Example of digital output driver.

### DIGITAL INPUT

The analyzer's Digital Inputs are internally pulled up to 5VDC and are operated by user equipment connecting an input to the Digital Ground (Main, Pin 6). Note that some lines require only momentary operation, and some selection lines are intended to be held continuously.

### DVR

The calibration gas valve drivers are application-specific and intended for solenoid valve drive. 24VDC valves with a maximum wattage of 12 Watts should be used. The 24VDC used to operate the valves should be connected to the coils and the analyzer inputs when operating will pull the valve current to Digital Ground.

### 24VDC

The 24VDC output is intended for use with properly rated solenoid valves.



**CAUTION:** *Use of this output for other purposes can damage the analyzer.*

## ANALOG INPUT

The Analog Input is reserved for factory signals. **CAUTION:** Do not connect to this input or damage may occur.

### 28-Pin Main (BPM) Connector Assignments

Pin #	Signal	Signal Type	Operation
1	Isolated Analog Ground	Analog Output	Isolated Analog Ground
2	User-Defined AO-1	Analog Output	1V, 5V, 10VDC or mA
3	User-Defined AO-2	Analog Output	1V, 5V, 10VDC or mA
4	User-Defined AO-3	Analog Output	1V, 5V, 10VDC or mA
5	User-Defined AO-4	Analog Output	1V, 5V, 10VDC or mA
6	Digital Ground	Digital Ground	Digital Ground
7	Sense Auto Range	Digital Output	NO Relay to Digital Ground
8	Sense Range 1	Digital Output	NO Relay to Digital Ground
9	Sense Range 2	Digital Output	NO Relay to Digital Ground
10	Sense Range 3	Digital Output	NO Relay to Digital Ground
11	Sense Range 4	Digital Output	NO Relay to Digital Ground
12	Set Auto Range	Digital Input	Hold to Ground in Remote
13	Control Range 1	Digital Input	Hold to Ground in Remote
14	Control Range 2	Digital Input	Hold to Ground in Remote
15	Control Range 3	Digital Input	Hold to Ground in Remote
16	Control Range 4	Digital Input	Hold to Ground in Remote
17	Auto Cal	Digital Input	Momentary Hold to Ground
18	Calibrate	Digital Input	Momentary Hold to Ground
19	Zero	Digital Input	Momentary Hold to Ground
20	Span	Digital Input	Momentary Hold to Ground
21	Sample	Digital Input	Momentary Hold to Ground
22	Zero Gas Flow	Digital Output	DRV

23	Span Gas Flow	Digital Output	DRV
24	Zero	Digital Output	DRV
25	Local/Remote	Digital Output	NO Relay to Digital Ground
26	Read Cal Mode	Digital Output	NO Relay to Digital Ground
27	24 VDC	24 VDC	24 VDC
28	Digital Ground	Digital Ground	Digital Ground

### 28-Pin Auxiliary (BPA) Connector Assignments

Pin #	Signal	Signal Type	Operation
1	Analog Ground	Analog Input	Analog Ground
2	Reserved	Analog Input	Reserved
3	Reserved	Analog Input	Reserved
4	Reserved	Analog Input	Reserved
5	Relay RTN 1	Digital Output	RTN Relays 1 - 4
6	Relay RTN 2	Digital Output	RTN Relays 5 - 8
7	Relay RTN 3	Digital Output	RTN Relays 9 - 12
8	Relay RTN 4	Digital Output	RTN Relays 13 - 15
9	User-Defined NO Relay 1	Digital Output	Uses Relay RTN 1
10	User-Defined NO Relay 2	Digital Output	Uses Relay RTN 1
11	User-Defined NO Relay 3	Digital Output	Uses Relay RTN 1
12	User-Defined NO Relay 4	Digital Output	Uses Relay RTN 1
13	User-Defined NO Relay 5	Digital Output	Uses Relay RTN 2
14	User-Defined NO Relay 6	Digital Output	Uses Relay RTN 2
15	User-Defined NO Relay 7	Digital Output	Uses Relay RTN 2
16	User-Defined NO Relay 8	Digital Output	Uses Relay RTN 2
17	User-Defined NO Relay 9	Digital Output	Uses Relay RTN 3
18	User-Defined NO Relay 10	Digital Output	Uses Relay RTN 3
19	User-Defined NO Relay 11	Digital Output	Uses Relay RTN 3

20	User-Defined NO Relay 12	Digital Output	Uses Relay RTN 3
21	User-Defined NO Relay 13	Digital Output	Uses Relay RTN 4
22	Reserved	Reserved	Reserved
23	Start Ignition	Digital Input	Hold to Ground in Remote
24	THC/CH <sub>4</sub> /NMHC Mode	Digital Input	Hold to Ground in Remote
25	Set THC Mode	Digital Input	Hold to Ground in Remote
26	Set Remote	Digital Input	Hold to Ground
27	User-Defined NO Relay 14	Digital Output	Uses Relay RTN 4
28	User-Defined NO Relay 15	Digital Output	Uses Relay RTN 4

## SERIAL INTERFACE

The serial interface enables remote control of the analyzer by a master computer. It is implemented as an RS232 V24 interface and meets all requirements of the AK protocol. A 9-pin male connector at the back of the unit is used to connect a master computer with the following pin assignment:

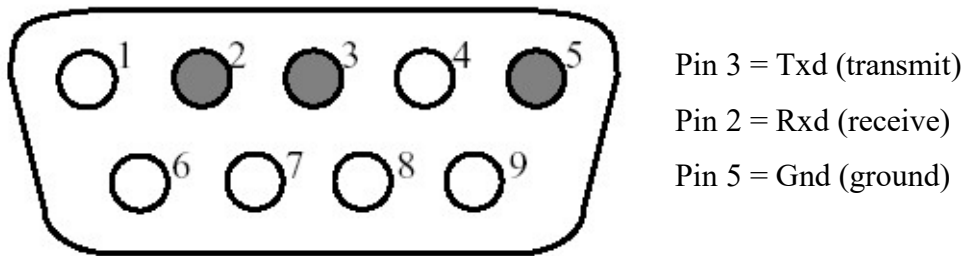


Figure 0-1 Serial Interface

### INTERFACE SPECIFICATIONS

Baud Rate:	9600, 4800, 2400, 1200, 600, 300 baud
Data Bits:	7 or 8
Stop Bit:	1 or 2
Don't Care:	1 byte, adjustable (e.g. 32)
Parity:	Even, odd, none
XON/XOFF:	Active or not active
Hand Shake:	No

### ETHERNET RJ47

If connecting directly to a computer (without using a hub or switch), a crossover cable is required.



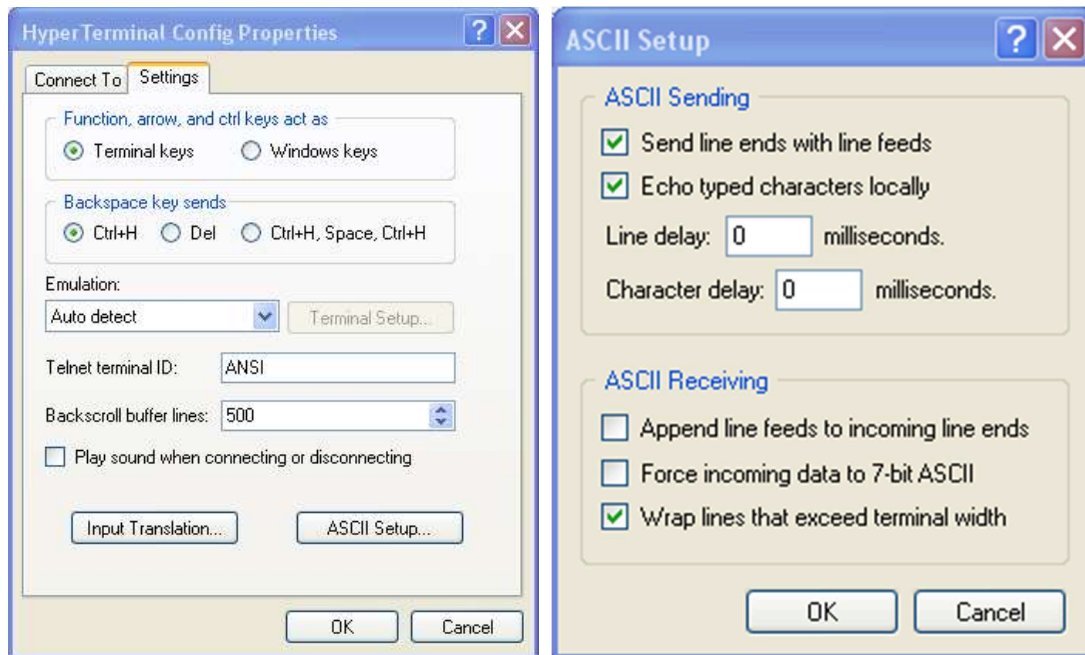
**Data Description**

Each command begins with STX (Start of Text) in the first byte. The “don’t care” byte can be any ASCII character. Generally, a blank space or an underscore ( \_ ) is used to increase readability. The four function bytes represent the AK command. A blank space comes next, followed by K and the channel number. The analyzer is a single-channel device, and because of that, the channel number is usually 0. For delimiting the command parameters from the channel number, another blank follows. This may be followed by command parameters with variable lengths. Every command ends with the ETX (End of Text) character. The Error Status byte does not indicate the real number of errors. For Error Status, use the ASTF command.

**Example:** Using Windows® HyperTerminal for Serial RS232 Communications with SERVOMEX 700 Series Analyzers requires:

1. HyperTerminal Software
2. Windows PC/Laptop
3. Null Modem Cable

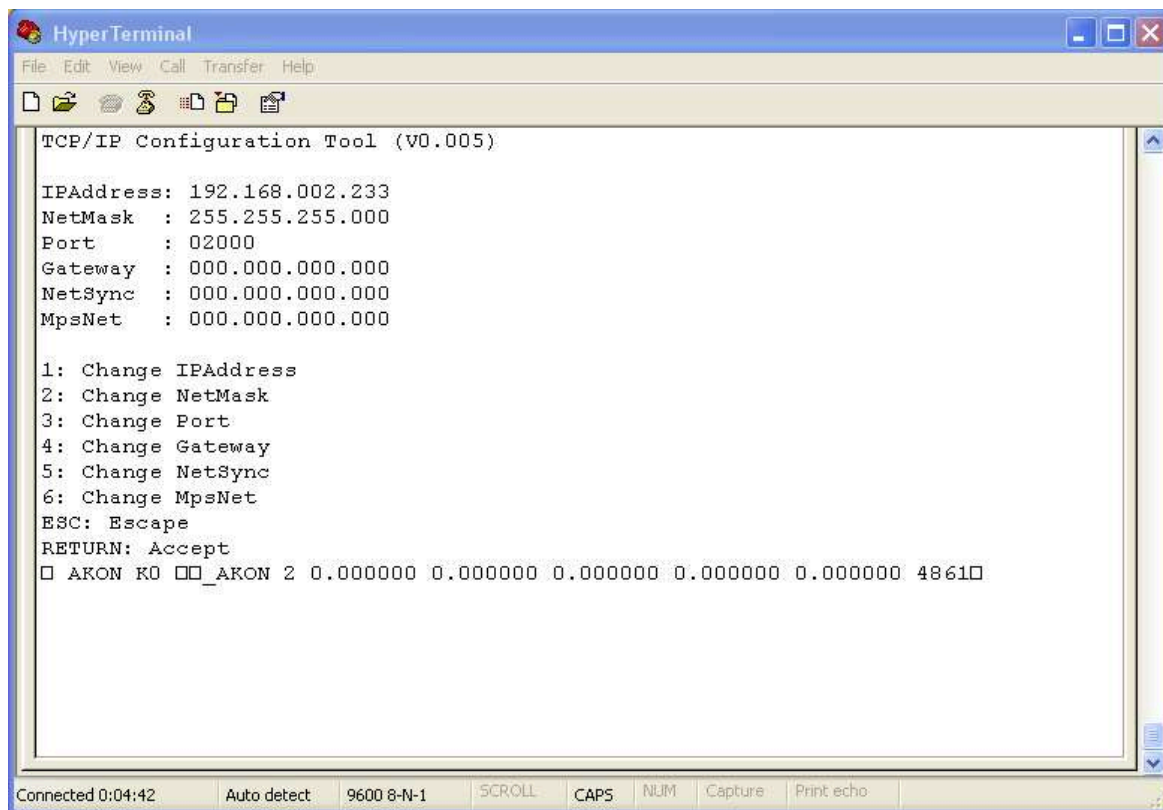
Setup Procedure: run HyperTerminal and configure as shown:



Other similar simple terminal programs should allow similar settings.

When both HyperTerminal and the analyzer are running while connected by the null modem cable, the analyzer will present a menu if sent a non-AK command. This menu can be ignored and AK commands will be acted on by the analyzer. The picture below shows a sequence with the AKON 0 command being sent to the analyzer.

Sending the analyzer characters not framed as AK commands should be prevented as the menu could recognize these characters and cause unplanned changes in configuration.



The AK command was typed into HyperTerminal using the following keystrokes:

Hit: Ctrl B (at the same time). This will start the text.

Hit: Ctrl Spacebar (at the same time).

Type: AKON (Function).

Hit: Spacebar.

Type: K0 (Channel #).

Hit: Spacebar.

Hit: Ctrl C (at the same time). This will end the text.

**NOTE:** *The analyzer will reply with numbers. If you receive ???? try the sequence again.*

## INSTRUCTION COMMAND

Byte	Character	Explanation
1 <sup>st</sup> Byte	STX	ASCII Code 02
2 <sup>nd</sup> Byte	Don't Care	Any ASCII code
3 <sup>rd</sup> Byte	Function Code 1	AK instruction, e.g. ASTF
4 <sup>th</sup> Byte	Function Code 2	AK instruction, e.g. ASTF
5 <sup>th</sup> Byte	Function Code 3	AK instruction, e.g. ASTF
6 <sup>th</sup> Byte	Function Code 4	AK instruction, e.g. ASTF
7 <sup>th</sup> Byte	Blank	
8 <sup>th</sup> Byte	K	
9 <sup>th</sup> Byte	0	
10 <sup>th</sup> Byte	Blank	
	D	AK instruction parameters; lengths variable
	A	AK instruction parameters; lengths variable
	T	AK instruction parameters; lengths variable
	A	AK instruction parameters; lengths variable
nth Byte	ETX	ASCII Code 03

### Example:

<STX>	02H Example: ASTZ K0
Don't Care	Any byte (default 20H)
Function Code	Code 4 bytes long (e.g. ASTZ)
Space 20H	20H
Channel N°	Always "K0" for the analyzer
Space	20H (only if followed by data, otherwise <ETX>)
Data	Data bytes (depending on the command)

<ETX>

03H

## ACKNOWLEDGEMENT COMMAND

Byte	Character	Explanation
1 <sup>st</sup> Byte	STX	ASCII Code 02
2 <sup>nd</sup> Byte	Don't Care	Any ASCII code
3 <sup>rd</sup> Byte	Function Code 1	Echo of the AK Instruction Command
4 <sup>th</sup> Byte	Function Code 2	Echo of the AK Instruction Command
5 <sup>th</sup> Byte	Function Code 3	Echo of the AK Instruction Command
6 <sup>th</sup> Byte	Function Code 4	Echo of the AK Instruction Command
7 <sup>th</sup> Byte	Blank	
8 <sup>th</sup> Byte	K	
9 <sup>th</sup> Byte	0	
10 <sup>th</sup> Byte	Blank	
	D	AK acknowledgement parameters; lengths variable
	A	AK acknowledgement parameters; lengths variable
	T	AK acknowledgement parameters; lengths variable
	A	AK acknowledgement parameters; lengths variable
nth Byte	ETX	ASCII Code 03

### Example:

<STX>	02H Example: STZ 0 SREM STBY
Don't Care	Adjustable, factory setting 20H
Function Code	Same code as command package (e.g. ASTZ)
Space	20H
Status	0 without error or 1 to 9 when error (see also ASTF command)
Space	20H (only if followed by data, otherwise <ETX>)
Data	Parameter (depending on the command)

<ETX>

03H

## ERROR HANDLING

It is possible that an unknown instruction is sent, the analyzer is busy with a function that is not the desired one, or an error occurred in the command parameters. The table below provides a summary of all errors that can appear upon any master instruction.

Analyzer's Acknowledgement	Explanation
???? f	Analyzer does not recognize the instruction sent.
xxxx f BS	Analyzer is busy with another function.
xxxx f SE	Syntax error within command parameters or incomplete command.
xxxx f NA	Requested function or data not available.
xxxx f DF	Data error: The kind or number of given parameters not valid.
xxxx f OF	Offline. The analyzer is offline, in local mode. Only inquiry commands and SREM (set analyzer in Remote Mode) are allowed.

### NOTES:

1. f is the Error Status byte.
2. xxxx is the function code of the command being sent.



## GENERAL AK REQUIREMENTS

1. If the command message contains no error, the Acknowledge message contains the echo of the Function code and the Error Status number (0 to 9).
2. If the transfer was faulty or the function code is unknown, the answer contains four question marks (for example, ??? 0).
3. If the displayed value is not valid, a # symbol is placed in front of the measured value (for example, AIKG 0 #9999).
4. If a control or adjusting command is sent via the serial interface while the device is in Manual mode, it sends an answer like SLIN 0 K0 OF.
5. If a channel does not exist, the answer for control and adjusting commands is, for example, ATEM 0 3 NA. 3 is the number of the sub channel.
6. If the device is busy with a running function (for example, SLIN), every arriving control command is ignored (except SRES and STBY), and the response message is e.g. SMAN 0 BS. If in the SINT mode an additional SINT KO command is received, the integrator is reset to 0 and the integration is restarted.
7. If the command message contains data that the device cannot process (for example, ESYZ K0 ABC), the response message is ESYZ 0 SE. A syntax error is recognized if the data does not match the expected format or if the parameters do not fit the expected size.
8. Numbers are in floating-point format with decimal point. The decimal point can be dropped for integers.
9. If you switch from Remote to Manual, the device will remain in Manual mode until a SREM K0 is received by the control computer. On the display, this mode is indicated by SREM (Remote Enable) on the Status line. In Manual mode, query commands via the serial interface are possible at any time.

## ABBREVIATIONS

Abbreviation	Description
Mn	Measuring Range Number
Mn .. M4	Measuring Range 1 .. 4
w.w .. ZZ.	Numerical Value
x	Number
t	Numeric Integer Value
a0 .. a4	Polynomial Coefficients
s	Status
Yyymmdd	Date of Format Year, Month and Day with 2 characters each and no spaces
Hhmmss	Time of Format Hour, Minute and Second with 2 characters each and no spaces

In general, AK commands are subdivided into three classes:

- Scan commands (Axxx)
- Control commands (Sxxx)
- Configuration commands (Exxx)

## SCAN COMMANDS

### AKON: Measured Concentration Value

Command	Response	Description
<b>_AKON_K0</b>	<b>_AKON_s_z.z_y.y_x.x_t</b>  SMAN	z.z : Current Measure Value  y.y : CH <sub>4</sub> concentration  x.x : NMHC concentration  w.w : THC concentration  <b>Note:</b> y.y, x.x, and w.w are normally 0.0 when “THC/CH <sub>4</sub> /NMHC” mode is not selected.  t = Timestamp (1/10 sec.).

### ARMU: Raw Engineering Value

Command	Response	Description
<b>_ARMU_K0</b>	<b>_ARMU_s_z.z_t</b>	Raw Engineering Value before linearization, offset and gain corrections for t = Timestamp (1/10 sec.). These are the values used to calculate the polynomial coefficients.

### ARAW: Raw Detector Volts

Command	Response	Description
<b>_ARAW_K0</b>	<b>_ARAW_s_z.z_t</b>	Raw Detector Volts  t = Timestamp (1/10 sec.)

### AEMB: Get Measuring Range

Command	Response	Description
<b>_AEMB_K0</b>	<b>_AEMB_s_Mn</b>	Current range n

### AMBE: Measuring Range Limit

Command	Response	Description
<b>_AMBE_K0</b>	_AEMB_s_M1_w.w _M2_x.x _M3_y.y _M4_z.z	All existing measuring range limits.

### AKAK: Calibration Gas Concentrations

Command	Response	Description
<b>_AKAK_K0</b>	_AKAK_s_M1_w.w _M2_x.x _M3_y.y _M4_z.z	All existing calibration gas values are responded.
<b>_AKAK_K0_Mn</b>	_AKAK_s_Mn_z.z	Calibration gas value of Range n.

### AMBU: Upper and Lower Range Switchover Values for Auto Range

Command	Response	Description
<b>_AMBU_K0</b>	_AMBU_s_M1_w.w_W.W _M2_x.x_X.X _M3_y.y_Y.Y _M4_z.z_Z.Z	Lower and upper range switchover value of auto range.

### ASTZ: Normal Device Status

Command	Response	Description
<b>_ASTZ_K0</b>	_ASTZ_s_K1_State 1_State 2_ . . State 4	Respond device status for all channels.

### Possible States

Possible States	Response	Description
State 1	SREM	Remote
	SMAN	Manual
State 2	STBY	Standby
	SPAU	Pause
	SMGA	Measuring gas
	SNGA	Zero gas
	SEGA	Span gas
	SATK SNGA	Zero gas during auto cal
	SATK SEGA	End gas during auto cal
	SSPL	Purging / Overflow
State 3	SHCG	THC mode
	SCH4	CH <sub>4</sub> mode
	STNM	THC/CH <sub>4</sub> /NMHC mode (THC)
	SMNM	THC/CH <sub>4</sub> /NMHC mode (CH <sub>4</sub> )
State 4	SARE	Auto range On
	SARA	Auto range Off

#### ASTF: Error Status

Command	Response	Description
_ASTF_K0	_ASTF_s_f1_f2_f3_...f26	Current error numbers of all are responded.

## ERROR NUMBERS AND DESCRIPTIONS

1	No Flame
2	Check Sample Pressure
3	Check Air Pressure
4	Check Fuel Pressure
5	Check Air Inject Pressure
6	Check Fuel Inject Pressure
7	Check Filter Temperature
8	Check Burner Temperature
9	Check Oven Temperature
10	Check Cutter Temperature
11	Check Pump Temperature
12	Check Sample EPC
13	Check Air EPC
14	Check Fuel EPC
15	Check Air Inject EPC
16	Check Fuel Inject EPC
17	Range Overflow
18	ADC Range Overflow
19	ADC Range Underflow
20	Range 1 Calibration Error
21	Range 2 Calibration Error
22	Range 3 Calibration Error
23	Range 4 Calibration Error
24	Concentration 1 Warning
25	Concentration 2 Warning

26	Dummy Text for RTC-Time
----	-------------------------

### AKEN: Device Identification

Command	Response	Description
<b>_AKEN_K0</b>	_AKEN_s_devicename	Device identification is responded.
<b>_AKEN_K1</b>	_AKEN_s_model	Device Model
<b>_AKEN_K2</b>	_AKEN_s_serial no	Device Serial Number
<b>_AKEN_K3</b>	_AKEN_s_Air pressure	Air Pressure
<b>_AKEN_K4</b>	_AKEN_s_Sample pressure	Sample Pressure
<b>_AKEN_K5</b>	_AKEN_s_Fuel pressure	Fuel pressure

### ATEM: Temperatures

Command	Response	Description
<b>_ATEM_K0</b>	_ATEM_s_z.z_y.y_x.x.....	<ol style="list-style-type: none"> <li>1. Filter Temperature</li> <li>2. Burner Temperature</li> <li>3. Oven Temperature</li> <li>4. Cutter Temperature</li> <li>5. Pump Temperature</li> </ol>
<b>_ATEM_K0_x</b>	_ATEM_S_xtemp	Temperature of x

### ADRU: Pressures / Electronic Pressure Control Valve Voltage in Percent

Command	Response	Description
<b>_ADRU_K0</b>	_ADRU_s_z.z_y.y_x.x.....	<ol style="list-style-type: none"> <li>1. Sample Pressure</li> <li>2. Air Pressure</li> <li>3. Fuel Pressure</li> <li>4. Air Inject Pressure</li> <li>5. Fuel Inject Pressure</li> </ol>

		6. % of Sample EPC Volts 7. % of Air EPC Volts 8. % of Fuel EPC Volts 9. % of Air Inject EPC Volts 10. % of Fuel Inject EPC Volts
<b>_ADRU_K0_x</b>	<b>_ADRU_S_xpress/x% voltage</b>	Reading of x

### ADUF: Flows

Command	Response	Description
<b>_ADUF_K0</b>	<b>_ADUF_s_z.z_y.y</b>	1. Sample Flow 2. Air Flow 3. Fuel Flow
<b>_ADUF_K0_x</b>	<b>_ADUF_S_xflow</b>	Flow of x

### AGRD: Polynomial Coefficients

Command	Response	Description
<b>_AGRD_K0_Mn</b>	<b>_AGRD_s_a0_a1_a2_a3_a4</b>	Polynomial coefficients of Channel m Range n

### AKAL: Percent Deviations of Last Accepted Calibration

Command	Response	Description
<b>_AKAL_K0_</b>	<b>_AKAL_s_M1_z.z_y.y_x.x_w.w</b> <b>_M2_z.z_y.y_x.x_w.w</b> <b>_M3_z.z_y.y_x.x_w.w</b> <b>_M4_z.z_y.y_x.x_w.w</b>	Percent Deviation of Ranges M1 to M4. z.z: Zero gas relative to last calibration y.y: Zero gas absolute to factory calibration x.x: Span gas relative to last calibration w.w: Span gas absolute to factory calibration

### AAOG: Applied Offsets and Gains



Command	Response	Description
_AAOG_K0_	_AAOG_s_M1_z.z_y.y _M2_z.z_y.y _M3_z.z_y.y _M4_z.z_y.y	Offset and Gain of Range M1 to M4.  z.z: Offset  yy: Gain

#### AANG: Verifying Zero-Point Deviation During Auto Calibration

Command	Response	Description
_AANG_K0	_AANG_s_M1_z.z_da_dr _M2_z.z_da_dr _M3_z.z_da_dr _M4_z.z_da_dr	Verifying deviations of Ranges M1 to M4 from zero point stored after auto calibration.  Values: measured value (z.z), absolute dev (da), relative dev (dr).

#### AAEG: Verifying Span-Point Deviation During Auto Calibration

Command	Response	Description
_AAEG_K0	_AAEG_s_M1_z.z_da_dr _M2_z.z_da_dr _M3_z.z_da_dr _M4_z.z_da_dr	Verifying deviations of Ranges M1 to M4 from span point stored after auto calibration.  Values: measured value (z.z), absolute dev (da), relative dev (dr).

#### AFDA: Auto Calibration Times and Purge Time

Command	Response	Description
_AFDA_K0_SATK	_AFDA_s_z_y_x_w	Auto calibration times in seconds  z: Purge time  y: Verify time  x: Purge after time  w: Calibrate time

		v: Total time
_AFDA_K0_SSPL	_AFDA_s_z	Purge time will be responded.

#### APAR: Auto Calibration Tolerance Values

Command	Response	Description
_APAR_K0_SATK	_APAR_s_z.z_y.y_x.x_w.w	Auto calibration tolerance value (%):  z.z: Range 1  y.y: Range 2  x.x: Range 3  w.w: Range 4

#### ASYZ: Respond System Time

Command	Response	Description
_ASYZ_K0	_ASYZ_s_yymmdd_hhmmss	System Time:  yymmdd: year, month, day (each 2 characters wide, no spaces)  hhmmss: hour, minute, second (each 2 characters wide, no spaces)

#### AT90: Respond Lowpass Filter Time

Command	Response	Description
_AT90_K0	_AT90_s_t	Low-pass filter time in seconds.  t = filter time in seconds.

#### ADAL: Diagnostic Alarm Limits

Command	Response	Description
_ADAL_K0	_ADAL_s_al.min_al.max_....	All alarm limits.

	_a16.min_a16max	
_ADAL_K0_x	_ADAL_s_x.min_x.max	Alarm limits of x

## Alarm Limit Numbers and Descriptions

1	Sample Pressure
2	Air Pressure
3	Fuel Pressure
4	Air Inject Pressure
5	Fuel Inject Pressure
6	Filter Temperature
7	Burner Temperature
8	Oven Temperature
9	Cutter Temperature
10	Pump Temperature
11	EPC Coil Sample Voltage %
12	EPC Coil Air Voltage %
13	EPC Coil Fuel Voltage %
14	EPC Coil Air Inject Voltage %
15	EPC Coil Fuel Inject Voltage %
16	Concentration 1 / Concentration 2

## AVER: Query Software Version

Command	Response	Description
_AVER_K0	_AVER_s_FMAIN_Z_mm.dd.yyyy_	Z: FMAIN version build number

	FUSER_Y_mm.dd.yyyy_OSMSR_ X_dd.mm.yyyy	Y: FUSER version build number X: OSMSR version build number  dd: Day  mm: Month  yyyy: Year
--	---	--

#### ATCP: Query TCP/IP Settings

Command	Response	Description
_ATCP_K0	_ATCP_s_ zzz.zzz.zzz.zzz  _yyy.yyy.yyy.yyy  _xxxx	zzz: TCP/IP Address  yyy: TCP/IP subnet mask  xxxx: TCP/IP port

#### AUDP: Query UDP Data Streaming Parameter

Command	Response	Description
_AUDP_K0	_AUDP_s_ <UDPPort>  <DataFrequency> _ [<Mode>]  _ [<UDP_IP>]	UDP port: opened for connection  Data Frequency: Transmission Frequency of the Data in Hz  Mode: A: ASCII Mode  UDP_IP: Alternative IP address open for the UDP connection when it should use the IP connected to the TCP/IP client.

#### AGRW: Max Absolute / Relative Deviation Limits

Command	Response	Description
_AGRW_K0_Mn	_AGRW_s_ z.z.y.y	z: Absolute  y: Relative for range ' n '

#### AFGR: Default Factory Polynomial Coefficients

Command	Response	Description
_AFGR_K0_Mn	_AFGR_s_ a0_a1_a2_a3_a4	Factory coefficients for range ' n '

**AEFF: CH<sub>4</sub> Correction Factors**

Command	Response	Description
<b>_AEFF_K0</b>	<b>_AEFF_s_z.z_y.y_x.x</b>	z.z: CH <sub>4</sub> Offset  y.y: CH <sub>4</sub> Correction Factor  x.x: CH <sub>4</sub> Response Factor

**AATK: Query Auto Calibration Parameters**

Command	Response	Description
<b>_AATK_K0</b>	<b>_AATK_s_z_y_x</b>	z: 1) CH <sub>4</sub> Mode 2) THC Mode  y: 1) ALL gases 2) Zero gas only

**AENT: Query Calibration Gas Flow Settings (Pumps or Valves)**

Command	Response	Description
<b>_AENT_K0</b>	<b>_AENT_s_x</b>	x: 10 = Pump  11 = Valves

## CONTROL COMMANDS

### SRES: Reset

Command	Response	Description
_SRES_K0	_SRES_s	Reset

### SPAU: Pause

Command	Response	Description
_SPAU_K0	_SPAU_s	Pause mode (Shuts off Flame)

### STBY: Standby

Command	Response	Description
_STBY_K0	_STBY_s	Standby mode (Ignites if Auto-ignite is on)

### SNGA: Open Valve for Zero Gas Calibration

Command	Response	Description
_SNGA_K0	_SNGA_s	Sets to Zero Calibration mode.
_SNGA_K0_Mn	_SNGA_s	Sets to Zero Calibration mode for Range n.

### SEGA: Open Valve for Span Gas Calibration

Command	Response	Description
_SEGA_K0	_SNGA_s	Sets to Span Calibration mode.
_SEGA_K0_Mn	_SNGA_s	Open to Span Calibration mode Range n.

### SSPL: Purge Analyzer with Zero Gas

Command	Response	Description
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<b>_SSPL_K0</b>	<b>_SSPL_s</b>	Open Purge Gas valve.
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### **SATK: Start Automatic Calibration**

<b>Command</b>	<b>Response</b>	<b>Description</b>
<b>_SATK_K0</b>	<b>_SATK_s</b>	Start automatic calibration of all available ranges.
<b>_SATK_K0_Mn</b>	<b>_SATK_s</b>	Start automatic calibration of range ‘ n ‘.

### **SEMB: Set Measuring Range**

<b>Command</b>	<b>Response</b>	<b>Description</b>
<b>_SEMB_K0_Mn</b>	<b>_SEMB_s</b>	Set measuring range to range ‘ n ‘. Auto range will be disabled.

### **SARE: Auto Range On**

<b>Command</b>	<b>Response</b>	<b>Description</b>
<b>_SARE_K0</b>	<b>_SARE_s</b>	Set auto range On.

### **SARA: Auto Range Off**

<b>Command</b>	<b>Response</b>	<b>Description</b>
<b>_SARA_K0</b>	<b>_SARA_s</b>	Set auto range Off.

### **SREM: Remote Mode for AK Commands**

<b>Command</b>	<b>Response</b>	<b>Description</b>
<b>_SREM_K0</b>	<b>_SREM_s</b>	Set analyzer in Remote mode.

### **SMAN: Manual Control to Control Device Manually**

<b>Command</b>	<b>Response</b>	<b>Description</b>
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<b>_SMAN_K0</b>	<b>_SMAN_s</b>	Set analyzer in Manual mode.
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### **SMGA: Start Measuring; Turn On Pumps if Fitted**

Command	Response	Description
<b>_SMGA_K0</b>	<b>_SMGA_s</b>	Sets analyzer to Measure mode.

### **SNKA: Saves Measured Value as New Offset**

Command	Response	Description
<b>_SNKA_K0</b>	<b>_SNKA_s</b>	Saves measured value of actual range as offset if Zero mode is set.

### **SEKA: Saves Measured Value as New Span Value**

Command	Response	Description
<b>_SEKA_K0</b>	<b>_SEKA_s</b>	Saves measured value of actual range as gain if Span mode is set.

### **SUDP: Start/Stop UDP Data Streaming**

Command	Response	Description
<b>_SUDP_K0_ON</b>	<b>_SUDP_s</b>	Start data streaming via the UDP channel. Configure the channel before starting with EUDP command.
<b>_SUDP_K0_OFF</b>	<b>_SUDP_s</b>	Stop streaming via the UDP channel.

### **SVZS: Reset Offset to 0 and Gain to 1**

Command	Response	Description
<b>_SVZS_K0</b>	<b>_SVZS_s</b>	Sets all range offsets to 0 and all gains to 1.

### **SENT: Set Calibration Gas Flow (Pumps or Valves)**



Command	Response	Description
_SENT_K0_X	_SENT_s	x: 10 = Pump 11 = Valves

## CONFIGURATION COMMANDS

### EKAK: Set the Four Span Gas Concentration Values

Command	Response	Description
<b>_EKAK_K0_M1_ w.w_M2_x.x_M3_ y.y_M4_z.z</b>	<b>_EKAK_s</b>	Set the span gas values.

### EMBE: Set the Four Measuring Range Full Scale Limits

Command	Response	Description
<b>_EMBE_K0_M1_ w.w_M2_x.x_M3_ y.y_M4_z.z</b>	<b>_EMBE_s</b>	Set the range full scale limits.

### EMBU: Set the Upper and Lower Range Switchover for Auto Range

Command	Response	Description
<b>_EMBU_K0_M1_ w.w_W.W_M2_x.x_ X.X_M3_y.y_Y.Y_ M4_z.z_Z.Z</b>	<b>_EMBU_s</b>	Set the lower and upper range switchover limits.

### EGRD: Set the Range Polynomial Coefficients

Command	Response	Description
<b>_EGRD_K0_Mn_ A0_a1_a2_a3_a4</b>	<b>_EGRD_s</b>	Set the user polynomial coefficients for range 'n'.

**EFDA: Set Auto Calibration and Purge Times**

Command	Response	Description
<b>_EFDA_K0_SATK_ z_y_x</b>	_EFDA_s	Set auto calibration times:  z: Purge time  y: Verify time  x: Purge after  (z, y, x, w in seconds)
<b>_EFDA_K0_ SSPL_z</b>	_EFDA_s	Set analyzer purge time to z seconds.

**EPAR: Set Auto Calibration Tolerance Values**

Command	Response	Description
<b>_EPAR_K0_SATK_ z.z_y.y_x.x_w.w</b>	_EPAR_s	Auto calibration tolerance value (%):  z.z = Range 1  y.y = Range 2  x.x = Range 3  w.w = Range 4

**ESYZ: Set System Time**

Command	Response	Description
<b>_ESYZ_K0_ yymmdd_hhmmss</b>	_ESYZ_s	Set system time:  yymmdd: year, month, day (each 2 characters wide, no spaces)  hhmmss: hour, minutes, seconds (each 2 characters, no spaces)

### ET90: Set Lowpass Filter Time

Command	Response	Description
<b>_ET90_K0_t</b>	<b>_ET90_s</b>	Set lowpass filter time:  t = filter time

### EDAL: Set Diagnostic Alarm Limits

Command	Response	Description
<b>_EDAL_K0_ai.min_ a1.max..._a16max</b>	<b>_EDAL_s</b>	Set all alarm limits.
<b>_EDAL_K0_x_ x.min_xmax</b>	<b>_EDAL_s</b>	Set alarm limit of x.

## ALARM NUMBERS AND DESCRIPTIONS

1	Sample Pressure
2	Air Pressure
3	Fuel Pressure
4	Air Inject Pressure
5	Fuel Inject Pressure
6	Filter Temperature
7	Burner Temperature
8	Oven Temperature
9	Cutter Temperature
10	Pump Temperature
11	EPC Coil Sample Voltage %
12	EPC Coil Air Voltage %
13	EPC Coil Fuel Voltage %
14	EPC Coil Air Inject Voltage %
15	EPC Coil Fuel Inject Voltage %
16	Concentration 1 / Concentration 2

### ETCP: Set TCP/IP Parameters

Command	Response	Description
<b>_ETCP_K0_</b> <b>ZZZ.ZZZ.ZZZ.ZZZ_</b> <b>yyy.yyy.yyy.yyy_XXXX</b>	<b>_ETCP_s</b>	Zzz = TCP/IP address yyy = TCP/IP subnet mask xxxx = TCP/IP port All changes take effect after next Power On cycle.

### EUDP: Set TCP/IP Data Streaming Parameters

Command	Response	Description
<b>_EUDP_K0_&lt;UDPPort&gt;_&lt;DataFrequency&gt;_&lt;Mode&gt;_&lt;UDP_IP&gt;</b>	_EUDP_s	<p>Configure a UDP channel for data streaming of the measuring values via Ethernet UDP.</p> <p>Port: port for opening the UDP connection.</p> <p>Data Frequency: Frequency for transmitting the data in Hz.</p> <p>Mode:</p> <p>A: ASCII Mode (optional)</p> <p>UDP_IP: Alternative IP address for opening the UDP connection when it should not be using the IP of the connected TCP/IP client (optional).</p>

#### EEFF: CH<sub>4</sub> Offset and Correction Factor

Command	Response	Description
<b>_EEFF_K0</b>	_EEFF_s_z.z_y.y_x.x	<p>z.z: CH<sub>4</sub> Offset</p> <p>y.y: CH<sub>4</sub> Correction Factor</p> <p>x.x: CH<sub>4</sub>Response Factor</p>

#### EATK: Set Auto Calibration Parameters

Command	Response	Description
<b>_EATK_K0_z_y_x</b>	_EATK_s_z_y	<p>z: 1) CH<sub>4</sub> Mode</p> <p>2) THC Mode</p> <p>y: 1) ALL gases</p> <p>2) Zero gas only</p>

### EFDA: Set Auto Calibration Time

Command	Response	Description
<b>_EFDA_K0_SATK_z_y_x</b>	<b>_EFDA_s_z_y_x</b>	z: Purge time y: Verify time x: Purge after

### EGRW: Set Maximum Allowed Absolute / Relative Deviations

Command	Response	Description
<b>_EGRW_K0_Mn</b>	<b>_EGRW_s_z_x</b>	z: Absolute y: Relative
<b>_EGRW_K1_Mn</b>	<b>_EGRW_s_z_x</b>	K1 or option

## MODBUS PROTOCOL

### MODBUS ON TCP/IP APPLICATION DATA UNIT

#### MBAP Description

This section describes the encapsulation of a Modbus request or a response when it is carried on a Modbus TCP/IP network.

A dedicated header, called the MBAP (Modbus Application Protocol) header, is used on TCP/IP to identify the Modbus Application Data Unit. This header provides some essential differences compared to the Modbus RTU application data unit used on the serial line:

1. The Modbus Slave Address field usually used on a Modbus Serial Line is replaced by a single-byte Unit Identifier within the MBAP Header. The Unit Identifier is used to

communicate via devices such as bridges, routers and gateways that use a single IP address to support multiple independent Modbus end units.

2. All Modbus requests and responses are designed to allow the recipient to verify that a message is finished. For function codes on which the Modbus PDU has a fixed length, the function code alone is sufficient. For function codes carrying a variable amount of data in the request or response, the data field includes a byte count.
3. When Modbus is carried over TCP, additional length information is carried in the MBAP header to allow the recipient to recognize message boundaries even if the message has been split into multiple packets for transmission. The existence of explicit and implicit length rules and use of a CRC-32 error check code (on Ethernet) virtually eliminate the possibility of undetected corruption to a request or response message.



## MBAP HEADER DESCRIPTION

The MBAP Header contains the following fields:

Field	Length	Description
Transaction Identifier	2 Bytes	Identification of a Modbus request / Response transaction
Protocol Identifier	2 Bytes	0 = Modbus
Length	2 Bytes	Number of following bytes
Unit Identifier	1 Byte	Identification of a remote slave connected on a serial line or on other buses

The header is seven bytes long:

- **Transaction Identifier** – Used for transaction pairing, the Modbus server copies in the response the transaction identifier of the request.
- **Protocol Identifier** – Used for intra-system multiplexing. The Modbus protocol is identified by the value 0.
- **Length** - The Length field is a byte count of the following fields, including the Unit Identifier and Data fields.
- **Unit Identifier** – This field is used for intra-system routing. It is typically used to communicate to a Modbus+ or a Modbus serial line slave through a gateway between an Ethernet TCP-IP network and a Modbus serial line. This field is set by the Modbus client in the request and must be returned with the same value in the response by the server.

**All Modbus/TCP ADU are sent via TCP to Registered Port 502.**

**The different fields are encoded in Big-endian.** The SERVOPRO HFID analyzer uses only the Length bytes from the MBAP section.

**Code 01**

**This function code is used to read from 1 to 2000 contiguous status bits in a remote device.**

The requesting remote device specifies the starting address, including the address of the first bit specified and the number of bits. The device bits are addressed starting at zero. Therefore, bits numbered 1-16 are addressed as 0-15.

The bits in the response message are packed as one bit per bit of the data field. Status is indicated as 1 = ON and 0 = OFF. The LSB of the first data byte contains the output addressed in the query. The other bits follow toward the high order end of this byte, and from low order to high order in subsequent bytes.

If the returned output quantity is not a multiple of eight, the remaining bits in the final data byte will be padded with zeros (toward the high order end of the byte). The Byte Count field specifies the quantity of complete bytes of data.

**Request**

Function Code	1 Byte	0x01
Starting Address	2 Bytes	0x0000 to 0xFFFF
Quantity of Bits	2 Bytes	1 to 2000 (0x7D0)

**Response**

Function Code	1 Byte	0x01
Byte Count	1 Byte	N*
Bit Status	n Byte	n = N or N+1

\*N = Quantity of Outputs / 8, if the remainder is different of 0  $\Rightarrow$  N = N+1.

## Error

Function Code	1 Byte	Function code + 0x80
Exception Code	1 Byte	01 or 02 or 03 or 04

Here is an example of a request to read discrete outputs 20–38:

Request		Response	
<i>Field Name</i>	<i>(Hex)</i>	<i>Field Name</i>	<i>(Hex)</i>
Function	01	Function	01
Starting Address Hi	00	Byte Count	03
Starting Address Lo	13	Status of Outputs 27-20	CD
Quantity of Outputs Hi	00	Status of Outputs 35-28	6B
Quantity of Outputs Lo	13	Status of Outputs 38-36	05

The status of outputs 27–20 is shown as the byte value CD hex, or binary 1100 1101. Output 27 is the MSB of this byte, and output 20 is the LSB.

By convention, bits within a byte are shown with the MSB to the left and the LSB to the right. Thus the outputs in the first byte are 27-20 from left to right. The next byte has outputs 35-28 left to right. As the bits are transmitted serially, they flow from LSB to MSB: 20 . . . 27, 28 . . . 35, and so on.

In the last data byte, the status of outputs 38-36 is shown as the byte value 05 hex, or binary 0000 0101. Output 38 is in the sixth bit position from the left, and output 36 is the LSB of this byte. The five remaining high-order bits are zero filled.

CAI Modbus Interface Demo

	Address	Count	Data	
01 Read Coils	200	1		01 (HEX)
05 Write Coil	0		True	
03 Read Reg (FP)	1	1		None
16 Write Reg (FP)	1		1234.56789	
04 Read Reg (Int)	0	1		None
06 Write Reg (Int)	0		0	
26 Read Ascii	0	1		None

Scan

Comm Status

Winsock state: DUT connected well

Communication state: Receive 10 bytes

Error

None

Exit

Request Sent (HEX)

01 01 00 00 00 06 03 01 00 C8 00 01

Response (HEX)

01 01 00 00 00 04 03 01 01 01

Command 01, Read Coil 200 Count 1. Result = 01.

CAI Modbus Interface Demo

	Address	Count	Data	
01 Read Coils	200	16		55 55 (HEX)
05 Write Coil	0		True	
03 Read Reg (FP)	1	1		None
16 Write Reg (FP)	1		1234.56789	
04 Read Reg (Int)	0	1		None
06 Write Reg (Int)	0		0	
26 Read Ascii	0	1		None

Scan

Comm Status

Winsock state: DUT connected well

Communication state: Receive 11 bytes

Error

None

Exit

Request Sent (HEX)

01 01 00 00 00 06 03 01 00 C8 00 10

Response (HEX)

01 01 00 00 00 05 03 01 02 55 55

Command 01, Read Coil 200 Count 16. Result = 55 55 hex.

## Code 03

**This command has been modified to read floating-point numbers in 32-bit IEEE format.**

This function code is used to read the contents of a contiguous block of floating-point registers in a remote device. The Request PDU specifies the starting register address and the number of registers. In the PDU, registers are addressed starting at zero. Therefore, registers numbered 1-16 are addressed as 0-15.

The register data in the response message are packed as four bytes per register, with the binary contents right justified within each byte. For each register, the first byte contains the high-order bits and the second byte contains the low-order bits.

### Request

Function Code	1 Byte	0x03
Starting Address	2 Bytes	0x0000 to 0xFFFF
Quantity of Registers	2 Bytes	2 to 124 (0x7C)

### Response

Function Code	1 Byte	0x03
Byte Count	1 Byte	2 x N*
Register Value	N* x 2 Bytes	

\*N = Quantity of Registers

Here is an example of a request to read Register 0:

Request		Response	
<i>Field Name</i>	<i>(Hex)</i>	<i>Field Name</i>	<i>(Hex)</i>
Function	03	Function	03

Starting Address Hi	00	Byte Count	04
Starting Address Lo	00	Register Value Hi (1)	52
Number of Registers Hi	00	Register Value Lo (1)	2C
Number of Registers Lo	02	Register Value Hi (0)	44
		Register Value Lo (0)	9A

The contents of Register 0 are shown as the four byte values of 44 9A, 52 2C hex, or 1234.56789 decimal.

Here is an example of a request to read Register 40201:

<b>Request</b>		<b>Response</b>	
<i>Field Name</i>	<i>(Hex)</i>	<i>Field Name</i>	<i>(Hex)</i>
Function	03	Function	03
Starting Address Hi	9D	Byte Count	04
Starting Address Lo	09	Register Value Hi (40202)	33
Number of Registers Hi	00	Register Value Lo (40201)	33
Number of Registers Lo	02	Register Value Hi (40201)	41
		Register Value Lo (40201)	8F

The contents of register 40201 are shown as the four byte values of 41 8F 33 33 hex, or 17.9 decimal.

Here is an example of a request to read three registers starting at 40201:

<b>Request</b>		<b>Response</b>	
<i>Field Name</i>	<i>(Hex)</i>	<i>Field Name</i>	<i>(Hex)</i>
Function	03	Function	03
Starting Address Hi	9D	Byte Count	0C
Starting Address Lo	09	Register Value Hi (40202)	33

Number of Registers Hi	00	Register Value Lo (40201)	33
Number of Registers Lo	06	Register Value Hi (40201)	41
		Register Value Lo (40201)	8F
		Register Value Hi (40204)	33
		Register Value Lo (40204)	33
		Register Value Hi (40203)	41
		Register Value Lo (40203)	8F
		Register Value Hi (40206)	00
		Register Value Lo (40206)	00
		Register Value Hi (40205)	00
		Register Value Lo (40205)	00

The screenshot displays the 'CAI Modbus Interface Demo' window. It features a table for command execution with columns for Command, Address, Count, and Data. The '03 Read Reg (FP)' command is highlighted, showing an address of 1 and a count of 1, resulting in a data value of 1234.56789. Below the table, the 'Comm Status' section indicates 'Winsock state: DUT connected well' and 'Communication state: Receive 13 bytes'. The 'Request Sent (HEX)' and 'Response (HEX)' fields show the corresponding hexadecimal data. The 'Error' field is set to 'None'.

Command	Address	Count	Data
01 Read Coils	200	16	55 55 (HEX)
05 Write Coil	0		True
03 Read Reg (FP)	1	1	1234.56789
16 Write Reg (FP)	1		1234.56789
04 Read Reg (Int)	0	1	None
06 Write Reg (Int)	0		0
26 Read Ascii	0	1	None

**Comm Status**  
Winsock state: DUT connected well  
Communication state: Receive 13 bytes

**Request Sent (HEX)**  
01 01 00 00 00 06 03 03 00 01 00 02

**Response (HEX)**  
01 01 00 00 00 07 03 03 04 52 2C 44 9A

**Error**  
None

Command 03, Read Floating Point Value from Address 1. Result = 1234.56789.

The screenshot shows the 'CAI Modbus Interface Demo' window. It contains several command rows with input fields for Address, Count, and Data, and a corresponding Data field showing the result. The commands shown are:

- 01 Read Coils:** Address 200, Count 16, Data 55 55 (HEX)
- 05 Write Coil:** Address 0, Data True
- 03 Read Reg (FP):** Address 1, Count 4, Data 1234.568, 0, -1234.568, 10000
- 16 Write Reg (FP):** Address 1, Data 1234.56789
- 04 Read Reg (Int):** Address 0, Count 1, Data None
- 06 Write Reg (Int):** Address 0, Data 0
- 26 Read Ascii:** Address 0, Count 1, Data None

Below the command rows, there is a 'Scan' button and a 'Comm Status' section showing 'Winsock state: DUT connected well' and 'Communication state: Receive 25 bytes'. An 'Error' section shows 'None'. A 'Request Sent (HEX)' field displays '01 01 00 00 00 06 03 03 00 01 00 08', and a 'Response (HEX)' field displays '01 01 00 00 00 13 03 10 52 2C 44 9A 00 00 00 00 52 2C C4 9A 40 00 46 1C'. An 'Exit' button is located at the bottom right.

Command 03, Read four Floating Point values starting at Address 1.

Result = 1234.56789, 0.0 -1234.568, 10000.

## Code 04

**This function code is used to read from 1 to 125 contiguous input registers in a remote device.** The Request PDU specifies the starting register address and the number of registers. In the PDU, registers are addressed starting at zero. Therefore input registers numbered 1-16 are addressed as 0-15.

The register data in the response message are packed as two bytes per register, with the binary contents right justified within each byte. For each register, the first byte contains the high-order bits and the second byte contains the low-order bits.

## Request

Function Code	1 Byte	0x04
Starting Address	2 Bytes	0x0000 to 0xFFFF
Quantity of Input Registers	2 Bytes	0x0001 to 0x007D

## Response



Function Code	1 Byte	0x04
Byte Count	1 Byte	2 x N*
Input Registers	N* x 2 Bytes	

\*N = Quantity of Registers

Here is an example of a request to read Input Register 8:

<b>Request</b>		<b>Response</b>	
<i>Field Name</i>	<i>(Hex)</i>	<i>Field Name</i>	<i>(Hex)</i>
Function	04	Function	04
Starting Address Hi	00	Byte Count	02
Starting Address Lo	08	Input Register 9 Hi	00
Quantity of Input Registers Hi	00	Input Register 9 Lo	0A
Quantity of Input Registers Lo	01		

The contents of Input Register 8 are shown as the two-byte values of 00 0A hex, or 10 decimal.

The screenshot shows the 'CAI Modbus Interface Demo' window. It contains a table of function codes and their results:

Function Code	Address	Count	Data
01 Read Coils	200	16	55 55 (HEX)
05 Write Coil	0		True
03 Read Reg (FP)	40200	1	17 8. 0. 0. 0.
16 Write Reg (FP)	1		1234.56789
04 Read Reg (Int)	0	1	1234
06 Write Reg (Int)	0		0
26 Read Ascii	0	1	None

Below the table, there is a 'Scan' button and a 'Comm Status' section showing 'Winsock state: DUT connected well' and 'Communication state: Receive 11 bytes'. An 'Error' section is also present. On the right, 'Request Sent (HEX)' is shown as '01 01 00 00 00 06 03 04 00 00 00 01' and 'Response (HEX)' is shown as '01 01 00 00 00 05 03 04 01 04 D2'. An 'Exit' button is at the bottom right.

Command 04, Read one integer value from Address 0. Result = 1234.

## Code 05

**This function code is used to write a single output to either ON or OFF in a remote device.**

The requested ON/OFF state is specified by a constant in the request data field. A value of FF 00 hex requests the output to be ON. A value of 00 00 requests it to be OFF. All other values are illegal and will not affect the output.

The Request PDU specifies the address of the bit to be forced. Bits are addressed starting at zero. Therefore the bit numbered 1 is addressed as 0. The requested ON/OFF state is specified by a constant in the Bit Value field. A value of 0xFF00 requests the bit to be ON. A value of 0x0000 requests the bit to be off. All other values are illegal and will not affect the bit.

The normal response is an echo of the request, returned after the bit state has been written.

## Request

Function Code	1 Byte	0x05
Output Address	2 Bytes	0x0000 to 0xFFFF

Output Value	2 Bytes	0x0000 to 0xFF00
--------------	---------	------------------

## Response

Function Code	1 Byte	0x05
Output Address	2 Bytes	0x0000 to 0xFFFF
Input Registers	2 Bytes	0x0000 to 0xFF00

Here is an example of a request to write bit 173 ON:

Request		Response	
<i>Field Name</i>	<i>(Hex)</i>	<i>Field Name</i>	<i>(Hex)</i>
Function	05	Function	05
Output Address Hi	00	Output Address Hi	00
Output Address Lo	AC	Output Address Lo	AC
Output Value Hi	FF	Output Value Hi	FF
Output Value Lo	00	Output Value Lo	00

	Address	Count	Data
01 Read Coils	200	16	55 55 (HEX)
05 Write Coil	0		True
03 Read Reg (FP)	1	1	None
16 Write Reg (FP)	1		1234 56789
04 Read Reg (Int)	0	1	None
06 Write Reg (Int)	0		0
26 Read Ascii	0	1	None

**Scan**

**Comm Status**  
 Winsock state : DUT connected well  
 Communication state : Receive 12 bytes

**Error**  
 None

**Request Sent (HEX)**  
 01 01 00 00 00 06 03 05 00 00 FF 00

**Response (HEX)**  
 01 01 00 00 00 06 03 05 00 00 FF 00

**Exit**

Command 05, Write a single-bit value (true) to Address 0.

## Code 06

**This function code is used to write a single holding register in a remote device.** The Request PDU specifies the address of the register to be written. Registers are addressed starting at zero. Therefore the register numbered 1 is addressed as 0.

The normal response is an echo of the request, returned after the register contents have been written.

## Request

Function Code	1 Byte	0x06
Output Address	2 Bytes	0x0000 to 0xFFFF
Output Value	2 Bytes	0x0000 to 0xFFFF

## Response

Function Code	1 Byte	0x06
---------------	--------	------

Output Address	2 Bytes	0x0000 to 0xFFFF
Input Registers	2 Bytes	0x0000 to 0xFF00

## Error

Error Code	1 Byte	0x86
Exception Code	1 Byte	01 or 02 or 03 or 04

Here is an example of a request to write Register 1 to 00 03 hex:

Request		Response	
<i>Field Name</i>	<i>(Hex)</i>	<i>Field Name</i>	<i>(Hex)</i>
Function	06	Function	06
Register Address Hi	00	Register Address Hi	00
Register Address Lo	01	Register Address Lo	01
Register Value Hi	00	Register Value Hi	00
Register Value Lo	03	Register Value Lo	03

The screenshot shows the 'CAI Modbus Interface Demo' window. It features a table with columns for Function Code, Address, Count, and Data. The function codes listed are 01 Read Coils, 05 Write Coil, 03 Read Reg (FP), 16 Write Reg (FP), 04 Read Reg (Int), 06 Write Reg (Int), and 26 Read Ascii. The 'Data' column shows the results of these operations, such as '55 55' for Read Coils and '17.8:0.0,0.0' for Read Reg (FP). Below the table, there are sections for 'Comm Status' (Winsock state: DUT connected well), 'Request Sent (HEX)' (01 01 00 00 00 06 03 06 00 00 04 D2), 'Response (HEX)' (01 01 00 00 00 06 03 06 00 00 04 D2), and an 'Error' field. An 'Exit' button is located at the bottom right.

Command 06, write one holding register.

## Code 16

**This function code is used to write a single floating point register to a remote device.**

The requested written values are specified in the request data field. Data is packed as four bytes per register. The normal response returns the function code, starting address and quantity of registers written. *The analyzer ignores the numbers in the register and byte count and expects four data bytes.*

## Request

Function Code	1 Byte	0x10
Starting Address	2 Bytes	0x0000 to 0xFFFF
Quantity of Registers	2 Bytes	2
Byte Count	1 Byte	4
Registers Value	4 Bytes	value

## Response

Function Code	1 Byte	0x10
Starting Address	2 Bytes	0x0000 to 0xFFFF
Quantity of Registers	2 Bytes	2

## Error

Error Code	1 Byte	0x90
Exception Code	1 Byte	01 or 02 or 03 or 04

Here is an example of a request to write two registers starting at 2 to 00 0A and 01 02 hex:

Request		Response	
<i>Field Name</i>	<i>(Hex)</i>	<i>Field Name</i>	<i>(Hex)</i>
Function	10	Function	10
Starting Address Hi	00	Starting Address Hi	00
Starting Address Lo	01	Starting Address Lo	01
Quantity of Registers Hi	00	Quantity of Registers Hi	00
Quantity of Registers Lo	02	Quantity of Registers Lo	02
Byte Count	04		
Registers Value Hi	00		
Registers Value Lo	0A		
Registers Value Hi	01		
Registers Value Lo	02		

CAI Modbus Interface Demo

	Address	Count	Data
01 Read Coils	200	16	55 55 (HEX)
05 Write Coil	0		True
03 Read Reg (FP)	Scan (FP)	1	4
16 Write Reg (FP)	1		1234.56789
04 Read Reg (Int)	Scan (Int)	0	1
06 Write Reg (Int)	0		0
26 Read Ascii	0	1	None

Scan

Comm Status

Winsock state: DUT connected well

Communication state: Receive 12 bytes

Error

None

Exit

Request Sent (HEX)

01 01 00 00 00 0B 03 10 00 01 00 02 04 52 2C 44 9A

Response (HEX)

01 01 00 00 00 0B 03 10 00 01 00 02

Command 16, Write one floating point register.

CAI Modbus Interface Demo

	Address	Count	Data
01 Read Coils	200	16	55 55 (HEX)
05 Write Coil	0		True
03 Read Reg (FP)	Scan (FP)	40200	1
16 Write Reg (FP)	1		1234.56789
04 Read Reg (Int)	Scan (Int)	0	1
06 Write Reg (Int)	0		0
26 Read Ascii	0	1	None

Scan

Comm Status

Winsock state: DUT connected well

Communication state: Receive 9 bytes

Error

Exit

Request Sent (HEX)

01 01 00 00 00 0B 03 03 9D 08 00 02

Response (HEX)

01 01 00 00 00 04 03 83 02

Command 16, Write one floating point register at Address 40200 showing error response.

Not a valid address.



## Code 26

This is a non-standard code used to read an ASCII string.

### Request

Function Code	1 Byte	0x1A
Starting Address	2 Bytes	0x0000 to 0xFFFF
Quantity of Registers	2 Bytes	1

### Response

Function Code	1 Byte	0x1A
Length of String	1 Byte	0x00 to 0x7D
String	N Bytes	Data

The screenshot shows the 'CAI Modbus Interface Demo' window. The '26 Read Ascii' command is selected. The 'Address' is set to 0 and 'Count' is 1. The 'Data' field displays 'This is a test'. Below the command list, the 'Comm Status' section shows 'Winsock state: DUT connected well' and 'Communication state: Receive 24 bytes'. The 'Request Sent (HEX)' is '01 01 00 00 00 06 03 1A 00 00 00 01' and the 'Response (HEX)' is '01 01 00 00 00 18 03 1A 0F 54 68 69 73 20 69 61 20 61 20 74 65 73 74 2E'. An 'Exit' button is visible at the bottom right.

Command 26, Read ASCII string from Address 0.

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**01H SINGLE-READ COIL**

**NOTE:** Modbus Commands Use TCP/IP Port 502. (Do not change TCP/IP port from 7700.)

**Coil Numbers and Descriptions**

Coil Number	Read Data
1	No Flame
2	Sample Pressure
3	Air Temperature
4	Fuel Temperature
5	Air Inject Pressure (if fitted)
6	Fuel Inject Pressure (if fitted)
7	Filter Temperature
8	Burner Temperature
9	Oven Temperature
10	Cutter Temperature
11	Pump Temperature
12	Sample EPC Voltage
13	Air EPC Voltage
14	Fuel EPC Voltage
15	Air Inject EPC Voltage (if fitted)
16	Fuel Inject EPC Voltage (if fitted)
17	Range OverFlow
18	ADC OverFlow
19	ADC UnderFlow

<b>Coil Number</b>	<b>Read Data</b>
20	Range 1 Calibration Error
21	Range 2 Calibration Error
22	Range 3 Calibration Error
23	Range 4 Calibration Error
24	Low Concentration
25	High Concentration
26	0 - Standby, 1 - Measure
32	General Alarm
33	Eng units
37	For additional alarms and status
101	0 - Manual, 1 - Remote
102	0 - Standby, 1 - Measure
103	1 - Zero,
104	1 - Span,
105	1 - AutoCal
106	1 - Purge
107	1 - Pause
115	0 - via Pump, 1 - via Valves
118	0 - Auto Off, 1 - Auto On
119	0 - Auto Off, 1 - Auto On
145	THC Mode
146	CH <sub>4</sub> Mode
148	Dual Switching

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## 05H WRITE SINGLE COIL

**NOTE:** Modbus Commands Use TCP/IP Port 502. (Do not change TCP/IP port from 7700.)

### Coil Numbers and Descriptions

Coil Number	Write Data
101	0 - Manual, 1 - Remote
102	0 - Standby, 1 - Measure
103	1 - Zero,
104	1 - Span,
105	1 - AutoCal
106	1 - Purge
107	1 - Pause
108	1 - Ignite
115	0 via Pump, 1 via Valves
118	0 - Auto Off, 1 - Auto On
121	1-Sets Current range Offset to 0.0
122	1-Sets Current range Gain to 1.0
127	1-Sets Offset of Range if Zero Gas
128	1-Sets Gain of Range if Span Gas
133	1-Sets to Range 1
134	1-Sets to Range 2
135	1-Sets to Range 3
136	1-Sets to Range 4
145	THC Mode
146	CH <sub>4</sub> Mode
148	Sets Dual Switching



### 03H READ FLOATING POINT

**NOTE:** Modbus Commands Use TCP/IP Port 502. (Do not change TCP/IP port from 7700.)

#### Register Numbers and Descriptions

Register Number	Contents IEEE
40001	UNDILUTED Real Time Concentration = Diluted Conc* Dil. Ratio / 10000
40003	DILUTED Real Time Concentration
40005	Concentration before Linearization & Zero / Span Corrections
40007	Raw Detector Volts
40009	CH <sub>4</sub> Concentration - Switching Mode
40011	NMHC Concentration - Switching Mode
40013	THC Concentration
40025	Current Range Full Scale Concentration
40031	Sample Pressure
40033	Air Pressure
40035	Fuel Pressure
40037	Air Inject Pressure
40039	Fuel Inject Pressure
40041	Filter Temp
40043	Burner Temp
40045	Oven Temp
40047	Cutter Temp
40049	Pump Temp
40051	Sample EPC Coil V
40053	Air EPC Coil V
40055	Fuel EPC Coil V

<b>Register Number</b>	<b>Contents IEEE</b>
40057	Air Inject EPC Coil V
40059	Fuel Inject EPC Coil V
40061	Range 1 Offset
40063	Range 1 Gain
40065	Range 2 Offset
40067	Range 2 Gain
40069	Range 3 Offset
40071	Range 3 Gain
40073	Range 4 Offset
40075	Range 4 Gain
40109	Range 1 Full Scale
40111	Range 2 Full Scale
40113	Range 3 Full Scale
40115	Range 4 Full Scale
40133	Range 1 Auto Up
40135	Range 2 Auto Down
40137	Range 2 Auto Up
40139	Range 3 Auto Down
40141	Range 3 Auto Up
40143	Range 4 Auto Down
40201	Range 1 Span gas concentration
40203	Range 2 Span gas concentration
40205	Range 3 Span gas concentration
40207	Range 4 Span gas concentration
40225	Dilution Ratio
40227	Sample Pressure Alarm Minimum

Register Number	Contents IEEE
40229	Sample Pressure Alarm Maximum
40231	Air Pressure Alarm Minimum
40233	Air Pressure Alarm Maximum
40235	Fuel Temperature Alarm Minimum
40237	Fuel Temperature Alarm Maximum
40239	Air inject Pressure Minimum (if fitted)
40241	Air inject Pressure Maximum (if fitted)
40243	Fuel Inject Pressure Minimum (if fitted)
40245	Fuel Inject Pressure Maximum (if fitted)
40247	Filter Temperature Minimum
40249	Filter Temperature Maximum
40251	Burner Temperature Minimum
40253	Burner Temperature Maximum
40255	Oven Temperature Minimum
40257	Oven Temperature Maximum
40259	Cutter Temperature Minimum
40261	Cutter Temperature Maximum
40263	Pump Temperature Minimum
40265	Pump Temperature Maximum
40267	Sample EPV Voltage Minimum
40269	Sample EPV Voltage Maximum
40271	Air EPC Voltage Minimum
40273	Air EPC Voltage Maximum
40275	Fuel EPC Voltage Minimum
40277	Fuel EPC Voltage Maximum
40279	Air Inject EPC Voltage Minimum (if fitted)



40281	Air Inject EPC Voltage Maximum (if fitted)
40283	Fuel Inject EPC Voltage Minimum (if fitted)
40285	Fuel Inject EPC Voltage Maximum (if fitted)
40287	Sample Concentration Minimum
40289	Sample Concentration Maximum

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## 16H WRITE FLOATING POINT

**NOTE:** Modbus Commands Use TCP/IP Port 502. (Do not change TCP/IP port from 7700.)

### Register Numbers and Descriptions

Register Number	Contents IEEE
40201	Range 1 Span Gas Concentration
40203	Range 2 Span Gas Concentration
40205	Range 3 Span Gas Concentration
40207	Range 4 Span Gas Concentration
40225	Dilution Ratio
40227	Sample Pressure Alarm Minimum
40229	Sample Pressure Alarm Maximum
40231	Air Pressure Alarm Minimum
40233	Air Pressure Alarm Maximum
40235	Fuel Pressure Alarm Minimum
40237	Fuel Pressure Alarm Maximum
40239	Air Inject Pressure Minimum (if fitted)
40241	Air Inject Pressure Maximum (if fitted)
40243	Fuel Inject Pressure Minimum (if fitted)
Register Number	Contents IEEE
40245	Fuel Inject Pressure Maximum (if fitted)
40247	Fuel Temperature Minimum
40249	Fuel Temperature Maximum
40251	Burner Temperature Minimum
40253	Burner Temperature Maximum
40255	Oven Temperature Minimum

40257	Oven Temperature Maximum
40259	Cutter Temperature Minimum
40261	Cutter Temperature Maximum
40263	Pump Temperature Minimum
40265	Pump Temperature Maximum
40267	Sample EPC Voltage Minimum
40269	Sample EPC Voltage Maximum
40271	Air EPC Voltage Minimum
40273	Air EPC Voltage Maximum
40275	Fuel EPC Voltage Minimum
40277	Fuel EPC Voltage Maximum
40279	Air Inject EPC Voltage Minimum (if fitted)
40281	Air Inject EPC Voltage Maximum (if fitted)
40283	Fuel Inject EPC Voltage Minimum (if fitted)
40285	Fuel Inject EPC Voltage Maximum (if fitted)
40287	Sample Concentration Minimum
40289	Sample Concentration Maximum